

CONFERENCE PROCEEDINGS 20

Refocusing Transportation Planning for the 21st Century

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Refocusing Transportation Planning for the 21st Century

Proceedings of Two Conferences

Washington, D.C.
February 7–10, 1999

Irvine, California
April 25–28, 1999

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This report has been reviewed by a group other than the authors according to the 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 the presentations and papers contained in this report are those of the authors and do not necessarily reflect the views of the steering committee, the Transportation Research Board, the National Research Council, or the sponsors of the conferences.

The conferences were sponsored by the Transportation Research Board, the Federal Highway Administration, and the Federal Transit Administration.

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GENERAL OVERVIEW

The Conferences, Their Objectives, and Their Formats

The Transportation Equity Act for the 21st Century (TEA-21) reauthorized the federal surface transportation program. The legislation provides for the continuation of a number of federal programs and requirements that support transportation investments. Among these requirements is the conduct of a transportation planning process by metropolitan and state agencies that must meet certain criteria to qualify for federal financial support. At the metropolitan level, this requirement has existed since the early 1960s. At the state level, the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) established the first federal requirement for statewide transportation planning.

Although ISTEA produced significant changes in the planning process, particularly related to environmental and institutional issues, TEA-21 retains most of the core programs and the basic relationships among the federal, state, and metropolitan agencies. Therefore, the current set of changes that results from TEA-21 generally refines and clarifies the existing federal requirements. Areas of added emphasis include streamlining and improving the process by using

- Emerging planning tools and approaches,
- Operations and management (including intelligent transportation systems),
- Coordination of transportation service providers (including welfare-to-work and social equity concerns),

- Inclusion of freight planning, and
- Early consideration of environmental impacts (including sustainability and environmental justice).

As a result of the emergence of new emphasis areas, the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) requested that the Transportation Research Board (TRB) conduct two conferences on Refocusing Transportation Planning for the 21st Century. The overall objectives of Conference I, held in Washington, D.C., February 7–10, 1999, were to (a) engage a broad range of stakeholders in the discussion of key issues within the transportation planning process; (b) review the “lessons learned” during implementation of ISTEA; and (c) identify research, analytical, and programmatic issues that will be encountered during implementation of TEA-21.

To meet the objectives of Conference I, the Steering Committee agreed to an “open space” format guided by a facilitator. This type of format encouraged open participation to allow conference participants a voice in establishing the conference agenda. A total of 60 time slots, each 1.5 hours in length, were available to the conferees. A total of 52 slots were filled by the conferees who led the discussions according to the following workshop format:

- Summary of discussion,
- Major issues discussed,

- Action items recommended,
- General research items, and
- Priority of issue (optional).

The 52 workshops generated 311 action items and 211 general research items (workshop reports and general items are found in the Appendixes). For a summary of the workshops, see the section on workshop summaries.

Following completion of these workshops, a plenary session was held for participants to identify the major crosscutting issues that had resulted from the conference. As a result of the deliberations, the Steering Committee developed a consensus on an umbrella issue, nine crosscutting issues, and two additional issues. These issues formed the basis for the workshops held on the final day of Conference I (see Executive Summary, Figure 1, which identifies the crosscutting issues, p. 4).

Each workshop was devoted to one issue. The participants were given a threefold charge to (a) develop a list of concerns and problems related to the issues; (b) project 10 years ahead and create a vision for that issue area for the year 2009; and (c) develop a series of steps or actions that will be required in the next 10 years. A member of the Steering Committee was assigned as discussion leader. To accomplish this exercise, the groups were provided with the resource papers, the results of the 52 workshops that covered the issues, and a list of issues and concerns that was developed during the roundtable discussion held the previous afternoon. Only a limited amount of time was allowed for the workshops, and as a result, some of them were not able to complete a thorough discussion of all the items.

The strategy developed by the Steering Committee for closure to Conference I was to merge, where possible, the research items identified in the resource papers, the workshops, and the visioning sessions and group them under the umbrella issue, the nine crosscutting issues, and the two additional categories. In many instances, research suggestions from resource papers and workshop summaries contain items that fall within several crosscutting issue categories. Although some of the suggestions are redundant, they apply different words or emphasis to similar issues. These suggestions are all presented under one of the 73 research items as input to Conference II (see Vision, Steps to Accomplish the Vision, and Research Needs, p. 19).

The second conference, held in Irvine, California, April 25–28, 1999, had the specific objective of producing a number of research problem statements. The

mission of Conference II was to sort through the details of each of the 73 research items, incorporate the results of the National Survey on Planning Needs, combine some items where appropriate, and develop research problem statements that capture the importance of each item.

The results of the first conference, therefore, served as the resource base for the development of the research problem statements at Conference II. Each of the attendees at the second conference received, well in advance, the results of Conference I. It is significant to note that a majority (40) of the total number of attendees at Conference II (70) had participated at Conference I.

The format for the workshops at the second conference was driven by the results of Conference I. Steering Committee members chaired the workshops to ensure continuity and to ensure that the sense of Conference I was not lost in the deliberations at Conference II. Each workshop had a maximum of 2 working days to review and discuss the results of the first conference and to produce the desired (106) research problem statements. The National Cooperative Highway Research Program (NCHRP) format was used as a model in the development of each statement. Furthermore, the Steering Committee adopted the approach that was used in putting together TRB's highly successful *Circular 469: Environmental Research Needs*. This document was a compilation of research needs without a priority ranking.

The Steering Committee members agreed that Conference II had met its objectives of producing the necessary research statements that will form the basis of the National Agenda for Transportation Planning Research. A national planning research agenda is a document that federal agencies, national organizations, state and local agencies, and the private sector can use for sponsoring and conducting research activities in a more coordinated and comprehensive manner.

The Steering Committee participants further recognized that these research statements will be refined and redefined by the various TRB committees and research oversight panels and that existing gaps in the resource package will be filled in by subsequent conference and committee activities. Therefore, although this report presents the findings of these two conferences, making it a valuable resource, it should not be viewed as a definitive and comprehensive blueprint for subsequent proceedings. As one conferee stated, "This is not the end, but the end of the beginning."

GENERAL OVERVIEW

Executive Summary

The history of TRB conferences that focused on the transportation planning process dates back to 1957. The timing of these conferences has usually followed the passage of major transportation legislation, and their output has been used to guide federal, state, regional, and local efforts to modify and improve the transportation planning process, both metropolitan and statewide, for the next period of years.

Two conferences were held in 1999 that followed the passage of TEA-21. The first conference, held in Washington, D.C., February 7–10, focused on the identification of key trends, issues, and general areas of research (not detailed statements). The results of Conference I, which produced stand-alone products, were used as input for Conference II, held in Irvine, California, April 25–28.

Conference II had the specific objective of producing needs statements. Its mission was to review the results of the first conference by developing these statements. Conference II produced a number of detailed research statements that form the basis for the National Agenda for Transportation Planning Research. The proceedings of both conferences are presented in this report.

TEA-21 reauthorized the federal surface transportation programs for 1998 through 2003. Because the reauthorization continued the current structure and relationships for the statewide and metropolitan planning processes, the conferences dealt with many of the emerging responsibilities that were present before the reauthorization, as well as with some of the changes that were emphasized in TEA-21.

From the discussions conducted at Conference I, one overriding umbrella issue emerged: the need for a more robust planning process to address the new areas of

emphasis in TEA-21 and the other emerging challenges identified at the conference. In addition, nine crosscutting issues were identified that relate to the umbrella issue (see Figure 1). These issues are

1. Development of a customer- and user-based planning process,
2. Linking planning to the political decision process,
3. Creating a vision for the community and defining the role of transportation to achieve the vision,
4. Understanding current and future movement of freight,
5. Technical processes, including models, are unsatisfactory,
6. Role and impact of technology on transportation,
7. Land use and transportation,
8. Determining institutional issues: Do we need new institutions, should we change existing ones, or should we create new relationships? and
9. Professional development.

A number of issues that were raised at the conference did not fit neatly into these nine crosscutting issues; therefore, these issues have been included in two equally important categories that were added to the crosscutting issues. The two additional categories are

1. Connecting linkages of the transportation planning process to other program areas, and
2. Encouraging the consideration of certain transportation solutions or outcomes of the planning process.

Conference I produced the following products for its sponsors and for the wider transportation community:

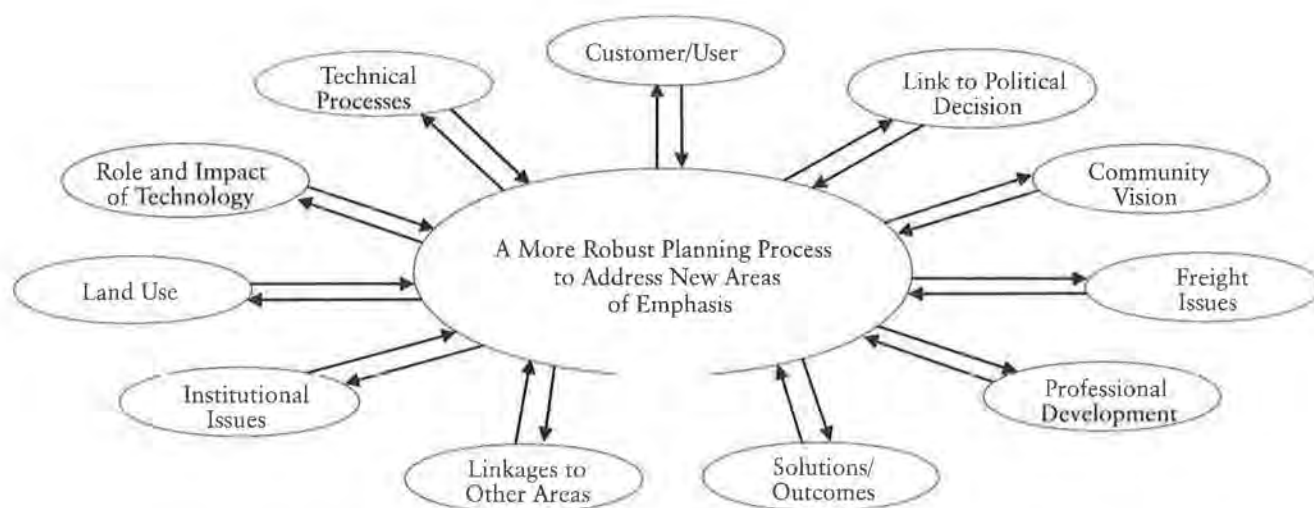


FIGURE 1 Relationship of crosscutting issues.

- Seven resource papers on critical issues, including a list of research topics contained in each paper (see Conference I Resource Papers).

- Fifty-two workshop reports containing 313 action items and 211 research needs. The action items are available to the transportation industry to use as deemed appropriate to local situations. A summary of workshop reports grouped by issue area appears later in these proceedings (see Appendix A for the workshop reports).

- Summary of the vision, steps to accomplish the vision, and general research areas for the umbrella issue and each of the nine crosscutting issues. The research areas were developed by consolidating the 211 research areas identified by the workshops and the needs identified in the resource papers into 73 research items. The participants at Conference II considered each item as a candidate for the development of a research needs statement (see Vision, Steps To Accomplish the Vision, and Research Needs, p. 19).

- Input to FHWA and FTA for the regulatory process that is related to implementing the various planning provisions of TEA-21.

Conference II produced 106 research statements that, in addition to creating the National Agenda for Transportation Planning Research, will have a number of potential uses, such as input for

- U.S. Department of Transportation (USDOT) research budget request for FY2000—immediate,

- Selection of projects for NCHRP—this summer and fall,

- Selection of projects under the state planning research program, NCHRP 8-36—this summer and fall,

- Transit Cooperative Research Program (TCRP)—this summer and fall,

- TRB committees to refine and structure proposals in their areas of interest—this summer at midyear meetings and in January 2000 at the annual meeting, and

- State, regional, and university research programs—ongoing.

Although much has been accomplished, additional work must be done to maximize the benefit of these conferences:

- Review the research statements for duplication and combine where appropriate;

- Compare the research statements to the first conference lists and identify gaps;

- Examine the research statements to create a strategic or programmatic approach, perhaps by using the approach suggested by Michael D. Meyer (see Proceedings of Conference II; Opening Session Summary, p. 168).

- Develop a system to track and disseminate information on planning research; and

- Develop a system for integrating the research results.

Proceedings of Conference I

Washington, D.C., February 7–10, 1999

Introduction and Overview

Session Summaries

Workshop Summaries

Vision, Steps to Accomplish the Vision, and Research Needs

Summation and Conclusions

CONFERENCE I

Introduction and Overview

BACKGROUND

The purpose of Conference I, held in Washington, D.C., was to provide a forum to explore current programs and practice in transportation planning in the United States, to identify and discuss process changes resulting from TEA-21, and to disseminate information concerning current practices and related research. Key trends, issues, and research needs in the conduct of the planning process were identified.

Conference I developed a vision for the planning process for the next 10 years and identified a number of crosscutting issues that must be addressed to achieve that vision. Steps to accomplish the vision and to identify research needs were developed for these issues.

The report on Conference I served as input for Conference II, held in Irvine, California, April 25–28, 1999. Detailed research needs statements were prepared during the second conference as input to the National Agenda for Transportation Planning Research. The purpose of a national planning agenda is to provide a document that federal agencies, national organizations, state and local agencies, and the private sector can use to sponsor and conduct research activities in a more coordinated and comprehensive manner.

CONFERENCE STRUCTURE AND ATTENDANCE

The structure of the first conference was in many ways different from that of previous conferences. One aspect that was common to previous conferences was the preparation of resource papers to present challenges to the participants and to cover emerging topics of importance in the planning process. The resource papers appear in the section starting on page 41. Descriptions of major differences between Conference I and previous conferences follow.

Participants

The 154 participants included a balance of state, metropolitan planning organization (MPO), transit, and academic representatives, consultants, and transportation private-sector and federal officials, as well as a significant number of “nontraditional” participants, who were also referred to as “customers” of the planning process. The nontraditional representatives were from national and local organizations that focused on environmental, social action, land use, economic development, pedestrian, bicycle, local government, neighborhood coalition, fish and wildlife, public land, and non-transportation private-sector concerns. Four customers were asked to outline their expectations and needs from the 21st century planning process at the beginning of the conference and

were again asked to comment on how the conference addressed their needs at the end of the conference.

Format

The conference used an "open-space" format. Following the presentations of the resource papers and customer comments, a facilitator guided the participants through the open-space format. A total of 60 workshops were available. Any conference participant could voluntarily suggest a topic for a workshop and lead the discussion at one of the workshop sessions. The volunteer would also agree to write up the results of the workshop immediately after the session, for which a computer room was made available. A prescribed format for each workshop report was developed that required the following information:

- Summary of discussion,
- Major issues discussed,
- Action items recommended,
- Research needs, and
- Priority of the issue (optional).

At the beginning of the second day of the conference, the participants were given copies of the workshop reports from the previous day. At the beginning of the third day, participants received copies of the workshop reports for the entire conference. Thus, one of the first stand-alone products of the conference—workshop reports on 52 topics—was available to the conference sponsors as well as to the participants before the conference was completed.

At the beginning of the second day, a conference consultant summarized the topics covered during the first day's workshops and contrasted the issues to those that were raised in the resource papers. Some gaps were identified, and participants had the opportunity to suggest additional workshop topics for the second day to fill some of these gaps or to elaborate on aspects of topics that were covered on the first day. In summary, the conference's direction was determined by the participants, and opportunities were provided for participants to offer feedback and exchange ideas as well as to produce an early product. The 52 workshop reports are reviewed in *Workshop Summaries*, p. 13, and appear in the *Appendixes*, p. 197.

Dynamic Visioning

Following the second day of workshops, a plenary session was held during which the participants were asked to identify the major crosscutting issues that had resulted from the conference. First, the members of the panel of nontraditional customers from the first day's presentations were asked to comment. A panel with representa-

tives from the various stakeholder groups then provided their input. Finally, the floor was open for commentary from any participant. From this discussion, the Steering Committee developed one umbrella issue and nine crosscutting issues that would form the basis for workshops on the final day (see Figure 1 on crosscutting issues, p. 6).

Each workshop on the final day was devoted to one of the issues. The participants were given a threefold charge. First, they were to develop a list of concerns and problems related to the issue. Second, they were to project 10 years ahead and create a vision for that issue area for the year 2009. Finally, they were asked to develop a series of steps or actions that were required in the next 10 years to reach this vision. At the end of the conference, the results of the 10 workshops were presented. Commonalities and the linkages between the 10 issues were apparent and are included in *Summation and Conclusions*, p. 35. This dynamic process allowed the participants to identify the issues and to create future visions according to the results of the discussion. The 10 issues and visions formed the basis for Conference II, which developed research needs statements that were associated with the issues.

Conference Products

The benefits of the Conference I included the exchange of ideas and viewpoints of the critical issues, discussion of approaches that were used in different areas, and the establishment of a network of contacts. In addition, the conference produced the following products for its sponsors and for the wider transportation community:

- Seven resource papers on critical issues, including a list of research topics contained in each paper (see *Conference I Resource Papers*, p. 41).
- Fifty-two workshop reports containing 313 action items and 211 research needs. The action items are available to the transportation industry to use as deemed appropriate to local situations. A summary of workshop reports grouped by issue area appears later in these proceedings (see the *Appendixes* for the workshop reports, p. 197).
- Summary of the vision, steps to accomplish the vision, and general research areas for the umbrella issue and each of the nine crosscutting issues. The research areas were developed by consolidating the 211 research areas identified by the workshops and the needs identified in the resource papers into 73 research items. The participants at Conference II considered each item as a candidate for the development of a research needs statement (see *Vision, Steps to Accomplish the Vision, and Research Needs*).
- Input to FHWA and FTA for the regulatory process that is related to implementing the various planning provisions of TEA-21.

CONFERENCE I

Session Summaries

The following summary statements of the conference cochairs and the project sponsors provide the overall tone and accomplishments of the conference.

Cochair Ysela Llort, State Transportation Planner for the Florida Department of Transportation, stated, "The results of this conference in terms of the proposed changes to the planning process do not entirely depend on federal regulations or the results of research studies, but in many places it is up to us as practitioners to implement some of the many ideas which were generated here. We can take these ideas back and improve the way we do business, as well as create a research agenda for the future."

Cochair Les Sterman, Executive Director for East-West Gateway Coordinating Council, stated, "We heard at this conference optimism for the future of transportation planning, not pessimism. We heard from our customers how our processes affect the lives of people every day. We are optimistic that we can attract bright, young people to this profession."

Speaking on behalf of the conference sponsors, Gloria Jeff, FHWA Deputy Administrator, stated, "When the last conference was held 7 years ago, many of the same themes were discussed, and it is clear that the profession has come a long way in the past years. The basic principles of the three Cs (continuous, coordinated, and comprehensive) planning process are still intact. There is an ongoing need for process improvements to deal with the

new issues and a continuing need to engage all customers and stakeholders at the appropriate level in the process. The revised planning processes must be outcome-based, linked to the political process, and open to all stakeholders. The process must link land use planning, the human and natural environment, quality-of-life issues, and the global economy."

UMBRELLA AND CROSSCUTTING ISSUES

From the review of the resource papers and the workshop summaries and from the ensuing discussion at the conference, one overriding umbrella issue emerged: the need for a more robust planning process to address the new areas of emphasis in TEA-21 and the emerging problems identified at the conference. In addition, nine crosscutting issues that relate to the umbrella issue were identified (see Figure 1).

The nine crosscutting issues developed during the conference include

1. Development of a customer- and user-based planning process,
2. Linking planning to the political decision process,
3. Creating a vision for the community and defining the role of transportation to achieve the vision,
4. Understanding current and future movement of freight,

5. Technical processes, including models, are unsatisfactory,
6. Role and impact of technology on transportation,
7. Land use and transportation,
8. Determining institutional issues: Do we need new institutions, should we change existing ones, or should we create new relationships? and
9. Professional development.

A number of issues that were raised at the conference did not fit neatly into these nine crosscutting issues; therefore, these issues have been included in two equally important categories that were added to the crosscutting issues shown in Figure 1. The two additional categories are

1. Connecting linkages of the transportation planning process to other program areas, and
2. Encouraging the consideration of certain transportation solutions or outcomes of the planning process.

SUMMARY OF OPENING SESSION

The opening session was designed to provide an overview of the transportation planning issues for the participants and to raise questions from professionals in

the field as well as from customers of the planning process.

The first presentation, which covered the history of the transportation planning process, was given by Kevin Heanue, former FHWA Director of the Office of Environment and Planning. Mr. Heanue recently retired after a 40-year career with FHWA. He traced the evolution of the transportation planning process from four perspectives, beginning with federal legislation that dated back to the 1956 Federal Highway Act and that triggered the planning and construction of the interstate system, which led to the recently passed TEA-21 legislation.

Next, Mr. Heanue tracked the evolution of the planning institutions from original voluntary cooperative groups to present organizations, of which more than half are created by legislative action. He then reviewed the evolution of the technical process and its models from the simple growth factor analyses and to the latest model initiative, TRANSIMS, which will be available early in the next century. Finally, Mr. Heanue presented the planning process as a reflection of the issues and values of respective time periods, with additional issues being layered onto the planning process in different legislative eras.

Michael Meyer, Chairman of the Department of Civil Engineering at the Georgia Institute of Technology, delivered the keynote address (included as the first paper under

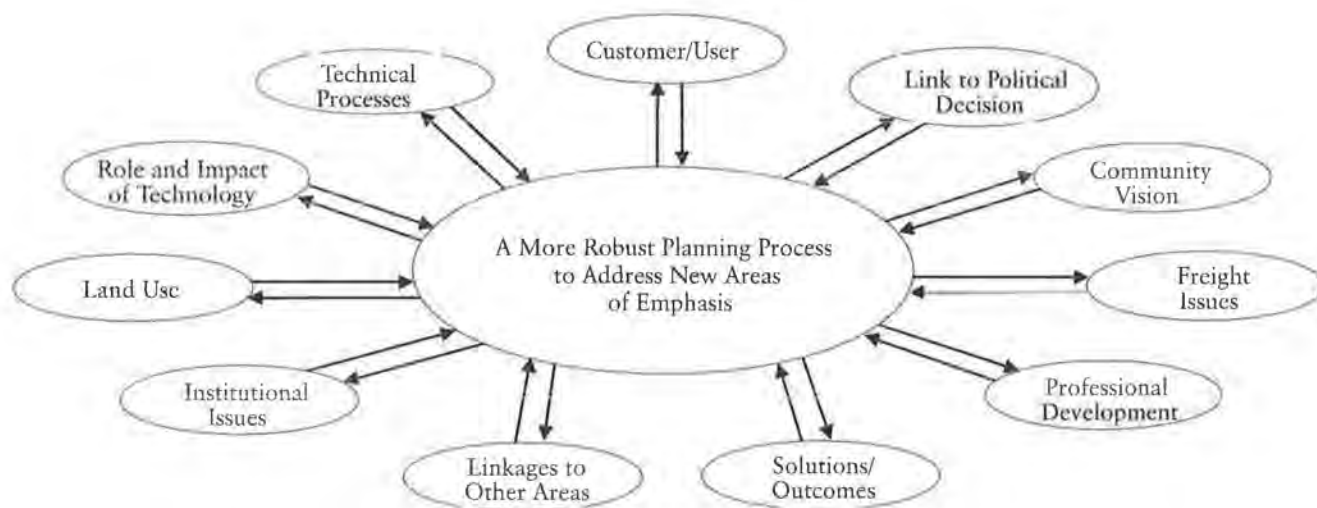


FIGURE 1 Relationship of crosscutting issues.

Conference I Resource Papers). Dr. Meyer reviewed the evolution of issues that were discussed at previous conferences on planning and identified a number of trends. He concluded by describing 10 areas in which future transportation planning will likely face challenges:

1. Demographic changes, including higher household income and increased immigration and aging of the population;
2. Economic production and market forces;
3. Highways plus: multimodal and intermodal issues;
4. Operations perspective;
5. Role of technology;
6. Sense of community;
7. Laying the groundwork for pricing;
8. Putting teeth into growth management;
9. Transportation planning within a sustainability framework; and
10. Decision making and planning accountability.

These challenge areas became topics for the conference.

PANEL SESSION ON VIEWS FROM CUSTOMERS OF THE PLANNING PROCESS

The first customer panelist, Jerome Walcott, Associate Director of the Commission on Catholic Community Action, Cleveland, Ohio, recounted how his agency became concerned with transportation issues. The commission became involved in transportation issues as it worked on environmental issues in Cleveland and realized that some issues concerning quality of life revolved around traffic patterns. The way in which traffic systems run can affect spatial disparity in poor and minority neighborhoods and can cause environmental problems that range from toxic waste dumps to incinerators to the actual quality of the air. The commission was also involved with welfare reform and the realization that the poor population in Cleveland could not get to the outlying rings of suburbs where jobs were created. The transportation system that served the inner-city population was built around its needs as they were defined in 1960, not in the present.

Mr. Walcott described the situation in his city and efforts to create linkages with jobs through public and private partnerships. These efforts have resulted in Cleveland officials starting to talk about the real problems and in an invitation to Mr. Walcott's clients to participate in the discussions.

The second panelist was Judy Corbett, Executive Director of the Local Government Commission, a non-profit membership organization of mayors, city council members, and county supervisors. The commission, located in Sacramento, California, is in charge of the Center for Livable Communities. Ms. Corbett stated

that one of the greatest concerns of communities in California and across the country is urban sprawl and its impact. "I think that the thing the elected officials whom I work with the most are concerned about is losing a sense of place. There are communities, especially fast-growing ones, that look just like the one next door, in the next state, across the country. If everything is looking the same, you are losing the sense of who you are." She described several efforts in California in which businesses and public officials have come together to address this issue. She described growth management principles—the Ahwahnee Principles, which were developed at a conference at Yosemite National Park in 1991—and their relationships to transportation. New federal legislation, such as ISTEA and TEA-21, now provide the flexibility and funding to implement some of the ideas that encourage growth management.

The third customer panelist, Randy Walker, Manager of Transportation and Packaging for the Oak Ridge National Laboratory, spoke on the needs of the freight industry in the 21st century. Mr. Walker described the economic importance of the freight industry to national and local economies. He identified key issues in six areas that are relevant today and that will be in the future. The six areas are the workforce, the economy, the infrastructure, urban and community development, safety, and the environment. He discussed how some of these issues correspond with issues raised by the previous two customers by stating, "Economic deregulation was a great thing for the industry. It lowered the cost and the price of service of transportation, but the result is more trucks on the highways. We now are starting to see supply chain management with smaller products, smaller amounts of material moving more rapidly and more frequently, and the challenge is that the lift-and-haul capacity isn't there in the industry."

The fourth person on the panel, Omar Wilson, Assistant Vice President of Employee Relations, PNC Bank in Philadelphia, presented his comments at the close of the meeting. He has been a manager of transportation services for two large Philadelphia area companies that provide transportation services for employees because local public transportation agencies cannot do so. Mr. Wilson believes that although transportation professionals are moving toward public involvement, they are being pushed into it, and they do not appreciate the public's input. He said, "You are going to deal with the public sooner or later, so why not bring them in on the beginning of the planning process? Most transportation professionals, in my opinion, do not see the residents and employers as the customers. Most feel that the MPOs and DOTs [departments of transportation] and elected officials are the only customers. We need to refocus." He cited the lack of cooperation from government agencies in dealing with

welfare-to-work programs and the need to use marketing research techniques as a way to involve the public in the beginning stages of any transportation project.

Two presenters summarized six of the seven resource papers. Mark Norman, Deputy Executive Director of the Institute of Transportation Engineers summarized three papers on mainstreaming management and operations (M&O), multimodal and intermodal considerations, and sustainability. Dr. Meyer summarized the final three papers on environmental linkages, environmental justice, and access to jobs.

Both speakers agreed that the resource papers were thought provoking and provided many issues for the conference. Mr. Norman concluded that the 21st century transportation planning process will be different than it was in the 20th century by saying,

Pogo said "we have met the enemy and he is us." In this case we have met the customers and they are not us. The customers are not the state DOTs, they are not the MPOs, they are not the local DOTs. The customers are those people out there that have a broader set of objectives than just increasing capacity and increasing speed. We must address these broader community objectives, and we must adopt a total systems mind-set and approach, and we will need new sets of tools and new sets of performance measures.

From his summaries of the three resource papers, Dr. Meyer concluded that, in terms of environmental justice and access to jobs and the environment, the importance of transportation to society is critical. Transportation and transportation planning will need to include environmental justice, access to jobs for low-income individuals, and biodiversity. Flexibility must be part of the planning process, and regulations must respond to these issues at the regional and state levels. In transportation planning, we need to expand our customers to include low-income and welfare workers. The challenge, Dr. Meyer said, "will be institutionalizing these many issues into the transportation planning process so that, in fact, they are formally considered as transportation plans, programs, and strategies and are implemented at the regional and state level."

The question-and-answer session that followed the summaries of the resource papers raised a number of important points, including the following:

- We need to clearly communicate in a manner that everybody understands and not with the usual professional jargon.
- We need to determine whether we are at a point where we can focus on the core mission of delivering service, measuring performance, and being accountable.
- Many transportation services that customers want cross modes, and to deal with these services, major

changes in how we think, plan, and fund will be required.

- Outcomes of past planning processes that reflected values and desires of the political decision-making system are now viewed by some as unacceptable; therefore, a new course of action is needed.

- How do we implement a service-oriented management operational viewpoint?

- Who is the customer?

- There are lessons to be learned from other countries. Many areas in the world are ahead of the United States in changing transportation institutions and in looking at public roles as opposed to private roles.

- How can we deal with the problems of pipeline projects and the timing of decisions to reflect new challenges?

- Access to jobs means not just meeting the short-term schedule of welfare reform but requiring a long-term view that looks at all the factors of low income and unemployment.

- What is the role of the transit industry, and when do we need deregulation?

- We need to incorporate environmental justice concerns into the planning process at an early date.

The final opening-day presentation was delivered by Mortimer Downey, Deputy Secretary, USDOT. Mr. Downey discussed the TEA-21 legislation and the proposed FY2000 federal budget as evidence of new opportunities for transportation by stating, "Much of our federal transportation funding is now flexible between the different highway programs and transit investments. The planning process for highways and transit projects has been opened to much broader public participation, although not yet with all the tools that are needed to make it a transparent process. Transportation policy has come a long way during the decade of the '90s. It has been transformed from simply making a decision about how to move cars and trucks from one point to another to a recognition of investment as a societal tool that has to be coordinated with other social, environmental, and economic development goals and policies."

Mr. Downey cited many challenges when dealing with the new issues that are now being presented. He concluded,

This conference ought to be the first step in creating a new process for the 21st century. We must move quickly to develop an agenda and then to implement it. The American people are looking for a responsive process. They don't want an extended period spent on research into planning issues. They want to see action, but they want to see movement in the right direction. So my challenge to you is to help develop a responsive, flexible transportation planning process that will meet the needs of the nation in the 21st century.

CONFERENCE I

Workshop Summaries

The 52 workshop products make up one of the important stand-alone products of the first conference. They are summarized in this section by grouping the subject, where possible, into the umbrella issue, the nine crosscutting issues, and the two additional categories described previously. A tally of the resulting action items and research needs follows each summary. The short summaries are presented to orient the reader to the more detailed workshop products found in Appendix A and to outline the various aspects of each issue or category.

UMBRELLA ISSUE: A MORE ROBUST PLANNING PROCESS

1. Workshop: Development of Principles for Flexible Federal Planning Regulation

Summary: The participants determined that federal regulation should be focused on protecting a narrowly defined national interest, with broad flexibility allowed for areas outside the definition of national interest.

Action items: 2

Research needs: 1

2. Workshop: How to Reintroduce Variety and Abandon the Uniform Lockstep Processes and Procedures (How to Deregulate Planning)

Summary: The participants discussed all sides of the issue of deregulation and suggested some modifications to current practices.

Action items: 0

Research needs: 1

3. Workshop: Refocusing Planning to 5- and 10-Year Regional Transportation Plans

Summary: The participants developed a problem statement and noted current practices in several states. The consensus of the group was that the refocusing should be done without changing federal regulations.

Action items: 3

Research needs: 0

4. Workshop: Outline for a Single Transportation and Environmental Planning Process

Summary: The participants concluded that a seamless process instead of a single process is required. They also determined that the barriers between planning and environmental analysis should be eliminated and that the interaction between transportation and resource professionals should be continuous and begin as early as possible. Also, respect for professional expertise should be observed with shared decision making throughout the process. Examples of the use of these principles were presented. No research items were suggested. It was noted that because FHWA and FTA are in the process of rewriting regulations, the best practices should be captured in the regulations.

Action items: 5
Research needs: 0

5. Workshop: How to Integrate Regional Transportation Planning into a Broader Environmental, Economic, and Social Context

Summary: The participants determined that there is an increasing demand that transportation plans become more like comprehensive regional plans, which cover a wide variety of projects and elements, and that in the absence of a true regional planning framework, a multiplicity of specialized and often uncoordinated plans are promulgated. Four common themes were presented.

Action items: 8
Research needs: 3

6. Workshop: How Do We Make NEPA Work as It Was Intended in Section 101 Rather Than as an Environmental Clearance Process?

Summary: The participants decided that the National Environmental Policy Act (NEPA) is not simply an environmental impact statement or a dumping ground for everything that wasn't addressed in planning, it is a process. There is a need to reinvent the ways in which agencies apply and internalize NEPA's principles, including addressing environmental concerns early in the planning process.

Action items: 6
Research needs: 9

7. Workshop: Recognizing and Remediating Transportation Harms and Disparate Impacts: Crossroads of Transportation, Environment, and Civil Rights

Summary: The participants raised a number of issues that were related to institutional training, guidance, and public involvement, and they identified impediments to action.

Action items: 5
Research needs: 2

8. Workshop: Quickly Making the Shift from Supply Side to Integrated Management and Operations (and Retiring the Grandfathered Projects)

Summary: The participants focused their discussion on how to accelerate the incorporation of new and emerging strategies into plans, programs, projects, and operating and management frameworks. They discussed at what point large, "unbuilt" capital projects should be reconsidered, weighing alternatives that may better satisfy their purpose and need or make better use of scarce resources, as well as meeting contemporary project and plan-review criteria and stakeholders' aspirations.

Action items: 5
Research needs: 4

9. Workshop: Better Integration of Air Quality and Transportation Planning

Summary: The participants listed perceived problems in the relationship between air quality planning and regulation and transportation planning, as well as some best practices.

Action items: 4
Research needs: 3

10. Workshop: Reality-Based Air Quality Conformity Requirements

Summary: The participants listed a number of problems concerning conformity requirements.

Action items: 9
Research needs: 6

11. Workshop: How Do We Improve the Identification of Environmental Resources and Priorities in the Planning Process?

Summary: The participants noted that identification of environmental resources does not always occur within the transportation or land use planning processes. They also identified a number of problems and issues related to this issue.

Action items: 22
Research needs: 6

12. Workshop: Integrating Economic Development Planning with Transportation Planning

Summary: The participants identified a number of issues involved in integrating economic development concerns into the transportation planning process.

Action items: 11
Research needs: 4

13. Workshop: Expanding the Geography of Planning: Opportunities for Regional, National, and International Planning

Summary: The participants narrowed the issues to four areas: cross-border concerns, national system planning, freight planning, and international planning. They presented recommendations for each area and proposed a need for two NCHRP syntheses.

Action items: 6
Research needs: 3

14. Workshop: Pricing in the Transportation Planning Process

Summary: The participants determined that pricing may provide the only comprehensive, long-term solution to efficient transportation capital investment and finance, yet pricing is not a topic that planners embrace easily.

Action items: 2
Research needs: 6

15. Workshop: Multimodal and Intermodal Issues

Summary: The participants covered the issues involved in the trade-off between modes and how the modes interact, both for passenger and freight movements.

Action items: 17
Research needs: 3

16. Workshop: How Do We Approach M&O in the Planning Process When We Haven't Yet Dealt Effectively with Our Existing Needs and Responsibilities?

Summary: The participants decided that the perspective on M&O introduced in TEA-21 transcends the entire transportation planning process and has implications for not only the built system but for the planned system as well.

Action items: 5
Research needs: 6

ISSUE 1: DEVELOPMENT OF A CUSTOMER- AND USER-BASED PLANNING PROCESS

1. Workshop: Who Are the Customers and How Do We Get to Them?

Summary: The participants' discussion centered on the customer and the product. There were confusion and differences of opinion concerning each issue. The consensus was that research efforts need to focus on satisfying customers and on listening to their needs.

Action items: 0
Research needs: 5

2. Workshop: Neighborhoods' Role in the Transportation Planning Process

Summary: The participants identified the neighborhoods' role and barriers to neighborhood involvement.

Action items: 10
Research needs: 7

3. Workshop: Public Involvement—How to Really Make It a Part of the Whole, Not Just Another Task

Summary: The participants identified problems and barriers to public involvement.

Action items: 2
Research needs: 3

4. Workshop: Transit—Serving Competing Customers

Summary: The participants identified competing customer groups and presented issues related to those groups.

Action items: 0
Research items: 1

5. Workshop: Outside Reviews—Why Don't They Work?

Summary: The participants listed reasons why outside reviews do not work and reasons why outside reviews can be beneficial.

Action items: 5
Research needs: 3

6. Workshop: Moving from Planning to Doing While Involving Stakeholders

Summary: The participants listed and discussed issues of involving stakeholders and the impact on implementation.

Action items: 8
Research needs: 2

ISSUE 2: LINKING PLANNING TO THE POLITICAL DECISION PROCESS

1. Workshop: Tomorrow, Today, and Yesterday: Will Officials Believe That Planners Can Plan for Tomorrow If We Cannot Describe to Them What Conditions Are Today or Yesterday?

Summary: The participants identified obstacles to building trust with public officials.

Action items: 7
Research needs: 4

2. Workshop: How Do We Do 21st-Century Planning with a 19th-Century Political Process?

Summary: The participants generated two contrasting views that involved dealing with the existing structure and seeking changes to the structure. They presented obstacles that block progress, as well as new directions.

Action items: 5
Research needs: 5

3. Workshop: Effective Communication with Appointed and Elected Officials

Summary: The participants discussed barriers to communication, positive experiences, translating outputs to outcomes, and techniques for communication.

Action items: 8
Research needs: 3

ISSUE 3: CREATING A VISION FOR THE COMMUNITY AND DEFINING THE ROLE OF TRANSPORTATION TO ACHIEVE THE VISION

No workshop dealt exclusively with this topic. The topic was raised in the resource papers and during discussion in a number of workshops that dealt with other issues; thus, it was selected as a crosscutting issue.

ISSUE 4: UNDERSTANDING THE CURRENT AND FUTURE MOVEMENT OF FREIGHT

1. Workshop: Yes, But What About Freight?

Summary: The participants determined that the freight community believes the needs of its transportation logistics and infrastructure are not understood and are generally overlooked by state DOTs and MPOs in the planning, programming, and decision-making process. They discussed the obstacles to incorporating these concerns into transportation planning more effectively.

Action items: 4

Research needs: 11

Freight issues were raised in many other workshops and in the resource papers; thus, understanding modern freight was selected as a crosscutting issue.

ISSUE 5: TECHNICAL PROCESSES, INCLUDING MODELS, ARE UNSATISFACTORY

1. Workshop: Expanding and Integrating Decision-Support Tools

Summary: The participants' discussion highlighted the need for integrating disparate management and information systems to provide the ability to make decisions among competing interests and programs.

Action items: 6

Research needs: 11

2. Workshop: Negotiating Financial Estimates

Summary: The participants discussed their experiences with this issue under ISTEA and TEA-21 and identified barriers to state compliance.

Action items: 5

Research needs: 3

3. Workshop: Throwing Out the Model and Determining Solutions Some Other Way

Summary: The participants' opinions on the need and effectiveness of models differed. They identified obstacles to the proper use of models.

Action items: 2

Research needs: 9

4. Workshop: If Not Level-of-Service and Volume-to-Road Capacity Ratios, Then What?

Summary: The participants emphasized the use of systems operations data in planning and the need for new performance measures.

Action items: 4

Research needs: 8

5. Workshop: What Should Be the New Performance Measures for Transportation Programs?

Summary: Participants discussed the need for different performance measures at different levels of government. They also presented action items for determining what data and what changes to existing data-collection efforts are needed.

Action items: 6

Research needs: 0

ISSUE 6: ROLE AND IMPACT OF TECHNOLOGY ON TRANSPORTATION

1. Workshop: Long-Range Technology Forecasting—Predicting Technological Change and Its Impact on Supply and Demand

Summary: The participants discussed two sides of the issue: (a) What are the changes in technology, and how will they affect the services and characteristics on which travelers base their decisions? and (b) How will these changes in characteristics and technologies alter the way we travel, our activities and behavior, and the demand for both personal travel and movement of goods? Also, participants identified the need for a 20-year national technology-based forecast.

Action items: 1

Research needs: 6

2. Workshop: Incorporating ITS into Transportation Planning—Issues and Opportunities

Summary: The participants determined that now that intelligent transportation systems (ITS) are moving away from the testing phase and into the mainstreaming phase, it is clear that there must be a stronger link among ITS, planning, and the operations community to realize the full benefits of ITS technology. They presented a full discussion of the issues, including the need for a common set of objectives.

Action items: 1

Research needs: 6

The role and impact of technology were mentioned in many other workshops, as well as in the resource papers; thus, this topic was identified as a crosscutting issue.

ISSUE 7: LAND USE AND TRANSPORTATION

1. Workshop: What Is the Role of MPOs in the Land Use Planning Process?

Summary: The participants developed major themes and generated several ideas. They concluded that discussion must continue about (a) the current system of local land use authority and (b) equitable representation on MPOs between urban and suburban interests.

Action items: 0

Research needs: 0

2. Workshop: Improving the Connection Between Land Use and Transportation Planning While Preserving Local Authority

Summary: The participants developed three premises, presented two policy questions, and proposed six priority areas.

Action items: 9

Research needs: 5

3. Workshop: Using Economics and Free Enterprise to Execute Land Use Plans and Sustainable Development Versus Regulation

Summary: The participants determined that marketing and regulatory simplification is needed to motivate sustainable and mixed-use development.

Action items: 7

Research needs: 7

4. Workshop: Providing Infrastructure for New Development

Summary: The participants discussed the issues related to the fact that new development is occurring, largely at the urban fringe, with no provision for the infrastructure needs of a built environment.

Action items: 8

Research needs: 8

5. Workshop: Why Do People Want to Build Homes Next to Transportation Nuisances?

Summary: The participants discussed this topic from viewpoints of the buyer, the developer, local officials, and transportation agencies.

Action items: 2

Research needs: 3

ISSUE 8: DETERMINING INSTITUTIONAL ISSUES: DO WE NEED NEW INSTITUTIONS, SHOULD WE CHANGE EXISTING ONES, OR SHOULD WE CREATE NEW RELATIONSHIPS?

This issue was raised in the resource papers and in a number of workshops but was not the subject of any particular workshop. Therefore, it was selected as a crosscutting issue.

ISSUE 9: PROFESSIONAL DEVELOPMENT

1. Workshop: Professional Development

Summary: The participants raised a number of issues about training, staffing, and education, including the lack of a manual on transportation planning.

Action items: 9

Research needs: 1

2. Workshop: How Do We Bridge the Gap Between Planners and Engineers?

Summary: The participants prepared lists of the general orientation of planners and engineers and compared them side by side. They identified common issues and suggested solutions, many of which were related to education and training.

Action items: 10

Research needs: 0

3. Workshop: MPO Capacity Building—Overcoming Barriers, Getting It Done

Summary: The participants reviewed the FHWA-funded capacity-building project and its progress. They recommended several action items to continue and accelerate the capacity building of MPOs.

Action items: 5

Research needs: 6

This issue needs also to be included in a number of other workshops; thus, this topic was chosen as a crosscutting issue.

LINKS AND ENCOURAGING SOLUTIONS OR OUTCOMES OF THE PLANNING PROCESS

In addition to the umbrella issue and the nine crosscutting issues, several workshops were grouped into two additional categories: (a) how the transportation planning process is linked with other program areas and (b) how to encourage the consideration of certain transportation solutions or outcomes of the planning process.

Category 1: Connecting Linkages of the Transportation Planning Process to Other Program Areas

1. Workshop: Ensuring Links Between Planning and Programming at State DOTs and MPOs

Summary: The participants identified impediments to effective linkage of planning and programming and suggested several organizational and regulatory approaches.

Action items: 2

Research needs: 2

2. Workshop: Destination Access—Impact of Transportation to and from National Parks and Other Public Lands on Local, Regional, National, and International Economies

Summary: The participants determined that there is a need to educate public land managers about the various transportation programs available to them and to include their concerns in the appropriate planning processes.

Action items: 11
Research needs: 8

3. Workshop: Federal Public Lands

Summary: The participants decided that managers of federal public lands must become aware of how actions of other federal agencies, states, MPOs, tourism groups, and others could affect management of public lands.

Action items: 6
Research needs: 5

Category 2: Encouraging the Consideration of Certain Transportation Solutions or Outcomes of the Planning Process

1. Workshop: Beyond Automobile Dependency—Providing Real Choice by Setting and Achieving Mode-Split Goals

Summary: The participants' consensus was that use of mode-split goals in long-range plans as a policy statement was not a good or viable idea. They identified what research would be necessary to improve the planning process and to deal with multimodal planning.

Action items: 0
Research needs: 2

2. Workshop: How to Cope with the Predominant Role of the Automobile in the 21st Century

Summary: The participants accepted the fact that the automobile will remain the largest single force in transportation. They determined that our main public purpose is to provide mobility to the population and to provide travel options in certain markets that are supported by market demand.

Action items: 2
Research needs: 5

3. Workshop: Getting Pedestrians into the Mainstream—Data, Facilities, Policy, and Land Use

Summary: The participants discussed concerns about pedestrians in the planning process, the design of facilities and developments, safety, modeling, and the great need for data on pedestrian activities.

Action items: 7
Research needs: 2

4. Workshop: If You Build It, They Will Come—Bike and Pedestrian Issues

Summary: The participants identified a number of issues dealing with the planning process's ability to predict the need for and use of bicycle and pedestrian improvements accurately. They described a number of obstacles that block effective action.

Action items: 11
Research needs: 4

5. Workshop: How to Redevelop Transportation Infrastructure in Established Areas

Summary: The participants concentrated on the issues arising from the redevelopment of inner-ring subdivisions and older neighborhoods and listed the critical issues that are confronted during redevelopment.

Action items: 4
Research needs: 6

6. Workshop: How to Deregulate Transit

Summary: The participants determined that the regulation of public transit, including bus, rail, taxi, and other for-hire transportation, imposes barriers and constrains the ability of existing service providers to offer efficient, customer-oriented services. The planning process should not assume that business-as-usual in transit should continue and that deregulation may offer dramatic opportunities to increase transit market share. They presented issues that are related to the deregulation of transit.

Action items: 4
Research needs: 4

7. Workshop: Parking—Who's in Charge?

Summary: The participants determined that the importance of parking in shaping development, urban form, and travel choices is critical and widely unappreciated. They discussed institutional issues, including the roles of developers, local governments, and state and federal policies.

Action items: 4
Research needs: 3

8. Workshop: How to Transport Luggage

Summary: The participants discussed the unique problems and the obstacles that are related to transporting luggage during the various phases of a trip.

Action items: 3
Research needs: 4

CONFERENCE I

Vision, Steps to Accomplish the Vision, and Research Needs

During the final set of workshops, the participants were asked to form 10 groups. Each group was assigned one of the 10 crosscutting issues and was asked to report on three items for each topic:

1. Present the key issues of 1999.
2. Describe the vision for 2009 after Item 1 issues are successfully addressed.
3. Describe the action steps that were used to move from Item 1 to Item 2. What happened?

A member of the conference Steering Committee was assigned as the discussion leader for each group. The groups had the following resources available to accomplish this exercise: the resource papers, copies of results of workshops that had dealt with their issues, and a list of issues and concerns that were developed during the roundtable discussion held on the previous afternoon. Because only a limited amount of time was given to the workshops, some participants were unable to complete a thorough discussion of all three items. Even so, the output was very thought provoking and provided input for consideration at the second conference in California.

The research needs identified in the resource papers, the workshops, and the visioning sessions are grouped under the umbrella issue, the nine crosscutting issues, and the two additional categories. In many instances research topics from resource papers and workshop sum-

maries contain items that fall within several crosscutting issue categories. Although some of the suggestions are redundant or apply different words or emphasis to similar issues, they all are presented under one of the 73 research topics as input to the second conference. The mission of that conference was to sort through the details of each of these research topics, incorporate the results of the national survey on planning needs, combine some topics where appropriate, and develop research statements that capture the topic's essence.

For each research topic, statements from the resource papers and the workshops are presented, along with the source of the statement in parentheses. This will allow the writers of the research statements to refer to the source of the topic for context and additional detail.

UMBRELLA ISSUE: A MORE ROBUST PLANNING PROCESS

Vision for 2009: To develop a restructured, more robust process with the following attributes:

- Faster;
- More feedback;
- Greater choices;
- More comprehensible information;
- More visual outputs;
- Connection to land use planning;

- Comprehensive planning, including sustainable planning; and
- Agile and responsive.

Steps Recommended to Meet the Vision by 2009

1. Perform a synthesis of the pieces of the planning processes that are working and producing results so that the results may be compiled and disseminated broadly;
2. Conduct pilot projects for changing or revamping regulations or institutions in transportation;
3. Sell or market the planning process to everyone by showing how the process is relevant and how it produces benefits and results;
4. Obtain a stronger commitment to planning by all agencies (respect = results);
5. Provide adequate funding, personnel, and time to restructure the process;
6. Obtain new data and new methods to present information; and
7. Monitor and evaluate the changes to make sure we are where we want to be.

Research Needs

Transportation and Economic Development

- How can the process accurately depict the fundamental relationship between economic activity and demand for transportation, taking into account the changes in the technology of production and the movement of resources and products that affect the transportation system? (Meyer)
- Develop a better understanding of the freight system and the connection between the freight system and economic competitiveness. (Neumann)
- Analyze the results of economic development-transportation investment cooperative actions (e.g., the Iowa RISE program) and whether the state infrastructure banks are the most cost-effective type of investment for economic development purposes. Evaluate the impact of changing demographics on the types of needed economic development, their location, and the demand on the transportation system and evaluate strategies to deal with situations such as cuts in transportation services. (Workshop: Integrating Economic Development Planning with Transportation Planning)

Multimodal and Intermodal

- Determine how the process can evaluate the full spectrum of multimodal and intermodal actions and

have the proper analysis tools, evaluation methods, prioritization schemes, and funding mechanisms in place to answer simple questions about how much each action will cost and what will be its impact. (Meyer)

- Develop the tools for trade-off analysis. (Neumann)

Integrating Management and Operations

- Determine what tools and processes are necessary to integrate management and operations (M&O) concerns into the planning process. (Meyer)

- Define M&O performance characteristics and evaluate the potential for development of public and private partnerships. What is the MPO's role? Research methods and processes to facilitate integrated operations. Determine approaches and systems for incorporating real-time data into M&O and institutional arrangements for MPO brokering and disseminating information about M&O. Research the development and application of management options and flexible options to the planning process within an M&O framework. (Workshop: How Do We Approach M&O in the Planning Process When We Haven't Yet Dealt Effectively with our Existing Needs and Responsibilities?)

- Develop methods for appraising the cumulative and secondary impacts of transportation projects, M&O strategies, and related transportation demand management (TDM) measures on travel, equity, land use, system performance, and environment and fiscal elements. Identify the range of alternatives to business-as-usual projects, and Transportation Improvement Programs (TIPs), including best practices. Determine M&O and transportation demand management TDM strategies. [Workshop: Quickly Making the Shift from Supply Side to Integrated M&O (and Retiring the Grandfathered Projects)]

- Determine how to develop an ITS strategy and link it to program development. (Lockwood)

- Research the new resource requirements for M&O projects. (Lockwood)

Congestion Pricing

- Analyze how the transportation planning process can catalyze the collective learning curve toward the eventual implementation of congestion pricing. (Meyer)

- Evaluate the development of public information about the potential costs and benefits of pricing, interaction of road and transit pricing, equity impacts of road pricing, and goods-movement benefits of road pricing. Develop a model of the highway finance system with road pricing, including congestion pricing, as appropriate. (Workshop: Pricing in the Transportation Planning Process)

Transportation and Sustainability

- Analyze how the transportation planning process can routinely consider the sustainability criteria. Ten criteria are listed. (Meyer)
- Evaluate how the transportation processes (systems planning and management, project planning, design and operation) reflect concerns for sustainability. Twelve proposals are listed. (Burwell)

Personal Mobility

- Describe the use of growth management strategies and transit strategies for personal mobility. (Neumann)

Funding

- Research increasing funding flexibility and innovative financing approaches. (Neumann)

ISTEA and TEA-21 Effectiveness to Promote Sustainability

- Evaluate the effectiveness of new tools that are used in ISTEA and TEA-21 to promote sustainability, including the Transportation System and Community Preservation Pilot Program, cash-out parking innovations, expanded commitment to congestion mitigation and air quality and enhancement programs, flexibility on moving funds between projects and programs, expanded commitment to intermodalism, and a charge to expand sustainable transportation technologies through ITS. (Burwell)

Integrating Transportation and Environmental Planning

- Investigate how transportation planning, environmental regulations and procedures, and project and program funding can become, over time, more integrated and less opposed to one another. (Wachs)
- Investigate and develop better environmental systems analysis tools for systems planning and for developing mechanisms for better public access. Provide a hammer and NEPA-like documentation. What areas have incorporated NEPA principles so as to make better decisions instead of better documents? (Workshop: How Do We Make NEPA Work as It Was Intended in Section 101 Rather Than as an Environmental Clearance Process?)
- Develop performance measures on environmental protection, community protection, and other environmental or community issues, data, and information on

environmental systems and design transportation with these systems. Develop a geographic information system (GIS) or model for identifying those areas in which induced growth could occur and identify cumulative impacts. Develop a synthesis of what works in conservation and in environmental protection and environmental agency activities by using the Web site of EPA Region III's Green Communities as an example. (Workshop: How Do We Improve the Identification of Environmental Resources and Priorities in the Planning Process?)

- Develop an understanding of the incremental and cumulative impacts at project and system levels. (Workshop: Expanding and Integrating Decision-Support Tools)
- Research the need to monitor, estimate, and forecast the environmental impacts of transportation strategies that involve variations in development densities, land use mixes, highway- and transit-pricing changes, and other policies that do not involve traditional capacity expansions. (Wachs)

New Environmental Concerns

- Research how the transportation planning process can handle and incorporate several additional environmental issues. Research is needed in terms of scientific understanding of fine particles to address these problems effectively in plan development. There is a need to research the contributions that regional transportation planning and investment strategies can make to control greenhouse gases and to address the reduction of CO₂ emissions in the regional planning process. Regional transportation planning methods must be improved so that concerns for water quality can be effectively integrated into the siting and design of transportation projects. What is the appropriate role of federal requirements and planning regulations in the protection of threatened species and in the recognition of the significance of biodiversity in the development of transportation plans? What can states and MPOs do to take the lead in developing methods and procedures to include biodiversity in regional transportation planning. (Wachs)

Planning Guidelines

- Analyze how planning regulations and guidelines can be streamlined to avoid duplication and delay yet maintain a focus on meeting region mobility and conformity requirements and on responding to the environmental consequences of individual transportation improvements. (Wachs)
- Develop criteria for determining national interest with clear recognition of a hierarchy of values and ways to work with them (e.g., negotiation and exemption).

(Workshops: Development of the Principles for Flexible Federal Planning Regulation; How Do We Do 21st-Century Planning with a 19th-Century Political Process?)

Environmental Justice

- Research how the direct, secondary, and cumulative effects of environmental justice considerations can be integrated into the planning process and how the seven planning factors can incorporate environmental justice requirements. (Kennedy)

- Acquire analysis tools to look at secondary and induced impact and harm. Engineers and planners need a cookbook. What is "disparate impact" and why is it a problem? (Workshop: Recognizing and Remediating Transportation Harms and Disparate Impacts: Crossroads of Transportation, Environment, and Civil Rights)

- Investigate how the planning process can be refocused on the needs of low-income populations, taking into consideration such factors as the role of subsidies; maximum use of existing transportation; coordination of transportation planning with social services; input from under-represented groups; better estimates of economic change and evolving business practices on labor markets; locational decision making and the demand for transportation services; and the review of regulatory processes and mandates for relevance, appropriateness, equity, and consistency and of impacts on innovation and enterprise. (Loveless)

Access to Jobs

- To deal effectively with access to jobs, research is needed on differences in travel patterns by gender, age, race, income, geographic location, educational or skill level, and household characteristics, including housing tenure, number of children, ages of children, marital status, number of working adults in the family, work-shift times, and number of jobs per working adult. Research is also needed on observed differences in commuting patterns between genders and among races. (Loveless)

International Practices

- Develop a synthesis of international best practices in the planning process and its implementation and international transportation barriers. (Workshop: Expanding the Geography of Planning:

Opportunities for Regional, National, and International Planning)

Air Quality

- Determine the level of air quality considerations that is appropriate to the regional or systems planning process, or both, as opposed to the level that is appropriate to specific project plans. Explore the integration of multimedia (i.e., air quality plus other environmental considerations) environmental planning with transportation plans and review success stories, not just to gain technical information about the impact of air quality but also to look into processes that created better environmental decisions. (Workshop: Better Integration of Air Quality and Transportation Planning)

DEVELOPMENT OF A CUSTOMER- AND USER-BASED PLANNING PROCESS

Vision for 2009: To develop a process that reaches out and engages or creates a dialogue with the broad public, not just with those who are traditionally involved, recognizing that there are different market segments with different needs and solutions. The process will use the following techniques:

- Market research to identify customers and customer needs;
- Service and performance standards, with customer input used for design standards;
- Customer satisfaction surveys;
- Focus groups and visioning instead of formal public meetings;
- Consumer education programs on the products of planning; and
- Engaging youth in planning for their future in partnership with the education community.

Steps to Accomplish the Vision

1. Refocus and reeducate existing staff on customer-outreach methods, including new technology;
2. Diversify staff to include market specialists and human service agencies to better reflect the community it serves;
3. Change the focus of the process from outputs to meeting customer needs and change performance measures and standards appropriately; and
4. Educate policy makers about our changing vision and what needs to be done to move toward that vision.

Research Needs

How to Engage the Public

- Investigate how to better engage the public and agencies in the planning process. Evaluate education on why it is important to be actively involved in the planning process. (Workshop: How Do We Make NEPA Work as It Was Intended in Section 101 Rather Than as an Environmental Clearance Process?)

- Use best practices on community engagement. (Workshops: How to Integrate Regional Transportation Planning into a Broader Environmental, Economic, and Social Context; Public Involvement—How to Really Make It a Part of the Whole, Not Just Another Task; Moving from Planning to Doing While Involving Stakeholders; Expanding and Integrating Decision-Support Tools)

- Align metropolitan planning and public involvement with NEPA requirements. (Workshop: Public Involvement—How to Really Make It a Part of the Whole, Not Just Another Task)

- Develop better means of communicating with and gathering information and ideas from the public and the stakeholders, especially from those with little time and resources for participation and who often benefit least and pay the highest share of their income for transportation services. [Workshop: Quickly Making the Shift from Supply Side to Integrated Management and Operations (and Retiring the Grandfathered Projects)]

- Determine techniques that are available to expand the planner's toolbox (i.e., high technology visuals and displays) and that will increase content and improve the marketing of plans, programs, projects, and operations. (Workshop: Tomorrow, Today, and Yesterday: Will Officials Believe That Planners Can Plan for Tomorrow If We Cannot Describe to Them What Conditions Are Today or Yesterday?)

Customer

- Will today's customer be the customer of the future? Are we listening to the customer? How can we do it better? Is the product we deliver what the customer asked for? Is the current regulatory scheme still applicable? (Workshop: Who Are the Customers and How Do We Get to Them?)

Neighborhood Involvement

- Develop success stories of win-win solutions to neighborhood involvement that show how neighbor-

hood input has helped the project or process. Research economic development and quality-of-life improvements achieved through transportation projects or policies and structures that are user-friendly and that support existing neighborhoods. Consider impacts on neighborhood noise and the effect of particulate matter on neighborhoods. Make sure research and best practices are disseminated to grass root organizations, such as neighborhood groups. (Workshop: Neighborhoods' Role in the Transportation Planning Process)

National Poll

- Conduct a national poll to determine public satisfaction with and desire for transportation service and community development and the public's preference for residential location. (Workshop: Public Involvement—How to Really Make It Part of the Whole, Not Just Another Task)

Outside Reviews

- Evaluate why outside reviews don't work and how can they be made to be beneficial. (Workshop: Outside Reviews—Why Don't They Work?)

LINKING PLANNING TO THE POLITICAL DECISION PROCESS

Vision for 2009: Decisions will be made at the level that is relevant to users' needs. Information that supports the decisions will be in appropriate formats, which may or may not be in documents. Fully informed communities will receive information that is sufficient to aid them in making decisions.

Steps to Accomplish the Vision

1. Perform a best practices study;
2. Describe how we do business on the basis of the best practices study;
3. Develop effective communication tools that are designed to facilitate dialogue among all parties;
4. Provide adequate resources to support the vision;
5. Beginning with joint FHWA and FTA regulations, promote flexibility, customer orientation, and community-based processes;
6. Include these principles in other federal programs; and

7. Write new planning regulations with outcome-based information for decision makers.

Research Needs

Decision Making and Information to Political Leaders

- Improve decision making and accountability; use audits, program assessments, and performance-based planning to improve political accountability. (Meyer)
- Use best practices and accessible decision making. (Workshop: How to Integrate Regional Transportation Planning into a Broader Environmental, Economic, and Social Context)
- How much influence does the information that is produced by the planning process actually have on decisions? (Workshop: How to Deregulate Transit)
- Identify relationships between transportation and various broader measures that are considered important by officials, such as real personal income. How to better perform winner-loser analyses, or when do new projects result in net regional gain even though there may be specific local loss. Identify best practices that lead to particular outcomes while accounting for state-to-state and local differences. (Workshop: Effective Communication with Appointed and Elected Officials)
- Develop the tools, methods, and data to produce information for decision makers that address the critical relationships between transportation and other elements of a healthy community and region, including the economy, environment, and overall quality of life. Such methods should produce information that can tell the story in ways that address the needs of citizens and their elected officials instead of the needs of the system. (Workshop: How Do We Do 21st-Century Planning with a 19th-Century Political Process?)
- Are there ways to shorten the turnaround time of the plan analyses, processes, and development because of the shortened average tenure of officials due to term limitations? How can planners plan more quickly? Best practices? (Workshop: Tomorrow, Today, and Yesterday: Will Officials Believe That Planners Can Plan for Tomorrow if We Cannot Describe to Them What Conditions Are Today or Yesterday?)

Political Support for M&O

- Develop a policy that understands and supports M&O. (Lockwood)

Trade-Off Analysis Techniques

- The trade-off analysis process has a technical and a political component. How can the planning process develop and communicate information that effectively characterizes the choice (a more robust planning process), and how can it provide a better forum for understanding these choices and for building consensus? (Neumann)
- Develop a history of regional plans to determine which projects and programs were delivered and how effective were the resulting investments. (Workshop: How Do We Do 21st-Century Planning with a 19th-Century Political Process?)

Strengthen Implementation of ISTEA and TEA-21

- Research strategies for strengthening political, policy, and technical implementation of ISTEA and TEA-21 criteria in updates to plans, programs, and projects. [Workshop: Quickly Making the Shift from Supply Side to Integrated Management and Operations (and Retiring the Grandfathered Projects)]

Implementation of Plans

- Create decision mechanisms that more closely tie regional transportation plans to implementation, including a toolbox of implementation programs (e.g., a revenue program, a growth management program, a service program, and a legislative program. (Workshop: How to Integrate Regional Transportation Planning into Broader Environment, Economic, and Social Context)
- What methods can be used to break down the planning activities into manageable units or increments so that planners can effectively plan interdependently with decision makers' involvement, understanding, and guidance, particularly in development of land use and multimodal transportation plans? How can cause-and-effect relationships be made more understandable? Is it important to work with an optimal number and a range of options? How do we more effectively aggregate bottoms-up plans in a cooperative manner yet bring in a discipline and expectation of some pertinent control totals? (Workshop: Tomorrow, Today, and Yesterday: Will Officials Believe That Planners Can Plan for Tomorrow if We Cannot Describe to Them What Conditions Are Today or Yesterday?)

Empowerment Zones

- Should an "empowerment zone" for transportation be established in areas in which processes, funding

restrictions, and other barriers to innovation are relaxed or eliminated? These test areas should be carefully monitored, and the results should be documented and studied. (Workshop: How Do We Do 21st-Century Planning with a 19th-Century Political Process?)

CREATING A VISION FOR THE COMMUNITY AND DEFINING THE ROLE OF TRANSPORTATION TO ACHIEVE THE VISION

Vision for 2009: Community visioning is widely practiced (institutionalized), and transportation plans support the community vision. Communities have more choices of types of transportation. New technologies, such as alternative fuel vehicles, have minimized transportation's impact on air quality. Technical tools that are used in the planning process factor in community values and outcomes. Government institutions are highly responsive to community issues and resolve problems quickly. Neighborhood-level collaborative planning is the norm. The decision-making process will include qualitative measures and alternatives according to community values. The executive order on environmental justice will be fully implemented by all federal agencies. The private sector will be encouraged through marketing or incentives to develop according to the community vision.

Steps to Accomplish the Vision

1. Bring a broader range of stakeholders into the process;
2. Improve public input processes to allow for early and meaningful input.
3. Make funding available for capacity building and for educating community groups on transportation issues;
4. Continue to provide continuing education on partnering, collaborative planning, community needs, and values;
5. Establish ombudsmen to assist communities that are harmed by transportation projects and policies; and
6. Continue to form new stakeholder and advocacy groups that effectively represent groups not previously involved, including youth.

Research Needs

Context of Community

- The transportation planning process needs to be able not only to deal with the issues of quality of life and environmental justice but also to place them in a larger context of community responsibility and values. (Meyer)

Best Practices

- Determine best practices for visioning activities. (Workshop: Expanding and Integrating Decision-Support Tools)

UNDERSTANDING CURRENT AND FUTURE MOVEMENT OF FREIGHT

Vision for 2009: To develop a successful and seamless multimodal and intermodal freight-delivery process that is capable of handling 50 percent more freight in an environmentally friendly way, with safety as the first priority and with use of technology to expedite the process.

Steps to Accomplish the Vision

1. Baseline the data today and determine the barriers;
2. Work with the freight industry to solve infrastructure development issues;
3. Work with the freight industry to share data at all levels;
4. Develop dynamic models or forecasts for at least regional models to estimate demands and develop infrastructure solutions;
5. Bring freight to the national, state, and local political tables;
6. Develop best practices from multistate coalitions;
7. Develop a national policy on freight;
8. Determine the role of the different levels of government in private-sector decisions;
9. Develop more information on small-parcel shipments: how much, how many, how often? and
10. If time and quality are critical to the freight industry, integrate these factors into the planning process.

Research Needs

Structure of the Freight Planning Process

- Develop the planning and decision-making structure for freight, including structure and public- and private-sector roles and planning approaches that involve all beneficiaries of freight improvements when they entail multistate regions, corridors, and the national level; and bring freight interests to the table. What information is required to allow freight projects to compete? Is freight planning a different process from passenger planning? If so, how can they be reconciled? (Neumann)
- Talk to the freight industry about short-term project improvements. (Workshop: Multimodal and Intermodal Issues)

- Synthesize best-good practices by identifying ways in which freight issues have been elevated in metropolitan areas and in institutional mechanisms to ensure that freight concerns are being considered adequately. (Workshop: Yes, But What About Freight?)

Tools and Process

- Develop the required data, analysis tools, and evaluation methods to better understand the freight transportation system and potential public- and private-sector improvements to the system at the national, multistate, state, and metropolitan levels. Five suggested subtopics. (Neumann) (Workshop: Multimodal and Intermodal Issues)

- Develop a national and international freight-flow model as a tool for decisions on national freight transportation policy. Develop tools to assist in evaluating, prioritizing, and trade-off analysis of freight projects. This includes full (externalities) economic benefits and costs of projects, which involves dedicated freight facilities and freight-mode shifts, obstacles to freight-mode shifts, the role of pricing as it affects freight and shipping decisions, and how pricing can be used to achieve other public policy goals (e.g., air quality). (Workshop: Yes, But What About Freight?)

Synthesis on the Domestic Waterway Industry

- Develop a synthesis of best-good practices that identify incentives to bring representatives of the domestic waterway industry to the state and the MPO table. (Workshop: Yes, But What About Freight?)

Containerization for Inland Waterways

- Assess the potential for containerization on the inland waterway system. (Workshop: Yes, But What About Freight?)

TECHNICAL PROCESSES, INCLUDING MODELS, ARE UNSATISFACTORY

Vision for 2009: Visualization models like SIMCITY and virtual reality will replace or supplement current models. Our tools will measure real community outcomes according to more user input. New sketch planning tools will be able to better illustrate the "big choices." The air will be clean, and there will be fewer,

more flexible regulations. Planning technical staffs will be well trained, and salaries will be competitive with those of software engineers.

Steps to Accomplish the Vision

1. Invest in the development of visual tools (SIMCITY, virtual reality);
2. Develop the analytical engine to link transportation to other community outcomes, such as land use, economic equity, and environmental issues;
3. Invest in professional development and higher salaries;
4. Make TRANSIM more user-friendly;
5. Develop new sketch-planning methods;
6. Inventory the issues that the technical processes need to address; and
7. Develop models that address risk.

Research Needs

Demographic Changes

- How can the process accurately predict the impact of the following demographic changes: increasing immigration, higher household incomes, and aging of the population? (Meyer)

Technical Tools for Integrating M&O

- Develop the necessary technical tools and data to mainstream M&O into the planning process, including codified costs and benefit data for a range of ITS improvements and applications; a set of agreed-on evaluation criteria; first-generation, order-of-magnitude, travel-behavior impact of ITS services; and behavior-based simulation techniques. (Lockwood)

- Develop a model for transitioning from planning a build environment to planning a management environment. What skills will be needed to manage transportation from a planning perspective? Reexamine the role of demand management in the decision-making process. Research state-of-the-art analyses to see what others are doing in areas in which capacity expansion is not an option. (Workshop: If Not Level-of-Service and Volume-to-Road Capacity Ratios, Then What?)

- Need tools for benefit-cost evaluation. How does ITS affect multimodal travel choices? Include life cycle costing. (Workshop: Incorporating ITS into Transportation Planning—Issues and Opportunities)

Using ITS Data

- Capitalize on ITS data for planning purposes. (Lockwood)
- Are current activities that are related to use of ITS data as a resource for planners comprehensive enough? Does more research need to be done? (Workshop: Incorporating ITS into Transportation Planning—Issues and Opportunities)

Indicators and Performance Measures

- Identify an appropriate set of indicators and proper ways to measure each indicator. Several examples are listed. Research should include best practices at neighborhood, community, regional, state, and national levels; how to integrate the indicators over different geographic scales; and how to integrate sustainability indicators with other indicators (e.g., social, economic, environmental). (Burwell) (Workshop: What Should Be the New Performance Measures for Transportation Programs?)
- Identify performance measures for new elements of the transportation picture—13 new measures suggested. (Workshop: If Not Level-of-Service and Volume-to-Road Capacity Ratios, Then What?)

Models for Sustainability

- Research models to promote sustainable transportation planning, including best practices in use of policy-sensitive models; use of pedestrian and bicycle environmental factors; modeling for nonplanners; and integration of models (e.g., subdivision, neighborhood, community, region). (Burwell)

Models for Access to Work

- Travel-demand models and trip-generation models are inadequate when dealing with the issue of access to jobs. Research is needed to enable models to differentiate on the basis of detailed demographic and household characteristics and the effect of travel mode on the number, duration, and type of stops. Eight data categories and research needs are listed. (Loveless)

Model Accuracy and Improvement

- Improve modeling accuracy by developing better information and realistic assumptions for use in the modeling process, for example, freight needs and trans-

portation modes that are vital to economic development. (Workshop: Integrating Economic Development Planning with Transportation Planning)

- Develop an analytical model that begins with goals or objectives. Strategies would be used to develop policy. Performance would be defined by desired outcomes. Define how quality-of-life measures can be used as a coefficient to evaluate transportation projects. (Workshop: If Not Level-of-Service and Volume-to-Road Capacity Ratios, Then What?)
- Develop a model that considers all modes, measures the effect of the interaction of land use and transportation, and recognizes public desires. If these measures prove too expensive, other tools endorsed by the federal government and the planning community are needed. What tools other than the model have been used effectively in major investment studies (MIS) or in project alternative analysis? (Workshop: Throwing Out the Model and Determining Solutions Some Other Way)

Air Quality Models

- Conduct research on different aspects of air quality analysis, including nonmodeling ways of addressing air quality conformity issues; more data on model emissions and ambient air quality; more disaggregated emissions models; methods that are being implemented that actually reduce emissions; and the affects of diesel engines other than heavy-duty trucks. (Workshop: Reality-Based Air Quality Conformity Requirements)

Macroscale and Sketch Planning

- Develop macroscale tools that can support program allocation and make multiobjective trade-offs. (Workshop: Expanding and Integrating Decision-Support Tools)
- Develop more sketch-tool methods and update quick-response modeling. Try new tools such as benchmarking, visual preference surveys, and market research surveys. (Workshop: Throwing Out the Model and Determining Solutions Some Other Way)

Data Issues

- Identify approaches to integrate national, state, and local databases, as required. Catalog public and private data resources and identify barriers to obtaining such

information. Determine what data are needed to support decisions that consider new variables for enlarged planning questions. Identify guidelines for collecting data and common criteria for evaluation. (Workshops: Expanding and Integrating Decision-Support Tools; If Not Level-of-Service and Volume-to-Road Capacity Ratios, Then What?)

Cooperative Revenue Forecasts

- Develop a synthesis of the development of cooperative financial forecasts and of solutions to the institutional and policy obstacles to the development of cooperative revenue forecasts. Develop or adapt methods of quick-response revenue forecasting. (Workshop: Negotiating Financial Estimates)

- Identify strategies for MPOs to use when dealing with state DOTs, with an emphasis on cooperative revenue forecasting. (Workshop: MPO Capacity Building—Overcoming Barriers, Getting It Done)

Induced Travel

- Develop ways to measure and account for induced travel. (Workshop: Throwing Out the Model and Determining Solutions Some Other Way)

Better Pedestrian Models

- Develop better, more cost-effective pedestrian models. (Workshop: Throwing Out the Model and Determining Solutions Some Other Way)

ROLE AND IMPACT OF TECHNOLOGY ON TRANSPORTATION

Vision for 2009: Technology will change the modes that are used for transportation, making them more efficient and integrated, as well as the amount, time, and location of travel demand. The planning process will make more information available and will deal with more integrated systems. It will need to deal with a world in which the following situations exist:

- Virtual offices with interactive television;
- Integrated home and work space;
- Social and recreational trips and deliveries are the more important trip objectives;
- Increased air travel;
- Regional high-speed rail travel;

- Increased oil prices, which will necessitate gasoline-efficient cars;
- More international travel;
- Company involvement in the transportation needs of employees;
- Continued inadequate mode of travel for the poor;
- Global economy with nonvirtual production (developing countries) and virtual service;
- Two-tiered economy with increased disparity;
- Workers closer to work, and production moving to workers; and
- Privatization of services.

Highways:

- More electric vehicles;
- Vehicles with self-diagnostic emission detectors;
- More fleet-maintenance capability;
- In-vehicle technology;
- Real-time information;
- Accident-avoidance systems in vehicles;
- Linkage between the highway and the vehicle;
- Incident management;
- Integration of road systems among states, among jurisdictions, and at international borders;
- Increased enforcement;
- More automated toll collection (fewer toll booths).
- More HOV lanes.

Freight:

- Greater emphasis on small-package deliveries and just-in-time delivery,
- Impact on land use resulting from reduction in the need for warehousing, and
- On-line shopping and community delivery systems increasing with the need to locate pickup areas as one of the planning issues.

Transit:

- More integration of services and more demand-responsive transit for specialized uses with increase in information,
- Smart buses with increased efficiency,
- Increased use of commuter rail with improved management, and
- No greater mode share.

Railroads:

- Increased use with larger trains and the need to add tracks,
- High-technology trains, and
- More integration with other modes.

Multimodal:

- Better integration among modes—everyone will get the same information on travel conditions; and
- Integration with police, fire department, and emergency medical services.

Steps to Accomplish the Vision

1. Estimate changes due to technology in travel behavior or patterns by social group or customer type, with consideration of changes in demographics, socioeconomic factors, the global economy, and environmental factors;
2. Encourage development of safer, less impact, and more efficient vehicles;
3. Develop improvements to the planning process to deal with implementation and integration of services and operations, institutional changes, technological choices, a shift to performance measurement of customer satisfaction, and changes in consumption choices of transportation;
4. Integration among modes and commodity movements;
5. Broaden scale and scope of planning to include a system perspective; a seamless transportation system; and reduced effects of political, institutional, and legal boundaries;
6. Consider changes in long- and short-haul freight movement and the resulting changes in land use;
7. Plan for increased participation of the private sector in the planning process and in the provision of services;
8. Emphasize the cooperation in the 3C process through public-public and public-private partnerships, including public funding of private projects;
9. Broaden the process to include nontraditional technologies with programs so as to fund beneficial technologies and tools and evaluate the benefits and impacts;
10. Create a larger role for facilitating partnerships—move out of the regulatory role into a leadership role;
11. Better define the private sector's role; and
12. Research the thresholds of technology: What can technology do?

Research Needs

How to Estimate the Impact of Technology

- Identify transportation planning needs to anticipate the application of ever more advanced technologies in system operation, including the compatibility of infrastructure and systems design with the ITS national archi-

ture, as well as identify operational improvements that include ITS strategies. (Meyer)

- Determine the likely technological changes and identify how they will affect system characteristics on which people make their travel decisions? How will changes in communication and other technologies affect the activities and demand for travel by societal segments or cohorts? How will each societal segment or cohort use technology and the difference in penetration histograms? How can data classifications and techniques be adjusted to account for new technologies? How can the impacts of rapidly changing technology be incorporated into local planning and decision making, and how can national technology-based conditions be adjusted to local conditions? How will costs to public and private providers and users change over time? A 20-year national technology-based forecast and a national inventory of existing public-sector technology and its characteristics are needed. (Workshops: Long-Range Technology Forecasting—Predicting Technological Change and Its Impact on Supply and Demand; Incorporating ITS into Transportation Planning—Issues and Opportunities)

Environmental and Sustainability Consequences

- Research technology and planning for sustainability. Research the effect of computing power, ITS technology, and expanded consumer choice and the effect on consumer behavior. Research operations performance of public transit on sustainability. (Burwell)
- Develop the capacity to understand and forecast the environmental consequences of ITS improvements on existing and new facilities. (Wachs)

Information Transfers

- While great amounts of money are expended on forecasting travel, often resulting in environmental consequences at the metropolitan level, similar capacities should be developed to (a) forecast information transfers from one locale to another, (b) incorporate the flow of information as significant causal determinants of regional travel patterns, and (c) estimate the environmental consequences of these changes in telecommunications patterns and in the urban form and travel patterns that they will engender. (Wachs)

Air Quality Impact of Technology

- Environmental consequences of transportation are determined more by technology than by physical plans. How can regional plans to meet federal air quality

requirements integrate technology measures more effectively with land use, management of travel demand, and transportation capacity measures? Can the process of preparing State Transportation Improvement Programs (STIPs) be integrated into substance, content, and time with regional long-range transportation plans? (Wachs)

LAND USE AND TRANSPORTATION

Vision for 2009; Land Use—A New Dawn. There will be a better understanding of the value of appropriate infill and redevelopment strategies and the impacts of unplanned development on the urban fringe.

Steps to Accomplish the Vision

1. Recognize the need to modify building and subdivision codes;
2. Better understanding and connection between regional and local planning;
3. Incorporate the needs of major industries;
4. Harmonize the planning of large economic development projects with the planning process;
5. Better understanding of the cost impact of development and communication with developers and decision makers to encourage appropriate infill and minimize unplanned fringe development; and
6. Create tools to help shape development:
 - Require that infrastructure be in place, planned, or provided in areas where development is planned,
 - Provide transit and pedestrian access for major developments,
 - Coordinate parking policies with regional transportation goals,
 - Enhance development activities around major transit facilities,
 - Establish siting processes for locally undesirable land uses,
 - Estimate demand for industrial uses,
 - Establish more accurate estimating or modeling for freight and transfers,
 - Measure the economic impact of major development on local and regional areas, and
 - Develop special exception zoning for major development.

Research Needs

Planning Process

- Decision makers are developing more stringent approaches to development decisions—they want

transportation policies to be conducive to their overall goals and transportation agencies to be part of the team. This action may require a very different role for the transportation planning process. (Meyer)

- Examine the role of comprehensive planning in integrating transportation and land use planning at the community level. (Burwell)
- Develop improved analytical ability and tools to help MPOs demonstrate the benefits to localities of regional growth management. Include a better understanding of why sprawl exists and why local areas compete for growth. Develop tools to define and visually portray what smart growth looks like. (Workshops: Improving the Connection Between Land Use and Transportation Planning While Preserving Local Authority; What is the Role of MPOs in the Land Use Planning Process?)

Redevelopment

- Can economics and free enterprise execute land use and sustainable development as opposed to regulation? Identify the kinds of businesses that have higher success rates as part of redevelopment projects and identify why. Examine regulations and identify barriers to sustainable development. Identify economic and fiscal benefits to sustainable development from the private-sector perspective. Identify environmental barriers to redevelopment and how to mitigate them. Determine positive financial actions to encourage sustainable development. Conduct market research to identify the kind of campaigns that could change buyers' perceptions about the desirability of sustainable development. Research the development of excellence with homebuilders and developers. (Workshop: Using Economics and Free Enterprise to Execute Land Use Plans and Sustainable Development Versus Regulation)

- What tools are needed to analyze the redevelopment potential of existing neighborhoods? What infrastructure design standards are appropriate for established neighborhoods? Can they be flexible? How can one retrofit established areas to achieve bicycle, pedestrian, and efficient transit accessibility? Who should market transportation alternatives? What are the best practices? What land use controls can be beneficial to redeveloping established areas? Who should be at the table? How can transportation funding be linked to neighborhood priorities? (Workshop: How to Redevelop Transportation Infrastructure in Established Areas)

New Development

- Provide infrastructure for new development and develop guidelines to support multimodal infrastructure needs of developing areas. Provide examples of best and

worst cases with cause-and-effect relationships. Update functional classification systems, including the incorporation of multimodal needs. Can techniques such as zoning, funding methods, determination of total costs, and total trip generation help? (Workshop: Providing Infrastructure for New Development)

Land Use Near New Infrastructure

- Develop guidelines for municipalities, realtors, and homebuyers on residential locations in areas planned for new infrastructure. Investigate the success of incentive programs for short home-to-work commutes, infill development in urban or transit-served areas, and location-efficient mortgages. Determine the effectiveness of public outreach. Research the relationship between long-range planning and zoning and factors that affect the choice of location for new homebuyers. (Workshop: Why Do People Want to Build Homes Next to Transportation Nuisances?)

DETERMINING INSTITUTIONAL ISSUES: DO WE NEED NEW INSTITUTIONS, SHOULD WE CHANGE EXISTING ONES, OR SHOULD WE CREATE NEW RELATIONSHIPS?

Vision for 2009: The region (metropolitan and nonmetropolitan) has a multifunctional vision developed by a public or private consortium that can guide the transportation program. There is a public or private, service-oriented, customer-driven umbrella organization of transportation, as well as other organizations with linked implementation programs, that can manage large quantities of input from diverse sources. The umbrella organization will be a virtual institution, a network of organizations that link the affected parties. There will be linked implementation programs, not just plans, with milestones, responsible parties, funding, and regulatory and legislative goals. There will be partnership memoranda of understanding that will be up-to-date, clear to the public, and capable of promoting accountability both politically and to the customer. The organizations will be doing, not talking.

Steps to Accomplish the Vision

Some organizations are currently evolving into this model, such as TRANSCOM in the New York metro area. This organization began as a public-information-sharing organization and is now a not-for-profit organization. A study of the evolving organization models should be conducted, possibly in coordination with the new paradigm study under TCRP.

Research Needs

New Cooperative Relationships

- Develop an integrated regional approach to the need for new cooperative relationships, vertical and horizontal, among potential service providers. (Lockwood)

Institutional Roles and Responsibilities for Sustainability

- Investigate institutional roles and responsibilities for sustainability for federal, state, MPO, nongovernmental organizations, citizens, and environmental agencies in promoting sustainable development in the transportation planning process. (Burwell)
- Study how governance institutions are changing and reforming to respond to the challenges of new growth. This change should be authoritative instead of anecdotal. (Workshop: How Do We Do 21st-Century Planning with a 19th-Century Political Process?)

Best Practices

- Research best practices for becoming a "green" state DOT. (Burwell)

Internalize NEPA

- How have transportation agencies internalized NEPA's principles into their business decisions? Pennsylvania is an example. (Workshop: How Do We Make NEPA Work as It Was Intended in Section 101 Rather Than as an Environmental Clearance Process?)

Work Across Modes and Organizations

- Develop methods for working across modal and organizational functions and for supporting internal efficiency measures. (Workshop: Expanding and Integrating Decision-Support Tools)

PROFESSIONAL DEVELOPMENT

Vision for 2009: There is an adequate supply of multidisciplinary planners. All planners are skilled and use an open, collaborative planning process. A structured, professional development program (curricula, sites, and instructors) is in place. Academic planning curricula are expanded, improved, and coordinated. A professional

pipeline is in place. Other transportation staff, managers, executives, and the public have a basic understanding of the planning process.

Steps to Accomplish the Vision

1. Obtain industrywide commitment to developmental programs;
2. Lead taken jointly by USDOT, the American Association of State Highway and Transportation Officials (AASHTO), and the Association of Metropolitan Planning Organizations (AMPO);
3. Obtain adequate funding to pay staff and for fund-development programs, including internships;
4. Develop, implement, evaluate, and document development programs;
5. Promote rotations throughout the industry;
6. Create a professional association for transportation planners;
7. Develop and implement outreach programs on the planning process for the public and executives;
8. Develop continuing education programs for planners; and
9. Develop academic curricula for planners.

Research Needs

Software and Expert Systems

- Because critical estimates of travel outcomes and the implications of conformity in alternative land use and transportation plans require rather sophisticated mathematical modeling and because the ability of MPOs to perform such analyses is extremely uneven, it may be necessary for the federal government to develop, package, and disseminate advanced software packages that would permit MPOs to conduct appropriate and accurate forecasting as part of the regional planning process. Such a program may be coupled with a federally sponsored training program in land use, transportation, and emissions modeling, with peer review of the modeling capabilities of designated MPOs. (Wachs)

- Develop a planning "expert" system. (Workshop: Professional Development)

International Information

- Develop a better flow of information on international regulations, activities, planning, and data. (Workshop: Expanding the Geography of Planning—Opportunities for Regional, National, and International Planning)

Capacity Building for ITS

- Provide professional training and capacity-building courses for specific groups, planners, decision makers, and the public. There are federally sponsored, professional capacity-building courses that relate to incorporating ITS into transportation planning and a course that is related to the ITS architecture. How can we bridge the gap between the two? (Workshop: Incorporating ITS into Transportation Planning—Issues and Opportunities)

MPO Capacity Building

- Continuing from the current MPO capacity-building project that is funded by FHWA, research federal support of other organizations as a context for permanent funding for an AMPO that serves all MPOs. Summarize the conditions that are attached to the non-federal match for MPO planning funds. Explore how AASHTO funded and developed its transportation-planning manual, and how it has managed to make it the Bible of USDOT planning programs. Investigate updates on MPO characteristics and practices, such as organizational structure, representation, and weighted voting. Consider the role of MIS. Evaluate GIS packages to meet new needs, such as Title VI and environmental impacts, and communicate easily with citizens and public officials. Track the progress of TIP projects. (Workshop: MPO Capacity Building—Overcoming Barriers, Getting It Done)

Public Lands Manager

- Educate public land managers about TRB and FHWA publications, research, and other services. (Workshop: Destination Access—Impact of Transportation to and from National Parks and Other Public Lands on Local, Regional, and International Economies)

CATEGORY 1: CONNECTING LINKAGES OF THE TRANSPORTATION PLANNING PROCESS TO OTHER PROGRAM AREAS

Research Needs

Engineers and Planners

- Incorporate system engineering and operations planning. (Lockwood) (Workshop: How Do We Bridge the Gap Between Planners and Engineers?)

Planning and Programming

- Examine the effective linking of planning and programming, including best practices. Evaluate the institutional, administrative, and financial prerequisites of success. Evaluate tools and methodologies that have been used successfully to establish and maintain links. Update the synthesis of multimodal financial forecasting. What are the elements of a successful planning and programming process at both state and MPO levels? Clarify the state role in MPO planning and programming with recommended regulatory enhancements, if necessary. (Workshop: Ensuring Links Between Planning and Programming at State DOTs and MPOs)

Destination Access

- With regard to destination access to national parks and other public lands, investigate strategies and best practices for managing visitation and disseminate the results to park managers. Include experiments for pricing entry and transportation, fee-free days, and transit shuttle systems, and for establishing park or refuge areas. Evaluate carrying-capacity thresholds for management action. Research pedestrian and bikeway facilities to link multi-jurisdictional destinations and transit systems. (Workshop: Destination Access—Impact of Transportation to and from National Parks and Other Public Lands on Local, Regional, and International Economies)

- Research a national GIS layer of federal public lands to be available for federal, state, and local transportation planners. Assess the need for an organizational structure that could provide rural areas with a corresponding MPO-type of coordinating organization. Create a best practices document. Document the economic benefits to local communities on federal public lands from improved transportation-transit systems and identify the potential impacts of transportation-transit changes on the resource values of federal public lands. (Workshop: Federal Public Lands)

CATEGORY 2: ENCOURAGING THE CONSIDERATION OF CERTAIN TRANSPORTATION SOLUTIONS OR OUTCOMES OF THE PLANNING PROCESS

Research Needs

Trip Capture

- Provide better information about what can be expected (in terms of trip “capture”) from various

modes and what kind of basic conditions or service levels are assumed or needed to realize these figures. This need should also address expectations from service investments. Transportation-planning models need to be more sensitive to level of facility “quality connectivity” and to service levels for bicyclists, pedestrians, and transit. (Workshop: Beyond Auto Dependency)

- Develop a “great model” that addresses bicyclists’ and pedestrians’ needs and distribute the model to states, consultants, and academia. (Workshop: If You Build It, They Will Come—Bike and Pedestrian Issues)

Discourage Automobile Travel

- Research ways to further tap the potential of carpooling as a transportation strategy (benefits of automobile use with higher efficiency). Design factors that better integrate the automobile into livable communities. Design a congestion-pricing demonstration to show how it really works. Research how to effectively plan and design car-based intermodal connections effectively (for trips with at least one leg by auto). Evaluate effective alternatives in an automobile-dominated environment. (Workshop: How to Cope with the Predominant Role of the Automobile in the 21st Century)

Data on Pedestrians and Bicycles

- Research comprehensive data on pedestrian use, projected use, and safety, collecting pedestrian data by the U.S. Census, the Nationwide Personal Transportation Study, and the Bureau of Transportation Statistics. Include linked pedestrian trips. Also, develop programs to collect these data at the regional and local levels. (Workshop: Getting Pedestrians into the Mainstream—Data, Facilities, Policy, and Land Use)

Synthesis of Pedestrians and Bicycles

- Develop state-of-the-practice when dealing with issues that concern pedestrians and bicyclists, including newly programmed projects, before-and-after scenarios that show induced travel, state-of-modeling work done to date, effectiveness of improving safety (intersections), comfort of pedestrians (benches, shading), and bicycling facilities. Document the connection between pedestrian and bicycle travel and public health and the social benefits of providing facilities for such travel. (Workshop: If You Build It, They Will Come—Bike and Pedestrian Issues)

Deregulate Transit

- Research transit to quantify the effect of regulations on barriers to market entry and to modify and customize service so as to meet current and emerging transportation requirements. Conduct case studies of areas that are developing public and private partnerships, such as in Detroit. Evaluate the use of ITS technologies for improving fleet-service management with real-time dispatching, an existing “ombudsman” broker, or one-stop shopping initiatives for businesses that need help with transportation issues. (Workshop: How to Deregulate Transit)

- Evaluate transit that serves competing customers and determine what is and what is not working. Under what circumstances should certain actions be tried, and what must be done when best intentions are not enough? Determine best practices. (Workshop: Transit—Serving Competing Customers)

Parking

- Research the use of parking for both transportation and land use purposes, including the impact of shared parking and understanding lender attitudes and the link between parking and ITS. (Workshop: Parking—Who’s in Charge?)

Luggage

- Research transportation of luggage. Determine needs. Design a tracking system that allows luggage to be sent ahead and provide a chain-of-control method that uses stable carts, which fold up to allow them to be carried on buses, to complement the tracking system. Integrate consideration for package transportation in each mode that is analyzed. (Workshop: How to Transport Luggage)

CONFERENCE I

Summation and Conclusions

The last major conference on planning, which was held in Charlotte, North Carolina, in May 1992, was concerned with many of the same issues that were discussed at Conference I, but as noted previously, the context of today's issues is different. We have the benefit of 6 years of experience under ISTEA, and there are a number of new issues confronting the planning processes that were identified in Washington. The Charlotte conference was followed up by a number of specialized conferences held during the past 7 years that dealt with such subjects as statewide planning, major investment studies, data needs and methods, institutional issues, intermodal, programming, financing, demand forecasting, and large cities and congestion management. Similarly, Conference I will be followed up by a number of specific conferences that will address the major issues raised here in more detail.

The chair of the Charlotte conference noted:

Ten years or so from now the participants at the next urban transportation conference will refer to the Charlotte conference as another milepost at which innovative approaches were adopted and the art and science of urban transportation decision-making was moved one step further in its evolution....The major obstacles have rarely been technical issues. The more difficult and vexing challenges have always been the institutional ones of achieving effective decision-making among different advocacy groups and power

sharing among federal, state and local elected officials and bringing together and synthesizing vastly different sets of values and priorities.

The Washington conference and the follow-up conference in California will also be viewed as another milestone in about 10 years. Not only will a National Agenda for Transportation Planning Research have been established, but a number of new and very complex issues will have been raised for discussion and resolution. If anything, the pace of change and the challenges to the planning process have accelerated since the Charlotte conference.

Several commonalities and differences are evident when comparing the results of the Washington conference with past conferences.

COMMONALITIES

- At all conferences that date back to the late 1950s, the relationship between land use and transportation was one of the key issues for action and research. Yet, the results from each subsequent conference recognized that not much progress had been made in this area. There was optimism this year, given some of the smart growth initiatives that were proposed or are underway in some states and the success of growth-limitation initiatives in the 1998 elections. However, there is still

concern about the ability of these initiatives to influence, in the long run, what is essentially a home-rule, local political decision process at the local level. At a minimum, the level of political discussion has been raised since past conferences.

- The basic 3C planning process is still the framework for current planning processes. TEA-21 continues the planning requirements of past legislation, but coordination is extended to include an ever-widening list of stakeholders. The number of items that are considered comprehensive continues to grow, not only with regard to transportation but including the impact of transportation on the human and natural environment.

- All conferences have been concerned with the linkage of the planning process to the implementation of projects. In the Washington conference it was recognized and emphasized that the planning process must be relevant to the political decision-making process and that political leaders were customers of the process.

- The planning requirements and the resulting planning processes must be flexible to meet the needs of vastly different states and metropolitan areas.

- Professional development has not kept up with the changing demands and with the new issues that must be considered.

DIFFERENCES

- At the 1992 conference in Charlotte much attention was focused on the products of the planning process (plans, transportation improvement plans, management systems) and on the regulations that were issued that prescribed content, dates, and process to meet these requirements. This attention was understandable given the revolutionary nature of the then recently passed ISTEA legislation. At the Washington conference, less attention was focused on regulations and products, while most of the attention was focused on improving the effectiveness and inclusiveness of the planning process and the process's ability to handle new issues or to increase emphasis on old issues.

- Adequate financing of transportation improvements is always an underlying concern. Most planning studies show that needs are greater than available resources. Yet, at this conference, the underlying need for funding was not one of the major issues raised, although it was recognized.

- The planning process should be concerned with community outcomes, not just transportation outputs.

- The process should be customer- and user-based, not just facility-based.

- The availability of information and information technology will be a major driving force in changing the transportation system and the planning process.

- Transportation technologies will change both the provision of transportation services as well as the demand for transportation.

- Transportation and planning institutions may need to change to meet some of the new challenges.

- The planning process must be in sync with the timing, structure, and language of the political process.

- Federal legislation and regulations are not the major driving forces for developing an effective planning process; rather the flexibility exists for developing a planning process that serves federal, state, and local needs—"It's not the Feds, it is us." The exception is the regulations on air quality issues.

CONCLUSIONS

- There is agreement that the future transportation planning process should be nested in and be coordinated with or guided by a larger regional or community vision or planning effort. It is also agreed that the planning process should describe community outcomes of transportation actions. Where and how this vision is created and its status is probably a local option. The role of transportation planning should be to serve the larger vision.

- There is agreement on some of the characteristics of a new, more robust planning process. These characteristics are summarized in Vision, Steps to Accomplish the Vision, and Research Needs, p. 19.

- There is agreement that a "one size fits all" planning process does not exist and that different areas have different needs, community values, and issues. The ultimate technical planning process may be modular so that the different areas can plug in the elements that are relevant to their particular situation. Perhaps one mission of the research agenda is to prepare the modules and the overall framework similarly to the intelligent transportation system architecture.

- There is a strong message that many people—customers, political leaders, elected officials, students, policy makers, and transportation officials—do not understand the planning process and what the process can do for (or to) them. One of the major efforts coming out of this conference could be a public information campaign on the transportation planning process.

- There is a strong message that the outputs of the process need to be more understandable and user-friendly. Also, the development of interactive techniques, such as SIMCITY and virtual reality, may be the models of the future because of their user friendly outputs, their ability to do interactive planning with a large number of stakeholders, and their ability to show outcomes to political leaders quickly.

- There is a sense that some of the current activities that require large amounts of staff time will or can be solved by

technology (e.g., air quality) and that planning efforts can and should be channeled to other parts of the process.

- There is agreement that the role of technology will affect both the amount and nature of travel as well as the availability of technological solutions to transportation problems, but the magnitude and impact of these changes is not known and is not currently incorporated into the planning process.

- There is a need for a structured, well funded professional development program for transportation professionals and stakeholders in the process.

- There is a concern that there is not a buy-in to the planning process from a variety of interests that are key to transportation decision making. This concern exists within our transportation agencies as well as within outside groups. It is particularly evident in the political arena; evidence of this is can be observed in the increasing earmarking of funding by legislative bodies.

Underlying the discussions and research needs that were developed at the Washington conference are a

number of policy questions that require serious discussion over the next several years.

- Given all the demands that the planning process be more comprehensive and more coordinated yet be agile, quick, and relevant to short-term decision making, is it really possible to do all these things in the next 10 years? What are the alternatives? Will comprehensiveness conflict with relevancy, quickness, and agility?

- Given the rapid changes in technology that affect both transportation facilities and services and also the demand for transportation, will technology solve some of the problems so that the transportation planning process can concentrate on other problems?

- Given the future visions developed at the Washington conference, are our current institutions and organizations properly structured to handle the rapid pace of change that is predicted 10 years from now? The 1992 Charlotte conference raised a number of institutional concerns. Since then, these concerns appear to be increasing instead of being solved.

Conference I Resource Papers

Refocusing Transportation Planning for the 21st Century

**Mainstreaming Management, Operations, and Intelligent
Transportation Systems into the Planning Process**

**Integration of Intermodal and Multimodal
Considerations into the Planning Process**

Transportation, Sustainability, and Land Use

**Linkages Between Transportation Planning and
the Environment**

**Environmental Justice and Where It Should Be Addressed
in the 21st Century Concerning the Transportation Industry:
Historical Perspective and Summary**

**Access to Jobs: Intersection of Transportation, Social, and
Economic Development Policies—Challenge for
Transportation Planning in the 21st Century**

CONFERENCE I KEYNOTE ADDRESS

Refocusing Transportation Planning for the 21st Century

Michael D. Meyer, *Georgia Institute of Technology*

The world moves into the future as a result of decisions not as a result of plans.

—Kenneth Boulding

The primary purpose of transportation planning, at its most fundamental level, is to provide information to those responsible for improving the transportation system and ultimately to benefit society as a whole. For the past 40 years, transportation planning has changed in process and substance to reflect the different issues and concerns that have risen to the top of federal, state, and local policy agendas. This evolution has reflected a broadening perspective on what constitutes a transportation system (e.g., modal, multimodal, and intermodal definitions); the types of actions that should be taken to “solve” our problems (e.g., capacity expansion, system management, demand management, and the application of advanced technologies); and an expanding definition of benefit measurement (e.g., quantitative system measures, societal costs, and sustainable development).

The federal government has played an important catalytic role in introducing new perspectives into the decision-making process. State and local policy concerns have also found their way into planning norms. Concern for environmental and social impacts, a desire for more equitable funding distribution among modes of transportation (i.e., substitutability), and the promotion of a more open and involved planning process were state and local policy issues that eventually became codified in federal regulations. The most tumultuous period of such questioning of the transportation planning process is described in a report by Gakenheimer (1). This paper

examines the future context of transportation planning and suggests areas in which today’s transportation planning must change to reflect tomorrow’s exigencies. The basic point of departure for this paper is that the transportation planning process, to be relevant to future decisions, must reflect the changing demographic, technological, environmental, and economic factors that will greatly influence lifestyles and future travel. To examine each of these factors in detail would itself require numerous conferences and lengthy treatises, certainly more attention than can be allowed in this paper. However, as we enter the 21st century, there are several clues that suggest some of the key issues that will be faced by transportation decision makers over the next 20 years, and thus, these issues should be reflected in the planning process. In some cases, these clues are found in historical trends that have consistently shown patterns of likely travel behavior. In other cases, the novelty and rapidity of change preclude any prediction on the basis of observable historical fact, thus leaving us with a best guess of likely changes and resulting consequences.

EVOLUTION OF TRANSPORTATION PLANNING ISSUES: BRIEF HISTORY

When contemplating the future of transportation planning, it is perhaps instructive to first examine how transportation planning has evolved over the past 40 years. A

detailed history of transportation planning is provided elsewhere in this conference; therefore, it is not repeated here. However, in the context of this paper, an examination of previous professional efforts in refocusing the planning process to reflect the then changing circumstances might provide some interesting parallels and lessons to our current situation.

Periodically over the past 40 years, the transportation planning profession has held national conferences on the status of transportation planning and on future issues that are likely to be faced by those responsible for statewide and metropolitan planning. Some of the more important conferences and their key issues are discussed in Table 1. Although generalizing the evolution of transportation planning can be fraught with peril in missing key trends and characteristics, Table 1 does suggest some interesting changes in focus over the past 40 years (the following format is credited to Steve Lockwood).

- From:* Emphasis on methods and data in support of capital programming.
- To:* Improved information on a wide-ranging set of impacts for a wide variety of capital, operational, pricing, lifestyle, and land use decisions.
- From:* Focus on the efficiency of highway networks and corresponding levels of service (speed and travel time).
- To:* Multimodal systems operation and broad performance measurement (accessibility and mobility).
- From:* Perspective on how to get from Point A to Point B.
- To:* Broader context of transportation's role in a community and in the global, national, state, and local economic market.
- From:* Primary attention to passenger-person movement.
- To:* Commensurate attention to freight movement and productivity improvements.
- From:* Vehicle and system technology viewed as a given.
- To:* Innovative technologies used to influence systems operation and travel behavior.
- From:* Acceptance of land use patterns as a given and not part of the solutions set.
- To:* Use of growth management tools in connection with corresponding transportation policies as a major strategy.

- From:* Environmental impacts as a project-level mitigation issue.
- To:* Linkage between transportation decisions and a broader systems and sustainability framework of ecological and community health.
- From:* User benefits and costs.
- To:* Equitable distribution of benefits and costs within the concept of a community.
- From:* Perspective on today's systems operation as a means of calibrating future predictions.
- To:* Use of today's systems operation for real-time control and development of historic files on the basis of monitoring and measurement.
- From:* What should the planning or transportation agency do to solve the transportation problem?
- To:* What should all of us do to solve the transportation problem (e.g., partnerships)?

As reflected in Kenneth Boulding's quote, decision making is the most important element of future change. If one accepts the proposition that planning informs such decision making, the characteristics of planning should reflect the requirements of the decision-making process (2). As noted by Friedmann (3), "planning is that professional practice that specifically seeks to connect forms of knowledge with forms of action in the public domain. . . planning becomes less a way of preparing documents, such as analyses and plans, and more a way of bringing planning knowledge and practice to bear directly on that action itself." This type of planning is exactly what transportation planning should have been doing over the past 40 years. One could surmise, however, that in many cases the decision process itself was limited by narrowly defined interests and by categorically limited boundaries of what could be funded with federal dollars. In the future, however, the transportation planning process is likely to be more open to a wide range of issues and constituent demands. These statements suggest that transportation planning for the next century will have to be more flexibly structured and more responsive to a variety of decision-making issues that will occur at many levels of decisions.

A recent example of the examination of the changing context of transportation decision making was provided by a study commissioned by the American Association of State Highway and Transportation Officials (AASHTO) (4). The study identified strategies adopted by state departments of transportation (DOTs) to "cope with the current conditions," that is, the

TABLE 1 Transportation Planning-Related Conferences, 1957 to Present

<i>Conference</i>	<i>Major Issues</i>
1957—Hartford, Conn.	<ul style="list-style-type: none"> • Designing urban interstates to fit into an urban environment • Importance of comprehensive land use plans and linkage to transportation plans
1958—Sagamore, N.Y.	<ul style="list-style-type: none"> • Extension of interstates into urban areas • Linking highway investment to economic development • Highway design characteristics • Need for comprehensive focus in planning • Benefit/cost evaluation strategies
1962—Hershey, Pa.	<ul style="list-style-type: none"> • Conflict between highway, housing, and land use goals • Desire for broader perspective in transportation planning
1965—Williamsburg, Va. <i>Highways and Urban Development</i>	<ul style="list-style-type: none"> • Cooperative planning among different groups • Community values and goals • Land use plan coordination with transportation planning • Desire for more formalized transportation planning process
1971—Mt. Pocono, Pa. <i>Organization for Continuing Urban Transportation Planning</i>	<ul style="list-style-type: none"> • Linkage between transportation investment and environment • Community values and their incorporation into transportation planning • Multimodal perspectives • Citizen participation
1982—Airlie House, Va. <i>Urban Transportation Planning in the 1980s</i>	<ul style="list-style-type: none"> • Need for systematic urban transportation planning • More flexibility in planning process; streamline regulations • Corridor perspectives • More responsibility to state and local officials
1988—Washington, D.C. <i>A Look Ahead: Year 2020</i>	<ul style="list-style-type: none"> • Linkage between transportation investment and economic productivity • Need to monitor demographic changes and impacts on travel • Environmental impacts • Institutional responsibilities • Urban form and relationship to transportation investment • Role of technology
1989—Boston, Mass. <i>Statewide Transportation Planning</i>	<ul style="list-style-type: none"> • Relating planning to decision making • Importance of vision • System management • Multimodal perspectives in evaluation • Role of technology
1990—Irvine, Calif. <i>Transportation, Urban Form, and the Environment</i>	<ul style="list-style-type: none"> • Importance of good data • Dynamics of demographic and social changes • Transportation and air quality • Accessibility and its measurement • Judging the effectiveness of the planning process • Institutional arrangements and financial innovation

(continued on next page)

TABLE 1 (continued)

<i>Conference</i>	<i>Major Issues</i>
1992—Charlotte, N.C. <i>Moving Urban America</i>	<ul style="list-style-type: none"> • Importance of partnerships to get things done • Serving needs of customers and system users • Mobility as a goal • Social costs of transportation provision and use • Importance of public involvement • Transportation and land use connections • Transportation and air quality • Management systems in context of transportation planning • Measuring quality-of-life indicators
1992—Irvine, Calif. <i>ISTEA and Intermodal Planning</i>	<ul style="list-style-type: none"> • Focus on effectiveness of intermodal connections • Partnerships • Role of freight movement in transportation planning • Stakeholder participation • Performance orientation in planning • Institutional barriers
1992—Seattle, Wash. <i>Transportation Planning, Programming, and Finance</i>	<ul style="list-style-type: none"> • Multimodal planning and programming • Transportation and land use • Consideration of freight in planning process • Need for cooperation among many different groups • Importance of demographics in travel characteristics • Performance-oriented planning and evaluation
1996—Coeur d'Alene, Id. <i>Statewide Transportation Planning</i>	<ul style="list-style-type: none"> • Private-sector role in transportation • System preservation as a goal of planning • Financial constraint • Performance-based planning • Incorporating operations issues into planning • Freight planning • System monitoring • Multistate planning efforts
1998—Irvine, Calif. <i>Statewide Travel Forecasting</i>	<ul style="list-style-type: none"> • Investment methods to provide support for decisions among modes and between capacity and operational improvements • Methods need to be tied into asset management • Performance measures • Integration of economic activities into forecasting • Need to test modes that do not exist today • Transportation and land use connections

changing context of decision making. Four general categories of activities, or initiatives, were reported in the study: customer-driven, partner-driven, workforce-driven, and activity-driven. Table 2 shows the different types of state DOT activities that were adopted in response to the "driving forces" for change. It is interesting to note that in the categories of customer-driven and partner-driven initiatives, the adopted characteristics are similar in nature to the trends in the planning

focus that were mentioned earlier. These trends include a broader participation in decision making, more concern for customers, multistate coalitions, and performance measurement. As noted in the AASHTO study, "some of the vectors of change among state DOTs suggest the emergence of new models of organization, process and relationships that reflect the special technical and institutional setting of surface transportation." Some of the features most relevant here (because they

TABLE 2 Overview of State DOT Organization, Management, and Program-Delivery Initiatives (4)

<i>Customer-Driven Initiatives</i>	<i>Driving Forces</i>	<i>State DOT Activities</i>	<i>Trends/Directions</i>	<i>Characteristics</i>
Priority Setting Process	Resource constraints	Strategic planning	Definition of "corporate" priorities	User/stakeholder survey
	Customer expectations	Definition of mission/objectives	Ties to SWP, STIP	Champion leadership
	Program proliferation		Customer focus	Broadened modal responsibilities
	Governmentwide requirements		Internal buy-in process	Expansion of operations and management functions (ITS) Increase in freight focus
Performance Measurement	Public expectations	Performance monitoring	Measurement of internal performance	Definition of input/output/outcomes
	Legislative accountability	Stakeholder identification	Measurement of outcomes	Customer definition/distinctions
	Resource shortfalls	External accountability	External performance audits	Customer satisfaction surveys
			Incentive programs	Life-cycle orientation
			Peer benchmarking	Legislative reporting
				Cooperative data sharing
<i>Partner-Driven Initiatives</i>	<i>Driving Forces</i>	<i>State DOT Activities</i>	<i>Trends/Directions</i>	<i>Characteristics</i>
Changes in Public-Sector Roles	Regional service scale	Interagency cooperation/coalition	New ISTEA responsibilities	Relationships with non-transportation entities
	Ties to other sectors	Devolution of administrative responsibility	Increasing planning/programming collaboration	New multistate coalitions
	Federal mandates		Transparent service delivery	New interagency agreements
	Customer responsiveness		Allocation of project administration responsibilities	Greater autonomy for MPOs in planning/programming
	Efficiency		Streamlined finance management	Arrangements with local government for project development
Innovative Finance	Budget shortfalls	Leveraging public funds	Consolidation of capital and operating budgets	Extensive use of advanced construction

(continued on next page)

TABLE 2 (continued)

<i>Partner-Driven Initiatives</i>	<i>Driving Forces</i>	<i>State DOT Activities</i>	<i>Trends/ Directions</i>	<i>Characteristics</i>
	Program flexibility	Access capital markets	Increase use of debt financing Public/private financing of private toll roads	Incorporation of toll revenues in budgets SIBs Use of ISTEA Sec 1012 Use of IRS 6320 non-profit corporation
<i>Workforce-Driven Initiatives</i>	<i>Driving Forces</i>	<i>State DOT Activities</i>	<i>Trends/ Directions</i>	<i>Characteristics</i>
Organization Reconfiguration	Budget/staff limitations	Downsizing	Reduction/stabilization in total staffing	Flattening of organization
Staffing	Workforce retention	Decentralization/centralization	Workforce retooling	Structural changes to enhance intermodal focus
	Stovepiping		Distinction between policy and line functions	Cross-functional teams
		Core competency	Increased responsibility to districts	Pay for performance
		Flattening Project focus		Increased operational orientation Focus on public contact activities Project management orientation
<i>Activity-Driven Initiatives</i>	<i>Driving Forces</i>	<i>State DOT Activities</i>	<i>Trends/ Directions</i>	<i>Characteristics</i>
Process Reengineering	Schedule maintenance	Quality management	QA/QC initiatives	Use of ISO 9000
	Partner expectations	Business process reengineering	Partnering	Centralization/standardization of information systems
	Legislative oversight		Internal staff buy-in Reengineering critical information or process-intensive procedures	Cycle-time-reduction focus
Program Delivery Modifications	Private-sector examples	Innovative contracting	Use of incentive-based contracts	Commercialization of services

(continued on next page)

TABLE 2 (continued)

<i>Activity-Driven Initiatives</i>	<i>Driving Forces</i>	<i>State DOT Activities</i>	<i>Trends/Directions</i>	<i>Characteristics</i>
	Customer responsiveness	Outsourcing	Turnkey approaches	Use of open RFPs
	Partners' expectations	Privatization	Contracting out more core/routine functions	Peak load or geographic responses
	Federal mandates		Increase in outsourcing design	Experimentation with managed competition
	Privatization interest		Broader cost and schedule risk-sharing	Tax-exempt funding
			Private project development	Cost/resource-sharing new toll roads
Research and Technology Innovations	Availability of federal support	Product evaluation	Implementation-oriented R&D	Product-evaluation teams
	Private-sector interest	Research partners	ITS programs	Multistate coalitions
				Public/private partnership SDOT/institutional partnerships

SWP = statewide plan; STIP = State Transportation Improvement Program; ITS = intelligent transportation systems; ISTEA = Intermodal Surface Transportation Efficiency Act of 1991; SIBs = state infrastructure banks; IRS = Internal Revenue Service; ISO = International Standards Organization; RFP = request for proposals.

suggest forms and substance of decision making) include

- Small departments which maintain the responsibility for provision (policy, priorities, funding, quality) with many production functions dispersed via devolution to lower levels of government and outsourced to private entities as determined by benchmarking and managed competition;
- Decentralized departmental units organized based on fluid task-oriented teams and vertical cradle-to-grave project management for closer customer contact and increased efficiency, supported by enterprise information and quality control systems;
- Outcome-oriented investment priorities developed through close user-customer dialogue focusing on interagency delivery of improved passenger and freight service in response to measurable logistics, economic development, and quality-of-life impacts;

- Emphasis on real time operations of upper level systems using the best available ITS technology for reliability, safety, and security in conjunction with a new multi-jurisdictional operating entities—authorities or private corporations;
- Enterprise-style management at all levels (strategic business plans) accomplished by a cross-trained staff maintaining core capabilities under performance incentive-driven employment agreements;
- Streamlined project delivery for reduced schedule/cost risk via competitive turnkey contracting, including public/private partnership franchises;
- Increased utilization of market mechanisms responding to customer willingness to pay (partnerships, tolls, commercialization), together with contemporary financial technology such as infrastructure banking, revolving funds and debt-financing accessing nationally securitized capital markets;
- Incorporation of the best available technology in process activities (information systems), product

development (material and process), and real time operation (intelligent systems); and

- Asset management orientation, including investment trade-off analysis, supported by life-cycle design and true cost evaluation based on improved performance monitoring.

What does the future hold for transportation planning and how should the process be refocused? The following section provides an overview of those issues that are likely to concern transportation decision makers over the next several decades.

TRANSPORTATION PLANNING AND THE FUTURE

Transportation planning over the next 20 years will be very similar in substance to what occurs today. It is likely that analysis tools and data-collection methods will improve by taking advantage of tremendous advancements in computing power and sensor technology. Information systems will provide more ability to synthesize large amounts of data and perhaps will create new avenues for public participation in the planning process. The great unknowns, however, are the level of technological change, the demands of economic and market forces, and the degree of environmental consciousness that will characterize this future. For example, the transportation profession has been urged for years to better consider the needs of freight movement in transportation planning. How ironic it would be if technological change (e.g., the application of nanotechnologies to the manufacturing process) and economic forces (e.g., globalization and distribution of the manufacturing process) would effectively make this newfound attention immaterial.

There are 10 areas in which future transportation planning will likely face challenges (i.e., demands from decision makers for information and solutions). Therefore, these areas are topics for this conference on Refocusing Transportation Planning for the 21st Century.

Demographic Change

In presenting the "distinguished lecture" at the 1999 Annual Meeting of the Transportation Research Board, Alan Pisarski argued that transportation professionals missed several key trends in the 1970s and 1980s that had profound impact on travel. These trends included substantial growth in jobs, increases in truck travel, the significant growth in vehicle-miles traveled, and changes in economic production processes. He also predicted that the trends to watch during the next decade will be the increasing immigration, higher household incomes

(which lead to increased vehicle ownership), and the aging of the population. As noted elsewhere, these trends are likely to have profound impacts on transportation planning (5). Mobility for the elderly, especially given the fact that this group, now more than ever, will be driving into their later years, creates a special challenge for transportation planners. This issue could have significant implications on how travel information is disseminated and on the importance of nonwork trips as they relate to daily travel. In urban areas, decision makers could be pressured into providing more transportation services to the elderly population.

Immigration presents special challenges to transportation planners. Immigrants tend to locate in metropolitan areas (by 90 percent) and in central cities within metropolitan areas over suburbs (55 to 45 percent). For example, the cities with the largest increases in zero-vehicle households between 1980 and 1990 were Miami, San Diego, and Phoenix. These cities also experienced large increases in Spanish-speaking immigrants (6). As immigrants become assimilated into society, it is likely that they will represent a new wave of automobile drivers. In the short term, transportation options that provide access to jobs will become a major issue.

Economic Production and Market Forces

The fundamental relationship between economic activity and transportation demand has been the cornerstone of transportation demand analysis for decades. And yet, my perception of our profession is that we are often caught unaware of the profound changes in the technology of production and in the movement of resources and products that so significantly affects the transportation system. Free trade agreements, globalization of the production process, diversification of employment sites, innovations in goods movements that increase productivity but shift flows (e.g., containerization), and larger capacity and faster goods movements all have important effects on metropolitan transportation systems. Transportation planning clearly needs to do a better job of incorporating freight movement into the process; however, my concern is that many planners view this simply as better understanding truck flows on the region's highway network. The scale of analysis goes way beyond such a simple perspective.

Highways, Plus...

One of the key trends that is illustrated in Table 1 is the desire for a transportation planning process that considers all modes of transportation in an unbiased and systematic way. Multimodal transportation planning has been discussed and pursued for many years, but only recently have

we begun to see examples of how such planning can occur (7,8). Increasingly, many public officials and transportation experts are calling for a more balanced transportation policy and planning process, one that recognizes the inherent subsidies prevalent in automobile use and that considers the full societal cost of alternative transportation options. Intermodal planning, a concept that gained interest after the passage of ISTEA, added to this discussion the focus on modal connections and their importance in the overall effectiveness of the transportation system, especially for freight movement (9).

With a growing sense that building more highways will not likely solve highway congestion, many metropolitan areas are looking at a range of possible solutions. These include enhancing highway operations (see following section), plus implementing demand management strategies, land use controls, pricing techniques, and marketing efforts to encourage use of nonsingle occupant vehicles. An excellent example of such an approach is the US-301 corridor study in Maryland that examined

- Transportation management associations in major employment centers,
- Employee vanpool programs,
- Home-based ride-sharing programs,
- Local paratransit programs with community centers,
- Improved park-and-ride amenities,
- New park-and-ride lots,
- Additional area telework centers,
- Additional bike and pedestrian facilities,
- Transit-oriented development amenities,
- Travel-demand management in the development-approval process,
- Congestion pricing,
- Reduced transit fares,
- Parking pricing for public facilities, and
- Parking cash-out programs.

Such actions will likely be commonplace in corridor and regional studies throughout the United States.

The implication for transportation planning of adopting a "highway, plus, . . ." perspective is that the data collection, analysis tools, evaluation methods, prioritization schemes, and funding mechanisms need to be in place to answer two simple questions: How much will each action cost? and What will be their impacts?

Operations Perspective

Beginning with the Transportation System Management (TSM) initiative, which was implemented in the mid-1970s, the U.S. transportation community has slowly placed greater emphasis in the planning process on more efficient operations of the existing transportation

system. Incorporating such concerns into the planning process reflects the convergence of several policy thrusts that originated in different policy environments. The targets of the transportation system and traffic management through time have in rough sequence been (a) increasing traffic efficiency and capacity, (b) providing alternatives for large-scale infrastructure investment, (c) reducing the consumption fuel when serious fuel-supply disruptions occur, (d) improving air quality through more effective use of road space, and more recently (e) mutually reinforcing a resurgent concern for land policy and urban densification.

Given that the focus of traffic operations managers tends to be short term, hardware-oriented, and technically grounded in engineering, operations strategies have not often found a place in the planning process. However, with the introduction of ITS technologies into the array of transportation strategies, operations personnel become a critical component of successful implementation strategies. One critique of the TSM initiative in 1975 was the incompatibility of incorporating an operations perspective into a planning process that was focused on large-scale capital investments programmed over a 20-year time horizon. Twenty-five years later, we need to do it right (this time).

Role of Technology

Each great leap in transportation progress occurred because of technological innovation. This innovation happened in transportation because of the desire to travel more quickly and to arrive safely, while the transportation system carried more passengers and cargo. Whether these outcomes occurred for land, water, or air transportation, the unmistakable role of technological advancement was present. The literature on transportation history is vast as demonstrated by Lay (10), Harrison (11), and Woodman (12) in their useful discussions on the role of technological advances and resulting consequences.

One of the unmistakable trends in urban transportation today is the increasing application of advanced technologies to vehicle and systems operation. In addition, low-emission vehicles are being designed that could greatly reduce pollutant emissions, and telecommunications technologies are evolving so rapidly that technological obsolescence is now measured in months instead of decades. In the broad perspective of transportation history, telecommunication technologies represent the first time that physical presence (and thus transportation) is rendered immaterial (telegraphs or telephones do not represent the full functionality that is necessary to fully substitute for physical presence). In a long-planning time frame, therefore, the consequences

of such travel substitution become a critical factor in assessing future demand, but admittedly one that is very difficult to gauge.

In the shorter time frame, transportation planning needs to anticipate the application of ever more advanced technologies in system operations. These technologies include infrastructure and systems design that is compatible with the ITS national architecture, as well as identifying operational improvements, including ITS strategies. Over the longer term, the use of information systems in all aspects of society will continue to shape dramatically personal and business decisions that directly relate to transportation.

Sense of Community

A book published by the Drucker Foundation in 1998 examined the future of society and concluded that one of the key guiding concepts of our future will be the search for a "sense of community." The amazing feature of this book was that its major contributors were most well known for their treatises on effective management techniques and corporate strategy. Yet, each contributor concluded that "seeking a community" was likely to be an important characteristic of our future. As stated by Peter Drucker (13), "the task today, therefore, is to create urban communities—something that never existed before. Instead of the traditional communities of history, urban communities need to be free and voluntary. But they also need to offer the individual in the city an opportunity to achieve, to contribute, to matter." Steven Covey (14), in the same volume, argued that the ideal community has four major elements: (a) principle-centered goodness; (b) vision and direction; (c) purpose, mission, and unity; and (d) economic equality.

In transportation, we have heard about quality-of-life and environmental justice, but I do not believe we have placed them in a larger context of community responsibility and values. As the disparity between central city and metropolitan median incomes continues to widen, decision makers will be faced with increasing pressures to provide economic opportunity for all of society (15). Transportation will have an important role to play in providing access to such opportunities.

Laying the Groundwork for Pricing

Economists for years have argued that road use is underpriced (especially when considering externalities) and that the solution is to implement road or congestion pricing. There is little argument that pricing will in fact have the biggest impact on congestion [Small, Winston, and Evans (16) discuss one of the latest proposals on the

subject in their report]. However, as noted in a recent article, the threshold level of congestion "cost" has not yet been reached, to any great extent, by automobile users in U.S. urban areas such that significant shifts in travel mode or times of travel have occurred (17). A review of several policy initiatives that were aimed at clearly defined groups and in which the costs of compliance were considered too intrusive (e.g., mandatory employer-trip-reduction programs in the 1990 Clean Air Act Amendments, Regulation XV in Southern California, congestion-pricing demonstrations, and an extensive congestion-pricing study in Minneapolis-St. Paul), led me to conclude that the public, and thus political decision makers, is not yet ready for a large-scale application of road pricing.

The transportation planning process can serve as a very important catalyst in the collective-learning curve toward eventual implementation of pricing schemes. By being selective in targeting potential markets for demonstrations or experiments, transportation agencies can lay the groundwork for a changing public perception. Note that this suggestion implies a role for transportation planning that goes beyond the development of the plan and program and goes to the heart of the pressures that are likely to be faced by decision makers. Without supportive constituencies, it is not likely that any dramatic changes in road pricing would be adopted by elected officials.

Putting Teeth into Growth Management

Planners have stated for many years that congestion reduction and mobility strategies must include land use actions, especially applied at a regional level (18). In some parts of the country, such regional or growth management strategies have been adopted in an effort to better link investment decisions on infrastructure with desired development patterns (the most recent and highly visible case is Maryland's Smart Growth Initiative). The incorporation of different land use patterns into transportation analysis has been fairly common for over a decade (19–22). However, many of these efforts were simply used as scenarios for determining "what if" contexts for transportation demand. The primary role for transportation plans in actually achieving these futures was the encouragement for new patterns of development through the provision of transportation infrastructure. Although policy statements often included encouragement to local governments to make land use decisions within such a regional context, very seldom were there any incentives or sanctions to do so.

A 1994 study conducted by the American Planning Association identified a number of principles for successful integrated regional transportation and land use

planning (23). The principles that are relevant here include

- Subregional planning in the absence of regional planning is not likely to be successful; neither is regional planning in the absence of an empowered regional government.
- Regional government may be a necessary condition for successful regional planning, but it is not a sufficient one.
- Possibilities for future urban form are few.
- Measurement in a multiobjective world is always faulty; regional planning led by technicians will be interesting to technicians only.
- Focus on direction, not destination; the only way for most people to evaluate a long-run vision is to focus on the short-run policies that are the first steps toward it.
- Work with the market to change behavior; change prices.
- Evaluations of regional policy focus on efficiency; interest groups and the public care about equity—what will this mean for me?
- Integrated regional planning needs champions.
- If you really want to affect the long run, take a long-run attitude toward change.

We are beginning to see in several instances a movement toward incentives and sanctions that reflect several of these characteristics for integrated land use and transportation planning. It seems likely that in instances in which decision makers are adopting more stringent criteria for developing decisions, they will want transportation policies that are conducive to their overall goal. Transportation agencies will have to be part of the “team.” This objective might require a very different role for the transportation planning process.

Transportation Planning Within a Sustainability Framework

A safe and healthy environment has been one of the mainstays of public opinion over the past several decades. This concern will continue and expand in the 21st century under the general umbrella of “sustainable development” or “sustainable transportation.” Sustainability means many things to many people. To some, sustainability pertains to the compatibility between a specific action and natural ecological principles (24). To others, and especially in the context of community development, physical, biological, and social “connectedness” requires a broader perspective on how we should design our communities. This broader context suggests certain principles (25–29):

- Coordinating decisions that relate to land use, transportation, environment, and social services;
- Reducing the exposure of natural hazards on people and property;
- Limiting exposure to air and water pollution and the consumption of nonrenewable resources;
- Developing land efficiently with higher densities and contiguous to existing development;
- Promoting a sense of place by protecting views and encouraging compatible urban design;
- Providing cultural life and vibrant public spaces that encourage the interaction of people from different social and economic groups; and
- Providing access and mobility for all socioeconomic groups.

Other researchers have focused on the characteristics of a sustainable transportation system and the implication for the transportation planning process (30,31). Perhaps the most forceful perspective on what sustainable transportation means to transportation planning is articulated by Cervero (32), who argues that planning for accessibility in all forms becomes the ultimate goal, rather than planning for the automobile (see Table 3).

It is likely that the concept of sustainability, especially that portion that relates to human impacts on natural ecosystems, will become stronger in the future. From a decision-making perspective (and thus with import to planning), this is likely to mean new demands on the planning process to place proposed actions in a much broader environmental evaluation context. For example, I could envision the future transportation planning process beginning with an environmental “scan” of the region that identifies sensitive environmental (broadly defined) areas and likely consequences of further infrastructure development. Some of the key issues in such an approach will be secondary and cumulative impacts.

In many ways, the business sector appears way ahead of the public sector in thinking through how sustainability can be incorporated into decision making. Business principles and environmental audits have been devised to influence the decision-making process. For example, the following checklist was proposed for those individuals considering investment opportunities (33):

1. “*Environmentally screen all investments*—All investments should be accompanied by an explanation of their environmental impact.
2. “*Reconsider costs*—Anticipated benefits of conventional proposals may disregard the environmental costs of the planned activity.
3. “*Reconsider benefits*—Have all environmental paybacks been presented? Proposals may underplay benefits of waste reduction and avoidance of anticipated cost increases.

TABLE 3 Transportation Mitigation Approaches Under Different Planning Paradigms (32)

<i>Automobility Planning</i>	<i>Accessibility Planning</i>
Road Construction Expansion <ul style="list-style-type: none"> —Motorways/freeways —Beltways —Interchanges/rotaries —Hierarchical networks —Arterial expansion 	Land Use Management/Initiatives <ul style="list-style-type: none"> —Compact development —Mixed uses —Pedestrian-oriented design —Transit villages —Traditional neighborhoods —New urbanism
Intelligent Transportation Systems/Smart Highways/Smart Cars <ul style="list-style-type: none"> —On-board navigational systems —Vehicle-positioning systems —Real-time informational systems 	Telecommunication Advances <ul style="list-style-type: none"> —Telecommuting/teleworking —Telecommunities —Teleshopping
Transportation System Management <ul style="list-style-type: none"> —One-way streets —Rechannelizing intersections —Removing curbside parking —Ramp metering 	Transportation Demand Management <ul style="list-style-type: none"> —Ridesharing —Preferential parking for HOVs —Car-parking management and pricing —Guaranteed ride-home programs
Large-Scale Public and Private <ul style="list-style-type: none"> —Heavy rail transit/commuter rail —Regional busways —Private tollways 	Community-Scale Public and Non-Motorized Transport <ul style="list-style-type: none"> —Light rail transit/trams —Community-based paratransit/jitneys —Bicycle and pedestrian paths

4. *"Reconsider the criteria applied"*—Have environmental objectives been explicitly considered in evaluation?

5. *"Reconsider the possible options considered"*—Does the action provide a solution in isolation, or would there be a more environmentally superior alternative?

6. *"Consider the opportunity costs"*—Has there been a serious analysis of the costs of not accepting the proposed solution? What is the cost of opportunities foregone if resources are utilized in implementing the current proposal?

7. *"Reconsider the time horizon"*—Realistic paybacks of environmental benefits might not occur for a long time.

8. *"Reconsider the discount rate"*—Discounting often does not take into account full costs of remediation or the long time frame of environmental benefits.

9. *"Consider the valuation of externalities"*—If true costs of environmental resources (such as water, air, waste disposal to land or water) were used, how would decision be changed?

10. *"Consider decisions in light of sustainability"*—Looking at decisions from a longer term, broader, sustainable perspective could change the evaluation results and overall assessment of viability."

We are already noticing in some metropolitan areas the beginnings of public interest in such criteria for transportation investment. I suspect that such criteria will be commonplace in the coming decades.

Decision-Making and Planning Accountability

An important trend in recent years in almost every government program has been public interest in accountability. What has actually happened or changed given public investment? In transportation, there is increased interest in audits, program assessments, and performance-based planning (34). As congestion becomes worse, the collective frustration of the public and political system can lead to dramatic finger-pointing. In Atlanta, for example, the business community led a regional examination of what to do about transportation problems in light of the perceived inability of public agencies to deal with the often opposing political forces for real change. The group recommended that the Atlanta region and the new governor take the following steps:

- Set and communicate short- and long-term performance objectives for Atlanta's regional transportation system;
- Adopt aspirations-based strategic planning and land use compliance incentives;
- Create a regional transit authority to plan and coordinate all transit in the region;
- Secure adequate and flexible funding for transportation needs;
- Build public awareness about transportation issues and alternatives to single-occupancy vehicle travel;
- Mobilize the business community to support recommendations and change commuter behavior; and
- Empower one regionally focused agency with integrated responsibility for planning, resource allocation and authority, and monitoring of implementation for all forms of transportation in the Atlanta region.

The latter recommendation was in response to a widely held belief that the current regional planning agency was unable to move forward a transportation plan that would really achieve congestion reduction and air quality goals. Atlanta's new governor is moving rapidly to create a regional agency similar to the one that was recommended.

We are in a period in which more accountability is being demanded of governmental programs. In a planning context, this demand means identifying ways of linking system-performance outcomes to targeted investments to show accomplishments. As noted in the Atlanta case, this could also mean institutional change

that is designed to overcome perceived barriers to program implementation.

CONCLUSION

Figure 1 illustrates, in a very simple way, the evolution of transportation planning over the past 40 years. As shown, the different "periods" of planning simply added new perspectives and decision-making requirements onto the core-planning process. To a large extent, the basic mission of the transportation planning process has remained the same over this period-how to provide mobility in as safe and cost-effective manner as possible. This core mission has been stretched and augmented to reflect changing issues of concern to policy makers and to respond to a much-expanded context within which success is now measured. Given the role of planning as support for decision making, this is exactly as it should be.

Although I have focused on the types of issues that will likely face decision makers in the 21st century, I cannot leave a discussion of planning without saying a few words about "process." The transportation planning process has evolved over many decades, guided by regulations and law, to encompass many tasks and activities that purport to meet decision-making needs. In general, this process has been opened to new perspectives and new participants. However, the analysis framework that has evolved to support state and regional planning has tended to offer little support in answering

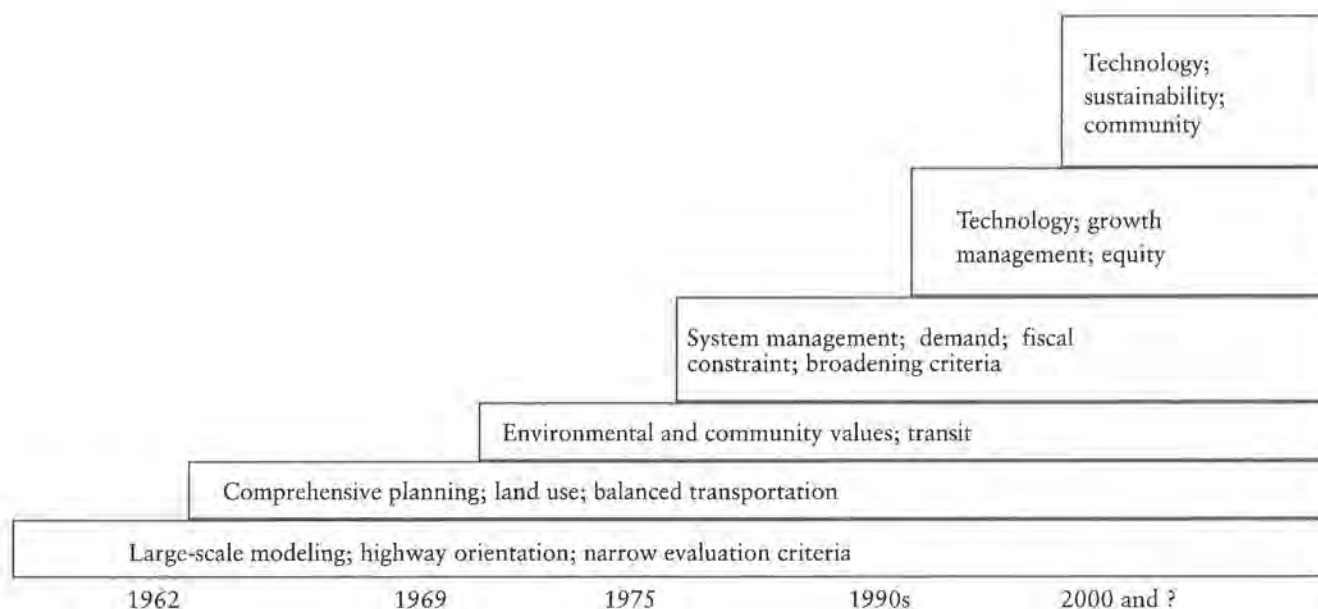


FIGURE 1 Key issues in the evolution of transportation planning.

the types of questions that are being asked by these new groups. A responsive 21st-century transportation planning process will have to be much more attuned to the customer, who ranges from the individual traveler to elected decision makers, about information that is being produced. This might require increased use of market research techniques, and most certainly, will require innovative opportunities for participation.

As noted earlier, the linkage between transportation and the environment and community will likely become much stronger than it is today. A strong linkage will lead to even more debate on the appropriate role for transportation in achieving community visions, and on how to measure transportation-investment outcomes with a very broad framework. Land use and community development will be an important issue in this debate.

Many different societal concerns and desires will likely influence the period of planning that we are now entering. However, the next era of transportation planning could very well be viewed by future historians as being defined by the convergence of two dominant trends—ever-increasing technological sophistication of society (and especially in the use of the transportation system) and ever-increasing societal concern for sustainable community development. If approached carefully, and planned for, these two trends can be mutually reinforcing. If not approached carefully, they can raise the prospect of technological advances fostering lifestyle patterns that are not in keeping with broader values of societal and ecosystem health. Many of the other issues can, in fact, fit into each of these categories (e.g., an operations focus in systems planning can lead to a discussion of technology).

The success of transportation planning in this next period could very well be measured by the degree to which these two issues are handled. Will technology (defined in its broadest sense to include fuels, materials, telecommunications, and system-vehicle control) be able to reinforce the desire for community development that is more livable and sustainable? Or, will technology be applied in ways that encourage travel behavior and development patterns that run counter to sustainability principles? This could very well be the next great challenge for transportation planners in the 21st century.

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Mainstreaming Management, Operations, and Intelligent Transportation Systems into the Planning Process

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The integration of intelligent transportation systems (ITS) and management and operations (M&O) into the institutionalized planning and programming process is an essential precondition for improving service. This paper attempts to incorporate the convergence of recent relevant experience and thinking from three sources. First, it includes the experience—through formal transportation system management (TSM) and congestion management systems (CMS) planning—with incorporating supply and demand management-based improvement projects (including ITS) into the conventional statewide or metropolitan planning and programming process and participants.

Second, this paper also reflects the more recent experience with ITS-deployment planning as a discrete systems engineering and integration activity that is conducted separately from the conventional planning and programming process by staff of facility-owner operations. Finally, it includes the emergence of a policy focus on systems M&O at the state and metropolitan level, with implications for not only planning and programming but also for the roles and relationships among stakeholders in the real-time service delivery that is implied.

The concept of M&O provides a distinct policy orientation—one that can stand alone or be combined with other policies and programs, such as highway capacity expansion. ITS is a principal programmatic means of pursuing this policy through the regionally integrated

application of computation, communication, and control technologies.

The context for surface transportation has changed radically over the last 2 decades, whereas the conventions of transportation network services have hardly changed. There is an emerging confluence of 21st-century context features that reflects a new reality: a knowledge-based society places a high premium on information, efficiency, convenience, and responsive services.

ORGANIZING FRAMEWORK AND DEFINITIONS

Systems M&O can be defined in terms of policy and programmatic orientation as a deliberate policy focus on improved M&O of the existing infrastructure. A working definition is

Maximizing performance of existing infrastructure in the provision of reliable, safe, and secure mobility under real-time conditions through regional deployment and integration of monitoring and information with customer-responsive systems operations and services.

This paper defines “operations” as real-time modifications to service features of existing facilities and “management” as activities that are oriented to improve user ability to capitalize on existing infrastructure.

Mainstreaming is defined to include the gradual development and organization in a logical, structured, open process of the complete range of policy and technical activities that are necessary to result in improved regional systems M&O. As described in the remainder of this report, the broad changes that are needed include

- Improvements to the existing “conventional” statewide and regional planning and programming process that focuses on performance;
- Establishment of regional ITS integration activities and resulting systems architecture as a part of an expanded cooperative planning process; and
- Incorporation of key aspects of ongoing operational planning and real-time system feedback into planning and programming.

Although it is not within the scope of this effort to invent a proposed new planning process, many of the key challenges that are emerging can be identified.

ROLE OF ITS AS A CONCEPTUAL, PHYSICAL, AND OPERATIONAL FRAMEWORK TO FACILITATE M&O

The concept of M&O provides a distinct policy orientation—one that can stand alone or be combined with other policies and programs, such as highway-capacity expansion. ITS is a principal programmatic means of pursuing this policy through the regionally integrated application of computation, communication, and control technologies.

Conventions of ITS planning have identified a set of basic service components that are broken down into 30 specific user services and equipment combinations that deliver those services. The basic components cover the complete range of traffic and transit operations, traveler information and navigation, incident and emergency management and response, electronic toll and fare systems, vehicle-safety systems, and commercial vehicle-regulatory automation. The basic surveillance, control, analysis, and communications features of these services support a host of specific “market packages” for a complete range of related programs that are consistent with M&O, such as preferential treatment, telecommuting, smart cards, and pricing. Not all of these programs are infrastructure-related, but they still benefit from communications and information systems that might be developed as part of ITS.

The principal feature of M&O is the reliance on combinations of integrated strategies that are enabled by advancing technology to provide the maximum possible service with the framework of the existing facilities. In addition to improvements in efficiency and effectiveness

of existing facilities, important new services and service functions are facilitated. The potential of operational integration on the basis of an “architecture” is introduced, which identifies the transportation systems functions, allocating them to subsystems and specifying how they are linked by communications with key data flows, interfaces, and institutional roles.

Thus, M&O is not the “same old traffic operations” and “too small to matter” (TSM) low-cost concepts. It adds not only new technology but also a conceptual, informational, and physical framework that supports a change in perspective and responsibilities of government for transportation services.

NEW M&O IMPERATIVE: DRIVING FORCES AND CHARACTERISTICS

The context for surface transportation has change radically over the last 2 decades, whereas the conventions of transportation network services have hardly changed. There is an emerging confluence of 21st-century context features that reflects a new reality: a knowledge-based society places a high premium on information, efficiency, convenience, and responsive services.

Yet, the performance offered by the transportation infrastructure is too often characterized by chronic peak capacity imbalances, long-lasting incidents, lack of information about mode and system status, jurisdictional fragmentation, unavoidable intermodal friction, and manual regulatory administration. The logic of M&O and the focus of ITS are being shaped by these factors as well as by the following:

- *Growing and changing demands*—Urban areas are facing a 50 percent growth in travel over the next 20 years. Spreading peaks and new movement patterns for which the existing network was not designed emphasize the need to actively adjust the existing facilities to better respond to changing requirements.
- *New service attributes required*—The service orientation of the U.S. economy is generating customer expectations, both passenger and freight, for a broader range of performance and service options. These options include new information-based user-service requirements on the basis of M&O, including reliability, navigation, traveler information, security, crash-avoidance, and speed and capacity.
- *Constraints on traditional approaches*—The impacts of new facility construction, both high fiscal and environmental costs, often set practical limits on additions of new capacity. These limitations necessitate the most aggressive efforts to make the best use of available assets, placing a premium on an asset management perspective.

• *Growing impacts of disruptions*—The “unpredictable” disruptions caused by the high frequency of crash, breakdown, or weather-related incidents are now routine. These disruptions cause more than 50 percent of urban travel delay. Added to this is the continuing reconstruction and maintenance activities that are associated with the aging infrastructure. Indeed, over half of urban delay is caused by such incidents, which cannot be addressed other than through operational measures.

• *Increased customer responsiveness*—The effectiveness of conventional capital-intensive strategies is limited. Much of the service performance that is demanded of a just-in-time society cannot be addressed by new capacity alone. Networks that operate at higher capacity, with peaks, imbalances, incidents, and a mix of users with various appetites for improved performance, imply the need for (if not a market for) active system M&O.

• *Pressure on government for improved effectiveness*—The continued pressures of deficits, downsizing, devolutions, and deregulation have encouraged state and local governments, through major strategic planning efforts, to “reinvent” themselves and find ways for more effective service delivery, focusing more on outcomes and less on inputs and outputs.

• *Enlarged role of the private sector both as partner and independent service provider*—A public-sector commitment to operations can support major emerging private industry service initiatives that offer important user benefits, especially those associated with emerging in-vehicle systems, such as safety and information, or privately provided market services, or both. New private-sector information services also have the potential to substantially change how users view and use the system.

• *Introduction of information technology and systems engineering*—The introduction of new computation, communication, and control technology now provides the basis for ITS architectures that can support a wide range of user services on the basis of M&O features, as well as strategies in which integration and synergy are important.

These forces suggest changes in demand that include the desire for a new mix of services. Together with the obvious constraints on other (“build”) options to better relate transportation supply with changing demand, these factors have resulted in the expansion of opportunities that are associated with evolving technology, which implies the potential for new services, processes, and relationships.

M&O CHARACTERISTICS: SERVICE, POLICY, PROGRAMMATIC, AND INSTITUTIONAL

The driving forces suggest the need to evolve toward new service delivery objectives of the surface transporta-

tion infrastructure above and beyond the traditional focus of relying primarily on new capacity provision for maintaining or improving service.

The key service objectives of M&O, in response to the driving forces, would relate to increased focus on a customer-oriented, performance-based approach to transportation infrastructure service provision. These features, recognized in existing TSM and travel demand management (TDM) practice and engaged through the CMS process, have been further developed in the ITS planning to date. In service objective terms, these features include

- Using the existing infrastructure with greater efficiency
 - Minimizing efficient use of existing capacity through real-time facilities and systems control of flows and access
 - Increasing convenience and efficiency through automatic electronic tolling and billing for a wide range of facilities and services
- Minimizing service disruption from nonstandard conditions
 - Minimizing (50 percent) the delay due to incidents through active response to disruptions and emergencies
- Responding to demand for new service attributes
 - Operating systems to increase reliability and security (more important than speed)
 - Providing premium (speed limit) service priorities for certain customers or vehicle classes
- Maximizing informed customer travel choice
 - Empowering user choices through provision of general and personalized travel-condition information to promote informed user decisions about route, mode, time, conditions, and transit service
 - Reducing delay, circuitry, and increasing convenience by offering on-board navigation and yellow pages information
 - Incorporating market choice through electronic pricing and traveler information
 - Increasing levels of safety and security
 - Providing priority service for emergency vehicles through controlled preemption
 - Providing personal security through emergency-response dispatching
- Improving commercial efficiency and competitiveness
 - Improving intermodal services through operation integration
 - Increasing efficiency through commercial fleet dispatching and automated regulation.

These objectives accept the notion that although congestion cannot be eliminated, it can be managed, including the improvement of a series of attributes that can

make them more acceptable to users. A regional program that adopted these objectives as the priority for use of available resources would look very different from today's typical program.

Toward a New Service-Delivery "Model"

This service orientation implies profound changes in the service-delivery "model"—what services are delivered, as well as how, when, and by whom. In fact, M&O introduces a new orientation to the overall "enterprise" of infrastructure-based services.

A set of low-cost, spatially extensive, high-tech capital improvements must be implemented to facilitate M&O. This new ITS infrastructure of surveillance, communications, control devices, centers, and information dissemination must be staffed, operated, and maintained on a continuing basis. Important policy decisions about operational regimes and protocols must cooperatively be reached. Taken together, these responsibilities imply characteristic activities and strategies with important institutional implications for the responsibilities, resources, organization, staffing, and processes for service delivery at both the state and metropolitan levels.

These strategies include a new set of planning, deployment, and operations processes that are generally considered outside the scope of current capital facilities-oriented planning, programming, and deployment processes. Three features of M&O, as facilitated by ITS, differentiate an M&O-oriented service-delivery process from a conventional process:

- Impacts of customer and performance orientation,
- Role of performance and feedback—systems engineering, and
- Need for new forms of partnership.

Impact of Customer and Performance Orientation

The emphasis on service delivery—defined in terms of real-time performance monitoring—radically shifts the focus of provision from facilities to operations. This service orientation is reinforced by the convention of ITS engineering that builds functionalities around a disaggregation of user-service requirements with specific functionalities that are allocated to identified control and informational devices.

The customer emphasis reflects the fact that M&O can respond, with ITS "assists," to a wider range of desired service attributes that are based on operational activities, such as minimizing incident-related disruption for improved reliability, disseminating information on travel conditions, or providing emergency responses

to real-time communications of individual vehicle problems (MayDay).

The implication of M&O, implicit in ITS-deployment conventions (and encouraged by its relatively low cost), is the provision of service at the relevant trip scale. ITS are defined on a functional instead of on a jurisdictional basis. A significant feature, therefore, is operational integration, which involves coordination across modes and jurisdictions through aggressive information sharing, operational cooperation, and joint service provision programs.

The customer (user) service function is also "provider neutral," that is, there is no technical assumption that the service provider is necessarily the infrastructure owner. In fact, the systems engineering as applied in ITS, with its discipline of "system, subsystem, and market packages," clarifies the opportunities for and technical interfaces to any potential service provider or cooperative arrangement.

Finally, ITS, with a strong focus on information, include both complementary and substitutable noninfrastructure components in service delivery, such as travel information delivered in a variety of venues (especially in vehicles) and enhanced communication and information services as a substitute for some types of trip making (telecommuting).

Role of Performance and Feedback: Systems Engineering

The role of information, both as service and as infrastructure, is a key characteristic that ITS bring to M&O, impacting the system design and concept of how they should be operated. Central to advanced M&O is active real-time, condition-responsive systems operations, and management to maintain performance. Service outcomes therefore are dependent on adjusting operations and facility characteristics. This capability focuses attention on important service potentials that have not been central to conventional planning and programming. For example, half of urban traffic delay is due to nonrecurring incident disruption. Introduction of systematic incident detection, response, and management dramatically expands the target and potential of transportation service improvements.

Monitoring conditions and disseminating information have equivalent potential in other modes in terms of more closely aligning customer needs with operational realities through, for example, transit and parking information systems and intermodal coordination.

The monitoring and feedback potential of ITS also affects improvements, cycles, scales, and related costs. Many ITS services can benefit from ad hoc "tuning" and short-term modification to provide better service. The

institutionalization of a service provision style with incremental facility improvements, technology upgrades, geographic extensions, and synergism of mutually supportive functional capabilities characterizes contemporary M&O.

Need for New Forms of Partnership

The very nature of integrated regional operations implies a continuing responsibility of facility owners in new relationships with other facility owners who participate in a given (multijurisdictional) "system." These relationships with other service-providing stakeholders, both vertical and horizontal, extend to nonpublic works entities, such as law enforcement and emergency service providers who are crucial to several incident-response and safety-related services. Intensive cooperation, including collocation, common training, and protocols, is required on a multiagency basis. New cooperative roles also extend to multiregional and multistate relationships.

An organized programmatic focus on M&O implies not only changes in the existing planning and programming process for capital investments but also an extension into planning for operations and possibly into operations themselves. These changes also highlight the importance of owner-operator responsibility beyond construction of capital improvements, including non-traditional players. This suggests that relationships with a broader range of service providers, both public and private, will be essential.

The potential for partnerships extends to the private sector, both technologically and institutionally. Technologically, the information side of M&O must maintain design approaches in terms of systems and standards that are open and interoperable to private service providers. Future private-sector roles may include both in-vehicle-related services and the support of a private provision that includes a variety of traveler information, logistics, and security and amenity services—both free, custom-tailored, and consistent with the wide range of needs.

Institutionally, it is not too much to expect that in-vehicle information as a consumer convention (starting with MayDay, mapping, and yellow pages) will substantially alter how customer and users view the transportation system and may introduce new players and services into the travel services arena. The revenue market and expanded service opportunities that are associated with automobile personal computers and ubiquitous perfect travel-condition information could someday alter the role of sectors in M&O substantially.

A full understanding of the potential and implications of these features is still incomplete.

M&O IN CONVENTIONAL PLANNING AND PROGRAMMING TO DATE: EVOLUTIONARY PROCESS

CMS Tradition

Traffic and transit operations are not new. The increased focus on M&O is part of an evolutionary process. It builds on the practice within the federal aid planning and programming conventions that are focused on efficiency-orientated, low-capital-cost, and noncapacity alternatives with minimum impacts. This tradition extends back to TOPICS (traffic operations to improve capacity and safety) and includes the TSM and TDM themes of the pre-Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) that were encouraged within the federal aid process.

Whereas TSM and TDM planning focused on levels of service and spot measurements and was generally highway-oriented and corridor-focused, CMS introduced a greater emphasis on multimodal performance, regular measurements, regional focus, and a broader array of integrated TSM and TDM strategies. The air quality constraints that were associated with the Transportation Management Area's (TMA) application of CMS also emphasized people, instead of vehicle, mobility strategies. (In these settings, "system" was defined as a process for developing strategies, not an operating construct.)

In this evolutionary context, CMS can be observed as a "bridging" experience that provides a valuable step toward greater operational focus on the part of the metropolitan planning organizations (MPOs). Their principal impact is the focus on a performance-based approach for identifying supply- or demand-related projects [for the Transportation Improvement Program (TIP)] that improve performance of the existing systems.

ITS Deployment Planning to Date

ITS, as a programmatic concept, evolved out of a recognition of the potential contribution of a more systematic application of new technology and systems concepts. The focus on an operational demonstration of new technology and the development of the logical framework for its systematic application preceded any widespread discussion of the implications of an M&O focused policy element on the part of federal, state, and local governments.

The early development plan (EDP) process was developed by the Federal Highway Administration (FHWA) as means to jump start ITS deployment by funding the development of initial ITS-deployment strategies in nearly 75 metropolitan areas. Although there was no

emphasis on changing state or regional policy, the ITS program in effect described M&O-oriented planning. The program also required a modest systems-integration process that was sufficient to provide the basis for some initial deployment of ITS-user services while accounting for legacy systems and establishing a strategy for potential future evolution.

With some exceptions, EDPs were led by state departments of transportation (DOTs) that focused on their network interests, with the processes taking place largely outside the established planning and programming process (enabled in part by their discretionary grant funding). However, MPOs often served as the "venue" or convenors of these efforts.

A standardized EDP process evolved according to FHWA guidelines as modified through experience in the field. As described in this section, the process was designed to accommodate initial implementations, with the minimum necessary connections to the existing planning and programming activities. As a one-time funded activity, it was assumed (usually correctly) that these plans would be used as points of departure for incorporating a regional ITS-focused planning and deployment process into the local institutional framework.

It is important to note that although most EDPs were focused on start-up ITS deployments at the metropolitan regional level, states have also begun to evolve parallel processes. Whereas these state-level processes are at an appropriately higher level of generality, attempts are underway to integrate these processes with regional level efforts within the state jurisdiction.

The EDP conventions include important features that, in the long term, must be part of the mainstreaming effort, including both a planning component and systems integration and operations planning component. The major steps in EDP planning are

- Define problems and needs in terms of measurable service outcomes. This activity is presumed to link directly to the established regional policy and to account for existing conditions and systems in place.
- Develop a consensus-building process and a commitment to cooperative roles. An expanded stakeholder group should include those additional parties that are necessary to M&O but are normally outside the planning process.
- Develop a mission and vision of how ITS can support the needs of specific users, including an initial cut at defining the specific priority user services.
- Develop a concept plan of how specific ITS elements (market packages of strategy components that deliver services) would be deployed to produce the desired services.
- Develop a regional systems integration strategy. This component includes a high-level systems descrip-

tion with subsystems and enough information about functional requirements to develop an initial "layered architecture," including transportation components, communications, and institutional responsibility.

- Develop operations and implementation strategies, including the approaches to deployment, operations, and maintenance, with associated institutional and financial arrangements.

Two principal weaknesses of the EDP process, which are being corrected in continuing efforts, were time and budget restrictions and the lack of familiarity of many participants with ITS technologies, cooperating concepts, and systems engineering approaches.

First, regional integration frameworks were often developed at the conceptual level, without details on subsystems and information flows or full logical and physical architectures. Subsequent studies and interaction with the model, provided by the National Architecture Effort, has led to a more disaggregated approach that is necessary to move to engineering-level decisions.

Second, lack of integration with the planning process, especially ongoing CMS efforts, hampered follow-on. EDPs typically recognized the need for these connections but, within their time frames, lack the opportunity to get in cycle with the MPO planning process for more rigorous relationships. Furthermore, such relationships have awaited a clearer expression of policy, especially regarding priority and resources from state DOTs and other MPO members within the TIP framework.

Beyond EDPs: Continuing ITS Planning

Systems integration and operational planning for ITS deployment continues as a discrete (semi-independent?) operation, with its own internal requirements. These efforts, principally state DOT-led, exhibit tremendous variation, from a focus on specific project deployment and actual operations to further development of regional service policy and regional integration apparatus.

In most metropolitan areas, the development of integrated regional ITS plans and operational planning to date has been "partial" and has focused on ad hoc ways of adding improvements to legacy systems, with the minimum necessary comprehensive system (architecture) development. In addition to their project-deployment focus, a few efforts have continued regional systems-integration activities as a necessary precondition to respond to the requirements or opportunities for legacy integration, interoperability, efficiency, and so forth.

To date, the ongoing ITS planning and deployment activities have had little impact on the plans and programs within the "conventional" process. Systems integration and operational planning are generally developed outside the planning process. The effort typically has been state-led and focused on state-owned facilities or projects of state interest, such as metropolitan or statewide traveler information. States have developed the necessary bilateral relationships with local governments and with participants of other nonpublic works (such as state highway patrol). To some degree, this reflects the lead times that are necessary to interest the majority of MPO members and to initiate a consideration of the issues of M&O within the multiyear cycle of MPO policy and plan development. It also reflects the fact that the funds being used have not typically been those controlled by MPO consensus and that the funds have not competed on a major scale with other agreed-on MPO priorities.

As they become more comprehensive, the overlaps with regional planning and programming will become more obvious, and stronger interconnections—if not integration—will be necessary. However, it is important to preserve the features of ITS planning that serve to promote the importance of M&O. Steps to preserve these features include

- Highlight the potential of specific services and functions at the operational level.
- Establish long-range comprehensive frameworks and standards for statewide integration and interoperability, to name a few.
- Communicate ITS (and M&O) potential through the rest of the policy and planning process.
- Draw attention to resource and institutional issues.
- Consider the tremendous variation among states and metropolitan areas regarding the state of fully integrated systems framework.
- Remember federal aid rules—both architecture and systems integration will push for fuller application of more systematic approaches.

MAINSTREAMING CHALLENGES

Mainstreaming could be defined at many levels, from the existing modest role of CMS within the conventional planning process in TMAs to a higher level that involves the gradual development and organization in a logical, structured, and open process. This process includes the complete range of policy and technical activities that are necessary to improve regional systems' M&O. Such complete integration must meet a broad range of policy, institutional, technical, and resource challenges, many of which are summarized in Table 1.

This discussion does not cover the complete range of activities that are associated with M&O service delivery; in fact, no commonly accepted overall framework exists that would incorporate all the steps from policy development to real-time operations (such as adjustment of a traffic-control device). This paper discusses the implications of an increasing M&O orientation on those activities that are within the conventional scope of planning and programming, and how they may evolve as part of the larger framework. Current experience is used to identify some of the critical challenges that planning and programming, whether formal or informal or whether within the current institutionalized process or outside, must initially meet to move this process forward.

Current thinking about M&O and ITS is still in a pioneering phase. Responsible institutions are reinventing the planning and programming process as they proceed, in some cases formally, but in most cases, by informal actions and relationships around the margin of their regular institutionalized responsibilities. The overarching issue is the degree to which planning and programming are likely to be substantially transformed as they become increasingly responsive to real-time delivery of service as distinct from the long-term provision of service-supporting infrastructure.

Contexts: Basic Scales and Activities

Although the range of issues that are related to mainstreaming varies by context, there are certain common crosscutting challenges that are suggested by the experience to date. These challenges are discussed in the remainder of this section and are listed as follows:

- Policy understanding and support for M&O,
- ITS strategy and program development,
- Systems integration and operations planning,
- Necessary technical tools and data,
- Expanded cooperative context,
- New resource-allocation requirements, and
- Process implications.

Mainstreaming must be achieved in five separate contexts in which resource allocation or design decisions are being made that critically affect what services are offered and how they are achieved. These five contexts include

- *Statewide and regional planning and programming*—existing statewide regional planning and programming process (as generally defined by federal guidelines) at the level of the statewide long-range plan and the State Transportation Improvement Program (STIP), as well as at the level of the regional long-range

TABLE 1 Traditional Planning Process Versus Management, Operations, and ITS

	<i>Traditional</i>	<i>ITS/Operations</i>
Orientation	Major capital facility (build/preserve) "Build" New capacity/service expansion Solving recurrent or "average" conditions Aimed at capacity, LOS, and safety	Systems operations & service provision "Do" Operations & efficient management of existing system Response to variation in conditions Solves different problems reliability, security, incident response
Temporal	Problems of tomorrow Forecast driven Long-term, multi-year implementation One-time decisions Static once in place Fixed, predictable technology and characteristics	Problems of today Response to current conditions Short-term, immediate implementation Continuous, incremental System evolves through feedback Rapidly changing technology and characteristics
Costs/Funding	Medium/high major capital facility Low/medium M&O Federal aid context and requirements	Low/medium capital/infrastructure Major life cycle operations costs Often implemented using local funds
Implementers	Public agency Construction industry, real estate, current users	Public and private partnership High-tech industry, small current constituency
Other Attributes	Stand-alone Separable Facility-based Low/medium technology Capital, service improvements Major construction Visible and permanent	Piggyback on other projects Connected through communications System-based, core central systems Advanced technology Non-capital (protocols, algorithms, communications) Minor or no construction Often hard to see

SOURCE: NCHRP 8-35, Mitretek, and Parsons Brinckerhoff

plan and the regional transportation improvement plan (TIP).

- *Corridor and project planning*—focusing on an analysis of corridor and subarea levels of alternatives that involve environmental analysis and preliminary design activities, as per major investment study (MIS) practice. However, this guidance does not address key issues that are related to integration of ITS into these processes.

- *Regional system integration and operational planning*—focusing on establishment of regional architecture systems integration. There is an initial effort that is required for initial ITS deployments; the process can be continued to an appropriate level of completion as deployment proceeds. Federal guidance for this process is under development, with a strong emphasis on relationships with other parts of the planning process.

- *Project development*—including not only conventional design activities but also, in the case of ITS projects, the involvement of key stakeholder operators in

operations planning and systems analysis to ensure architectural consistency with related projects and for integrated follow-on.

- *Project and systems operations*—conventionally a voluntary, consensual, and ad hoc facility-owner-based activity that is undertaken as part of actual real-time facility and systems operations by specific operation staff.

These issues and those described in the following subsection must be considered at each level of planning in recognition of the time gaps and the often-tenuous relationships between higher-level and lower-level planning activities.

Policy Understanding and Support for M&O

The initial barriers to the integration of M&O and ITS into the existing planning and programming process is a general appreciation of the benefits of M&O on the

part of elected decision makers and management, including an understanding of ITS as the conceptual and infrastructure "bridge" to actual systems operations.

Concept Familiarization

The idea of M&O, on the basis of a user-services delivery system that is integrated regionally through a series of communications, analytical, and control systems and that involves the real-time cooperation of a series of service providers, is a new model of service delivery from the current mainstream. Education and familiarization are essential at two levels. First, the transportation decision-making and management levels of state and local governments must be convinced of the virtues of M&O (and therefore ITS). Second, the technical community must become familiar and comfortable with the concepts to understand and develop a systematic implementation process. Familiarization can be accomplished through technical documentation, demonstrations, and scan tours, to name a few. The EDP process fostered the use of visioning as an effective means of conveying the potential of ITS to potential constituencies that were not familiar with ITS concepts and their applicability.

Jargon

Jargon itself (as this paper demonstrates) is a barrier to broader understanding.

Scale of Benefits

A precondition to widespread understanding and acceptance may also be overcoming the "why bother?" phenomenon. Although the benefits of M&O and ITS, in general, are intuitively obvious, competition for resources and the planning process require quantification of impacts, benefits, and cost effectiveness. A special challenge to be faced in this regard is that although the cost effectiveness of ITS is typically quite high, the visible impacts are typically subtle and often depend on widespread level of implementation.

At the same time, as an increasing number of non-mobility program objectives have been formally incorporated into the planning process (and attracted their own constituencies), there has been a general professional unwillingness to use rigorous measures of the relative short-term measurable transportation benefits of alternative investments. Jump start projects, such as those undertaken through the federally sponsored model-deployment initiative, can demonstrate highly visible payoffs.

Constituencies

The focus of state and local investment in transportation improvements responds to an aggregation of stakeholder views about what is desirable and effective according to professional judgment and norms, industry and political interests, public values, and expectations. Each type of transportation improvement has its champions, whether it is highway expansion, light rail, or high-occupancy vehicle (HOV) lanes. Without such a constituency it is unlikely that major shifts in policy and resource allocation will take place. In this regard ITS have obvious handicaps and advantages. On one hand, they participate in the enthusiasm for new technology. The transportation professional community, over time, will undoubtedly become increasingly supportive as the promise of the concepts is realized in deployment. On the other hand, ITS lack the scale of capital investment that in itself attracts support because of direct (construction) or indirect (real estate) impacts. The lack of major ribbon-cutting opportunities (except for transportation management centers) is a handicap in this regard.

Promotion

ITS, within an M&O policy framework, must be promoted. Within the planning and programming process, institutional support can be very influential. Senior-agency leadership has already played a key role. Federal policies, through funded demonstrations and guidance, are obviously influential within the institutionalized planning community. State DOT leadership is also a consistent primary factor in the progress made by bellwether regions in ITS implementations. In a few cases, local leadership has emerged, recognizing the need for interjurisdictional cooperation to deal with local problems despite resource constraints. A remaining challenge is to support existing champions (who are often one-person bands) and nurture additional champions.

The existing committee structure within the planning community can be an important resource. Some regions and states have established ITS committees with expanded membership, bringing in other service-delivery stakeholders (such as law enforcement and emergency services). A few states have also undertaken ad hoc efforts to engage private-sector entities—users, technology vendors, and service providers—who are knowledgeable and interested parties regarding the promise of M&O.

ITS Strategy and Program Development

A key step in mainstreaming is an emphasis on M&O, which must be accorded an appropriate level of priority

in both statewide and metropolitan planning and programs. At present, individual ITS projects are being implemented but not as part of the mainstream. This results from the range of special demonstrations, dedicated federal aid programs, active interest by a division of state DOTs or specific local government support, or special MPO policy, to name a few.

Several Contexts

Mainstreaming M&O as a policy and ITS as a program is likely to evolve from both top-down and bottom-up influences. The challenge is to seek the appropriate approach at several levels. At the state level, a commitment to increased intensity of operations and introduction of new forms of transportation management must flow in part from a policy conviction. At the regional level at which projects are visible, a commitment to management must be understood in terms of specific project implications as well.

Strategic Outcomes

From the top down, the increased recourse to formal strategic planning within state DOTs in recent years has led to a more careful statement of basic policy objectives as the basis for the top element of a department's strategic planning activity. An "outcome" focus has placed greater emphasis on customers' definitions of desirable performance. Nonetheless, communication with customer perspectives, both private and commercial, by using surveys or other techniques with regard to refined program objectives remains tenuous.

At the same time, the pressure of resource constraints has continued the push toward efficiency and an increased general focus on preservation and operations program elements. In addition, federal policy has encouraged strategies that emphasize efficient systems management. ISTEA and the Transportation Equity Act for the 21st Century (TEA-21) include factors that support increased focus on improved M&O on an integrated basis at the appropriate scale. These factors include

- Competitiveness, productivity, and efficiency;
- Safety and security;
- Environment, energy conservation, and quality of life;
- Integration and connectivity;
- Operations;
- Preservation of existing systems;
- Coordination across boundaries; and
- Freight and transit stakeholders.

These factors establish a positive environment for the development of an M&O-related policy.

Performance Orientation

The key focus of mainstreaming is to ensure that the benefits of M&O are fully incorporated into the service provision and resource-allocation decisions and that the broadest range of customer-relevant strategies is considered. The real-time service focus on M&O responds to a high premium on maximizing system performance. A strong role for M&O within state policy is likely, therefore, to depend substantially on the orientation of the state plan and policy to link its achievements to performance (as distinct from physical measures of infrastructure output or conditions). As an increasing number of states adopt strategic approaches, it can be expected that operational performance will become an explicit element in statewide planning.

A key step in the logic of performance is the use of deficiency analysis, with performance measured against the objectives, standards, or measures of effectiveness, which state DOTs may wish to establish for each of their principal policy goals or objectives, or both. The linkage of policy goals with measurable standards for various operations services represents a powerful leverage, because M&O-oriented investments will often, although not always, be part of the most cost-effective approach.

In a few instances, statewide policies refer explicitly to improving the M&O of existing systems and the role of technology and ITS concepts. But few states have put into operation such policies in plans and programs.

ITS Program Elements

A key feature of the ITS approach to M&O is that it suggests a method to generate an overall M&O program. The concept behind such a program is that systematic, regionwide, and multiservice ITS deployment generates synergistic benefits that are not captured by piecemeal projects. For example, the addition of arterial traffic control integrated with freeway operations substantially enhances each. Full mainstreaming of ITS implies this type of programming.

There are a variety of mechanisms to generate service-specific ITS programs. The conventions of user service and user-service bundles, or core services, offer another mechanism for identifying the types of programs that might be implied by an M&O policy (such as freeway and arterial management, traveler information, and emergency vehicle preemption). If a regional or statewide ITS strategic plan or EDP has already been

created, the overall architecture framework that identifies the broad range of potential user services represents a resource from which the next logical phases of M&O investment can be drawn.

This type of thinking can also be extended to sections of state corridor planning in which generic appropriate strategies can be identified, the details of which are appropriately worked out within lower-level planning efforts.

From the bottom up, early deployment of ITS projects has, in some cases, provided sufficient visibility (i.e., demonstrable success, or staff support, to "gain a place" in state-level policy. There are additional roles for the same ITS technology and integrated systems as part of other programs for increased effectiveness of conventional improvements, such as ramp metering, as well as "stand alone" ITS-service programs (MayDay).

An M&O focus at the policy and program level also provides an opportunity to include nonconventional demand management strategies that have typically received ad hoc treatment. Value pricing and telecommuting provide two examples of non-infrastructure-related strategies, the implication of which is not yet visible, with strong ties to other components of comprehensive ITS programs through their dependency on real-time traffic monitoring and related functionalities.

ITS architectural concepts also suggest ways in which ITS and technology can benefit other state-level programs, such as safety, maintenance, and regulation. For example, the communications network that is used for traffic control may also be viable for maintenance operations.

Corridor-Specific Projects

At the corridor and subarea level, the challenge in mainstreaming shifts from the strategic to the tactical—the appropriate M&O treatment—which is consistent with regional policy. Corridor and subarea studies are typically occasioned by proposed major investments. Typically, ITS improvements have been afterthoughts, whereas major improvements were under consideration. However, the value of ITS in this context flows from three potentials:

- ITS improvements may permit a reduced scale or enhanced effectiveness of capital alternatives by virtue of operational features.
- ITS, in some cases, may represent cost-effective, stand-alone alternatives for the first phase in corridor-improvement strategies.
- ITS components may offer additional service features that are not presented by conventional capital alternatives.

Slating Projects

Whereas ITS may be part of the operations program emphasis at the state level, a crucial step in mainstreaming M&O at the regional level is the appropriate inclusion of ITS projects in the TIP. The source of such projects may be an ongoing regional ITS integration study or other ITS strategic activities, a specific corridor-related project, or the product of a systematic TIP candidate project evaluation.

The completion of a regional integration strategy can serve as a useful source for corridor-level M&O improvements that are consistent with a broader regional framework. A key feature on this scale is explicit analysis and comparisons among alternatives (as per MIS), with a strong emphasis on cost effectiveness and impacts (often air quality constraints).

TIP projects, in a financially constrained environment, are typically subject to some kind of evaluation process by using common criteria. Such criteria typically include

- Cost,
- Urgency,
- Impact on level of service or congestion,
- Air quality impact, and
- Support of land use.

Scoring methods are frequently weighted for noncapacity improvements or projects with an efficiency impact. An important aspect of mainstreaming is to develop criteria that respond to the unique features of M&O improvements, such as their short-term, cost-effective implementation and their ability to respond to nonstandard conditions.

Systems Integration and Operations Planning

Characteristics of ITS, including the use of remote, real-time conditions monitoring, automated analysis, data communications, feedback-based control algorithms, cross-system integration, and other features of advanced transportation and communication technology, require the introduction of systems engineering concepts and disciplines to the transportation planning, design, and operations processes. The importance of achieving interoperability for policy, efficiency, and market reasons requires explicit systems integration efforts. These efforts include an analysis of both legacy and future program development to establish a framework that minimizes the chances of major system, service, or geographic incompatibility, or technology-acquisition inefficiencies. FHWA has placed special emphasis on ensuring

interoperability by requiring systems integration efforts.

Systems integration studies are a form of planning and engineering that focuses on the technical demands that regional interoperability places on information-based systems if efficient systems operations and cost-effective development are to be achieved. Systems engineering as a discipline has a well-defined set of rigorous procedures for developing and designing customer-oriented, functionally defined, and information-based systems (with major software, hardware, and communications elements). An important product of such an effort is an architecture that documents key functions, relationships, and processes and that interfaces at the logical, physical, technical, and institutional levels. For ITS applications, much of this has been prepackaged in the form of a federally sponsored prototype called the "national architecture," which can provide useful examples and guidance to ensure more efficient development of each specific custom-tailored regional architecture.

There are, however, a range of important points of contact between systems integration studies and both statewide and regional planning. These elements include the need to cover a broad range of services (some of which may not be within the planning process) and the involvement of the complete range of potential stakeholders, some of whom are outside the traditions of the planning and programming process.

To date, regional systems integration has been partial, ad hoc, and state-led, sometimes with strong participation from affected local governments. (In a few instances, MPOs have played the role of convenors and organizers.) Indeed, as a "start up," it may be preferable to construct a special ITS strategic plan to generate an increased focus on the unique characteristics of and potential for ITS, as well as on the appropriate level of detail. These measures can build off the existing EDPs and add elements that have often been missing, including geographic and service coverage, a more complete regional systems integration framework (architecture), and a complete range of stakeholders. Features that can be more easily included within a stand-alone study include

- More comprehensive analysis of a complete range of user services and a more concrete definition of projects (as distinct from general concepts);
- Clear description of the regional systems framework and related investments that are implied;
- Opportunities to identify the benefits more widely to build an understanding of M&O; and
- Identification of necessary internal and external legal and administrative arrangements that include agreements with other necessary "partners," both public and private.

Planning for M&O, by definition, does not end with design and deployment. Given the built-in monitoring and feedback character of ITS-based M&O improvements, there are opportunities for minor improvements in operational regimes on a regular basis. Many ITS systems have, by their nature, the ability to make adjustments in their operations or upgrades in hardware or software in relatively short-time cycles, often at relatively low cost. Therefore, a logical follow-on to systems integration studies and deployment of any specific user-service-oriented system is the continuing cycle of upgrades and modifications. Decisions must be made about the nature of these improvements, which often involve renegotiations of protocols that are agreed on by participating state and local government owners and operators. This operational planning, therefore, takes place continuously "below the planning horizon" and is conducted not by planners but by operations personnel of the affected jurisdictions in various cooperative groupings.

Necessary Technical Tools and Data

If M&O-based programs and projects are to compete in the planning and programming process, they must be represented in the technical procedures in such a way that their inherent features and advantages are accounted for. Several mainstreaming activities, such as plan-strategy development, program slating, and alternatives evaluation, require that the costs, impacts, and benefits of ITS options be compared with other options.

However, the conventional alternatives definition, forecasting, impact evaluation, and costing procedures have been developed with terms and methods that are appropriate to long-lived, fixed, capital-intensive, and environmentally intrusive projects that have long lead times and in which travel behavior is forecasted. The very different characteristics of M&O strategies and ITS improvements indicate that a level playing field will require significant adjustments in these processes and supporting technical tools. These adjustments must account for

- Regional or area coverage (versus corridor),
- Incorporation of incident-delay reduction,
- Improvements in level-of-service reliability and safety (as well as delay),
- Value of enhanced traveler information,
- Life cycle M&O costs,
- Zero negative impacts,
- "Tunability,"
- Short-term payoffs, and
- Synergism with "off-site" improvements.

At present, data, codified experience, and analytical methods do not support an even-handed comparison of capacity versus operating-oriented alternatives, although current development of federally sponsored methods is making important progress. Critical needs include

- Codified costs and benefits data for a range of ITS improvements and applications;
- First-cut set of agreed-on evaluation criteria (measures of effectiveness) that reflect the targets, impacts, time scales, and geographic scale of ITS applications that are different from conventional improvements;
- General rules on the order of magnitude for travel behavior impacts of the broad range of ITS services, including guestimates on future synergism among services at widespread levels of deployment; and
- Behavioral-based simulation techniques that are also based on validated assumptions for network-based alternatives in terms of first-generation sketch-planning techniques that are easy to use

Capitalizing on ITS Data

ITS-related detection systems are already beginning to generate vast amounts of data on traffic patterns, including data on traffic response to varying conditions, both standard and nonstandard. Although the potential of these data has been much discussed, little systematic effort has been undertaken to organize the "archived data" function of ITS. Some metropolitan areas are now reaching the point at which detection coverage on the upper-level network is sufficient to justify the effort that is involved in developing quality control, sampling, and storage protocols for use in planning and evaluation.

The value of the data in the planning process covers the following functions:

- Developing and validating travel-demand models on the basis of the full variation of traffic conditions instead of a single average;
- Researching and developing new model structures on the basis of the ability to more accurately relate behavior to actual conditions;
- Providing systems performance data;
- Developing and analyzing plans; and
- Regulating development of special vehicle operations.

The value of ITS-derived data is likely to be related to the data's ability to provide the information currently missing from databases that is used to forecast, analyze, or evaluate. This formation includes substantial improvements in geographic coverage, duration, sensitivity to vehicle type, incorporation of variability, and

relationships of recurring or nonrecurring causes and conditions. Those individuals who mainstream ITS-generating data into the planning process will have to grapple with a series of problems. These include responsibility and cost of archiving and analyzing data; interactions between planners and operators to improve quality control; and technical challenges of editing, data-quality control, data management, and access.

In addition, the transition from a data-starved, antiquated environment to a rich and recent-data environment will require a fundamental reassessment of the relationship between the "cost and value of knowing."

Expanded Cooperative Context

A key feature of ITS is the implication of the broad range of services and the integrated regional approach on the need for new cooperative relationships, both vertical and horizontal, among potential service providers.

Vertical cooperation among state and local governments and regional agencies has always characterized regional planning and programming, and in some instances, actual service provision (transit authorities). The concept of integrated operations emphasizes vertical interdependence. Much of the promise of advanced traffic management, for example, depends on integrated freeway-arterial operations, which require close cooperation between state DOTs and local governments.

Horizontal cooperation refers to the need for transportation agencies and other transportation-related service providers, such as law enforcement and emergency services, to move toward closer cooperation. The existing degree of independence and differences in motives can place an absolute cap on the ability to improve certain key transportation services. At the same time, improved joint response to roadway incidents and the opportunity to share information and communications infrastructure provide motives for collocation, joint program development, and shared policies among transportation and nontransportation agencies, all of which may have on-system responsibilities. Closer relationships at the operating level have been developing in several locations, but the opportunities associated with ITS infrastructure and the development of more formal comprehensive programs suggest the value of formalizing some of these relationships as a more stable basis for planning and investment.

Questions have been raised about the need for new institutional arrangements among multimodal transportation management ("metropolitan operating authorities" is a multimodal version of transit authorities), which might also formally involve nonpublic works agencies. There are a few such multijurisdic-

tional entities with operational responsibilities, such as TranStar and TRANSCOM. However, control of facilities and budgets will not be lightly loosened, and it can be expected that jurisdictions will move very carefully and slowly down the vector from cooperation to formal consolidation. Furthermore, the evolution of technology suggests the possibility that close operational integration can take place on a carefully targeted basis from distributed locations and with the aid of new communications and improved display systems, combined with automated analytical routines and predefined protocols. The future "metropolitan management institution" may indeed be a set of overlapping, virtual, bilateral, or multijurisdictional entities.

New relationships with private-sector players, who act as providers of services for ITS infrastructure on a commercial basis, are also needed. There is already a range of experience with informal relationships between private service providers and various state and local transportation agencies, particularly in the traveler information and incident-response areas. Formal contractual arrangements, both public and private partnerships, become important when there is a commingling or sharing of valuable resources, as in the bartering of public right-of-way in return for the private provision of communications capacity. As quality of information continues to improve and dissemination technology advances, the opportunities to turn more and more aspects of M&O into a "business" will increase.

Major barriers to more aggressive partnering are the administrative barriers that require major efforts when creating each new partnership, along with the general cultural divide of sectorial values and objectives, which must be overcome in each public or private partnership arrangement. Mainstreaming partnerships, therefore, will involve not only standardizing partnership arrangements but also a learning process (on both sides) of the values and objectives of each partner.

Such partnership arrangements will become increasingly important as the development of ITS spreads, and the resources that are represented become more commercially valuable. The private market for in-vehicle and personal communications devices is forecast to substantially outweigh the total public investment in ITS-related infrastructure. If the market for automobile personal computers and for personal transportation-related information services develops as anticipated, it can be expected that private-sector entities will take on new roles in the M&O arena. For example, non-intrusive vehicle-detection technology, such as the technology being developed to meet the Federal Communications Commission's cellular 911 geolocation requirements, could result in private entities becoming the principal suppliers of traffic information. Given the central role played by detection within ITS, it

is not too great a leap to imagine major private entities replacing public agency roles as ITS service operators.

Promote New Resource Allocations

The end of an earmarked ITS program that was introduced by TEA-21 marks the passing of the "honeymoon period" in which ITS projects did not have to compete for resources and adds a compelling dimension to mainstreaming. ITS projects will have to compete for capital funds with other projects, as discussed earlier. M&O also introduces the need to account for the costs (e.g., maintenance and staff costs) for continuing service provisions. Therefore, resources for deployment of ITS systems that support M&O, as well as funds associated with service delivery, need to be separately identified in STIPs and TIPs.

The use of ITS as an "add-on" to conventional alternatives (e.g., new highway capacity within the context of an MIS) introduces the need to include M&O-related costs on a continuing life-cycle basis.

However, some of the most critical resources may not appear in STIPs. M&O programs introduce the need for additional operations personnel. This need has typically been a key constraint in the development of ITS programs. Because ITS projects evolve and may be too small to merit proper naming, a program-level budget is a logical approach.

In addition to departmental resources, attention must be given to the coordination and promotion of programs with related state and other public agencies, such as law enforcement, whose capacities are important for effective M&O. Most staffs from state DOTs have yet to reflect the substantial personnel time that should be devoted to developing the new arrangements on an interjurisdictional level that are required for cooperative systems operations to develop new public and private partnerships.

The competition for state and local funds for ITS, especially for operating resources, suggests that an aggressive effort should be made to open opportunities for private-sector investment. These efforts should be used not only when user-fee revenues are available but also to tap outsourcing opportunities in which private management efficiency and experience may reduce overall costs. Resources are also needed for the development of regional integration and basic ITS infrastructure as a stand-alone activity, as well as for service-oriented projects themselves.

Process Implications

This discussion suggests that M&O cannot play an essential role in the planning and programming process

without substantially affecting the existing policy process, conventions, methods relationships, and resource-allocation priorities. If the institutionalized process appears unable to support improved operations, as well as development and deployment of ITS, then the supporters of ITS, including state DOTs, operations-oriented units within state DOTs, interested local governments, and other public agency and private stakeholders in M&O and ITS, will continue to “work around” the process. M&O planning and deployment and operational planning would continue, and resources would be allocated in a separate process that would suggest sub-optimal use of public resources and major opportunity costs in improving service. This places a burden on state planning entities and MPOs (and USDOT), as advocates of 3-C planning, to work with their constituencies toward effective accommodation and support of M&O.

A more desirable scenario is the gradual mainstreaming of M&O into the planning and programming process by “blending” the activities. In other words, the key aspects of the current conventions of statewide and metropolitan planning and programming would be integrated with

principal features of systems integration and operations. This blending is based on the assumptions that

- A new orientation toward service delivery and performance feedback becomes a central feature of planning.
- The existing planning and programming process provides the necessary resource priority.
- Planning and programming institutions provide a positive technical setting for M&O strategies.
- Operations proceed at an integrated regional scale.

Figure 1 suggests the point of departure for such integration. The important role of operational monitoring and feedback is shown, with the potential linkage to needs assessment within the planning process. In addition, use of the user-service approach for mapping out a comprehensive ITS program in support of M&O is indicated relative to long-range and subarea planning activities. Figure 1 also illustrates the budgetary impact of continuing operations. Even though regional systems integration is shown as a somewhat separate process,

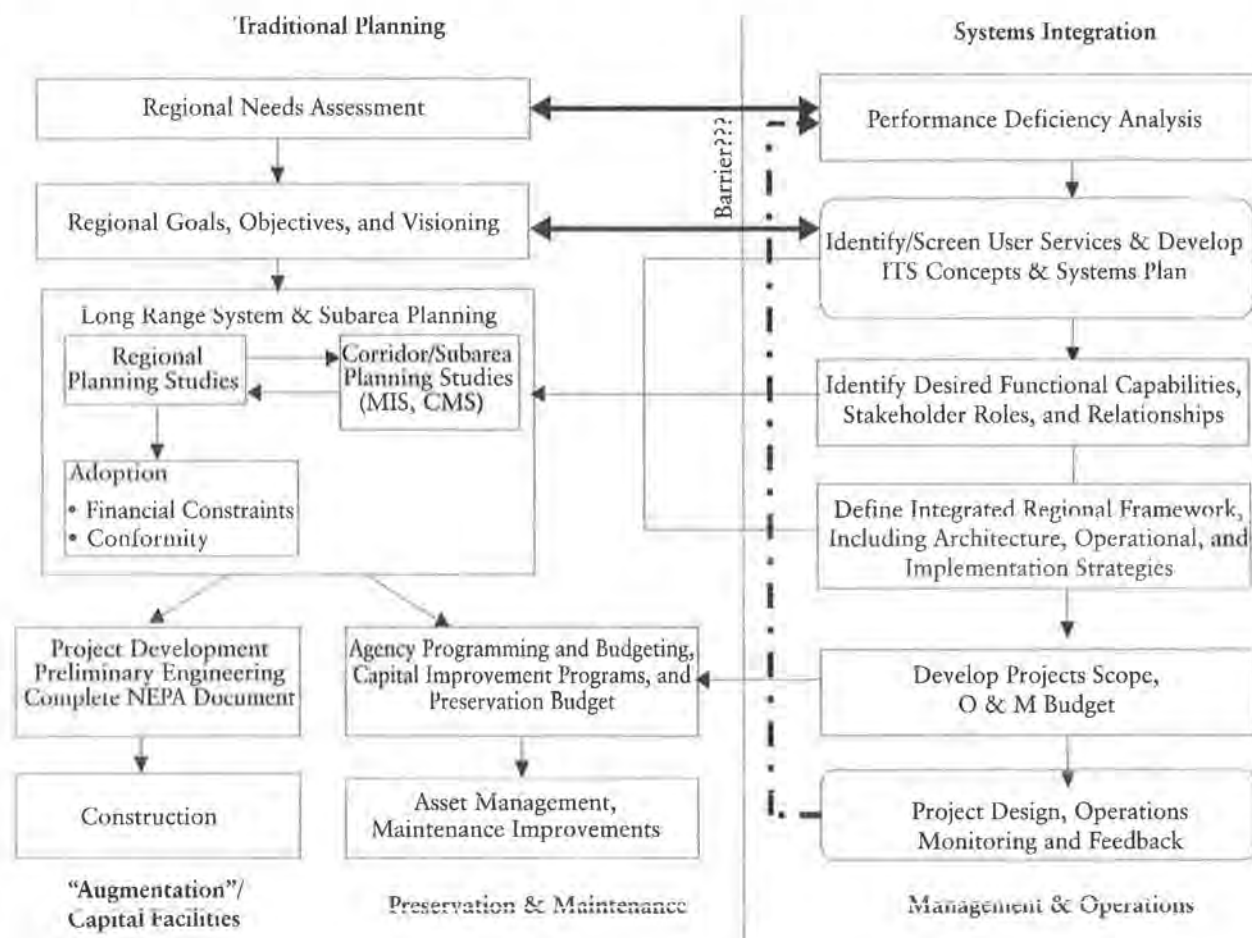


FIGURE 1 Transportation decision-making process elements.

reflecting current realities, institutional barriers, not technical barriers, keep these processes apart. This reality emphasizes the importance of the complete range of mainstreaming activities that have been discussed.

BEYOND MAINSTREAMING TO REINVENTION

Although the challenges to mainstreaming may seem formidable, future progress is ensured by important context forces. The logical outcome of these forces is likely to induce change in several dimensions that will substantially affect the level and type of infrastructure-related transportation services that are delivered in the future, as well as the institutional arrangement for their delivery. Most of the forces that have been cited are external to current transportation institutions. It is important, therefore, to consider the efficient and effective response as a matter of policy. Just as the existing transportation planning and programming process and institutions were invented for a previous mission, they can be reinvented for a new one.

The reinvented 21st-century transportation service delivery model for planning and programming may include

- Acceptance of "managed congestion" as the principal performance objective of state and local planning and programming, accepting the limitations of major new capacity in most settings. This would imply a consequent priority focus on incident response, traveler information, and security-mobility attributes

that reduce the impact of congestion on the individual traveler.

- Availability of archived data to the planning process to support detailed and reliable simulations of travel behavior in response to varying operational regimes and capacity additions, including the impact of information and pricing.

- Incorporation of the full development and deployment of integrated regional ITS infrastructure into planning to better support infrastructure owners in terms of their day-to-day service delivery, with secondary consideration of long-term capital improvements and preservation. The shift to a strong operations orientation may take place only after sufficient ITS deployment has occurred such that a "threshold effects" demonstration of the impacts and benefits is visible.

- Improved technical understanding of the synergism potential among reinforcing operational strategies, including the as-yet-untested impact of a ubiquitous, high-quality supply of information on demand.

- Use of information technology and distributed systems to forge a series of overlapping but coordinated virtual coalitions for specific operations purposes, without relying on a single institutionalized agency or entity and guided by a common understanding of systems architecture and protocols.

- Increased role of the private sector in outsourced development and operation of systems according to new nonintrusive technology and increased commercialization of data-collection distributions and dissemination, including private entities that provide operations services on a multijurisdictional basis in a "broker" role.

Integration of Intermodal and Multimodal Considerations into the Planning Process

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Over the years, numerous conferences and research agendas have focused on creating a truly multimodal transportation system planning and decision-making process. The issue is once again being examined at a time when it might be argued that more progress has been made toward achieving the objective in the past 5 years than in the previous 20 years. However, it is also believed that we are moving into an era in which the imperative for continued progress has never been stronger and that the risk of business as usual has never been greater. Although the Transportation Equality Act for the 21st Century (TEA-21) significantly increased the funding that is available for surface transportation, needs still outstrip resources. Moreover, global economic trends and the need to respond to a range of economic, social, and environmental objectives create strong incentives to find the right balance and mix of modes to serve a wide variety of market segments. However, a range of institutional, financial, policy, and regulatory barriers remain. Gaps in data and limitations of analytic methods constrain our ability to define and evaluate system choices. The challenge is to define a research agenda that can reduce these constraints and that can accelerate the progress that has been observed over the past several years.

A number of conferences in the early days of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) served as forums for lively debates on the definitions of intermodal and multimodal. To preempt

a return to that discussion, a consensus understanding of the terms is offered here before discussing why we would like to promote them. The transportation system that serves all passenger and freight trips and that connects to international origins and destinations involves all surface and air modes (highway, transit, rail, air, marine, pipeline, and nonmotorized). Some might argue that we need to add telecommunications and information technology to the list as either a substitute or an enabling technology. In some areas, or for some markets, different modes provide competitive service. In other cases, they are complementary. For many trips, few real modal options exist. A truly multimodal planning process provides a forum to consider all modal options for freight as well as for passenger trips. Furthermore, such a process should not unduly constrain our ability to invest in the particular mix of modal options that will best serve different market segments and geographical areas while reflecting diverse economic, social, and environmental objectives.

Within this multimodal planning process as defined, a particular class of solutions known as intermodal solutions, which has received too little attention until recently, can serve freight and passenger trips with a combination of modes. In the past, mode-specific institutional arrangements, regulation, and financing restricted or at least discouraged the consideration of intermodal options. More recently, deregulation, global economic forces, and a logistics and information-sys-

tem revolution have led to dramatic increases in productivity and to great examples of creative and seamless intermodal freight transportation in the private sector. ISTEA has encouraged the public sector to promote similar solutions for both passenger and freight movements.

There are a number of issues that drive the logic for a multimodal system's view of transportation networks and service and seamless intermodal connections as one critical component of that system. These issues are

- *Serving the total trip*—Freight and passenger users of the system are concerned about the quality, safety, cost, and reliability of the overall trip from origin to destination. Trips cut across modes, jurisdictions, and borders, and terminal and transfer points are key system components for improving intermodal connections.

- *Serving different market segments*—On the passenger side, trip purpose, household characteristics, and other demographics define distinct market segments with different sensitivity to various transportation system characteristics and different modal options. On the freight side, very distinct market segments exist as well, depending on the industry and its total logistic costs and strategy and the nature of the commodity (e.g., weight, value, time sensitivity). In both cases, different modes or combination of modes will often best serve different market segments.

- *Responding to diverse objectives*—Although market and economic objectives drive much of the freight transportation business and influence passenger travel as well, the transportation system must support a wide range of objectives that reflect equity, environmental quality, land use, and community livability. Balancing these objectives often requires balancing the mix of modes that are used to respond to different transportation needs.

- *Allocating capacity and service for shared facilities and operations*—The highway system serves a significant portion of passenger (auto and transit) and freight trips. Highway rail-grade crossings create safety and service issues, and bridge clearances often constrain double-stack rail options. Rail lines often serve both freight and passenger movements, and high-speed rail passenger service creates particular challenges. A significant portion of airfreight moves on passenger planes, and intermodal terminals often mix passenger and freight activity.

- *Meeting resource constraints*—Resource limitations are coupled with the need to preserve and maintain investment in a significant portion of the existing system. This situation creates an environment in which the many competing opportunities to improve passenger and freight transportation involve difficult trade-offs. Overall system effectiveness, instead of mode-specific objectives, need to shape these choices.

All these issues indicate a planning process that focuses on system service and performance as a whole for both passenger and freight trips. The issues have been recognized for a long time, and ISTEA took a major step in encouraging such a planning process. The state and the metropolitan planning organization's (MPO's) planning factors, emphasis on performance, funding flexibility, and emphasis on freight and intermodal concerns and interests all have resulted in real progress. Have we made as much progress under ISTEA as we had hoped? If TEA-21 offers the potential to continue to make progress, where should we focus research efforts to make the most progress?

CURRENT STATE OF THE PLANNING PROCESS

To address the issues that were identified in the previous section, such as serving the entire trip, the planning process must focus on the entire multimodal system, encourage intermodal solutions, and integrate both the passenger and freight elements of the system. The process needs to define key trade-offs and choices and provide a forum in which all interests can search for consensus. Even if consensus is not possible, at a minimum, the process needs to provide information on choices to the broader public political decision-making process and private business decision making as well. If the ideal is a well-informed "level playing field" and the reality is a continuation of fragmented institutions, funding restrictions, and segregated passenger and freight decision making, the question is how have we fared over the past 6 years, and what can that tell us about future research directions?

ISTEA produced significant changes in the planning process. It strengthened the role of MPOs; established a broad set of planning factors to guide both metropolitan and statewide planning efforts; encouraged more explicit consideration of trade-offs through the management systems and the requirement for fiscal constraints in plans, State Transportation Improvement Programs (STIPs), and Transportation Improvement Programs (TIPs); increased funding flexibility and eligibility; and emphasized inclusion of freight interests in the process. Although it is not the intent here to provide a comprehensive summary of the status of the planning process at the state and metropolitan levels, good progress has been made, and it is useful to provide a few examples to highlight this progress and to identify potential next steps. Furthermore, whereas a number of examples of good practice are mentioned, many other states and MPOs also have been making progress in integrating multimodal and intermodal considerations into their planning processes.

Multimodal Planning

ISTEA did encourage a new round of multimodal planning at the statewide, metropolitan, and corridor levels, though ownership, operation, and financing of each mode remains fragmented, and freight is still largely in private ownership. The role of MPOs was strengthened by ISTEA, although the ability of these institutions to create a regional framework for decision making and to integrate planning for different modes varies widely. The Metropolitan Transportation Commission of the San Francisco Bay Area (MTC) has a stronger role than most MPOs because it has significant control over some portion of funds that are allocated to the region. MTC has identified a "regional multimodal system" as one tool to help focus investments and operating strategies. However, leadership and innovation are being demonstrated by MPOs in a number of different metropolitan areas, even in areas where their control over funding allocations is much weaker.

The recent *Enhanced Planning Reviews* conducted in 14 metropolitan areas by the Volpe National Transportation Systems Center for the Federal Highway Administration (FHWA) and the Federal Transit Administration reviewed key elements of the planning process in each area. Even though most of areas that were reviewed had entered into one or more major investment studies (MIS), the degree to which these studies were integrated into the metropolitan planning process varies widely. In many cases, a preferred mode, or alternative, is clear in advance, especially for projects already in the pipeline and in situations in which the implementing agency is the lead agency. However, MPOs in St. Louis, Dallas, and the San Francisco Bay Area are cited for clearly linking MIS with the metropolitan plan and for playing an active, coordinating role. In St. Louis, an interagency management group has been established, and in Dallas, the lead agency for each study is selected collaboratively.

In the past most MPOs have dealt with all modes, at least on the passenger side. Today, the extent to which planning is truly multimodal varies widely from place to place and is more a reflection of institutional arrangements and funding constraints. The planning reviews indicate that ISTEA had relatively little effect on MPO structure and governance in most areas and that arrangements and approaches to involve all modes vary as well. Although local elected officials are on the policy boards of each MPO that is reviewed, a transit agency representative sits on only half of the boards. Port and airports are involved formally even less often at the policy level. In states like California, where significant funding and decision-making authority has been delegated to the regional level, a more integrated approach to planning may be encouraged. Certainly the strengthened role of

MPOs has created a new partnership between the state departments of transportation (DOTs) and MPOs in many states, and the congestion mitigation and air quality (CMAQ) and transportation enhancement programs have brought more interest groups to the table. The extent to which these measures have resulted in a more integrated approach to planning versus a finer slicing of the funding pie is arguable. At a minimum, more issues are surfacing and more interest groups are involved, resulting in a broader range of project (if not system) trade-offs that are being considered.

At the state level, ISTEA also created a new round of planning activities. The extent to which these planning efforts are truly multimodal depends on a wide range of institutional and funding arrangements, as well as on each state's unique transportation needs and economic, social, and geographic characteristics. In some states, such as Maryland and Wisconsin, where there is broad state involvement in all modes and funding flexibility at the state level, more integrated plans can be developed and a broader range of trade-offs can be considered. The Wisconsin *Translinks21* document reflects a comprehensive effort to look at all modes for passengers and freight, including intermodal options. The identification of a need for more support for intercity bus service, primarily for social and equity reasons, represents the type of trade-off and choice issues that would not surface in states with much greater restrictions on funding.

The Oregon Transportation Plan, an early state transportation plan adopted in 1992, provided a policy framework and a multimodal system element for guiding further planning throughout the state. The plan identified minimum levels of service for various transportation modes and functions and provided an estimate of the resources that were necessary to meet those service levels. A preferred investment program was also identified that included all modes. Later efforts by the Oregon DOT and by the Oregon Transportation Commission provided greater details in terms of statewide modal plans, including the Public Transportation Plan of 1997 and the Oregon Highway Plan of 1999. Trade-off analyses have been advanced through these efforts, particularly with Oregon DOT's recent development of a "constrained investment strategy," which provides guidance on what will be implemented at different funding levels below what is desirable. All of these efforts featured a broad and comprehensive outreach process.

Colorado DOT is now developing a constrained funding strategy around different concepts that will guide investment choices. The Texas Transportation Plan developed investment programs and was organized around goals and strategies. Texas used a very broad range of committees to develop goals, objectives, and strategies for important topics such as mobility and

accessibility, economic development, trade, and finance. The development of the Texas Transportation Plan was conducted with comprehensive outreach to all interest groups. The Ohio statewide planning effort also was notable for its degree of outreach and public participation. Washington DOT structured its statewide plan around a process that defined the resources required to meet various service levels for different components of the state system and that distinguished between facilities that were state owned versus of state interest.

Many other states have undertaken new and noteworthy planning efforts over the past 5 years. Almost all of these efforts involved a broader range of interests, greater public participation, and consideration of a broader range of modes and issues, including freight, than were reflected in earlier plans. Although the highway mode still dominates state involvement in transportation in most states, multimodal policy plans or system plans have generally been developed to provide a framework within which more specific and detailed modal plans are defined.

Freight

When ISTEA was enacted, freight was identified as a topic that deserved special attention and focus. One of the conclusions from a conference on ISTEA implementation held by the Transportation Research Board (TRB) in Irvine, California, in 1992, was that few transportation planners knew much about freight or its transportation needs, and seldom did transportation policy boards or other decision-making bodies include representatives from shippers or carriers. A recommendation was made to incorporate freight considerations into transportation planning, not only in the problem identification stage of the planning process, but also in the goal-setting analysis, and evaluation stages. Since 1992, freight transportation has been the subject of numerous initiatives, each one having the goal of maximizing consideration of freight issues in the transportation planning process.

One widespread development has been the formation of freight stakeholder groups that are made up primarily of private-sector representatives, often with active participation from government agencies. In general, these groups have served as forums for identifying impediments to efficient freight transportation and as advocates for specific freight infrastructure improvements. The Heartland Freight Stakeholders Coalition in Kansas City, for example, involves a wide spectrum of trucking companies, railroads, and shippers. MPOs in Seattle, Chicago, Philadelphia, and Dallas have established similar groups. New York and Miami have established project-specific advisory committees, and a number of states, such as Ohio and Texas, have con-

ducted significant outreach or have established freight and business advisory committees to assist in developing statewide plans.

Although many freight stakeholder groups are organized by the private sector as advocacy organizations, some have a measure of official status in the planning process. For example, the MTC of the San Francisco Bay Area regularly convenes a group of freight representatives to provide advice on transportation issues that affect their businesses. The group helped establish TIP project-selection criteria, and a portion of that region's CMAQ funds were directed at projects of interest to the freight community. Similar efforts to increase the number of active freight advisory committees have been undertaken by MPOs in St. Louis and in Binghamton, New York.

The freight stakeholder groups have been effective in elevating the discussion of freight transportation issues in areas where they have been established. However, it is important to note that their role is, for the most part, advisory. To date, no state or MPO has provided the freight community with voting representation on its decision-making body for allocating transportation funding, although at least one is actively considering to do so.

Several states and MPOs have taken steps to develop intermodal systems plans that are either focused on freight transportation requirements or on highlighting freight as a major area. For example, the Mid-Ohio Regional Planning Commission conducted an infrastructure study for the Columbus Inland Port. The objective of the study was to develop actions and strategies to position Columbus as a major "inland port" warehousing and distribution center. The study also included forecasts of economic and population growth in the region and translated these into specific infrastructure and service requirements for the Columbus area.

Colorado is also undertaking a freight infrastructure study to be used in developing the freight component of the statewide transportation plan and the freight elements for the 10 transportation planning regions within the state. Florida is just beginning work on a statewide intermodal systems plan for the year 2020. The plan will analyze conditions and trends for the movement of passengers and freight and will define an intermodal system of statewide significance.

Washington, Oregon, and Wisconsin, among many other states, identified the portion of the state transportation system that was most critical for freight movements and intermodal connections. A special commission in Washington State also looked at the state's airport system in terms of intermodal passenger and freight movement and options for improving capacity for both passengers and freight. Other states, such as California and Michigan, also took advantage

of the intermodal management system requirement by building freight and intermodal databases that will continue to be used even though the management system requirement has been eliminated.

At the federal level, FHWA made the identification of connections to intermodal facilities a high priority of the designation of the National Highway System (NHS). Although the connectors themselves were roads and highways, they had the effect of identifying specific intermodal freight facilities as having some level of priority when competing for funding for access improvements.

Under ISTEA a number of freight projects received funding, largely as a direct result of the greater attention paid to freight issues. The majority of these projects involved improvements to highways that served freight facilities and that were identified as intermodal connectors on NHS. Rail projects proved much more difficult to implement. ISTEA did not explicitly name rail freight projects as being eligible for federal funding assistance. Therefore, states and MPOs that wished to advance a rail freight project found it necessary to qualify the project under some other category, usually the CMAQ program.

The highest profile freight project funded under ISTEA was the Alameda Corridor, which serves the Ports of Los Angeles and Long Beach in southern California. The federal support that was provided, however, was not under any ISTEA program. Instead, an innovative federal direct loan was structured, and special legislation was enacted that gave USDOT the authority to enter into the loan. Nevertheless, the policy framework of ISTEA gave the project the visibility it needed to obtain federal support. Moreover, the loan served as a model for one of the credit programs that was included in TEA-21.

TEA-21 continued the planning framework specified in ISTEA, but it also included some new funding provisions that could be beneficial to freight interests. The National Corridor Planning and Development Program is a new discretionary program that will provide funding for the coordinated planning, design, and construction of corridors of national significance, economic growth, and international or interregional trade. The Coordinated Border Infrastructure Program was established to improve the safe and efficient movement of goods at or across the U.S.-Canadian and U.S.-Mexican borders.

These new programs respond to a desire, long expressed by some freight interests, that a dedicated source of funding for freight projects is needed to ensure that these projects receive any funding at all. Although not limited to freight projects, the project-selection criteria favor projects that demonstrate international trade benefits, particularly to motor carriers. The funding level, however, is relatively small. Only \$700 million is authorized over the 6 years of TEA-21.

The Alameda Corridor project, by comparison, has a total project cost in excess of \$2 billion. The challenge will be to use these programs to leverage other funding sources. The danger will be that these programs will evolve as the only potential source of funding for freight projects.

TEA-21 also includes two new credit programs, both having significant applicability to freight projects. The Transportation Infrastructure Finance and Innovation Act will provide direct loans, loan guarantees, and standby lines of credit for large highway, transit, intercity passenger rail, and publicly owned intermodal freight facilities on NHS. The Rail Rehabilitation and Improvement Financing Program (RRIF) will provide direct loans and loan guarantees to public agencies and railroads to acquire, improve, develop or rehabilitate intermodal or rail equipment or facilities, including track, bridges, yards, and shops. Both of these programs will be useful in the appropriation of financing for freight projects, because many of these projects have the potential to generate revenue through user fees or lease payments. To date, however, no funds have been appropriated for RRIF, which means that applicants will need to produce some amount of money up front to cover the credit subsidy before they can receive a loan. It remains to be seen whether this will be a significant disincentive for participation in the program.

TEA-21 does not extend eligibility guidelines for its grant programs to cover privately owned rail and intermodal facilities. Neither USDOT nor Congress was able to develop a reasonable approach for separating public benefit from private advantage, a crucial requirement if public funds are to be used. In the absence of such methodologies, federal grant funding for projects that involve private-sector participants will be difficult to assemble.

TEA-21 added freight shippers and providers of freight transportation services to the list of those to be included in the process of developing state and metropolitan long-range transportation plans. However, although the composition of MPOs was considered by FHWA and Congress in the reauthorization process, the final bill did not call for MPOs to be reconstituted, as some freight interests had hoped.

Tools and Methods

Although a comprehensive review of the status of the tools and methods that are available to support multimodal and intermodal planning is not the objective of this paper, a few observations are useful in the areas of data, travel-forecasting methods, and evaluation-trade-off analysis tools. In general, the capabilities in each area are much more developed for passenger travel than

for freight at the national, state, and metropolitan levels. The reduction of that gap, notwithstanding well-known constraints related to the confidentiality of some freight-related data, is a priority and a necessary step to define more effectively the trade-offs that are associated with freight-related investments.

In terms of data, a number of recent conferences and reports have focused on the information needs of transportation decision makers and on the adequacy of current data sources to meet those needs. At the federal level, the Bureau of Transportation Statistics (BTS) has made significant progress in collecting, organizing, and distributing a range of data and making it more accessible for metropolitan and statewide planning efforts. This information on passenger and freight movements, system conditions and performance, and underlying economic and demographic trends has created a valuable resource for developing a more comprehensive understanding of the system. However, a recent report by BTS identified critical gaps in existing information on freight and passenger movements and in the system itself. In the freight area, these gaps include insufficient information on international trade; on commodity movements for some industries and modes; and on system cost, time, and reliability. The report also emphasizes that significant work still must be done to make national data sets useful at the state and metropolitan levels. This is a significant challenge when statistical sampling is used because site-specific samples can become prohibitively expensive.

A wide variety of new databases also have been established at the state and metropolitan levels as a result of the most recent round of planning. Some of these efforts involved developing more complete inventories of the multimodal system in terms of facilities, services, and conditions, as well as surveys of shippers, receivers, and carriers, to better define freight movements. The extent to which these data become institutionalized remains to be observed. A variety of states and MPOs are also attempting to establish performance-monitoring and planning systems that may refocus existing data-collection strategies and budgets or supplement existing ones. The cost of collecting and maintaining data is a growing concern, and many agencies are questioning the usefulness of some legacy databases. A number of states, such as Michigan and Mississippi, have attempted to create enterprisewide databases both to cut costs and to provide more useful and consistent information to all levels of the organization. The application of better sampling and statistical methods and the use of data from intelligent transportation systems (ITS) applications are also being examined at the national, state, and metropolitan levels.

Most, if not all, MPOs have multimodal passenger-travel-forecasting capabilities for work and nonwork

trips within their regions. Some also have analysis capabilities for examining airport-access issues and mode choice. Most of these models are the traditional four-step process, and a large number of metropolitan areas have been updating and enhancing these procedures over the past 5 years. Improvements in the traditional modeling approach have focused on mode choice, automobile ownership, access modes, nonmotorized travel, and time-of-day modeling for peak and off-peak periods. Some areas have also begun to focus on activity-based and tour-based modeling approaches. To support these model enhancements, some areas are undertaking land use, demographic, and economic data-collection efforts for the first time in 30 years. No MPO has a similar forecasting capability for multimodal freight flows, though truck trips are typically estimated and loaded on networks. At the corridor level, many MPOs are making modeling improvements as part of MIS or broader corridor studies.

At the state level, a number of DOTs have developed statewide passenger models, and a few also have developed some freight-forecasting capabilities. A recent TRB conference on statewide modeling indicated that 14 states currently have such models, and four more are in the process of developing them. While some of these models mirror the four-step urban process, the conference participants generally believed that different approaches are required for statewide modeling. A number of federal efforts to improve the state of the practice support these efforts at the metropolitan and state levels. The Travel Model Improvement Project has developed a number of improvements for traditional urban models, and the TRANSIMS system is about to be deployed in a number of urban areas to test a much more detailed approach to simulating passenger travel in these areas. A variety of freight-forecasting procedures have also been developed, such as the publication of the *Quick Response Freight Manual* under FHWA sponsorship.

A critical need that is frequently cited to improve multimodal planning and decision making is an improvement of evaluation tools for making trade-offs within and between modes or among different modal mixes. In the early days of ISTEA, there was hope that a series of mandated management systems would provide new evaluation tools and information for analyzing trade-offs and resource-allocation decisions for a range of system elements (pavement, bridge, transit) and performance objectives (congestion, safety, intermodal). The nature of the mandate, coupled with the cost and effort that was required to comply, led to the elimination of the requirement for most of these systems as part of the NHS legislation in 1994.

Notwithstanding this change, almost all states have or are developing bridge and pavement management

systems, and some states and MPOs have developed a number of other systems, at least to some extent. Perhaps the most ambitious effort was the Michigan DOT's integrated management system that covered all six system areas. However, although significant effort throughout the country has been devoted to developing some of these management systems, their use in defining key resource-allocation choices and trade-offs has been disappointing. When surveyed as part of a recent National Cooperative Highway Research Program synthesis report, most states reported that they did not use their bridge and pavement systems to select the budget level or projects in these program areas. A continued interest at the state level in better tools and approaches for broader asset management may lead to new tools. Michigan, Wisconsin, and Washington have all made progress in either integrating management system tools or developing a process for more formal program-level trade-off analysis.

A number of other tools have been developed at the national level. The Highway Economic Requirements System (HERS), developed for national needs analysis, has been adapted to meet state highway investment analysis needs in Oregon and Indiana. HERS can deal with trade-offs between rehabilitation and capacity-enhancement (widening) projects. A more comprehensive set of investment actions can be analyzed with the ITS Deployment Analysis System (IDAS) and the Surface Transportation Efficiency Analysis Model (STEAM), both of which are being developed under FHWA sponsorship. IDAS will allow network-level analyses of benefits and costs of ITS deployments at statewide or metropolitan levels. STEAM allows network-level cost-benefit analyses of traditional transit and highway investments. To make the playing field level, intermodal and freight projects need to be analyzed within the same type of network model and evaluation capabilities.

Challenges and Barriers

Although progress has been made in further integrating multimodal and intermodal considerations into the planning process over the past 10 years, significant barriers remain. On the passenger side, continued fragmentation of responsibility for the planning, operation, and maintenance of different modal facilities and services among a variety of state, regional-metropolitan, and local agencies and special authorities is a well-known fact of life. This fragmentation, while often an impediment to multimodal planning and decision making, is unlikely to change dramatically and requires a constant examination of the incentives and disincentives for creating a more integrated system. Similarly, the degree of funding flexibility at the state, regional, and local levels

varies widely and constrains the range of solutions and trade-offs that can be considered.

The effectiveness of the link between state and metropolitan system planning can also be questioned in terms of the degree to which investments and operating strategies that are examined at the system level effect project-by-project decision making in the context of TIPs and STIPs. Finally, the degree to which a range of nonautomobile options can be given serious consideration is often constrained further by trip-making patterns. In some fast-growing decentralized metropolitan areas across the country, the effectiveness of nonautomobile options may depend critically on our ability to further integrate land use and growth management policies with transportation.

Notwithstanding these challenges that are related to passenger travel, a more significant set of challenges confront efforts to integrate freight transportation into the public-sector multimodal planning process. As a result, the rest of this section focuses on the key barriers to addressing freight issues more effectively.

It is clear that the topic of freight transportation has received significant attention from policy makers since ISTEA was enacted. However, actual progress in integrating freight transportation needs into the planning process has been more limited. Freight transportation is a complex area with different players, funding mechanisms, and market characteristics than what most states and MPOs are familiar with. Moreover, in terms of transportation planning, the years since ISTEA was enacted indicate a relatively short period of time to implement fully the policy framework that was originally envisioned. Looking ahead, there are a number of challenges and barriers that need to be addressed if freight is to be integrated more completely into transportation plans and funding programs.

In terms of institutional structure and decision making, ISTEA and TEA-21 both delegated principal responsibility for transportation planning and project selection to state DOTs and MPOs. Although this makes sense for evaluating the ability of projects to address regional traffic congestion, it does not work as well for freight issues. Freight transportation is driven by the private sector and encompasses national and international economic impacts. Whereas many freight projects have local impacts, either on congestion or air quality, the beneficiaries are often located elsewhere. For example, some of the major beneficiaries of improved links between coastal ports and railroads are shippers and consignees that are located in the Midwest. An MPO board member might focus less on this sort of project than on a project that would have more tangible benefits for his or her constituents.

The new programs aimed at trade corridors and border areas could help address these problems by focusing

federal attention on them. But on the larger question of the representation of freight interests, neither ISTFA nor TEA-21 called for state and MPO decision-making bodies to be reconstituted to include freight interests. For now, it will be necessary to find ways to improve on the existing institutional arrangements. This area should be looked at with an eye toward the next reauthorization to see if changes are warranted.

Limitations of the tools and methods that are appropriate to support freight planning is another barrier to integrating freight into the planning process. ISTFA and TEA-21 both operate under the premise that state and local decision makers are in the best position to develop plans and to establish project priorities because they are "closer" to the needs of the traveling public. However, our experience has been that, although there have been examples of freight projects being added to transportation plans, they have not necessarily been substituted for or prioritized ahead of projects already included in these plans.

The tools and methods that could be used by transportation planners to evaluate freight projects relative to one another and relative to other transportation needs are still lacking. States and MPOs find it difficult to evaluate trade-offs between different types of projects. As a result, a project's relative ranking has more to do with how long the project has been around and its political support instead of any transportation benefit.

Since the enactment of ISTFA, there have been calls for better tools for evaluating trade-offs and relative benefits of different investments. Recognizing that transportation decision making is a political process, it is fair to ask whether these tools will actually be used by transportation decision makers. While it is probably unrealistic to assume that an "optimized" project portfolio could be developed, it is nevertheless important to illuminate the discussion of project priorities with good technical information on the relative impacts of alternative investments.

Financing freight infrastructure projects represents a significant challenge for state DOTs and MPOs. Often these projects require blending funds from a variety of public and private sources. The most sensitive issue, funding rail projects and rail intermodal access, was expanded somewhat in TEA-21 by making publicly owned facilities eligible at least for credit programs. However, eligibility questions will continue to plague many worthwhile projects.

The fact that many freight projects involve a private-sector participant raises questions about public versus private benefits. Separating the benefits and costs is time consuming and may lead decision makers, in both the public and private sectors, to decide that it is not worthwhile. Research on how best to approach this question is certainly warranted.

Finally, it is important to recognize that although many freight projects are modest in scope, a significant number constitute very large projects. The \$2-billion Alameda Corridor project is only one of several port-access projects that is under active consideration around the country. For the most part, these projects are too large to fit comfortably into state and MPO planning frameworks, and the federal funding that is available for these projects is extremely limited. Not every project can cover its cost, even in part, through user fees. Financing large freight-oriented infrastructure projects is likely to continue to be a major problem in the coming years.

TRENDS

A review of the state of the planning process suggests that significant progress has been made but that significant barriers to further integration of multimodal and intermodal concerns into that process remain. On both the passenger and freight side, these barriers involve institutional issues, financing constraints, and limitations to available data and analytic methods. However, before suggesting future research directions, it is useful to look at a number of issues and trends that will affect passenger and freight transportation in the future. Many of these trends are not new and will continue to create pressures on the system that we have experienced during the ISTFA era. However, continuation of these trends, coupled with the pervasive influence of technology in both passenger and freight transportation, will accelerate the need to take full advantage of existing infrastructure and all modes. These trends also will generate pressure to develop more creative approaches for problems for which traditional solutions are not having an impact.

Passenger

A variety of recent research reports and data summaries have characterized the status of passenger travel and demographic trends. The intent here is not to repeat the results of these studies in detail but to simply summarize a few trends and issues on which the planning process will need to focus in the next decade. Addressing these issues may require a reexamination of the appropriate mix and balance of modes and may create the need to integrate transportation more effectively with broader economic and land use planning.

Although not as dramatic as the statistics for freight transportation, passenger travel continues to grow, though the trend varies by mode. Highway person-miles-of-travel and vehicle-miles-of-travel have continued to grow, though vehicle-miles-per-vehicle have

leveled off. Household vehicles that are available per person of driving age now reflect almost saturation levels of automobile and light truck ownership. Automobile and light truck ownership exceeds the number of licensed drivers. Less than 10 percent of households do not have an automobile or light truck, and only 6 percent of the population is in a household without access to an automobile or light truck. While total transit ridership declined by 11 percent from 1985 to 1995, overall transit-person-miles of travel remained constant, with bus and urban rail declining and other modes, such as commuter rail and light rail, showing increases. Long-distance travel (trips greater than 100 miles in length) has been increasing. While the bulk of these trips are served by automobiles, air travel also has been increasing and accounts for a significant share of the total number of miles a person travels for intercity trips. Travel on other intercity modes has been declining, though this trend may change as the population ages.

The overall growth in personal travel is driven by a number of factors: strong economic growth, population growth, greater female participation in the workforce, and a growth in households that has exceeded population growth and has resulted in smaller-than-average household size. The growth in automobile-ownership levels cited earlier is also contributing to the trend. The most tangible result of this growth in person travel, whether the specific indices used in various report cards are embraced, is an increase in the level of congestion and in the duration of peak periods that are experienced in many large urban areas. More problematic is the fact that the majority of the employment and population growth that drives the increases in personal travel has been in suburban and low-density urban areas where options to the automobile often are not available and where traditional transit service concepts are not effective. As a result, the percentage of trips that are served by nonautomobile modes is declining. As a result of the shift to automobile travel, growth focused in suburban areas, and longer peak periods, the average travel speed of commuters has increased, while both the average length of a commute trip and, to a lesser extent, the time that the commute trip takes have increased.

A number of challenges exist that are created by both the growth and shifting pattern of personal travel. First, in many suburban and low-density areas, traditional transit services may have little potential, but highway capacity and operational improvement alone also may have limited impact. A mix of different modal options, balancing capital and operational improvements and increasing the emphasis on linking transportation with growth management, land use, and economic development planning, as suggested by Vice President Gore's recent announcement, may all be required. Second, in

denser urban areas and for the trips traditionally well served by transit, the national trend in terms of ridership should not mask the critical role that transit plays in some of the country's most important economic centers. Such service is essential to making the multimodal system work in these areas, for both passenger and freight transportation, by relieving pressure on the highway system while giving individuals mobility options. However, continued success for high-capacity transit involves addressing a key intermodal issue—adequate parking facilities at transit stations, which often are the only effective access mode. Finally, both within urban areas and for intercity and international travel, continued growth will increase pressure to take maximum advantage of existing infrastructure and service. Expanding capacity alone will not solve the problem. Improved intermodal connections, operational improvements, and potentially more segregation of freight and passenger travel in both facilities that are used and in hours of operation will continue to be an appropriate focus.

In addition to a variety of factors that affect the growth of personal travel, a number of other trends exist that are influencing the pattern or nature of personal travel and that are placing new demands on the system and the planning process. All of these trends have been well documented in a number of recent studies:

- Increased female participation in the workforce and growth in households headed by women, which has contributed to overall growth, also has tended to result in more linked trips and more complicated trip chaining behavior. This trend influences mode choice, time of travel, schedule constraints, and the potential for more integrated transportation and land use strategies.

- The aging of the population will become a more important determinant of transportation issues as the baby boom generation reaches retirement age. Income, physical vitality, and life expectancy of this group, coupled with an increase in leisure time, will create new demands on the system as well as create potential safety issues. The per-person long-distance travel by those individuals over age 65 almost doubled over the last two decades.

- Employment growth has outstripped population growth over the past 20 years. However, more significant than the growth in jobs is the changing nature of the job market. Dramatic growth in the service sector has resulted in three out of four civilian jobs being service related. A growing component of this workforce, particularly at the lower end of the pay scale, involves variable work hours, part-time employment, and workers holding more than one job.

- Information technology is having a dramatic effect both on location of jobs, the extent to which work is done

in the home or at some location other than a central job site, and flexibility of work schedules.

These and other factors will continue to change the demands that are placed on the transportation system and the nature of the transportation strategies that will be most effective in meeting these demands. They will also create a stronger need to integrate planning and decision making for freight and passenger travel as competition for shared facilities increases.

Freight

Similar to passenger travel, a number of trends are influencing freight transportation and have significant implications for the transportation system now and in the future. Freight movements have been growing dramatically, even more than personal travel. The preliminary results of the 1997 Commodity Flow Survey (CFS) indicate that freight shipments may have increased by 30 percent in value, 19 percent in tons, and 16 percent in ton-miles during 1994 to 1997. During this same period, intermodal shipments (trips using more than one mode) may have increased by as much as 44 percent by value, 17 percent by tons, and 20 percent by ton-miles. These figures do not include shipments that involve air and truck movements. Air shipments, while representing a very small percent of total freight on any dimension, grew the fastest of any mode. Small-package deliveries also grew dramatically. The value and ton-miles that were shipped by every major mode (truck, rail, water, pipeline, and intermodal) also increased.

The dramatic growth in small-package deliveries bears particular attention. As users of the freight transportation system have come to depend on frequent and smaller shipments, it is reasonable to expect that this segment will continue to grow. However, this means that larger shipments to warehouses and manufacturing and retail establishments are being replaced, to some extent, by smaller, more random shipments that are carried in increasing numbers of small trucks. The effect of the growth of small-package deliveries on urban congestion may become a significant question in the future.

Even though intermodal shipments grew rapidly, they still represent a relatively small, albeit growing, percentage of total shipments. From 1994 to 1997, the value of intermodal shipments grew from 11.3 to 12.5 percent of the total value, and the share of ton-miles increased from 7.9 to 8.2 percent. The share of tons that were moved stayed constant at 2.3 percent. Even if all air shipments are assumed to involve some truck movement, the intermodal share of total shipments would not change significantly in terms of percentage.

However, the share of intermodal shipments is expected to continue to rise over the next decade and to continue to represent higher-than-average value freight.

A key component in the overall growth in freight shipments has been international trade. The value of U.S. imports and exports grew by 45 percent from 1992 to 1996. In terms of tonnage, about 95 percent of these shipments were by water. Over the past 25 years, international waterborne shipments have doubled in tons, while domestic shipments have grown 15 percent. The 10 largest ports account for the vast majority of these shipments and account for close to 75 percent of the total port capital investment over the past 5 years. During this same time frame, the regional shares of this port traffic have shifted dramatically from East Coast to West Coast ports. Similarly, on the air side, over the past 15 years, freight revenue ton-miles on passenger carriers grew twice as fast in the international market as in the domestic market. All cargo carriers grew even faster, and once again growth in international shipments out paced domestic growth. The air share of the value of total imports and exports has increased from 11 to 25 percent from 1970 to 1994. The 15 largest gateways accounted for more than 91 percent of all air shipments by weight in 1994. Of the nation's top 20 gateways for imports and exports by value, 5 are airports and 15 are ports.

The concentration of international trade at a relatively small number of ports, air gateways, and border crossings creates unique demands on key intermodal facilities and corridors. It also reflects the fact that origin and destination patterns for both international and domestic freight movement involve a different portion of the transportation system and geographic area than the typical "commuter shed" that the MPO transportation planning process addresses. While the preliminary results of the 1997 CFS suggest that the average miles per shipment have decreased overall, and for most modes, a large amount of shipments cross metropolitan and state borders. Only 7 states had within-state shipments that represented more than 50 percent of the value of total shipments, and 25 states had through-state shipments that represented more than 50 percent of the value of total shipments.

The growth of freight movement has been fueled by a number of factors that include a strong global economy, international trade agreements, and emerging markets, particularly in Asia and South America. These factors, coupled with a logistics revolution that has been enabled by dramatic improvements in information technology, have changed the location of global industry activities and the way in which these activities manage an increasingly integrated supply chain. While the cost of logistics, as a percent of total product costs, varies widely by industry, total logistics costs (inventory, carry-

ing costs, and transportation) were \$797 billion in 1996 and represented 10.5 percent of the gross national product. Transportation represented about 57 percent of this total (\$455 billion), of which 80 percent were trucking costs.

Even though worldwide expenditures for logistics have more than doubled over the past 25 years, increasingly sophisticated logistics strategies are allowing many industries to trade off information for inventory and dramatically reduce logistics costs per unit of production. As a result, average inventory turnover is expected to double, and order cycle time is expected to decrease by 40 percent over the next decade. To take advantage of these logistics strategies, many shippers are reducing in-house logistics capability and capacity and are using third party logistics providers to manage their supply chain. As a result, many of these shippers have less of a direct connection to the transportation system than they did a decade ago.

Both the dramatic growth in freight transportation and the change in logistics strategy are placing new pressures and demands on the system. The increase in freight movement makes increases in capacity and operational efficiency critical for individual modes, as well as for intermodal connections, services, and terminals. The trend toward specialty manufacturing, just-in-time manufacturing, and the dramatic increase in small-package deliveries all place pressure on the system for reliability and time and cost efficiencies.

Implications

The future trends in both passenger and freight will continue to put more pressure on the transportation system and to increase the need for development of a more integrated and effective multimodal and intermodal planning process. The need to address the barriers to the development of this process, identified in a review of the state of the planning process, will become even more critical as these future trends unfold. Specifically, the implications of these trends include

- Both passenger travel and freight shipments are expected to continue to grow, placing more pressure on system capacity and preservation.
- Operational improvements, as a means to better manage existing capacity and to improve system reliability, especially for freight shipments, will continue to increase in importance.
- Growth in international trade will increase congestion at key gateway airports and ports and at related intermodal access facilities. Serving this trade efficiently will be critical to the national economy and competitiveness. Growth in international person travel will

have broader impacts on the air system and intermodal connections to that system.

- Growth patterns and other factors are increasing automobile use, but system capacity and management strategies cannot keep pace. This situation is likely to encourage continued decentralization of jobs and housing unless new approaches to growth management are adopted.

- Aging of the population may shift both trip patterns and mode usage, especially for long-distance travel.

- Concerns for environmental quality, equity, social objectives, and community livability will continue to create advocates for particular and often conflicting transportation objectives and often for modal strategies that require more complex choices and trade-offs.

- Technology will continue to change the nature of global businesses and personal travel patterns and to increase the importance of real-time information on system conditions and status.

RESEARCH PRIORITIES

Progress has been made under ISTEA in the integration of multimodal and intermodal concerns into the planning process. TEA-21 offers the opportunity for further progress, but some significant barriers remain. On the basis of the recent trends in freight and passenger travel and the implications of those trends for the future, addressing the barriers to a more integrated transportation planning process becomes even more important.

Suggestions for some candidate research topics that are provided in this section were guided by the need to address some broad themes. Summaries of these themes are

- Further integration of transportation, economic development, and land use planning will be required to address some key emerging transportation issues and to receive full benefit from the entire system.

- Our understanding of the freight system, of the logistics strategies that drive demand for that system, and of the impact of various capital and operating options is insufficient and not nearly as developed as our understanding of passenger travel. Nonetheless, we are moving into an era in which integrated freight and passenger planning will be essential.

- More integrated multimodal and intermodal planning implies more explicit consideration of trade-offs that will cut across modes, freight and passenger travel, and operating and capital strategies. Our ability to develop and communicate the implications of these system trade-offs is too limited.

To respond to these broad themes, a number of more specific research topics are suggested. Within each topic, a range of more detailed research projects can be defined.

Broad Economic Impacts of Transportation

Even though a lot of work has been done on this topic over the past 10 years, it is worthy of continued attention. At the root of the concern, with the development of a better understanding of the freight system and with giving more emphasis and priority to the examination of potential improvements to that system, is the connection between the efficiency of the freight system and economic competitiveness. However, strengthening our understanding of the connection between transportation and the economy as a whole involves both the passenger and freight systems. Projects that have analyzed the economic impact of dramatic decreases in transit service in dense metropolitan areas have made this point clearly. In addition, issues that involve labor force productivity and accessibility, as well as facilities and services that provide both passenger and freight movement on the highway, rail, and air systems, make the connection as well.

Strategies for Personal Mobility

The challenges facing the transit industry as a whole have been well documented, and there are ongoing efforts at both the national and state levels to reexamine the role and structure of the industry and to define a "new transit paradigm." Although there is a range of opinions on the nature of the problem with appropriate responses, the problem of congestion and personal mobility is growing rapidly in areas where nonautomobile solutions are limited. Some, of course, may not see this as a problem, but environmental, social, and resource constraints will pressure communities to examine ways to do a better job of integrating economic, land use, and transportation strategies. The current initiatives on livable communities will provide useful experience, as will the regions that have implemented growth management policies. Still, more work needs to be done.

Planning and Decision-Making Structure for Freight

Much of the freight transportation system is in private ownership. Shippers, third-party logistics providers, freight forwarders, and private carriers make daily decisions on transportation choices. Yet, public infrastructure is critical for freight movement, and public policy

on both freight and passenger issues influences the capacity and service characteristics that are available for freight movement. The freight system is going to have to handle significant growth over the next decade. It will continue to be under pressure to reduce costs and to improve or maintain reliability, and it will have to respond to continued restructuring of global businesses and improved information technology. How does the public sector respond to these issues and reflect freight transportation issues and concerns in the planning and decision-making process? Are further adjustments to the existing state and MPO structure adequate? Specific topics might include

- How do we reexamine the appropriate structure and public- and private-sector roles for freight planning to include changing the role and status of freight in the current process and its structure at the state and MPO levels?
- Given the pattern of freight trips within state and metropolitan areas, as opposed to the pattern of the majority of personal travel, how do we define planning approaches that involve all beneficiaries of freight improvements when they involve multistate regions and corridors and the national level?
- No matter what the forum, can we improve the ability to get freight interests "to the table," where they could have a stake in the decisions and where the time-frame for operating decisions and longer-term capital improvements are recognized?
- What is required to build a better consensus concerning priority freight improvements, and what information is required to let these improvements compete with other projects in the current process?
- Given the dramatic differences between personal travel and freight travel, in the extreme, do we need to consider a separate process for planning and funding freight-related projects? How would the separate processes be reconciled?

Data, Analysis Tools, and Evaluation Methods

We need to improve our understanding of the freight system and our tools to better evaluate the impact of system capital and operating improvements on freight transportation. Some specific areas of emphasis include

- Development of better information on how the freight system works at the national, regional, state, and metropolitan levels. This approach needs to go beyond just the movement of goods to include the logistics strategies and rationales that drive private-sector decision making.

- A key area already identified by BTS is to supplement existing national data-collection and data-distribution methods and to develop a set of tools and potentially supplementary data-collection efforts to make this information more useful at the state and metropolitan levels.

- Freight-forecasting methods lag behind comparable techniques for passenger travel at both state and metropolitan levels. Given the nature of freight movements, what multistate and national efforts make sense?

- Tools used for freight project evaluation, including benefit and cost analysis and other impacts, need to be strengthened because the distribution of benefits and costs between geographic regions and the public and private sectors may be very different than for passenger-oriented improvements.

- Freight-oriented system performance measures should be defined and integrated into existing efforts so as to develop performance measure systems at the state and metropolitan levels.

Increasing Funding Flexibility and Innovative Financing Approaches

A lot of progress has been made in the development of more funding flexibility and credit reform programs at the national level. More work needs to be done because funding eligibility constraints and restrictions on public and private partnerships still limit the range of solutions that can be considered in many areas or that require a tremendous effort to patch together financing programs for nontraditional projects. As mentioned in the previous section, the expansion of funding eligibility for public investments in private facilities may be particularly important for some components of the freight system, though it will be sure to create a lively debate within the freight community and elsewhere.

Tools for Trade-Off Analysis

The issue of providing better information for making investment and operating resource allocation decisions cuts across modes, passenger and freight travel, and jurisdictional levels. In most cases, these trade-offs do not involve the choice of one mode or another to provide the same service to the same set of market segments. Instead, they involve a complex set of choices that concern the right mix of modes and services to meet a variety of objectives and to serve diverse market segments. Much like the need to define objectives before one begins to develop system performance measures, it is necessary to define the types of trade-offs that the decision-making process is likely to deal with or to want bet-

ter information on, before plunging into tool development. Typical trade-off issues that could be the subject of better information and evaluation tools include

- Maintenance and operating versus capital investment within a mode,
- System preservation versus passenger mobility versus freight-efficiency improvements,
- Appropriate mix and balance of modal investments in a particular corridor or area to serve diverse market segments,
- Benefits of investments in intermodal facilities and services versus modal improvements, and
- Equity in providing service to urban and rural passenger and freight needs or service to groups and industries with constrained modal options.

In each of these cases, the trade-off process has a technical and political component. The issue is how the planning process can both develop and communicate information that effectively characterizes the choice, and how it can provide a better forum for understanding these choices and building consensus.

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CONFERENCE I RESOURCE PAPER

Transportation, Sustainability, and Land Use

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There is now a consensus for radical change in transport policy.
—Prescott (1)¹

Transportation has always been based on values. For most of the 20th century, these values have revolved around (a) road improvements (“getting us out of the mud”), (b) speed (reducing the friction of time on access), and (c) improved access to land. Opening up new lands for development and improving the road system to accommodate the automobile were clear national priorities. We can be proud of our success in meeting these goals for building America’s infrastructure in the 20th century.

As we greet the 21st century, however, we confront a new set of values for our infrastructure and for our society. In 1999, land consumption no longer has the high value that was placed on it in 1899. Speed has been achieved but, as distances have extended between destinations, travel times have not significantly shortened. We are “out of the mud” in all but the most remote locations. The challenge now is to ensure that our extensive transportation system does not sink back into it.

New values are now constraining our devotion to speed and to cheap land access. Sustainable development is a phrase that encompasses several of these new values, including conservation, efficiency, choice, and community. Perhaps most significant for transportation, consumption of our natural environment as an economic development strategy was replaced by conservation of our natural environment as an economic development strategy upon enactment of the National

Environmental Policy Act of 1970 (NEPA). Gradually, as the profound significance of NEPA took hold, the values of conservation have seeped into public and private economic behavior at all level of organization and activity.

The transportation sector has been slow to recognize this paradigm shift in values. State departments of transportation (DOTs) initially used the social, environmental, and economic analyses that were required by NEPA to identify methods of project mitigation, without questioning the core objectives of transportation service delivery. This approach became increasingly untenable as the very process by which transportation problems were identified and solutions were devised came under increasing scrutiny. The “no build” option was increasingly pressed upon transportation planners, as were pricing solutions, traffic calming, transportation-control measures, and other demand-side strategies. Planners were asked to look at the system, not just the project, when considering NEPA’s mandate.

Sustainable development and transportation for sustainability are the ultimate manifestations of this shift in values. Transportation must now be “embedded” within concepts of sustainability; there is no independent justification or political mandate for unsustainable transportation. As stated by the Canadian Institute of Planners, sustainability is now “the intent and central operating principle of planning.” (2) This principle includes transportation planning. This is what John

Prescott meant when he said that it is time for radical change in transportation policy.

TRANSPORTATION AND SUSTAINABILITY: PLANNING DILEMMA

It is one thing to adopt sustainability as a policy goal, but it is quite another thing to implement or even define it. Nevertheless, sustainable development is rapidly moving from the policy arena to becoming a statutory and regulatory mandate. The 1992 Rio "Earth Summit" on environment and development and the 1997 Kyoto Protocol on climate change impose specific targets for the control of greenhouse gases, of which U.S. transportation activities are estimated to be the largest single source in the world.

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) placed nontransportation objectives, such as social equity, environmental quality, and community integrity, on an equal footing with mobility as a desired output of transportation decision making. The Transportation Equality Act for the 21st Century (TEA-21) made ISTEA's shift to sustainability more explicit by creating a community-and system-preservation pilot program. The mandate for change is clear.

The Clinton administration has also made sustainable development an administration priority with the creation of the President's Council on Sustainable Development in 1993, which continues to promote the concept across all federal agencies. The U.S. Department of Transportation (USDOT) responded with the creation of a Livable Communities Initiative within the Federal Transit Administration and, most recently, with the creation of a task force on climate change. In January 1999, Vice President Gore announced a \$1-billion "Livability Agenda," which included \$50 million to improve coordination between transportation and land use planning.

Finally, sustainable development is also a "critical issue" in transportation research (3, p. 13). The Transportation Research Board (TRB) has published a research report on the long-term effects of motor vehicle transportation on climate and ecology (4). A new, permanent TRB Committee on Transportation and Sustainability is under active consideration, and a study panel is reviewing how transportation can be not only a significant part of the problem of global warming but part of the solution as well. A special TRB report of the social impacts of our national highway program has recently been published, and a new interest in transportation policies that support sustainable development is evident among many of America's trading partners (5).

State and local actions to promote sustainability are also increasingly specific. In November 1998, more than

200 state and local growth management initiatives were on the ballot, and 81 percent of them passed. At least 21 state and local laws and ordinances now require compliance with sustainable development goals, essentially limiting growth to the ability of existing public facilities and services to accommodate such growth (6, p. 37). A recent survey of 102 city and county transportation agencies in the San Francisco Bay Area found that more than 40 agencies were already integrating concepts of sustainable transportation into their transportation planning processes.

Quality of life is now an organizing principle for grassroots transportation activists and a way for diverse community groups to address common concerns about how transportation services are delivered (7). The interactions between transportation infrastructure or regulatory initiatives and the three dimensions of sustainability (economic, environmental, and social) are now a focus of research within the World Bank (see Figure 1).

These developments present challenges to the transportation planning community. Increasingly, planners are confronted with statutory and regulatory directives to act in support of sustainability goals, yet they are provided with neither (a) the power to act, (b) the analytical tools that are needed to support such action, nor (c) a clear statement of desired outcomes. Is sprawl (however defined) good or bad? Is mobility, as measured by increased average speed or increased vehicle miles traveled (VMT), still a public policy objective? How should transportation efficiency in the production and distribution of goods and services be measured within a context of sustainable development? These are the types of questions that are raised by placing transportation in the context of sustainability.

Ironically, the transportation planning community is being pressed to take action in support of sustainability at a time when the political environment is making planning for sustainability increasingly difficult. Examples of these constraints include the following:

- The price of gasoline, the most obvious variable cost of driving that can affect transportation behavior, is at a post-World War II low.
- Sales of sport utility vehicles and trucks, both with low gas mileage, now outpace the sale of automobiles.
- The primary performance measures for transportation—VMT and level of service—are still measures of consumption, not of access. If these are not the right performance indicators for transportation, what are?
- While transportation policy has now clearly shifted from an emphasis on construction to an emphasis on system preservation, transportation planning is still conducted within a planning structure that is designed to increase access to land, primarily by increasing physical

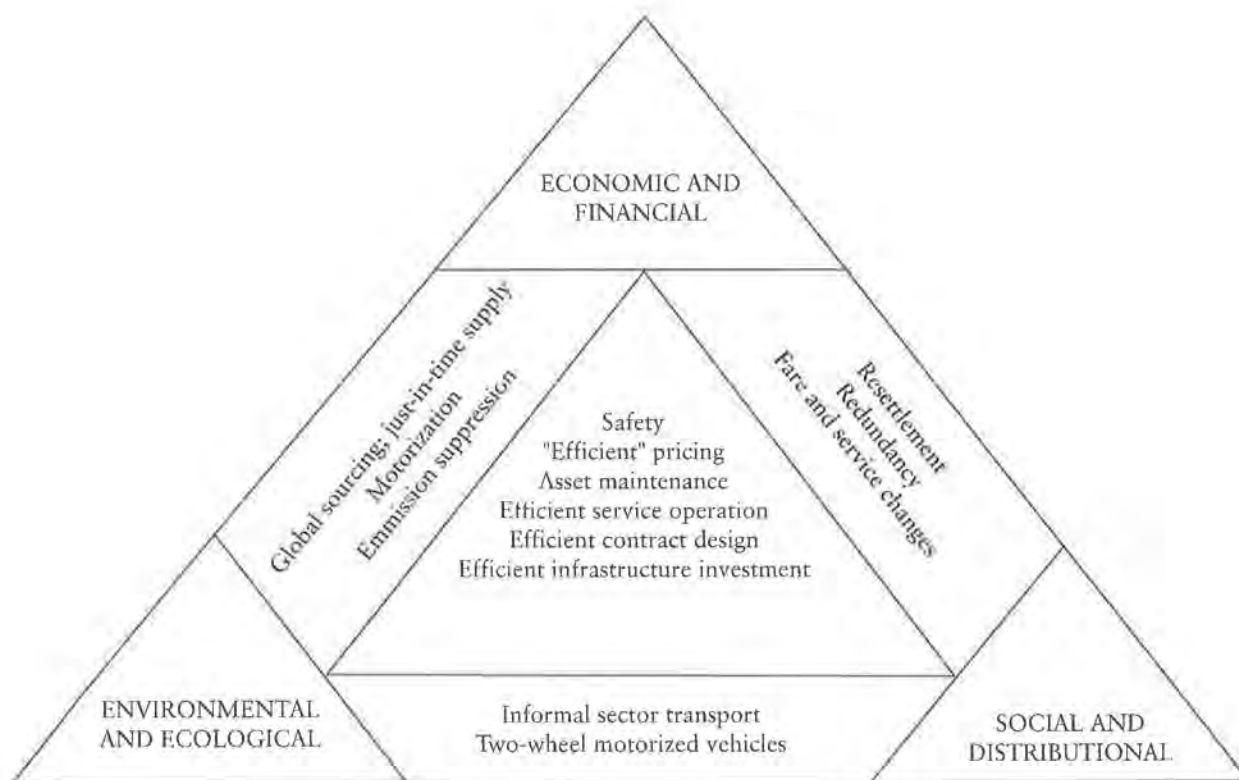


FIGURE 1 Three dimensions of sustainable development synergies and trade-offs (8).

capacity. Projects are still the primary output, not an efficient, sustainable transportation system.²

- The “tragedy of the commons” applies. The benefits of the existing planning paradigm are captured by individuals (through reduced travel time and increased access to land), whereas costs are felt at the community level (social and environmental costs, primarily). Conversely, the benefits of actions toward sustainability are captured at the community level (improvement in system efficiency), whereas the costs are heavily assigned to individuals (by internalizing the full environmental and social costs of travel). This makes political consensus on sustainability truly difficult.

- Legislative earmarking is an increasingly popular strategy for dictating the outcome of the transportation planning process as choices become more difficult.

These present constraints on the ability of transportation to advance sustainability goals are also burdened by an historical truth about transportation: Urban form has always been a function of the dominant transportation technology in place at the time an urban area experienced its greatest growth. Sustainability, with its emphasis on land conservation, represents a fundamental challenge to this historical imperative.

Specifically, it presumes that transportation technology can be managed to support, instead of drive, public objectives on land use, landscape design, and urban form. This is a very tall order. TRB’s *Special Report 231* provides a good discussion of research needs on transportation and urban form (9).

SCOPING AND DEFINITIONAL ISSUES

The purpose of this paper is to stimulate ideas for planning research that will help integrate transportation planning with notions of sustainable development. Ideas from other countries, especially from European countries, on promoting transportation and sustainability will be referenced. However, the scope of these ideas for planning research is national, because that is the context of transportation planning in the United States.

This paper focuses on efforts by transportation planners to recognize, and respond to, primarily intergenerational impacts of transportation on natural resources. This is basically the approach taken by the TRB study panel in its *Special Report 251: Toward a Sustainable Future* (4). The report includes such issues as climate change, ecosystem integrity, long-term air

quality issues, and irreversible resource depletion.³ It does not address actions for sustainability in transportation that are beyond the purview of transportation planners, such as materials management, which includes disposal of transportation materials (e.g., used asphalt and construction materials) or transportation supply (e.g., tires, used motor oil, leaking underground storage tanks, and junk cars). We deal here with the planning context within which the development and management of transportation infrastructure occur, period.

This paper does not cover research needs on transportation technology (e.g., Partnership for a New Generation Vehicle, electronic toll collection, the "hypercar," and new fuel technologies) that can promote sustainability goals. That is a job for technology research, not planning research. Regardless of what technological breakthroughs occur that benefit sustainability goals (primarily in materials and fuel technology), changes in our collective behavior regarding how we use transportation services will be needed (10).⁴ For that reason, research on how transportation technology can be used to improve transportation planning for sustainability is covered in this paper.

Finally, the seven consolidated planning factors of TEA-21 cover a broader range of objectives than can be addressed in this paper. They include everything from planning for global competitiveness to increasing the safety and security of the transportation system. All efforts to integrate sustainability into the transportation planning process must be measured, not only by the degree to which they advance specific, measurable benchmarks or indicators of sustainability, but also by the degree to which they defeat or advance these other policy objectives. In this context, sustainability refers to efforts to achieve these objectives in a sustainable fashion. Global competitiveness and safety are relative goals (there is no way to be 100 percent safe or 100 percent globally competitive) and are therefore constrained by principles of sustainability in the same manner as other community goals.

INTEGRATION OF SUSTAINABLE DEVELOPMENT GOALS INTO TRANSPORTATION PLANNING: TAKING STOCK

Overview

Measured by outcomes, we are not doing a very good job integrating sustainability objectives into transportation service delivery. If consumption of transportation services per capita is used as a rough indicator of directional progress toward sustainability, nearly every indicator is trending downward.⁵ Congestion is increasing;

safety and security are still major problems (especially if the safety and security of nonusers are considered); the environmental footprint of transportation infrastructure continues to expand at an alarming rate; emissions and energy use per capita continue to rise (as does VMT per capita); and access and choice are declining, particularly for those too old, too young, too poor, or too disabled to have access to an automobile.

This generalized failure of transportation service delivery to advance sustainable development objectives applies across all sectors (economic, social, and environmental) and within all time frames. It also applies at all levels of system analysis: neighborhood, community, regional, state, and national. Why?

The answer to this question is complex. However, some core assumptions of transportation planning, as predominantly conducted, contribute to this dilemma. The first assumption that postulates that problem identification is nonpolitical and technical is wrong. It is a function of many, sometimes conflicting, human aspirations and policy responses to those aspirations. Deciding which aspirations require action, and what type of action, is a nonlinear process that requires broad public involvement. Technical analysis can inform this process, but not control it.

The second assumption postulates that transportation is a derived demand, which means that demand is solely a function of the desire for access to a place, not of the cost of getting there. According to this assumption, making transportation cheaper by keeping gas prices low and roads both toll-free and designed for speed will not induce more travel. Economists know this is false—that making any product cheaper will increase its use. Transportation models do not know this.

The third assumption, which is a corollary to the previous assumption, is that transportation is a function of land use (i.e., land use alone determines travel demand) and does not influence land use itself (by providing cheap access to land). This statement is also false. Most transportation planners recognize this fact but claim that, because they do not control land use, they do not have to plan for it. It is also very hard to develop transportation models that have feedback loops to recognize the impact of transportation access on land use. As a result of these arguments, this assumption is largely ignored.

The fourth assumption theorizes that nonmotorized transportation trips (primarily walking and bicycling) need not be included in surveys of transportation behavior because they are difficult to count and, therefore, should not be included in transportation models. The exclusion of such trips is why so few sidewalks and bicycle paths were included in transportation projects over the last 50 years, until mandated by ISTEA. Yet, people want places to walk and bicycle, so they identify the lack of such places as a transportation problem.

Not all transportation planners make these assumptions, but they are the majority view, and they certainly dominate transportation models. Bicycling and walking do not appear on the National Personal Transportation Survey, which is the primary survey conducted by USDOT to measure personal travel behavior; the results of which are fed into models to estimate future travel demand. It is little wonder, therefore, that nonmotorized modes are largely ignored in both problem identification and project development. This is not sustainable.

Although we cannot address all the challenges that are faced by planners in promoting sustainability goals, two particular problems that are augmented by these assumptions inhibit progress toward sustainability: land use and climate change.

Land Use

Two issues deserve prominence here: ecosystem fragmentation and sprawl. The ability of the transportation infrastructure to cause permanent damage to wildlife and plant populations is extensively covered in TRB's *Special Report 251: Toward a Sustainable Future* (4). In response to the threat to ecosystems that are identified in this report, TEA-21 explicitly directs USDOT to conduct a study on transportation and ecosystem preservation.⁶ No action has yet been taken on this mandate.

No planning factor, including system planning, requires planners to conduct research on road-related habitat fragmentation beyond the project level. The transportation footprint is now so ubiquitous within urban regions that the ability of transportation investment and management strategies to retrofit the system for habitat integrity is incredibly difficult (11). Nevertheless, progress in this area is being made in Europe where the population (and infrastructure) is significantly more dense (12). Options are available, and TEA-21, with specific funding to reconnect habitats of endangered species under the Transportation Enhancements Program, has signaled that not only research but action is expected in this area. This development presents a planning challenge.

Sprawl is another incredibly difficult subject. Vice President Gore recently observed that it is now not unusual that "a gallon of gas can be used up just driving to get a gallon of milk." [This remark was delivered at the announcement of the American Institute of Architects' Livability Initiative (13).] Despite this increased sense of frustration with spread-out development, little agreement exists as to (a) the definition of sprawl, (b) whether sprawl exists regardless of how it is defined, and (c) if sprawl does exist within some agreed-on definition, whether its effects are harmful or helpful to long-term sustainability goals.

However, a recent TRB report provides guidance on this subject, including a working definition (spread-out, leapfrog development, both commercial and residential), and rough measures of consensus on both (a) the concerns raised by sprawl, and (b) whether sprawl is, in fact, causally linked to that concern (6). This study reveals that there is general agreement in a few areas that are directly related to the contribution of transportation to sprawl, including (a) more VMT, (b) more automobile trips, (c) higher household spending on transportation, (d) loss of prime agricultural lands and environmentally fragile lands, and (e) loss of modal choice (transit is less effective and efficient).

As agreement emerges on the causes and consequences of sprawl, decision makers will increasingly demand options for action. Research is needed to help transportation planners respond to concerns for which there is a will to act. With the ability of the transportation infrastructure to permanently consume land, including prime farmland and environmentally sensitive areas, this issue promises to be on the transportation planning agenda for years to come.

A third and final aspect of land use and sustainability is gaining increased public visibility: land as history and the consumption of land as the consumption of our history. A striking indicator of history as a nonrenewable resource that we are consuming at an unsustainable rate is the rapid, recent involvement of the historic preservation community at all levels of transportation planning—advocacy and even litigation. From Civil War and Revolutionary War battlefields, to historic transportation corridors (e.g., Erie Canal and Natchez Trace), and now to landscape preservation, the historic preservation community has clearly moved beyond buildings to claim land preservation as a central component of our national heritage (14). The transportation planning community must integrate this new concern about protecting history at the system (community, landscape, or regional) level as a new sustainability objective.⁷

Climate Change

As mentioned earlier, climate change, or global warming, is now a national concern. President Clinton signed a document that called for U.S. reductions in greenhouse gases to a level of 7 percent below 1990 emissions, a very difficult task. U.S. transportation emissions of greenhouse gases are now estimated to be the largest single source of such emissions in the world, and transportation's share of total U.S. greenhouse gas emissions continues to climb, now totaling about 33 percent. Controversy over this issue is highly likely to constrain the selection, location, and management of transportation projects into the indefinite future.

That said, global warming presents a unique challenge to transportation planners. Unlike land use, an area in which both the concerns and the solutions are locally driven, global warming is a national, and even an international, concern that appears to have very little ability to generate political will for action at the local level. Even in low-lying states, such as Florida, where the potential long-term effects of climate change are the highest (e.g., floods, hurricanes, droughts or fires, spread of tropical diseases), there appears to be little political will to act. Given the lack of political will to address climate change, what is the transportation planner to do?

Much literature exists on this issue, and it comes to a striking consensus. Nothing can be done at the local level as long as the issue is perceived as climate change alone. Instead, transportation planners that seek to reduce greenhouse gas emissions at the system level must focus on other regional concerns, such as land use issues that were described earlier, brownfield redevelopment, or livable communities through improved transportation choice, that have collateral benefits in reduced greenhouse gas emissions (15). [Additional information on greenhouse gas emissions is provided by a Federal Highway Administration (FHWA) report on transportation and global climate change (16).] Smart growth, energy efficiency, community livability, and "healthy cities" initiatives, which promote infrastructure that invites, not discourages, outdoor, nonmotorized human activity, are local strategies with collateral benefits in terms of reducing greenhouse gases.

In this regard climate change presents a fundamental challenge for sustainable development, because it requires a focus on system performance instead of on project development. The ability of climate-change strategies to advance multiple sustainable development objectives at the system level sets this issue aside from traditional transportation problem solving. Research is needed on how to make the leap from single-objective to multiple-objective planning at the system level.

Natural Resources, Community Development, and Other Derivative Sustainability Issues

Beyond land (including ecosystem integrity, protection of special areas and landscapes, and historically significant lands) and climate change, sustainable development becomes a medley of place-based aspirations. Some non-climate change—air quality issues are truly intergenerational. These issues include ground-level ozone, which can alter natural plant cycles, and other emissions that can have cumulative and long-lasting effects on the function and biological composition of ecosystems (4). These long-term effects present another level of com-

plexity to transportation planners that seek to promote sustainability.

PLANNING RESEARCH: NEW AGENDA FOR THE 21ST CENTURY

ISTEA and TEA-21: Approach to Sustainable Transportation

ISTEA was a "paradigm shift" in transportation policy, from construction to system preservation, from single-to multiple-outcome planning, and from project planning to system management. TEA-21, on the other hand, is perceived as "fine-tuning" this new direction. Although TEA-21 was indeed an endorsement of the new direction taken by ISTEA, it includes several new tools that can be used for moving transportation toward a more sustainable foundation. Many of these tools are untested and therefore present good areas for planning research. These tools include

- Transportation System and Community Preservation Pilot Program (best practices research);
- Cash-out parking innovations (ability to affect commuting mode choice);
- Expanded commitment to Congestion Mitigation and Air Quality and Transportation Enhancement programs;
- Broader flexibility on moving funds between projects and programs;
- Expanded commitment to intermodalism; and
- Charge to expand sustainable transportation technologies through intelligent transportation systems (ITS).

Each of these new tools should be evaluated by transportation planners for its ability to improve system integration and system performance and, therefore, the overall sustainability of transportation service delivery.

Characteristics of Sustainable Systems

Sustainable development is as much about attitude as it is about technical knowledge. It requires a new mindset about outcomes, not in terms of projects but in terms of functions. Key ideas expressed in ISTEA and TEA-21 include (17)

- *Plan for multiple outcomes*—Plan for multiple outcomes, not for single objectives, such as how to provide access, air quality, energy efficiency, and minimum physical disturbance. Sustainable systems are conservative. They seek to mimic natural systems that have evolved symbiotically over millennia and, therefore, are nat-

urally in balance. "First do no harm" is a principle of sustainability.

- *Think like a system*—Think like a system is another mindset of sustainability. It is not a particular "hot spot" that is the main focus of planning, but how the entire system is operating. Is it efficient? It is resistant to shock? What happens when part of the system "crashes," such as in a flood or earthquake? Are there backup systems? How resilient is the system, that is, how fast does it adapt to changing circumstances? These are the types of questions that "thinking like a system" engenders. Planning for sustainable transportation systems must ask the same types of questions.

- *Develop indicators*—Benchmarking is a key ingredient of sustainability. Performance measures that reflect sustainability objectives must be developed. A particular number or ratio does not necessarily represent achievement of a sustainable system. Those numbers and ratios must change as the environment within which they operate changes. However, they must be able to demonstrate directional movement. For example, acreage of developed land per capita within a metropolitan region may be an appropriate indicator of sprawl, although there is no "ideal" ratio that represents sustainability. The directional signals that each community establishes for moving toward sustainability, informed by data on the environmental, economic, and equity consequences of such movement, that drives the process.

- *Provide flexibility, choice, redundancy*—Sustainable systems should not be brittle but flexible in all aspects. Flexibility in choice of mode, in siting, in design, in funding sources, in institutional arrangements, and in avenues of participation, to name a few. Flexibility implies real-time feedback on performance and a bias toward incrementalism.

With these characteristics in mind, what are the major opportunities in planning research to bring the transportation planning process more in line with notions of sustainability? Research ideas in five areas include process, models, indicators, institutions, and technology. Together, these proposals underscore the paradigm shift needed in transportation planning to resolve the conflicts between the way we plan our transportation infrastructure and our sustainability goals.

Process Research

The process—the rules and regulations under which transportation planning takes place—is not conducive to the production of sustainable outcomes. This observation applies to all levels of transportation planning: systems planning and management, project planning,

and design and operation. Each of these areas deserves analysis.

Systems Planning and Management

A predicate for transportation planning for sustainability is the development of mechanisms for system management. However, the transportation planning process is not designed to provide for operational control. ISTEA initially required the development of transportation management systems in six areas: highway pavement, bridges, highway safety, traffic congestion, public transportation facilities and equipment, and intermodal transportation facilities and equipment. Each of these management systems, if guided by a set of performance indicators, could significantly advance sustainability objectives (18, pp. 123–141).⁸

Unfortunately, system management was not easily integrated into the existing system planning structure. Lack of data for system management, inflexibility in both statutory mandates and planning structure, lack of organizational capacity both at the federal and state levels, lack of training, short timelines, and other factors resulted in poor compliance or outright resistance (19). In 1995 amendments to ISTEA, the management system mandate was made discretionary. By the end of 1996, only 24 states were implementing all 6 management systems, and performance continues to be spotty. Research is needed to provide planners with the tools that they need to develop operational control over transportation system management. A study by Lindquist provides a good analysis of why ISTEA management system provisions failed (20).

Some state and local agencies have responded to the need for real-time management of transportation systems by setting up transportation management centers (TMCs). About 140 TMCs are presently in operation, but they focus primarily on single systems (mostly highway) and work mostly on incident management and customer service (e.g., "talking billboards"). Planning research could study ways to make these TMCs work on a multimodal basis and to measure and operate transportation systems for sustainability. A summary of TMC progress to date is presented in *NCHRP Synthesis of Highway Practice 270* (21).

Project Planning

Project planning, as presently conducted, fails to promote sustainability goals. Although ISTEA applied the needed financial rigor to the project-selection process through the requirement that the Transportation Improvement Program (TIP) be financially constrained

within available funding sources, it did nothing to improve the quality of project selection. The reason is that, even though planning factors were improved, the project-selection process was not connected to the planning factors. The failure of this existing TIP process to produce projects that reflect the values in the planning factor, and what to do about it, is described in the *ISTEA Planner's Workbook* (22).

One solution to this problem is to apply screening criteria that eliminate clearly unripe or ineligible projects. Good screening criteria have the ability to control the tempo (timing) and sequence (phasing) of projects, and therefore can incorporate sustainability objectives such as promotion of in-fill projects, system efficiency, and control of sprawl.⁹ [More information on this subject is provided by *TCRP Report 39* (6, p. 5).] This approach requires political discipline in project selection, which can be encouraged, if not imposed, by good planning.

In addition to screening criteria, which primarily address project timing and sequencing, planners can develop scoring criteria that rank meritorious projects against sustainability objectives. For example, because a characteristic of sustainability is multiobjective functionality, projects that serve several functions, including improved access and mobility, should do better in the scoring criteria than those projects that serve only one goal. Planning for multiobjective outcomes is a key needed improvement in transportation planning and project selection. A good analysis of how ISTEA and TEA-21 highway funds can be used to advance environmental objectives as well as transportation objectives is provided by a report titled *The Road to a Cleaner Environment: How to Use Highway Funds to Enhance Water Quality, Wetlands, and Habitat Connections* (23).

Design and Operation

Transportation for sustainability can also be approached through the "three Ds of sustainable transportation," which include density (siting of transportation improvements), diversity (choice of mode), and design. Transportation systems can be evaluated on the basis of all of these "three Ds." However, once selected, projects must focus on design and operation.

There are many ways for improving project design to advance sustainability goals. NEPA analysis is conducted primarily to inform project location, not design. However, there are many ways to turn a project from generating negative to positive sustainability indicators at the design stage, especially if the project, once constructed, is added to a system that is under strong operational control. The statute on federal aid highway design was amended in 1995 to make it clear that the

design guidelines developed by the American Association of State Highway and Transportation Officials (AASHTO) can be waived to promote "context-sensitive design."¹⁰ Former AASHTO President Francis François observed that "aesthetic, community-sensitive design is where our nation wants to go, and we should go with them." (24) More information on this subject can be found in a FHWA book on flexibility in highway design (25).

Land Use and Sustainability

As mentioned earlier, land use and sustainability is a key issue in transportation planning. How can the issues be integrated into the transportation planning process? For what types of land use should we be planning? What can transportation do to promote such land uses? What planning research is needed to inform these questions?

There are several ways to approach land use and transportation at the several levels of government. One way is the state approach through smart growth statutes (Maryland) and concurrency requirements between development and public infrastructure to support such development (Florida). Another method is through regional schemes, such as urban growth boundaries (Oregon) and tax-based sharing (Minneapolis area). [Carson presents a critique of the urban growth boundary in his report *Paying for Our Growth in Oregon* (26). A critique of Carson's report is at www.friends.org/rccarson.html.]

A final method used to approach land use and transportation is through local strategies for conforming the local comprehensive planning process to sustainability goals. Lindquist (20) provides an excellent analysis of how to integrate transportation planning for sustainability into the local comprehensive planning process.

It is not the intent here to analyze these different approaches to coordinating transportation and land use decision making. It is important to point out that the transportation planning process is being increasingly constrained at all levels of government by statutory and regulatory prohibitions on the consumption of undeveloped land. Because access to undeveloped land has been a driving justification for transportation improvements during the entire 20th century, this is obviously an area of great conflict for planners.

Process Research for Sustainability

- Data, capacity, and training needs for effective transportation system management for sustainability;
- Improvements in timeliness of transportation planning and regulatory processes to support sustainability,

including strategies to apply real-time indicators of performance to project and system planning;

- Context-sensitive design for sustainability—best practices;
- Urban growth boundaries—their effectiveness in capturing the true cost of transportation service delivery;
- Transportation and land use—approaches to integrated planning at the local, regional, and state level;
- Transportation planning for efficient use of land—best local practices;
- More behavioral research, including how advertising affects modal choice;
- Planning for multiobjective outcomes;
- Regulating project tempo and sequencing through planning for sustainability;
- Planning for sustainability—new tools from ISTEA and TEA-21;
- Sustainable transportation and the three Ds—density, diversity, and design; and
- Zoning codes and sustainability, especially how zoning affects infrastructure financial burden and options for reducing this burden through sustainability.

Performance Indicators for Sustainability

If the goal is to develop a transportation system that is sustainable at the intergenerational time scale, we need a set of indicators that will measure performance against sustainability objectives over time. Conventional indicators of transportation system health do not include indicators of sustainability. We must move away from indicators of how well vehicles move and toward a set of indicators that reflect how efficiently people can access what they want and need.

Indicators for sustainable transportation would identify not only the ability of the transportation system to deliver access but also the impact of the transportation system on the larger system. Such indicators provide a feedback loop that reflects the overall health of our communities. Target levels of impact are less of an objective than is direction of movement. Taken as a set, such indicators could provide signals when positive trends turn to negative trends, and vice versa. This approach would allow the entire transportation system to be managed on a real-time basis for its contribution to sustainability objectives.

The basic research task is to identify an appropriate set of indicators and proper ways in which to measure each one. Often, the mere presence of information is enough to alter individual behavior. Some guiding principles for all indicators of transportation system performance for sustainability include the following (27):

- *Relevant:* What is the indicator measuring? Is the measure of performance particular to transportation or

does it link transportation to performance of the larger system?

- *Value-based:* Because each indicator measures the health of some sector of the transportation system, the community must value that measurement. Otherwise, it will be disregarded.

- *Attractive to the media:* Changing behavior is difficult. If indicators are understandable to the media, the job will be easier.

- *Statistically measurable:* Some useful indicators are very difficult to measure. Bicycling and walking trips are an example. Transportation demand models must figure out a way to account for such trips and to measure latent demand should adequate bicycle and pedestrian facilities be developed in conjunction with appropriate land uses.

- *Reliable:* We must be able to trust what each indicator is showing. This means that the indicator must be accurate as well as consistently measured over time.

- *Leading:* The best indicators will be leading, providing information about a trend while there is still time to act. Carbon emissions are an example.

The value of indicators is that they help us understand linkages between various parts of the system. All of our systems are linked together in complex chains of cause and effect. Some may reflect more or less strong associations; therefore, a weighting system may be necessary.

Communities in the United States and around the world have begun to use indicators to evaluate the health of environmental and social systems and to monitor progress toward sustainability. These indicators cover a wide range of topics: environmental, economic, social, cultural, and political. The indicators allow these communities to compare current conditions to desired performance and to evaluate trends over time. For example, the Maryland Department of Natural Resources and the Delaware Department of Natural Resources and Environmental Control have developed formats that specify the use of various indicators (28). Seattle, Washington, keeps track of miles of pedestrian-friendly sidewalks and miles of bike lanes. Portland, Oregon, has developed a pedestrian environment factor (PEF) that measures neighborhood characteristics, which make them more or less amenable to walking.

Once developed, indicators can then be incorporated into the visioning, planning, budgeting, and project-selection processes. Use of indicators will force us to focus on purpose instead of on process. What we seek, however, is a moving target; therefore, the development of indicators will always be a work in progress.

The indicators can be divided into those that are specific to the transportation system and into those that reveal the impact of the transportation system on some

larger social or environmental system. Indicators must also be scaled to the appropriate geographic level. Finally, an indicator that looks good at one level of analysis (e.g., walking or bicycling modal split in a neo-traditional community), may not look as good at another level of analysis (regional transportation impact if the community is located at the urban fringe).

The following indicators of transportation system performance, with these qualifications, are being tested around the country:

- Transportation performance indicators
 - Access to goods and services
 - Portion on transportation costs that are internalized
 - Ability to maintain what we have already constructed
 - System's resistance to shock or redundancy resiliency
 - Adaptability in the face of rapid technological change
 - Extent of facilities that are available for nonmotorized transportation (i.e., miles of sidewalk per capita, and miles of bicycle lanes and trails per capita);
 - Vehicle-fleet mix
 - Mode split
- Environmental performance indicators
 - Land consumption (i.e., rate of consumption, developed land per capita, and acreage of protected open space per capita)
 - Air quality
 - Water quality
 - Transportation energy use per capita
 - Loss of prime farmland or environmentally sensitive areas (i.e., absolute acres, rate of loss, and loss due to transportation improvements).
- Social indicators
 - Health and fitness in terms of infrastructure footprint
 - Safety and fatalities
 - Neighborhood or community health indicators, such as crime
 - Distributional effects—public transportation expenditures per capita compared to such factors as average household income, ethnicity, and location (urban, suburban, rural). The disconnect between those who benefit and those who pay is a significant destabilizing factor to the sustainability of our transportation systems.

Of course, the most relevant indicators are ratios, comparing one measurement with another to demonstrate a correlation. Our knowledge base is far from complete in terms of knowing which ratios are most relevant for measuring the overall contribution of transportation systems to notions of sustainability.

Planning Research on Indicators

- What are the best practices for measurement of transportation system performance for sustainability at the neighborhood level? Community level? Regional level? State level? National level?

- How do we integrate indicators over different geographic scales so those indicators that show a positive correlation to sustainability at one level do not show a negative correlation at another level?

- How do we integrate indicators of transportation system performance for sustainability with indicators of performance for the total system (social, environmental, and economic)?

Technology and Planning for Sustainability

As noted earlier, the environmental footprint of transportation in any given urban area has historically reflected the dominant transportation technology at the time of its greatest growth. Thus, Boston and Philadelphia still reflect the land patterns dictated by the maritime trade; Chicago was built around railroad technology; New York was built around transit; and Los Angeles was built around the automobile (along with most "edge cities"). Technology, facilitated by land development subsidies, has been the destiny of urban form and, increasingly, the form of our countryside as well. (An excellent source of information and contacts on transportation technology for sustainability is the Transportation Technologies for Sustainable Communities Project at www.transact.org.)

In recent years technology has been increasingly used to counteract its own adverse environmental impacts. Thus, new ways of capturing nonpoint sources of pollution from highways have been developed, along with the development of

- Catalytic converters for tailpipe emissions;
- New techniques for disposal of highway construction materials;
- New ways to improve fuel efficiency;
- "Hypercars" made of light composite materials that are indestructible and recyclable, powered by fuel cells with no apparent emissions; and
- ITS to improve the efficiency of the relationship between the car, the driver, and the road.

Under this game plan, the solution to the problems of technology is more technology.

Technology also affects sustainability by providing remote access to places that were previously only accessible by private or public transit. The effect of electronic commerce (e-commerce) on shopping mall sales is a

prime emerging example of this trend. The real estate industry recently increased its estimate of projected bankruptcies for shopping malls by 15 percent on the basis of the competition they now face from e-commerce. In response, many malls are now promoting themselves as tourist destinations, as well as retail outlets, in a vigorous effort to retain traffic through their facilities. E-commerce may well have profound effects on transportation behavior, especially in suburban areas.

Technology is certainly a powerful tool to improve system efficiency and all its component parts. However, although essential, technology alone is not sufficient. Behavior must change as well, both in terms of how we move around and how much we move around, if we are to move the indicators of sustainability in a persistently positive direction. How can planners use technology to move system performance toward sustainability? Three possible answers to this question are discussed in the following paragraphs.

First, technology has the power to inform choice. Advanced Travel Information Systems include many promising ITS technologies that allow system managers to provide travelers with improved choice of mode. These technologies also provide the means to achieve that choice by providing real-time feedback on the effect of those choices on the environment, the community, and the pocketbook. Recent studies indicate that more information does not necessarily affect behavior, which may have something to do with the type and timeliness of information provided and the existence of available options. If the system itself is so rigid that modal "lock-in" occurs, no amount of information will change behavior (29).

Second, the power of technology for measuring system performance is a powerful new tool for moving transportation system investment and management toward sustainability. The computing power of desktop computers now allows planners to characterize system performance in ways that are unimaginable, even a few years ago. For example, sources and flows of transportation system investments, both capital and operations, can now be tracked relatively simply at the local, regional, and statewide level. Such tracking can reveal anomalies between where new investments are made and the documented surveys of system need, between who benefits and who pays, and between sources of system inefficiency and actions taken to reduce such inefficiencies. By using existing data sets and a few computers, planners have the capabilities to take the politics out of pothole management.¹¹

Third, technology can be used to improve public transit efficiency. An unhappy fact about transit is that often the rolling stock is so old, or so fuel-inefficient, that on a passenger-mile basis it is less sustainable than single-occupancy driving. It is untenable for public

advocates to promote greater modal choice when such choices have declining sustainability trends.

Just because ITS and other transportation-related technologies can be used to promote system sustainability does not mean it will happen. According to a Congressional Budget Office report on use of federal ITS funds, just 1.2 percent of the funds have been spent on projects with "environmental concerns," whereas 65.3 percent of the funds have been spent on travel management projects that move cars and trucks around the highway system faster and more efficiently (30). Although this is not necessarily an inefficient use of ITS technology, given limited resources, more sustainable applications of ITS technology may be appropriate.

Planning Research on Uses of Technology for Sustainability

- How can advances in computing power be used to plan for transportation system sustainability?
- How can ITS technology be used to improve overall system sustainability?
- How can ITS technology be used to expand consumer choice and affect consumer behavior to promote sustainable outcomes?
- How can technology improve operational performance of public transit to move overall system performance toward sustainability?

Model Improvements for Sustainability

Models have guided transportation planning for nearly half a century and have not evolved substantially over the years. There is room for improvement both in the depth with which the models treat the movement of goods and people as well as in the breath of the domain they address. Modeling for sustainability is a prime focus area for transportation planning research.

The traditional transportation four-step modeling process was developed at a time when the emphasis of transportation planning was on infrastructure development. (The four steps were trip generation, trip distribution, mode split, and trip assignment.) The basic questions asked were "Where should the new roads be placed?" and "How many lanes should the roads be?"

Starting in the 1970s a series of management paradigms were implemented. Transportation system management, then travel demand management, and more recently, transportation control measures (TCM) were used to control demand-side pressure on transportation systems. These methods proved to be too sophisticated for the traditional travel demand models because they

targeted specific travel segments and policies that the models could not accurately represent (31).

The simplicity of the models that were developed 50 years ago are no longer able to keep up with the increasingly complex ways that people move about and the remedies being considered to address the travel problems that we face. Specifically, the current models are deficient in the following areas (31):

- Internal inconsistencies (trip productions and attractions do not match).
- Data inefficiency (household characteristics are lumped into zonal averages).
- Lack of behavioral foundation (trip generation does not consider employment status).
- Not policy sensitive.
- Issues of accessibility and land use are not integrated into the models (i.e., impact of new transportation infrastructure on land use and impact of congestion on trip generation and attraction).
- Time of day is ignored; thus, shifts in travel time, as suggested by TCM, are not captured by the current process.
- Congestion pricing is difficult to model because of this lack of ability to model specific time periods.
- Induced travel, namely the tendency of new capacity to generate new trips, is not considered.
- Bicycling and walking trips are not considered.

These deficiencies in traditional transportation models act as a barrier to the use of models to promote sustainable outcomes in transportation planning.

Travel Model Improvement Program

A joint program of the USDOT and the Environmental Protection Agency (EPA), with input from state DOTs and metropolitan planning organizations (MPOs) as well as from private-sector entities, is underway to remedy many of the problems with the current modeling process. Started in 1992, the Travel Model Improvement Program project is designed to develop a new model structure that will be sensitive to policy scenarios, including environmental concerns and growth management issues. Links to land use will be direct, and increased accuracy for air quality impacts will be included.

The project has four tracks:

1. *Outreach*—This track helps practitioners improve their existing planning procedures, which include training, technical assistance, research coordination, and a clearinghouse for new findings.
2. *Near-term improvements*—Similar to outreach efforts, this track in particular aims to assist state DOTs

and MPOs in implementing model improvements that have already been developed but have not been widely disseminated.

3. *Long-term improvements*—This track is a complete redevelopment of travel and land use forecasting models.

4. *Data collection*—Because the new models will be so data intensive, this track was developed to improve data-collection procedures and evaluate data needs (32).

Of particular note, the new model TRANSIMS (Transportation Analysis and Simulation System) is being designed to more accurately model congestion and air quality. The model will predict trips for individual households, residents, and vehicles instead of for zonal aggregates of households, as do the current models. TRANSIMS is now being tested in Dallas, Texas, and Portland, Oregon.

LUTRAQ

Begun in 1988, the project headed by 1,000 Friends of Oregon called Making the Land-Use-Transportation-Air-Quality (LUTRAQ) Connection has been analyzed in depth (33). Started as an effort to oppose a proposed western bypass around Portland, the project grew into a model program that sought alternative outcomes to automobile-dependent land use patterns. This secondary objective demonstrated that development could be accommodated while minimizing land consumption, thus reducing vehicle trips per capita and improving air quality.

The LUTRAQ project used many of the transportation planning tools that support sustainable development. Of primary note, transit-oriented development, market strategies (parking charges and free transit passes), and a balanced transportation system were included in the model. The success that was demonstrated by the LUTRAQ project was made possible, in part, because changes were made to the standard travel demand forecasting process. This was done by developing the PEF variable that models how the natural and built environment makes walking easier or harder, thus influencing how a person decides to make a trip. The four components are ease of street crossing, sidewalk continuity, local street connections, and topography (33).

Models also need to be capable of scenario-based planning. This means that transportation models need to be linked to land use and economic models. For example, a sprawl scenario needs to be compared to a transit-oriented development scenario in deciding what land use pattern the design of the transportation system should support.

Planning Research for Transportation Models

- State-of-the-art or best practices in the use of policy-sensitive models to promote sustainable transportation planning.
- Use of PEFs in transportation models. Perhaps a similar methodology can be used for bicycling to measure the relative bicycle-friendliness of land uses for predicting bicycle usage under various land use scenarios.
- Modeling for nonplanners—how to inform transportation decision makers of the consequences of their land use and transportation decisions.
- Integration of models (subdivision, neighborhood, community, region) to promote sustainable outcomes.

Institutions

One of the most overlooked aspects of ISTEA and TEA-21 is how thoroughly these two laws “reshuffled the deck” on institutional roles and responsibilities for transportation planning. A great deal of attention has been focused on the increased role, and power, of MPOs in project programming and financing under the new laws and the discipline imposed on both MPOs and state DOTs through the requirement that transportation improvement programs be financially constrained. Opportunities for citizen participation also have been increased at all levels of transportation planning, not just at the traditional project location stage. All these new institutional roles and relationships, by expanding the number of participants in project development and selection beyond the traditional transportation community, provide opportunities to integrate notions of sustainability into transportation planning.¹²

However, an institutional change that has not received much attention is the role reversal in program objectives between the federal, state, and local participants in the federal aid program. Specifically, the federal interest in “getting us out of the mud” through capital construction has been transformed into a priority on “taking care of what we’ve got” through efficient system management, operations, and preservation. Conversely, the state and local roles, which were at first limited to system maintenance, have been increased to assume more of the burden of system expansion as the benefits of such expansion are perceived as being captured locally, not nationally.

Transit, in many places, is also perceived as making a significantly higher contribution to national objectives of choice, efficiency and social equity than previously recognized. TEA-21 includes more than 100 “new starts” for transit, a clear endorsement of the perceived national benefits of this travel mode.

Intermodalism is strongly supported in the new statutory scheme, which will require changes in program administration to allow people, data, and funds to flow more easily between modal agencies as well. Bicycling and walking, another traditionally local priority, have been given a strong federal endorsement in the Transportation Enhancements Program, as their contribution to a broad array of sustainability objectives is increasingly recognized.

Even the area of transportation research has experienced this role reversal. During the early stages of our national highway construction program, research, especially policy research, was not a priority. USDOT had fewer policy positions than any other federal agency. Building infrastructure was a technical job, devoid of policy choices. Thus, research was highly decentralized and focused almost exclusively on ways to improve pavement performance or bridge loads. As the need to incorporate multiple objectives into transportation decision making became more important, so did research to accomplish this objective. This meant more centralized research, more technology transfer, and more policy research.

Finally, the role of the customer—the transportation user and the host community—has gained in importance as objectives and concerns about community impacts have expanded. As sustainability becomes a higher priority for transportation planning, the role of communities and citizens will become even more important, perhaps even sharing the role of problem identification with transportation professionals. Fitting transportation within the “visioning process,” by which many communities conduct their comprehensive planning, instead of fitting community goals within a long-range transportation grid developed by computer models, represents a huge change in institutional relationships between the professional and nonprofessional in transportation planning.

This bottom line of transportation planning for sustainability is that a lot more people, representing a lot more interests, are going to be involved in the transportation planning process. These interests are not just vertical but cut across agency and jurisdictional lines as well. That means more cross-jurisdictional planning at the regional level and more cross-agency planning at all levels. An EPA task force on TEA-21 has been established with one overriding goal: early involvement in the planning process. Communities are demanding “place-based decision making” to ensure that community goals are respected throughout the planning process. The days when the district highway engineer wrote up an annual work program and had it rubber-stamped by the regional planning organization are over.

ISTEA and TEA-21 require that the transportation planning process be much more participatory and much

more inclusive in terms of desired outcomes. This requirement is good for sustainability. However, stalemate is not good for anyone. How can the planning process be participatory and effective in promoting sustainability? That is the big institutional issue.

Institutional Roles and Relationships for Sustainability: Research Agenda

- Role of comprehensive plans in integrating transportation and land use planning at the community level,
- Federal role in promoting sustainable development in the transportation planning process,
- State role in promoting sustainable development in the transportation planning process,
- Role of MPOs in promoting sustainable development in the transportation planning process,
- Role of nongovernmental organizations in promoting sustainable development in the transportation planning process,
- Role of the citizen in planning for sustainable development in the transportation planning process,
- Strategies for effectively involving environmental agencies in transportation planning for sustainability, and
- Best practices for becoming a "green state DOT."

CONCLUSION

This discussion does not cover many strategies for promotion of sustainability through improved transportation system development and management. That subject is enormous and includes a complete analysis of material sources and flows for transportation, policy options (especially pricing for sustainability, life-cycle costing, and measurement and pricing of externalities), and a whole host of technological strategies that have nothing to do with transportation planning. If we are to achieve the radical change in transportation service delivery that is called for at the beginning of this paper, all these strategies will be needed.

This paper has outlined a few research ideas for the transportation planning community to help integrate concepts of sustainable development, smart growth, and livability into the transportation planning process. Certainly, if interest in such issues continues to grow, and if new strategies are sought to meet the targeted reductions in greenhouse gases that was called for by the Kyoto Protocol, there is much fruitful work to be conducted in this area. Instead of being a barrier to meeting rising public demand for action to promote sustainability, transportation could become the catalyst for such action.

NOTES

1. The quote is by John Prescott, the Secretary of State for the Environment, Transport and the Regions (1). His duties combine those of EPA and USDOT.

2. This is not entirely a problem of poor implementation. The explicit predicate of both Title 23 (highways) and Title 49 (transit) of the U.S. Code is that transportation is a federal, state, and local partnership, with the federal government largely funding capital costs and state and local governments assuming costs of maintenance and system preservation. This partnership reflected a perception that the benefits of new construction were primarily national (promoting interstate commerce), thus, justifying the federal lead in capital funding. This relationship has now flipped, with federal priorities focusing on system preservation to meet national financial, environmental, and social goals, while new capacity is increasingly perceived as providing mostly localized benefits that should be financed locally. The structures of Titles 23 and 49 do not yet reflect this role reversal.

3. An intergenerational approach to sustainability focuses on "keeping within the environmental fences" (i.e., avoiding system collapse or impacts that are not reversible within a generation). Impacts that are controllable within a generation are not included on the assumption that we are not compromising the ability of future generations to meet their own needs (Brundland definition of sustainability), as long as we pass on natural, social, and economic systems that, however depleted, can still feasibly be restored to health. This is a minimalist definition of sustainability. Most statements of sustainability aspire to pass on to future generations social, environmental, and economic systems that show continuous improvement in their performance indicators.

4. For example, the Center for Sustainable Transportation in Toronto, Canada, estimates that about one-third of the reduction in transportation-related greenhouse gases needed to meet Kyoto targets can be achieved through technology. The other two-thirds will have to come from changes in our patterns of travel consumption and behavior (10).

5. Defenders of the status quo in transportation often point to the fact that air emissions or other environmental impacts are declining per VMT as a demonstration that transportation is getting more sustainable. This makes no sense in the context of sustainability because it is the total load of transportation-related impacts on larger natural systems that count. Any metric of efficiency relative to a measure of consumption (VMT) is irrelevant in a sustainability context.

6. PL 105-178 (June 9, 1998) at Section 5107 requires the secretary of transportation to undertake a transportation-environment cooperative research program, which includes a project "to study the relationship between highway density and ecosystem integrity, including the impacts of highway density on habitat integrity and overall system health, and develop a rapid assessment methodology for use of transportation and regulatory agencies in determining the relationship between highway density and ecosystem integrity."

7. ISTEA and TEA-21 specifically identify historic transportation facilities and railroad corridor preservation (including conversion to trail use) as historically important, and set aside significant funds for their preservation and development under the Transportation Enhancements Program. Also, corridor preservation is one of the seven planning factors required to be considered in the metropolitan and state planning processes [23 U.S.C. Sections 134(f)(1)(G), 135(c)(1)(G)]. The preservation of historic transportation facilities, such as depots and corridors, can promote in-fill development around these facilities and help preserve historic downtown areas. These facilities may also qualify for funding under EPA's Brownfield Redevelopment Program.

8. Three of the management systems address asset management and three systems address performance management. The Surface Transportation Policy Project's report entitled *ISTEA Planner's Workshop* provides a good discussion on the different requirements of these two management systems and how the performance management systems, especially congestion management, can advance sustainability goals (18).

9. The failure of land use controls to regulate timing and sequencing of new land development in the United States has been identified as a prime contributor to sprawl.

10. 23 U.S.C. Section 109(a)(2) directs the secretary of transportation to ensure that highway design, in addition to meeting minimum safety and other requirements, will "conform to the particular needs of each locality." Additional information is presented in the FHWA report *Flexibility in Highway Design* (25).

11. The Surface Transportation Policy Project has used technology in this manner to analyze transportation system performance from a new sustainability paradigm. The resulting studies, effectively publicized through the media, have significantly influenced the public policy debate on transportation. A summary of some of these studies can be found at www.transact.org.

12. Under orders from the governor, the Pennsylvania Department of Transportation has developed a plan for becoming a "green agency." This is a new role for a state DOT.

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Linkages Between Transportation Planning and the Environment

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Transportation investments have in the past been among society's most important contributors to environmental improvement, but today transportation programs and projects are more often of concern as sources of major environmental problems. Over the past 30 years, since the enactment of the National Environmental Protection Act (NEPA) and the first Clean Air Act amendments, the relationship between transportation planning and environmental policy making has continuously become more complex and problematic.

Until about 1835, when early public transport was just being introduced into many cities, virtually everyone resided within walking distance of where he or she worked, whether on a family farm or in an urban area. The limited capacities of transportation systems determined that most people traveled very little and experienced tightly bounded environments. By the beginning of the 20th century, transportation had evolved rapidly from horse carts to horse-drawn omnibuses to street railways, and cities expanded dramatically in response to increasing mobility. But cities were still mostly crowded, dirty, dense, congested places, beset by a myriad of environmental problems and limited in size by their transportation systems.

The first national conference on city planning and the problems of congestion was held in Washington, D.C., in 1909. The conference was characterized by many speeches in which intellectuals of the day insisted that the environmental challenges of their time—the disease,

poverty, darkness, and vice of the North American city—were caused by the scourge of high-density living and that it was the job of urban transportation planners to build public transit routes to outlying areas for the explicit purpose of lowering density and improving living conditions.

Mary Kingsbury Simkhovich, for example, the only woman to address the first annual conference on city planning, urged that new immigrants to New York City should be whisked to low-density suburbs before they had a chance to settle in lower Manhattan and be destroyed by the urban densities, vices, and diseases induced by squalid urban environments. Subways to new outlying communities were urged, combined with low flat fares, so that low-income people could afford to live at low density at the edge to benefit from environmental improvement and to avoid the pitfalls of inner-city living. The transportation system was the key to environmental betterment. The relationship between transportation and the environment at this time was an intimate one, as it is now, but there was greater emphasis on policy discussions about transportation as a provider of environmental benefits instead of a source of environmental pollutants.

Similarly, the arrival of the automobile was understood to be an environmental blessing of enormous proportions. The city could be freed from environmental insults of horse manure, diseases carried by horse flies, and the need to regularly remove from the

streets tens of thousands of carcasses of dead horses that had expired on the job. No wonder newspapers and magazines, before 1920, described the emerging transportation system based on the internal combustion engine as a clean and environmentally benign improvement.

How times have changed during these last 100 years. At the turn of the century, urban densities were considered too high, and "spreading the city" was seen as a solution. Today, the vast majority of urban critics believe suburbanization is a problem, and the reversal of sprawl is the solution. When the automobile was new it was widely considered to be an environmental savior. Today, it is often labeled an environmental disaster.

As times change so does our understanding of the facts about the linkage between transportation systems and the environment. The goals of public policy on transportation and the environment similarly evolve. A succession of laws has been enacted that reflect our changing understandings, as well as the many competing interests that make up our society—from the trucking, petroleum, and auto industries to cyclists and lung associations. These laws encapsulate our current understanding and our hopes about the relationship between the environment and the transportation system. A series of regulations have also been promulgated by which we attempt to implement these laws. At this Conference on Refocusing Planning for the 21st Century, we are discussing the latest of these laws, TEA-21, and possible changes in the regulations that govern metropolitan transportation planning in the context of transportation and environmental requirements that have been enacted over several decades.

I started addressing this important topic with a brief reference to history because I am always both amazed and humbled by historical facts and analyses. Our current problems often appear so complex and insurmountable, and the solutions we passionately espouse to current problems are so very important to us, until we set them in their proper historical context. Only a brief examination of history shows that our current understanding of the transportation-environment relationship is partial, is constantly changing, and is largely mistaken. History also demonstrates that our commitments to particular policy solutions are highly subjective and are strongly influenced by well meaning fads as much as by scientific certainties.

This paper briefly examines several trends and emerging themes in urban and regional transportation planning. The emphasis here is on breadth instead of depth, and each theme is offered as a subject for elaboration and consideration at the conference workshops. For emphasis, and as a resource for easy reference for use in the workshop sessions, recommendations for planners and policy makers follow each theme.

ENVIRONMENTAL QUALITY WITH, NOT AGAINST, MOBILITY

When the environmental movement took the transportation community by storm, we were in the midst of building a vast national highway system that some consider as being a great force for national unification and economic growth. Others, in comparison, see the post-war interstate era as a monument to greed and pork barrel politics. It could well be both of these, but the magnitude and extent of the highway program of the fifties, sixties, and seventies were enormous, and the bureaucracy of institutional machinery that was built to support it was equally as impressive. It is therefore not surprising that the environmental movement was at first largely an opponent of the highway program instead of a component of it. NEPA and the Clean Air Act amendments were in a sense reactions more than they were initiatives. Their proponents were contending with the prohighway forces and were attempting to put a brake on what many in the transportation business thought of as progress. Many transportation officials have referred to the Clean Air Act requirements as "the tail that wagged the transportation dog." Interestingly, and appropriately, that perspective is voiced with decreasing frequency as we approach the new century.

Today, the situation is rather different. Although there are some individuals in the transportation community who believe they are besieged by environmentalists and there are some environmentalists who continue to consider transportation officials as their enemies, for the most part, a successful working relationship has been forged that aims at providing mobility in combination with environmental responsibility. A broad cross section of the public is committed to congestion relief and environmental responsibility. The Surface Transportation Policy Project and the American Association of State Highway and Transportation Officials (AASHTO) actually do talk with one another and find grounds for compromise.

Given this evolution of feelings and understandings, it is possible today to urge that we adopt regulations and procedures based on the principle that mobility and environmental quality are not mutually incompatible, but that it is our mission to serve both of these masters. In fact, to go further, many of us would even assert that the principal purpose of transportation investments is to respond to society's environmental goals, whereby the environment is perceived broadly as a combination of the social, economic, and natural contexts within which we live. In other words, over time, we have all become environmentalists to some extent, and the planning of transportation systems and facilities is observed to be a component of shaping the environment. The environment is no longer an afterthought or a checklist of fac-

tors and questions asked of otherwise completed transportation plans; our transportation planning is becoming a fundamental determinant of and an ingredient in the way we think about the environment.

Recommendation: Transportation planning, environmental regulations and procedures, and project and program funding should become more integrated and less opposed to one another over time.

GROWING COMPLEMENTARITY BETWEEN TRANSPORTATION AND INFORMATION

The single most influential social trend that is having an ever-greater influence on transportation over time is the growing role of information processing and telecommunications in modern society. During the first decades of the approaching century, the impacts of this relationship will be as influential as was the invention of the automobile and the telephone in the early part of the 20th century. The development of a telecommunications-transportation linkage will probably be even more influential over the next few decades than was the construction of the national highway network during midcentury. At the very least, our ability to expand mobility will increasingly depend on our ability to use telecommunications and information processing in concert with the transportation system.

Even though fully automated highways are probably decades away, on-vehicle collision-avoidance systems, the provision of "real-time" information on the arrival of transit vehicles, widespread use of electronic toll collection to finance highways, the capability to navigate around traffic congestion, and the ability to reserve in advance a time slot to cross a congested bridge are closer at hand. Larger shares of transportation budgets will undoubtedly be spent on telecommunication enhancements that expand and manage the capacity of existing facilities than will be spent on the construction of extensive new facilities. We must develop planning methods that include the capability to evaluate telecommunication enhancements to current facilities in programs for congestion relief as easily as they presently include evaluations of new transportation facilities.

Recommendation: Regional transportation agencies must develop the capability to understand and forecast the environmental consequences of intelligent transportation system improvements on existing facilities as well as on new facilities. Over time these systems will become important strategies that will help regional agencies to achieve their transportation goals.

The use of computers and other information-processing devices is also changing the amount of hours we work and the places at which we work, and consequently, it is changing the spatial and temporal patterns of travel and the spatial patterns of cities. The pressure for continued decentralization will be hard to minimize given the availability of information-exchange devices. Although relatively few people are literally telecommuting by working full days at home, more are working at multiple locations during day and at unusual times of day because of information-processing opportunities at home and at night. E-mail and the Internet are changing travel patterns dramatically.

We are already experiencing a great increase in non-work travel in proportion to all travel, in part because of the new telecommunication devices and as the result of other social changes. For the same reason, we are already observing heavier peaks of traffic at midday and on weekends at many locations other than at the traditional morning and evening weekday rush hours. We are less certain of the environmental consequences of these changes than we are of the travel consequences, but they will be significant and must be addressed in the development of transportation planning and environmental regulations and procedures if those procedures are to truly accommodate emerging societal needs. If we fail to incorporate considerations of information processing into transportation planning for the coming two or three decades, we will be planning transportation systems to meet yesterday's needs.

Recommendation: While we expend great amounts of money forecasting travel and its environmental consequences at the metropolitan level, we should be developing similar capacities to forecast information transfers from one locale to another; to incorporate information flows as significant, causal determinants of regional travel patterns; and to estimate environmental consequences of these changes in telecommunications patterns and of the changes in urban form and travel patterns that they will engender.

ENVIRONMENTAL CONSEQUENCES OF TRANSPORTATION

To the extent that our society has progressed in the reduction of the harmful impacts of transportation systems on the natural environment, the last 30 years have indicated that technological changes have been responsible for far more of these impacts than have regional plans or facility changes. Air pollution has decreased primarily as a result of more demanding tailpipe-emission standards and longer periods during which new cars are required to meet those standards, as well as the

implementation of inspection and maintenance programs to ensure that they do so. Thus, air pollution has declined substantially in cities that have the most severe problems, including even Los Angeles, despite increased driving, increased suburbanization, worsening traffic congestion, and failed efforts to achieve more environmentally responsible travel behavior.

It is difficult to attribute recently measured improvements in air quality to transportation control measures or to behavioral changes by travelers. Because of failure to use even a significant portion of the capabilities of these measures, some states are attempting to reconvert high-occupancy vehicle (HOV) lanes to mixed flow, while transit use continues to decline nationally at the same time that a proportion of all travel and ridesharing is at a 20-year low. Efforts to induce transit-oriented development have met with some limited success, but the national trend toward lower density for most people in most places remains dominant, even as some central city, urban residential communities grow and prosper.

Despite important implications for policy on investments in both technology and infrastructure, vehicle-technology improvements have been emphasized in the preparation of state implementation plans (SIPs) for air quality, whereas land use and transportation-capacity measures have been emphasized in the development of long-range regional mobility plans.

During the coming decades, the most cost-effective ways to reduce pollutants from the air, water, and land that are attributable to transportation systems will continue to be through technological changes in vehicles, engines, fuels, lubricants, and telecommunications capacities that are linked with transport instead of through transportation control measures and other efforts to induce behavioral changes (e.g., major shifts from driving to public transit, cycling, or walking). Goods-movement vehicles and off-road mobile sources are not yet as tightly regulated for environmental pollutants as are light-duty passenger vehicles, but they are expected to come under closer scrutiny for regulation and technological change in the first decade of the new century.

Recommendation: Regional plans to meet federal air quality requirements should integrate more effectively technological measures with land use, travel-demand management, and transportation-capacity measures. In nonattainment areas the timing of and organizational responsibility for the preparation of SIPs, which emphasize technological improvements, are not sufficiently integrated with the preparation of the long-range regional mobility plans, which tend to emphasize transportation facilities. These two planning processes are often far too independent of one another. They are frequently implemented in a com-

petitive mode among agencies that have separate responsibilities for air quality and regional transportation planning. There is a need to rethink these planning processes so that SIPs and regional long-range transportation plans are more integrated in substance and content and that their preparation is more synchronized with time (1).

TRAVEL-BEHAVIOR CHANGE BY POLICIES, NOT BY FACILITIES

Traditional transportation planning at the regional level has emphasized the construction of transportation facilities and the analysis of the environmental impacts of their construction and of forecasted flows on those facilities. It is likely that in the coming decades transportation plans will consist, to a decreasing extent, of facilities plans, and that, to a greater extent, both mobility and environmental objectives of transportation planning will be addressed by a mix of policies that are much broader than facility construction.

For example, strategies such as the promotion of higher-density residential communities and mixed land uses in residential and commercial areas are being promoted as environmentally responsible. Some believe that these approaches to planning will reduce the geographic expansion of metropolitan areas, reduce the rate of urbanization of agricultural land, promote more walking and transit use, and require less automobile travel. While I personally believe that the general trend will continue toward lower densities and metropolitan areas of growing expansiveness, it is possible to envision a trend within the larger trend toward nodes of greater density and more deliberate attempts to create mixed-use developments. Although most new development will undoubtedly take place at the urban edge, it is reasonable to think that we will simultaneously witness the redevelopment of urban brown fields and the conversion of older industrial and military sites to new commercial and residential uses.

The increase of reliance on telecommunications and the complementarities between telecommunications and travel will permit a wider variety of living environments, and it is certainly appropriate for communities to experiment with a wider variety of arrangements of land and public transit. Thus, it will be necessary to develop theories, empirical evidence, and mathematical models to support the assessment of the traffic generation and the environmental consequences of a wider range of types of urban development.

Similarly, in addition to alternative land use and development patterns, some predict a wider range of policies in the future that is intended to influence travel behavior on existing facilities rather than to construct

new capacity. For example, urban areas and metropolitan planning organizations (MPOs) have proposed, and in some cases already implemented, the addition of electronic toll collection to existing toll roads, the addition of high-occupancy toll lanes to existing HOV lanes (i.e., lanes in which single-occupant vehicles can use an HOV lane by paying a toll), the conversion of some free lanes to toll operations, and the institution of congestion pricing. The methods of analysis that are currently used to measure the environmental impacts of transportation facilities were not developed to be directly or easily applicable to the evaluation of the environmental impacts of such a wide range of policy alternatives, and efforts to extend them to the analysis of such policies have revealed many limitations.

Recommendation: Federal planning regulations should foster and encourage a wider variety of approaches to urban development and the management of travel. There is a need to monitor the environmental impacts of transportation strategies that involve variations in development densities, land use mixes, highway and transit-pricing changes, and other policies that do not involve traditional capacity expansions. In addition, it is necessary to develop methods for estimating and forecasting environmental consequences of such policies.

SHIFT IN THE FOCUS OF ENVIRONMENTAL ANALYSIS OF TRANSPORTATION IMPACTS

Reactive Organic Gases, Oxides of Nitrogen, and Particulates

For the last 30 years the single most pressing environmental concern that affected regional transportation institutions has been air quality at the local and regional levels. With regard to air quality, emphasis has been placed on the reduction of lead, oxides of nitrogen (NO_x), reactive organic gases (ROG), and carbon monoxide (CO). For several different but complementary reasons, it is predicted that in the new century attention to other environmental consequences of transportation systems will increase, both in terms of air quality and other areas. In part, this increased attention is the result of the substantial progress that has already been made in addressing the environmental hazards of lead, ROG, NO_x , and CO. Even with the implementation of increasingly stringent ozone standards, the control of these pollutants will be accomplished, to a greater and greater extent, largely through national emissions standards for vehicles, inspection and maintenance programs, and the retirement of grossly polluting vehicles instead of through regional transportation

plans, land use initiatives, or transportation control measures. But this progress will not solve the environmental problems that are associated with modern urban transportation systems.

There is increasing awareness that the measures used to reduce pollutants that are derived from mobile sources have been far less effective at controlling particulates, which are an increasingly recognized health hazard. Environmental requirements that are related to the reduction and filtering of fine particles are quickly becoming a pressing and dominating problem for regional air quality and transportation planners. Because heavy-duty diesel trucks are estimated to account for about three-fourths of highway-related emissions of particulate matter [diesel engines associated with off-road activities are another major source of pollutants (2)], it would appear that technological controls will continue to be an important strategy by which to meet newly revised particulate standards. This will involve more stringent control of both on-road and off-road vehicles and will place a much heavier burden of regulation and compliance on the goods-movement industry. It should also result in increased attention to the efficiency of goods movement within regional transportation plans and is one of the motivations, for example, for the inclusion of trucks-only lanes and even trucks-only highways in the latest regional transportation planning effort in Los Angeles. It should be noted that a substantial proportion of fine particles, such as entrained road dust, are caused by wind and water erosion instead of by engine emissions.

Recommendation: Attention to the reduction of fine particles will become a more dominant part of the process of addressing the environmental impacts of the transportation system. We are not yet sufficiently well equipped in terms of scientific understanding of the phenomena to address these problems effectively in plan making, and a great deal of research is needed before particulate pollution can be more fully understood and properly managed.

Growing Importance of Greenhouse Gases

Similarly, we are just now understanding of the risks of producing greenhouse gases, and global warming is increasing in salience as a transportation planning and policy problem. It has been estimated that transportation is responsible for about 20 percent of worldwide carbon dioxide (CO_2) and that motor vehicles in the United States account for 20 to 25 percent of worldwide transportation emissions (or about 5 percent of the total of worldwide greenhouse gases that are pro-

duced by people as opposed to natural sources) (3, pp. 210–211).

Long-term environmental consequences of the greenhouse gas buildup remains uncertain, and a great deal of current research is aimed at reducing that uncertainty. Nevertheless, with public awareness rising and the risks of greenhouse gas accumulation substantial, transportation will continue to be the focus of research on this topic, and transportation strategies are certain to be included in policies aimed at reducing greenhouse gases.

Most strategies are aimed at either reducing the amount of motor vehicle travel or substantially changing the amount and type of fuel that is used to produce motor vehicle travel (3, p. 212). Once again, because so many other trends that tend to increase instead of reduce travel exist, technological changes in fuels and vehicle-propulsion systems are expected to play the larger role, and changes in travel behavior are expected to play a limited role in addressing this emerging problem. Yet, it should be noted that although regional long-range transportation planning in the United States is a rather unimportant contributor to today's efforts to control greenhouse gas emissions, there are major disagreements among sectors of the professional community as to the role that it could play. The extent and nature of regional transportation planning could be a major topic for discussion in the conference workshops.

Recommendation: There is a need to research the contributions that regional transportation planning and investment strategies can make to the control of greenhouse gases and to address the reduction of CO₂ emissions in the regional transportation planning process.

Water Quality

Transportation facilities can dramatically alter the nature of water systems. Highways and transit routes often alter the courses and volumes of flows in waterways and can change natural drainage patterns. The pavement of large areas of ground surface in airport and highway projects also affects runoff patterns and can result in flooding or in major changes in drainage patterns. Vehicles, highways, and transit routes are also sources of substantial amounts of liquid, solid, and gaseous pollutants that can settle on water surfaces or be carried by runoff into water courses.

Over time we have come to realize that an indeterminate but large proportion of surface and groundwater pollution originates in or is modified and affected by the transportation system. The construction process is itself a source of water pollution, and the operation of transportation facilities will continue to produce water pollution for many years to come.

The U.S. Army Corps of Engineers has jurisdiction over navigable waterways in the United States and must review and provide permits for transportation projects that will affect the character and content of flows on those waterways. Also, provisions of the Clean Water Act and regulations of the U.S. Fish and Wildlife Service can and often do limit the routing and design of transportation facilities.

In recent years it has become more common that transportation agencies have had to mitigate the impacts of their projects and programs on wetlands and waterways. At times when irrevocable intrusions into wetlands and waterways are necessary to complete transportation projects, mitigation measures may involve replacements or rejuvenation of damaged wetlands or waterways that are located away from the project itself. For example, consideration is now being given to expanding the runways at the San Francisco International Airport by filling in several hundred acres of the San Francisco Bay.

To mitigate the effects of the proposed San Francisco project, some suggest that several thousand acres of commercial salt ponds, located elsewhere on the Bay, be acquired and returned to their more natural historical character as marshlands. These areas could provide habitats for a large number of local species of animals, fish, and birds, as well as stopping points for migrating species. Some environmentalists portray this move as a win-win proposition for the Bay Area. The transportation agency, however, is reluctant to accept responsibility for projects that involve major wetlands restoration in areas away from its own facilities, and some environmentalists continue to oppose intrusion into the Bay by the transportation agency, even if the marshlands would be restored in a compensatory project. These situations are becoming more typical in transportation planning.

Recommendation: Regional transportation planning methods must be improved so that we can integrate more effectively concerns for water quality into the siting and design of transportation projects. This integration requires basic and applied research on the relationships between transportation systems and water quality, and it also requires use of planning processes that recognize the environmental significance of the impact of transportation systems on water quality.

Biodiversity

The impact of transportation investments on biodiversity is emerging as a major concern of environmental organizations that monitor transportation programs and participate in public debates on transportation planning

and programming. Highways, ports, airports, and rail transit lines can affect biodiversity by, for example, fragmenting habitats, placing barriers between sheltered habitats and sources of food and water, placing barriers in the way of normal animal or insect migration routes, or polluting local water courses. No requirement now exists that addresses biodiversity in the regional transportation planning process, but of course the issue of species habitats is addressed at the level of project planning because it is one of the critical components of an environmental impact statement (EIS). The decision to address biodiversity at the project level can vary greatly with the scale and location of the project and with knowledge of local conditions.

A survey of state highway and transportation departments revealed that in 21 of the 32 responding states, the issue of biodiversity had been raised during highway-development processes. Although the issue had been raised in general because of the concerns of environmental groups and citizens' associations, it has also, in a few instances, been a point of contention over specific species at specific locations. Only four states reported in this survey that they had conducted scientific studies of the biodiversity impacts of particular transportation projects, and three others described specific highway location decisions or transportation agency investments that involved planting or grading specifically to support biodiversity (4).

Progress has been made in the development of tools and techniques for assessing the potential impacts of transportation facilities on biodiversity. In particular, West Virginia, Pennsylvania, and Maine have all developed approaches that vary considerably from qualitative assessments to more quantitative data-collection tools (5).

What role should considerations of biodiversity play in regional level transportation planning? While specific evaluations of the impacts of alternative routes or project designs are part of the environmental impact review of specific projects, it would appear that, in an environmentally responsible regional transportation planning process, the protection of areas with special ecological significance and habitats of endangered or highly valued species should be among the key considerations of preliminary regional network analysis and should be a part of the formulation of basic alternative transportation system designs. I project that considerations of biodiversity and habitat protection will become increasingly important in the regional transportation planning process.

Recommendation: Consideration should also be given to defining an appropriate role for federal requirements and planning regulations in the protection of threatened species and in recognition of the significance of biodiversity in the development of transportation plans. States and MPOs should take

the lead in developing methods and procedures for the inclusion of biodiversity considerations in regional transportation planning.

DISSATISFACTION WITH REGULATORY COMPLEXITY

One of the hallmarks of the transportation-environment relationship during the past 30 years has been bureaucratic complexity. This complexity arose from a well-meaning commitment to environmental protection but has certainly imposed high costs and significant delays. As noted earlier, the complexity of the regulatory framework by which the transportation-environment relationship is managed arose because the provision of mobility and the protection of the environment were, until quite recently, opposing public policy goals that were almost always in tension with one another. This opposition naturally gave rise to a system of opposing checks and balances, with organizational structures and procedures that reflected and balanced the distinct interests associated with each and the need to mediate between them. Costly and time-consuming litigation is similarly the frequent result of multiple and overlapping statutory and regulatory responsibilities that are perceived to be needed to protect competing interests.

If, however, we are truly approaching a period of cooperation between transportation and environmental interests and if we are moving toward a planning and policy-making context in which there is a genuine commitment to the provision of both mobility and environmental quality, we should be able to simplify the process by which transportation systems are planned and projects are approved.

In the conference report that accompanied TEA-21, Congress clearly stated its concerns with the "delays, unnecessary duplication of effort and added costs often associated with current practices for reviewing and approving surface transportation projects." (6, p. 3) In Section 1309 of TEA-21, Congress called for "a coordinated environmental review process for highway construction and mass transit projects." The language of the law specifies that this process "shall insure that, whenever practicable...all environmental reviews, analyses, opinions, and any permits, licenses, or approvals that must be issued or made by any Federal agency for the project concerned shall be conducted concurrently and completed within a cooperatively determined time period." (7, p. 141)

The goal of this section of the law is clearly the creation of a more unified project development, environmental review, and permitting process that will encourage federal, state, and other agencies to work together to ensure both greater effectiveness and faster

environmental decision making. In support of this coordinated review process, TEA-21 provides further language about process elements, time limits for review processes, the participation of appropriate federal and state agencies, dispute resolution procedures, and funding for process implementation. Congress apparently intends that planning regulations be revised to facilitate these goals without devolving decision authority from the Secretary of Transportation.

Under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), transportation capital investments at the corridor or at the major project level were required to be the outcomes of a major investment study (MIS), which was similar to the earlier requirement that transit capital investment projects be supported by "alternatives analysis" studies. In Section 1308 of TEA-21, Congress revised this requirement, directing the secretary of transportation to promulgate regulations that eliminate the MIS process as a separate requirement. It specified instead that the evaluation of alternative projects designed to meet major transportation needs should be carried out as part of the process that is generally performed in the development of the regional long-range transportation plan and the programming that results in the preparation of the Transportation Improvement Program (TIP) (7, p. 141).

AASHTO encouraged and supported this revision, arguing that some of the "good principles of MIS should be retained: the lead agency should continue to be proactive in building a cooperative relationship between the many public agencies that must be involved in evaluating projects at the corridor level, the planning agency should vigorously pursue the active participation of affected citizens and interest groups, the alternatives that are evaluated at the corridor level should be multi-modal in nature, and the evaluation of alternatives should incorporate the financial capacity of the agencies involved to actually deliver the projects." AASHTO advises, however, that new regulations developed by the U.S. Department of Transportation (USDOT) should "integrate MIS principles into metropolitan planning requirements only to the extent that is actually required by statute," and also urges that the integration of MIS principles into existing planning and programming procedures should not "in any way apply more broadly than the existing MIS requirements, and to the extent allowable by statute, should be less prescriptive." (6, p. 9) This conference may wish to consider whether AASHTO's preference for limiting environmental review in this way is consistent with a planning process that gives appropriate weight to both the provision of mobility and the responsiveness to concerns over environmental quality.

MPOs do not all operate in exactly the same way, but development of the long-range regional transportation

plan does not always require detailed, project-level evaluation of design alternatives. The type of detailed evaluation of alternatives that is included in the MIS process must, however, usually be completed before the inclusion of the project in TIP. If the MIS process is a useful exercise, contributing in some degree to the efficient expenditure of public funds, we must ask where in the planning process should the equivalent evaluative functions be placed by the revised planning and programming regulations envisioned by Congress? And what should be the relationship between this evaluation and the assessment that is required to fulfill the requirements of NEPA?

Under ISTEA the agency that performed the MIS process was allowed to choose between two different evaluation processes by which it could approach the MIS and EIS processes. It could treat the MIS and EIS requirements separately by first selecting the major characteristics of the preferred project alternative during the MIS review, and then subjecting the preferred version of the project to environmental evaluation. Although this two-step process would appear to focus and simplify the reviews by making them sequential, the NEPA evaluation itself requires broad consideration of social, economic, and environmental concerns and requires the comparison of the recommended alternative with other possible courses of action. This would imply that, to some extent at least, the two-step approach to MIS and NEPA reviews was required to be duplicative by the prevailing regulations and laws.

The other evaluation alternative was for the agency to integrate the MIS review with the NEPA review, performing them simultaneously and presumably integrating into its evaluation criteria those reviews that are related to transportation effectiveness and cost efficiency and those that are related to the potential social, economic, and environmental impacts of the project alternatives. Although it might appear less efficient to require an agency to thoroughly evaluate a large number of more broadly defined alternatives, it appears to ensure a more thorough evaluation of a wider range of alternatives.

Can we envision a planning process that is more streamlined and efficient, while ensuring that a broad set of multimodal alternatives is thoroughly evaluated according to transportation effectiveness and efficiency criteria as well as environmental criteria? In a paper presented at the Transportation Research Board's (TRB's) annual meeting in January 1996, Frazier and Henneman outlined a planning process developed for the Pennsylvania DOT that aims to do just that (8). In this case the researchers are trying to satisfy both conformity requirements on the one hand, a planning process conducted at the regional level and similar in nature to the development of the long-range

regional transportation planning process, and on the other hand, trying to satisfy project-specific NEPA requirements.

In this process, the regional planning process for conformity analysis characterizes the emissions of criteria pollutants that are associated with a potential project as being at a certain "benchmark" level. An early identification is conducted of the potential mitigation techniques that can be used at the detailed project evaluation and design stage to keep the project within the benchmark level of emissions, which was determined in the conformity review. This benchmark level is then tracked through the later NEPA project-level review process.

The project-level benchmark of emissions is considered a firm requirement in detailed project design, engineering, and evaluation. Failure to meet the benchmark pushes a region out of compliance. This process encourages planners to be realistic at the conformity review stage and also to view the benchmark as a requirement when later conducting detailed project development and evaluation (8). I cannot specifically advocate this benchmark process because I am not intimately familiar with its operation in practice, but I can say that the integration of MIS requirements that are required by Section 1308 of TEA-21 suggests that processes having similar characteristics to this process are applicable or appropriate.

In the spirit of "environmental streamlining," AASHTO has also suggested to the secretary of transportation that new regulations on the implementation of TEA-21 should provide greater flexibility in the format of environmental documents. Currently, Federal Highway Administration and Council on Environmental Quality regulations prescribe the format for EISs. AASHTO asserts that the prescribed format is "topic oriented rather than process oriented or decision oriented," and that this format makes it difficult for the reader to understand and follow the evolution of the proposed project through its various phases (i.e., purpose, need, analysis of alternatives). AASHTO recommends an EIS format that would be "process and decision oriented" and would "document the various stages of a proposed project, the consensus reached, and decisions made." (6, p. 7) Although I am not certain that AASHTO's recommendation is ideal for each and every case, I certainly concur that use of greater flexibility and probably greater variety in EIS formats would be desirable.

Recommendation: Planning regulations and guidelines should be streamlined in character to avoid duplication and delay, focused on meeting regional mobility and conformity requirements, and responsive to the environmental consequences of individual transportation improvements.

DEVELOPMENT OF APPROPRIATE TECHNICAL CAPACITY

The development of regional transportation plans is a data-intensive activity that uses relatively standardized models to estimate traffic flows and their environmental consequences under alternative growth scenarios and for alternative proposed mixes of transportation improvements. Analytical requirements that are placed on the planning process by federal regulations should reflect reasonable expectations about the ability of standard methods to provide an accurate picture of the environmental consequences of alternative future urban development and transportation strategies.

The capabilities of some of the most widely used mathematical modeling packages are disappointingly shallow. A major law suit, for example, was brought by a consortium of environmental groups in the San Francisco Bay Area that challenged the adequacy of the regional transportation plan and suggested that the plan should not be found to be conforming because the quality of the Metropolitan Transportation Commission's estimates of the pollution reductions of alternative transportation control measures did not enable the agency to confidently implement some measures in its own plan (9). A TRB committee examined the capability of current models on the basis of existing databases to estimate the effects of transportation control measures on air quality, specifically on conformity analyses, as well as the effects of new highways that are proposed to accommodate projected growth in population and travel. The committee's pessimistic conclusions are as follows:

After examining the considerable literature on the relationships among transportation investment, travel demand, and land use, as well as the current state of the art in modeling emissions, travel demand, and land use, the committee finds that the analytical methods in use are inadequate for addressing the regulatory requirements. The accuracy implied by the interim conformity regulations issued by the EPA, in particular, exceeds current modeling capabilities. The net differences in emission levels between the build and no-build scenarios are typically smaller than the error terms of the models. Modeled estimates are imprecise and limited in their account of changes in traffic flow characteristics, trip making, and land use attributable to transportation investments. The current regulatory requirements demand a level of analytic precision beyond the current state of the art in modeling. (10, p. 5)

In part, the limitations of the models that are currently in use can be traced to the inability of data-

collection methods and theories to determine causal relationships among land use patterns, transportation facilities, travel volumes, and the production of pollutants. Beyond this, many models in widespread use have not been updated for years and have often been used inappropriately by inexperienced staff members. The committee concluded that the addition of highway capacity to alleviate congestion, in most instances, would have beneficial impacts on air quality. However, it acknowledged that there were significant differences of opinion on this question and that results could differ from case to case, depending on geographic conditions and particular contexts. Nevertheless, the committee's judgment was tentative, and it acknowledged that the models currently in widespread use are often inadequate to make a confident determination (3, p. 8).

Since the committee issued its report, there have been a number of efforts to strengthen relevant modeling capabilities, and Howett (1) recently stated that the models in use have shown substantial improvement over the past few years. A new "emissions factor" model is coming into use, and on a much broader scale, USDOT has initiated a travel-model improvement program to upgrade over 5 to 7 years the capabilities of models that are generally used at MPOs for integrated land use, travel-demand, and air quality analyses. Still, there continues to be enormous variability among metropolitan areas and among consulting firms that are retained in land use, transportation, and air quality modeling capabilities. Many smaller MPOs lack the capability to conduct sophisticated analyses that are more frequently required as the basis of conformity determinations.

Recommendation: Because critical estimates of the travel outcomes and conformity implications of alternative land use and transportation plans require rather sophisticated mathematical modeling, and the ability of MPOs to perform such analysis is extremely uneven, it may be necessary for the federal government to develop, package, and disseminate advanced software packages that would permit MPOs to conduct appropriate and accurate forecasting as part of the regional planning process. Such a program might be coupled with a federally sponsored training program in land use, transportation, and emissions modeling and with peer review of the modeling capabilities of designated MPOs.

CONCLUSION

Relationships among land use, economic development, travel, and environmental quality are inherently multifaceted and complex. Our understanding of these relationships has increased dramatically since the passage of the

first Clean Air Act and the enactment of NEPA. Federal planning and environmental regulations have evolved over time as planning and policy priorities have shifted. On one hand, federal requirements reflect our current understanding of these complex relationships. On the other hand, they motivate efforts to refine and deepen that understanding. The new regulations that will emerge in response to the passage of TEA-21 will serve, like past regulations, as a reflection of current priorities and the current knowledge base. They will also motivate research and experimentation to improve our knowledge base and refocus our regulatory requirements.

I hope that my analysis and suggestions will help the participants at this conference to develop meaningful proposals for refocusing the regional transportation planning process. I believe that now is the time to make regional planning guidelines more flexible and to promote a planning process that is less time consuming. If, at the same time, a broader range of environmental factors and potential impacts is to be incorporated into the transportation planning process, increasing flexibility is needed so that the planning process can be appropriately tailored to differences among regions and to the most pressing issues that are brought to the table by local and regional interests.

If regional transportation and environmental planning is to be effective, however, it is necessary for federal requirements and funding programs to recognize that transportation planning and analyses of the environmental consequences of transportation can be integrated to a far greater extent than they have been in the past. In addition, by focusing on improved methods, data-collection techniques, and technical training for those persons involved, it may be possible to improve the quality of the judgments produced by the process while allowing and encouraging greater flexibility.

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CONFERENCE I RESOURCE PAPER

Environmental Justice and Where It Should Be Addressed in the 21st Century Concerning the Transportation Industry Historical Perspective and Summary

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There is an underlying tug of war going on in the world of transportation: human rights versus environmental rights. This paper outlines the differences between human rights and environmental rights through a review of Title VI of the Civil Rights Act of 1964, Title VIII of the Civil Rights Act of 1968 (Fair Housing Act), the National Environmental Protection Act (NEPA) of 1969, and various executive orders that are related to environmental protection and human rights. An analysis of a number of legal cases concerning environmental justice (i.e., human rights) is also provided. This analysis offers various planning tools that the reader can use to minimize environmental justice concerns as they relate to transportation projects. Also shown are ways in which transportation planners and engineers can use these planning tools while working with strategies to solve major transportation issues or problems. Finally, environmental justice is examined as it relates to needed research to fill existing gaps with available tools.

HUMAN RIGHTS VERSUS ENVIRONMENTAL RIGHTS

Title VI of the Civil Rights Act of 1964

Section 601 of the Civil Rights Act (PL 88-352) specifically states that no person in the United States shall, on

the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity that receives federal financial assistance. Section 602 of the act requires that each federal agency empowered to administer a federal program to draw on the provisions of Section 601 by issuing rules, regulations, or orders that will be consistent with the objectives of the statute. The Federal Highway Administration (FHWA) is the federal agency under the U.S. Department of Transportation (USDOT) that administers federal financial assistance to all state highway departments for the planning and construction of many of the transportation projects in the United States and that is responsible for ensuring compliance with Title VI.

Through a review of the legislative history, Title VI of the Civil Rights Act of 1964 was enacted because of the many examples that were cited in which people of color in the United States were denied equal protection and equal benefits under federal assistance programs that were related to vocational and technical assistance, public employment services, manpower development and training, and vocational rehabilitation, to name a few. Specifically, the legislative history states that, in every essential walk of life, American citizens are affected by programs involving federal financial assistance. Through these programs, medical care, food, employment, education, and welfare are supplied to those in

need. For the government, then, to permit the extension of such assistance to be carried on in a racially discriminatory manner is to violate the precepts of democracy and undermine the foundations of the government (Civil Rights Act of 1964, Title VI, Legislative History).

Although Title VI of the Civil Rights Act of 1964 and Title VIII of the Civil Rights Act of 1968 have been around for decades, many audiences in the environmental and transportation arenas believe that the acts have not received the necessary attention by officials to ensure that discrimination is not occurring in federally assisted programs. As a result, key Title VI and Title VIII cases that involve land use and transportation issues have been litigated in the courts.

NEPA

NEPA, one of the major statutes that governs FHWA in terms of its planning for federally assisted transportation projects, was enacted, among other purposes, to establish a national policy for the environment and to establish a Council on Environmental Quality (CEQ). Specifically, the purpose of the act was to declare a national policy that would encourage productive and enjoyable harmony between man and his environment; to promote efforts that would prevent or eliminate damage to the environment and the biosphere and stimulate the health and welfare of man; and to enrich the understanding of the ecological systems and natural resources that are important to the nation (NEPA of 1969, PL 91-190, 42 USC 4321-4347, Jan. 1, 1970, as amended by PL 94-52, July 3, 1975, and PL 94-83, Aug. 9, 1975).

After reading the purpose of NEPA, one cannot help but observe why a tug of war has emerged between human rights and environmental rights concerning transportation projects in the United States. Obviously, NEPA has placed a great emphasis on protecting the environment. However, that is not to say the act did not intend for society (human rights) and communities to be a part of the "environment" that they set out to protect. Yet, further sections of the act clearly identify that the role of the federal government is to protect environmental rights.

Section 101(b) of the act requires that the federal government use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate federal plans, functions, programs, and resources to "fulfill the responsibilities of each generation as *trustee of the environment*...; assure for all Americans...esthetically and culturally *pleasing surroundings*; attain the widest range of beneficial uses of the environment without degradation...; *preserve important historic, cultural, and natural aspects* of our

national heritage...; achieve a balance between population and *resource use*...; and *enhance the quality of renewable resources*."

Section 102(2) of the act requires policies, regulations, and public laws of the United States and all agencies of the federal government to

insure the integrated use of the *natural and social sciences and the environment design arts in planning and in decision making* which may have an impact on *man's environment*; identify and develop methods and procedures...which will insure that presently unquantified *environmental amenities and values* be given appropriate consideration...; include in every recommendation or report affecting the *quality of the human environment*, a detailed statement by the responsible official on

- (i) the *environmental impact* of the proposed action,
- (ii) any *adverse environmental* effects which cannot be avoided,
- (iii) alternatives to the proposed action,
- (iv) the relationship between local short-term uses of *man's environment* and the maintenance and enhancement of long-term productivity, and
- (v) any *irreversible and irretrievable commitments of resources*.

Executive Order 11514

Executive Order 11514, *Protection and Enhancement of Environmental Quality*, signed by President Nixon on March 5, 1970, shows additional measures taken by the government to ensure protection and enhancement of the environment. Section 1 of the order states that "the Federal Government shall provide leadership in *protecting and enhancing the quality of the Nation's environment* to sustain and enrich human life."

The responsibilities of federal agencies under this executive order are outlined in later in this paper. Consonant with Title I of NEPA, the heads of federal agencies are required to "monitor, evaluate, and control on a continuing basis their agencies' activities so as to *protect and enhance the quality of the environment*; and develop procedures to ensure the fullest practicable provision of timely public information and understanding of Federal plans and programs *with environmental impact* in order to obtain the views of interested parties."

There is clearly a protection of the "environmental rights" that is promulgated in NEPA and Executive Order 11514 that has sparked civil rights activists over the past decade to question "human rights" in the equation of human rights versus environmental

rights. Have we as professionals overlooked the protection of society (human rights) and communities in the environment when balancing the impacts studied under NEPA in determining our final decisions and conclusions? Many of these human rights questions have been raised in a history of case law, which is discussed later in detail, over the past decade and a half. On one side of the equation, many governmental agencies believe they have addressed human rights through the adherence of NEPA and the Civil Rights Act, yet on the other side of the equation, civil rights activists believe that human rights have been ignored under NEPA and only environmental rights have been protected.

Although Title VI of the Civil Rights Act of 1964 and Title VIII of the Civil Rights Act of 1968 (Fair Housing Act) are not new to many governmental agencies that are charged with administering federally assisted programs, President Clinton recently signed Executive Order 12898, sparking yet a greater understanding of the human rights issues in the overall equation. It has therefore become apparent to many grassroots organizations and foundations that NEPA and other related federal regulations have not done enough in the past to ensure that these organizations' human rights are protected in terms of planning and constructing transportation projects throughout the country. The term environmental justice is the name many civil rights activists have given the term human rights in the human rights versus environmental rights equation.

What is environmental justice? Many professionals are struggling with this term. Suggestions have been made to call it something else. Does environmental justice mean discrimination? Is environmental justice an equity issue? Is environmental justice inclusive of social and community impacts? Can environmental justice arise at a project-specific level? Should environmental justice be evaluated in the planning stage? The answer to these questions is simply yes. Transportation professionals should focus on the evolution of the term environmental justice through the many cases and legislative acts in which it is found and not so much on the terminology. One will find in the review of legislation and in these cases that environmental justice is very broad reaching—from transportation-project-specific to intrarelated to transportation projects and planning. Are transportation professionals obligated to speak up for disadvantaged persons? Are transportation professionals obligated to use existing legislation, regulations, and tools that are available to them to identify disadvantaged populations in the planning phase and project stages of their programs and to include these populations in the decision-making process at the planning-program level and the project-specific level?

Executive Order 12898

Executive Order 12898, *Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*, was signed by President Clinton on February 11, 1994, in an effort to address environmental justice. Under the order, each federal agency will make the achievement of environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations in the United States and its territories and possessions (the Commonwealth of Puerto Rico and the Commonwealth of the Mariana Islands). The order also requires the creation of an interagency working group on environmental justice by the U.S. Environmental Protection Agency that includes USDOT.

The working group is required to

- (1) provide guidance to federal agencies on criteria for identifying disproportionately high and adverse human health or environmental effects on minority populations and low-income populations;
- (2) coordinate with, provide guidance to, and serve as a clearinghouse for, each federal agency as it develops an environmental justice strategy in order to ensure that the administration, interpretation and enforcement of programs, activities and policies are undertaken in a consistent manner;
- (3) assist in coordinating research by, and stimulating cooperation among, the Environmental Protection Agency, the Department of Health and Human Services, the Department of Housing and Urban Development, and other agencies conducting research or other activities in accordance with the order;
- (4) assist in coordinating data collection, required by this order;
- (5) examine data and studies on environmental justice;
- (6) hold public meetings; and
- (7) develop interagency model projects on environmental justice that evidence cooperation among federal agencies.

DOT Environmental Justice Strategy

In addition, Executive Order 12898 requires that each federal agency develop an agencywide environmental justice strategy that identifies and addresses disproportionately high and adverse human health and environmental effects of its programs, policies, and activities on minority and low-income populations. USDOT issued its final environmental justice strategy in the *Federal*

Register on June 29, 1995. Elements of this strategy are as follows:

- 1) *Public Outreach on Implementation of the Environmental Justice Strategy*—a review with environmental justice stakeholders, DOT's plans for the following activities: (a) grass roots meetings to better understand the environmental justice concerns and provide training on the transportation processes; (b) a secretarial level meeting of experts, traditional DOT stakeholders and environmental justice representatives to recommend specific policies and actions to implement Executive Order 12898 and the Department's Environmental Justice Strategy; and (c) regional workshops for state and local officials on implementing the Strategy.
- 2) *DOT Order on Environmental Justice*—ensure DOT managers are fully aware of their responsibilities under Executive Order 12898 and pre-existing statutory mandates through information seminars (1).

USDOT Final Order on Environmental Justice

On February 3, 1997, Secretary of Transportation Federico F. Peña signed the USDOT Final Order on Environmental Justice, *DOT Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*. Within 6 months of the date of this order, each operating administration is required to provide a report to the assistant secretary for transportation policy and to the director of the departmental Office of Civil Rights describing the procedures that it has developed to integrate, or how it is integrating, the processes and objectives set forth in the order into its operations.

In accordance with this order, each operating administration (U.S. Coast Guard, Federal Aviation Administration, FHWA, Federal Railroad Administration, National Highway Traffic Safety Administration, Federal Transit Administration, St. Lawrence Seaway Development Corporation, Maritime Administration, and Research and Special Programs Administration) and responsible officials shall determine whether programs, policies, and activities for which they are responsible will have an adverse impact on minority and low-income populations and whether that adverse impact will be disproportionately high (2). In making determinations about disproportionately high and adverse effects on minority and low-income populations, mitigation and enhancement measures that will be taken and all offsetting benefits to the affected minority and low-income populations may be taken into account, as well as the design, comparative impacts, and the relevant number of similar existing system elements in nonminority and non-low-income areas (2).

The operating administrators and other responsible USDOT officials will ensure that any of their respective programs, policies, or activities that will have a disproportionately high and adverse effect on minority or low-income populations will be carried out only if further mitigation measures or alternatives that would avoid or reduce the disproportionately high and adverse effect are "not practicable." In determining whether a mitigation measure or an alternative is "practicable," the social, economic (including costs), and environmental effects of avoiding or mitigating the adverse effects will be taken into account (2). Operating administrators and other responsible USDOT officials will also ensure that any of their respective programs, policies, or activities that will have a disproportionately high and adverse effect on populations protected by Title VI ("protected populations") will be carried out only if

- A substantial need for the program, policy, or activity exists on the basis of the overall public interest; and
- Alternatives that would have less adverse effects on protected populations (and that still satisfy the need identified in the previous bullet) either would (a) have other adverse social, economic, environmental, or human health impacts that are more severe; or (b) involve increased costs of extraordinary magnitude. (2)

FHWA Final Order on Environmental Justice

On December 2, 1998, FHWA issued its Final Order on Environmental Justice, *FHWA Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*. FHWA's order basically provides the same information and format as the Final USDOT Order.

CASE HISTORY

Environmental justice or environmental discrimination was just as prevalent several decades ago as it is today; yet, because of societal emphases and differences, little litigation has ensued the topic. Looking back in history, in the 1950s urban renewal and freeway locations in parks and inner cities affected minority communities, yet hardly any litigation resulted. In the 1970s and 1980s, one can observe how NEPA was used frequently as a vehicle to stop undesirable development, such as low-income housing. Reviewing two mainstream cases and several central cases that surround the topic of environmental justice and environmental discrimination, one can observe the evolution of the important issues that transportation professionals need to be concerned with when addressing and planning for social and com-

munity impacts on a project-specific and program-level basis.

U.S. Supreme Court Cases

Two U.S. Supreme Court cases have played important roles in lower-court decisions that surround environmental justice cases, particularly in land use-related cases as well as in transportation-related cases to some degree: *Washington v. Davis*, 96 SCt 2040 (1976) and *Village of Arlington Heights v. Metropolitan Housing Development Corporation*, 97 SCt 555 (1977).

Both cases deal with the violation of the Equal Protection Clause under the Fourteenth Amendment of the U.S. Constitution. Also, in both cases, the U.S. Supreme Court concluded an important point that has been observed and used in subsequent cases—"official action will not be held unconstitutional solely because it results in a racially disproportionate impact; proof of racially *discriminatory intent* or purpose is required to show violation of the Equal Protection Clause" (3).

Washington v. Davis, 96 SCt 2040 (1976) is a case that surrounds black applicants for employment as police officers in the District of Columbia, challenging that recruiting procedures were racially discriminatory. The plaintiffs specifically challenged a written personnel test that was administered to applicants to determine a particular level of verbal skill. The plaintiffs in this case claimed that the written test was racially discriminatory, bore no relationship to job performance, and excluded a disproportionately high number (a disproportionate impact) of black applicants.

The district court noted no claim by the plaintiffs of intentional discrimination. However, the plaintiffs showed certain evidence that shifted the burden of proof to the defendants, but the court concluded that the plaintiffs were not entitled to relief because the defendants supported their burden of proof with several facts.

The court of appeals reversed the district court's decision and held that (a) the lack of discriminatory intent in the enactment and administration of the test was irrelevant; (b) the critical fact was that four times as many blacks as whites failed the test; and (c) such disproportionate impact was sufficient to establish a constitutional violation, absent any proof by the defendants that the test adequately measured job performance.

The U.S. Supreme Court held that (a) a law is not unconstitutional solely because it has a racially disproportionate impact regardless of whether it reflects a racially discriminatory purpose; (b) the disproportionate impact of the test, which was neutral on its face, did not warrant conclusion that the test was a purposely dis-

criminatory device; and (c) a positive relationship between the test and the training school performance was sufficient to validate the test, wholly aside from its possible relationship to actual performance as a police officer (4).

The result of this U.S. Supreme Court case is not to say that evidence alone that supports a discriminatory impact can rise to the level to show discriminatory intent. The U.S. Supreme Court emphasized that "this is not to say that the necessary *discriminatory racial intent* must be expressed or appear on the face of the statute, or that a law's disproportionate impact is irrelevant in cases involving Constitution-based claims of racial discrimination. A statute, otherwise neutral on its face, must not be applied so as invidiously to discriminate on the basis of race, *Yick Wo v. Hopkins*, 6 SCt 1064." (4)

However, the U.S. Supreme Court also emphasized that an

invidious *discriminatory intent* may often be inferred from the totality of the relevant facts, including the fact, if it is true, that the law bears more heavily on one race than another. Nevertheless, we have not held that laws, neutral on its [their] face and serving ends otherwise within the power of government pursue, are invalid under the Equal Protection Clause simply because it [they] may affect a greater proportion of one race than of another. Disproportionate impact is not irrelevant, but is not the sole touchstone of an invidious racial discrimination forbidden by the Constitution (4).

Yick Wo v. Hopkins, 6 SCt 1064 (1886), the first racism case in the United States that was argued in the California Supreme Court, concerns an ordinance that was passed in 1880 by the city of San Francisco in which permission to carry on laundries were refused except in buildings of brick or stone. The plaintiff in this was case Yick Wo, a native of China, who came to California in 1861 and engaged in the laundry business for 22 years in the same building. The California Supreme Court found that there was no reason for the ordinance, except hostility to race and nationality, and that the resulting discrimination was illegal and in violation of the Equal Protection Clause under the Fourteenth Amendment of the U.S. Constitution.

Village of Arlington Heights v. Metropolitan Housing Development Corporation, 97 SCt 555 (1977), is a U.S. Supreme Court case that has taken the Davis case one step further by identifying specific factors to be present in determining discriminatory intent. Arlington Heights is a suburb of Chicago where a nonprofit real estate developer had contracted to purchase a tract of land for building racially integrated low- and moderate-income housing and then brought action against local authori-

ties because of their refusal to change the tract from a single-family to a multifamily classification, arguing that their decision was racially discriminatory.

Although the court of appeals reversed the district court's finding and found that the "ultimate effect" of the rezoning denial was racially discriminatory, the U.S. Supreme Court held that the plaintiff failed to carry the burden of proving that racially discriminatory intent or purpose was a motivating factor in the local authorities' decision surrounding the rezoning. It was noted that "official action will not be held unconstitutional solely because it results in a racially disproportionate impact. (Such) impact is not irrelevant, but it is not the sole touchstone of an invidious racial discrimination" [*Washington v. Davis*, 96 SCt 2040 (1977)] (3).

The most important point that was emphasized by the U.S. Supreme Court in *Village of Arlington Heights v. Metropolitan Housing Development Corporation*, and one that has been used in many subsequent cases, was that "a racially discriminatory intent, as evidenced by such factors, ... must be shown." These are the factors that the U.S. Supreme Court evidenced for other courts to review in deciding discriminatory intent when a disproportionate impact has been identified.

In reaching these factors, the U.S. Supreme Court stated the following:

[*Washington v.*] *Davis* does not require a plaintiff to prove that the challenged action rested solely on racially discriminatory intents. Rarely can it be said that a legislature or administrative body operating under a broad mandate made a decision motivated solely by a single concern, or even that a particular purpose was the 'dominant' or 'primary' one. In fact, it is because legislators and administrators are properly concerned with balancing numerous competing considerations that courts refrain from reviewing the merits of their decisions, absent a showing of arbitrariness or irrationality. But racial discrimination is not just another competing consideration. *When there is a proof that a discriminatory purpose has been a motivating factor in the decision, this judicial deference is no longer justified* (3).

In identifying the factors, the U.S. Supreme Court stated the following:

Determining whether invidious *discriminatory purpose* was a motivating factor demands a sensitive inquiry into such circumstantial and direct evidence of intent as may be available. 1) *The impact of the official action*—whether it 'bears more heavily on one race than another,' *Washington v. Davis*—may provide an important starting point. Sometimes a clear pattern, unexplainable on grounds other than race,

emerges from the effect of the state action even when the governing legislation appears neutral on its face, *Yick Wo v. Hopkins*, 6 SCt 1064 (1886). The evidentiary inquiry is then relatively easy. But such cases are rare. Absent a pattern as stark as that in *Yick Wo v. Hopkins*, impact alone is not determinative, and the Court must look to other evidence...2) *The historical background of the decision* is one evidentiary source, particularly if it reveals a series of official actions taken for invidious purposes...3) *The specific sequence of events leading up to the challenged decision* also may shed some light on the decision maker's purposes...4) *Departures from the normal procedural sequence* also might afford evidence that improper purposes are playing a role...5) *Substantive departures* too may be relevant, particularly if the factors usually considered important by the decision maker strongly favor a decision contrary to the one reached...6) *Legislative or administrative history* may be highly relevant, especially where there are contemporary statements by members of the decision making body (3).

Court of Appeals Case

In the U.S. Supreme Court case of *Village of Arlington Heights v. Metropolitan Housing Development Corporation*, 97 SCt 555 (1977), the plaintiffs also alleged that the refusal to rezone also violated Title VIII of the Civil Rights Act of 1968 (Fair Housing Act). Because the Supreme Court believed that the court of appeals did not address this statutory question, they remanded the case to the court of appeals for further consideration.

In the case *Village of Arlington Heights v. Metropolitan Housing Development Corporation*, 558 F2d 1283 (1977), the court of appeals pointed out that "in determining whether the Village's failure to rezone violated the Fair Housing Act, it is important to note that the Supreme Court's decision does not require us to change our previous conclusion that the Village's action had a racially discriminatory effect. What the Court held is that under the Equal Protection Clause that conclusion is irrelevant" (5).

The basic question that the court of appeals was required to answer was whether the village's action violated the Fair Housing Act because it had discriminatory effects, even when that action was taken without discriminatory intent. The court found

the major obstacle to concluding that action taken without discriminatory intent can violate the Fair Housing Act is the phrase 'because of race' contained in the statutory provision. The narrow view of the phrase is that a party cannot commit an act 'because

of race' unless he intends to discriminate between races. The broad view is that a party commits an act 'because of race' whenever the natural and foreseeable consequences of that act are to discriminate between races, regardless of his intent. Under this statistical, effect-oriented view of causality, the Village could be liable since the natural and foreseeable consequence of its failure to rezone was to adversely affect black people seeking low-cost housing and to perpetuate segregation in Arlington Heights (5).

The court of appeals noted that the U.S. Supreme Court adopted the narrow view for equal protection purposes in *Washington v. Davis*. Specifically, the court of appeals pointed out that the U.S. Supreme Court

created a dichotomy between the Equal Protection Clause and Title VII of the Civil Rights Act of 1964. Although the Court announced its new intent requirement for equal protection cases, it reaffirmed the viability of *Griggs v. Duke Power Co.*, 91 SCt 849 (1971), in which it had previously held that an employment practice that produced a racially discriminatory effect was invalid under Title VII unless it was shown to be job-related. Thus, a prima facie case of employment discrimination can still be established under Title VII by statistical evidence of discriminatory impact, without a showing of discriminatory intent (5).

The court of appeals also pointed out that "the Supreme Court in *Griggs* held that this provision did not sanction all employment tests administered without *discriminatory intent*, in spite of the "because of race" language that it contains. Rather, the Court looked to the general congressional purpose in enacting Title VII—which was to achieve equality of employment opportunities—and interpreted VII in a broad fashion in order to effectuate that purpose." (5) Because of this, the court of appeals chose not to take a narrow view of the phrase "because of race" that was contained in the Fair Housing Act. Therefore, the court of appeals concluded that "at least under some circumstances a violation of the Fair Housing Act can be established by a showing of discriminatory effect without a showing of *discriminatory intent*." (5)

In the remanded case, *Village of Arlington Heights v. Metropolitan Housing Development Corporation*, 558 F2d 1283 (1977), the court of appeals found that the village's refusal to rezone constituted a violation under the Fair Housing Act of 1968. Similar to the U.S. Supreme Court's *Village of Arlington Heights* case, the court of appeals on remand used four critical factors in its decision:

1. How strong are the plaintiffs' showings of discriminatory effect?

2. Is there some evidence of discriminatory intent, though not enough to satisfy the constitutional standard of *Washington v. Davis*?

3. What is the defendant's interest in taking the action in question?

4. Do the plaintiffs seek to compel the defendant to affirmatively provide housing for members of minority groups or merely to restrain the defendant from interfering with individual property owners who wish to provide such housing?

The court of appeals pointed out two types of racially discriminatory effects that a facially neutral decision about housing can produce: (a) the decision has a greater adverse impact on one racial group than on another; and (b) the effect that the decision has on the community that is involved: if the decision perpetuates segregation, and thereby prevents interracial association, it will be considered invidious under the Fair Housing Act, independently of the extent to which it produces a disparate effect on different racial groups (5).

In this case, the court believed that discriminatory effect was weak, because the class that was disadvantaged by the village's action was not predominantly nonwhite (60 percent of the people in the Chicago that were eligible for federal housing subsidization in 1970 were white). In addition, the court believed that the second fact, evidence of discriminatory intent, was the least important of the four factors they were examining. The court stated that "if we were to place great emphasis on partial evidence of purposeful discrimination we would be relying on an inference—that the defendant is a wrongdoer—which is at best conjectural." (5)

The court found the third factor, the defendant's interest in taking the action in question, thus producing a discriminatory impact, to be important. Because the village was acting within the scope of its authority to zone under state law, the court believed that this factor weakened the plaintiff's case.

The court found the final factor, the type of relief sought by the plaintiffs, to favor the plaintiffs. The court concluded that "they own the land on which Lincoln Green would be built and do not seek any affirmative help from the Village in aid of the project's construction. Rather, they seek to enjoin the Village from interfering with their plan to dedicate their land to furthering the congressionally sanctioned goal of integrated housing." (5)

Land Use: Case Histories

Little has been written on the topic of environmental justice as it relates to transportation. Although environ-

mental justice has not been the main issue that has been brought to the surface with several documented transportation-related legal cases, it has always been an underlying theme. Several of the legal cases that surrounded environmental justice surfaced from the 1950s through the 1980s in the area of urban land use (e.g., landfills, hazardous waste sites, and zoning). Many authors who have written on the topic to date have cited the following three cases as the core sources of the environmental justice movement.

East Bibb Twiggs Neighborhood Association v. Macon-Bibb County Planning & Zoning Commission

The case *East Bibb Twiggs Neighborhood Association v. Macon-Bibb County Planning & Zoning Commission*, F. Supp. 880 (M.D. GA, 1989), concerns the development of a private landfill. The residents of the area brought action against the Macon-Bibb County Planning and Zoning Commission for a decision that allowed the development of a private landfill in a census tract that was mostly black. A judgment in favor of the defendants was rendered by the U.S. District Court and affirmed by the U.S. Court of Appeals for the 11th Circuit. The court considered the same six factors that the U.S. Supreme Court cited in the *Village of Arlington Heights v. Metropolitan Housing Development Corporation*, 97 SCt 555 (1977), case in determining its decision:

1. Effects of the official action;
2. Historical background of the decision;
3. Specific sequence of events leading up to the challenged decision;
4. Any departures, substantive or procedural, from the normal decision-making process;
5. Departures from normal substantive criteria; and
6. Legislative or administrative history of the challenged decision [97 SCt 555 (1977)] (6).

The court found insufficient evidence that the commission's decision was motivated by race discrimination and that the only other commission-approved landfill was located in a mostly white area.

With respect to the impact of the official action, the court did not argue that the decision surrounding the location of the landfill was in a predominately black area (60 percent of the total population of the census tract). However, the court pointed out that the only other landfill approved by the commission was located in a census tract that was mostly white (76 percent of the total population). The court stated that the decision failed to establish a clear pattern of racially motivated decisions (6). Specifically, the court noted that

the commission may not actively solicit a landfill application and that the commission reacts to applications from private landowners requesting permission to use their property in a particular manner (6). In this case, a private developer, Mullis Tree Service, Inc., applied for a conditional use to operate a nonputrescible waste landfill.

The court also looked at the historical background of the commission's decision by reviewing several newspaper articles that the plaintiff submitted as evidence. It concluded that often times the commission refused development proposed by the opposition, while other times development was allowed. The court found that the plaintiff's evidence did not establish a background of discrimination.

Upon examination of the specific sequences that led to the challenged decisions, the court could not find any support that race was a motivating factor in the commission's decision. Specifically, the court believed that the statements made by the commissioner during deliberations indicated real concern about both the desires of the opposing citizens and the needs of the community in general. An excerpt of one of the statements is as follows:

I'm interested in that because I think government and ultimately democracy functions on the legitimacy of its purpose and if people don't have faith in their institutions, the system won't work. They may not like all of the decisions that government institutions make, but I would feel badly if they thought that there was some sort of conspiracy afoot and I can tell you that I received a number of calls before and after my own meanderings through that land and I received no calls from big corporate people asking me to vote a particular way (6).

The plaintiff also believed that because the commission solicited input from the county and the city on the matter, the commission deviated from normal procedures. The court made it clear that, because of these efforts made by the commission, such efforts had their genesis in the commission's concerns about accountability to the public for certain controversial governmental decisions (6).

The final factor that was examined by the court was the legislative or administrative history. The plaintiff believed that because the commission initially denied the petitioner's application for the landfill, there was some racial purpose in motivating the commission to reconsider and approve the landfill site. The court disagreed with this.

In the court's discussion of the case, it quoted an important point that has been cited in other relevant cases: "to prove a claim of discrimination in violation of the Equal Protection Clause a plaintiff must show not only that the state action complained of had a dispro-

portionate or discriminatory impact but also that the defendant acted with the *intent to discriminate*, *Washington v. Davis*, 96 SCt 2040 (1976).” (6) In other words, although the plaintiff showed a disproportionate impact, the fact that the landfill location was in a predominately black area, racial motivations were not established under the applied factors.

Margaret Bean v. Southwestern Waste Management Corporation

The case of *Margaret Bean v. Southwestern Waste Management Corporation*, 482 F. Supp. 673 (S.D. Texas, 1979), also involves the selection of a site for the development of a solid waste facility. In this case, the plaintiff moved for a preliminary injunction to stop the selection of a site for a solid waste facility because of a racially discriminatory motive. The court reviewed the following four prerequisites in granting the preliminary injunction:

1. Substantial likelihood of success on the merits.
2. Substantial threat of irreparable injury.
3. Threatened injury to the plaintiff outweighs the threatened harm that the injunction may cause the defendant.
4. Granting the preliminary injunction will not deserve the public interest [*Canal Authority of State of Florida v. Callaway*, 489 F2d 567, 572 (5th Cir. 1974)]. (7)

The court found that the plaintiff did adequately establish a substantial threat of irreparable injury. The court specifically stated that the opening of the facility will affect the entire nature of the community—its land values, its tax base, its aesthetics, the health and safety of its inhabitants, and the operation of Smiley High School, located only 1,700 feet from the site (7). However, the court also found that the plaintiff did not establish a substantial likelihood of success on the merits. As in the *East Bibb Twiggs Neighborhood Association v. Macon-Bibb County Planning & Zoning Commission*, the burden of proving discriminatory purpose was placed on the plaintiff [*Washington v. Davis*, 96 SCt 2040 (1976); *Village of Arlington Heights v. Metropolitan Housing Development Corporation*, 97 SCt 555 (1977)]. Similarly, the court stated that the plaintiff must show not just that the decision to grant the permit is objectionable or even wrong, but also that it is attributable to an intent to *discriminate* on the basis of race. However, statistical proof can rise to the level that it, alone, proves discriminatory intent as in *Yick Wo v. Hopkins*, 118 U.S. 356 (1886) (7).

The court viewed two different theories of liability that were similar to the factors the U.S. Supreme Court

raised in the *Village of Arlington Heights v. Metropolitan Housing Development Corporation*, 97 SCt 555 (1977). First, the court looked at whether the Texas Department of Health’s (TDH’s) approval of the permit was part of a pattern or practice of discriminating in the placement of solid waste sites. Second, the court looked at whether TDH’s approval of the permit, in the context of the historical placement of solid waste sites and the events surrounding the application, constituted discrimination. In both theories the court found that the plaintiff failed to prove intent to discriminate.

Under the first theory the court viewed statistical data, both citywide and in the target area. Of the 17 sites that were viewed in the citywide area, the court found that 58.8 percent of them were located in areas with a <25 percent minority population, and 82.4 percent of them were located in areas with a <50 percent minority population. Of the two sites that were viewed in the target area, the court found that Site 1 comprised a <10 percent minority population and that Site 2 comprised a 60 percent minority population. From this data, the court concluded that there was no discriminatory intent.

Under the second theory, the plaintiff focused on the two solid waste sites that were used by the city of Houston (target area). First, the plaintiff argued that 100 percent of the Type I municipal landfill sites that Houston uses contain only 6.9 percent of the entire population of Houston. The court countered by stating that two sites are not a statistically significant number to make an argument and that 58.4 percent of the population is minority in Site 1, and 18.4 percent of the population is minority in Site 2, thus proving no inference of discrimination.

Second, the plaintiff argued that the total number of solid waste sites that were located in the target area have created a statistical disparity. The plaintiff argued that the target area contained 15 percent of Houston’s solid waste sites but contained only 6.9 percent of its population, with an overall 70 percent minority population comprising the target area. The court countered by looking specifically at the location of the particular sites in the target area and found that half of the sites in this area were in census tracts with a >70 percent white population.

Third, the plaintiff looked at the city as a whole and argued the following: 17.1 percent of the city’s solid waste sites were located in the southwest quadrant where 53.3 percent of the white population lived, and 15.3 percent of the sites were located in the northwest quadrant where 20.1 percent of the white population lived; thus, 32.4 percent of the sites were located in the western half of the city where 73.4 percent of the white population lived, and 67.7 percent of the sites were located in the eastern half of the city where 61.6 percent

of the minority population lived. The court again countered with (a) the fact that a large number of the sites were located around Houston's ship channel (eastern half of the city) because of industry and not because a minority population lived there, and (b) 42.3 percent of the sites in Houston were located in minority census tracts, while 57.7 percent of the sites were located in white census tracts.

The court finally allowed the plaintiff to present nonstatistical data to establish purposeful discrimination. On this issue the plaintiff presented the fact that the county commissioners denied a permit for a site that was proposed for the almost identical location in 1971. The plaintiff also pointed out that the site, which was being placed within 1,700 feet of Smiley High School, had changed from a white school to one that was predominantly minority.

The court's final statements were that the plaintiff established that the decision to grant the permit was both unfortunate and insensitive; however, the plaintiff did not establish a substantial likelihood of proving that the decision to grant the permit was motivated by purposeful racial discrimination. The court also pointed to several unanswered questions, such as,

Where, for instance, are the solid waste sites located in each census tract? How large an area does a solid waste site affect? How are solid waste site locations selected? What factors entered into TDH's decision to grant the permit? The court believed that racial composition of the neighborhood and the racial distribution of solid waste sites in Houston were primary concerns of the plaintiffs. And it remains unclear to what degree TDH was informed of these concerns (7).

In conclusion, the court believed that, in accordance to the evidence, it would have denied the permit. However, under the court's responsibility—to find whether the plaintiff has established a substantial likelihood of proving that the decision to issue the permit was motivated by purposeful discrimination—it could only deny the injunction.

R.I.S.E., Inc. v. Robert A. Kay, Jr.

R.I.S.E., Inc. v. Robert A. Kay, Jr., 768 F. Supp. 1141 (E.D. VA, 1991), is yet another case that involves the site location of a regional landfill. R.I.S.E. (Residents Involved in Saving the Environment), a biracial community organization, was formed to stop the development of a regional landfill in King and Queen County, Virginia. R.I.S.E. challenged the County Board of Supervisors on the following counts: equal protection

violation, conspiracy to deny equal protection, due process violation, and violation of the Virginia Procurement Act. In this case, the court again looked at the six factors (presented earlier) that the U.S. Supreme Court identified in the *Village of Arlington Heights v. Metropolitan Housing Development Corporation*.

The court did not argue that the placement of landfills in King and Queen County from 1969 to the present had a disproportionate impact on black residents (8). After reviewing the facts, the court concluded:

The population of King and Queen County is approximately 50 percent black and 50 percent white. Sixty-four percent blacks and thirty-six percent whites live within a half-mile radius of the proposed regional landfill site. A 100 percent black population lived within a one mile radius of the Mascot landfill when it was sited in 1969. An estimated 95 percent black population lived in the immediate area of the Dahlgren landfill when it was sited in 1971. And, an estimated 100 percent black population lived within a half-mile radius of the Owenton landfill when it was sited in 1977 (8).

However, the court stated that official action is not unconstitutional solely because it results in a racially disproportional impact and that such action only violates the Fourteenth Amendment's Equal Protection Clause if it is *intentionally discriminatory* and cited *Washington v. Davis*, 96 SCT 2040 (1976) (8).

The court specifically stated that the impact of an official action—in this case, the historical placement of landfills in predominantly black communities—provides "an important starting point" for the determination of whether official action was motivated by discriminatory intent [*Arlington Heights*, 97 SCt 555 (1977)]; however, the plaintiff did not provide any evidence that satisfied the remainder of the discriminatory purpose equation as set forth in *Arlington Heights* (8). In this case, the judgment was again entered for the defendants.

Statistical evidence and data certainly play an important role in proving discrimination in environmental justice cases. However, statistics alone that show a disproportionate or discriminatory impact are not enough, as illustrated in this case history involving land use. Plaintiffs must show that the defendants intentionally discriminated; the court cited *Washington v. Davis* in all three cases. Yet, it is important to remember that "statistical proof can rise to the level that it, alone, proves intentional discrimination, *Yick Wo v. Hopkins*, 118 U.S. 356 (1886)." (7) These three cited cases were unable to do this with the factual statistics presented.

Transportation: Case Histories

Transportation cases involving environmental justice have also addressed the issues of disparate effect and impact. However, they have done so under Title VIII of the Civil Rights Act of 1968 (Fair Housing Act), Title VI of the Civil Rights Act of 1964, and the Federal-Aid Highway Act.

Ralph W. Keith v. Volpe

Ralph W. Keith v. Volpe, 858 F2d 467 (9th Cir., 1988), is a case that concerns the displacement of minority and low-income residents because of freeway construction. In 1972, individuals and organizations that were concerned about people being displaced by the proposed I-105, "Century Freeway," construction, brought action against state and federal government officials. The plaintiffs sought injunctive relief.

In 1982, a final consent that permitted further work on the freeway subject to the decree's provisions was approved by the district court. Specifically, the decree required that the state and federal defendants provide freeway displacees with 3,700 units of decent, safe, and sanitary replenishment housing, either by rehabilitating existing structures or constructing new units. The decree referenced a "housing plan" to be coordinated and implemented by the California Department of Housing and Community Development. It also established a housing advisory committee comprised of representatives from each city that was affected by the freeway. Under the plan, 55 percent of all replenishment units must be affordable to low-income households, and 25 percent must be affordable to moderate-income households. Finally, the plan required that as many of the units as possible must be placed in the "primary zone," located within 6 miles of each side of the proposed freeway.

The proposed freeway ran through the northern edge of the city of Hawthorne, thus reducing their housing supply by about 1,104 units. Although the decree's housing plan required 275 units to be built in Hawthorne, there were only 128 units, including the development outside of Hawthorne's city limits, pending development.

In response to the decree, two Century Freeway apartment developments were proposed for construction in Hawthorne—Cerise Development and Kornblum Development. The Century Freeway housing program approved both development projects, and the state agreed to fund them in accordance with the decree.

The Cerise Development consisted of 32 apartment units. The Planning Department of Hawthorne recom-

mended approval of the developer's application for a change of zone from limited industrial to high-density residential and for a site-development permit with a disclaimer that only 35 percent of the units be rented to low-income households. The Hawthorne Planning Commission approved the zoning change and the 35 percent disclaimer. The developer appealed to the Hawthorne City Council. The City Council affirmed the Planning Commission's decision even though the 35 percent disclaimer conflicted with the terms of the consent decree.

The Kornblum Development consisted of 96 apartment units. The Planning Department of Hawthorne recommended approval of the developer's application for a lot split, a zoning change from horticultural to residential, and site development. The planning commission denied the applications for lot split, zone change, and site development. The developer appealed to the Hawthorne City Council. The council held two public hearings at which local residents expressed position-raising concerns about tax loss to the city, traffic increases, school crowding, maintenance of the development, and low-income tenants. The developer addressed each of the legitimate concerns that were raised (9). The city council affirmed the planning commission's decision.

As a result of the city council's actions against the development for the low-income housing, the plaintiffs filed a supplemental complaint to add allegations that the city of Hawthorne had illegally refused to permit the construction of two replenishment rental developments, violating the Fair Housing Act, Title VIII of the Civil Rights Act of 1968, and the Fourteenth Amendment of the U.S. Constitution. In response, the city of Hawthorne submitted to the developers a compilation of 52 alternate parcels of property where the housing for the Century Freeway could be developed. The court concluded that a prima facie case of race discrimination was established and awarded the plaintiffs costs and attorney's fees.

Under Title VIII of the Civil Rights Act of 1968 (Fair Housing Act), the district court reemphasized that it is unlawful to "make unavailable...a dwelling to any person because of race, color, religion, sex, or national origin." (9). Unlike the land use cases cited earlier, in this case the district court stated that under the Fair Housing Act, the circuits that have addressed the issue have agreed that the phrase "because of race" does not require proof of discriminatory intent; rather proof of discriminatory effect may be sufficient to demonstrate a violation of Title VIII [*Metropolitan Housing Development Corporation v. Village of Arlington Heights*, 558 F2d 1283 (1977)] (9).

Once the plaintiff has established a prima facie case by demonstrating racially discriminatory effect, the

burden shifts to the defendant to demonstrate that non-discriminatory reasons justify its conduct. If the defendant offers no valid non-discriminatory reason for its [his or her] actions, then the plaintiff has succeeded in proving a Title VIII violation. If the defendant does offer valid non-discriminatory reasons, the court must determine whether they are substantial enough to justify the racially discriminatory effect, *Arlington Heights*, 558 F2d 1283 (1977) (9).

The district court in this case also pointed out that the circuit courts have applied different standards in proving a prima facie case that involves discriminatory effect. Under Title VIII, the third and eighth circuits have held that proof of discriminatory effect alone is always sufficient to establish a prima facie case. Yet, the seventh circuit has held that proof of discriminatory effect without discriminatory intent, only under certain circumstances, violates Title VIII [*Arlington Heights*, 558 F2d 1283 (1977)]. *Arlington Heights*, 558 F2d 1283, listed the following critical factors for determining whether discriminatory effect establishes a prima facie case:

1. Effect—How strong is the plaintiff's showing of discriminatory effect?
2. Intent—Is there some evidence of discriminatory intent, though not enough to satisfy the constitutional standard of *Washington v. Davis*, 96 SCt 2040?
3. Justifications—What is the defendant's interest in taking the action complained of?
4. Prohibitory remedy—Does the plaintiff seek to compel the defendant to affirmatively provide housing for members of minority groups or to merely restrain the defendant from interfering with individual property owners who wish to provide such housing (9)?

The fourth circuit has used the same four-factor analysis (*Smith*, 682 F2d 1065).

In light of other circuit rulings, the district court in this case believed that the city of Hawthorne would be liable under any of the standards that the other circuits have applied. Specifically, the court believed that, aside from the discriminatory effect, two of the other three factors under *Arlington Heights*, 558 F2d 1283 (1977), have been shown to establish a prima facie case:

- (1) Effect—The evidence clearly demonstrates that Hawthorne's actions in imposing the 35 percent limitation on the Cerise Development, knowing it would prevent funding of the project, and in denying the applications for zone change, lot split, and site development on the Kornblum Development, had a racially discriminatory effect.

The District Court also pointed out that under *Arlington Heights*, 558 F2d 1283 (1977), the seventh

circuit identified two kinds of racially discriminatory effect a facially neutral decision about housing can produce:

- (a) when the decision has a greater adverse impact on one racial group than on another, and
 - (b) the effect which the decision has on the community involved; if it perpetuates segregation and thereby prevents interracial association it will be considered invidious under Title VIII independently of the extent to which it produces a disparate effect.
- (2) Intent—The court found that the plaintiffs failed to show that the City Council acted with discriminatory intent. But, reaffirmed *Arlington Heights*, 558 F2d 1283, "this is the least important of the four factors" and "should be partially discounted."
- (3) Justifications—The court found the city of Hawthorne's justifications for imposing the 35 percent limitation on the number of units in the Cerise Development that may be rented to low-income tenants and [for] denying the zone change, lot split, and site development applications for the Kornblum Development pretextual.
- (4) Prohibitory remedy—The court found that the plaintiffs do not seek to compel Hawthorne affirmatively to provide housing for members of minority groups, but merely to enjoin Hawthorne from interfering with private property developers who wish to provide such housing (9).

The district court in this case also pointed out that once a plaintiff has established a prima facie case of discriminatory effect, the circuits apply different tests or standards for the defendants rebutting the established discriminatory effect. The eighth circuit court has used the "compelling interest" test in *Black Jack*, 508 F2d 1185. Under this test, the defendant must demonstrate that his or her conduct was necessary to promote a compelling government interest. Although the eighth circuit court has ruled the same as the third circuit in proving a prima facie case, the courts differ in the rebuttal of a prima facie case. The third circuit rejected the "compelling interest" test of the eighth circuit and held that the defendant need only prove a compelling government interest when the plaintiff has made a showing of purposeful discrimination sufficient to establish a constitutional violation (*Rizzo*, 564 F2d 148). For the third circuit court, the analogy is the "business necessity" test that is applied in Title VII employment discrimination cases. The *Rizzo* case formulated the following test: "a justification must serve, in theory and practice, a legitimate, bona fide interest of the Title VIII defendant, and the defendant must show that no alternative course of action could be adopted that would enable that interest to be served with less discriminatory impact" (9).

Under Title VII of the Civil Rights Act of 1991, unlawful disparate impact exists when (a) a plaintiff demonstrates that an employment practice results in a disparate impact of a protected group, and (b) the defendant is unable to demonstrate that the employment practice is required by "business necessity." Under Title VII, unlike Title VI, the burden of proof is put on the defendant. Therefore, under the *Rizzo* case, one focuses on the "consequences" of the embodied government's decision instead of the "motivation" of that decision, as observed in the land use cases discussed earlier.

Coalition of Concerned Citizens Against I-670 v. Damian

In October 1984, the Coalition of Concerned Citizens Against I-670 brought action against city, state, and federal officials claiming that (a) defendants failed to involve the public in the decision process that concerned the need of the freeway, thereby violating federal requirements under the Federal-Aid Highway Act; and (b) defendants failed to account for the disproportionate impact of I-670 on minority citizens of Columbus, Ohio, thus violating Title VI of the Civil Rights Act of 1964. The plaintiff sought an injunction to stop the construction of I-670 until further public hearings were held. The district court held that although the plaintiff made a prima facie case of the proposed freeway's disparate effect on racial minorities, the officials met their burden of justifying the location of the proposed freeway.

The proposed project involved the extension of I-670 (about 5.7 miles) that would connect the Columbus, Ohio, Innerbelt and I-71, a north-to-south route that runs through Columbus, with I-270, the Columbus Outerbelt. The origination of the proposed I-670 extension was located in the northeast quadrant of Columbus, near the existing Fort Hayes Interchange. From this interchange, I-670 was proposed to run east following Penn Central Railroad, an abandoned railroad line, and also to run in an area that was more than 90 percent black. However, there was minimal displacement of the residents in this area because of the available right-of-way from the abandoned railroad line. I-670 was then proposed to run north to follow Alum Creek and to turn northeast to follow US-62. About 85 percent of the displacees in these areas were members of racial minorities. The proposed I-670 was then to join I-270, the Columbus Outerbelt. Also a major interchange was being proposed in this area to provide access to Port Columbus Airport. About 20 percent of the residents that would be displaced in this area were minorities.

To comply with the regulations that address economic, social, and environmental impacts, the Ohio

Department of Transportation (ODOT) published an "action plan" that was approved by FHWA on February 19, 1974, along with procedures for the plan that were also approved on July 29, 1977. The ODOT development projects were divided into the following phases:

- Phase I—systems planning phase,
- Phase II—location phase,
- Phase III—design phase, and
- Phase IV—construction phase.

The Mid-Ohio Regional Planning Commission (MORPC) is the federally designated metropolitan planning organization (MPO) for the central Ohio area and has held this role since the conception of I-670. MORPC includes an executive committee that consists of 10 members (51 percent of the membership are elected officials, one member is appointed to represent minority, disadvantaged, and low-income groups) who ultimately hold authority within MORPC. The policy committee, an expansion of the executive committee, also includes representatives from the Transit Authority and from state and federal highway departments.

Two additional committees, the Transportation Advisory Committee and the Citizens' Advisory Committee (CAC), periodically review staff proposals and reports before they are referred to the policy and executive committees. CAC includes individuals from government, neighborhood organizations, civil groups, organized professional interest groups, and low-income and minority groups. Membership in CAC is open to all interested parties. However, there is no formal process by which applicants are solicited. To become a member, an individual or an organization must hear of the existence of CAC and its activities through the media and take the initiative to join.

During the planning process, the need for transportation improvements in the northeast quadrant of Columbus was never disputed. The planning process for the area is outlined in Table 1.

As was similar in earlier cases, the burden of proof in this case was on the plaintiff to show that the federally aided administrative action had a disproportionate effect on racial minorities. The plaintiff here was able to show a disproportionate impact—the extension of I-670 would extend through neighborhoods that were 50 to 90 percent minorities. However, the defendants were able to show that their actions in determining the location of the proposed project were based on nondiscriminatory reasons, specifically, the fact that the proposed project had less impact on minorities than the construction of an alternative location.

Upon examining this case, the court raised several interesting observations. In the June 1974 systems analysis study that compared I-670 with the 17th

TABLE 1 Planning Process for the Proposed Freeway Project

1957	Columbus City Planning Commission proposed in its annual report a freeway connecting Fort Hayes Interchange to the Port Columbus Airport. Also proposed an expressway connection between I-71 and airport along 17th Avenue (17th Avenue Freeway).
1961	Franklin County Commissioners authorized engineering study of feasibility of 17th Avenue Freeway.
1967	Portion of 17th Avenue Freeway ready for construction.
1972	MORPC completed the Franklin County Regional Transportation Plan that included the 17th Avenue Freeway and Leonard, Maryland, and Sunbury Avenues as an artery to northeast corridor, meeting transportation needs up to 1990.
1973	FHWA, ODOT, City of Columbus, and MORPC met and discussed how "action plan" requirements will affect 17th Avenue Freeway. Concluded that a corridor location alternative report should be prepared.
3/1974	An extension of I-670 as an alternative to 17th Avenue Freeway proposed publicly by City of Columbus due to growing concern by government entities and local organizations of the impacts from 17th Avenue Freeway on other local streets and environmental concerns, as well as the availability of right-of-way from abandoned railways.
6/1974	City, MORPC, ODOT, and FHWA met to determine methodologies for a systems analysis to compare I-670 and 17th Avenue Freeway as solution to northeast corridor. Study looked at five alternatives, including a no-build alternative. Conclusion of study—build I-670.
6/1976	I-670 project entered Phase II-Location phase. I-670 coordinating committee, consisting of FHWA, ODOT, City of Columbus, and project consultants, had primary responsibility for this phase. During this phase, location of I-670 was selected according to social, economic, and environmental impacts of various alternatives, using the no-build alternative as the point of comparison for defining beneficial and adverse impacts.
1977	Due to significant public opposition, Columbus City Council authorized funds for the restudy of mass transit alternatives to the construction of I-670, "Northeast Corridor Transit Alternative Study to I-670." Study concluded that the light rail alternative to the freeway would not provide sufficient ridership.
10/1980	Final environmental impact statement completed after public hearing and solicitation of comments. Sixteen different "reasonable alternatives" were considered.

Avenue Freeway, the court noted that, with the exception of the number of businesses and residences displaced, there was minimal discussion of the social impacts of the alternatives that were studied, and there was specifically no discussion of the impact on racial groups and on other minority groups of the various alternatives (10). The MORPC report noted several primary reasons for the selection of I-670 as an alternative to the 17th Avenue Freeway: (a) I-670 would minimize the taking of homes as compared with the 17th Avenue Freeway; (b) I-670 would allow use of an abandoned railroad track, minimizing acquisition of right-of-way; and (c) I-670 would create opportunities for industrial and commercial development in the area.

The final environmental impact statement noted that reasonable alternatives were evaluated according to four categories of impacts: socioeconomic and land use, environmental, transportation, and cost. Within each category, several variables were assessed, with a total of 37 being considered. Specifically, under the first category, the effect of different freeway locations on community cohesion, accessibility, and availability of

services and their impact on disadvantaged groups were considered. The court noted that it was clear during this stage that public involvement was substantial (10). Efforts that involved the public include the following:

- A citizens advisory committee was established to receive public comments and to provide information to the public; met at least 16 times to discuss the project.
- A number of public information meetings were held.
- The I-670 newsletter was published with a mailing list of 2,000 people.
- Radio talk show participation by public officials was developed.

Finally, the court concluded from the record that the restudy performed in 1977 showed that the coalition's alternative solution to the acknowledged transportation problem in the northeast quadrant of the city was considered in good faith and was rejected as inadequate (10). The court also noted that the restudy was unique and was not directly comparable to the results of the other I-670 studies (10).

Despite the observations that were raised by the court, the merits of the case were judged on the following two claims: (a) violation of regulations under the Federal-Aid Highway Act, and (b) violation of Title VI of the Civil Rights Act.

Before the court judged the merits of the case, the limits of their review, as observed by the court, were outlined. Specifically, the court stated that unless it could conclude from the whole record of this case that the defendants acted arbitrarily, capriciously, or otherwise not in accordance with the law, or that the defendant's actions failed to meet statutory, procedural, or constitutional requirements, the agency's actions must be upheld (10). The court was not to conduct a *de novo* review or to substitute that the defendants had taken a "hard look" at the impacts that the law mandates to be considered; therefore, its inquiry was over (10). With this scope of review in mind, the court judged the merits of the two claims.

Under the Federal-Aid Highway Act, the plaintiffs challenged compliance with regulations promulgated under Sections 128 and 129. Under Section 109(h), Congress directed the secretary of transportation to promulgate regulations "designed to assure that possible adverse economic, social, and environmental effects relating to any proposed project...have been fully considered in developing such project." (10) Specifically, the plaintiffs argued that the requirements of public involvement in the planning and development process within these regulations were violated under 23 CFR 795. The court concluded that CAC was not sufficient in complying with the public involvement requirements of Part 795, citing the following observations: (a) no attempt was made to solicit involvement in CAC of persons representing neighborhood groups in the affected area; (b) the membership of CAC was heavily weighted in favor of business and governmental groups; and (c) the proposed analysis of the I-670 and 17th Avenue Freeway systems focused very little on social impacts and impacts on racial minorities (10).

The court therefore concluded that the plaintiff had carried the burden with respect to its claim that the defendants' provision for public input during the systems planning phase of the I-670 project was inadequate to meet the regulations under Section 109(h). Under Section 128 every state highway department is to offer certification to the secretary of transportation that it has held public hearings, or has afforded the opportunity for such hearings. State highway departments must also consider the economic and social effects of each proposed project's location, its impact on the environment, and its consistency with the goals and objectives of such urban planning as has been promulgated by the community when plans are submitted for a Federal-Aid Highway Project that involves the bypassing of or going through any city, town, or village (10).

In this case, the plaintiff did not carry its burden with respect to Section 128. The court pointed out that the proper issue is whether public hearings are conducted "to assure consideration of (social, economic and environmental impacts) at a point that is meaningful. That is, the planners are permitted to have a specific proposal and even to be promoting it. Unless there is a specific proposal to be discussed, it is difficult to see how meaningful public meetings could be held, for there would be no focus. However, planners are not permitted to have closed their minds to the social, economic and environmental impacts of their proposal. The law requires good faith objectivity, not subjective impartiality. The purpose of public hearings is to bring the planners face-to-face with public reaction to their proposals and projects." (10)

In the second claim raised by the plaintiff, violation of Title VI of the Civil Rights Act, the court concluded that the defendants had met their burden of justifying the location of I-670 with legitimate nondiscriminatory reasons for the location. The defendants specifically stated that the construction of I-670 would have substantially less impact on racial minorities than would the construction of a freeway along the 17th Avenue Freeway (10). The court also recognized that the preferred alternative was selected to minimize impacts on minority neighborhoods. The alternative was aligned along Alum Creek and the existing railroad right-of-way to avoid dividing neighborhoods and to minimize displacements of persons and businesses (10).

As shown in the previous Title VI cases, plaintiffs have the initial burden of proof of showing disparate impact. Once the plaintiffs demonstrate a *prima facie* case, the defendants have the burden of justifying their actions. Unlike the previous cases, the court in this case noted that FHWA regulations, 23 CFR 710.405, provide that discriminatory effect can be a violation, even in cases in which there is no discriminatory purpose. Although the plaintiff in this case showed discriminatory effect because the location of the proposed I-670 would have had a disparate impact on minorities, the court was quick to point out that the defendants are not prohibited from locating a highway to an area where disparate impacts on minorities will occur; Title VI only prohibits officials from taking actions with disparate impacts without adequate justification. The court in this case believed that the defendant had adequate justification.

From these conclusions, the court determined that, although the defendants did violate Section 109(h) of the Federal-Aid Highway Act, the defendants did not violate the law in all other respects. Therefore, violation of Section 109(h) alone does not justify injunctive relief for the plaintiff; instead the court must balance the equities of the parties and the interest of the public (10).

SUMMARY OF CASES

What can be learned from these cases? Table 2 summarizes the issues and the concluding points of each case. The following information constitutes important facts and points to remember in distinguishing the cases from each other.

Yick Wo v. Hopkins

- First discrimination case in the United States in which the defendant was found to be in violation of the Equal Protection Clause under the Fourteenth Amendment of the U.S. Constitution.

- The totality of the facts will determine whether the disparate impact rises to the level of discriminatory intent.

Washington v. Davis

- Disproportionate impact was shown by the plaintiffs.
- Under the Equal Protection Clause of the Fourteenth Amendment of the U.S. Constitution, the burden of proof is on the plaintiff to show discriminatory intent.

- A purpose to discriminate (intentional discrimination) must be present to show a violation of the Equal Protection Clause under the Fourteenth Amendment of the U.S. Constitution.

- Disproportionate impact is not irrelevant in cases that involve Constitution-based claims; however, the disproportionate impact must be shown to have been applied so invidiously so as to discriminate on the basis of race that it rises to the level shown in *Yick Wo v. Hopkins*.

- The totality of the facts will determine whether the disparate impact rises to the level of discriminatory intent.

Village of Arlington Heights v. Metropolitan Housing Development Corporation, 97 SCt 555 (1977)

- Disproportionate impact was shown by the plaintiffs.
- Under the Equal Protection Clause of the Fourteenth Amendment of the U.S. Constitution, burden of proof is on the plaintiff to show discriminatory intent.

- A purpose to discriminate (intentional discrimination) must be present to show a violation of the Equal Protection Clause under the Fourteenth Amendment of the U.S. Constitution.

- Disparate impact alone is not the determining factor for showing intentional discrimination or purpose.

- Six factors must be evaluated to show discriminatory intent was a motivating factor:

- Impact of official action,
- Historical background of the decision,
- Events leading up to the challenged decision,
- Departures from the normal procedural sequence,
- Substantive departures, and
- Legislative or administrative history.

Village of Arlington Heights v. Metropolitan Housing Development Corporation, 558 F2d 1283 (1977)

- Discriminatory effect was shown by the plaintiff.
- Violation of Title VIII of the Civil Rights Act of 1968 (Fair Housing Act) can be established by showing discriminatory effect without showing discriminatory intent.

- Burden of proof shifts to defendant to demonstrate that nondiscriminatory reasons justify action.

- Four factors must be evaluated to show discriminatory intent was a motivating factor:

- Strength of plaintiff's showing discriminatory effect.
- Some evidence of discriminatory intent, though not enough to satisfy the constitutional standard of Washington.
- Defendant's interest in taking the action complained of.
- Does the plaintiff seek to compel the defendant to affirmatively provide housing for members of minority groups or merely to restrain the defendant from interfering with individual property owners who wish to provide such housing?

East Bibb Twiggs Neighborhood Association v. Macon-Bibb County Planning & Zoning Commission; Margaret Bean v. Southwestern Waste Management Corporation; and R.I.S.E., Inc. v. Robert A. Kay, Jr.

- Discriminatory impact was shown by the plaintiff.
- Under the Equal Protection Clause of the Fourteenth Amendment of the U.S. Constitution, burden of proof is on the plaintiff to show discriminatory intent.

- A purpose to discriminate (intentional discrimination) must be present to show a violation of the Equal Protection Clause under the Fourteenth Amendment of the U.S. Constitution.

- Disparate impact alone is not the determining factor for showing intentional discrimination or purpose.

TABLE 2 Case Summary

<i>Case</i>	<i>For</i>	<i>Issues</i>	<i>Prima Facie Case</i>	<i>Burden of Proof</i>
Supreme Court Cases				
<i>Washington v. Davis</i> (1976)	Defendant	Police officer recruiting practices discriminatory under the Equal Protection Clause of the 14th Amendment	Discriminatory intent from totality of relevant facts	Plaintiff (discriminatory intent)
<i>Arlington Heights</i> (1977)	Defendant	Rezoning denial of tract of land to build racially integrated low & moderate housing racially discriminatory under the Equal Protection Clause of the 14th Amendment	Discriminatory intent from totality of six established factors	Plaintiff (discriminatory intent)
Court of Appeals Case				
<i>Arlington Heights Remanded</i> (1977)	Plaintiff	Supreme Court case remanded to determine if rezoning denial of tract of land to build racially integrated low and moderate housing racially discriminatory under Title VIII of the Civil Rights Act of 1968 (Fair Housing Act)	Discriminatory effect from four critical factors	Plaintiff (discriminatory effect)
Land Use Cases				
<i>East Bibb Twiggs</i> (1989)	Defendant	Development of private landfill in mostly black census tract racially motivated	Six factors of Arlington Heights (Supreme Court)	Plaintiff (discriminatory intent)
<i>Bean</i> (1979)	Defendant	Development of a solid waste facility racially motivated	Six factors of Arlington Heights (Supreme Court)	Plaintiff (discriminatory intent)
<i>R.I.S.E.</i> (1991)	Defendant	Development of a regional landfill created a racially disparate impact	Six factors of Arlington Heights (Supreme Court)	Plaintiff (discriminatory intent)
Transportation Cases				
<i>Keith</i> (1988)	Plaintiff	Displacement of minority and low-income residents by freeway construction resulted in racial discrimination under Title VIII of the Civil Rights Acts of 1968 (Fair Housing Act)	Four factors of Arlington Heights (Court of Appeals)	Defendant, once prima facie case shown
<i>Coalition of Concerned Citizens</i> (1984)	Defendant	Extension of I-670 had disproportionate impact on minority citizens. Systems planning phase of project violated public involvement requirements under Federal-Aid Highway Act & Title VII of the Civil Rights Act	Disparate impact shown through statistics	Defendant, once prima facie case shown

- Six factors in *Arlington* were used to show that the Equal Protection Clause of the Fourteenth Amendment of the U.S. Constitution was not violated.

- Similar factors (2) that were used in *Arlington* were also used to show that the Equal Protection Clause of the Fourteenth Amendment of the U.S. Constitution was not violated in *Bean*. These factors are pattern or practice and historical placement.

Ralph W. Keith v. Volpe

- Discriminatory effect was shown by the plaintiff.
- Violation of Title VIII of the Civil Rights Act of 1968 (Fair Housing Act) can be established by showing discriminatory effect without showing discriminatory intent.

- Burden of proof shifts to defendant to demonstrate nondiscriminatory reasons justify action.

- Under the Fair Housing Act, circuit courts that have addressed this issue all agree that the phrase "because of race" does not require proof of discriminatory intent; discriminatory effect is sufficient to show violation.

- Different standard used by the circuit courts in proving prima facie case that involves discriminatory effect. In the third and eighth circuits, under Title VIII, proof of discriminatory effect alone is sufficient to establish a prima facie case. Seventh and fourth circuits use a four-factor analysis, as observed in *Arlington*, to establish a prima facie case.

- Different standards were also used by the circuit courts for defendants to rebut prima facie cases. The eighth circuit uses a "compelling interest" test in which defendants must show that conduct was necessary to promote a compelling government interest. The third circuit uses a "business necessity" test in which defendants must show that

- Justification served a legitimate bona fide interest, and
- No alternative course of action could be adopted that would enable that interest to be served with less discriminatory impact.

Coalition of Concerned Citizens Against I-670 v. Damian

- Plaintiffs made a prima facie case of disparate effect under Title VI of the Civil Rights Act.

- Defendants met their burden of justifying their action under Title VI of the Civil Rights Act. Defendants showed that their actions were based on nondiscriminatory reasons.

- There was substantial involvement with the public (i.e., a citizen advisory committee, several public infor-

mation meetings, a newsletter, and radio talk show participation.

- Court noted that FHWA regulations (23 CFR 710.405) provide that discriminatory effect can be a violation even in cases in which there is no discriminatory purpose (intent). Defendants are not prohibited from locating highways where disparate impact exists; however, adequate justification must be shown under Title VI.

- Although the defendants did violate the Federal-Aid Highway Act, they did not violate the law in all other respects. Violation of the Federal-Aid Highway Act alone does not justify injunctive relief for plaintiffs; the court must balance equities.

All these cases that were analyzed showed a prima facie case of disparate impact by the plaintiffs. The land use cases looked to the Supreme Court cases of *Washington* and *Arlington* and required the plaintiffs to provide a showing of discriminatory intent or purpose by the defendant. However, the two transportation cases paralleled the Title VII of the Civil Rights Act of 1964 cases in that, once a prima facie case is established, defendants are required to justify their actions that led to the disparate impact.

PLANNING FOR THE FUTURE

NEPA

Does the fact that NEPA provides very limited case law on environmental justice mean that we should not take a hard look at environmental justice during this stage? Regardless of whether a minority or low-income population is within the study project area that is involved, environmental justice and discrimination claims have the potential to surface when any type of social impact, community impact, or relocation impact is inevitable. This is evident in the cases that have been reviewed here. Perhaps NEPA will not be the vehicle to be used to enjoin the officials whose actions have resulted in a disparate impact, but the Civil Rights Act and the Fair Housing Act will be used.

It is clear that the term "environment" mentioned in NEPA, CEQ, and other executive orders does include both the human environment and the natural environment. Transportation professionals have an obligation to balance these impacts from both environments and to ensure that once a disparate impact exists, it is without discriminatory intent.

Also defined in NEPA are secondary and cumulative impacts. Secondary impacts are caused by an action and occur later in time or are farther removed in distance but are still reasonably foreseeable (11).

Examples of secondary impacts from transportation-related projects include land use changes, water quality, floodplains, population changes, community impacts, and economic impacts. Cumulative impacts result from the incremental consequences of an action when added to other past and reasonably foreseeable future actions (12). These impacts are less defined than secondary impacts; however, examples often overlap secondary impact examples.

NEPA requires transportation professionals to examine "direct effects" as well as "indeterminate effects" that are sometimes not easily recognizable (i.e., cumulative and secondary impacts). Just as environmental justice has been a term with which we have struggled, cumulative and secondary impacts are also terms with which transportation professionals have grappled when evaluating NEPA documents. We do not lack in the development of techniques for measuring and analyzing direct impacts. But techniques for measuring the indirect impacts, such as cumulative and secondary impacts and discriminatory impacts (i.e., environmental justice), are lacking.

Ralph W. Keith v. Volpe, 858 F2d 467 (1988), showed that it was the "consequences" of the government's decision instead of the "motivation." Therefore, the ramifications of disparate impacts as cumulative or secondary impacts, although difficult to evaluate, must be determined beyond their immediate effects on the existing environment. Several factors to consider when evaluating disparate impacts as possible secondary or cumulative impacts are as follows:

- Use an interdisciplinary approach (social, economic, and environmental effects);
- Look at the impacts as a cause and effect relationship;
- Look at the impacts from a functional relationship to the larger system; and
- Evaluate secondary and cumulative impacts as early as possible in the planning stage, thereby allowing more information to be accessible to those who evaluate and analyze the impacts at the project level.

Planning

The following seven broad areas should be considered in the planning process under the Transportation Equity Act for the 21st Century (TEA-21):

1. Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency;
2. Increase the safety and security of the transportation system for motorized and nonmotorized users;
3. Increase the accessibility and mobility options that are available to people and for freight;

4. Protect and enhance the environment, promote energy conservation, and improve quality of life;

5. Enhance the integration and the connectivity of the transportation system, across and between modes, for people and freight;

6. Promote efficient system management and operation; and

7. Emphasize the preservation of the existing transportation system.

Can environmental justice concerns be incorporated into these seven planning factors? Yes, environmental justice issues can and should be incorporated into these seven planning factors under TEA-21. Governmental agencies and organizations that are involved in decision making that has any effect on society and communities should use existing information and data and new information and data to the extent possible so as to evaluate the effects their short-term and long-term plans have on society and communities. Techniques to consider when incorporating disparate impact analysis into short- and long-term planning processes should include the following:

- Involve the public extensively through public meetings, workshops, newsletters, questionnaires, surveys, personal contact, radio talk shows, to name a few;
- Conduct meetings in locations that are accessible to the minority and low-income communities;
- Use a multilingual professional in nonspeaking communities;
- Document your findings;
- Keep a historic record of your findings;
- Use a variety of sources to gather your data (public involvement, MPOs, DOTs, local agencies or organizations, labor departments or other state agencies, libraries, local historical societies, census bureau statistics and publications, tax records, real estate surveys, to name of few); and
- Consider the development of a clearinghouse at the regional, statewide, or tristate level.

One of the more difficult aspects during the planning process may be the encouragement of community participation when dealing with environmental justice. The demographics and the population characteristics are a good starting point. The economic and social history of the community, as well as the physical attributes, is also important. Once these characteristics are determined, factors such as who to involve in the community and where to meet in the community become clearer.

If environmental justice has already been raised as a concern at a project level or a planning level, address the concerns immediately. This may require additional

public involvement. Document the historical findings of all public and community meetings. Documentation was shown to be an important tool in *Coalition of Concerned Citizens Against I-670 v. Damian*, 608 F. Supp. 110 (S.D. Ohio, 1984).

Gaps

Although *Washington* and *Arlington* showed disparate impact but could not show that governmental actions rose to the level of discriminatory intent, as in *Yick Wo v. Hopkins*, 6 SCt 1064 (1886), what level of action will it take to prove discriminatory intent? Certainly the "totality" of the facts will be important to keep in mind and will include, at a minimum, public involvement, impact of the action(s), historical background information, sequence of events, departures from normal procedures, substantive departures, legislative or administrative history, and so on. This and other information are the same information transportation professionals should be guided by in their planning phases (short term and long term) and at the project-specific level. Is this an area of the law in which a gap exists? Perhaps we won't have more definitive definitions and answers without more case law from which to draw.

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CONFERENCE I RESOURCE PAPER

Access to Jobs: Intersection of Transportation, Social, and Economic Development Policies Challenge for Transportation Planning in the 21st Century

Shirley Loveless, *Transportation Planning Consultant*

You had better have a car. In our society to be without a personal automobile is to be without basic services, without entertainment, without employment, and without a prayer.

—Scott Bogren (1)

The passage of the national welfare reform legislation—the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (PRWORA)—focused attention on a long-standing problem: the impaired access to jobs for low-income, inner-city, and rural residents. The time limits on welfare receipt and the work requirements for all nonexempt recipients during the transition period, which are central to this legislation, have created an urgent need to find connections for this population to jobs. They cannot wait for economic revitalization programs to create jobs where they live nor can they relocate to housing that is nearer to the existing job markets in the foreseeable future. They need access to jobs now.

STATUS OF JOB ACCESS FOR LOW-INCOME POPULATIONS

Background

Transportation is a major barrier for many low-income workers during initiation of the job-search process. A Detroit study found that “those [unemployed workers] with cars searched for work over a wider area and range of neighborhoods, and this increased breadth was reflected in the number, type, and character of job opportunities discovered.” (2, p. 24) But significant numbers of low-income individuals do not have access to

cars and are transit dependent. (See Tables 1 and 2 for low-income household vehicle availability by household type and geographic area type.)

In the larger cities, where most of the welfare and other low-income households live, transit service usually exists, but connections from the inner cities to the suburbs, where demand for low-skill, entry-level workers is strongest, are problematic. If transit runs to a desired destination, it may not operate at the needed times, and service intervals may be extremely long. The transportation situation is even worse for rural low-income workers without cars. The Commuter Transportation Association of America estimates that nearly 40 percent of all rural counties have virtually no public transportation (1). The 1995 Nationwide Personal Transportation Survey (NPTS) paints a grimmer picture: it finds that only 14.3 percent of all rural areas have any bus service available at all (3, p. 28).

Solutions to the mobility problems of low-income individuals and improved access to jobs are critically important measures to the individual, to businesses, and to the national economy. Lengthy and convoluted commutes limit an individual’s opportunities spatially. Long commuting times have heavy opportunity costs. The reduced time available for interaction with family and community may carry a heavy price tag for society. Labor force access and mobility are key to business operations. Suboptimal labor mobility and access have clearly adverse effects on regional and national economic development.

TABLE 1 Vehicle Availability of Low-Income Households (5)

<i>Household Categories</i>	<i>Total HHs</i>	<i>Low Inc.</i>	<i>Non-Low</i>	<i>Low-Inc. Single Parent</i>
Avg. Household Size	2.58	2.73	2.57	3.28
Avg. Number of Vehicles	1.78	1.16	1.89	0.72
Avg. Vehicle Age (Yrs.)	8.3	10.9	8.1	10.8
% of Hhlds w/o Vehicles	8%	26%	4%	36%
1 Adult Hhld	0.98	0.66	1.09	0.72
2+ Adult Hhld	2.11	1.59	2.18	—

TABLE 2 Vehicles per Adult Type (3)¹

<i>Vehicles per Adult</i>	<i>Area Type</i>					<i>Total</i>
	<i>Second City²</i>	<i>Rural</i>	<i>Suburban</i>	<i>Town</i>	<i>Urban</i>	
Less than one	27.1	18.4	20.1	18.3	47.0	25.1
One vehicle	61.6	56.1	65.6	62.4	46.1	59.1
More than one	11.3	25.4	14.3	19.4	6.9	15.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

¹ Percentage of vehicular distribution by area type.

² Second city is defined as an area with a population center density <79 persons >40 persons per sq. mi. that is not a town or rural area.

Labor access and mobility problems are often cited by businesses as reasons for location and relocation decisions. Businesses that cannot move because they provide services to local markets, such as nursing homes or restaurants, may find labor unreliability such a large problem that they are forced out of business.

Mobility and Access

Mobility is a key requirement of access to jobs.¹ Limited mobility means limited access, and it serves to restrict an individual's employment and other opportunities spatially. The lesser degree of mobility of low-income households is reflected in the fact that they make 20 percent fewer trips and travel 40 percent fewer miles than nonpoor households. Mobility barriers are especially severe for the single, low-income working mother. The 1995 NPTS trip data are consistent with what common sense tells us is likely to be the case. Sixty-eight percent of all trips that are taken by a single head of a low-income household (mostly women) are for 3 mi (4.8 km) or less and only 9 percent are in the 6- to 10-mi (9.7- to 16.1-km) range (5).

A personal motor vehicle provides the ultimate mobility under most circumstances. But, for the low-income family, car ownership is a huge financial burden.² In the urban areas where many such families live,

car insurance costs alone can amount to more than \$200 a month for one car.³ Although insurance costs may be lower for the rural poor, the greater distances they often must drive to work, as well as to other destinations, raise operating costs. In addition to insurance, the older cars⁴ that are owned by most low-income households typically incur frequent and large repair and maintenance bills. However, NPTS shows that low-income individuals still make most of their trips by private vehicles,⁵ often borrowing a car from friends or relatives. Many low-income, nonwelfare families find that a household vehicle is such a necessity that they incur the burden anyway, at the expense of other things. For most welfare-recipient households, this is not an option,⁶ leaving them highly dependent on transit.

Transit agencies have been preoccupied by their own fiscal and operational concerns. The dramatic cuts over the past 2 decades in the level of federal subsidies to transit agencies have not been offset by commensurate increases in state and local government subsidies, making transit authorities extremely reluctant, if not unable, to take on additional high-loss services. In many metropolitan regions, routes and runs, even in urban areas that are more cost-effective to serve, have been cut back or dropped entirely.⁷ In efforts to improve the recovery ratios of their fare boxes, many transit agencies have raised their

fares, essentially to the point of inelastic demand. Between cuts in services and fare increases, much of the potential "choice" passenger market in the cities has been lost, and most of those who are left are the "captive" urban poor.

Political forces, driven in no small part by businesses feeling the pinch of low-wage, entry-level labor shortages, have pressed transit agencies to expand transit service in the suburbs, often at the perceived expense of urban services. However, low densities and circuitous road networks in suburban areas make traditional transit service practically impossible from a cost-efficiency standpoint, and state and local governments generally have been reluctant to commit increased funding to support the expansion of urban services.

Most transit agencies will not be able to increase service to low-density suburban areas without substantial subsidies from some source. Some businesses have entered into agreements with transit agencies and have underwritten customized transit service, but overall, there has been a perplexing failure on the part of most businesses to help support the transportation costs of their low-wage employees. Even the degree of employer participation in subsidized transit pass programs—which can be treated as tax-deductible business expenses—has been very disappointing, especially considering that virtually all suburban businesses provide free parking to employees who earn enough to own cars with which to drive to work.

Transit dependency can be an employment barrier to welfare recipients and to other low-income individuals in many ways—spatially, temporally, financially, and in inconvenience.⁸ Examples of these barriers include the following:

- Even when routes that connect inner-city neighborhoods with suburban job centers exist, they usually suffer from a "missing link"—the pedestrian portion of the trip between the transit stop and the workplace, which often is one-half mi (0.80 km) or more away and without sidewalk access. Particularly at night, this walk raises safety issues for women. It is also a serious problem in bad weather.

- Employment in jobs with changing work locations, such as construction, in-home health care, or sales, is difficult, if not impossible, if one must rely on public transportation. A growing number of entry-level work opportunities are temporary or part-time positions.⁹ Temporary agency employees must be able to go from job-to-job, often within a wide geographic area. For the transit-dependent worker, this means learning new travel routes and even new fare structures frequently. Transportation is such a problem that some temporary employment agencies will not accept a worker who does not have reliable access to a private vehicle.

- Many job openings are for night and weekend shifts, but often no transit service exists at the times

needed, effectively foreclosing them as employment possibilities.

- Reduced off-peak service poses problems for the multiple jobholder. Many low-skilled, entry-level workers discover that quality, full-time jobs are much harder to find than low-paying, part-time ones. To achieve something that approximates full-time employment, an individual may have to take more than one part-time job. This means an additional commuting trip and finding transportation to serve it, but service infrequency in off-peak periods may create insurmountable timing problems.

- The single working mother must meet child care transportation needs as well as her own commuting requirements. If she is using transit for both, this usually entails a detour from her commute to drop off or pick up children. Unless she has an unlimited ride pass, she may have to pay either additional fares or transfer costs, in addition to the time costs of the detour. If she is late in picking up her child, she faces serious child care coverage problems, not to mention overtime surcharges. The typically complex, more than one-seat ride commute results in long travel times, with high opportunity costs in lost family time.

Between transit and the privately owned vehicle, there are several means of transportation that offer varying degrees of mobility and access to jobs. Among the more common intermediate modes are shared-ride taxis, dial-a-ride services (paratransit), employer-provided vanpools and shuttle services, and employee carpools.¹⁰ With the exception of employer-operated vanpools and shuttles, there is little subsidization of these alternatives by employers. Other means of transportation that are used by low-income "reverse commuters" are "gypsy" vans and taxis. These services operate illegally but provide transportation for many.¹¹

Car-sharing is a relatively new concept in this country, although it has been in existence in Europe for decades. On the West Coast, several car-sharing organizations have recently been formed, primarily for environmental reasons. The basic operational concepts could easily be adapted to meet the mobility needs of low-income individuals without vehicles at a cost within reach for many. [More information on car-sharing and station cars, which are a variant of this concept, can be found at a number of websites (11).] This latter alternative offers increased mobility for all travel purposes because the cars would also be available for noncommuting purposes. (See Table 3 for comparison of modes.)

Equity Issues

Table 4 shows federal transportation outlays between 1980 and 1994 by mode and in constant dollars. In real

TABLE 3 Comparison of Commuting Modal Alternatives

<i>Mode</i>	<i>Convenience</i>	<i>Availability</i>	<i>Reliability</i>	<i>Service Type</i>
Privately owned vehicle	High	High	Moderate to high depending on vehicle age, condition	On demand, door-to-door
Car-share vehicle	High	High, if prearranged	High	On demand, door-to-door
Shared-ride taxi	Moderate, depending on number of pick-ups, drop-offs	High, if prearranged	High, if prearranged	On demand, pre-arranged, hail request
Carpool ^{2,3}	Moderate, depending on number of pick-ups, drop-offs	Variable—difficult to form and maintain	Moderate to low, depending on members	Group-determined scheduling, door-to-door
Vanpool ^{2,5}	Moderate, depending on number of pick-ups, drop-offs	Variable—needs critical mass of close together riders, organized support	Moderate to low, depending on members	Group/employer-determined scheduling, usually door-to-door
Public transit				
• Express bus ²	Moderate to low, depending on access to/from stops, service frequency	Usually limited number of runs, peak period only, and large metropolitan areas only	High	Fixed schedule, route-limited service
• Regular bus	Moderate to low, depending on access to/from stops, service frequency	Low frequency, limited availability outside urban areas; limited night & weekend service	Moderate to high, depending on traffic conditions	Fixed schedule, routes
• Light rail (partial grade separation)	Moderate to low, depending on access to/from stops, service frequency	Moderate to high, depending on schedule, access to/from stops, limited night & weekend service	High to moderate, depending on traffic conditions	Fixed schedule, route
• Heavy rail (grade separation)	Moderate to low, depending on access to/from stops, service frequency	Off-peak frequency low; limited area cover; likely to need connections	High	Fixed schedule, route
Paratransit ⁷	Moderate to high, depending on number of stops, dwell time for route, advance schedule	Restricted access (for legal providers)	High for legitimate providers, low to moderate for illegals	Prearranged schedule, occasionally by phone request
Connector/circulator shuttles	High, usually timed to connect to work, transit schedules	Limited service areas/hours; private providers may limit eligibility	High to moderate, depending on traffic conditions, connections	Generally fixed route, schedules

NOTE: 1 mi = 1.6 km.

¹ Average 1996 cost, AAA: "Your Driving Costs, 1996."

² If much of route is on HOV lanes, time savings for longer trips can be significant.

³ Carpools are difficult to form and maintain because of differing travel needs of members; some accommodate this well and are very reliable, but others falter and eventually fail.

⁴ CARAVAN for Commuters, Inc. estimates the following costs per mile for a 2-person carpool: \$0.29/mi for 30-mi roundtrip; \$0.19/mi for 50-mi roundtrip; \$0.15/mi for 100-mi roundtrip.

TABLE 3 (continued)

<i>Mode</i>	<i>Service Configuration</i>	<i>Maximum Passenger Load</i>	<i>Commuter Cost</i>	<i>Other Characteristics</i>
Privately owned vehicle	Typically one-to-one	4–5/sedan; 6–7/minivan	High, averaging \$0.53/mi. ¹	High overhead for short period of use
Car-share vehicle	Typically one-to-one	4–5/sedan; 6–7/minivan	Moderate, ~\$0.30–\$0.35/mi.	Greater usage than private car, almost as available
Shared-ride taxi	Few-to-one & few-to-few, door-to-door	4	Moderate for short trips, high for long ones	Not allowed in many municipalities, but often exists informally
Carpool ^{2,3}	Few-to-one	4–5/sedan; 6–7/minivan	Moderate-to-low, depending on number sharing cost ⁴	Need “guaranteed ride home” to cover emergency, overtime, etc.
Vanpool ^{2,5}	Many-to-one	9–15 depending on van size	Low cost, amount depends on number sharing cost ⁶	Need “guaranteed ride home” to cover emergency, overtime, etc.
Public transit				
• Express bus ²	Few-to-few, some few-to-one	50–75, depending on bus type	Low to moderate, depending on whether subsidized, per-mile cost low	Need “guaranteed ride home” to cover emergency, overtime, etc.
• Regular bus	Many-to-many	50; more if bus is articulated	Moderate, lower if monthly/frequent user discount available	Cash flow deters purchase of discount fare instrument
• Light rail (partial grade separation)	Many-to-many	~450, if 3-car train w/150 passengers/car	Moderate, lower if monthly/frequent user discount available	Cash flow deters purchase of discount fare instrument
• Heavy rail (grade separation)	Rapid rail: many-to-many; regional rail: few-to-few	~900, if 6-car train w/150 passengers/car	Often higher fare than for bus or light rail	Cash flow deters purchase of discount fare instrument
Paratransit ⁷	Few-to-few, some one-to-one	6–10	High without subsidy—\$10–\$20/roundtrip	Often empty seats unavailable due to restrictions or cost
Connector/circulator shuttles	Connectors: many-to-one; circulators: many-to-many	6–30, depending on vehicle type	Low, often subsidized or transfer fare—\$0.50–\$2.00/ride	Typically fills “missing link” in O-D not served by transit

¹ Vanpools need a critical mass of riders in close proximity to each other and organizational support.

⁶ CARAVAN for Commuters, Inc. estimates the following costs per mile for a 14-person vanpool: \$0.13/mi for 30-mi roundtrip; \$0.09/mi for 50-mi roundtrip; \$0.05/mi for 100-mi roundtrip.

⁷ Defined here as vans/ small buses typically used to transport elderly and handicapped and unlicensed “gypsy” vans/taxis. Robert Cervero uses the term with broader definition to include everything between privately owned vehicle and traditional public transit. (See Robert Cervero, *Paratransit in America: Redefining Mass Transportation*. Westport, Conn., Praeger, 1997.) This definition would include shared-ride taxis, vanpools, carpools, and shuttles that are broken out separately in this table.

TABLE 4 Federal Transportation Outlays by Mode (Millions of Constant 1987 Dollars)¹

Year	Air	Highway	Transit	Rail	Water	Pipeline	Unallocated	TOTAL
1980	5,125	15,948	4,505	2,957	3,865	4	241	27,520
1985	5,106	15,512	3,537	1,091	3,163	4	188	23,495
1990	6,581	13,921	3,452	481	2,765	8	171	20,798
1991	7,183	13,755	3,398	676	2,910	8	234	20,981
1992	7,748	13,954	3,057	749	3,155	10	240	28,914
1993	8,078	14,535	2,827	655	3,107	11	268	29,480
1994	7,835	15,485	2,911	642	2,983	10	299	22,330
1980	(18.6%)	(58.0%)	(16.4%)	(10.7%)	(14.0%)	(0.0%)	(0.9%)	
1994	(35.1%)	(69.3%)	(13.0%)	(2.9%)	(13.4%)	(0.0%)	(1.3%)	
1980-94	(+52.8%)	(-2.9%)	(-35.4%)	(-78.3%)	(-22.8%)	(150.0%)	(+24.1%)	

NOTE: Total may not equal sum of columns due to rounding. Figures in parentheses represent share of total outlays in given years. Figures in bold parentheses represent % change in constant dollars between 1980 and 1994.

¹ Five-year intervals for FY80-90 and annually for FY90-94.

SOURCE: Federal Transportation Outlays by Mode (Table 2-26). *National Transportation Statistics 1997*, Bureau of Transportation Statistics, U.S. Department of Transportation, Dec. 1996.

terms, transit's share of federal outlays declined by more than 35 percent. Since 1994, transit has suffered even greater erosion of federal support, as operating costs for large urban transit agencies are no longer federally subsidized. Systems in urbanized areas with less than 200,000 people are still eligible to receive operating subsidies.

Not only does funding support for public transit suffer in comparison to support for roadways, there are also discriminatory funding disparities within the category of transit service. The operations of existing public transportation systems appear to favor the middle-to-upper income commuter. Service expansions to meet the needs of "captive" riders appear to receive less priority than costly programs that are intended to try to attract more "choice" riders (1). An example is the highly controversial and enormous investment in commuter rail by the Los Angeles MTA, a transit system in which bus passengers account for more than 90 percent of the agency's total ridership. More than 70 percent of MTA's funding resources have gone into commuter rail, but "L.A.'s 350,000 bus riders deal with peak-hour bus overcrowding, aging equipment and shelter and benchless bus stops." (1)

Transit ridership is largely low income. In areas with a population of 1 million or less, more than half of transit riders are persons with incomes of less than \$15,000 per year. In rural areas, nearly two-thirds of all transit riders have incomes under \$15,000 (1). These populations are heavily transit-dependent, but transit gives them limited service and poor accommodations. Rural and suburban transit stops typically are without shelter or seating. Often, identification of a bus stop may be just

a small placard that is nailed to a telephone pole. In cities, during peak periods, typically passengers are jammed aboard aging, dirty vehicles that transit agencies would not think of offering to "choice" riders. Fare structures are often very complicated, and those individuals without exact change, token, or ticket in hand are not allowed to ride. Ticket sale locations are often few and far between.

Many inequities in transit service can be attributed to disparities in public funding. In 1996, the largest urbanized metropolitan areas received overall about \$35 per capita; rural areas received only \$1.50 per capita. Towns (small urban centers with populations between 50,000 and 200,000) fared only a little better, receiving about \$8 per capita in funding (1). But within urbanized metropolitan areas, services that are targeted to affluent suburbanites receive the highest degree of subsidy. A Los Angeles study found that "inner city service, patronized largely by the poor, received less than 22 cents in total operating subsidy per passenger boarding, while express service, patronized largely by the affluent, received more than \$1.18 per boarding." (1)

Federal tax policies have consistently favored the automobile driver over the transit rider. Although the Transportation Equity Act for the 21st Century (TEA-21, Section 9010) reduces the degree of tax favoritism for drivers of privately owned vehicles, it is still far from a level playing field. Revisions in the federal tax law that were made in concert with TEA-21 now allow employers to provide up to \$65 per month per employee for subsidy of transit or vanpool commuting services (increasing to \$100 per month after December 31, 2001).

The employee who drives alone and who parks at the employer's site generates a \$175 per month per employee tax benefit for the employer, which is treated as excludable income for the employee. TEA-21 does remove one major inequity. Previously, parking benefits were not treated as taxable income to the employee "even when provided in lieu of other compensation payable to an employee under the Taxpayer Relief Act of 1997" (10), whereas transit subsidies were "excludable from gross income only if provided *in addition to* and not in lieu of, any compensation otherwise payable to an employee [emphasis added]." (12)

Commuting Trends

This paper is concerned with the commute of the low-income worker, which is very different from the most typical commute—the suburb-to-suburb journey of the middle-to-upper income worker. Low-wage workers typically either live and work in the inner city or live in rural areas¹² and commute to outer-ring suburban areas or, as is true for a growing number, live in the inner city and commute to work in the suburbs—the so-called "reverse commute." Overall, most commuters live and work in the same county, but intercounty commuting is growing as a share of total commutes (13, p. 73).

The trend toward increased intercounty commuting has important implications for traffic management and transit service. Where "welfare-to-work" traffic is significant, roads between rural communities and suburban worksites may experience congestion and increased numbers of traffic accidents. In areas with large numbers of welfare recipients without vehicles, alternative transportation programs or new transit service may be required to create access to jobs. For the "reverse commute" runs between center cities and suburban employment centers, additional capacity and more frequent transit service may be necessary.

Commuting is now the third most frequent trip purpose, though it only accounts for 1 out of every 6 trips taken and for about 1 out of every 5 mi (8 km) traveled (14, p. 11).¹³ Commutes are more spread out during the day and over a wider geographic area than before, but there is enough concentration still to place strain on all transportation systems. The importance and timing of the commute also influence the timing and characteristics of other trips. Single female heads of households especially often chain this trip, combining it with household and personal business purposes. Not surprisingly, women with children aged 5 and under are the most likely to trip-chain. More than 60 percent of women make at least one stop on the trip home from work, and nearly 30 percent make 2 or more stops (15, p. 4). NPTS data for 1995 suggest that picking some-

one up (often a child) takes nearly 12 min longer than dropping someone off, adding significantly to the time spent on the trip home. Fewer intermediate stops are made on the journey to work, except for women in households with children aged 5 and under (15, p.12); the running of errands appears to be more common during the trip home.

Although the degree of gender difference in trips has lessened over the years as women's employment has come to resemble men's more closely, significant differences in commuting patterns remain, with implications for welfare-to-work programs (15, p. 23). Overall (without income distinctions), women make more total trips and longer trips, except for shorter work commutes, perhaps reflecting decisions to limit work opportunities spatially to those closer to home and the fact that women tend to earn less and work fewer hours than men, thus making longer commutes not worthwhile (16, p. 41). Although the commutes are for shorter distances, they involve more chaining, which makes transit a difficult means of transportation. So far, little attention has been devoted to finding ways to help working women meet their travel needs more expeditiously.

Most commutes by privately owned vehicles are solo trips. Vehicle occupancy rates for the commute for low-income households averaged 1.20 persons (1.16 for all groups) as compared with 2.48 persons (2.07 for all groups) for trips made for social and recreational purposes (5, p. 8).¹⁴ Notwithstanding their trip-chaining requirements, many low-income women carpool, though as Rosenbloom notes, overall, women tend to carpool less than men with comparable incomes (17, p. 24) do. Costs that likely outweigh convenience as a modal decision factor in such cases as carpooling is particularly difficult for women who must transport their children as part of the commuting trip chain. The difficulties in juggling family and work responsibilities lead many low-income women to incur the burden of owning a car, even at the expense of other family needs (18).

The increased speed of the average commute in recent years (all modes together) is a benefit less likely to be shared by low-income, inner-city workers. The 1995 NPTS found an increase in commuting times in the most densely populated areas, perhaps a result of increasing congestion levels and the fact that the average commute by public transit (the commuting mode for large numbers of low-income urban workers) took twice as long as the average commute by car (15, pp. 44, 51).

The older cars that low-income people have at their disposal for commuting can create problems. Higher incidences of needed repairs but lack of money to pay for them may lead to more breakdowns on the road, causing inconvenience to others and job-retention risks for those who are dependent on the car for commuting trans-

portation. A single vehicular breakdown on a heavily traveled road can cause costly delays for thousands of other motorists. Many studies show that such incidents are major factors in regional traffic congestion.

THEORY AND HISTORY

Spatial Mismatch of Labor and Jobs-Housing Imbalance

The rationale for the "mobility strategy" represented by access to jobs programs is that a spatial mismatch exists between the location of low-wage workers (their residences) and the market for their services. Underlying such a spatial mismatch of labor is a jobs-housing imbalance. Basic assumptions include a (a) serious shortage of affordable housing in proximity to employment centers, (b) serious shortage of jobs in proximity to the housing of low-income workers, (c) distance between work and residence that acts as a barrier to employment, and (d) lack of reasonable transportation options between the two. These are conditions that are typical of metropolitan regions with high concentrations of poverty and large welfare caseloads.

John Kain articulated what has come to be known as the "Spatial Mismatch Hypothesis" in 1968.¹⁵ The focus of Kain's research was the effect housing discrimination had on work opportunities for black males. His study, which was limited to locations in Detroit and Chicago and based on demographic and economic development and travel data from a period before the greatest suburbanization occurred, stirred controversy and criticism from those who thought he had drawn unsubstantiated conclusions. Recent reviews of Kain's hypothesis under present labor market and development patterns, however, tend to confirm his basic conclusions (20).

The analogy offered in the statement that 'poor people are excluded from buying into expensive residential neighborhoods not because of exclusionary zoning, but in the same way that they are excluded from buying Lexus or Mercedes automobiles; they cannot afford them' (21, p. 102) might be more apt if some level of government were limiting production of Geo Metros.

—Jonathan Levine (22, p. 135)

A survey of housing conditions in most metropolitan areas suggests that housing policies do matter. It is unarguable that public housing policies at the federal level effectively concentrated extremely poor populations in urban centers, and exclusionary land use and density ordinances at the local level have distorted the market to the detriment of low-income and minority popula-

tions. The result of these policies, in tandem with market forces, has been virtually no addition to the stocks of affordable housing in the high-growth suburbs. In the most rapidly growing metropolitan suburbs, there are low vacancy rates for the limited affordable rental housing, generally high rents and housing prices, and few, if any, public housing facilities.

The "hot" suburban job markets generally have a strong demand for low-skilled, entry-level service workers. Suburban malls, restaurants, hotel and conference centers, nursing homes, and other businesses are experiencing serious labor shortages, but with suburban affordable housing shortages, they cannot expect to hire many current, local residents.

Although discriminatory zoning practices and limited development profitability currently work against it, the increase of suburban affordable housing stocks could help meet suburban service labor needs. It would also benefit the welfare-to-work population for several reasons: (a) a move near high job-growth areas improves accessibility to a wider job choice; (b) a move closer to the job market is desirable from the perspective of a single mother; (c) available suburban housing stocks would give low-income households a measure of choice in location that they presently do not have; and (d) suburban communities offer better access to many opportunities, especially higher quality public education.¹⁶ Negative aspects for low-income households that move into suburban housing include (a) the virtual necessity of a car; (b) lack of nearby support networks of friends and family; (c) likelihood of encountering open discrimination; and (d) perhaps most important, the burden of paying a higher share of household income for housing.¹⁷

The time constraints of welfare reform made the mobility strategy¹⁸ the most promising job-access policy, and proponents touted it as a means of revitalizing poor neighborhoods by bringing new money, in the form of wages, back into poor communities.¹⁹ Perhaps the most prominent proponent of the mobility strategy is Mark Hughes whose enterprise *Public/Private Ventures* was selected by HUD to implement it in the "Bridges to Work" demonstration program. The key features of the program have been replicated in varying degrees in many welfare-to-work policies, if not in actual program implementations. These features include

- Metropolitan placement mechanism that connects inner-city residents to job openings throughout the labor market and to suburban jobs in particular. Examples are an alliance of city and suburban service delivery areas that administer the federal Job Training Partnership Act, or a computerized regional placement network.

- Targeted commute mechanism that connects inner-city workers to previously inaccessible employment locations. These connections might be implemented

through a new demand-responsive service provided by public transit workers or through community-based or employer-based vanpooling and ride sharing.

- Set of support services that would mitigate demands created or exacerbated by the daily commute to more distant job locations. These services would include extended child-car arrangements, a guaranteed ride home in emergencies, orientation to suburban opportunities, and conflict resolution with coworkers (28).

Development of Spatial Mismatch in Labor Markets

There are many causes of labor supply and demand disconnections. Factors often described as “engines of sprawl”—federal housing and highway investment programs; cheap, raw, easily developable land made accessible by new roads; city-suburban tax differentials; development incentives offered by suburban municipalities; and other practices—have been widely blamed for drawing jobs out of the central city and into the countryside, leaving fiscally and physically deteriorating cities to cope with the poor, high-maintenance population left behind. Although this interpretation may have validity at least as a partial explanation for robust growth in the suburbs and the concurrent decline in the central cities of some regions,²⁰ it does not explain the jobs-housing imbalance and spatial mismatch of labor everywhere.

How “Sprawl” Can Suck the Life Out of Inner Cities:

Jobs follow households as employers look to serve relocating populations and workforces. Mobile households flee neighborhoods that have been left

without commercial amenities. On top of these forces, practices and legacies of discrimination continue to exert their influence.

—Dan Immergluck and Marti Wiles (29)

The circumstances fostering spatial labor mismatches vary from place to place. Older cities with industrial economic bases, such as Boston and Philadelphia, experienced dramatic losses in jobs and in middle- and upper-income households from the central cities and coincidental gains in the neighboring suburbs. In Boston and Philadelphia, not all of the lost businesses failed or moved to lower-production cost regions. Many businesses that were once located in the central business districts stayed within the regions but moved to spacious office parks in the suburbs.²¹ Philadelphia’s high wage and business taxes, high labor costs, and incentive-loaded economic development packages offered by suburban municipalities played no small part in many of these relocation decisions.

Between 1970 and 1995, Philadelphia suffered a net loss of 272,000 jobs—25.9 percent of its 1970 employment base. During the same period, the suburban counties of Bucks, Chester, Delaware, and Montgomery experienced significant growth. Employment in both Bucks and Chester Counties more than doubled (see Table 5). However, in other areas, such as in the numerous resort cities and towns that have sprouted up along the Carolina coast and the Panhandle and Gulf Coasts in Florida, development patterns and employment opportunities were driven by entirely different factors. Geography determined the locations of these tourist centers, and growing national affluence fueled their development. It was not at the expense of another region. Although these coastal areas boomed and experienced

TABLE 5 Population and Employment Trends in Pennsylvania Counties of the Philadelphia Region

	Population (Thousands)			Percent Change		Employment (Thousands)			Percent Change	
	1970	1980	1990	'70-'80	'80-'90	1970	1980	1990	'70-'80	'80-'90
County of Residence										
Bucks	417	479	541	15.0	12.9	117	170	221	45.5	29.7
Chester	278	317	376	14.0	18.9	85	123	176	45.3	43.1
Delaware	603	555	548	(8.0)	(1.3)	162	181	207	11.6	14.5
Montgomery	624	644	678	3.1	5.4	259	325	407	25.4	25.1
Philadelphia	1,950	1,688	1,586	(13.4)	(6.1)	876	760	761	(13.3)	0.1
Total	3,872	3,683	3,729	(4.9)	1.3	1,500	1,560	1,772	4.0	13.6

NOTE: Totals may not add due to rounding

SOURCE: Population and Employment Growth in the Delaware Valley Region. In *Journey to Work Trends in the Delaware Valley Region, 1970-1990*, Report 5. Delaware Valley Regional Planning Commission, Philadelphia, June 1993.

labor shortages,²² inland agricultural areas had unemployed or underemployed labor pools that stemmed from the shift from traditional to more capital-intensive and commercial farming. Employment in tourism-related service businesses beckoned, but many of the inland farmworkers could not move closer to the demand for their services because of the higher cost of living, among other reasons. A spatial labor mismatch was inevitable.

It is important to understand the differences in labor-mismatch characteristics among regions. In older urban centers, the infrastructures (social and physical) and critical mass for redevelopment still exist. These cities usually already have extensive, if imperfect, public transit systems within their urban cores. Though the path to economic revitalization is likely to be long and difficult, the potential exists. However, prospects for creating sufficient local employment in the internal rural areas of north Florida and South Carolina are remote, and as long as the coastal resort communities are booming, the real estate market will not induce creation of new, affordable housing there. The inland rural areas may slumber indefinitely, but the resort areas, blessed by geographic and climatic advantages, have job openings now, so a commuting strategy that uses new transportation services may be the only realistic solution to this type of jobs-housing gap for the foreseeable future.

The general shift in the U.S. economy from manufacturing to service industries has had many effects on labor markets. The spatial effect of this shift has not received the attention that the regional job gains and losses have, but it is perhaps just as important. Manufacturing is traditionally a more spatially concentrated activity. Agglomerative and scale economies were important so many manufacturing plants located within compact urban areas. Large manufacturing workforces provided the density that usually supported transit operations. Service industries are inherently more spatially distributed, and without the population density of a manufacturing plant, it is more difficult for transit to serve their employees. With the exception of a few bigger, service-based entities like hospitals, large hotels, or shopping malls, most service businesses do not have large workforces at a given site.

A basic difference in treatment of transportation costs between manufacturing and service industries should also be noted as its effects have become more pronounced with the increasing dominance of the service sector. In manufacturing firms, the transportation costs of material inputs and outputs are factored into costs of doing business. The inputs in service industries are essentially labor, but the transportation of these inputs rarely are treated as business costs by service firms. The inputs (labor) are expected to pay these costs.²³ Although blue collar factory workers pay their own transportation costs, they do so with significantly higher wages.

Unfortunately for service workers, entry-level service positions pay a fraction of what the average entry-level manufacturing positions pay, making their costs of getting to and from work disproportionately high.

WELFARE REFORM: NEW FOCUS ON ACCESS TO JOBS

Welfare reform presents both an opportunity and a challenge to solving long-standing transportation problems of all low-income populations, the working poor as well as welfare recipients. Before welfare reform, little attention was paid to the plight of low-income commuters. They were largely left to figure out how to get to work on their own. For many, the difficulties and costs involved in commuting to distant jobs made welfare more attractive than working. Welfare reform in the 1990s has changed that. Under PRWORA and the various state-implementing laws, able-bodied welfare recipients are expected to get jobs and become self-sufficient within prescribed time limits. With rare exceptions, transportation difficulties are not a cause for exemption from the work requirements of the transition period. Although transportation was generally known to be a major barrier to employment for low-income people, only a few states gave it much stress in their welfare-reform-implementation plans, and fewer states have made concerted efforts to measure its impacts on either the ability of welfare recipients to find and keep jobs or the wellbeing of welfare-recipient households.

Early results of welfare reform under PRWORA indicate that, at best, a lot of fine tuning of all types of programs is going to be needed, but generally it is not yet clear what should be done.²⁴ Some states are now conducting follow-up studies on welfare caseloads,²⁵ but others have yet to establish comprehensive data-collection methods and programs.²⁶ There is a serious lack of the type of connected databases that are necessary for ongoing tracking of welfare clients as they transition into the workforce, much less for follow-up studies.²⁷ A variety of information that crosscuts public agency functions and private-sector partners, such as employers, job-placement agencies, and training agencies, is needed. (For types of data that would be useful for tracking and evaluation purposes, see Research and Data Needs under the section Planning for Access to Jobs in the 21st Century, p. 158.)

Transportation Planning Under PRWORA and TANF—What Have We Learned So Far?

Results of PRWORA so far are decidedly mixed. Welfare rolls have been greatly reduced, and large numbers of

welfare recipients have begun the transition from dependency into the workforce, but the news is not all good. According to Susan Golonka, Program Director for Welfare Reform at the National Governors' Association, the most significant findings about welfare reform to date include the following (27):

- 50 to 60 percent of those individuals leaving welfare rolls find jobs, but these jobs typically pay less than \$7 per hour. This amount is not enough to move a welfare family out of poverty, but with the earned income tax credit, it is generally more than what they would have received just from welfare.²⁸

- Child care and transportation continue to be major barriers to getting jobs and keeping them.

- Most welfare recipients who enter the workforce continue to receive some kind of assistance—at least food stamps, child care subsidies, or Medicaid, if not cash assistance [Temporary Aid to Needy Families (TANF)].

- There is a troubling rate of recidivism that may be understated because rigorous tracking studies are lacking.²⁹

- The easiest-to-place welfare recipients are already working; those left on the rolls have multiple problems and placing them in work will be far more difficult.

The U.S. Conference of Mayors conducted a 34-city survey of welfare reform efforts in fall 1998. The survey found that more than four out of five municipal respondents identified a lack of transportation to existing jobs as a continuing major problem, although three-quarters of the respondents also said they had plans in place to address the problem (32, p. 3).

Legislative Context

The federal reform legislation epitomizes devolution of responsibility to the states. Aid to Families with Dependent Children (AFDC), the former cash-assistance program, was replaced by the TANF lump-sum block grant to the states. Within a set of minimum requirements that was stipulated in the federal legislation,³⁰ states were free to design their own transitional programs to turn welfare recipients into wage earners and to provide temporary cash assistance and supportive programs, including transportation services. TANF measures for funding eligible transportation services include

- Use of contracts for shuttles, buses, carpools, and other services;

- Purchase of vans, shuttles, and minibuses for transportation of TANF-eligible individuals;

- Purchase of capacity (including vouchers and transit passes) on public or private transportation systems;

- Whole or partial reimbursement to TANF recipients for work-related transportation expenses, including mileage, gas, public transit fare, auto repairs, and insurance, or a basic cash allowance for transportation;

- Loan assistance to TANF recipients to purchase a vehicle for work-commuting purposes or work-related activities;

- Facilitating donation and repair of previously owned or reconditioned vehicles;

- Funds for one-time, short-term, or other alternatives to ongoing assistance as "diversion" payments to keep people from going on welfare³¹ because of transportation problems, such as inability to cover insurance costs or pay for repairs;

- Funds for start-up or operating costs for new or expanded transportation services that benefit TANF recipients, provided that such costs are necessary, are reasonable, and are only the portion of costs that are associated with services for TANF recipients;

- Establishment of individual development accounts for TANF recipients that can be used to cover qualified business capitalization expenses to establish transportation services, such as vans, shuttles, or door-to-door transportation service [Section 404(h) of the Social Security Act]; and

- Transfer of TANF funds to the Social Services Block Grant (SSBG) to address the lack of transportation infrastructure in many rural and inner-city areas (34).³²

Unfortunately, not many of these options have been used very much. It may be that states are reluctant to use TANF funds for support services beyond job training and child care because of uncertainty about level of needs should a downturn in the economy occur and because constraints on use of funds inherent in PRWORA discourage full use of the block grant in some instances (33, 35, 36).

"Great Leap Forward: End of Welfare as We Knew It"

As the states began to implement welfare reform, the nation was fortunate enough to have the strongest economy and the greatest new job growth in years—almost 2 million new jobs per year since 1983 (37). Even most of the larger, older cities that had suffered serious economic reversals are now enjoying a measure of prosperity, but a major challenge exists for welfare-to-work programs because of spatial mismatch in the low-skill, entry-level job market. Nationally, the influx of welfare recipients into the labor force will have little impact. Estimates of the total number of people entering the workforce from the welfare rolls range from 1 million (37) to 3 million (38) between 1997 and 2002, respectively.

Analysis of job markets at a regional or local level yields a far less sanguine prospect. The distribution of welfare recipients that need jobs is very uneven. One study found that "only 13 states appear to have the capacity to create enough jobs without some type of public subsidy or workfare program."³³ Half of the 10 states with the worst prospects for absorbing their case-loads are in the Northeast³⁴ (39, p. 9). There will be tremendous pressure on transportation providers to help connect welfare recipients in these markets to jobs wherever they can be found, but this may be an impossible task. (A further discussion of commute distance problems is presented later in this paper.)

Differences in State Transportation Assistance Treatment in Welfare Reform Implementing Legislation and Underlying Assumptions There are wide variations in state approaches to transportation planning and assistance for welfare recipients who are entering the workforce. Some approaches are highly coordinated and include many specific provisions for transportation assistance. New Jersey typifies an integrated and comprehensive state approach. From the earliest stages of welfare reform planning in the state, the New Jersey Department of Transportation and New Jersey Transit were at the table as full partners in the planning process. Neighboring Pennsylvania is almost at the other end of the spectrum; its state agency that is responsible for welfare issues (Pennsylvania Department of Public Welfare) is in charge of virtually all aspects of the TANF program. There has been little formal coordination among agencies. Pennsylvania's welfare reform is highly devolved, so the burden of implementation, including any transportation-assistance planning, is concentrated at the county level.

State provisions for specific transportation assistance, such as monetary support for car use, also diverge widely. Table 6 shows the vehicle and asset exemption policies for each state. Some are quite generous and recognize that households with more than one worker may need more than one car so that all adult members can get and retain jobs. Other states make no such concession. Transportation subsidy policies differ from state to state. Some states offer no transportation assistance at all. Others provide subsidies during job search and training activities only, or for a brief time, once a job has been obtained. Presumably, this is an equity consideration—if states provide subsidies to welfare recipients to get to work, they should provide similar assistance to all working poor. This is a politically charged and fiscally loaded issue, and the temptation will be to ignore it, leaving welfare recipients and all other low-income workers to pay a disproportionate share of their incomes for work-related transportation expenses.

Access to Jobs Planning and Programs Under TEA-21 Under TEA-21, an entirely new program was created to encourage a provision for appropriate transportation services for job access for all welfare recipients and for low-income persons. Section (3037) of TEA-21 recognizes the immense transportation needs that are associated with welfare-to-work and the insufficient resources that are currently available to transit agencies and to other transportation providers to meet them. Congress authorized \$750 million for the years 1997 to 2003, of which \$500 million is guaranteed, to fund this program. Up to \$10 million is set aside specifically for "reverse commute" services. The legislation places a high premium on coordination of services and cooperation of providers. In a deviation from standard practices regarding matches to federal program funds, this legislation allows other federal program grants, such as TANF funds, to be used as part of the matching fund requirements as an incentive to recipient agencies to coordinate different programs that serve the same needs. Submitted plans are required to have transit agency approval. The competitive grants under this program are judged on the following criteria:

- Percentage of the population to be served that are welfare recipients;
- Need for additional services;
- Coordination with and use of existing transportation providers;
- Coordination with state welfare agencies that implement the TANF program; and
- Use of innovative approaches, the presence of a regional plan, long-term financing strategies, and consultation with the community to be served. (40)

The transit agency approval requirement for proposal submission embodies congressional intent to rely on transit as the backbone of any regional strategy to improve transportation options for low-income commuters. Although this reliance makes sense in many ways, it carries a risk that cash-starved transit agencies may be tempted to go after a region's allotted funding with a preemptive proposal for traditional kinds of transit services that should be funded from other sources, and it blocks potential, creative solutions to service gaps that transit cannot address.

Conflicts and Inconsistencies Among Policies and Program Goals

The federal government adopted an interagency, cooperative approach on welfare reform issues very early. Admirable efforts were made to avoid inconsistencies in departmental policies and regulations and to stream-

line programs. Informative workshops and conferences, sponsored by the Department of Housing and Urban Development (HUD), USDOT, U.S. Department of Health and Human Services, U.S. Department of Labor (USDOL), the Small Business Administration, and other federal agencies, were held around the country to apprise both public- and private-sector stakeholders in the welfare reform process and to bring the parties together. The transportation programs under Section 3037 of TEA-21 and USDOL's welfare-to-work grants were designed to dovetail and allow for maximum leverage of federal dollars. Notwithstanding these good intentions, some inherent inconsistencies and conflicts among policies and program goals persist that may impair the success of all affected programs. The following subsections provide examples.

HUD's Housing Mobility Policies (Moving to Work) and Suburban Transportation Realities The demonstrated successes of relocation programs for the public housing population, such as the Gautreaux program in the Chicago area, have spurred plans to decentralize the low-income housing population and assist individuals in moving out of depressed inner-city neighborhoods into mixed-income, suburban communities that are closer to good job markets. Production of new public housing in markets close to areas that are experiencing high job growth is very unlikely, so HUD has relied on the portable Section 8 vouchers to subsidize rental housing so as to open up more suburban housing opportunities for low-income families.

There are several barriers to successful implementation of this relocation strategy. First, affordable housing stocks are severely inadequate. Not only has little new affordable housing been constructed in the suburbs, there have been "mounting losses of low-rent apartments from the private market." (24) Second, the suburban rents are so high that many low-income families are paying over half of their income for housing (see Note 17). Third, access problems in most suburbs make car ownership a necessity and a significant added cost. A final barrier is that there is inadequate subsidy assistance available to even come close to meeting the demand for it. The funding for 50,000 new welfare-to-work housing vouchers recently authorized by Congress is a "drop in the bucket." In some of the most acute shortfall markets, such as Chicago, waiting lists for these subsidies (Section 8 vouchers) average 5 years or more for households already deemed to be eligible.

Moving to the suburbs may be highly desirable in many ways, but without better transportation options, a low-income family may have less mobility and accessibility and be worse off. They can experience social and economic isolation and higher fixed costs of living.

TANF/PRWORA Goal of Self-Sufficiency and Disproportionate Burdens of Work-Associated Expenses Moving from full dependence on welfare into the workforce has the immediate effect of dramatically raising the share of transportation costs in a household's budget. (Additional information on cost burdens is presented later in this paper.) When a low-income family is already paying at least one-third of its income for housing—and this rarely improves when an adult enters the welfare-to-workforce, even with continuing supplemental cash assistance³⁵—there is very little discretionary money to cover these new costs. If a low-income household must assume these work-related costs entirely on its own, it is likely to be at the expense of necessities, such as food. Most low-income household budgets are so tight that the added high costs of transportation to and from work are likely to keep most low-income families in poverty and in need of continuing public assistance to meet basic needs, but cash assistance is now time limited.

Reducing or Eliminating Public Transit Subsidies and Increasing Need for Cost-Efficient Suburban Services to Low-Income, Transit-Dependent Populations

At a time when greatly expanded public transit services are desperately needed by low-income commuters, public transit agencies are faced with their lowest ever level of federal subsidy and are under severe pressures to cut costs as sharply as possible. Federal subsidies for operating costs have been sharply curtailed. Labor costs are the major component of operating costs, and because of contractual requirements, the most expedient way to cut operating costs is to reduce or even abolish service (see Note 7).

Regulatory and Administrative Barriers

Transit authorities have many constraints that limit their flexibility in providing service. Typical restrictions include mandatory fare-box-recovery ratios and level-of-service requirements for contributing political jurisdictions. Fare-box-recovery ratios can be systemwide, or they can be operating-division specific or even route specific. If they are route specific and combined with level-of-service requirements for each funding jurisdiction, they can make it extremely difficult to launch a service for which documented demand at a level adequate to meet fare-box-recovery requirements does not already exist. Required public hearing processes also impede rapid response planning to meet emerging needs. Extensive public input precedes implementation

TABLE 6 State Asset Limits for Welfare Recipients

<i>State</i>	<i>Asset Limit</i>	<i>Vehicle Exemption</i>	<i>Restricted Savings Account</i>
Alabama	\$2,000/3,000 ¹	one vehicle ²	—
Alaska	1,000	all vehicles for approved purposes ³	—
Arizona	2,000	one vehicle	\$9,000
Arkansas	3,000	one vehicle	*
California	2,000/3,000 ⁴	\$4,650	5,000
Colorado	2,000	one vehicle	*
Connecticut	3,000	one vehicle	—
Delaware	1,000	\$4,650	5,000
Dist. of Columbia	1,000	\$1,500	—
Florida	2,000	\$8,500	—
Georgia	1,000	\$4,650	5,000
Hawaii	5,000	one vehicle	—
Idaho	2,000	\$4,650	—
Illinois	3,000	one vehicle	—
Indiana	1,500	\$1,000	—
Iowa	5,000	\$3,889 ⁵	*
Kansas	2,000	one vehicle	—
Kentucky	2,000	one vehicle	5,000
Louisiana	2,000	\$10,000	6,000
Maine	2,000	one vehicle	10,000
Maryland	2,000	one vehicle	—
Massachusetts	2,500	\$5,000	—
Michigan	3,000	one vehicle ⁶	—
Minnesota	5,000 ⁷	\$7,500 ⁸	—
Mississippi	1,000	\$1,500	—
Missouri	5,000 ⁹	one vehicle; \$1,500 of a second	—
Montana	3,000	one vehicle ¹⁰	No limit
Nebraska	4,000/6,000 ¹¹	one vehicle	—

NOTE: Asset rules may differ for families applying for assistance and for families who are already receiving assistance. This table refers only to asset rules for recipient families.

*Limit on restricted savings is unspecified.

¹ The asset limit is \$2,000 for assistance units without a member age 60 or over, and \$3,000 for assistance units with a member age 60 or over.

² The value of one vehicle per licensed driver in assistance unit is exempt.

³ Any vehicle needed for family transportation, as a home, to produce self-employment income, to transport a disabled person, or to participate in approved work activities is exempt.

⁴ The asset limit is \$2,000 for most families, and \$3,000 for families in which any member is over the age of 60.

⁵ The value of one vehicle up to \$3,889 for each adult and working teenage child is exempt.

⁶ The value of up to two vehicles if "necessary as a condition of employment" is exempt.

⁷ The asset limit is effective 1/1/98. Prior to 1/1/98 the asset limit is \$1,000.

⁸ The vehicle exemption is effective 1/1/98. Prior to 1/1/98 the vehicle exemption is \$4,650.

⁹ This is the asset limit for families with self-sufficiency agreements.

¹⁰ All other income-producing vehicles are exempt.

¹¹ The asset limit is \$4,000 for a single individual, and \$6,000 for two or more households.

TABLE 6 (continued)

<i>State</i>	<i>Asset Limit</i>	<i>Vehicle Exemption</i>	<i>Restricted Savings Account</i>
Nevada	2,000	one vehicle	—
New Hampshire	2,000	one vehicle ¹²	—
New Jersey	2,000	\$9,500	—
New Mexico	1,500	one vehicle	*
New York	2,000/3,000 ¹³	\$4,650	*
North Carolina	3,000	\$5,000	—
North Dakota	5,000/8,000 ¹⁴	one vehicle	—
Ohio	1,000	\$4,650	\$10,000
Oklahoma	1,000	\$5,000	2,000
Oregon	2,500/10,000 ¹⁵	\$10,000	* ¹⁶
Pennsylvania	1,000	one vehicle	*
Rhode Island	1,000	\$4,650	— ¹⁷
South Carolina	2,500	\$10,000	10,000
South Dakota	2,000	\$4,650 ¹⁸	1,000
Tennessee	2,000	\$4,600	—
Texas	2,000/3,000 ¹⁹	\$4,650	—
Utah	2,000	\$8,000 ²⁰	—
Vermont	1,000	one vehicle	10,000 ²¹
Virginia	1,000	\$7,500 ²²	5,000
Washington	1,000	\$5,000 ²³	3,000
West Virginia	2,000	\$4,500 ²⁴	—
Wisconsin	2,500	\$10,000	—
Wyoming	2,500	\$12,000 ²⁵	—

¹² The value of one vehicle per adult in assistance unit is exempt.

¹³ The asset limit is \$2,000 for most families, and \$3,000 for families in which any member is over the age of 60.

¹⁴ The asset limit is \$5,000 for a single individual, and \$8,000 for two or more individuals.

¹⁵ The asset limit of \$2,500 is increased to \$10,000 for families with at least one JOBS participant who is progressing in his/her self-sufficiency plan.

¹⁶ The state allows participants in JOBS Plus to establish and IDA to be used for education.

¹⁷ Rhode Island state law provides for a statewide pilot program that allows recipients to keep up to \$2,500 in an IDA for microenterprise, but the program is limited to 30 recipients.

¹⁸ The value of a second vehicle up to \$4,650 is exempt when it is used for employment or training by another member of assistance unit.

¹⁹ The asset limit is \$2,000 for most families, and \$3,000 if an elderly or disabled person is in the household.

²⁰ Exempt the entire value of a vehicle when it is equipped to transport a disabled household member.

²¹ The account is restricted to savings from earnings, but there is no restriction on what the savings may be used for.

²² The vehicle exemption shown is based on rules that apply to families subject to the time limit. The vehicle exemption is \$1,500 for families exempt from the time limit.

²³ The entire value of a vehicle is exempt when it is equipped to transport a disabled household member.

²⁴ The entire value of a vehicle is exempt when it is used for employment or to transport a disabled household member.

²⁵ The value of a second vehicle up to \$12,000 is exempt for married couples.

SOURCE: *One Year After Federal Welfare Reform: A Description of State Temporary Assistance for Needy Families (TANF) Decisions as of October 1997*, Table III.1. The Urban Institute, Washington, D.C., May 1998.

<http://newfederalism.urban.org/html/1year.html>.

of any new service routes or facilities. This process often can take months, but the populations that need the service need it "yesterday."

Institutional Barriers

Changing institutional cultures so as to carry out new missions under welfare reform has been every bit as difficult as anticipated (41). Some states understood at the outset that expecting agencies to take on entirely new functions, and perhaps sharing program authority and working with unfamiliar groups, could raise major problems. The states that have been the most successful in implementing welfare reform are generally those that had engaged in extensive preplanning and interagency coordination, such as Wisconsin, New Jersey, and Ohio.³⁶

The assumption of new roles and working with new partners are only two types of institutional barriers. Devolution has brought perhaps the most challenging institutional problems of all. Devolution of authority to the most local levels may have political cachet, but for purposes of implementing a cohesive and efficient welfare reform plan and especially for planning transportation services, it raises some problems. Where counties have responsibility for carrying out state welfare reform regulations, multicounty regions present major coordination challenges. The Atlanta metropolitan region is an extreme example of multiple jurisdictions.

The development of transportation services to connect persons from low-income Atlanta neighborhoods to far-flung suburban and exurban job centers requires extensive cooperation, not only between municipal officials and more than one transit agency, but also among all the myriad job developers and client support services, such as child care in each locality. The inherent difficulties bring to mind the metaphor of herding cats. Welfare-to-work programs should recognize that labor markets are regional, and therefore plans—transportation and otherwise—that affect them should also be regional in scope. Transportation planning especially should be comprehensive and regional, both to avoid the wasteful duplications of services that have occurred³⁷ and to ensure the most complete coverage possible. Barriers to meaningful cooperation rise to another level when the regional market and the metropolitan area encompass more than one state, for example, St. Louis and Philadelphia, and the metropolitan planning organization (MPO) has an advisory role only. This is not to say that achieving comprehensive and consistent transportation and jobs-access planning for multi-jurisdictional regions is not possible, but it is certainly more difficult.

Knowledge Barriers

Absence of a Shared Vocabulary The absence of a shared vocabulary and what the Council for Urban Economic Development has termed a "cultural disconnect" have made the coordination necessary for effective welfare reform programs difficult to achieve. As an example, a transit agency may measure efficiency by increases in ridership, fare-box-recovery ratios, and on-time service rates; an employer may measure it by how well transit schedules mesh with its operations, and a commuter may value it by how fast the commute is and how few transfers it entails. One party may consider a particular service to be a great success, while others may consider it to be a dismal failure. Without a mutual understanding of the perspectives of all parties involved, much time and effort may be wasted, and the intended beneficiary, the welfare recipient entering the workforce, may not be well served.

Not Knowing the Needs of the Clients Some of the most egregious welfare-to-work transportation "glitches" have occurred for lack of basic market research, failure to "think beyond the box," and adoption of unfounded assumptions about the needs of the working poor. Much of the early transportation planning for the welfare-to-work population appeared to ignore the fact that most of these new commuters are single mothers who need very flexible transportation. They have to accommodate both work and family demands. They cannot afford the time that is lost in lengthy commutes that leave them with very little left to spend with their children or to pursue educational opportunities that could enhance their lifetime earnings. Transportation planning for this population rarely goes beyond the basic commute to include all of their accessibility and mobility needs.

Both transportation planners and social policy planners appear to have overlooked the cash-flow problems of low-income households. Often, low-income people do not have cash on hand to purchase the most cost-effective transit fare instruments—monthly passes—or to pay for unanticipated car repairs.

Failure to recognize client needs and circumstances has led to some amazing mismatches between client needs and the transportation benefits offered to them. Some examples include issuing gasoline vouchers to people without cars, dispatching transit passes to people employed when or where there is no transit service, and donating reconditioned "clunkers" to people without the financial capacity to keep them in repair. Mismatches have occurred from the employment and training assignment perspective as well, with welfare clients sent to jobs or training programs with variable sites and no reliable means of getting from one site to the next.

Social Barriers

Not Quite "Ready for Prime Time": Realities of Moving from Long-Term Welfare to Work from the Individual's Perspective Although many welfare recipients have some work experience, this is much less true of long-term welfare recipients. They have not had to get from one place to another on someone else's schedule. Trying to figure out how complex transit schedules will fit their lives, or handling the costs and maintenance requirements of car ownership, can be overwhelming to someone who has little experience with such considerations, much less the culture of work.

Some welfare agencies have understood the need to familiarize their clients with the transportation details of getting and keeping a job and have included these details in their job preparation activities.³⁸ For the most "ready-to-work" people, these familiarization activities been quite useful; for those individuals still on the welfare rolls, ease of transportation access may be a formidable employment barrier that requires more intensive educational efforts. Many of these people do not own a car or even have a driver's license.³⁹ At least in the short run, such people will be entirely dependent on either public transit or some other type of transportation service to travel to places completely new to them.

Reliance on Undependable Networks Except for extreme hardship or temporary exceptions, able-bodied, adult welfare recipients are expected to assume job and family responsibilities—that is, the premise of PRWORA. To meet these responsibilities, low-income workers often have to rely on their informal network of supports (43). Occasionally, this means counting on friends or relatives to give them rides to work and for other purposes. Many will also depend on friends and relatives for child care. Reliability is a serious problem, and lack of it may cost a low-wage worker his or her job.

Financial Barriers

Cost Burdens to the Commuter Most of the jobs that welfare recipients find are low-paying, "dead end," service-sector jobs. Typical starting pay is well under \$8 per hour. Most such jobs do not include health care or

other benefits, and few employers subsidize commuting costs for them. On these low wages, the costs of long commutes between low-income neighborhoods and distant suburban job centers are so burdensome that their sustainability is very questionable.⁴⁰

Blumberg and Ong have found, not surprisingly, that in the Los Angeles region, "the net wages of low-wage workers who commute relatively long distances are reduced by both out-of-pocket expenses and opportunity costs. Therefore, long commutes may discourage employment and result in higher turnover rates and lower net earnings." (44, p. 17) Research on transportation costs and wage differentials in the Philadelphia region found some evidence that higher wages are being offered for jobs in outer-ring suburbs than are offered for the same positions in the central city, but the difference is not enough to cover the increased commuting costs for the individual, whether using either transit or a privately owned automobile (Loveless, S., University of Pennsylvania, Ph.D. dissertation, unpublished).

Transportation is now the second largest category of household expenditure, accounting for more than food (45, p. 24). The travel to work greatly increases a household's transportation expenses. Table 7 shows household expenditures by public assistance status, household parental status, and work status. It shows a dramatic increase from 9.5 percent spent for transportation when a public assistance household has no workers to a 19.1 percent share of household expenses as soon as someone in the household takes a job. The impact of this increase in expenses can be staggering for families that often pay half or more of their income just for shelter.

Table 8 shows transportation costs and other budget categories for various types of families that live in Philadelphia, using the "self-sufficiency standard" developed by Pearce (46). Pearce's transportation figures show costs that are typical of a "reverse commuter" who travels from southwest Philadelphia, an area with many poverty census tracts, to the job-rich King of Prussia area in suburban Montgomery County, using public transit. These figures are shown in the table's shaded rows. Estimated transportation costs for other family members have been added. These figures also are based on assumptions that households will not have cash-flow problems to prevent them from purchasing weekly TrailPasses, which will bring transit costs down

TABLE 7 Household Expenditures from First Quarter of 1992 to First Quarter of 1994 (by Percent of Total Expenditures) (5, Table 5)

Budget Categories	Public Assistance Recipient	Not Public Assistance Recipient	Households Receiving Public Assistance			
			No Workers	Some Workers	Single-Parent	Two-Parent
Food & Shelter	59.5	46.9	71.7	53.4	69.1	54.0
Transportation	15.3	19.2	9.5	19.1	10.2	19.6

TABLE 8 Household Expenses for Selected Family Types Using the Self-Sufficiency Standard for Philadelphia (46)*

Monthly Costs	Single Adult	Adult + Infant	Adult + Preschooler	Adult + Infant + Preschooler	Adult + School-ager + Teenager	Adult + Infant + Preschooler + School-ager	2 Adults + Infant + Preschooler
Housing	\$549.00	\$678.00	\$678.00	\$678.00	\$678.00	\$678.00	\$678.00
Child Care	\$0.00	\$450.78	\$489.72	\$940.50	\$268.18	\$1,208.68	\$940.50
Food	\$153.48	\$225.28	\$233.09	\$303.24	\$400.26	\$407.90	\$434.90
Transportation	\$93.10	\$93.10	\$93.10	\$93.10	\$93.10	\$93.10	\$186.20
w/weekly							
Zone 4 TrailPass ¹	\$161.80	\$161.80	\$161.80	\$161.80	\$289.80 ²	\$225.80 ³	\$303.60 ⁴
w/monthly							
Zone 4 TrailPass ¹	\$136.00	\$136.00	\$136.00	\$136.00	\$264.00 ²	\$200.00 ³	\$282.00 ⁴
Medical Care	\$66.53	\$139.00	\$125.56	\$153.89	\$157.28	\$167.89	\$190.41
Miscellaneous	\$86.21	\$158.71	\$161.95	\$216.87	\$159.68	\$272.56	\$243.00
Taxes	\$220.85	\$409.28	\$421.72	\$577.35	\$340.08	\$748.18	\$621.39
Earned Income							
Tax Credit (-)	\$0.00	\$0.00	\$0.00	\$0.00	(\$86.44)	\$0.00	\$0.00
Child Care							
Tax Credit (-)	\$0.00	(\$44.00)	(\$44.00)	(\$80.00)	(\$46.00)	(\$80.00)	(\$80.00)
Monthly Self-Sufficiency							
Wage	\$1,169.18	\$2,111.04	\$2,159.13	\$2,882.95	\$1,964.14	\$3,666.30	\$3,214.40
w/weekly							
Zone 4 TrailPass	\$1,237.88	\$2,179.74	\$2,227.83	\$2,951.65	\$2,160.64	\$3,799.00	\$3,331.80
w/monthly							
Zone 4 TrailPass	\$1,212.08	\$2,153.94	\$2,202.03	\$2,925.85	\$2,135.04	\$3,773.20	\$3,310.20
Hourly Self-Sufficiency							
Wage	\$6.64	\$11.99	\$12.27	\$16.38	\$11.16	\$20.83	\$9.13
w/weekly							
Zone 4 TrailPass	\$7.03	\$12.38	\$12.66	\$16.77	\$12.28	\$21.59	\$9.47
w/monthly							
Zone 4 TrailPass	\$6.67	\$12.24	\$12.51	\$16.62	\$12.13	\$21.44	\$9.40
							Per adult

NOTE: Assumptions include 8-h workday, 22 working days per month; housing costs based on HUD's Fair Market Rents, apt. w/ separate bedroom for parent(s) and no more than two children per bedroom; food costs based on USDA "Low-Cost Food Plan"; child-care costs from surveys mandated by Family Support Act of 1988, 75th percentile cost; full-time employees assumed to have health care, cost reflects employee's premium, out-of-pocket costs, including copayments.

*PA-NJ Philadelphia Metropolitan Statistical Area (PMSA)—Philadelphia County, 1996.

¹ Includes \$10 for taxi, other incidental travel cost.

² Includes 2 monthly Transpasses (city only) for each school-age child; School District of Philadelphia does not bus most children.

³ Includes one monthly Transpass for school-age child.

⁴ Assumes both adults work in same area; one adult assumes all extra household travel expenses.

considerably from the per trip plus transfer costs they would otherwise face, but that they cannot afford the purchase the monthly Zone 4 TrailPass this commute would require. Purchase of the monthly pass requires an outlay of \$126 at the same time most low-income households must pay their rent.

Need for Funding Beyond Demonstration Projects

Many transportation demonstration projects and provisional transit services have failed for lack of long-term, reliable funding. Welfare recipients and low-income workers without vehicles have complained bitterly that time and again they have gotten settled into jobs, relying on these transportation services, only to have them shut down, leaving them without means to continue to get to work. Some of the problems encountered by non-profit and other nontransit agency providers have been due to inexperience in transportation operations—the programs were not well designed to begin with, but failure to establish guaranteed funding has been a pervasive problem that has caused the demise of many programs that initially appeared well conceived.

Unfortunately, many “experimental” programs have unrealistic performance expectations built into them. Transit agencies, in particular, have imposed their standard operating requirements on new starts. The demonstration period may be too short to build ridership, and supplementary marketing efforts may be missing or misdirected.⁴¹ The best way to raise prospects for self-sustaining service is to aim for as broad a ridership as possible, including nonwelfare recipients. Still, there may be services that are deemed essential for policy reasons, whether they are self-supporting or not. In such cases, this services should be made clear, and the appropriate public subsidies guaranteed.

Resistance from Both Public and Private Sectors to Provision of Subsidies Subsidies are not popular, but they are facts of life. Subsidies are explicit or hidden in virtually every economic arena—food production, housing, foreign trade, and transportation, to name a few. Transit subsidies are particularly unpopular—everyone appears to be looking for a “free ride.” Federal tax policy enables employers to subsidize the commute for both car owners and transit users, but few employers participate in transit subsidy programs, and fewer yet run their own employee transportation systems. Transit agencies know what response to expect when they ask for more public funding or for approval of a fare increase to cover increased operating costs; yet, they are expected to continue costly services without adequate funding.

The public appears not to recognize that thousands of single mothers now must go to work, but most do not earn enough to cover their own commuting costs fully without economic hardship over the long run. If it is a public pol-

icy goal to keep people off welfare, then it is not inconsistent to make it possible for them to get to work—which may be at considerable distances from where they live—by subsidizing their transportation. The private sector should also be expected to help make the commute affordable for its low-wage employees. Asking the public sector to pick up what are essentially business costs for ensuring workforce accessibility may not be an easy “sell.”

Characteristics of Successful Programs

Mandatory Program Coordination and Information Sharing

Two essential features of successful transportation programs for job access are the designation of a lead agency or coordinator to ensure planning consistency and comprehensiveness and the existence of a central data bank that can be accessed by all parties that need information for planning purposes. The responsible agency should be at least at the regional level—such as an MPO—if not the state level; it must be an authority with “clout” (fiscal authority), not a purely advisory organization; and it must have decision-making authority. Unfortunately, experience has shown that without clear delineation of responsibility and some real power, a coordinating agency can be ignored. The coordinating agency should have knowledge of and influence over transportation initiatives throughout a region to avoid the wasteful duplications and the gaps in services that have occurred when planning is highly localized. This is a primary reason for developing and maintaining a central data bank. One of the major impediments to effective and efficient welfare reform planning has been the lack of integrated databases that are accessible to planners and policy makers.

Public and Private Partnerships

Fortunately, numerous examples of fruitful public and private partnerships exist. These partnerships are key to maximizing the utility of existing resources. The most complex kinds of public and private partnerships—like Detroit’s regionwide joint initiatives developed by the Metropolitan Affairs Coalition, the Southeastern Michigan Council of Governments (an MPO), and the regional transit agency [Suburban Mobility Authority for Regional Transportation (SMART), which is described later]—typically require a very high degree of coordination. Simple partnerships, such as the arrangement in North Carolina between a car rental agency and a local service agency to lease donated used cars for \$50 per month to welfare recipients who obtained jobs (32, p. 2), can contribute significantly, but they should not

operate in isolation. Some regional entity should evaluate them and ensure that they operate within some kind of comprehensive plan and that necessary supportive services, such as in this case access to inexpensive but reliable car repair service, are in place.

Flexible Transportation Planning Approaches

States are increasingly recognizing that the use of existing vehicles is one of the most economical ways of getting welfare recipients to jobs and other destinations. Tapping into such resources is a group effort that requires collaboration among agencies and organizations that may have never worked together.

—April Kaplan (47)

Transportation planning for mobility and job accessibility of low-income workers must be tailored to meet the differentiated needs of the target population; the characteristics of the local labor market, such as its spatial concentration; and the needs of employers, such as service to meet shift times. The most successful state programs recognize that there is no "one size fits all" approach, even within a region, and that transit-only assistance programs cannot reach some of the most transportation-needy people. Some examples of transportation options that could improve low-wage worker mobility and access are discussed in the following subsections.

Use of Paratransit—Senior Citizen Transportation Vehicles Typically, paratransit—senior citizen transportation vehicles are in their designated uses for only a few hours a day. In most cases, a dedicated funding stream has been paid for them. This is both a plus and a minus: a plus because the capital costs are largely already covered, and the vehicles are insured; a minus because often the existence of a dedicated funding stream carries with it an exclusive use requirement. Unless there is some way to revise that, these lightly used vehicles may not be available for any other purpose.

Where paratransit vehicles are within the fleet of a transit agency—for example, Southeastern Pennsylvania Transportation Authority (SEPTA) has paratransit vehicles—a funding problem may exist. The nonregular users must pay the agency for the use of the vehicles and drivers. These specialized vehicles are very expensive to operate, and funding for the specific purpose of transporting welfare recipients to work may not be available. If, however, there are empty spaces on any scheduled service runs, there is potential to use these vehicles to transport welfare clients. Detroit's transit system, SMART, runs transit service for seniors and handicapped persons in cooperation with local communities. For a minimal

fee, in addition to SMART's base fare, the vans used for this service will pick up low-income commuters, if space is available.

Use of Nonprofit and Community Organization Vehicles Nonprofit and community organization vehicles are another potential pool of existing multipassenger vehicles that could be used to transport low-income workers. Even in rural areas, many communities have church-owned vans, day care organization-owned vans, and the like. These vans are used for relatively short periods of time and sit idle otherwise. The main limitations are that use of these vehicles for commuters must be secondary to the demands of the organizations that own the vehicles, and again, as with the paratransit vehicles, there may be exclusive use conditions. Insurance should not present a problem; in most cases, a rider can be added to existing coverage without prohibitive expense.

Use of School Buses Highland County, Ohio, is one of several rural areas that allows its school buses to be used to transport welfare recipients to jobs, interviews, and training when the buses are not needed to transport school students. Use of school buses for non-school-related purposes may be restricted by law in some states or by board of education policies. These laws and policies are not necessarily immutable. School buses can be especially valuable transportation modes in very rural areas. Where public transit does not exist and community vans are insufficient, school buses may be the best means of transporting low-income workers to jobs.

Another variation of school bus use is a policy approved by the North Carolina Board of Education and the Department of Public Instruction that allows welfare recipients to ride school buses to jobs in the local school systems if they have no other transportation. In return, the adults serve as bus monitors.

Transit-Supplementary Services New Jersey Transit's "Jersey Jitneys" program uses 24-seater buses to collect 670 commuters per week on a route that links them to the Morris-Essex line, which goes directly into midtown Manhattan. Besides providing efficient transportation to commuters of all income levels, this connector service reduced the need for an expanded park-and-ride parking deck and increased the number of transit riders. The New Jersey Department of Transportation provided funding for two natural gas-fueled buses. New Jersey Transit is offering challenge grants to encourage communities to create their own jitney services.

Numbers of similar services have developed in the last couple of years, making existing transit service more readily usable to people of all income levels. Some like the "Jersey Jitneys" are sponsored by transit agencies,

but others are run by transportation management associations (TMAs) and other nonprofits to fill observed needs.

Nontraditional Transit Services Transit agencies can expand usage of their existing routes and services by offering point deviation service for commuters on some routes, as SMART does in Detroit. When riders board the bus, they give the driver their work destination. The bus travels on the dedicated routes but, when necessary, will turn off to the places of employment. Riders can also request return service. A 25-cent fee is charged in addition to the base fare. SMART has also diversified its fleet mix to include more small buses and vans that can serve scattered locations and populations more cost effectively.

Specialized Commute-Supplementary Transportation Services The Ride-On TMA of San Luis Obispo, California, runs several types of specialized transportation services that could improve the mobility and access of transit-dependent, low-income workers. Among these are a "dial-a-ride" service that is available to those persons needing transportation at times that regular transit service does not operate, a "lunch time express" shuttle that enables workers to run errands during lunch time, and perhaps the most valuable of all, the "children's shuttle" that transports children to and from day care (48).

The Lehigh, Allentown, and Northampton (Pennsylvania) Transportation Authority (LANTA) plans to offer another variation of day care transportation service for low-income working mothers. LANTA has been working with area day care providers to develop a "drop off" arrangement to help transit users who must transport children to day care on their way to work. Day care personnel will meet buses and take the children to day care facilities so that the parents can stay on the buses and not lose time by having to wait for other ones.

Volunteer Drivers A program using volunteer drivers and patterned after the successful, widespread "wheels" programs that serves senior citizens offers some potential, though probably it would work best for occasional or emergency transportation services for low-wage workers. Use of volunteer drivers to transport commuters in private or community organization vehicles keeps transportation costs down, because labor is a large part of the cost of any transit program, but there are some cautions. Drivers must be very carefully screened. Most of the welfare-to-work population are women, some traveling with their children, so the driver's background is very important. Another likely problem is reliability, a weakness of many volunteer efforts. Workers must be able to count on their transportation. However,

this strategy offers a possible bonus: employment for welfare recipients as drivers or qualification as a TANF-eligibility activity. At least one public housing authority is exploring the potential for setting up such a service among its residents.

Car Ownership Programs Access to one's own vehicle provides the highest degree of mobility, so welfare agencies in many areas have encouraged development of programs to place cars with working welfare recipients. There have been some serious problems, however, and several programs have been abandoned. The United Way in Berwick, Pennsylvania, for example, solicited donated used cars that were reconditioned. After 18 months, only two cars had been placed with working welfare recipients, and one of those placements had an unhappy result, with the recipient bringing suit against the donor. Detroit's ambitious Empowerment Through Car Ownership program had problems with cars being vandalized or stolen in the recipients' neighborhoods. Additional difficulties arose from failure of recipients to take proper care of the vehicles, even though they were given extensive instruction before receiving the cars.

Perhaps the most advantageous and workable variation of car ownership for low-income people is car sharing through car-sharing cooperatives. Car-sharing co-ops usually operate with enough vehicles in their pool that if one is out of service, another is available, which is key to people dependent on these vehicles for commuting to work. The joint ownership and sharing of operating expenses, including dispatch management, maintenance, repair, and insurance, bring the cost of access down into the affordable range for many low-income households. Public housing agencies and other institutions, including faith-based organizations, could provide several elements necessary for the establishment and operation of a successful co-op: (a) a critical mass of members; (b) a secure site for keeping the vehicles; and (c) assistance with organization and management.

Inclusion of Wraparound Services

Low-income workers, especially single parents, need transportation services that go beyond the work commute, if they are going to meet their nonwork responsibilities in ways that do not adversely impact their work responsibilities. The child care transportation services, such as San Luis Obispo's "children's shuttle" and LANTA's "drop-off" plan described earlier are examples of the kinds of additional transportation programs that can help keep working mothers on the job. Another critical transportation service for working mothers without vehicles is the "guaranteed ride home." Without this feature, many single parents could not consider long-distance commutes,

such as the PACE express bus routes out of Chicago to suburban workplaces 60 mi (96.6 km) away.

The "comprehensive, coordinated, and centralized" approach of the Greater Richmond Transit Company as a partner in the Virginia Initiative for Employment, Not Welfare (VIEW) provides one model of a full-service transportation program (49, p. 38). This agency runs a transportation database for its VIEW partners, operates "one stop" information services for VIEW participants, and offers the participants a "stratified range of transportation options to include carpools, vanpools, transit, taxi, and shared-ride services." (49, p. 38)

Long-Term Outlook

In general, the "mobility" strategy for connecting welfare recipients to employment should be regarded as a short-term "fix." Welfare reform deadlines create a strong tendency for agencies that are responsible for placing welfare recipients in jobs to connect them with whatever job they can find, wherever it might be. Unless due consideration is given to the impact of commuting time on the individual's family responsibilities and to the real potential of a given job to allow an individual to progress to a self-sufficient wage level, job placements are likely to fail.

Unfortunately, many of the areas with the greatest number of entry-level, low-skill job openings that are suitable for most welfare recipients are just too far away. Few realistically self-sustaining job opportunities are concentrated in transportation corridors, such as the ones served by PACE outside of Chicago. Extensive mapping studies undertaken in both Cleveland and Boston came to discouraging conclusions: most of the job opportunities are out of commuting reach. In Cleveland, the finding was that "even with an 80-min commute, residents from these areas (low-income neighborhoods) could reach less than 44 percent of the appropriate job openings." (50, p. 7) In Boston, 48 percent of existing entry-level jobs "cannot be reached by transit within 2 hours," and "not one of the potential employers in high-growth areas for entry-level work can be reached within 30 minutes by transit." (51, pp. 8, 9)

Financial Sustainability

To be useful to low-income working people, transportation programs must be dependable. This requires adequate and predictable funding to sustain them. TANF and other federal programs provide significant public sector funds that can be used for transportation, but these funds should be considered only transitional. For the longer term, transportation services for low-income

workers should be based on local public funding, private funding, or self-sustaining fares. This should be a guiding principle of any proposed service.

PLANNING FOR ACCESS TO JOBS IN THE 21ST CENTURY

Societal and Economic Importance of Improved Job Access

The political decision to "end welfare as we knew it" carries with it a moral imperative to ensure that those who depended on the welfare safety net, and now must fend for themselves, can in fact do so, with some prospect of certainty. Failure to be cognizant of this and to have the appropriate assistance for job access in place carries with it a very real and very high social cost and a potential threat to political stability. Social tranquility and economic vitality require a solution to the spatial and skills mismatches of labor.

Job-access policies must look beyond the short-term, welfare reform, and time-limit-driven "work first" goals. The jobs that welfare recipients are placed in must have some prospects for advancement to wage levels that are truly self-sustaining. Welfare assistance ends for all able-bodied adult welfare recipients at some point. If they start in "dead-end" low-paying jobs, there is considerable evidence that they may never be able to improve themselves and become economically self-sufficient (35). This concern strongly suggests that access to continuing education and training is as critical as the initial job placement. Transportation planning for low-income populations must include improved links from workplaces and residences to training and educational centers. This development will require more flexible service—perhaps by means other than standard bus and rail routes—and fuller transportation service to these educational and training facilities on weekends and evenings when low-income working people are most likely to be able to use them.

A highly trained, fully employable, mobile workforce has major economic development benefits. Support of this should be regarded as a goal of both public- and private-sector human capital development programs. Because of the direct benefit to businesses, these programs should be expected to take a more active partnership role with educational institutions in providing employees with the necessary skills and education and in assisting employees with transportation access to education facilities, if necessary.

Welfare to work policies should be amended to reflect the fact that low-wage workers need transportation assistance that is income, not time limited. Arguably, workers who use transit or other nonprivate

vehicular modes are entitled to the same degree of consideration as their higher-wage coworkers who drive to work and park for free. When Congress created TEA-21, the equity that it was concerned with was the equity among states in their ratios of gas tax contributions and returns in federal transportation funds. It is time to emphasize a different concept of equity—the social equity of transportation services and tax treatments.

What the Demographic Trends Portend

Women have a labor participation rate that has grown from 37 percent in 1969 to just under 60 percent in 1995, although the rate of growth has been leveling off in recent years. There are important underlying employment trends: more women are holding multiple jobs. As Rosenbloom notes, “almost 40 percent of all women workers do not have a day shift job (defined as a work schedule where at least one-half of the hours fall between 8 a.m. and 4 p.m.). Twenty-three percent of all full time working mothers and almost 60 percent of those working part time not only don’t work the classic 9-to-5 day, they don’t even work most of their hours during that traditional period.” (17, p. 21) Those maintaining such work schedules presumably have managed to cover their transportation and child care needs. But it is dangerous to assume that welfare mothers will have the ability to take jobs in these nontraditional shifts, given the capacity of existing services to help them connect to such jobs and still manage their family responsibilities.

Aside from inadequate off-peak transit services, which preclude many employment possibilities for those persons without vehicles, child care coverage remains a serious problem. Most day care facilities are just that—they do not operate in the evening. Typical day care will be inadequate for many because older children will be out of school and unsupervised for several hours a day. Many child care facilities will not take older children after school, which undoubtedly will contribute to the “latchkey” child phenomenon.

The 1995 NPTS showed an unsettling, growing disparity in household vehicle ownership. While the number of households without vehicles dropped from 13 million to 8 million between 1969 and 1995, the incidence of low-income households and African-American households without vehicles remains disproportionately high. At the same time, the number of households with three or more vehicles has grown during the same period from 3 million to 19 million (13, p. 7). This growth suggests continuing mobility and accessibility access equity issues.

The aging of the population will increase the “sandwich generation” of women who will have elder care, as well as child care responsibilities, in addition to their job

demands (17, p. 22). This, in turn, is likely to increase the number of trips made by women.

Increasingly Mobile Labor Market

In the 21st century, there will be a greater premium on mobility, both in the workforce and in goods movements. In service industries, instant delivery is a trend. In businesses with multiple worksites, such as nursing home chains and retail stores, management will need to be able to shift employees around to meet rapidly changing staffing needs. Flextime employment is growing. Between 1985 and 1991, workers with flexible schedules increased from 12.3 to 15.1 percent of total employment. More businesses are 24-h operations by necessity, as in health care and criminal justice facilities, and for cost-efficiency reasons. This means an increased demand for night-shift and weekend-shift workers. If transit is to serve a significant number of low-income commuters, it will have to provide far more service, spatially and temporally, than it does now. This development would raise serious fiscal and policy issues.

Telecommuting is still in its infancy, but many predict that it will account for a larger share of work-access practices. Directly, this trend may not affect low-skilled, low-income workers, especially those lacking computer literacy. Indirectly, it may create the need for support services (e.g., office supply stores, printing businesses, and food service) that typically employ large numbers of low-skilled, low-wage workers in widely dispersed locations, thus creating new accessibility challenges.

Continuing Location Constraints

The “theory of second best”: Where low density residences in suburban job centers are protected by regulation, they are effectively subsidized for those households that can afford such housing. Households unable to afford residence in such communities may choose the closest substitute available to them: commuting there.

—Jonathan Levine (22)

At least in the short term, transportation planning should focus on finding ways to mitigate long commutes for welfare recipients and for other low-income workers. Opportunities for low-income households to move closer to suburban job centers will be very limited. Affordable housing has been a long-neglected market segment, and it remains to be seen whether any of the new government-provided or non-profit-generated incentives will have any measurable impact on afford-

able housing stocks—rental or sale—in the suburbs. However, in the long run, serious efforts to change exclusionary housing policies are needed. Jobs-housing imbalances are costly to sustain.

Effective Use of New Technologies

Several of the more ambitious transportation programs that involve welfare reform have made effective use of new Geographic Information Systems (GIS) and intelligent transportation systems technologies. Some examples follow:

- Detroit is one metropolitan region that already relies heavily on technology for central dispatching, vehicle tracking, and scheduling purposes and has plans for far more extensive use.

- New Jersey Transit and Gloucester County used GIS mapping to help the transit agency modify routes and schedules so as to pick up the maximum number of welfare recipients. Through geocoding, Rutgers University had determined that 94 percent of all New Jersey's WorkFirst New Jersey/TANF participants lived within one-half mile of fixed-route bus or rail service. Knowing exactly where the participants lived and where they needed to go allowed New Jersey Transit to make modifications to broaden access.

- To improve access of transit riders to child care facilities, SEPTA and the Delaware Valley Child Care Council are collaborating on a GIS mapping project that identifies streets, SEPTA routes, licensed child care facilities, and major employment locations. The information will be presented in map form and distributed to public welfare agencies, job-placement agencies, employers, libraries, and major transit centers.

Research and Data Needs

There is a great need to fill the knowledge gaps and to disseminate the knowledge required for sound planning and program implementation. Consideration must also be given to developing a more relevant evaluation system. Trying to measure the success of welfare-to-work transportation programs with standard transit ridership statistics and other service performance measures is inappropriate—it puts the needs of the transit agency, not the client, first (49, p. 37). Some transportation providers have taken steps to make their services more customer-driven. A transportation task force developed by the Santa Cruz (California) Metropolitan Transit District's Coalition for Workforce Preparation identified the following set of "guiding principles" as useful service and program-evaluation measures:

1. Transportation issues will not constitute a barrier to work or workforce preparation in Santa Cruz County.

2. Transportation will be accessible and affordable for job seekers, students, workers, employers, and their children.

3. Transportation planning for welfare-to-work participants and single parents will take into account transportation for children to school and child care.

4. Transportation will build closer links to the regional labor market for Santa Cruz County job seekers.

5. The transportation system will include workforce preparation and welfare reform as priorities, and will proactively develop flexibility to respond to the emerging needs of single parents, current trainees, and school leavers.

6. Job seekers, trainees, and employers will be involved in transportation planning to the extent possible.

7. Child care planning will include consideration of transportation issues for low-income job seekers, trainees, and their children.

8. Workforce preparation planning will include consideration of transportation issues for low-income job seekers, trainees, and their children.

9. Transportation planning will include consideration of transportation issues for low-income job seekers, trainees, and their children.

10. The Coalition for Workforce Preparation will promote transportation alternatives that do not increase congestion or degrade air quality (49, p. 40).

Few states specifically survey welfare recipients or those leaving the welfare system about their transportation needs. In a survey of the states conducted by the National Governors' Association, the National Conference of State Legislatures, and the American Public Welfare Association, only Kentucky, Oklahoma, South Carolina, Tennessee, and Washington indicated that they specifically sought or intended to seek such information, which is critical to comprehensive and effective welfare reform and job-access transportation planning (53).

Much more detailed research is needed on differences in travel patterns by gender, age, race, income, geographic location, educational and skill levels, and household characteristics (e.g., housing tenure, number of children, ages of children, marital status, number of working adults in the family, work-shift times, and number of jobs per working adult). Rosenbloom calls for research into the observed differences in commuting patterns between genders and among races. She warns against making assumptions about the reasons for these differences (18, pp. 23–24).

Travel demand models have been limited in their accuracy by assumptions made because information

was lacking. Most trip-generation models do not presently have the capability to differentiate on the basis of detailed demographic and household characteristics, even though it is known that these differences do have large impacts on travel decisions. McGuckin and Murakami recommend extensive research on the effects of travel mode on the number, type, and duration of stops, as well as on the effects of density and commuting distance on the probability of trip chaining (14, p. 10).

Data categories and research that have been identified as important to coordinated transportation, social services, and economic development planning are as follows:

1. Demographics, including labor force participation rates, and detailed breakouts for low-income individuals and households by public assistance categories, number of children and their ages, and level of education attained;
2. Transportation system characteristics, especially transit schedules and routes relating to employment centers (especially for low-skill, entry-level jobs), educational and training facilities, child care facilities, and hours of operation for all; private-sector transportation capacities and availability;
3. Detailed travel data, especially for trip-making purposes and reasons for modal choice; effects of part-time employment and nontraditional shifts on travel patterns and traffic loads;
4. Land use data, especially location of affordable housing in proximity to major employers;
5. Economic conditions and business practices;
6. Labor market characteristics, especially spatial distribution and growth rate of entry-level job openings by skills requirements and industry classifications; spatial distribution of entry-level jobs by gender, skills, and qualifications;
7. Regulatory and planning requirements; and
8. Improved communication and planning techniques.

SUMMARY AND CONCLUSIONS

Critical Role of Transportation Planning in Facilitating Access to Jobs in the 21st Century

Transportation is the crosscutting factor in all welfare-to-work planning. It is the function that provides the mobility to individuals that opens up their widest range of opportunities and access to those opportunities and the supportive services they need, particularly continuing education, training, and child care. Furthermore, transportation is essential to achieving full employment of the most economically vulnerable segments of the labor force.

Major Issues and Policy Questions

Efforts to refocus transportation planning for low-income populations should address the following questions:

- Are transportation subsidies appropriate to support the mobility and access needs of low-income populations? If they are appropriate, who should pay the cost and how much? Who decides?
- How can maximum utility of existing transportation capacity—in both the public and the private sectors—be achieved in meeting the travel needs of low-income individuals without vehicles? What modifications are required in regulations, attitudes, and organizations? How can private-sector partnerships be encouraged?
- How can coordination of transportation planning with social services planning be improved? How can institutional barriers be overcome?
- How can input from underrepresented groups be incorporated into planning processes more effectively? What techniques can be used to build trust and gain information from these groups?
- What can be done to develop better estimates of the impacts of economic change and evolving business practices on labor markets, locational decision making, and demand for transportation services?
- Should regulatory processes and mandates be reviewed for relevance, appropriateness, equity, consistency, and impacts on innovation and enterprise? If so, by whom? How often?

NOTES

1. The definitions for “mobility” and “access” used in this paper are those given in U.S. Department of Transportation’s (USDOT’s) *Transportation Statistics Annual Report 1997: Mobility and Access* (4). Mobility is defined as the “potential for movement. It expands the geographic choices available to people and to businesses.” Accessibility is defined as the “potential for spatial interaction with various desired social and economic opportunities.”

2. The American Public Transportation Association lists the following annual costs for a small car (1996 dollars) at \$4,380 for 10,000 mi/year (16,093 km/year), \$5,565 for 15,000 mi/year (24,140 km/year), and \$6,680 for 20,000 mi/year (32,187 km/year) (6). Most single heads of low-income households will not drive more than 10,000 mi/year (16,093 km/year). The average vehicle miles traveled per household for low-income households was about 11,600 mi (18,668 km) in 1995 according to the 1995 NPTS (5, Table 9).

3. One insurance company in Philadelphia charges the following insurance rates for full coverage, with

\$100,000 to \$300,000 liability and a \$500 deductible for drivers with clean records: \$6,200 per year for a 20-year-old single male driving a 1998 Mustang GT Coupe and \$2,600 per year for a 27-year-old single woman driving a 1996 Honda Accord wagon (7).

4. The 1995 NPTS shows that the average age of a vehicle is 10.9 years for low-income families and 8.3 years for all families (5, Table 4).

5. Private vehicles are used for most work commutes: 84 percent for low-income persons; 83 percent for low-income, single persons; and 90 percent for non-low-income persons (5, Figure 2).

6. A detailed check of Milwaukee County welfare recipients in 1995 found that 12 percent of those who would be expected to work under welfare reform laws actually owned vehicles or that members of their households did, even though an earlier survey showed that only 3 percent of this household population owned a car (8).

7. An example of a cutback in services: Loss of federal subsidies led to a reduction of Birmingham, Alabama's, Express (MAX) service by one-half and cancellation of all Saturday service. Alabama does not provide state funding for public transit (2).

8. David Oedel describes how limited transit service excludes minority and low-income job seekers in Macon, Georgia:

The bus system still cannot be relied upon for transportation to most entry-level positions. Such jobs typically require evening, weekend and holiday shifts. At those critical times, Macon's bus system is silent.

Meanwhile, Macon's largest employers are located on the periphery away from any bus line. One result is that the first and most important question on the lips of Macon's employers of unskilled labor is, 'Do you have a car or some other reliable (private) way to get to work?' The absence of a car means the absence of a job, because the bus system is typically useless for a worker. (9, p. 103)

9. The National Alliance of Business commissioned a national survey of employment practices of private-sector establishments in 1998. The survey found that nearly half of all companies use workers from temporary help agencies. Nearly two-thirds of the survey respondents also indicated that they expect to increase their use of "flexible staffing" arrangements (temporary, part-time, contract workers) in the next 5 years (10).

10. Walking and bicycling are not evaluated in this report, even though walking is a much more common mode of travel for the low income individual than with other groups. Single, low-income workers walk for 7 percent of their commuting trips, but all others walk for only 3 percent of their commutes (5, Figure 2).

Bicycling is a minimally used means of commuting for the working poor. Where transit accommodates bicycles, bicycles have the potential to bridge the trip end between final destination and transit stop.

11. One nursing home facility in Delaware County, Pennsylvania, estimates that as many as half of the certified nursing aides and other low-wage, entry-level workers use these services to come to work. It is well known that these "gypsy" vans and taxis exist, but because they are illegal, it is difficult to get "hard" information on them. For the commute from central Philadelphia out to the nursing facility, the average charge is about \$20 per week.

12. The 1995 NPTS sample population of low-income and low-income, single-parent households is geographically distributed as follows: 23.1 percent (25.8 percent) in urban areas, 20.6 percent (24.1 percent) in what are termed "second cities," 11.8 percent (14.7 percent) in suburban areas, and 25.1 percent (17.2 percent) in rural areas (5, p. 5).

13. Work trip data may be obscured somewhat because NPTS breaks down any home-to-work or work-to-home with an intermediate stop (e.g., to pick up or drop off a child) into separate trips for separate purposes.

14. There is a slight discrepancy between the average vehicle-occupancy (AVO) figures in the Bureau of Transportation Statistics' *Early Results* report and in Murakami and Young's report (5) apparently due to different weighting procedures. The former figures show a 1.14 AVO for work trips and a 2.17 AVO for "social and recreational" trips for all households (14, p. 24).

15. Spatial mismatch has been defined as "the disjunction between where jobs are now located as a result of economic restructuring and where job seekers live." (19, footnote 23)

16. Housing has been described as "the basic way we distribute opportunity in metropolitan America." (23, p. 192)

17. One out of three households with circumstances that are characterized by the U.S. Department of Housing and Urban Development (HUD) as having a "worst case housing need" (defined as households with incomes less than 50 percent of the area median income or living in severely substandard housing) are in the suburbs (24).

18. Mark Hughes discounts the other two main strategies—dispersal and development—for addressing regional labor market imbalances. He describes the phenomenon of metropolitan decentralization, a basic assumption of both of the dispersal and development strategies, and gives the following explanation of the inadequacies of these alternative strategies:

[E]mployment and population have relocated toward the periphery while the poor have remained behind

in the core. Dispersal strategies seek to decentralize the residences of poor people from the central city to the suburbs. Development strategies seek to recentralize regional employment from the exurbs to the central city. For the most part both strategies have failed. In essence, dispersal strategists underestimate the politics of the problem: the structure of our metropolitan settlements provides numerous mechanisms to prevent dispersal. Development strategists misunderstand the economics of the problem: jobs have relocated to the metropolitan periphery for reasons that would be too costly to reverse, if they could be reversed at all. (25, p. 294)

19. This assumes that inner-city welfare residents will find well-paying jobs in the suburbs (self-sufficiency wages) and will bring wealth back into the community. This belief is both naive and unfounded. There is a considerable body of study and early postwelfare reports that contradict the notion that low-income "reverse commuters" will bring back more money into their home communities. Studies of welfare recipients in Maryland and in Philadelphia show that most welfare recipients are finding jobs in the lowest-wage categories (e.g., child care, low-end retail, housekeeping, and nursing aides (26; Loveless, S., University of Pennsylvania, Ph.D. dissertation, unpublished) and that actual wages are typically \$5 to \$7 per hour (27). Furthermore, there is no guarantee that if low-income "reverse commuters" make enough money to move to the suburbs that they will choose instead to remain in their typically run-down, underserved neighborhood. Better schools, lower crime, and other suburban advantages may outweigh the comfort of an immediate network of family and friends.

20. Nationwide, between 1980 and 1990, 75 percent of the growth in population occurred in suburban areas, raising the suburban share of metropolitan populations from 58 to 62 percent. The most rapid growth was in moderately large metropolitan areas—2.5 million to 5 million. The larger urban areas experienced stagnation (13, pp. 18, 20). During the same period, two-thirds of total employment growth occurred in the suburbs, raising the total share of jobs from 37 to 42 percent.

21. Both cities also suffered large employment losses as a result of national and global market trends. Boston lost virtually all of its textile and apparel businesses; these labor-intensive industries shifted to developing countries with much lower labor costs. Later, a new computer industry emerged, but workforce-skill requirements for this industry were quite different from those for the textile industries. Philadelphia, long a center of banking and insurance, was a victim of mergers and consolidations with new entities that chose to locate merged headquarters offices in other regions.

Philadelphia, too, had once-prominent textile and apparel industries. They now have passed into the twilight, along with brand names like Stetson Hats and After Six Men's Formal Wear. Many of the jobs lost were relatively low-skilled positions. Only recently has Philadelphia experienced net job creation, but almost entirely low-wage, service-sector jobs with limited advancement potential.

22. Between June 1997 and 1998, the Sarasota-Bradenton area experienced greater than 15 percent growth in its service sector. The Charleston-North Charleston-South Carolina region placed second in service-sector job growth (30).

23. This separation of labor transportation costs from other business transportation costs has led to some perverse business location decisions. A case in point: Asher's Chocolates, an old Philadelphia candy maker, had its manufacturing plant in the Germantown section of the city for decades. Recently, the firm's management decided to move plant operations to Franconia in Montgomery County, a very rural area on the outermost fringe of the metropolitan area. Asher's had a valued workforce, including many second- and even third-generation employees, that management wanted to keep. When management broke the news of the move to its employees, there was great consternation. Management had assumed that the employees would make the move of more than 60 mi (96.6 km) and continue to work for the candy maker. Employees explained that they could not afford to move, and most did not wish to, even if they could. To keep its valued workers, Asher's has decided, for the time being, to bus them from the old plant location to the new plant, a 120-mi (193.1-km) daily round-trip.

24. Some states find comfort in the fact that they have dramatically reduced their welfare rolls since PRWORA was enacted. But failure to look beyond why and how the welfare rolls were reduced will leave the states in poor shape for taking corrective actions should job growth falter. For some states, the drop in welfare rolls is a continuation of a trend that was well established before welfare reform. In addition, most states have adopted far more stringent eligibility requirements for welfare assistance, turning away applicants with admonitions to get help from friends and relatives.

25. Maryland is one of the few states presently engaged in in-depth postplacement assessment. A random sample of 5 percent of exiting cases is drawn each month and profiled. Each individual is recontacted at 3, 6, 12, 18, and 24 months postexit, and information is gathered on such key topics as employment status, earnings and job type, job-retention history, returns to welfare status, recidivism risk factors, length of subsequent welfare spells, and child welfare impacts, especially any foster care placements (26, p. ii).

26. Even Wisconsin, a leader in welfare reform, cannot definitively tell what has happened to those individuals who went off the welfare rolls or to those who have come back on. A study by the University of Wisconsin-Milwaukee of 8,500 recently closed cases found that nearly 70 percent were still receiving welfare, but 3 in 10 could not be found in the administrative data systems (31).

27. In 1998, nearly a year and a half after its state welfare-reform-implementing legislation went into place, Pennsylvania's Department of Public Welfare conducted a telephone survey of welfare clients who had been placed in jobs. Nearly one-quarter of the sample reported that they were no longer working. As negative a finding as this was, it probably under-represents the actual fallout rate, because only respondents who had telephones were included.

28. Household income, after deducting job-related expenses such as transportation and child care costs, may be much less.

29. Maryland's preliminary follow-up study found a 23 percent return-to-welfare rate after 1 year.

30. Among the hard and fast limits on state welfare reform programs are a 5-year lifetime cap on individual eligibility for TANF funds and a requirement that recipients be engaged in least 25 h of work or approved activities per week after receiving TANF assistance for 2 years. These approved activities may include community or volunteer service and a limited amount of training and schooling. States cannot give more than 20 percent of their caseloads "hardship" exemptions from these limits (33). These time provisions are maximums; states were allowed to elect shorter periods for TANF eligibility for their caseloads.

31. This "diversionary" tactic has been used by many public assistance agencies to keep their welfare rolls down by basically not allowing new people on.

32. SSBG funds "may be used to serve families and children up to 200 percent of the poverty level, allowing States to address the needs of the disadvantaged population with a blend of transportation services." (34)

33. Most states have been reluctant to provide any kind of workfare.

34. The Greater Upstate Law Project, Inc., estimates that New York's job gap is more than 900,000.

35. A HUD study found that "a family moving off the welfare rolls when a member enters the workforce as a result of welfare reform is likely to still have the worst case needs for housing assistance, because such individuals typically begin working at a very low wage level." (24)

36. Ohio's implementing legislation requires each county to develop a transportation plan, with articulated policies for meeting the transportation needs of all of its low-income residents who are seeking employment or who are striving to keep their jobs. These plans

must be developed in concert with county departments of human services; with transit agencies where they exist; with any community-action agencies that serve the area; and with representatives designated by board of county commissioners from private, nonprofit, and government entities with overlapping missions. In addition, at the state level, Ohio requires the participation of the Director of Human Services (42).

37. In the absence of regional coordination, several nonprofit organizations operated overlapping services in Philadelphia. As a result, some neighborhoods were well served with transportation options to employment and training centers, while others had none at all. This situation has been replicated across the country.

38. The Southeastern Pennsylvania Transit Authority (SEPTA), the Philadelphia region's transit agency, instituted a "train the trainer" program to familiarize those responsible for placing welfare recipients into training programs and jobs with fare structures, route options, and schedules. SEPTA also produced a very well-received series of pamphlets that give detailed transit alternatives for commuting from six geographic areas of Philadelphia to major job locations in the suburbs.

39. A car provides the optimal mobility. But one of the most significant barriers to using a car—if one is available—is the lack of a valid driver's license. In a Wisconsin study of AFDC recipients who were classified as "expected to work" in December 1995, only 25 percent had a valid driver's license (8).

40. At best, many low-income families will be stuck in poverty, while the head of the household spends hours a day on the "Soweto Express." As a work incentive, many states allow some degree of income disregard in calculating the amount of cash assistance a given household is entitled to. Thus, a working welfare recipient may appear to be better off than one who does not work. However, the cash-assistance supplement does not continue indefinitely, whether a recipient is working a full, 40-h week or not. In a short time, virtually all welfare recipients and their families are expected to be self-sufficient.

41. Transportation providers should market their services to prospective employees as well as to employers. They also should treat these potential new riders as "choice," not "captive," even if realistically these riders have no alternatives.

42. These affordable housing incentives include the Fannie Mae-supported "location-efficient mortgage" (LEM) program that was announced in the fall of 1998. The program gives mortgage credit for transit access and corresponding lack of need for a personal vehicle. Qualifying households are allowed to calculate what they would have otherwise spent on a vehicle and to increase their mortgage eligibility by that amount.

43. The Metropolitan Affairs Coalition developed a very ambitious regionwide transportation program that

will rely on GIS and Global Positioning Systems technology to create a seamless "two-tiered system, with a Community Transit Service level for short, local trips linked with a Regional Transit Service level for longer, multi-community trips...a system using various types of vehicles tailored to customer needs...a technology-rich system offering customers immediate and accurate information about vehicle departure and arrival times, with the flexibility to adapt vehicles and routes to customer needs" (52).

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Proceedings of Conference II

Irvine, California, April 25–28, 1999

Introduction and Overview

Opening Session Summary

Workshop Results: Proposed Research Statements

Closure, Next Steps, and Summary

CONFERENCE II

Introduction and Overview

Conference II on Refocusing Planning for the 21st Century was held at the Beckman Center in Irvine, California, on April 25–28, 1999. The primary purpose of the second conference was to prepare research needs statements for the issues that were developed at the first conference. The conference was attended by more than 70 participants. The diversity of participants that was found at the first conference was also present at the second conference. Many of the participants could be classified as nontraditional customers of the planning process. While the majority of the participants had attended the first conference, there was a sufficient number of new participants to introduce additional issues not raised or fully explored at the first conference.

On the first day of Conference II, the participants were introduced to the results of the first conference. A copy of a draft report on the first conference had been mailed to each participant before the second conference. They also received a presentation on the results of a survey, *Transportation Planning Issues: Needs for Planning Research*, which was conducted by FHWA and cosponsored by 10 organizations. Several presentations from several perspectives on the expectations of research were given. Finally, the results of the first conference were summarized into a strategy for the establishment of a National Agenda for Transportation Planning Research.

The remainder of the conference was devoted to eight concurrent workshop sessions, summaries of which are

not presented in these proceedings. The workshop topics comprised 12 issue areas that were developed at the first conference (see Figure 1 in General Overview: Executive Summary, p. 4). Some workshops were assigned more than one issue area. The participants were asked to follow a five-step process:

1. Review the draft of the Conference I proceedings for the issue area(s) that were assigned to the workshop, including the 73 research items that were recommended from the conference;
2. Discuss recommended areas of research;
3. Identify missing areas or gaps for which research needs statements should be prepared;
4. Develop a strategy for preparation of research needs statements; and
5. Prepare and review research needs statements and submit final copies by the end of the meeting.

Participants were given opportunities to receive a briefing on the effort of each workshop, to suggest additional areas for research, and to move ideas between workshops. At the end of the conference, a panel similar to the panel from the first day reviewed conference products. As a result, 106 research needs statements were produced by the participants. The research statements are summarized in *Workshop Results: Proposed Research Statements* (p. 170). The actual statements are presented in the Appendixes (p. 243).

CONFERENCE II

Opening Session Summary

Martin Wachs of the University of California-Berkeley described the development of the research needs statements and a national agenda for transportation planning research as being analogous to a market like any other market for goods and services. He said, "We have suppliers offering goods and services for sale. Research studies can be thought of as a product like any other commodity or service. Those of us in universities, think tanks, and consulting firms want to sell our research services just like other purveyors of good things. And there are potential consumers of research results, in our case these include federal, state and local agencies, and private sector purchasers of research results. The sellers of research products have ideas and concepts and perceptions of need in mind. The buyers of research whom we may prefer to think of as sponsors have research questions in their minds. We should understand research as the range of activities in which the two sets of interests come together (create a market) and are able to make a deal to actually get something done."

The concept of viewing the development of the research agenda in market terms set the basis for the opening session. Dr. Wachs presented views from the supply side of the market. He concluded his presentation with a number of principles for the development of research agendas:

- "Don't ask a researcher to design a policy. Ask a researcher about the implications of one dimension of a policy in one specific context."
- "It is better to define research topics that are narrow, bounded, and precise than ones that are broad and general. Products of research are more useful when the funding agencies are more clear and precise in formulating their expectations...."

- "There is far too little evaluative research done in the field of transportation planning and policy."
- "The development of new technology and devices and materials are critical parts of a transportation research program, but they must be complemented by research on institutional and organizational issues in transportation and on decision-making processes."
- "It is appropriate to set aside at least a portion of our resources for research support for basic research, for speculative and exploratory work, for researcher initiated studies."
- Research in transportation has been less productive and less useful than it could be because the funding agencies (customers) are not committed to the long-term exploration and development of topics.
- Some topics have been on research lists for a number of years, yet meaningful research has not been accomplished (i.e., there is no market). At the conference, Dr. Wachs said, "let's not be satisfied by just making lists of research needs. We need to do more than that."

Three speakers were present from the customer side:

- Ken Leonard, Wisconsin DOT and Chair of the AASHTO Standing Committee on Planning, Research Subcommittee;
- Paul Larrousse, Madison, Wisconsin, Metro Transit and Chair of the Cooperative Transit Oversight Committee, Transit Cooperative Research Program (TCRP); and
- Sheldon Edner, FHWA.

Mr. Leonard listed four major expectations from research:

- Planning tools that provide the best and most current information;
- Timely information, including quick-response research that can be used immediately and can be widely disseminated;
- Applied research that deals with real world issues; and
- Research that is field-tested and proven by pilot projects and applications.

Mr. Leonard described the new NCHRP Quick Response Research Program 8-36, from which six projects were selected to be completed in 1999. Finally, he described examples of quick-response research needs in Wisconsin.

Mr. Larrousse described the TCRP and illustrated the research needs that were recognized from his experience in running the Madison, Wisconsin, transit system. TCRP is relatively new on the research scene, and in the early years after passage of ISTEA, the program concentrated on applied research. In more recent years, its concentration has been on both applied research and research that is aimed at reinventing the transit industry (new paradigms). The new focus is on systems approaches, institutional and organizational issues, technology improvements, and the role of transit in the future transportation system.

Sheldon Edner described the proposal for the development of a National Agenda for Transportation Planning Research and stated that the output of this conference will form the basis for the national agenda as well as provide input to USDOT research budget requests. He presented the results of the survey on transportation planning issues: needs for planning research. More than one-third of the respondents identified issues that were related to land-use planning and financial and funding planning as key transportation planning issues. Almost 25 percent of the respondents identified issues that were related to intermodal and multimodal planning, including access to alternative modes and modal choices. Between 15 and 20 percent of the respondents cited 5 other issues—transit, socioeconomic concerns, air quality, congestion management and reduction, and public education and involvement. The report on the summary of survey results is under Conference II Resource Papers (p. 179).

The final speaker was Michael Meyer of the Georgia Institute of Technology, who proposed a framework for a research agenda on refocusing transportation planning for the 21st century. "The results of the 'refocusing' conference serve as the basic point of departure for this agenda, but the proposed research framework is designed to allow constant revisions to the agenda to reflect changing societal and technological contexts, many of which we cannot imagine today," he reported.

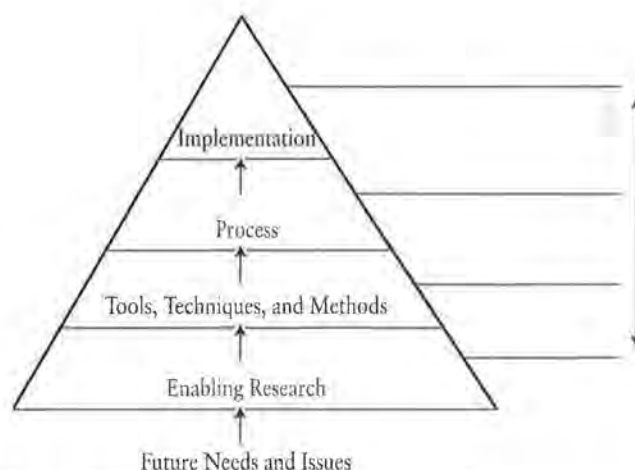


FIGURE 1 Framework for planning research.

Dr. Meyer proposed a framework (see Figure 1) that has five levels of research activities:

- Future needs and issues;
- Enabling research;
- Tools, techniques, and methods;
- Process; and
- Implementation.

Dr. Meyer presented definitions and examples for each research level and illustrated how an issue can move upward (the building-block approach) from enabling research to implementation, with the appropriate feedback loops. "The national agenda for transportation planning research should thoughtfully identify those fundamental issues that lead to insights into the planning context that suggest new tools and approaches for enhancing the planning process and that put in place an early warning system for research needs that will prepare the profession for the exigencies of the future," he indicated.

In his resource paper, which is presented under Conference II Resource Papers, Dr. Meyer grouped the research topics from the first conference into the four proposed research categories. He concluded that the topics are spread among the categories, with the largest number falling into the tools, techniques, and methods and process categories. He also concluded that the list of enabling research topics that were identified in the first conference is a good beginning, but that "it is by no means comprehensive and should be reexamined first at this conference." Citing examples from 2025, *Scenarios of U.S. and Global Society Reshaped by Science and Technology*, he cautioned that "this conference should not concentrate solely on solving the problems of the 1990s, but should anticipate future research needs in the next century."

CONFERENCE II

Workshop Results: Proposed Research Statements

The participants in the eight workshops were asked to follow the five-step process described earlier to create research needs statements. Each workshop received a format for the statements. The format is similar to one that was used to submit research proposals to the National Cooperative Highway Research Program (NCHRP). By the end of the meeting, 106 research needs statements were prepared. It is recognized that some of the statements will be refined by Transportation Research Board (TRB) committees and by review panels during the implementation of the research. There may be some errors or omissions in some of the statements. These errors will also be corrected over time, and they do not affect the basic thrust or need for research in the identified areas. There is also some duplication among the different workshops because of the short time available to prepare the needs statements. Subsequent publications will attempt to minimize the duplication.

The participants were concerned that no effective source or process exists that adequately and accurately describes current research on transportation planning. Several sources of information are available, but none was judged to be comprehensive or up-to-date. Therefore, it is possible that some of the topics proposed here are already the subject of research elsewhere. During the selection of research topics for funding and subsequent scoping of the research work program, an opportunity will be available to incorporate existing research and to

build on past research to avoid unnecessary duplication. However, in some cases, it may be appropriate to conduct research on similar topics from different viewpoints.

The discussion of overlapping research and the building-block approach led participants to make two important recommendations. First, an improved process for identifying, tracking, and disseminating ongoing transportation planning research activities should be developed. In fact, research needs statement 101, identified later in this section, is concerned with the development of such a process.

The second recommendation involves the need to integrate the results of the different kinds of research within a particular issue area, again following the building-block approach. It was recommended that TRB is the best mechanism for accomplishing the integration through various committees, sections, and departmental activities.

The following is a listing of the titles of research needs statements by issue area. Detailed statements are in Appendix B. Note that many of the statements are identified according to Meyers' proposed classification scheme: enabling research (ER); tools, techniques, and methods (TT&M); process (P); and implementation (I).

A MORE ROBUST PLANNING PROCESS

1. To What Extent Do Transportation Investments Result in Economic Development and Growth? (ER)

2. Identifying Emerging 21st-Century User Needs Driving Transportation Services Demand
3. Future Trends and Expected Changes in Goods Movement
4. Barriers to Intermodal Rail Freight
5. Overcoming Institutional Barriers to Multimodalism
6. Role of Planning in Improving the Reliability of Transportation System Performance (ER)
7. Effect of System Reliability on Freight-Sector Planning and Decisions
8. Comparative Benefits of Investments in Management, Operations, System Preservation, and Capacity Expansion (TT&M)
9. Institutional Issues Associated with Addressing M&O in the Planning Process (ER)
10. Quantifying the Benefits of Congestion Pricing for Commercial Productivity
11. Explore How Congestion-Pricing Projects Could Redistribute Financing Responsibility of Transportation Improvements
12. Understanding the Linkages Between Transportation Systems and Sustainable Communities: Evaluating Alternative Plans and Policies
13. Consideration of Environmental Factors in Transportation Planning (TT&M)
14. Identifying and Communicating the Purpose and Need of Transportation Projects (TT&M)
15. Integration of Transportation Corridor and Land Use Planning (TT&M)
16. Defining Disparate Impact in the Context of Environmental Justice and How To Analyze It
17. Methods and Techniques to Better Identify Transportation Issues of Disadvantaged Populations and Costs Associated with Providing Potentially Different Transportation Services for These Populations (TT&M)
18. How Should the Equity of Benefits and Disbenefits Be Looked At in the Planning Process?
19. Understanding Travel Characteristics of Welfare Recipients and Low-Income Individuals (ER)
20. Planning for Effective Coordination of Nonemergency Transportation Services (ER) (P)
21. Systemwide Approaches to Planning for Safety
22. Creative Approaches to Transportation Planning
23. Identifying Transportation Planning Needs of the Future (ER)
24. Applying New Information Technology to Improve the Transportation Planning Process (TT&M)
25. Integrating New Environmental Concerns into Transportation Planning Processes
26. Survey of International Best Practices in Planning Processes and Implementation
27. Resource and Energy Consumption and Sustainable Transportation
28. Using ITS-Generated Performance Data in the Planning Process (ER)

DEVELOPMENT OF A CUSTOMER- AND USER-BASED PLANNING PROCESS (COMBINED WITH CREATING A VISION FOR THE COMMUNITY)

29. What Basic Research is Needed to Develop Customer-Related Planning and to Create a Vision for the Community
30. Users Guide to the Transportation Planning Process
31. Promoting Effective Public Involvement in the Most Challenging Situations
32. Tools for Fostering Stakeholder Collaboration and Dispute Resolution in Transportation Planning (TT&M)
33. Public Involvement and Customer Interaction Analysis for Transportation Decisions (ER)
34. Cultural Sensitivities for Communications with Diverse Populations
35. Measuring the Effectiveness of Internet Tools for Soliciting Public Involvement
36. Tools for Assessing the Effectiveness of Public-Involvement Processes
37. Institutional Barriers to Integrating Public Involvement
38. Incorporating Visioning into the Transportation Planning Process

ALIGNING PLANNING PROCESSES, DECISION-MAKING INSTITUTIONS, AND THE POLITICAL PROCESS TO MEET 21ST CENTURY CHALLENGES

39. Measuring the Impact of Transportation Systems' Decisions in Terms that Matter to Decision Makers and the Public
40. Effectively Defining and Communicating Investment Trade-Offs and Choices for Decision Makers
41. Closing the Gap Between Regional Planning and Positions Taken by Decision Makers and the Public
42. Improving the Linkage Between Decision Making and Accountability Through Performance Audits and Program Assessments
43. Aligning the Planning Process with Faster-Paced Political Change and Participatory Democracy
44. Reinventing Transportation Planning
45. Documenting for Elected Officials the Importance of M&O Investments to Performance of the Overall Transportation System
46. Forty Years of Regional Plans: Critical Review of Lessons Learned
47. Implementing Transportation Plans: Current Practice
48. Administrative Reform at States, MPOs, and Transit Agencies: Integrating Environmental and

Economic Factors into Business and Investment Decisions

49. New Cooperative Relationships for Planning, Design, Construction, Operation, and Management

50. Changing Institutional Capacity of Planning Organizations: Benchmarking Progress

51. New or Reformed Political Institutions: Is There a Better Way to Make Planning Decisions?

UNDERSTANDING THE CURRENT AND FUTURE MOVEMENT OF FREIGHT

This workshop topic identified a number of initial discovery and synthesis needs, research that is needed to integrate freight considerations into the planning process, and additional supporting research that is deemed desirable. Research needs statements were prepared for seven topics. Additional topics were outlined (see Appendix B for detailed reports).

52. Understanding the Freight Industry: Trends and Future Characteristics (ER)

53. Integrating Freight Needs into Regional Land Use Planning (TT&M)

54. Strategic Measurement for Evaluating and Assessing Impacts of Freight-Related Projects (TT&M)

55. Identifying Freight Forecasting Guidelines and Methods (TT&M)

56. Impact of Technology on the Way Commodities Are Purchased and Delivered

57. Land Use and Circulation Implications of Express-Package-Delivery Services

58. Intermodal Terminal Capacity and Access

TECHNICAL PROCESSES, INCLUDING MODELS, ARE UNSATISFACTORY

59. Socioeconomic Research Program for Metropolitan and Nonmetropolitan Areas

60. Techniques for Equity Analysis in Metropolitan Transportation Planning

61. Enabling Research Program on Travel Behavior (ER)

62. Developing Guidelines to Collect Impact and Performance Data

63. System Operation Considerations in Planning Models

64. Integration of Current Travel-Demand Forecasting Procedures with Dynamic Assignment Methods

65. M&O Performance Indicators

66. Multimodal Evaluation

67. Methods for Assessing and Incorporating Public Preferences in Transportation Decision Making

68. Development of a Holistic Ecosystem Evaluation Tool

69. Tools for Assessing the Impacts of Neighborhood-Scale Projects

70. Sensitivity Analysis and Error Assessment in Travel-Demand Forecasting Models

71. Comparison of Forecasted and Actual Travel Impacts

72. Integrating Significant and Emerging Emission-Factor Elements with Travel-Demand Models

73. Techniques for Improving Communication with Community Groups and the General Public

74. Package of Quick-Response Planning Tools for Small Communities

75. Time-Use Research To Support New Generation of Travel and Activity Models

76. Induced Travel and Mode-Substitution Reactions to Transportation Improvements

77. Telecommunication and Travel Interactions

78. Statewide Planning Model

79. Nonmotorized Transportation Research Program

80. Developing Procedures and Tools for Investing in Transportation Assets to Improve the Overall Transportation System

81. Strategic Data Research: Transportation Equity

ROLE AND IMPACT OF TECHNOLOGY ON TRANSPORTATION

82. Technology and Organizations: Learning from Other Industries

83. Bringing Transportation Planning Alive: Use of Advanced Technologies to Enhance the Interactivity of the Transportation Decision-Making Process

84. Using ITS Data to Enhance the Transportation Planning Process

85. Evaluation of Benefits Provided by Information Technology to Transportation System Operation

86. Reexamination of Transportation Planning Assumptions That May Have Become Outdated by Technological Advances

87. Technology Scanning 2025

88. Best Practice Survey Methods for Capturing Information Technology Impacts on Transport Activity

89. Applying Technology to Improve Transportation System Performance Measurement

LAND USE AND TRANSPORTATION

90. Land Use and Transportation Planning Process: Two-Phase Study

91. Transportation Strategies for Successful Redevelopment of Established Areas

92. Analytical Method Using GIS to Evaluate the Potential Transportation and Land Use Impacts of New Land Development, Redevelopment, and Rural Community Development

93. Considering Environmental and Land Use Issues and Community Values in the Transportation Planning Process

94. Techniques To Increase Multimodal Accessibility in Suburban Communities

95. Flexible Approaches to Parking Development

96. Linking Metropolitan Travel Growth and Sprawl

97. Integration of Transportation Corridor and Local Land Use Planning

98. Best Practices in Metropolitan Land Use Planning and Regulation

99. Impacts of New Community and Neighborhood Designs on Household Travel Behavior

PROFESSIONAL DEVELOPMENT

100. Professional Development in Transportation Planning

LINKAGES TO OTHER PROGRAMS AND OUTCOMES

101. Development of a National Shared-Knowledge Network for Social and Environmental Aspects of Transportation Planning

102. Information Sharing Among Planning Processes

103. Rural Participation in Transportation Decision Making

104. Determining and Planning for the Impacts of Tourism on Transportation Infrastructure

105. Analysis of Network Connectivity for Bicycling and Walking

106. Revisiting Vision in the Planning Process

CONFERENCE II

Closure, Next Steps, and Summary

The final session of Conference II was composed of representatives from the Research Marketplace, who represented the supply and demand side of research. The panel members were

- Edward Mierzejewski—University of South Florida, Center for Urban Transportation Research;
- Mary Lynn Tischer—U. S. Department of Transportation (USDOT), Volpe Center;
- Ken Leonard—Wisconsin DOT;
- Ron Fisher—Federal Transit Administration; and
- Ron McCready—Transportation Research Board (TRB), National Cooperative Highway Research Program (NCHRP).

The participants generally agreed that the conference had met its objectives and that the research needs statements prepared at the conference, while being only the first step in refocusing transportation planning for the 21st century, would be valuable in shaping the future National Agenda for Transportation Planning Research. The panel recognized that the initial research needs statements would go through a process of refinement and redefinition by the various TRB committees and by research oversight panels selected for particular projects. It also recognized that there were gaps in the research package, which will be filled in by subsequent conference and committee activities. As one panelist stated, "This is not the end, but the end of the beginning."

A number of salient points were raised during the session:

1. While all researchers would like clearly defined topics, there are some topics and institutional and organizational issues that, by their nature, will be undefined and broad in the initial research.
2. We need to convince elected officials of the payoff of good research.
3. We need to find ways to keep students involved in transportation research when they graduate.
4. The research agenda proposed at this conference is really a refocusing agenda and not an agenda that starts over from scratch. We need to build on past and current research efforts.
5. The proposed agenda reflects changes in our society by dealing with issues of public accountability, rationalization of activities, a holistic approach to transportation that involves many different stakeholders, planning at many different scales, disparate solutions and projects, the blurring of policy and planning decisions, and new areas such as asset management and sustainability.
6. The planning process for the 21st century will require a diversity of tools and consistency of inputs and outputs among the different applications. The underlying concern about data quality continues to be central to the success of the process.
7. There is a concern that some tools, techniques, and methods that have been developed are not being

used because of the lack of knowledge that they exist or because of the lack of resources of some agencies.

8. Quick turnaround research is needed, and with proper administration, it can be conducted without compromising quality. Many of the research needs statements that were prepared at this conference fit into that category.

9. We need to find champions for these research needs, people who will refine the statements, push for funding through the various programs, follow the research through to the development of a usable product, and ensure that the results are broadly disseminated.

10. The overall goal of the research program is to improve the transportation product.

NEXT STEPS: USES FOR THE RESEARCH NEEDS STATEMENTS

The panelists pointed out that the research statements could be used as input for

- USDOT research budget request for FY2000—immediate;
- Selection of projects under the state planning research program, NCHRP 8-36—this summer and fall;
- Selection of projects for the \$21-million-per-year NCHRP project to increase the percentage of the program devoted to planning—this summer and fall;
- TCRP—this summer and fall;

- TRB committees to refine and structure proposals in their areas of interest—this summer at midyear meetings and in January 2000 at the annual meeting; and

- State, regional, and university research programs—ongoing.

SUMMARY

The conference has met or exceeded the expectations of the sponsors and the participating agencies. The preparation of a draft National Agenda for Transportation Planning Research, with 106 initial research needs statements, was a significant accomplishment. As listed previously, there are a number of immediate uses for this information.

Even though much has been accomplished, additional work needs to be done to maximize the benefit of these conferences:

- Review research statements for duplication and combine where appropriate;
- Compare research statements to the first conference lists and identify gaps;
- Examine research statements to create a strategic or program approach, perhaps by using the approach suggested by Mike Meyer;
- Develop a system to track and disseminate information on planning research; and
- Develop a system for integrating the results of the research.

Conference II Resource Papers

Summary of Survey Results

Research Agenda for the 21st Century

Refocusing Transportation Planning for the 21st Century

CONFERENCE II RESOURCE PAPER

Summary of Survey Results

The Survey on Transportation Planning Issues and Needs for Planning Research was developed to solicit input on future research needs from a broad range of transportation professionals and stakeholders. Administered by the Transportation Research Board (TRB), with the cooperation of key stakeholder organizations, the open-response survey encouraged respondents to share their ideas about key issues in transportation planning, upcoming challenges, the resources needed by their organizations, and priority research needs (see Table 1). The varied and thoughtful responses to the survey pro-

vided participants at the TRB Conferences on Refocusing Planning for the 21st Century additional input and information about the views of the transportation community and our stakeholders.

DISTRIBUTION

The survey was distributed between December 23, 1998, and January 22, 1999, to 3,836 members of 10 key organizations. Each organization identified the segments of

TABLE 1 Survey Questions

Key Planning Issues

1. What is your primary role in the transportation planning process?
2. What do you see as the five key issues in transportation planning in the next 5 years?
3. Why? How will the issues you have identified affect you or your organization?
4. What are the most significant recent changes in transportation planning as they affect your organization?

Barriers/Challenges

5. What are the major barriers or problems you face (excluding funding constraints) in dealing with these key issues?

Resource Needs

6. What additional resources could you use to facilitate your work on these issues, assuming sufficient funding?
7. What are your priorities for building the capabilities of your organization?

Research Priorities

8. In your opinion, what should be the priority objectives for transportation planning research in the next 5 years?

their membership to receive the survey. Because individuals could be affiliated with more than one of these organizations, there was some overlap among the distribution lists. The participating organizations were

- TRB (members of Planning and Environment Committees);
- American Association of State Highway and Transportation Officials (AASHTO) (planning directors);
- American Public Transportation Association (APTA) (members of Planning and Legislative Committees);
- Institute of Transportation Engineers (ITE) (Planning Council);
- Surface Transportation Policy Project (STPP) (member organizations);
- American Planning Association (APA) (Transportation Division);
- Association of Metropolitan Planning Organizations (AMPO) (Planning Office directors);
- National Association of Regional Councils (NARC) (Planning Office directors);
- Federal Highway Administration (FHWA) (division administrators, Resource Center directors, and Federal Lands Highways Division engineers); and
- Federal Transit Administration (FTA) (regional administrators).

SURVEY RESULTS

Of the 3,836 surveys distributed, 400 survey responses were received, a reply rate of 10.4 percent. Responses were received from a broad cross section of the transportation community, advocates, and customers. Figure 1 illustrates the proportion of responses received from members of the participating groups.

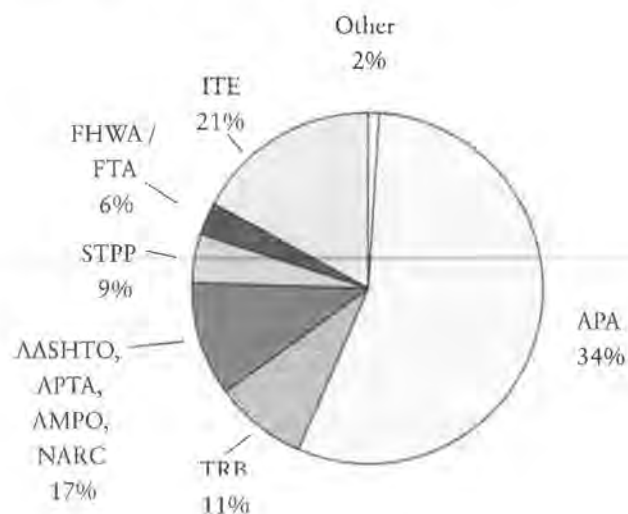


FIGURE 1 Proportion of responses by group.

Key Issues in Transportation Planning

Over one-third of the respondents identified issues that were related to land use planning and financing-funding as key transportation planning issues. Almost 25 percent of the respondents identified issues that were related to intermodal and multimodal planning, including access to alternative modes and modal choices. Five other issue areas were cited by 15 to 20 percent of respondents. These issues were transit, socioeconomic concerns, air quality, congestion management and reduction, and public education and involvement. The results are summarized in Figure 2.

Challenges and Barriers

Among a wide variety of challenges that confronted respondents, problems that related to institutional issues were cited most frequently. These challenges include concerns about public involvement, awareness, and understanding; problems that relate to governance and decision making; and issues that involve effective coordination and partnerships with other organizations.

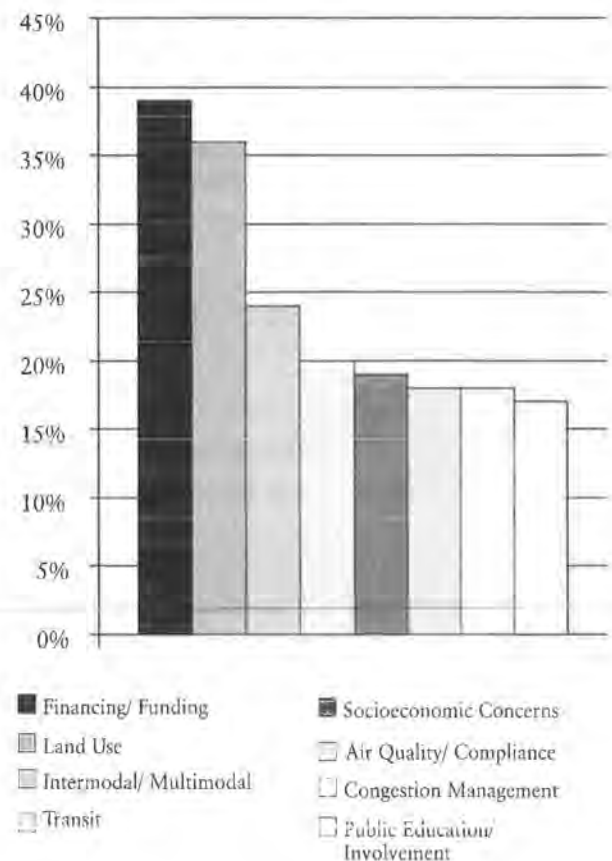


FIGURE 2 Survey results: key planning issues.

TABLE 2 Survey Results: Research Topics Recommended

<i>Research Topic Area</i>	<i>384</i>	<i>Total 100%</i>
Land use planning/issues	97	25.3
Travel demand/travel behavior	68	17.7
Transit	65	16.9
Intermodal/multimodal/alternative modes/mode choice	61	15.9
Socioeconomic concerns	56	14.6
SOV use	40	10.4
ITS/ITS data/ITS integration	38	9.9
Public: involvement/education/information/community/opposition	35	9.1
Planning tools/technologies	34	8.9
Sprawl: reducing/alternatives/urban	33	8.6
Financing/funding	33	8.6
Freight/trucking/CVO/goods movement	32	8.3
Data/databases/accessibility/monitoring	32	8.3
Air quality/compliance	31	8.1
Safety: traffic calming	30	7.8
Congestion: pricing/management/reduction	29	7.6
Regional/local planning/processes/authority	25	6.5
Systems operation/management/access management	20	5.2
Fuels: pricing/alternatives/clean	20	5.2
Cost of investments/projects	20	5.2
Environmental concerns	19	4.9
Old/existing systems	18	4.7
Travel demand management	18	4.7
Streamlining processes/planning/systems	14	3.6
Research programs: application of information/findings	14	3.6
Standardization: design/procedure/over jurisdictions	14	3.6
Government policies/programs/regulations	13	3.4
Measurements	12	3.1
Environmental process	9	2.3
Performance measurement	9	2.3
GIS and modeling/analysis/integration	8	2.1
Staff/ professional issues	6	1.6
Systems planning/regional planning	5	1.3
Corridors: preservation/access/growth	5	1.3
Efficiency	5	1.3
Global warming	4	1.0
Involving elected officials	4	1.0
Maintenance	4	1.0
Liability/legal/litigation	2	0.5
Clean Air Act/conformity	1	0.3
Other	107	27.9
No response	16	

CVO = commercial vehicle operations.

systems (GIS) capability (10 percent), developing more advanced modeling capabilities (7 percent), and additional research activities (6 percent).

Priorities for Planning Research

Respondents were asked to identify their top 5 priorities for research over the next 5 years. The 400 respondents recommended more than 40 topic areas, which are summarized in Table 2. One-quarter of the respondents identified research that was related to land use planning as a top priority topic area. Research on travel demand and travel behavior was identified as a top priority by close to 18 percent of the respondents. Two other recommended research areas closely followed this area: transit (17 percent) and topics related to intermodal and multimodal issues (16 percent). The need for socioeconomic research was identified by 15 percent of respondents. Both research

on single-occupancy vehicle (SOV) use and development and integration of Intelligent Transportation System (ITS) capabilities were recommended by 10 percent of the respondents (Figure 3).

When research priorities were assessed by organizational affiliation, the survey results indicated a significant level of consensus on some research priorities across organizations. Four areas of research were among the top 5 topic areas for at least half of the 10 groups. Every group cited land use research as one of the top five priorities. Socioeconomic research was recommended by 7 of the 10 groups. Intermodal and multimodal research (6 groups) and travel demand and travel behavior research (5 groups) also had strong support across organizations. Other research topics were more often recommended by members of some organizations than of others. Table 3 summarizes the top five research priorities for the members of each group that responded.

CONFERENCE II RESOURCE PAPER

Research Agenda for the 21st Century

Michael D. Meyer, *Georgia Institute of Technology*

As noted in the Conference on Refocusing Planning for the 21st Century (hereafter referred to as the refocusing conference), held in Washington, D.C., much has changed over the 40 years that we have been holding such conferences. Not only are the types of issues different, but the technology of planning has evolved so rapidly that we are now contemplating analyses at the microscale of the individual traveler. Only 10 years ago these analyses would have appeared like something out of "Buck Rogers." As I pointed out in my background paper for the refocusing conference, the future could hold even more challenges for the planning profession.

This paper describes a framework for a research agenda on refocusing transportation planning for the 21st century. This is truly a daunting task given the diversity of interests and needs that are represented by those who plan and by those who (we hope) use the results of this planning. The results of the refocusing conference serve as the basic point-of-departure for this agenda, but the proposed research framework is designed to allow constant revisions to the agenda to reflect changing societal and technological contexts, many of which we cannot even imagine today. This flexibility, after all, is one of the important characteristics of a successful research program.

FRAMEWORK FOR A NATIONAL AGENDA FOR TRANSPORTATION PLANNING RESEARCH

The refocusing conference resulted in substantive recommendations from 52 different workshop areas (see Appendix A: Workshop Reports, p. 199). Each of these workshops provided a list of action items or research needs specific to that workshop topic. These 52 areas were further aggregated into 11 issues that appeared to cut across all topic areas. The overall goal of the research program (the so-called umbrella issue) was to develop a more robust planning process (see Figure 1).

Linking the results of the first conference to a national planning research agenda is difficult without having some framework that shows how proposed research relates to key issues and how one research result relates to another research effort. Simply taking the 11 issues shown in Figure 1 and stating them as research agenda items misses some of the building-block aspects of more fundamental research that is critical in understanding the underlying phenomena being studied. A national agenda for transportation planning research should thoughtfully identify those fundamental issues that (a) lead to new insights into the context of planning, (b) suggest new tools and approaches for enhancing the planning process, and (c) put in place an early warning system for research needs that will prepare the profession for the exigencies of the future,



FIGURE 1 Issues from refocusing conference.

In its simplest form, Figure 2 shows a framework for developing such a national agenda. A key concept in this framework is that there are fundamentally different types of research efforts that build off of one another. At the base of the research framework is "enabling research." This term is borrowed from a recent Transportation Research Board workshop on enabling transportation research (1). Enabling research was defined in this report as "basic and applied research and technology development that supports...long term goals. The characteristics of this type of research that make it appropriate for federal funding are that it is long-term, high-risk, and cross-cutting such that no single private company could manage and benefit from the requisite investment." The six areas of enabling research in support of the long-term goals of the nation's transportation system include

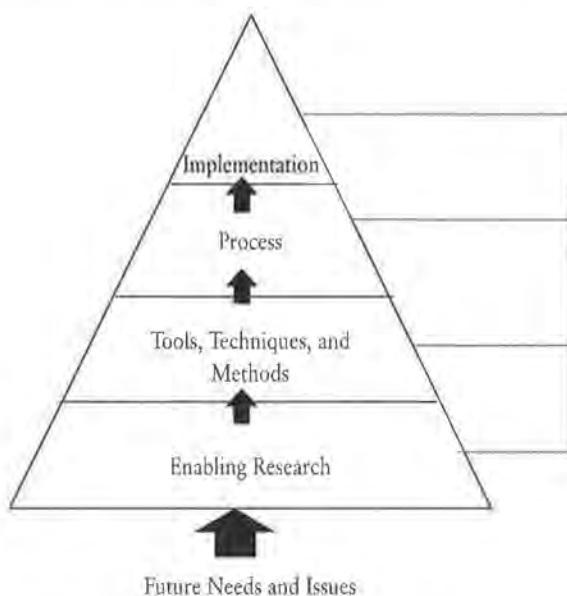


FIGURE 2 Framework for planning research.

- Human performance and behavior (e.g., combating fatigue, reducing human error, enhancing performance, readiness testing, and operator overload);
- Sensing and measurement (e.g., sensors embedded into structures and vehicles to provide information on performance and location, to monitor weather conditions, and to provide real-time weather information);
- Advanced materials (e.g., high-performance concrete, new steel alloys, composite materials and adhesives, and new approaches to corrosion control);
- Computer, information, and communications systems (e.g., systems design and software engineering, wireless communications, integration of the Global Positioning System, and "high-confidence" systems);
- Energy and environment (e.g., advanced propulsion systems with reduced emissions, such as electric drives, flywheels, and hybrid engines); and
- Tools for modeling, design, and construction (e.g., models and simulations to support design and planning, construction, operations, and transportation logistics).

Research in each of these areas was viewed as "enabling" the further development of approaches and technologies that would lead to an improved transportation system.

It is interesting to note that during this workshop, participants concluded that two additional focus areas for enabling research were necessary: (a) focusing on social, economic, and environmental issues and (b) focusing on institutional issues. Both of these focus areas have a significant presence in the research needs that were identified during the refocusing conference.

The next level of research in the framework uses the understandings that come from enabling research to develop alternative tools, techniques, and methods for use in the planning process. An example of this level of research is the Travel Model Improvement Program, an effort to improve systematically transportation modeling in the United States. The enabling research in this context would be a better understanding of travel behavior and urban activity patterns and the relationships between the two. The tools would be the improved models that are based on this new knowledge. Examples of what this type of research can focus on is shown in the following three objectives that were established for this program:

1. Increase the ability of existing travel forecasting procedures so as to respond to emerging issues that include environmental concerns, growth management, lifestyle, and traditional issues;
2. Redesign the travel-forecasting process to reflect changes in behavior, to respond to greater information needs that are placed on the forecasting process, and to take advantage of changes in data-collection technology; and

3. Integrate the forecasting techniques into the decision-making process, providing a better understanding of the effects of transportation improvements and allowing decision makers in state and local governments, transit operators, metropolitan planning organizations, and environmental agencies the capability of making improved transportation decisions.

This type of research should be part of a national planning research agenda, however, not at so dominant a level that resource demands overwhelm other legitimate research needs.

The third level of research in the framework, and somewhat unique to the transportation community, emphasizes the process of planning. Research on the planning process could include the (a) investigation of interrelationships between transportation planning and other planning programs (e.g., transportation and air quality); (b) examination of the steps that are necessary to ensure a participatory and an inclusive process (e.g., public involvement strategies); and (c) assessment of the relationship between the planning process and political decision making or institutional contexts. Research on process is often multidisciplinary and reflects changing demands on transportation planners to produce new information on issues that are of great concern to today's political agenda.

The final level of research focuses on the steps that are necessary to implement new processes or methods, or both. This research could include such topics as innovative outreach efforts to educate customers of the planning process, professional development activities to train the existing professional community, and programs to educate the next generation of professionals. Although, in a strict sense, these activities are not often considered research topics, such investigations are critical elements of successfully translating research results into practice.

The framework that was shown in Figure 2 can be a useful point-of-departure for the development of a national agenda for planning research. One can simply apply this framework by asking questions that relate to each level of research, to the changing needs of society, and to our customers who drive the research agenda. Thus, the following sequence of questions appears appropriate for the development of a comprehensive and coordinated agenda. The first question was the focus of the refocusing conference.

1. What are the current and likely future characteristics of society that will affect travel behavior and how we provide transportation services? (*which leads to*)

2. What are the core economic, technological, and social research needs that relate to these characteristics, and which are necessary before the development of

tools, methods, and processes that will allow transportation planners to provide useful information to the decision-making process? (*which leads to*)

3. What tools, techniques, and methods are needed to better assess the impact of changing system and community factors? (*which leads to*)

4. What are the desirable characteristics of the planning process that not only use the outputs of these tools and methods, but also reflect a more responsive and open participatory approach toward planning? (*which leads to*)

5. What steps are necessary to implement both the process and the tools in a way that is understandable and useful to users and customers alike?

As an illustration of this construct, the following sequence of questions relates to one of the key demographic characteristics of the future—an increasingly older population. A possible research agenda on this issue might include the following:

- *Issue:* The percentage of urban Americans that are elderly will increase significantly over the next 20 years.

- *Enabling Research:* What are the important relationships between age and travel characteristics, especially given the likely mobile nature of tomorrow's older Americans?

- *Tools:* How do we incorporate consideration of an aging population into demand models and service strategies to reflect this increasingly important travel market?

- *Process:* How do we include the concerns of older Americans in the planning process, and which groups should be invited to represent this constituency?

- *Implement:* What outreach strategies can be used to educate this population (one that is likely slower in visual acuity and reading comprehension) on transportation needs and choices?

Note that in Figure 2 there are feedback loops so that discoveries or needs at higher levels of the research hierarchy provide input into fertile research directions that should occur at more fundamental levels. Thus, for example, process changes that require a closer linkage between transportation and sustainable communities might well need new tools and methods to measure "sustainability" in the context of transportation, which in turn, may require more fundamental research that examines the social, economic, and environmental relationships in an urban ecology. A successful national research agenda is constantly updating research needs as the decision-making context changes and as more information about the needs of the planning process becomes available.

APPLYING THE FRAMEWORK TO THE REFOCUSING CONFERENCE

If one accepts the framework presented in Figure 2 as a plausible approach toward defining research needs, then the results of the refocusing conference can be applied to this framework to determine where gaps might occur in a comprehensive research agenda. Figure 3 shows the 11 crosscutting issues that were defined in the first conference and how they map onto the framework. Note that it is possible for each issue to consist of research needs at all levels of the hierarchy. One of the observations that surfaces from this mapping is that the research category that relates to tools, techniques, and methods appears to be underrepresented. However, further disaggregation of the 52 workshop research topics shows, in fact, a more balanced set of research needs. These results are shown in this paper's appendix.

With this finer level of disaggregation of the research projects, we continue to see the importance of process-oriented research topics. However, the category of research on tools, techniques, and methods becomes much more expansive with ideas for tools and methods that span a variety of topics. The results of the refocusing conference thus provides a good point-of-departure for the identification of a national agenda on transportation planning research in each of the categories shown in Figure 2.

MY OWN THOUGHTS

The process of identifying a national agenda can be "directed" in a variety of ways. As noted earlier, a logical starting point is the identification of enabling research, that is, those issues, societal trends, and needs for knowledge that lead to subsequent research on the planning process and the tools that are used in this



FIGURE 3 Crosscutting issues applied to framework.

process. A national research agenda for transportation planning should anticipate the information needs of future decision makers and immediately put in place the creation of knowledge that will inform these decisions. Although the list of enabling research topics that is presented in the appendix of this paper is a good beginning, it is by no means comprehensive (and thus should be examined first at this conference).

To provide some imagination to this process and to "test" the comprehensiveness of the refocusing conference results, I have listed the following scenarios from a recent "futures" book. As noted by the authors, "these high-probability forecasts become assumptions in understanding how any particular area may develop under the influence of new scientific, technological, social, political, or economic developments...the convergence of evidence indicates that these 107 developments are of such high likelihood that they form an intellectual substructure for thinking about any aspect of the year 2025" (2). Only those forecasts that are directly relevant to transportation or to travel behavior are listed here.

- Everything will be smart, that is, responsive to its external or internal environment.
- More people in advanced countries will be living to their mid-80s while enjoying a healthier, fuller life.
- Remote sensing of the earth will lead to monitoring, assessment, and analysis of events and resources at and below the surface of land and sea.
- Per capita energy consumption in the advanced nations will be at 66 percent of per capita consumption in 1990; such consumption in the rest of the world will be at 160 percent of 1990 per capita consumption.
- Throughout the middle and prosperous class of the advanced nations, face-to-face, voice-to-voice, person-to-data, and data-to-data communication will be available to any place at any time from anywhere.
- Ubiquitous availability of computers will facilitate automated control and make continuous performance monitoring and evaluations of physical systems routine.
- Virtual reality technologies will be commonplace for training and recreation and will be a routine part of simulation for all kinds of physical planning and product design.
- The fusion of telecommunications and computation will be complete. We will use a new vocabulary of communications as we televote, teleshop, telework, and tele-everything.
- New infrastructures throughout the world will be self-monitoring.
- Interactive vehicle-highway systems will be widespread...rather than reconstruct highways, engineers may retrofit them with the new technologies.

- Applied economics will lead to greater dependency on mathematical models embodied in computers. These models will...routinely integrate environmental and quality-of-life factors into economic calculations. One major problem will be how to measure the economic value of information and knowledge.
- Family size will be below replacement rates in most advanced nations.
- The majority of the world's population will be metropolitan, including people living in satellite cities clustered around metropolitan centers.
- NIMBY [not in my back yard] will be a global-scale problem for a variety of issues, ranging from hazardous-waste disposal to refugees to prisons to commercial real-estate ventures.
- Worldwide, there will be countless virtual communities based on electronic linkages.
- The absolute cost of energy will rise, affecting the cost of transportation. Planners will reallocate terrain and physical space to make more efficient use of resources. In other words, cities will be redesigned and rezoned to improve efficiencies in transportation, manufacturing, housing, etc.
- Sustainability will be the central concept and organizing principle in environmental management, while ecology will be its central science.
- Going to work will be history for a large percentage of people. By 2020 or 2025, 40 percent of the workforce will be working outside the traditional office.
- Privatization of many highways, particularly beltways and parts of the interstate system, will occur.
- Fuel cells will be a predominant form of electro-mechanic energy generation.
- 120-mi-per-gallon cars will be in widespread use. (2)

If these are indeed likely characteristics of the future, my own list of enabling research that should be found in a national agenda for transportation planning research is shown in the following list:

- Sustainable development, equity, and urban ecology;
- Technology and its impact on urban form, travel behavior, and planning;
- System management in its broadest sense; and
- Demographic changes and implications for transportation planning.

Although there are only four topics listed, each could be expanded to include a variety of different emphasis areas. These topics correspond nicely to the enabling research topics identified in the appendix of this paper. The enabling research provides "point-of-departure" knowledge that leads to other research needs that more directly affect the actual process of transportation planning.

SUMMARY

This paper has suggested a framework for conceptualizing a national agenda for refocusing transportation planning research. In addition, it has suggested areas of research for the initial step in the creation of an agenda-research that should lead to additional research that is more focused on process and tools. Such a framework is necessary to organize and link different research initiatives while providing a bridge to likely future issues.

There very well might be additional enabling research topics that are deemed important by this conference. However, this conference should make sure at the outset to have in place a research agenda that will provide the information and knowledge that is needed and desired to inform future policy and policy decisions. With input from the refocusing conference, we have taken a giant first step in defining the starting point. This conference will hopefully get us to the next level of detail and relevance.

APPENDIX: RESEARCH IDEAS LISTED BY CATEGORY

Enabling Research

- National poll to determine public satisfaction and desire for transportation service
- Understanding and support for management and operations
 - Freight industry and movement of cargo
 - Relationship between technology and travel behavior
 - Technology and planning for sustainability
 - Understanding information transfer and role in community
 - Parking

Tools, Techniques, Methods

- Research on economic development and quality of life improvements that will help local groups understand impacts
 - Produce tools, methods, and data to produce information for decision makers on relationship between transportation and broader issues
 - Tools and techniques for freight planning
 - Develop national and international freight-flow model
 - Demographic and economic changes need to be reflected in models
 - Management and operations consideration in analysis tools

- Benefit-cost approaches
- ITS data
- Performance measures
- Policy-sensitive models
- Access-to-job factors in models
- Incorporate outcomes into analysis methods
- Multimodal analysis tools
- Better air quality tools
- Quick response tools
- Multiobjective tradeoff analysis
- Sketch planning tools
- Database integration
- Revenue-forecasting techniques
- Induced travel
- Better pedestrian models
- Efficient motor vehicles

Environmental impact analyses of technology options

- Growth management-related tools
- Tools to analyze redevelopment potential of existing neighborhoods
- Multimodal infrastructure options
- Incentive programs for transit-oriented development
- Trip capture analysis
- Alternatives to an auto-dominated environment
- Comprehensive data on pedestrian use and safety
- Transit deregulation

Process

- How to engage the public and agencies in the planning process?
 - Best practices on community engagement
 - Public involvement and National Environmental Protection Act (NEPA) requirements
 - Better means of communicating with and gathering information and ideas from public
 - Toolbox for planning outreach
 - Who will be customer of the future?
 - Evaluate outside reviews
 - Decision making and accountability-best practices
 - What is planning influence on decision making?
 - Identify relationships between transportation and broader outcomes
- How to shorten turnaround time for plan analyses and processes?
 - How to make tradeoff analysis more understandable and useful to public and decision makers?
 - Historical perspective on effectiveness of regional plans
 - Strengthening criteria of the Intermodal Surface Transportation Efficiency Act of 1991 in plans and programs

- Create decision mechanisms that more closely tie plans to implementation
 - How to break down planning activities into manageable units?
 - Should an empowerment zone for planning be created?
 - How to place planning in larger context of community responsibility and values?
 - Best practices for visioning
 - Planning approaches for freight
 - Synthesize best practices on freight issues in transportation planning
 - How to bring waterway representatives into the planning process?
 - Better integration of technology choices into planning process
 - Broaden scope to include systems perspective
 - Increased participation of the private sector in planning
 - Integration of transportation and land use planning
 - Models on new cooperative relationships
 - Institutional roles and responsibilities for sustainability
 - How to incorporate NEPA into business decisions?
 - Models for multimodal decision making
 - Incorporating system engineering and operations planning into planning process
 - Best practices on aligning planning and programming
 - Rural and public lands best practices for transportation planning

Implementation

- Development of advanced software packages that provide forecasting capability
 - Better information on international regulations, activities, and planning
 - Professional training-capacity
 - Federal funding support for institutional capacity building
 - Educate public land managers

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Refocusing Transportation Planning for the 21st Century

Martin Wachs, *University of California–Berkeley*

As the director of a major university transportation research center, I am honored and pleased to have been included in this program in which we are exploring the contributions that research can make to the refocusing of transportation knowledge and planning practice. It is actually quite rare that line agencies or federal funding programs try to assess what research can provide and what it cannot do. But it is important to think strategically about research just as it is to think about planning and policy matters that hopefully are informed and improved by good research.

It is probably useful to conceive of the world of research as being analogous to a market like any other market for goods and services. We have suppliers who offer goods and services for sale; research studies can be thought of as a product like any other commodity or service; and those of us in universities, think tanks, and consulting firms want to sell our research services just like other purveyors of good things.

There are also potential consumers of research results. In our case, these customers include federal, state, and local agencies, and private-sector purchasers of research results. The sellers of research products have ideas, concepts, and perceptions of need in mind; and the buyers of research, whom we may prefer to think of as sponsors, have research questions in their minds. We therefore should understand research as the range of activities in which the two sets of interests come

together and are able to make a deal to actually get something done.

At conferences like this one, the vast majority of participants are customers in this research marketplace—the people who labor to solve complex problems in the world of policy and planning (e.g., public officials, consultants, or representatives of interest or advocacy groups). The problems and issues that planners and policy makers address typically include many dimensions—for example, technological, organizational, political, and fiscal. They involve conflicting objectives, such as providing more cost-effective transportation service at the same time as minimizing environmental damage, providing social and economic opportunities to disadvantaged populations, or promoting the political agendas of those who pay our bills.

Most people in these problem-solving roles make decisions and promote progress by relying on a very wide variety of resources in support of their complex assignments. They have to rely to a great extent on (a) technical analysis conducted by their staffs; (b) modeling and software that are produced by consultants; (c) federal regulations and rules; (d) critical comments and advice from citizens' committees and elected boards of directors; (e) skills and knowledge acquired from their own education; (f) information from the latest journals and technical reports (when time permits); and (g) instinct, experience, judgment, and political pressures to guide them in particular situa-

tions. Researchers have to think broadly, integratively, and synoptically so as to synthesize strands of insight from many fields, studies, and experiences so as to address their current questions.

People working in the policy world view research as finding answers to their most immediate and pressing questions in a short time. An example of such a question is "What could we do in this region to increase the modal share of public transit from 5 to 25 percent over the next 30 years?" This is really not a question that is amenable to a meaningful answer by a researcher, but it illustrates the type of questions that is often posed to researchers by agency directors and other clients of research. Many of the questions that were identified as potentially promising areas of research at the first refocusing conference in Washington, D.C., had this character. They were statements of the most pressing problems that face real-world decision makers—for example, that research is needed on ways to better engage the public in the planning process and how to more accurately measure the effects of transportation investments on economic development. These are broad, strategic questions of great importance in public policy, but are they really effectively addressed by research?

Most of us researchers, in universities, think tanks, or consulting firms, enter this research marketplace for a number of reasons. First, we have an interest in some specific body of knowledge. Second, we believe that there is a great deal more to learn in that area, and third, we want to sharpen and hone our knowledge in that area.

Whereas policy requires synthesis, we specialize in analysis. Researchers are good at breaking problems down into component parts and looking at those parts one at a time. We're not very good at building up complex answers by blending together a lot of component parts. Don't ask a researcher to design a policy, but ask a researcher to identify the implications of one dimension of a policy in one specific context.

Researchers specialize, and thus go deep and narrow, in travel demand forecasting, traffic operations, geographic information systems, maintenance and replacement of pavements, or transportation demand management. Research in these areas tend to make us not only smarter and more insightful but also narrower. If you ask a researcher what is the most pressing research need at the moment, he or she is likely to say that funding is desperately needed to study the distribution of error terms when the log normal form of the multinomial logit model is applied to non-home-based work-related trips!

We could say that the researcher comes to the research marketplace wanting to gain more and more knowledge about narrower and narrower subjects. But of course the logical consequence of trying to learn more and more about ever more narrowly defined prob-

lems is that, in the limit, we will know everything there is to know about nothing. The public policy maker or decision maker who hopes to make better decisions comes to the research marketplace wanting to gain a little more useful knowledge about more and more subjects. But of course the logical consequence of trying to learn a little bit about a growing number of issues is that, in the limit, we will know nothing about everything. There is danger in either going ever broader or ever deeper.

Somehow our process of defining research topics, allocating funding, gaining support for research, writing research proposals, and so forth, tries to start from these different perspectives of finding a meeting of the minds so that a transaction can take place in the research marketplace. You want me to offer the use of my research background, skills, and data to solve your particular, most pressing, current problem; I know only a little about your particular problem, but I want your money to address the problems that are of intellectual and professional interest to me. We barter, negotiate, and agree on the terms of a research contract. In the end, we are both dissatisfied because you find my work too abstract, too intellectual, and not quite specifically helpful to your current and pressing problem, and I find you unappreciative of the sophisticated analysis I have done.

In a marketplace you can sometimes find quality goods and sometimes you can find junk. You can find genuinely crafted products, and you can find cheap imitations. There is often a demand in the marketplace for each. This is true in the marketplace for research as well. Very often, I find that people in the public policy arena want to call upon me as a researcher to "validate" something that they know in their gut is true or to "prove" that some particular approach to resolving a problem is consistent with findings in the research literature. You are often most delighted with research results when they provide you with a vote of confidence for what you instinctively know to be true; and decision makers are often outraged and disappointed in research results when they tend to suggest the opposite—that some carefully constructed public policy is not likely to achieve its intended and hoped-for objectives. There is a natural human tendency to define research as good in quality when it supports your preconceived notions and as "deeply flawed" when it does not.

Yet researchers by nature are trained to be eternally skeptical. We are always trying to test findings that appear to be promising by trying out generalizations in new circumstances and by testing the limits of what appears to be true to find out the conditions under which these generalizations are no longer true. Often, this proves enormously frustrating to policy makers. It's easier to buy junk research—quick and dirty studies that

prove something we intuitively know to be correct—than to stick with high-quality research that remains skeptical and goes ever deeper to try to test the limits of truth. I want to illustrate this assumption by using as a case the relationship between transportation and economic development. Virtually every supporter of a proposed highway project, a subway project, a port expansion, or an airport renovation wants to make the argument that this project, if built, will contribute to the economic wellbeing of the area—that is, economic development benefits will make the project worthy of the costs, and it will be an investment in jobs, economic efficiency, and so forth.

Invariably, research is commissioned to prove that the economic benefits of an intended project are indeed significant. One of the most competent young researchers in this field is Marlon Boarnet, who is right here at the Irvine campus. I've studied his research really carefully. He has looked at a number of studies of economic benefits from highway and transit investments, and his findings are rather disturbing. Those studies showing most unambiguously that highway and transit investments create net economic benefits tend to be methodologically the most flawed. The most thorough and rigorously conducted studies raise the biggest doubts. The studies tend to show that most of the benefits are the result from redistributions of economic benefits that would have occurred elsewhere had the projects not been built, instead of as a result from the creation of net benefits.

In other words, the studies that give the answers that are most desired by the policy makers are the studies that are the weakest when criteria of good research are applied to them. When rigorous research is done, it tends to be unable to sustain the conclusions that the policy makers want most from the research. This inability tends to cause policy makers to prefer to fund cursory, shallow research that gives them results that support their gut reactions, while at the same time, decrying research that other researchers think of as brilliant but that decision makers find indecisive or unhelpful. There may be a great market for schlock, while the work of the true craftsman is left on the shelf. This thought may be very disturbing, but it is an extremely important insight.

By using the notion of a marketplace as a metaphor, we might ask, Are there some principles that we can bring to this marketplace that will help us make it more productive for both researchers and for those who are engaged in public policy making? What should we expect is possible from research, and how can we get research results that are more useful and more valid at the same time and also more timely?

I can think of a few general statements that I would like you to consider as you conduct your workshop dis-

cussions over the next few days. These statements grow out of this notion that if there is a "market" for research, there has to be, at some point, a meeting of minds between the buyer and the seller to address ways in which, I think and hope, these perspectives can be brought closer together.

First, it is better to define research topics that are narrow, bounded, and precise than to define topics that are broad and general. Researchers are unable to respond as effectively to calls for general thrusts in research as they are to specific requests for analyses and evaluations. Products of research are more useful when the funding agencies are more clear and precise in formulating their expectations from research. This task is hard to do, but it is a mistake to place the burden for doing this on the researcher alone.

Second, there is far too little genuine evaluative research being done in the field of transportation planning and policy. We are constantly implementing new concepts or applying older concepts in new contexts. An enormous amount of learning could take place if we did genuine, unbiased evaluations of many more of those applications. Too many transportation innovations are unstudied, and perhaps even worse than that, too many innovations are evaluated in cursory and politically motivated ways so that real lessons are not learned at all. We cannot admit our failures, so we pursue our self-interest by declaring every experiment a success, and we apply weak and self-serving evaluation techniques. Research would be more useful and valuable if we funded truly independent evaluation studies of experiments. The Federal Highway Administration and the Federal Transit Administration could play an enormously valuable role if they insisted on truly independent and truly rigorous evaluations of new transportation projects and services. Examples of these projects and services include land use impacts of capital investments, social or economic effects of construction programs, rail lines, and commuter bus lines.

Third, the development of new technology, devices, and materials are critical parts of a transportation research program; but they must be complemented by research on institutional and organizational issues in transportation and on decision-making processes. In addition, people who are interested in planning and environmental issues must insist that our research programs should be more balanced to include these softer issues as well as the traditional harder topics. I think often of the really exciting work being done on smart vehicle technology, which blends telecommunications and transportation. But as we go deeper and deeper into intelligent transportation systems research, we really are not doing enough on the institutional and organizational aspects of these technologies. How human beings respond, how organizations respond, and how planning

should respond to ITS are issues that are in enormous need of research attention. Engineers think that the technical dimensions of these issues are the interesting parts; planners deny the significance of the whole endeavor; and there is no meeting of the minds in the critical realm of organizational processes that promise true social progress.

Fourth, it is appropriate to set aside at least a portion of our resources for research support for basic research, for speculative and exploratory work, and for researcher-initiated studies. In comparison with other fields, such as medicine, health sciences, physics, and chemistry, the client agencies for research in transportation call for specific project-related products, and creativity is not given a sufficient chance to blossom on the basis of the initiatives of the researchers themselves. The research in transportation is, by comparison with other fields of endeavor, too much driven by crises, current needs, and short-term interests. We suffer from discontinuities and from lack of depth, because we are unwilling to sustain our research programs over a long period of time.

Fifth, research in transportation has been less productive and less useful than it could be, because the funding agencies don't have sufficient "stick-to-it-tiveness." Studies are initiated, and before they can be refined, perfected, and fully developed, they are dropped as we pursue other areas that have become more faddish. We discard the older topics before the researchers develop a sufficient understanding to make the results usable. In the 1970s, we had an active and a creative research program in travel demand analysis and forecasting, and we let it languish. Now, some are trying to rebuild that program with the Travel Model Improvement Program and are having an extremely difficult time. The discontinuities in this program have been enormous, and today we are paying dearly for long lapses in our commitment to conduct research in this field.

Sixth, I would like to note that some areas of transportation research have been on the list of topics that

need to be researched for decades. Yet, we have failed to create the marketplace in those areas to actually enable a meeting of the minds between those individuals who need the results and those who might be willing and able to do it.

Once again, the first refocusing conference in Washington identified a need for research in goods movement. Goods movement will be one of the major areas of growth in traffic, an area in which environmental policy will be pushing (diesel engines and particulates). Every major research conference on transportation for the past 25 years has listed better models, better data, better forecasts, and better analysis tools for goods movement as a pressing research need. I would predict that this conference will do the same thing. But why have we not started a major research program in goods movement? Why are there so few projects funded and so little to call on in the way of research results? Every organization thinks that goods movement is an important topic, but not one has the responsibility to invest resources in a program or sees it as a topic for which it has a particular competitive advantage. In other words, no market exists in which there are real suppliers of needed resources for research on goods movement nor are there real bidders who are pressing to do more research in goods movement. Therefore, we remain content to give goods movement research a place on our lists of things to do, but we never get around to doing it.

If you want to make a genuine contribution to research in the public interest over the next 3 or 4 days, try to structure research and strategy programs for creating markets in research. Also, after we leave here, try to get your organization to become involved in creating those markets in which clients and purveyors of research might actually meet. Please commit yourselves to answering questions honestly and to intellectual rigor and honesty in the research that you do in transportation. Don't be satisfied at this conference by just making lists of research needs. We need much more than that.

Appendixes

Conference I Workshop Reports

Conference II Research Statements

Participants in the Conferences

CONFERENCE I

Workshop Reports: Monday, February 8

IF NOT LEVEL-OF-SERVICE AND VOLUME-TO-ROAD CAPACITY RATIOS, THEN WHAT?

Reporters: Diana Carsey, Juanita Wieczorek, and William Wilkinson

At present, transportation planning uses level-of-service (LOS) and volume-to-road capacity (V/C) ratios to evaluate whether a transportation improvement is needed or to prioritize competing improvements. What other measures should be used in addition to LOS and V/C to approach these decisions?

There are two kinds of worlds. In one world, people are unable to continue to build new capacity; in the other world, people are developing new ways to respond to capacity needs. These new ways require more coordination with previously (apparently) unrelated fields and activities. The key concern will be to better manage what we have.

Action Items

- Educate transportation planners on the value of systems operations data.
- Educate transportation planners on Intelligent Transportation Systems (ITS) architecture.
- Equip all transportation systems with technology for gathering data.

- Understand how systems operate so that they can be better managed.
- Understand how related systems operate so that commonality of purpose can be developed across disciplines.

Research Needed

- Data
 - Need a model for sharing data between local operators and regional or state planning agencies.
 - Need a model for getting information from non-transportation data collectors.
 - Need a model for standardizing handling of data.
 - Identify data-collection techniques that meet public needs.
 - Define a model in which various stakeholders can interpret transportation data effectively.
- Define performance measures for new elements of the transportation picture.
 - Nonrecurring incidents
 - Personal mobility
 - HOV use
 - Quality of life; quality of travel—in terms of extent, duration, intensity, variability, and causality
 - ✓ Access to services, jobs, and entertainment
 - ✓ Availability of goods
 - ✓ Time of travel (by any mode) to destinations
 - ✓ Walkability

- ✓ Ability to live without a car
- ✓ Neighborhood interaction (friendliness factor)
- ✓ Safety—Do kids play? Do kids walk alone?
- Goods movement—Allow quality measures to differ between communities; develop a basket of measures that can be used.
- Measure more than auto mode—measure bicycles, walkers, etc.
- Rethink the transportation planning process at the state and metropolitan planning organization (MPO) level for the new millennium.
 - State-of-the-art analysis—See what others are already doing in areas in which capacity expansion is not an option; compare and develop a best practices for others to use.
 - Develop an analytical model that begins with goals or objectives. Strategies would be used to develop policy. Performance would be defined by desired outcomes. Don't use feasibility too early in the process because it reduces choices and closes down analysis of options.
 - Develop a model for including land use in transportation decisions.
 - Develop a model for transitioning from planning a "build" environment to planning a "management" environment. What skills will be needed to manage the transportation from a planning perspective?
 - Reexamine the role of demand management in the decision-making process.
 - Define how quality-of-life (QOL) measures can be used as a coefficient to evaluate transportation projects (QOL = people-capacity).

THROWING OUT THE MODEL AND DETERMINING SOLUTIONS SOME OTHER WAY

Many participants agreed with throwing out the model, but others wanted to keep it and use it as a tool for quantitative transportation analysis. One person thought that the model had already been thrown out.

Items of Discussion

- We need models that measure human behavior, not only vehicle behavior.
- Today's model is data hungry and therefore expensive to use.
- Models presume to predict the future, a weak presumption at best.
- Models are used for all sorts of analyses, but they should only be used for regional analysis, not detailed project analysis.

- We need to choose the right model for the information needed. For example, use pivot point analysis instead of the four-stage travel-demand-modeling analysis.
- Models should show a direction to take, not specific answers.
- We need to address the missing pieces in models, for example, pedestrian and bicycle trips.

Obstacles to Address

- How else to determine qualitative data.
- How to train planners in the proper use of models, other techniques, analysis tools, and sources of data, and how to evaluate answers.
- Decision makers demand "printouts" for validation of their decisions.
- There is an adversity to risk, taking chances, and fear of litigation.
- Federal regulations require using a model, at least for air quality analysis.
- There are funding restrictions to using other tools.
- We're relying on TRANSIMS, and we may never get to use it or be able to afford the cost for collecting the data required.
- Decision makers and the public only understand simple answers.
- Federal research is mostly for model development, without any research for developing other tools.
- Surveys and market research have not been validated by "the feds" as an appropriate analysis tool.
- We don't have anything as simple as SIMCITY to express quantitative analysis and outcomes.
- We need to consider the cost of using models.

What Needs to Be Accomplished

- Validate models to a future plan instead of to current behavior.
- Develop more sketch tool methods; update "quick response modeling."
- Develop ways to measure and account for induced demand.
- Develop public involvement requirements before using the model.
- Ask the public if LOS standards are appropriate for their area before assuming national standards.
- Try new tools like benchmarking, visual preference surveys, and market research surveys.
- Develop better and cost-effective pedestrian models.
- Bring other factors into the quantitative analysis process just as we have brought other factors into the policy and planning process.
- Although anything can be done for a price, we need a model that considers all modes, measures the

effect of the interaction of land use and transportation, and recognizes public desires.

- If the above is too expensive to achieve, we need other tools endorsed by the feds and the planning community.

- Research different areas in which other tools, besides the model, have been used effectively in major investment studies (MIS) or project alternatives analysis.

REFOCUSING PLANNING TO 5- AND 10-YEAR REGIONAL TRANSPORTATION PLANS

Reporters: Gary Erenrich and Theresa S. Petko

Problem Statement

- Need to link a 20-year plan with project development and environmental impact statement (EIS) and MIS processes.

- Need to identify current issues in a 20-year planning process.

- Need a commitment to implement and measure the plan.

- Need to link land use and transportation (shorter-term land use decisions; difficult to make 20 land use projections).

- Need to make the planning process more relevant to the general public—a shorter time frame would help.

- Need to have more realistic financial plans.

- Need to incorporate management and operations (typically shorter term) into the planning process.

- Need to involve the business community, freight providers, and shippers.

- Need to be responsible to sustainable communities and sprawl issues.

Some Current Practice

- Michigan has a 5-year program with strategies to bridge to a 20-year plan.

- Pennsylvania has a 12-year program with 3- to 4-year elements [first 4 years replicate the regional Transportation Improvement Program (TIP)].

- New Mexico has a 6-year State Transportation Improvement Program (STIP) and a 20-year policy plan.

- California has a 4-year program.

- San Francisco Bay Area's priority is rehabilitating existing infrastructure.

Relevant Questions

- What is the MPO structure?

- How do you get institutions to change planning processes?

- What performance measures would be relevant to a 10-year plan?

- Should implementation of a 10-year (interim) plan be voluntary or mandatory?

- What is the federal and state role in development and implementation?

Benefits

- Ability to monitor system performance on a regular basis.

- Provides regular feedback to 20-year plan.

- Incorporates management and operations.

- Directly ties to land use.

- Emphasizes system preservation.

- Encourages greater public participation.

- Provides realistic financial plans.

Proposed Solutions

- Encourage MPOs and state departments of transportation to develop midterm transportation plans.

- There is no attempt here to change the current metropolitan statewide planning regulations.

Action Items

- Investigate nationally the state of the practice of developing midterm plans.

- Recognize the distinction between requirements of transportation management areas and smaller MPOs.

- Fund two or three pilot case studies to develop 10-year plans and to identify the benefits and costs of the plans.

Priority

This is short-term effort with benefits that could be immediately derived or applied versus a long-term research program.

HOW DO WE IMPROVE THE IDENTIFICATION OF ENVIRONMENTAL RESOURCES AND PRIORITIES IN THE PLANNING PROCESS?

Reporter: Denise M. Rigney

Currently, environmental resource identification does not always occur in the transportation or land use planning phases. It has been suggested that the inclusion of environmental data earlier in the transportation planning

process would help streamline the delivery of transportation projects. However, a disagreement on the appropriate level of environmental data for the planning process exists between the transportation planners and the environmental agencies. The lack of resource agency involvement at the planning stage is identified as a significant barrier for addressing this issue.

The funding source for the collection of additional environmental data is also a significant outstanding issue. Currently, the environmental resource and regulatory have limited data. Other data sources may be available but are not currently known. It is recognized that addressing environmental resources, ecosystems, and sustainability are the key transportation issues of the future. However, many federal, state, regional, and local agencies do not currently set clear environmental protection priorities.

It was recognized that, in many cases, the transportation planning process is the only forum that the public or the agencies have to provide comments on the environmental issues.

Action Items

- Develop mechanisms: MIS, National Environmental Policy Act (NEPA)/404 Memoranda of Understanding, and financial assistance to resource agencies.
- Develop regional interagency teams and meetings to discuss regional planning issues.
- Use interagency teams for identifying the appropriate level of environmental detail in the plans.
- Integrate environmental information or data at the systems level into the systems planning phase.
- Identify the environmental systems first and then think of how the transportation system can fit into it.
- Develop performance measures for environmental protection at the systems level through an interagency team approach at the federal and state levels that are facilitated by U.S. Department of Transportation (USDOT).
- Ensure that geographic information systems (GIS) data are available, compatible, and convertible.
- Integrate transportation plans and land use plans at the regional level. Consider land use planning, habitat and ecosystem management and protection, cumulative impacts, property rights, and environmental and community values.
- Identify the appropriate role for the resource protection, management, and regulatory agencies. Can federal agencies provide expertise and data collection instead of just an after-the-fact review?
 - Balance national imperatives with local rule.
 - Recognize that land use, transportation, and environmental protection decisions have different time frames.

- Shift the focus from just building infrastructure or transportation projects to facilitating the design of livable communities. Use community performance measures as well as environmental performance measures. Look at transportation in the context of community and environmental goals.

- Transportation planners should facilitate community goals but should not have the authority to make these decisions.

- Develop (state, local, regional authorities, and the public) an "environmental protection plan" and integrate it with the transportation and land use plans for a region.

- Establish a statewide air quality goal—air quality conformity concept—and develop a transportation system to meet it. Establish similar statewide environmental and community goals and develop a transportation system to meet those them.

- Federal and state environmental agencies should be closer to the transportation decision and the MPO process.

- Better public involvement for the identification of the public's environmental and community priorities.

- Use of the technology that we have—GIS should facilitate a systems analysis approach.

- Translate the transportation and land use plans into commonly understood language. Translate the plans into issues that the public cares about.

- Coordinate early to identify key environmental resources.

- Identify cumulative impacts of the transportation plan on key environmental resources. Two types of impacts are direct and induced.

- Determine transportation needs and purposes, an action that leads to evaluation of the transportation system and alternative ways to the needs and purposes. Determine the impacts of the transportation system on key environmental and community resources.

Research Needs

- Determine performance measures for environmental protection, community protection, and other environmental or community issues.

- Develop more data and information on environmental systems and design transportation with those systems.

- Determine the existing databases and where they are housed.

- Synthesize what works in conservation and environmental protection. Why has there been a backlash among environmental agencies and resource groups against this type of planning?

- Use GIS or a model for identifying those areas in which "induced growth" could occur and for identifying cumulative impacts.

- Synthesize environmental agency activities to establish environmental and community priorities

such as the U.S. Environmental Protection Agency (USEPA) Region III's Green Communities web page.

Priority

The proposed solutions and research needs are significant for streamlining the planning- and project-level processes. The identified solutions help to facilitate the "shared decision-making process," which includes other governmental agencies and the public. These solutions not only help to provide a greater analysis of environmental resources and priorities in transportation planning, but they also help to move the planning process to consider the broader community and environmental protection goals.

HOW DO WE BRIDGE THE GAP BETWEEN PLANNERS AND ENGINEERS?

Convener: Wayne W. Kober

Engineers

- Orientation: doing and building
- Use quantitative tools
- Project orientation
- Not everyone can be an engineer—registration required
- Lack multidisciplinary training
- Engineers have become draftsmen
- Start with the solution
- Action
- Core issues (especially for electees)
- Uncomfortable with land use and community issues
- High entry-level salaries and broad career opportunities
- Not interested in planning
- Usually in charge of DOTs

Planners

- Orientation: regulatory and participatory
- Use qualitative tools
- System orientation
- Anyone can be a planner (seen as a generalist)
- Some multidisciplinary training
- Planners have become programmers
- Start by defining the problem
- Speculation
- Fringe issues
- Focus on land use and community issues
- Low entry-level salaries and limited career ladders
- Not interested in engineering
- Usually in charge of MPOs

Common Issues

- Respect, trust, and understanding for others' professions and approaches
- Weak secondary and cumulative impact analysis
- Limited forums for engineers and planners to come together at a systems and a project level
- Lack of multidisciplinary approach on either side
- Organizational structure doesn't promote a team approach
- Cookbook/template approach instead of context-sensitive planning and design
- Lack of training programs in transportation planning or engineering
- Inability to deal with the political process with agility

Proposed Solutions

- Use of multidisciplinary planning, management, and engineering teams.
- Create forums for interaction through professional organizations and conferences: Institute of Transportation Engineers (ITE), American Planning Association, American Society of Civil Engineers, and American Association of State Highway and Transportation Officials (AASHTO).
- Train both engineers and planners to think more broadly—transportation academy, expert systems, systems curricula, and distance learning.
- Educate planners in systems management, maintenance, and operation needs.
- Move engineering and environmental analysis and issues into the planning process.
- Involve at the outset
 - Stakeholders and
 - All interests (including financial, environmental, and maintenance).
- Include adequate budget for expanded involvement when scoping project.
- Open and collaborative planning and project development process.
- Divert federal, state, and other planning and research funds to training.
- Take full advantage of university resources for training transportation engineers and planners.

IF YOU BUILD IT, THEY WILL COME: BIKE AND PEDESTRIAN ISSUES

Reporter: Toni Dunagan

Many states are addressing bicycle and pedestrian needs without the tools necessary to accurately model those needs and without projected usage,

With respect to automobiles, there is "induced travel" when roads are widened. Is there a way to quantify or predict what the induced bicycle and pedestrian travel will be when a facility is proposed? How can we show needs in any but an anecdotal way?

Issues

- How do we model bicycle and pedestrian needs? (How do we incorporate these needs into the broader transportation plans and planning models?)
 - How do we predict induced travel by these modes?
 - How do we prioritize needs?
- How can we be assured that we are spending money effectively and equitably?
 - How can we take an infrastructure that is automobile oriented and retool it?
- What is the state of the practice or state of the art with respect to pedestrian facility design?
 - Pedestrian counts: What has been accomplished to document before and after so as to demonstrate what has hindered pedestrian movement?
 - Is there a systematic methodology for obtaining bicycle counts before and after a facility is constructed?
 - Is there a way to demonstrate the value of foot traffic to retailers?
 - Need to address pedestrian connectivity—where gaps exist and where interstates that pose a major obstacle exist.
 - Need to address the quality of the environment for bicycle and pedestrian facilities.
 - Safety: How do we protect people, and how do we make them feel safe so that they will use bicycle and pedestrian facilities?
 - Review of state of the art and best practice.
 - Document connection between pedestrian facilities and transit ridership.
 - Transit-oriented design connection—What impact does good access for bicycles and pedestrians have?
 - How can incentives and benefits (federal tax credit for transit, reduction of parking spaces) be maximized?
 - "Frequent flyer" benefits regarding mileage of transit usage in areas in which retailers would reduce prices for transit, bicycle, and pedestrian customers.

Action Items and Research Needs

- Document state of the practice through state and MPO surveys [AASHTO and Transportation Research Board (TRB)?], that is, percent of newly programmed projects for bicyclist and pedestrian in an MPO area or state (rural included).
- Document before and after scenarios that show "induced" travel.

- Use national standards to determine locations of bicycle and pedestrian facilities.
- Develop comprehensive survey of what modeling work has been done to date (urban and rural).
- Document bicycle and pedestrian needs statewide and nationwide. (How much would it cost to implement all the plans that are currently out there?)
- How do we make it easier for advocates to get into the planning and design process?
- Conduct national random sample surveys on the importance of bicycle and pedestrian facilities to citizens.
- Package grassroots education campaign on the value of bicycle and pedestrian facilities.
- Ask TRB to set up a task force to assess current condition of bicycle and pedestrian infrastructure nationwide.
- Document effectiveness of improving safety (intersections) and comfort (benches, shading) on bicycle and pedestrian facilities. What is important to pedestrians in terms of amenities and destinations?
- Need to capture and get the story out on the success of the Intermodal Surface Transportation Efficiency Act (ISTEA)—the level of investment nationwide has been huge.
- Research academic curricula on preparing planners and engineers to address bicycle and pedestrian needs.
- Capture and document connection between bicycle and pedestrian and public health and social benefits of provision of facilities.
- Consider the research and develop a great model that addresses the first issue listed and get it out to state agencies, consultants, academia, and others.

What Blocks Effective Action and What Are the Obstacles?

- Lack of interest by state departments of transportation (DOTs) and boards (less interest now than 5 years ago—citizens, advocacy groups, and ISTEA have had an impact).
- Lack of education in engineering departments in design—needs analysis for bicycles and pedestrians.
- Possible conflict between expanding facilities and environmental resources.
- No starting point concerning the comparison of how needs are addressed—automobiles, bicycles, and pedestrians.
- State motor fuel tax dedicated to roads and bridges in about 33 states.
- Existing zoning codes.
- Attitude
 - Logical termini without regard to neighborhoods.
 - Movement of people on bicycles between communities is considered less.
 - Transit authorities are not bicycle friendly. Among other things, there is also an overall lack of safe bicycle parking at transit stations.
- Funding

- DOTs are used to working on a large scale.
- Small-scale projects don't receive attention.
- Process is as cumbersome for smaller projects as it is for larger projects. There is a need to streamline the bureaucratic process.
- Institutional barriers
 - Need for engineers to "stamp" designs; inflexibility in choice of materials.
 - There's a manual for everything, and more flexibility is needed.
 - Highway designers don't routinely design for bicyclists and pedestrians.
- Modeling
 - Lack of basic information—no one conducts pedestrian and bicycle counts routinely. (What is actually being done?)
 - If no pedestrians are apparent at the moment, no one believes a facility will be used (induced travel).
 - Majority of bicycle and pedestrian trips are non-work related. How should this be handled?
- Federal regulations conflict with one another, for example, areas where new schools can be located.

Toward What New Directions Must We Move?

European mindset is totally different regarding bicycle and pedestrian activities and facilities. Bicyclists and pedestrians are underrepresented. (What are DOTs and MPOs doing during the planning and design process to consider such needs?) What is actually happening about outreach? The interpretation of road needs to be broadened to include bicycle and pedestrian facilities (e.g., dedicated gas tax). Need educational outreach to national organizations and legislators, to name a few.

Priority

Priority is high because the level of investment has been high since ISTEA was enacted.

HOW TO REINTRODUCE VARIETY AND ABANDON THE UNIFORM, LOCKSTEP PROCESSES, AND PROCEDURES (AKA: HOW TO DEREGULATE PLANNING)

Reporters: Jonathan Gifford and Amy Van Doren

Fundamental Issues

- How much push and pull is necessary?
 - One view is that DOTs don't exercise the flexibility that they have and need to be forced to "cede their hegemony" over the planning process.

We need to "smash" the federal-state partnership and bring other parties into the planning process. Regulations give other parties authority to participate. Both large and small communities feel very left out of the statewide process.

- The opposite view is that citizens have a positive responsibility to hold their elected officials accountable for their actions and that regulations ought not to be used for substitutions. Democracy is messy, and it will take time for issues to be part of the agenda. Lockstep procedures can force states to do stupid and unnecessary things.
- There's a concern about how much would get done if these regulations weren't required. Would planners ever look at pedestrians if it weren't in the regulations? Yet, this can also impose ritualistic, procedurally bound planning.
- "By the time localities recognize a need to plan, it's too late," and hence guidance from the national level is necessary.
- State of the planning process
 - The planning process is "struggling to be born." ISTEA's implementing regulations have only been in force for 6 years, so it's fairly early. ISTEA needs to become more flexible and accountable and to incorporate more noncapital elements.
 - The planning process is overburdened. We try to pack multiple additional agendas, and other things (ITS implementation) have diluted the process to the point that action on important things (e.g., consideration of a STIP amendment) is crowded out.
 - The planning process is pretty consistent with some states' programs.
- How much variety is actually out there?
 - There's variety in the Federal Highway Administration (FHWA) division offices due to discretion on interpretation. This can have both positive and negative effects. Division can be "in bed" with DOTs and just push projects, or division priorities may be ill founded (e.g., division's top priority is inventorying all sidewalks in 13 counties).
 - There's variety in how states and localities actually implement their processes and procedures, and also a variety in participants, sources of data, and the political culture of each jurisdiction or region, to name a few.
- There's a lack of alignment among political process, goals- and vision-oriented action, institutional structure and authority, and operational functions.
- It might be useful to focus on short- to medium-term planning horizons (5 to 10 years) than to focus on 20-year planning. This forces decisions to address real constraints and opportunities.
- Is there a need to have a more nimble and responsive decision-making process that can take action

instead of a process that requires decades to initiate and implement, so as to respond effectively to rapidly changing economic and social conditions?

- Consider a results-based process to achieve performance objectives instead of a procedurally prescribed approach. This process might eventually require retooling allocation formulas to include performance objectives (air quality, public health, mobility, and accessibility).
- Is planning responsive and to what is it responsive?
 - Statutory responsiveness is mandatory.
 - Responsiveness to policy guidance is more optional.
 - Responsiveness to local constituencies is up to the state or localities, or both.

Research Needs

It's decisions that matter. How much influence does the information coming out of the planning process actually have on decisions?

WHAT IS THE ROLE OF MPOs IN THE LAND USE PLANNING PROCESS?

Reporter: Michael Mittelholzer

Take into account five major elements:

1. Environmental requirements.
2. Legal restrictions.
3. Economic development needs.
4. Model tools. (What models are currently used and what models or tools need to be developed?)
5. Opportunities for stakeholder (e.g., industry and public interest groups) in the MPO process.

Major Themes

- Current models (e.g., four-step transportation models) are ineffective tools for considering land use transportation issues (similar to "using butter knives for brain surgery").
- Most MPOs are hesitant to address land use issues for several reasons:
 - Lack of authority.
 - Land use decisions are inherently local political decisions.
 - Current models are not capable of providing clarity to the decision-making process.
- Environmental requirements (e.g., Clean Air Act) increasingly force MPOs to make long-term predictions on growth and economic development that in the end they have no ability or authority to effect.

- Success of the MPO land use planning process is based more on sufficient stakeholder input than on development of precise models.

Ideas Voiced

- National solutions or models for land use or "Smart Growth" is not the answer. Regional solutions need to be developed to address regional growth patterns.
- If MPOs are to consider land use issues more comprehensively, they must consider, or evaluate, economic development plans for the metropolitan area. These plans include, but are not limited to, tax policies, economic incentives, market demands for housing, environmental impacts, and distribution of public resources.
- Part of the problem that MPOs encounter when considering regional land use trends is that MPOs themselves are composed of local government officials with sometimes competing interests (tax base, infrastructure resources, political supporters).
- Resources (federal) need to be spent to refine existing models and to develop new ones to help MPOs and stakeholders understand the relationship between land use and transportation needs.
- Analytical land use models alone will never replace the need for stakeholder involvement in transportation decisions. Without consensus on basic issues, models will only shift the debate to "a battle of competing science."
- Discussion needs to continue on two important issues:
 - Current system of local land use authority and
 - Equable representation on MPOs of urban and suburban interests.

OUTSIDE REVIEWS: WHY DON'T THEY WORK?

Reporter: Bruce D. McDowell

This session was in reaction to Kevin Heanue's assertion in his presentation on the history of transportation planning that the A-95 review and comment process had been a failure. He said it had been just a massive paper-pushing process from which he could not remember any benefit.

The concept of the outside review process is to provide an opportunity for local elected officials, and other affected parties, to review proposals for federal actions and make comments on them before federal agencies make their final decisions. This opportunity was provided by 1965 and 1968 federal laws and is still available for state and metropolitan clearinghouses to use. Eighteen states no longer use the process.

Thus, the effectiveness of this process obviously depends on the degree to which the comments are useful and on the extent to which the federal agencies take the comments seriously and respond to them. Thus, there are two opportunities for the process to fail: (a) the comments might be absent or useless, and (b) the federal agencies might be impervious to outside suggestions.

There was no forcing mechanism until 1983, at which time the process was changed to provide that a consolidated comment on a project or proposal from a state-designated "single point of contact" must be followed by the federal agency receiving it, unless the agency explains why it cannot do so. Before this change, multiple and often conflicting comments frequently were received from metropolitan clearinghouses and state agencies.

This change introduced a third point for failure: comments not from a single point of contact have even less legitimacy than before. This is now the case in at least the 18 states that do not have such contact points.

A second question was generated, "How can outside reviews work?" Opportunities for parties to influence federal decisions that affect them is a good idea, as evidenced by the fact that these opportunities are at the heart of the MPO process. But MPOs operate only in metropolitan areas and do not encompass many other federal decisions that are relevant to community development, mobility, and access to services. Thus, a broader mechanism for outside reviews (covering the Department of Housing and Urban Development, Department of Health and Human Services, Veterans' Administration, Postal Service, General Services Administration, Department of Defense, and many other federal decisions) could be useful as a supplement to the MPO process.

The six participants who took part in this work group had several other concerns:

- Using peer-review groups to improve programs,
- Making public involvement processes more effective,
- Accommodating advocacy groups,
- Handling lawsuits, and
- Accrediting and certifying transportation organizations and processes.

Outside reviews don't work because they

- Appear as an intrusion that causes extra work, disrupt the program, and are a resource drain.
- Provide little or no benefit.
- Distract the program from its intended goals, confuse the program, and are counterproductive.
- Are not properly supported with readable and understandable review documents and with a cooperative approach by the transportation agency to the review process.

- Can't attract appropriate or qualified reviewers with enough motivation to produce usable reviews.

- Strike fear into the transportation agency; the agencies may be afraid of receiving adverse reviews that can cause political problems, termination of people and projects, and reduction in budgets.

- Transportation agencies really don't want outside ideas; they just go through the process to get it over with.

- Attract reviewers who do not want the review process to work constructively; they may want to stop the process, project, or whatever is being reviewed.

- Decision has already been made before the review process begins.

Outside reviews can be beneficial if they

- Are allowed to address real issues at an early stage when they can still be reformulated and improved by new ideas;

- Look for and proactively seek out new ideas, including the unexpected idea that may come from a totally different context or source to cross-pollinate the process;

- Include planning processes and organization, as well as plans, programs, and projects; review of research programs can also be beneficial;

- Are structured in a nonthreatening way, if possible, but can still deal constructively with new ideas, different cultures, upsetting thoughts, conflicts, and even confrontations; professional facilitators and dispute-resolution agents from the outside may provide useful services in many difficult situations;

- Involve personal contact and probing, not just paper exchanges;

- Include feedback to the reviewers, so they know that they have been heard;

- Give reviewers opportunities to learn from the experience, apply this learning elsewhere, and improve their reviewing skills;

- Are used to developing improved relationships with outside persons and groups that provide the reviews; and

- Build the reputation of the transportation agency as an open organization searching for the best answers to difficult issues, as a highly professional and objective organization, and as an agency that can be trusted to be a fair and respectable part of public service.

Proposed Solutions

Action Items

Transform barriers into opportunities by

- Establishing ground rules for fair and objective evaluation of inputs from outside reviewers;

- Using professional facilitators and dispute-resolution experts when needed;
- Holding fears in perspective—dealing with challenges positively, as in a negotiation;
- Improving communication with outside reviewers; translating proposals so that they can be readily understood by nontechnical people, identifying issues on which ideas are needed, sincerely inviting and encouraging input; and
- Providing training for outside reviewers so they can be more productive.

Research Needs

- Search out success stories to show the benefits of outside reviews.
- Develop training curriculum that supports the review function for outside reviewers and staff.
- Set up and support a good, inviting review process; conduct reviews; use reviews.
- Provide feedback on reviews.
- Develop a review process that takes advantage of electronic notifications and responses to streamline and save time.

Priority

- Need for cross-constituency pollenization is increasing with the requirement that multiple new stakeholders be brought into the transportation planning process.
- Need for cross-functional pollenization is increasing for such programs (e.g., welfare-to-work; the Transportation, Community, and Systems Preservation Program; and land use and transportation coordination).
- Connect the nodes of the expanding “virtual institution” network that is addressed in Stephen Lockwood’s paper (see Conference I Resource Papers).

EFFECTIVE COMMUNICATION WITH APPOINTED AND ELECTED OFFICIALS

Reporters: Bob Winick and Alan Clark

The intent of planning and management is to carry out a set of recommended actions or activities. To effectively communicate the nature of the needed actions has been and will continue to be an important concern to transportation planning in the 21st century.

A number of participants talked about their experiences with blockages and obstacles to effective communication with officials. Barriers that were identified included (a) newness and turnover, (b) available time, (c) interest in the topic, (d) actual or perceived complexity of the topic, (e) the format in which information is pre-

sented, (f) need for a quick response, and (g) ability to provide constituencies with information that is relevant to their concerns.

The workshop participants then shared their experiences with successful communication. They maintained that their successes were based on several factors: (a) understanding their constituencies, (b) maintaining periodic contact, (c) giving their constituencies a sense of ownership, (d) needing to explore new ways of communicating, and (e) using an audit program to uncover and address some shortcomings that had developed in one metropolitan area.

Two interrelated items—what is the content that needs to be communicated and what techniques and methods of communication appear to be more effective—were discussed. Key concerns about the information content included that (a) outputs of the planning process need to translate better outcomes of importance to officials, and (b) we need to be aware and understand other items of concern to officials and account for the importance of these items in our work. Several communication techniques were stressed: (a) use of quality graphics and media; (b) use of scenarios of future conditions, perhaps in addition to or in lieu of just forecasts; and (c) develop ways to present information that is not now covered by transportation planning processes, such as information on freight movement, system maintenance and preservation, or M&O-oriented actions.

Action Items

- Restructure planning methods to meet other system goals and deal with real outcomes of importance to the officials.
- Put products in “plain English” and use more effective graphics and visualizations.
- Use more comparable examples that, both before and after results, show regional as well as local effects.
- Monitor and describe current conditions more effectively as a necessary step to show how forecast results may relate.
- Put more focus on products and less focus on process.
- Place priority on performing more long-term, larger-context, regional assessments.
- Develop an appreciation and acceptance of the need for more analysis and research as necessary steps for product or service delivery.
- Use more high-tech visualizations of outcomes from many perspectives, especially in project-development planning.

Research Needs

- Identify relationships between transportation and various broader measures that are considered important by officials, such as real personal income.

- Determine how to better perform “winner-looser” analyses or when new projects result in net regional gain even though there may be specific local loss.
- Develop benchmarking of urban areas to account for best practices that lead to particular outcomes while still accounting for state-to-state and local differences.

QUICKLY MAKING THE SHIFT FROM SUPPLY SIDE TO INTEGRATED MANAGEMENT AND OPERATIONS (AND RETIRING THE GRANDFATHERED PROJECTS)

Convener: Michael Repogle

Summary of Issues

New and emerging transportation M&O strategies, including TDM and growth management, may enable more effective solutions to mobility, access, and community-regional development problems as compared to many not-yet-built capacity-expansion-oriented transportation projects that have been carried over to today's plans from the pre-ISTEA era. But old projects often have entrenched support from powerful interests who resist consideration of secondary and cumulative impacts, or evaluation of feasible alternatives, as would be required if these were newly proposed projects.

When and how should large, unbuilt capital projects be reconsidered, weighing alternatives that might better satisfy their purpose and need, better use scarce resources, and better meet contemporary project and plan review criteria and stakeholder aspirations? How can we accelerate the incorporation of new and emerging strategies into plans, programs, and projects, as well as into M&O frameworks, to ensure the most timely attainment of social, economic, and environmental goals and objectives?

Proposed Solutions

Action Items

- Document and disseminate best practices for emerging transportation M&O and related TDM strategies to public, elected officials, media, and professionals.
- Strengthen public access to information and involvement in planning. If people don't know they have viable alternatives or know their attributes, they can't make choices. Fund independent research by community-based stakeholders on alternative strategies.
- Revise the Clean Air Act transportation conformity rule that now grants project-level conformity approval at the time of Record of Decision (ROD) on environmental documents, often many years before

the project advances to construction. Link approval to Section 106 project-funding agreements to ensure that air quality effects are considered, by using latest information, before letting of construction contracts.

- Pre-ISTEA ROD and NEPA reviews are still used at times without updating as the basis for advancing old projects to construction. Federal agencies should insist on new studies with current methods and assumptions to ensure adequate consideration of cumulative secondary, induced impacts (including land use and travel behavior) and alternatives for major capacity expansions and collections of segmented projects. If the project isn't built between 7 and 20 years, start over from scratch.

- Information on the status, procedures, and potential timing of transportation project and plan approvals, and possible points for intervention or reconsideration, must be made more readily available to the public and to community stakeholders.

Research Needs

- Better methods for appraising cumulative and secondary impacts of transportation projects, M&O strategies, and related TDM measures on travel, land use, equity, system performance, environment, and fiscal elements.

- Better methods for identifying the range of feasible alternatives to business-as-usual projects, TIPs, and plans, including standard best practices for M&O and TDM strategies.

- Better means of communicating with and gathering information and ideas from the public and stakeholders, especially from those individuals with little time or resources for participation and who often benefit least and pay the highest share of their income for transportation services.

- Strategies for strengthening political, policy, and technical implementation of ISTEA-Transportation Equity Act for the 21st Century (TEA-21) criteria in updates to plans, programs, and projects.

Priority

High priority need for developing information to inform the public and elected officials about availability of alternatives that involve new M&O strategies. Setting time limits on old project evaluations and allowing reappraisal at key checkpoints before construction can facilitate public and elected-official consideration of alternatives. Streamlining environmental reviews will be successful only if there is early and effective consideration of cumulative and indirect impacts of all unbuilt projects and alternative strategies that emphasize M&O and TDM. This measure will effectively engage affected stakeholders.

GETTING PEDESTRIANS INTO THE MAINSTREAM: DATA, FACILITIES, POLICY, AND LAND USE

Reporter: Ann Hershfang

Action Items

- Adopt a policy that pedestrians be accommodated on public rights-of-way (where they are permitted).
- Define performance criteria for pedestrian accommodations (e.g., indicators, specifications).
- Define a planning process that looks at land uses that induce people to walk, at pedestrian-oriented development, and at pedestrian-friendly overlay zoning.
- Develop new systems and procedures for including pedestrian projects in long-range plans by talking about policy and performance measures and provide a percentage of funding for pedestrian projects through TIP.
- Expand modeling needs to include
 - Nonmotorized modes,
 - Improved “resolution” to better capture pedestrian trips, and
 - Expanded range of trip purposes.
- Determine how to get all relevant participants to the table. Currently, pedestrian facilities are often not a priority for roadways, transit, MPOs, or local planners. These facilities fall through the cracks and are afterthoughts.
- Convince agencies to deal with major pedestrian safety issues—for example, priorities of the National Transportation Safety Board include oil line safety and railroad-crossing safety, in which deaths are in the hundreds, but do not include pedestrians, with between 6,000 and 7,000 deaths a year.

Research Needs

Research needs include comprehensive data on pedestrian use, projected use, and safety. More thorough pedestrian data, as well as data on linked-pedestrian trips, should be collected at the national level by the Census, the National Personal Transportation Study, and the Bureau of Transportation Statistics and also at the local and regional levels.

IMPROVING THE CONNECTION BETWEEN LAND USE AND TRANSPORTATION PLANNING WHILE PRESERVING LOCAL AUTHORITY

Reporter: John Thomas

The following premise was presented to the participants:

• A wide range of economic and noneconomic factors determines land use, but transportation investments play a key role in shaping the private markets that supply residential and commercial infrastructure.

• Local economic development plans and regional transportation plans are interdependent; they rely on each other to achieve policy objectives.

• Real or perceived competition among local jurisdictions in metropolitan areas is a barrier to effective growth management policies.

The participants were then asked consider the following two questions:

• What policies, processes, or institutional arrangements are needed to bridge the gap and to achieve better coordination of regional transportation policies and local economic development policies?

• How do we strike the appropriate balance between regional institutions’ ability to effectively coordinate policies and local jurisdiction’s traditional authorities and roles?

Proposed Solutions

Action Items

- Increase connection and feedback between planning at the local level and regional transportation plans.
 - Currently land use, population, and employment forecasts are often just an input to transportation planning, and numbers used for local planning can be different. We need to develop one set of numbers or assumptions for all planning processes.
 - Many localities do not even have updated comprehensive plans, let alone plans that are coordinated at a regional level.
 - Mechanisms generally do not exist to translate general agreements on “Smart Growth” or on growth management among MPO members into changes in local land use plans.
- Place more emphasis on developing visions of where the community should be over the long term instead of overcoming near-term problems like traffic congestion.
- Use of GIS-based systems to gather local comprehensive plans and show regional implications; in other words, “map out what people are currently planning.”
- Implement comprehensive planning requirements at the MPO, state, or multistate level.
 - Legislation may be needed.
 - States historically had a stronger role in planning.
- Educate local elected officials, key community leaders, and industry stakeholders on the benefits of growth management to communities and to the region; change attitudes and implement new approaches.

- Develop systems to hold local officials accountable for regional priorities and needs.
 - Empower MPOs to base transportation funding allocations on the extent to which local areas meet planning criteria.
 - Some MPOs link project evaluation in TIPs to the adequacy of planning surrounding corridors or projects.
- Increase flexibility of federal policies (e.g., land use SIP credits) to act as an incentive for coordinated land use policies in regions.
- Decrease the number of plan revisions required to allow for a more comprehensive process and better analysis. Many areas are spending so much time updating plans that they lack the time to develop new approaches.
- Center planning on improving our understanding of the communities in which people want to live, then develop land use and transportation plans around those visions. In the past, transportation plans have too often driven the process.

Research Needs

Improve analytical ability to demonstrate the benefits to localities of regional growth management.

- “Show that by cooperating, constituents get more because the ‘pie is bigger’ rather than fighting for ‘their piece of the pie’.”
- Improve tools that are available to MPOs to demonstrate the benefits of growth management-land use alternatives.
- Incorporate better local data and more basic research into behavior factors for land use and travel.
- Improve understanding of why sprawl exists (forces driving dispersed land use).
- Develop a better understanding of why local areas are competing for growth.
- Is there a blanket assumption that more development equals more revenue (bigger is always better)?
- Develop tools to define and visually portray “Smart Growth.”

Priority

- Reevaluate if “respect for local land use authority” or hands-off approaches to local planning is still appropriate or if it is part of the problem.
- Develop accountability for long-term consequences among elected officials who are often focused in the short term.
- Balance the use of incentives for comprehensive planning with mechanisms to hold people to the objectives in plans.
- Improve our ability to demonstrate the benefits of growth management in fiscal, transportation, environmental, and quality-of-life terms.
- Forge agreements to iterate local land use planning and regional transportation planning in a meaningful

way (evaluation of alternative growth scenarios and investment options).

- Increase flexibility for transportation funds [state transportation programs (STPs) or other program funds beyond transportation planning funds] to be used to support local land use planning.

MOVING FROM PLANNING TO DOING WHILE INVOLVING STAKEHOLDERS

Convener: Pat McLaughlin

Issues

- Perception is that involvement slows down “doing” and is perceived as an impediment.
- Stakeholders who are interested in quick action may drop out or not become involved at all.
- Late involvement of regulatory agencies can add time and cost (need involvement incentives).
- Need comprehensive (but tailored) list of stakeholders at project outset.
- Education and involvement need to be early, continuing, and inclusive—for elected officials, orientation for newcomers to transportation, educating the public on their role, and special techniques for underrepresented populations (low income, immigrants, non-English-speaking).
- Need information on different techniques, especially second-generation techniques, and need to know their advantages, that is, which techniques turn people into stakeholders.

Proposed Solutions

Action Items

- Establish incentives for early participation of federal regulatory agencies in an expanded stakeholder-outreach process (avoid late comments that can create delays).
- Allow use of federal project funding for public involvement—encourage expansion and application of current DOT eligibility and expand eligibility of other federal funding sources.
- Link or merge the training done by National Transit Institute (NTI) and the National Highway Institute (NHI) with TRB activities and open it up to the larger stakeholder population.
- Quantify the benefits of early stakeholder involvement (reduced litigation, reduced delays over project life span), but also articulate benefits relevant to people’s lives.
- Educate engineers on identifying needs and vision with the stakeholders before getting hooked on one solution.
- Translate research into useful information that can be used for education and outreach.

- Expand federal research funding eligibility to follow-up activities such as research “translation,” education, and outreach.

- Encourage such organizations as MPOs, DOTs, nongovernmental organizations, National Park Service (NPS), and U.S. Fish and Wildlife Service to develop common outreach channels and techniques.

Research Needs

- Synthesize and communicate previous research so that it is understandable and usable for nontransportation stakeholders.

- Synthesize
 - Best practices in involvement of underrepresented communities,
 - Second-generation outreach techniques, and
 - Involvement and role of stakeholder or partners (financial interests, regulatory agencies).

HOW DO WE APPROACH M&O IN THE PLANNING PROCESS WHEN WE HAVEN'T YET DEALT EFFECTIVELY WITH OUR EXISTING NEEDS AND RESPONSIBILITIES?

Reporter: Peter E. Plumeau

Proposed Solutions

Action Items

- Define M&O and articulate it for practitioners, planners, and decision makers.
- Assist MPOs with integrating M&O elements into the regional process.
- Develop approaches to dealing with nonrecurring regional congestion (60 percent of overall congestion problem).
- Develop approaches to dealing with system variation (e.g., real-time adjustments to transportation system in response to performance changes).

Research Needs

- Define M&O performance characteristics (multi-modal and cross-modal).
- Develop “public-public” partnerships to make M&O effective. What is an MPO’s role in M&O information management and brokering?
- Develop methods and processes to facilitate integrated operations (“take down the institutional barriers”).
- Develop approaches and systems for incorporating real-time data into M&O.
- Implement institutional arrangements for MPO brokering and dissemination of M&O information.

- Develop and apply management options and flexible options to planning process within an M&O framework.

Priority

The proposed solutions outlined have both immediate and long-term relevance to transportation needs in general. The M&O perspective that is introduced in TEA-21 transcends the entire transportation planning process. Although this perspective actually includes many issues that have been elements of the process since the 1960s, it is with the advent of TEA-21 that the transportation planning community faces a mandate to understand not only the M&O needs of our built transportation system, but also the M&O implications of our planned system. For many, this could represent a very fundamental change in how project, corridor, regional, and statewide planning is carried out. Furthermore, if we assume “fiscal constraint” will continue to frame transportation planning into the 21st century, the relevance of the M&O perspective is elevated.

DEVELOPMENT OF PRINCIPLES FOR FLEXIBLE FEDERAL PLANNING REGULATION

Reporter: Charlie Howard

The premise of the discussion was that one size never fits all and that everything is not equally important. Therefore, federal regulation should be focused on protecting a narrowly defined national interest, with broad flexibility allowed on areas outside of the national interest definition. The workshop group discussed different approaches to federal regulation development and interpretation and recommended that a more collaborative process be instituted to develop federal regulations that involve key stakeholders through a negotiated rule-making process. Also, a collaborative rule-interpretation process that uses a peer-review format should be instituted to resolve interpretation disputes and to advance the state of the practice. One warning was to ensure that flexibility does not become a proxy for “bad decisions.”

Proposed Solutions

Action Items

- Need to define “national interest,” which should be based on outcome.
- Reassess the process for regulation development and for interpretation of regulations with mediation, joint ventures, and peer approaches.

- For issues outside of the national interest, federal agencies should concentrate on the development of state-of-the-practice guidelines, peer exchanges, training, and other technology-transfer activities instead of on the development of regulation.

Research Needs

Develop criteria for determining national interest, with clear recognition of hierarchy of values and of ways to work with them (e.g., negotiation, exemption)

Priority

High

TRANSIT: SERVICE COMPETING CUSTOMERS

Identify Competing Customers

- Transit dependent versus choice
- Commuters versus reverse commuters
- Express versus local
- Transit boosters (neighborhood redevelopment) versus NIMBYs and BANANAs
- Fixed route versus paratransit
- Other customers
 - Transit-oriented design, place-based development
 - Special generators
 - Welfare-to-work-special service
 - Environmental justice

Issues

- How to provide service to customers whose needs are in conflict with each other.
- How to set priorities where resources are scarce.
- How to ensure equity of service, fairness.
- Importance of accessibility to transit stops or stations.
- Bus stops as gateways to neighborhoods and communities.
- Can mixed-use development reduce dependency on automobiles?
 - How to educate the public on new transit modes.
 - How to encourage employers to share the cost of transit service to suburban sites.

Proposed Solutions

Action Items

Examples of how issues that were addressed in different areas were discussed, but no action plans

emerged. Especially helpful was a discussion of ways to educate the public on new transit modes by using video imaging.

Research Needs

Compilation of best practices would be helpful. Also helpful would be a summary of what is working and what is not, under what circumstances should certain actions be tried, and what to do when best intentions are not enough.

Priority

Transit service decisions that affect our customers and potential customers are being made every day. We need all the help we can get in making the right decisions.

INTEGRATING ECONOMIC DEVELOPMENT PLANNING WITH TRANSPORTATION PLANNING

Issues Raised

- Combining “Smart Growth,” “livable communities,” and sustainable transportation. (How can transportation investments be leveraged for the benefit of communities? How do we build sustainable systems? Urban areas are particularly challenged.)
- How to view economic development given induced traffic and other disbenefits.
- Different types of economic developments have different impacts and require different kinds of transportation investments.
- Leveraging location and existing transportation investments for economic development potential—for example, location-efficient mortgages (LEMs) in Chicago.
- Urban versus rural economic development opportunities and differing impacts and needs.
- Zoning as an opportunity (draw) and as a barrier to economic development around transit facilities.
- Question of who pays for economic development and who benefits? How to balance between public and private sectors to encourage investment and ensure fairness.
- How to identify and attribute economic costs and benefits of a given project. (Difficult ones, e.g., cumulative and secondary impacts are important, but there is a lack of enforcement on considering them.)
- Macrolevel economic cost-benefit analysis is more common; microlevel analysis is more difficult. How should we deal with disparate impacts and benefits within a region?
- Jurisdictions don’t always agree on economic development goals and impacts. There are limitations to use of cost-benefit analysis.

- How to avoid tunnel vision in integration of planning with the community and transportation system and the "big picture."

- Need for greater collaboration between agencies, neighborhoods, and the private sector.

- Need to avoid the "race to the bottom" or "beggar-thy-neighbor" (avoiding destructive competition between regions and states); "mutually ensured" projects (coupling projects on a quid pro quo basis); subsidies to potential investors.

- Unclear lines of decisions: Who is responsible for "big box" retail and who thinks about transportation impacts?

Proposed Solutions

Action Items

- Encourage effective, informed public involvement (this is critical); need improved information access and sharing between transportation planners and economic development planners; give particular attention to keeping economic development planners informed about transportation alternatives and limitations.

- Develop information and databases on benefits of transit-oriented development and other transportation planning alternatives.

- Develop a workable "vision plan" for a region and carry out transportation planning and economic development planning under this plan, with mandatory consistency in goals and programs.

- Find ways to encourage and focus development along specific corridors in which transportation infrastructure already exists or is in construction.

- Require coordination between economic development and transportation planning agencies.

- Reach out to chambers of commerce and economic development organizations (e.g., Council for Urban Economic Development) and enlist them as partners in education and planning.

- Understand the politics of the development process and learn to work with what cannot be changed.

- Develop a better understanding and better measures of the economic benefits of open space versus the costs and liabilities of developing it.

- Find ways to make desired development attractive to developers, retailers, and so forth (may be different answers in different regions).

- Encourage capture of retail demand in dense, transit-oriented environments. (Point out benefits of existing underserved markets and lack of need for any additional transportation investments to support it.)

- Move from project-based planning to comprehensive community planning regarding projects.

Research Needs

- Research analyses of the results of economic development-transportation investment cooperative actions (e.g., the Iowa RISE program). Also, analyze whether transportation investments funded by state infrastructure banks are the most cost-effective type of investment for economic development purposes.

- Research on the impacts of changing demographics on both the types of economic development needs (and its location) and the demands on the transportation system.

- Improve modeling accuracy by developing better information and realistic assumptions to be used in the modeling process. Also include broader inputs, such as freight needs and transportation modes that are vital to much economic development.

- Research to develop strategies to deal with situations, such as the absence of an economic development plan or unanticipated cuts in transportation services.

OUTLINE FOR A SINGLE TRANSPORTATION AND ENVIRONMENTAL PLANNING PROCESS

Reporter: Kevin E. Heanue

Transportation and environmental interests are often in conflict at various stages of system planning and environmental analysis. It was proposed that a single process be established with goals and objectives broader than either transportation or the environment. Transportation solutions that meet the mutually agreed upon broader objectives could then be determined. Each workshop participant was asked to offer comments on the proposal or suggestions for a better approach. The presentations and the discussion indicated that there is a body of very positive experience that merits incorporation into practice. These positive experiences have been summarized as action items, although the format does not quite fit.

Action Items

- Building on the positive Pennsylvania experience, states are encouraged to develop broad action agendas to establish crosscutting environmental and economic goals. Pennsylvania has established a 21st Century Environmental Commission and a "Green Government Council" under which each state agency has to demonstrate environmental advocacy.

- Dispute resolution procedures should be put into place throughout the planning and environmental process. The governor of Georgia has taken a leader-

ship role in the long-standing dispute regarding transportation and development in the Atlanta area, and under proposed legislation, he will have a continuing role in all Georgia nonattainment areas. This is an extreme example, but Atlanta has a particularly difficult problem. The lack of adequate and timely dispute resolution within the federal system was noted.

- The many positive benefits of MIS should be captured as the FHWA-FTA environmental and planning regulations are rewritten. Of particular note was the significant increase in transit options in the documents when compared with NEPA documents. The significant benefits of having MPOs, transit operators, and local elected officials actively involved in the scoping process was noted—in particular an increase in ITS options originating with local officials. It was also mentioned that resource agencies are much more willing to accept an argument that a transit option is not appropriate from a transit operator than from a highway designer.

- There was a consensus that the project purpose and need should be defined as an outcome of the planning process, should occur earlier, and should be viewed more flexibly, that is, it should be expected to be refined as the project becomes more defined.

- A final and most significant action item establishes that a single process is not required, but a more seamless process is required. The barriers between planning and environmental analysis should be eliminated. The interaction between transportation and resource professionals should be continuous. It should begin as early in the process as possible, and respect for professional expertise should be observed, with shared decision making throughout the process.

Research Needs

Research in a traditional sense is not needed, but freedom to experiment with pilot approaches is essential.

Priority

Urgent: FHWA and FTA are about to rewrite their planning and environmental regulations. These new regulations will establish practice for many years to come. It is essential that current "best practices" be captured in the regulations.

PUBLIC INVOLVEMENT: HOW TO REALLY MAKE IT A PART OF THE WHOLE, NOT JUST ANOTHER TASK

The following information reflects the problems and barriers to public involvement and a list of action items and research needs that suggest solutions.

- We need to move beyond "check offs" and integrate public involvement into planning and project processes in a meaningful way.

- We don't always know better. The public is smart and is becoming more sophisticated every day.

- We should make people feel heard and respected.

- Feedback is ongoing and constant and stems from feedback to and from clients and participants.

- A wide variety of techniques exist, but they need to be used.

- The role of transportation in community fabric and how it affects people's daily lives must be considered.

Action Items

- Develop training programs to show agency staff and practitioners how to think outside the box. It's not just transportation when we do planning; it's a life issue for the public.

- Refine the definition of "early" involvement and then continually validate and update this involvement.

Research Needs

- Conducted in the past, best practices and methodology should be conducted periodically to keep up with the state of the practice.

- Measure penetration and effectiveness—to let us know if what we're doing works.

- Develop effective feedback loops.

- Determine impact of technology on applications of public involvement techniques.

- Align metropolitan planning and public involvement with NEPA requirements.

- Conduct a national poll to determine public satisfaction and desire for transportation service, community development, and preference for residential location.

REALITY-BASED AIR QUALITY CONFORMITY REQUIREMENTS

Reporters: Janet Oakley and Juanita Wieczoreck

Problems and Issues

- There is little to no connection between air quality and air quality-modeling results.

- There is little to no connection between transportation conformity and air quality improvement.

- There is too great an expectation of accuracy from air quality modeling.

- The horizon for transportation planning is mismatched with the horizon for SIP.
- The time and resource requirements for air quality conformity are out of proportion with the air quality improvements that are gained from transportation. Bookkeeping requirements are onerous.
- National programs have low creditability for affecting future emissions, particularly regarding modeling and enforcement.
- SIPs are static, whereas TIPs are dynamic.
- Lack of flexibility in the conformity process hinders a state's or an MPO's ability to change projects, thereby endangering its ability to use federal funding within the prescribed time period.
- EPA is unwilling to discuss administrative solutions to conformity problems.

Proposed Solutions

Action Items

- Develop protocols for project-specific impacts of pollutants, following the California model for screening carbon dioxide emissions.
- Tie CMAQ expenditures to SIP (not projects).
- Reallocate EPA's resources from health impact research to sources of air pollutants, particularly PM 2.5.
- Educate the public about the conformity process and use it as the basis for a broader discussion of air quality issues and for the measures and investments that are being made to improve it.
- Educate the public about how all choices (purchases, driving) impact air quality.
- Use conformity and air quality as the basis for a broader discussion of transportation options.
- Conduct peer reviews to address analytical mismatch or inadequacy of air quality modeling.
- Establish ranges of acceptable model results for air quality conformity.
- Establish administrative protocols for emission characteristics that do not fit emission models, such as heavy-duty diesel engines.

Research Needs

- Examine nonmodeling ways of addressing air quality-conformity issues (performance based) that do not rely on emissions and travel demand models.
- Gather more data on modal emissions for mobile models.
- Develop more disaggregated emission models.
- Gather more data on ambient air quality, in addition to the "Malibu test" in Ann Arbor, Mich., to improve knowledge of impacts of measures on ambient air quality.

- Determine which methods that are being implemented are actually reducing emissions.
- Conduct more research on the impacts of diesel engines other than heavy-duty trucks.

PRICING IN THE TRANSPORTATION PLANNING PROCESS

Proposed Solutions

Pricing is not a topic that planners easily embrace. Limited attendance at the breakout session prevented a thorough evaluation of the potential benefits of the use of pricing in transportation development. Indeed, FHWA has had difficulty in identifying partners for congestion pricing (CP) demonstration projects. The reported success of current high-occupancy toll lanes may encourage others to include pricing options in their transportation solutions.

Action Items

- Evaluate current CP projects and distribute the results widely.
- Collect and distribute information on international road-pricing activities.

Research Needs

- Study to determine why planners dislike pricing.
- Continue development of public information on the potential costs and benefits of pricing.
- Evaluate the interaction of road and transit pricing.
- Evaluate the complete equity impacts of road pricing.
- Estimate the goods movement benefits of road pricing.
- Construct a model of the highway finance system with road pricing and include CP as appropriate. (This might mean no fuel tax.)

Priority

Pricing may provide the only comprehensive long-term solution to efficient transportation capital investment and finance. This may include commercialization or privatization of some current road systems and all new systems. It is imperative that the planning community studies and understands pricing options and is prepared to include them in the planning process as appropriate.

RECOGNIZING AND REMEDIATING TRANSPORTATION HARMS AND DISPARATE IMPACTS: CROSSROADS OF TRANSPORTATION, ENVIRONMENT, AND CIVIL RIGHTS

Proposed Solutions

Action Items

- Atlanta and Chicago environmental justice-transportation issues
- Illinois court decision on transportation and land use
- Corridor H alternatives, impacts, and benefits distributed unequally
- Federal, state, and MPO interest in Title VI
- Road-location decisions driven by who screams

Blocks to Action

- Difficulty in identifying who is interested.
- Lack of knowledge of Title VI at all levels.
- Weak advocacy—capacity of community intervenors is limited in equity area, limited transportation access, meeting at times when people work, child care problems.
- Planning certification review has no teeth when public involvement inadequacy is raised.
- Chicago: alternating MPO meetings from urban and suburban locals, between night and day, and always in transit-served locations.
- MPO power imbalance: central city underrepresented relative to population.
- Transportation plan and land use plan interaction and programming, not planning.
- Flexibility in thinking outside the box.
- Innovative remediation: community relocation while keeping it intact; need early intervention.
- Looking at cut and cover; nonstraight line alignments for new projects (need for low-income neighborhoods too).
- Reevaluation of old environmental approvals. (FHWA should make sure these get reevaluated.)
- People from affected communities to be engaged in impacts, harms, alternatives, and projects.
- Look at good public involvement.
- Training professionals—integrate equity, environmental justice issues into NEPA, planning process.
- Make sure trainers have good grounding in issues.
- More litigation could prompt action.

Research Needs

- Analytical tools are needed for looking at secondary and induced impacts and harms.

- Engineers and planners need a cookbook—what is disparate impact and why is it a problem?

Priority

- Training
 - Need training for citizens to help them understand transportation planning process.
 - Train MPO, FHWA divisions, regions, and headquarters, as well as state DOTs, in Title VI requirements, guidance, and best practices.
 - Need to look at alternative land use impacts.
- Guidance
 - Need to link Title VI to NEPA.
 - Added guidance and case studies (standards) for MPOs on Title VI implementation.
 - Southern California Association of Governments' (SCAG's) long-range plan analysis of equity of transportation plan.
 - Document and communicate best practices to identify environmental (environmental justice) harms and remediation; look at alternatives.
- Public involvement
 - Need for transportation planning process to go out to community meetings, not ask public to come to MPO.
 - State DOTs to fund community intervenors from within communities to represent affected communities.
 - Need to fund organizers and neighborhood groups that can organize in a community.
 - Pay people to come to meetings (focus groups)—child care, time, etc.
 - Hire more social scientists (sociologists).
 - Communicate to different audiences—educate them.
 - Americans with Disabilities Act (ADA) survey of walking a neighborhood with a wheelchair to flag pedestrian issues.
- Institutional changes
 - Reporting of Title VI CRA compliance needs more exposure, scrutiny, and grounding in reality—not check offs.
 - Environmental justice needs higher priority exposure from headquarters level—certification reviews, questioning of reports.
 - Need to make the TRB-environmental justice subcommittee (TRB social and economic factors of transportation committee) into a TRB full committee and change the name (Community Impact Assessment) and move it to Section F.

HOW TO COPE WITH THE PREDOMINANT ROLE OF THE AUTOMOBILE IN THE 21ST CENTURY

Reporter: Charlie Howard

Trends in travel, automobile mode share, automobile occupancy, suburban population and employment growth, and land use intensity are leaning toward increasing predominance of the automobile. While many policies at the federal, state, and local levels are seeking to reverse this trend, actual data show little signs of having an effect on travel behavior. The group discussed and largely accepted the fact that the automobile will remain the largest single force in transportation. A key point of the discussion was that our automobile orientation has negated investments in other modes. CP has been underused and under-demonstrated as a mobility strategy.

The group concluded that our main public purpose was to provide mobility to the population and to provide travel options in certain markets that are supported by market demand. In some cases, automobile-oriented travel would be the type of mobility that we provide. If our goal then is to influence behavior, pricing should be the mechanism to most directly influence behavior of automobile travelers. One concern is that there will remain a large number of people who do not or cannot drive (children, the elderly, those who can't afford cars, and others), so providing efficient, yet effective, alternatives for them will be a challenge.

Proposed Solutions

Action Items

- Recognize that the automobile will be a key part of the transportation future, and work constructively to integrate the automobile into other societal goals, such as livable communities and intermodal connections.
- Ensure that the needs of the population without cars are included in transportation planning.

Research Needs

- Ways to further tap the potential of carpooling as a transportation strategy (benefits of automobile use with higher efficiency)
 - Design factors that integrate the automobile better into livable communities
 - CP demonstrations to show how it really works
 - How to effectively plan and design car-based intermodal connections (for trips with at least one leg by automobile).
 - Effective alternatives in an automobile-dominated environment

Priority

High

MPO CAPACITY BUILDING: OVERCOMING BARRIERS, GETTING IT DONE

Reporter: Bruce D. McDowell

The genesis for this session was the FHWA-funded MPO Capacity-Building Project being pursued by the Association of Metropolitan Planning Organizations (AMPO). The project began more than 1 year ago with less than half the funds anticipated and is progressing slowly. The project has four goals: (a) sharing helpful practices and expertise among MPOs, (b) promoting peer reviews of MPO processes to develop programs of self-improvement, (c) providing individualized help to MPOs on request, and (d) recommending a permanent source of funding to support an ongoing capacity-building function at AMPO.

The MPO Capacity-Building Project builds on two research studies that were prepared by the Advisory Commission on Intergovernmental Relations to track MPO progress in responding to ISTEA requirements. Those studies identified (a) the types of help required for MPOs to more fully respond to ISTEA requirements, and (b) a series of good practices that emerged from the first round of MPO certification reviews and enhanced planning reviews.

The AMPO project has provided a site review, with recommendations for improvement, to one MPO that needed to make changes to satisfy deficiencies noted in its certification review and in the TIP-approval process. The project also recommended an enhanced web page for sharing practices and expertise among MPOs and recommended a national take down from the planning funds for MPO planning as the most feasible way to support the AMPO capacity-building program on a permanent basis.

The AMPO steering committee for this project emphasized the need to develop and deploy the web page as soon as possible. Development of this resource is under way.

The six participants in this work group examined the meaning of MPO capacity. Its dimensions include authority of MPO provided by federal law, regulations, money, and the ability of MPO staff and officials to accomplish their responsibilities. The AMPO project is addressing these dimensions primarily through the sharing of successful MPO practices.

Use of the Internet for sharing good practices among members of the 300-strong planning staff of Parsons Brinckerhoff (PB) was described as very successful. One

method of sharing is through e-mail requests for information on current practices of interest. Another method is the creation of "public folders" in the PB computer network for subjects of frequent interest that can be accessed by the whole planning staff at any time.

Proposed Solutions

Action Items

The use of conferences for capacity building was suggested and illustrated by two examples: (a) statewide planning conferences in some states and (b) the USDOT goal of establishing intermodal planning groups in every federal region and getting them each to hold an annual conference. One MPO revealed that its staff gets much of its capacity-building help from conferences held by other professional groups.

The training roles of NHI and NTI were also noted, but problems of accessibility, cost, and MPO orientation were believed to be significant. A national MPO institute was suggested.

The potential roles of the four FHWA resource centers also were explored. They are new (being formed from the remnants of the now abolished FHWA regional offices). Thus, it is not clear yet exactly how they will develop. However, they are looking for useful roles, and MPOs are possible clients. It is suggested that MPOs could benefit by incorporating a new division of MPOs into DOTs to take care of their needs on a nonmodal basis.

The most basic federal capacity-building step that the federal government could take would be to increase the amount of planning funds available to support MPO planning programs.

The recommendation for a small percentage of funds set aside off the top of the planning funds to support a permanent capacity-building program at AMPO was tempered by the realization that AMPO's membership does not include all MPOs. However, it was noted that AMPO's membership is growing. It now includes most of the large organizations and about half of all MPOs.

Research Needs

The following studies were suggested:

- Sources and amounts of federal funding to support AASHTO, APTA, ITE, and other similar organizations as context for developing the permanent funding plan for an AMPO that serves all MPOs
- Sources of and conditions attached to the nonfederal match for MPO planning funds
- Exploration of how AASHTO funded and developed its *Transportation Planning Manual*, and how it has managed to make the manual "the Bible" of DOTs' planning programs

- Strategies for MPOs to use in dealing with DOTs, with an emphasis on cooperative revenue forecasting

- Updates of MPO characteristics and practices, such as
 - Organization and structure
 - Representation and weighted voting
 - Roles in MISS
- GIS packages to meet new needs and communicate more easily with citizens and public officials, such as
 - Title VI
 - Environmental impacts
 - Tracking the progress of TIP projects

Priority

ISTEA has expected a great deal from MPOs. TEA-21 expects even more. The planning funding for MPOs is not keeping pace. Current legal challenges are likely to expand the types of planning and analysis that MPOs may need to do, especially in the area of civil rights. It is imperative that MPOs be able to build new and up-to-date capacities to respond to all these needs.

BEYOND AUTOMOBILE DEPENDENCY: PROVIDING REAL CHOICE BY SETTING AND ACHIEVING MODE-SPLIT GOALS

Reporter: William Wilkinson

The general consensus of the group was that use of mode-split goals in long-range plans as a sort of policy statement was not a good or viable idea. Although there may be a place for goals in the planning process, they should be based on analysis and likely used in association with one or more of the following issues:

- As part of a strategic planning process—for instance, by assigning a mode share to transit and by using models to help determine what should be done to realize this level of use;
- For specific geographic areas (e.g., older, downtown areas) with good alternatives or choices;
- For specific conditions, such as areas or corridors with transit service;
- For setting "modest" goals for various modes to move beyond the current state; and
- For setting goals for subsets of trips (e.g., trips under 2 mi in length).

More attention needs to be given by the transportation sector to influencing land use planning and decision making so as to provide areas that are more conducive to bicycle, pedestrian, and transit trips. It was noted that people

are happier (e.g., less complaints) when they have mode choices.

Research Needs

We need better information on what can be expected (in terms of trip "capture") from various modes and on what kind of basic conditions or service levels are assumed (or need to be provided) to realize these figures. This information should also address what we can expect to obtain from our "service" investments.

Transportation planning models need to be more sensitive to level of facility "quality," "connectivity," and service for bicycles, pedestrians, and transit.

Priority

Our group did not discuss this matter.

WHAT SHOULD BE THE NEW PERFORMANCE MEASURES FOR TRANSPORTATION PROGRAMS?

Reporter: Kathleen Kelly

Issues Raised

- Different performance measures at different levels of government.
- Are we collecting "easy" data and neglecting to collect data that represent the full spectrum of needs?

Proposed Solutions

- Determine what data are needed to measure
 - Improvements
 - Goals
 - Transportation options that people have
 - Freight and port performance
 - Intermodal trips, especially bicycle and pedestrian trips
- Determine changes that are needed to existing data-collection efforts
 - Need additional analysis of transportation modes or choices by demographics (e.g., elderly, women, children)
 - Need data to be collected and analyzed at the regional level and at the smallest unit possible
 - Need to add surveys on customer-satisfaction research
 - Bridge the gap between system performance and regional-community performance

- Find ways to measure "quality-of-life" issues, not just cost-effectiveness measures

NEIGHBORHOODS' ROLE IN THE TRANSPORTATION PLANNING PROCESS

Convener and Reporter: Karen Akins

Summary of Issues Addressed

- What should neighborhoods' role be in the transportation planning process?
- What are the existing barriers to neighborhood involvement?
- What can neighborhood groups do to be more effective in the transportation planning process?

Summary of Discussion

What should neighborhoods' role be?

- Neighborhood groups should help build "the vision" and make sure transportation plans support it.
- Proactive (now reactive, if at all) and based on educated neighborhood leadership.
- Reality check of what the professionals developed (technically preferred versus community-supported solution).
- Translating transportation into "quality-of-life" terms (not number of lanes or modes).
- Neighborhood groups are "watchdogs" for a place.
- Neighborhood groups could be important communication link to elected officials; they provide leverage on programs or projects.

What are the existing barriers to neighborhood involvement?

- Transportation jargon and technically complicated issues are difficult to understand.
- Professionals assume the public is stupid. "They just don't understand."
- Transportation professionals regard neighborhood groups as "obstacles" to implementation of policies and projects.
- Transportation professionals think movement is more important than place (professional bias).
- Neighborhood groups often do not understand the process, funding, or categories.
- Neighborhood groups believe their concerns won't be heard over business and industry groups.
- Public input should be built into regular neighborhood meetings, which should be held in regular meet-

ing places (to minimize inconvenience and respect participants' valuable time).

- Neighborhood groups don't have paid staff to follow transportation projects over a 10-year project-planning cycle or to lobby for mall-improvement projects they need.

- Transportation issues that are of concern to neighborhood groups, such as safety on neighborhood streets and potholes, are not seen as critical as highway projects.

- Neighborhood groups often don't understand how they are affected by larger regional plans.

- Neighborhood groups spend a lot of time and energy on land use and economic development issues and don't always see the tie-in to transportation issues.

- Public comment opportunities are not always user friendly. (Internet, access TV, or call-in shows could improve this barrier.)

- Neighborhood groups need more lead time to respond to calls for projects and comments on EISs (usually only 30 days are allowed).

- Language barriers (English only) exist.

- Public involvement programs are underfunded.

- Neighborhood groups don't fully understand their rights (NEPA, environmental justice).

- Neighborhood groups don't understand how input fits into the overall project process and project outcome (numbers do count in the NEPA process).

- People get involved too late to be effective (need to be involved during the project-scoping process, for example).

- Needs of low-income and minority neighborhoods are subverted to the needs of commuters, often a city versus suburb conflict.

- Neighborhood groups are often pitted against each other (fights over alignments).

- Neighborhood concerns are labeled as NIMBY, which shows little respect for neighborhoods' role in preserving quality of life for a distinct geographic area.

Action Items

What can neighborhood groups do to be more effective in the transportation planning process?

- Build broad coalitions with other types of groups (environmental, business, and others) and across political jurisdictions (suburban and urban coalitions).

- Become more educated in

- Transportation jargon,

- Best practices, and

- Cutting-edge research and legal opinions.

- Know how your city and state compare with current practice (e.g., rankings, survey results).

- Meet with local transportation staff and elected officials; develop working relationships; let them know you're not going away.

- Keep abreast of local transportation and land use plans and of any changes being proposed.

- Get involved early.

- Develop community-supported plans and community-supported alternatives; don't just oppose other people's plans and project design.

- Act as a resource to transportation staff by providing them with articles and other interesting information that you come across.

- Be prepared and do your homework.

- Make sure the neighborhood membership is kept informed and understands the issues; spend time educating your residents through meetings and newsletter articles.

Research Needs

- Make sure research and best practices are disseminated to grassroots organizations such as neighborhood groups (clearinghouse, library).

- Transportation professionals should visit communities that are affected by projects or plans and should understand the history of the area as a common practice.

- Compile research on economic development and quality-of-life improvements that are achieved through transportation projects and policies.

- Do research on far structures that are user friendly and that support existing neighborhoods.

- Conduct more research of transportation impacts on neighborhoods, such as noise.

- Conduct more research and mapping of particular matter; effect on particular neighborhoods.

- Compile examples of success stories of win-win solutions on neighborhood involvement that show how neighborhood input has helped the project or process.

CONFERENCE I

Workshop Reports: Tuesday, February 9

PROFESSIONAL DEVELOPMENT

Convener and Reporter: Don Steiger

Summary of Discussion

- Getting new staff members who are trained (not just “book smart”), including minorities and women to address a general shortage of professionals—public and private sectors—possibly from other professions.
- Agencies and firms face staff-training challenges that include costs, time, availability of suitable courses, and travel expense; more severe challenge for smaller MPOs.
- Risk of losing trained staff to others.
- Current backlog of needs outstrip current delivery (NTI, NHI, T3, Travel Mode Improvement Program, and universities) in quantity and range of offerings. This is not the fault of these programs but instead an indication of the previous item—possible opportunity for FHWA resource centers.
- Traditional academic process is too broad for job-specific skills.
- Need for mentoring as a mode of training.
- Managerial training needs.
- Existing deficiencies in knowledge, skills, and abilities in core areas.

• Future changes (identified in this Conference on Refocusing Planning for the 21st Century) will dictate training needs.

- Need for advanced training for journey-level competency.
- Training for trainers.

Problems and Constraints

- Lack of a transportation planning manual
- Roles of planners constantly changing with time
- Legislation constantly changing
- Expectations constantly changing
- Need to train policy makers, decision makers, and grassroots groups
 - Importance of planning and transportation
 - Public involvement
 - Transportation processes
 - Serious consequences of disinvestment in staff
- How to hold trained staff longer

Action Items

- Increase support for planning, specifically for training nationally and locally.
- Develop distributive learning computer and Internet-based transportation training.

- Continue needs assessment process for future changes.
- Training is an effective networking tool for interagency cooperation among MPO, state, federal, and local planners.
- Develop opportunities for internships and mentoring programs.
- Define a role for professional organizations.
- Launch a major national initiative (like war effort).
- Establish a transportation academy.
- Stimulate best practices research—document output.

Research Needs

Develop a planning “expert” system.

INCORPORATING ITS INTO TRANSPORTATION PLANNING: ISSUES AND OPPORTUNITIES

Convener and Reporter: Rob Puentes

Summary of Issues Addressed

ITS projects, programs, and products are proliferating throughout this country and the world. However, now that ITS is moving away from the testing phase and into a “mainstreaming” phase, it is clear that, to realize the full benefits of ITS technology, there needs to be a stronger link between the ITS, planning, and operations communities. Thus, one of the first issues that was addressed is related to past difficulties in getting ITS embraced by the planning process. Other issues that followed were related to ITS data, education and training, measuring performance of the system, reciting benefits information, and connecting the national ITS architecture with the planning community.

Summary of Discussion

How do we plan for ITS? How do we get ITS into long-range planning? Should it be integrated or mainstreamed within the existing planning process, or should it be kept separate so that it may not have to compete for funds? It is important to understand that ITS is about partnering (e.g., public-public-private partnerships). Much has been done about ITS and planning—those who have had some success in this arena have used nontraditional, innovative funding sources initiated through these partnerships. But once ITS is in place, the “planning” doesn’t stop—ITS planning is both capital and M&O and information sharing.

What makes ITS different? ITS responds to variances in the transportation system. If the systems were always the same, you wouldn’t need ITS. ITS technology is a tool to support decision making. But it is difficult to get the buy-in of decision makers without proper and appropriate information about the benefits of such systems.

Relating the benefits of ITS is important in selling the technology to decision makers. However, particularly for ITS, benefits may include many dimensions and not all easily measurable. All benefits are not just travel-time savings (“hard” benefits), such as customer satisfaction (“soft” benefits), which is much more difficult to measure and quantify. How are benefits of day-to-day operations measured? How are behavioral changes that relate to advances in transportation technology measured?

Compounding the problem are politicians, the general public, and some MPO staffs who don’t fully comprehend what ITS technology is. The use of ITS projects is a low-cost way of doing business, but some people don’t know what solutions are derived from ITS projects. Therefore, what is needed is education and training. Much of ITS may be hidden, but the public still thinks of the technology as variable message signs or “hands-off” automated highways. There is also apparent confusion over consistency and conformity with the national ITS architecture.

We also addressed the issue that the data generated by ITS (almost as a by-product) through normal operations could or should be quite useful to transportation planners. The ITS architecture is addressing this issue with a new “user service” that is related to “archiving ITS data.” But how do planners get the data? How do planners ensure that the data will meet their specific need(s)? It is important to remember that ITS is not one-size-fits-all. ITS needs to be tailored to solutions in the region.

Action Items

The planning community and the ITS community need to come up with a common set of objectives. For too long the objectives of the ITS community have been simply to deploy ITS (i.e., in the 75 largest metropolitan areas).

Research Needs

- Need tools for benefit-cost evaluation. How does ITS affect multimodal travel choices?
- Need professional training and capacity-building courses for specific groups, such as planners, decision makers, and the public. There are two federally sponsored professional capacity—building courses—one that is related to incorporating ITS and planning and an

other that is related to ITS architecture. What is needed is a way to bridge the gap between the two so as to explain the details and specifics of the architecture to planners. The architecture should be described in terms that planners will understand (i.e., avoiding jargon).

- Need to manage life-cycle costing when it's out there. There must be a long-term commitment to funding.
- Need to research ways to predict the impact of technology on the surface transportation system.
- Are current activities that are related to using ITS data as a resource for planners comprehensive enough? Does more research need to be done?

EXPANDING THE GEOGRAPHY OF PLANNING: OPPORTUNITIES FOR REGIONAL, NATIONAL, AND INTERNATIONAL PLANNING

Convener and Reporter: John W. Fuller

The group began by stating our various perspectives on the opportunities to expand planning geographically. Transport by its nature has many broad, long-distance elements, but these are often neglected in today's planning for U.S. passenger and freight transportation. We noted that planning for trade corridors is fragmented and ad hoc. There are missed possibilities for planning national systems, such as rail transport and ports. Border states have international corridor issues. Environmental concerns extend beyond MPO, state, or national borders (including sustainability questions and issues of greenhouse gases).

National policy does not derive from nor direct national planning; in fact, the only national planning the United States has in transport is occasional and fragmented. Many transport entities, such as ports, have a broad geography in terms of trade origins and destinations, but such entities aren't coordinated. While we note the opportunities for wider-scope transport planning, the continuing direction for planning in transportation appears to follow devolution, with more and more emphasis on states and local planning, which neglects broader economic and social interactions between regions and nations.

As a result of the initial discussion, we decided to focus on planning in four fields: cross-border concerns, national systems planning, freight planning, and international planning. As part of this further discussion, we commented on research needs and action items, which are highlighted in the section that follows and noted as *recommendations*.

Cross-border planning—crossing geographic boundaries of MPOs, states, and the entire country—was

observed to have barriers such as inadequate data on freight flows. Private-sector information is guarded. It is hard to obtain information about future anticipated activity for projecting future transportation facility needs. The geographic constituency that supports current planning (such as local interest groups and citizens, often having their major concerns focus on localized NIMBYs) is different from the constituency that needs expanded planning (such as exporters and international carriers). However, the need for planning for such concerns as the North American Free Trade Agreement (NAFTA) requirements was seen as acute. It was recommended that a government-industry group be convened to negotiate data collection for freight flows.

A general issue of planning is the question of localized as opposed to widespread benefits that accrue from planning, where the cost of doing the planning is narrow, yet the benefits of the plan are broad. Must MPOs solve local "authority problems of roles" before they can be effective in conducting multistate freight planning? In a similar vein, it may be in the national interest to determine which ports grow, but harm will come to some local interests, both governmental and private sector. Finding an entity that is able and willing to take on a national port planning role is very difficult. One *recommendation* was for more national funding of planning that has national interest. An MPO member of the group noted that the U.S. Treasury had been a funding source for some of its planning efforts.

A general response to cross-border problems was seen as the establishment of regional governing mechanisms and institutional structures, together with interstate compact arrangements. The group members recognized the difficulties presented and the history of failures in this area, but they still believed that more regional arrangements are needed today than ever before. Also, trade issues are breaking new ground with new players at the table, which may offer better opportunities for regional planning than in the past. It was *recommended* that multistate compacts be eligible for planning funds and that TEA-21 regulations support the establishment of regional planning activities.

In terms of national systems planning, there is a need to break the highway mind-set that was epitomized by the National Highway System exercise (as opposed to a national transportation system identification process). Planners should become more involved and knowledgeable about flows of commerce and the reliance of economic activity on transportation. We need research on circumstances in which joint use of transportation systems is economical as opposed to cases in which single systems (such as all-truck highways or all-passenger facilities) have become justified. Private-sector action or buy-in is needed to bring about a federal framework to facilitate intermodalism.

Because communications and information flow are substitutes for transportation and facilitate efficient transportation, more attention is needed in planning to transport communications interactions. It was noted that many other countries have national ministries of transportation and communications, but USDOT lacks a communications mission. However, national information on communications and information flow (including how the technology is changing) should be made available to planners, and such an effort by a national organization was *recommended*.

There appears to be many barriers to planning for international trade and transportation, some of which could be reduced by the *recommendation* that more private entities be brought to the table in international planning. (It was pointed out, for example, that the private sector is strongly involved elsewhere in the world in matters such as European port facility planning and in planning for air carrier routes and landing rights.) The group believed it worthwhile to identify the benefits obtained by the private sector from planning that use a broader geographic perspective and *recommended* extending such dialogue to shippers and carriers. It was thought that the United States could learn from successful international examples of multimodal planning and implementation, and it was *recommended* that a National Cooperative Highway Research Program (NCHRP) synthesis on international best practices in the planning process and implementation be undertaken.

International regulation may produce unwarranted barriers, but most U.S. planners are uninformed about special international rules and regulations (even about domestic restrictions on international activity, such as the Jones Act). An NCHRP synthesis on international transportation barriers was *recommended*. The power of information and continuing education was stressed. The group also supported and *recommended* better information flow about international regulations, activities, planning, and data.

BETTER INTEGRATION OF AIR QUALITY AND TRANSPORTATION PLANNING

Convener and Reporter: Calvin W. Leggett

Summary of Issues Addressed

There is a disconnect between planning horizons in transportation and air quality (AQ) planning. New models will help this problem, but they will not be in common use for 5 or more years. Transportation plans largely rely on cleaner vehicles to "solve" the conformity problem. There appears to be very little

impact on AQ models when alternate plans or build-no build scenarios are analyzed. There is also a lack of a feedback loop between AQ analysis and land use assumptions.

Summary of Discussion

The discussion began with a description of the perceived problems with transportation and AQ planning. The problems noted were

- Different time horizons were involved with transportation planning than those used in making conformity analyses.
- Transportation investment decisions appeared to have little impact on AQ emissions.
- There was a lack of data to support direct connections between land use decisions and AQ. Problems existed that were associated with the development of transportation improvements in rural nonattainment areas where there are limited opportunities for mitigation efforts. Some believe that transportation planners and AQ modelers do not know or understand what the other is doing.
- There is a belief that, in many areas, AQ impacts have little meaning to transportation decision makers.

It was noted that there were some success stories in some areas in California and in Colorado where MPOs had made conscious transportation decisions that were based, at least in part, on AQ issues. There was some sentiment that the political climate had improved enough to raise the environmental consciousness of decision makers and to raise fear that AQ issues could be used to justify political decisions that have little scientific basis.

The issue was raised that planners often ignore immediate health hazards that are created by the transportation system. Concentrated emissions from diesel fleets constitute an immediate problem that needs to be addressed soon, but quantifying impacts is difficult.

We need to work to continue to improve the climate for better environmental decision making. More consideration needs to be given to AQ in long-range planning efforts while relieving as much of the overhead (paperwork) as possible. Some participants were concerned that simply looking at AQ did not provide the complete environmental analysis that people need to fully assess potential impacts of transportation decisions.

It was noted that EPA and state AQ agencies are regulators, not planners, and it is not reasonable to expect them to help conduct transportation planning. Transportation planners will have to recognize AQ as an issue that must be addressed in long-range plans, together with other social, economic, and ecological factors.

Transportation projects appear to have little impact on emission of air pollutants. Transportation planners should be very careful in using AQ benefits as a justification for a transportation-investment decision.

Action Items

- Assemble good examples of areas in which conformity analyses have helped to improve the decision-making process.
- Educate transportation planners on AQ issues and models.
- Do a better job of “selling” the health benefits of cleaner air and better decisions; not “we’ve got to do conformity to satisfy some EPA requirement.”
- Describe AQ issues in language that decision makers and citizens understand.

Research Needs

- Need to determine the appropriate level of AQ considerations in the regional or systems planning process, or both, versus specific project plans.
- Need to explore multimedia (AQ and other environmental considerations) environmental planning integration with transportation plans.
- Need to review success stories, not just for technical information on AQ impacts, but also for looking into the processes that created better environmental decisions.

HOW TO DEREGULATE TRANSIT

Convener and Reporter: Jonathan Gifford

Summary of Issues Addressed

The regulation of public transit, including bus, rail, taxi, and other for-hire transportation, imposes barriers to entry and constrains the ability of existing service providers to offer efficient, customer-oriented services. (Convener’s note: The link to the planning process, which wasn’t really discussed at the meeting, is that planning should not assume that “business as usual” in transit will continue and that deregulation could offer dramatic opportunities to increase transit market share.)

Summary of Discussion

• Transit and other for-hire transportation are heavily regulated in most jurisdictions, which effectively prevents entrepreneurs from entering markets to provide new ser-

vices that could serve changing customer requirements (see *Curb Rights* by Dan Klein, Brookings Institution).

- There is a wide range of regulatory issues:
 - Public transit agencies are often prevented from contracting out service that would “damage” existing private carriers.
 - There is an unknown but apparently large “underground economy” of transit service that is provided by casual and occasional providers, jitneys, and off-duty taxis, among others.
 - Work rules impose high operating costs.
 - Governance issues also play a role, in which the rules, charters, and board structures for particular transit providers can be Byzantine. Parochial interests of particular local jurisdictions can also override a regional perspective and inhibit coordination of services and route connectivity. (Coordinated service does not necessarily require hierarchical organization. See *Coordination Without Hierarchy* by Chisholm for a comparison of competition in the Bay Area versus hierarchical monopoly in the Washington metropolitan area.) Some metropolitan areas (e.g., Atlanta) are pursuing efforts to develop regionwide authorities to deal with issues such as conformity.
 - There can also be “ruinous” or unhealthy competition between transit providers in a particular region that prevents service coordination and makes “interlining” and fare coordination difficult. This can make transit service opaque, especially to occasional users.
 - Unions play an important role, especially in light of federal requirements [e.g., Section 13(c)].
 - ADA is also very important because it has procedural standards instead of performance standards that constrain the ability of transit providers to offer efficient service. Although these constraints may have been well intended, they often have extraordinary effects on costs.
 - Perspective of a private bank that has had difficulty arranging transit service to its new office location within on the outskirts of a major city was examined. The bank stayed within city limits to help preserve its tax base, but it needs transit service to transport its workers and has run into extreme bureaucratic morass.
 - (1) The bank is only one-half mile from the airport, but access to the airport is extremely difficult.
 - (2) The bank paid \$500,000 to fund a bus service from rail line to worksite the first year, but the public transit agency canceled service as soon as the bank subsidy ended.
 - (3) Public agencies are not working in tandem. Economic development wants the bank to stay, but public transit is not cooperating. The welfare office wants employment, but no transport

is available. The welfare agency is not using its funds for transit service.

(4) No clear responsibility for providing service. Is the employer responsible? Transit agency? Who?

(5) Different agencies have authority over sidewalks, shelters, and streetlights; no easy coordination.

(6) The situation is especially problematic in areas where the public provider cannot or will not provide service.

(7) If private providers enter the market and establish a successful service, transit agencies have the right to take over the route.

(8) The rail provider will not make improvements for passenger safety because the station is "temporary," but its unclear how much longer it will remain in this state.

(9) Business is not looking for a subsidy but is looking for a partner, a broker, or an ombudsman. There is a need for one-stop shopping for interagency coordination.

- Equity issues include the following:
 - There is a 25 percent fare box recovery in the suburbs versus 75 percent in the city.
 - Federal capital subsidy favors extension of new service over service improvement for existing riders.
 - Subsidy for new riders is much greater than subsidy for those riders downtown, although it may take time for demand to build.
 - Bias exists toward "choice" or discretionary customers over captive riders.
 - Not only is just the welfare-to-work bus population affected, but the rural, aging, nondriving population is also affected.

Action Items

- Cervero's *Paratransit in America* discusses the problem, but we need to go farther and look at individual markets. Possible case study: Georgia's Department of Human Resources is getting out of the transportation business and contracting out all of its services. Studies or analyses to back up this decision would be useful.

- Inventory regulations—federal, state, local, "perceived versus real" (i.e., the perceived constraints versus actual constraints), union, etc.

- Analyze regulation impact on, for example, market entry, level of service, cost, and provision of paratransit (broadly construed).

- Approach state-level organizations (National Governors Association, AASHTO), APTA, and the Community Transportation Association of America and recommend that states review regulations and look for simplifications or modifications to meet existing or emerging transportation requirements.

Research Needs

- Research to quantify the effect of regulations on barriers to market entry and on modifying and customizing service to meet current and emerging transportation requirements.

- Case study: Detroit has established a public and private partnership between SEMCOG (the MPO), MAC (a business organization) and SMART (the transit provider) that identifies existing transportation capacity that could be available for commuting and for establishing a real-time dispatch system (see Shirley Loveless' study on access to jobs under Conference I Resource Papers).

- Examine ITS technologies for improved fleet-service management, such as improved real-time dispatch as in previous item.

- Inventory and identify any existing "ombudsman," broker, or one-stop shopping initiatives for businesses that need help with transportation issues. Do any exist? Possibly develop a pilot or model program.

FEDERAL PUBLIC LANDS

Convener and Reporter: Sean Furniss

Summary of Issues Addressed

- Federal agencies, states, MPOs, tourism groups, and the public need to be aware of what individual federal land management agencies are doing on the public lands they manage.

- Managers of federal public lands need to be aware of what other federal agencies, states, MPOs, tourism groups, and others are doing that could affect the management of public lands.

Summary of Discussion

- Lack of awareness of each other, their roles, and responsibilities.

- Need to improve coordination at all levels.

- Integrate the scenic highways program and the recreation trails program into the activities of the federal land management agency.

- Need more opportunities to comment on federal agency projects.

Action Items

- Provide a directory of decision makers and points of contact for federal land management agencies, state and local agencies, and MPOs (web-based?) (FHWA).

- Provide international, national, and state forums for federal land management agencies, transportation planners, tourism organizations, and other interested parties to meet (TRB, AASHTO).

- Provide information and education about statewide transportation-transit processes (TRB, AASHTO, FHWA).
- Provide a forum for federal agencies, states, and others to comment on federal agency transportation projects (web-based?) (FHWA).
- Involve federal land management agencies in meetings that are related to scenic byways and recreational trails (FHWA).
- Identify how the seven statewide planning factors affect the transportation planning processes of federal land management agencies (FHWA).

Research Needs

- Make available national GIS layer of federal public lands for federal, state, and local transportation planners.
- Assess the need for an organizational structure that could provide rural areas with a corresponding MPO-type coordinating organization.
- Develop a best practices process to improve involvement by federal agencies, states, MPOs, and others in federal land management transportation-transit projects and to improve participation of federal land management agencies in transportation-transit projects that are being developed by states, MPOs, and others.
- Document the economic benefits to local communities from federal public lands' improved transportation-transit systems.
- Identify the potential impacts of transportation-transit changes on the resource values of federal public lands.

HOW DO WE MAKE NEPA WORK AS IT WAS INTENDED IN SECTION 101 RATHER THAN AS AN ENVIRONMENTAL CLEARANCE PROCESS?

Convener and Reporter: Denise M. Rigney

Summary of Issues Addressed

- NEPA is a dumping ground for everything that wasn't addressed in planning.
- NEPA provides the hammer for those who haven't been able to cause change in any of the other steps.
- NEPA is not just an EIS—it is the process.
- The EIS should reflect the process and not just document issues.
- We need to re-invent the way agencies apply and internalize the principles of NEPA.

Summary of Discussion

Currently, compliance with NEPA is considered to be the publishing of an EIS or other environmental document.

NEPA is looked at as an environmental clearance. The process for developing projects is not always considered to be part of NEPA and is not necessarily reflected in the document. The public and agencies view the EIS or other NEPA documents to be their legal entry point into the process. These legal objections typically come at the "end" of the project-planning process instead of earlier in the planning process. Although the public and agencies may have participated and commented on the project throughout its development, the lawsuit at the end of the process is looked at as the strongest "voice" when their considerations are not incorporated.

Section 101 of NEPA directs federal agencies to integrate the consideration of environmental, social, community, and other issues into their decision-making process. Decisions are made during all steps of the transportation process, including the planning phase. Recognition of this must be made so as to ensure that the NEPA principles outlined in Section 101 are incorporated into the transportation planning process. "Everything is preliminary until it is final" is a slogan of the Corridor H Alternatives group.

Agencies and the public do not always see the benefit of being involved in the planning process. We need to change the mind-set of the planners, agencies, and the public from looking at NEPA as a club at the end of the process to incorporating its principles into the entire decision-making process. In addition, the planning process is not always viewed as being open to the public. There is currently no mechanism or will to investigate "old" decisions so as to look at alternatives to highway projects.

A reevaluation of NEPA should be considered because it was enacted in 1969, and other laws and planning tools have been enacted since then. However, other laws do not necessarily provide the "umbrella" for balancing impacts with various environmental resources, which NEPA should do.

Finally, a rethinking of how we approach NEPA should be considered. We are caught in a paradigm of the current processes. Agencies should look at internalizing the NEPA principles into their business decisions. For example, the Pennsylvania DOT is looking at 600 of their decisions and trying to determine the environmental impact of each. One outcome of this review was a switch of the type of paint used on highways from a volatile organic compound (VOC) to non-VOC paint. This one change may have a greater impact on reducing VOC emissions than many other more intensive regulatory actions.

Action Items

- Encourage DOTs to concentrate on those projects that need to be completed instead of studying them into oblivion.
- Incorporate NEPA principles and the involvement of the public and agencies into the transportation planning process.

- Document decisions throughout the entire transportation planning and project-development process.
- Make the transportation planning process proactive instead of reactive.
- Use environmental management systems for looking at business decisions.
- Stop making NEPA the dumping ground for all issues; address the issues where appropriate—cumulative impacts, environmental justice, and other issues should be addressed in the planning stage.

Research Needs

- Investigate and develop better systems analysis tools (environmental) for systems planning.
- TRB should look at the developing mechanisms for
 - Opening up the planning process to provide better public “access,”
 - Opening and closing debate,
 - Providing a “hammer” similar to that found in NEPA earlier instead of waiting for the project stage, and
 - Providing “NEPA-like” documentation during the planning phase—a tool that forces comments from the public and the agencies. The former MIS was used in this manner.
- TRB should investigate how to better engage the public and the agencies in the planning process. Education should be provided on why it is important to be actively involved in the planning process. Because different agencies and groups currently become interested at different project stages, a mechanism showing that earlier involvement is important needs to be identified.
- TRB should investigate how transportation agencies have internalized the NEPA principles into their business decisions. Pennsylvania is an example of how NEPA principles are applied to all decisions to identify their environmental impacts.
- Investigate areas in which planning has incorporated NEPA principles. For areas that are doing this well, consider “delegating” NEPA.
- Investigate incorporating or integrating NEPA into transportation planning so as to make better decisions instead of better documents.

PARKING: WHO'S IN CHARGE?

Convener and Reporter: Robert T. Dunphy

Summary of Issues Addressed

- Parking is important in shaping development, urban form, and travel choices.

- Parking is often free, it is rarely cheap.
- There is a need for better information on parking demand under market (paid) conditions.
- Private sector is critical.
- Federal tax policy plays a major role.

Summary of Discussion

Parking is a critical and widely unappreciated component of the transportation system and its associated development. Its availability and cost have a major influence on travel choice, site design, the health of the central business district and activity centers, and the quality of life of their surrounding communities. The responsibility for parking is shared primarily among local governments (planning and zoning provisions and sometimes as operator and developer); private-sector fee-based operators; developers; lenders; owners; and tenants, who develop and operate parking, paid or free, on private properties. State DOTs' role is minimal, except as operator of intermodal facilities. The federal government has influenced parking largely through its tax treatment. MPOs have sometimes influenced parking policy and transportation by issue identification, such as in Boston and Washington, D.C.

Action Items

- Issue for big cities working group to address
- Continued action on federal tax policy
- Partnerships between local governments
- Symposium on lender attitudes in real estate development

Research Needs

- Data on the impact of shared parking
- Understanding of lender attitudes
- Research on the link between parking and ITS

LONG-RANGE TECHNOLOGY FORECASTING: PREDICTING TECHNOLOGICAL CHANGE AND ITS IMPACTS ON SUPPLY AND DEMAND

Convener and Reporter: James A. Bunch

Summary of Discussion

For the first time in a very long time we are observing rapid change in the technology of transportation that is affecting the basic performance of the transportation system. ITS and communications technologies are changing the volume-delay functions of roads by type, by the reliability of transit, and by creating opportunities for whole new types of transit service delivery.

Communications technologies, such as the Internet, are also reshaping how we live our lives and the demand for transportation. An example of this change is the impact of Internet shopping, which substitutes personal travel for an increase in demand for small-package goods movement.

When asked, technology experts throw up their hands on predicting change beyond 5 years. However, transportation planning must predict the environment that will exist, and within which transportation infrastructure and services it will be provided, in 10, 15, or 20 years. If technology improvements enhance the carrying capacity of roads by 20 percent by 2020, for example, this may translate into different requirements for traditional capital and other transportation improvements.

The issue at hand also has two sides: (a) What are the changes in technology and how will they impact the services and characteristics on which travelers base their decisions? (b) How will these changes in characteristics and technologies change how we travel, our activities and behavior, and the demand for both personal travel and goods movement?

There is therefore a critical need to carry out a future search and prepare a base forecast on future characteristics of the transportation system and new technologies. This forecast could include scenarios for slow implementation (most likely) and for advanced or rapid change. Once completed, it could then be used by local and state planning agencies as a baseline, and it could account for the impacts of their policies and programs. For example, an area that is promoting ITS deployment with full surveillance of the transportation network may have a higher market penetration of personal travel information services than an area that does not have such surveillance.

Issues discussed include

- How do you plan (20-year) for impacts of future technologies?
- How do you account for changes in customer behavior?
- How do you predict the impact of future technology advances?
 - From fixed to mobile services?
 - On new potential transit and paratransit modes?
 - On performance attributes such as capacity, system variability, and free-flow time?
- How do we incorporate the actions or activities of the private sector?
- How do these technologies change how people travel, their activities, and their behavior and demand for travel? How do these impacts vary by societal cohort (e.g., poor families without cars, the elderly, and high-income families)?

- How will these changes affect the mix of vehicles and trips by purpose, such as person travel versus freight, location, and trip distance?

- How do we account for the probability of different futures and risk analysis?

Action Items

- Need to fund a 20-year national technology-based forecast. This forecast would act as the base case that state and local planners could adjust to local conditions and activities. It must cover the following:

- Global communication and other technologies that will affect demand for travel—technologies that will reshape, or change, how we live, or reshape our demand for travel organized by activities that create travel demand. Examples include shopping and the Internet, the advent of portable computers and fax machines, off-site teaching, on-line medical advice, and child care. What or how will technologies reshape these activities?

- Nonpublic-sector transportation technologies—characteristics of the transportation and communication technologies and services that will be implemented by the private sector and used by individuals. An example is personalized route guidance and the Global Positioning System (either in vehicles or by some other means). We need to determine the characteristics, the percent penetration histogram by population cohort, and the likely user costs per unit of travel.

- Public-sector transportation technologies—characteristics of public-sector technologies that are available in the horizon year (e.g., coordinated signal systems, information systems, and advanced transit systems), the percent system penetration probability histogram, public-sector costs to implement and operate, and impact on user costs per unit of travel.

- Develop an inventory of existing public-sector technology and its characteristics across the United States.

Research Needs

Research needs to focus on the behavioral changes that new technologies may cause as they are introduced. These changes should build on the previous action items. The research needs that were discussed include

- What are the likely technological changes and how will they affect system characteristics on which people make their travel decisions (see action items)? An example is the impact of ITS (i.e., incident management, advanced signal controls, priority treatments, and vari-

able message signs) on the volume-delay relationships of roadways—by type of roadway—or the impacts of advanced transit systems on transit reliability and the type of services that can be offered.

- How will changes in communications and other technologies affect the activities and demand for travel by societal segment or cohort?

- How will each societal segment or cohort use technology—difference in penetration histograms?

- How do we adjust current data classifications and techniques to account for new technologies? An example of this adjustment is altering the vehicle classification system to be based on the use of the vehicle instead of on its physical characteristics.

- Research topic on incorporating the impacts of rapid technological change into local planning and decision making and on how to adjust the national base conditions to local conditions.

- How will costs change over time, both to the providers (both public and private) and to the users?

USING ECONOMICS AND FREE ENTERPRISE TO EXECUTE LAND USE PLANS AND SUSTAINABLE DEVELOPMENT VERSUS REGULATION

Convener: Brian Mills

Reporters: Brian Mills and Alan Clark

Summary of Issues Addressed

- Carrots are better than sticks. Incentives for sustainable development are needed.

- Creating an economic reason to do the right thing is better than regulation.

- Changing people's habits through marketing (market incentives).

- Discussed institutional and financial obstacles to use of market incentives.

- MPOs and transportation agencies taking a proactive approach to sustainable development versus a reactive approach.

- Developing new "messengers" to deliver the "message" (advocacy of "Smart Growth" by financial institutions and developers).

Summary of Discussion

A combination of marketing and regulatory simplification is needed to motivate sustainable and mixed-use development. This approach will be more effective than government-mandated regulation. Federal funds, such as the CMAQ program, should be used to create market incentives. For example, MPOs could allocate funds and issue

requests for proposals (RFPs) for privately implemented sustainable developments.

The group also discussed the difficulty in securing financial institutions to fund builders and buyers of these types of development. It is currently easier for planners and government agencies to "hide" behind regulations than to be accountable for risk taking. We must remove traditional blinders with regard to transportation plans and models. One size does not fit all.

Sustainable development is an issue not just for the urban core but also for the growing suburbs. It may be easier to create sustainable developments in the growing suburbs first, then focus on redevelopment efforts. There are different levels of sustainable development throughout a region. A major advertising campaign is needed to promote the development and desirability of sustainable developments, such as a "Development of Excellence" certification.

The group discussed different regulatory obstacles to private-sector creation of sustainable developments that are faced by builders and developers. Also discussed were the problems that were created by the perception of who is selling the messages of sustainable development (environmental community with a political affiliation). What is needed is new leadership from the development and home-building community to deliver a sustainable development message.

Action Items

- Create a marketing program that promotes "Development of Excellence" as an incentive for developers to build the kind of communities we desire.

- Initiate this effort in high-growth suburbs first, then work inward (stop the bleeding first).

- Create a funding or loan program to compensate for under capitalization for sustainable development and redevelopment areas (i.e., financial institutions creating a loan pool, such as those found in Chicago).

- Give mortgage credits as incentives for business and individuals to locate into these areas.

- Create more flexible regulations that reward or at least do not exclude desired developments.

- Create a model for including banks and developers in the delivery of the message of economic opportunities with sustainable development.

- Develop a pilot program for financial incentives by MPOs and local governments to leverage private investment in sustainable developments.

Research Needs

- Identify the kinds of businesses that have higher success rates as part of redevelopment projects and identify why.

- Examine regulations and identify barriers to sustainable developments.
 - Local agencies (planning and zoning boards)
 - Fire and emergency medical services
 - AQ
 - MPOs, state and federal agencies
- Identify the economic and fiscal benefits to sustainable development from the private-sector perspective.
- Increase automobile orientation in the urban core while increasing transit use in suburban areas.
- Identify environmental barriers to redevelopment and how to mitigate them.
- Determine positive financial actions to encourage sustainable development.
- Conduct market research to see what kind of campaigns could change buyer perceptions about desirability of sustainable development. Research the “Developments of Excellence” with home builders and developers.

HOW DO WE DO 21ST-CENTURY PLANNING WITH A 19TH-CENTURY POLITICAL PROCESS?

Convener: Les Stermann

Summary of Issues Addressed

As we consider the issues to be addressed by 21st-century transportation systems, there appears to be fundamental disconnects between our planning and decision-making processes. Although plans must be longer term and must deal with complex relationships between transportation, community, economy, and environment, our decision-making processes increasingly have short horizons, are easily influenced by special interests, and can't absorb the volumes of information and legal requirements to which they are increasingly dependent. What must change: the planning process or our institutions of governance?

Summary of Discussion

The discussion focused on deciding whether our planning processes and institutions need fundamental change or whether our systems of governance need to evolve to better address regional problem solving. Many participants believed that we must respect the role of elected decision makers, that our governing institutions are not likely to change, and that we must “re-engineer” the planning process to be more relevant to the outcomes that elected officials legitimately seek for their constituents.

Other participants believed that we must opportunistically seek reform in our governmental institutions to respond to the need for more regional approaches to

problem solving. Government institutions that were created to move slowly and protect individual rights are not as good at solving problems. The group pointed out the recent electoral success of growth management initiatives nationwide, with important governance changes taking place in the northwest in recent years. They identified several research questions that are responsive to both views.

Obstacles That Block Progress

- System “standards” and practices are not relevant to current community interests—for example, concepts of maintaining capacity and increasing speed and various federal regulations that are perceived (sometimes incorrectly) to limit design and planning choices.
- Self-imposed “rules” exist that affect traditional planning practices.
- There is an inertia of ideas. The profession is bound by traditional ideas and concepts about transportation system planning.
- Staff and decision makers dislike taking risks. The process doesn't “listen” to customers.
- Analytical processes don't generate the information about outcomes that people care about (economic growth, quality of life, and community sustainability).
- Building consensus results in “least common denominator” instead of bold approaches to problems.
- We are too driven by processes (mostly of our own making) instead of by community outcomes.
- Our planning processes and institutions are reactive instead of proactive. We react to change instead of plan for change.
- Professionals are not taught to be creative and innovative.
- Governance structures are not suited for the decisions that are needed. Special purpose units of government are proliferating.
- We too often manage the planning process instead of shape it.

New Directions

- The planning process must be far more opportunistic and fast moving, quickly taking advantage of fleeting opportunities like the current public interest in growth management.
- There should be a much more sophisticated focus on the customer through better market analysis and more inclusive planning processes in which input is valued.
- The planning process needs to respond to the real needs of communities and citizens—for economic growth, community health, and quality of life. Analytical processes must generate information on real community outcomes (e.g., changes in real personal income) instead of on simply transportation system outcomes.

- Transportation must become part of the “bigger picture” of communities and regions. While this principle has been discussed at length for 40 years, the planning process does not generate the information or the decisions that fit that view.

- More broadly defined, integrated, “homegrown” regional strategies are needed for professionals and elected officials to “point to” and to promote more discipline in decision making.

Research Needs

- Develop the tools, methods, and data to produce information for decision makers that address the critical relationships between transportation and other elements of a healthy community (and region), including its economy, environment, and overall quality of life. Such methods should produce information that can “tell the story” in ways that address the needs of citizens (and their elected officials) instead of the needs of the “system.”

- Declare an “empowerment zone” for transportation, in which processes, funding restrictions, and other barriers to innovation are relaxed or eliminated. These test areas should be carefully monitored, and the results should be documented and studied.

- Study how governance institutions are changing and reforming in response to new growth challenges. This should be authoritative instead of anecdotal.

- Develop a history of regional plans to determine which projects and programs were delivered and how effective were the resulting investments.

- Re-engineer the planning process from the ground up with private-sector models of process design and re-engineering.

WHY DO PEOPLE WANT TO BUILD HOMES NEXT TO TRANSPORTATION NUISANCES?

Convener and Reporter: Charnelle L. Hicks

Summary of Issues Addressed

Conflicts associated with land use and transportation planning.

Summary of Discussion

Our interest in the topic was based on several scenarios. People buying homes near planned infrastructure, existing or expanding infrastructure facilities, and infrastructure rights-of-way were all sources of concern.

Some of the issues discussed included the reasons for people choosing these locations, such as access to neigh-

borhood amenities, to jobs, and to highway infrastructure. Lack of buyer information about planned facilities, noise, or other nuisances were also discussed. Finally, we talked about how people who wanted to get away from urban life and urban problems (including noise and highway expansions and extensions) are often joined by thousands who share their sentiments. Infrastructure sometimes grows to meet and affect established communities.

One solution that we considered was providing better information to developers and prospective homebuyers. Sources of information might include realtors, planning agencies, neighborhood associations, mortgage companies, and transportation agencies. The types of information that would be useful might include rights-of-way boundaries, noise sheds (for airports) or highway noise contours, and area land use plans.

Information is not the only solution, however. Development often occurs in areas where developers, homebuyers, and local governments are fully aware of impending infrastructure developments. In some cases, new residents induce elected officials to mitigate noise or other impacts. In other cases, homebuyers factor the nuisance in among location, cost, and other decision-making factors. Local zoning and permitting agencies sometimes approve new development plans that conflict with planned infrastructure improvements. Texas recently passed new rules stipulating that its DOT would not be responsible for providing noise or other nuisance attenuation for developments that occur after the “date of public knowledge.” These rules have not yet been tested in court.

Action Items

Identify partnership between transportation providers and realtors, developers, and local zoning and permitting agencies. Provide general neighborhood education on infrastructure development.

Research Needs

We discussed the development of guidelines for municipalities, realtors, and homebuyers on residential location in areas planned for new infrastructure. We also discussed the investigation of the success of incentive programs for short home-to-work commutes, for in-fill development in urban or transit-served areas, and for location-efficient mortgages. Exploring the relationship between transportation and economic development would also be helpful.

Other areas for potential research include effectiveness of public outreach, the relationship between long-range planning and zoning, and factors that affect location choice for new homebuyers.

ENSURING LINKS BETWEEN PLANNING AND PROGRAMMING AT STATE DOTs AND MPOs

Convener and Reporter: Tom Brigham

Summary of Issues Addressed

- Typical impediments to effective linking of planning and programming at state DOTs and MPOs; prerequisites for effective linking
- Approaches that help to ensure or could improve links between planning and programming
- Identification of research needs
- Identification of action items

Summary of Discussion

Issues Identified

- A strong, clear organizational link between planning and programming at MPOs and state DOTs is important to ensure consistency between plans and programs.
- The issue should be broader than just capital programming—it should also include budgeting of annual operating expenditures and the appropriation of funding for capital budgets at the state legislature.
- In many cases, there's no real plan—only a program of projects. Another impediment is the statewide plan that is essentially a policy plan that does not reach the specific project level. A prerequisite for effective linking of planning and programming is a DOT or MPO plan that bridges both policies and projects and is effective in terms of having a general public and political support.
- A prerequisite to effective links is state legislative approval of the program of federally funded projects. State-funded projects are more difficult to link because often state legislatures select and appropriate the projects.
- Federal funds carry the requirement that the programs are derived from STPs. There is no such required link for state or locally funded projects.
- In some states, the institutional structure divides responsibility for planning and programming, for example, California. This can be an impediment to effective linking of planning and programming.
- Congressional earmarks (high priority projects in TEA-21) are often completely outside the state-MPO planning and programming process and are an impediment.
- An effective role must be achieved for transit at the MPOs. There are some organizations at which the transit operator still does not have a seat on the MPO policy board.

- The assumption is that the program follows and implements the plan. A feedback link between the program and the plan is also necessary.

Approaches to Ensure Links Between Planning and Programming

- Organizational: responsibility for planning and programming resides in the same office of the state DOT.
- Organizational: effective state DOT-MPO structure and communication; effective communication between planners (MPOs) and engineers (DOTs); the MPO policy board and staff using the same goals and objectives; and an effective link between the MPOs' long-range transportation plans and TIP.
- Organizational: improve the coordination between highways and transit by using the flexibility found in TEA-21 to shift funds between the highway and transit programs; the prospect of joint regulations sponsored by FHWA and FTA; and the recent establishment of state DOT metro offices.
- Regulatory: tighten up the link between the statewide plan and STIP.
- Regulatory: require tiered plans in more complex and larger regions.

Action Items

- Develop and distribute a "how-to" manual on multimodal financial forecasting at the MPO level.
- FHWA needs to cajole, encourage, arm twist, or otherwise persuade (by regulation?) state DOTs to cooperate with MPOs as MPOs do multimodal financial forecasting.

Research Needs

- Update synthesis of multimodal financial forecasting (existing work is 3 years old—Sarah Campbell?).
- Examine effective linking of planning and programming
 - Institutional, administrative, and financial prerequisites that are necessary for success.
 - Tools and methodologies that have been successfully used to establish and maintain links.
 - What are the elements of a successful planning and programming process at both the state and MPO levels?
 - Clarify the state role in MPO planning and programming, with recommended regulatory "enhancements," if necessary.
 - Review and present best practices (suggested sites to examine: Des Moines area MPO, Portland, and Pennsylvania).

HOW TO INTEGRATE REGIONAL TRANSPORTATION PLANNING INTO A BROADER ENVIRONMENTAL, ECONOMIC, AND SOCIAL CONTEXT

Convener and Reporter: David S. Boyd

Summary of Issues Addressed

The transportation planning process exists in a highly fragmented environment that is characterized by (a) a preponderance of uncoordinated (but often related) regulations; and (b) numerous agencies, organizations, and shareholder groups that represent federal, state, and local perspectives. This environment is manifested in two ways. First, there are increasing demands that metropolitan transportation plans become more like comprehensive regional plans that cover a wide variety of projects and "elements." Second, in the absence of a true regional planning framework, a multiplicity of specialized and often uncoordinated plans are promulgated.

Summary of Discussion

The participants represented a broad range of interest groups, each with unique concerns about the planning process. Issues include

- Pedestrians;
- Integrating community and transportation concerns into NPS facility plans;
- Incorporating local and MPO plans (especially land use elements) into STPs;
- Educating the public, community leaders, and agency staff about comprehensive planning and cumulative impact analyses;
- Integrating discreet plans into comprehensive documents;
- Thinking more broadly and in long-range terms about community-planning issues (e.g., social and economic development issues, accessibility, environmental justice);
- Preserving and revitalizing neighborhoods and communities;
- Investigating suburban sprawl and sustainable investment patterns;
- Streamlining planning and environmental regulations;
- Equity planning and grassroots organizing;
- Linking comprehensive and project planning (including environmental review processes);
- Establishing collaborative working relationships with a broad range of government agencies;
- Considering the role of transportation planning at the regional, community, and neighborhood levels and the "pyramid of impacts."

A number of barriers were identified:

- Institutional "fiefdoms" and the lack of a shared vision for the regional community;
- Existence of different planning horizons; milestones and schedules may make program and project synchronization very difficult;
- Public's distrust of agency staff members and their motivations (based on past experience and perceptions);
- Ability of the political process to disregard the planning process;
- Lack of definitive regional comprehensive plans; and
- Lack of implementation authority among metropolitan planning agencies.

As the discussion progressed, a number of common themes began to emerge. A brief synthesis of these themes follows:

• *Leadership and a shared vision are necessary prerequisites to successful regional planning.* The discussion of experiences appeared to indicate no best single source of these characteristics. In some situations, it was the grassroots community activists who were successful in obtaining political standing on an issue; in other cases, it was a matter of having "enlightened leaders." In some cases (e.g., Portland, Oregon, and Massachusetts), it was the process of grassroots advocates making a concerted effort to operate within "the system" by rising to political prominence.

• *Educational efforts are essential to cultivating informed leaders and community members.* Education comes in many shapes and forms. To help people understand their choices (and the ramifications of such) is a vital part of overcoming apathy and implementing a regional vision. For example, the residents of Portland are bombarded with media messages about implications of alternative development and investment choices. This has helped to keep the regional "vision" on the public's radar screens (despite numerous changes in political leadership).

• *Working at the grassroots level helps to integrate social concerns and may help to make project implementation cost-effective.* Working with the public early in the planning process may facilitate project implementation by cultivating stakeholder "ownership" of the final decision. This may, in turn, increase the cost-effectiveness of a project by reducing the potential for litigation.

• *Use of regulations has mixed blessings.* Regulations may provide a means of catalyzing a specific set of behaviors and may be an evil necessity to establish a minimal level of performance. This was certainly the case with the early MPO planning requirements under ISTEA. And it is hoped that some of the positive features of the now de-legislated MIS process are retained (e.g., interagency collaboration and consultation).

However, it was suggested that the modeling and distribution of creative practices may have a longer-lasting impact. In essence, the demonstration of benefits and advantages of entrepreneurial behavior are important motivators to risk-averse agencies.

Action Items

- There is a need to continue to foster collaboration between various units and levels of government (as was initiated under ISTEA's MIS procedures). MPOs represent acceptable venues and conveners of these parties. This effort must be continuous.

- Federal agencies can require multiparty collaboration and coordination as a prerequisite to receipt of funds (e.g., FTA's Job Access Commute Program has such requirements).

- MPO planning reviews can be used to compel performance with regard to community engagement in the planning process. Note that TEA-21 now requires USDOT review panels to meet with the public as part of these review processes.

- MPOs might take a more proactive position by using federal transportation funds as a lever to accomplish regional planning objectives (e.g., require local governments to complete updated planning documents that are consistent with regional goals and objectives to be eligible for federal aid projects). Further incentives (e.g., funding directed by MPOs to local agencies for planning purposes) may also be used to encourage desired behaviors.

- Transportation agencies need to move away from having a "public works" orientation and toward a "service organization" (see Stephen Lockwood's paper under Conference I Resource Papers).

- There is a general lack of definitive regional comprehensive plans to provide context to regional transportation planning. Where no such plans exist, MPOs should initiate a collaborative process to create them.

- MPOs generally lack the authority to implement their plans (e.g., land use controls, construction of infrastructure). In the absence of such authority, they should actively seek agreements to participate in these decisions (e.g., voluntary review or comment on local projects that may meet "regional significance" thresholds).

- To help overcome provincialism among institutions, MPOs should seek to initiate data-sharing initiatives (e.g., creation of web-based and "cyber-warehouse" data).

Research Needs

- There is a need to create decision mechanisms that more closely tie regional transportation plans to implementation. It has been suggested that the development of a series of implementation programs might be implemented to accomplish this objective. A revenue program,

a growth management program, a service program, and a legislative program may be part of a comprehensive toolbox to foster implementation of the plan.

- Best practices—community engagement. Three subtopics were suggested: (a) a survey of training needs for agency staff who are concerned with public involvement activities; (b) case studies about different engagement and communication techniques (especially those that focus on using jargon-free language); and (c) case studies on community empowerment education processes.

- Best practices—accessible decision making. Although ISTEA and TEA-21 required that the public have early access to the decision-making process, there are questions about the actual implementation of this process. An exploration of this issue, and the correlated benefits to the agencies and to their decisions, merits further research (e.g., synergy may result in better decisions and reduced litigation).

"YES, BUT WHAT ABOUT FREIGHT?"

Convener and Reporter: Janet Oakley

Summary of Issues Addressed

The freight community believes that their transportation logistics and infrastructure needs are not understood and are generally overlooked by state DOTs and MPOs in the planning, programming, and decision-making process. The focus traditionally has been on passenger needs and requirements because "people vote and freight doesn't." How can the planning process more effectively incorporate freight, given the change in and complexity of new production technology and the changing economic and market forces?

Summary of Discussion

Participants discussed technical, procedural, and policy issues in ensuring that freight needs are addressed; obstacles to more effectively incorporate freight concerns into transportation planning; and actions and research needs to overcome these obstacles. Obstacles to more effectively incorporate freight include

- Lack of analytical and measurement tools;
- Lack of understanding of emerging freight trends and concepts and their implications for transportation systems;
- Lack of understanding of the implications of NAFTA;
- Diversity of freight movements, logistics, and requirements across metropolitan and rural areas;
- Mismatch of short-term, market-based, and private-sector planning horizons versus the longer-term public planning horizons;

- Access to confidential private-sector freight data;
- Lack of understanding of the freight-related consequences of and for economic development; and
- Conflicts between freight-related land use requirements for port operations and gentrification of waterfront property.

Given the range of issues and the diversity, different tools to aid in the incorporation of freight into the planning process are needed for different geographic areas.

Action Items

- Develop educational tools that explain freight logistics and freight implications of new production techniques and new markets for use by schools, community groups, elected officials, and transportation planning professionals.
- Assemble more user-friendly and cost-effective freight databases.
- USDOT should communicate the results of the truck size and weight study to states, MPOs, communities, and other interested groups.
- Assemble and distribute stories about public and private freight partnership financing successes.

Research Needs

- Develop a national and international freight-flow model as a tool for decisions involving national freight transportation policy.
- Prepare a synthesis of best-good practice that identifies incentives to bring representatives of the domestic waterway industry to the state and metropolitan transportation planning "table."
- Prepare a synthesis of best-good practice that identifies ways in which freight issues have been elevated in metropolitan areas and institutional mechanisms to ensure that freight concerns are adequately addressed.
- Develop tools to assist in evaluating and prioritizing freight projects, including benefit and cost methodologies.
- Assess the potential economic benefits and costs of freight-mode shifts.
- Assess and evaluate obstacles to freight-mode shifts.
- Assess the benefits and costs of dedicated freight facilities (e.g., truck ways).
- Evaluate how pricing affects freight and shipping decisions; assess how pricing can be used to achieve other public policy goals (e.g., air quality).
- Assess the potential for containerization on the inland waterway system.
- Develop new evaluation tools and methods for assessing trade-offs between freight versus passenger investments and between modes.
- Develop methods for measuring the full costs and benefits (including externalities) of investment in freight-transportation projects.

HOW TO REDEVELOP TRANSPORTATION INFRASTRUCTURE IN ESTABLISHED AREAS

Convener: Adolfo Mendez

Reporters: Adolfo Mendez and Ryan McKenzie

Summary of Issues Addressed

This session addressed the challenges in redeveloping inner-ring subdivisions and older neighborhoods. We addressed such issues as

- Working with neighborhood residents,
- Maintaining aging infrastructure,
- Lack of bicycle-pedestrian alternatives in older suburbs,
- Adding new transit infrastructure to existing communities, and
- Reconciling the demand from established communities and new development.

Summary of Discussion

- Develop tools that help identify zones for redevelopment and reinvestment.
- Use GIS to examine existing neighborhood strengths and weaknesses; identify areas with the most redevelopment potential.
- Use GIS to analyze areas in which transit service is most effective and to enhance transit-oriented redevelopment.
- Focus public and private resources and efforts in these zones.
- Look to principles of new urbanism for design guidance.
- Do not assume that existing infrastructure is adequate for redevelopment needs.
- Consider suburban subdivisions as islands—need to remove barriers to noncar mobility.
- Need to address walking environment to boost transit.
- Demand responsive transit and paratransit as service response.
- In-fill development within targeted zones is good for transit
- General in-fill development may not be served well by existing routes.
- Public policy decision about service—can't serve everybody at the same level; must consider the demands of taxpayers who are not well served by transit agencies.
- Operating solutions should encourage flextime—schedule alterations to serve large employers and schools. Some counties have staff to market participation in commuting alternatives to single-occupancy vehicles.

- Need to provide jobs in areas where people live instead of providing only transportation solutions.

Action Items

- Research and develop analysis tools to identify priority redevelopment districts.
- Educate local officials around the country about funding availability and best practices.
- Highlight success stories nationally.

Research Needs

- What tools are needed to analyze the redevelopment potential of existing neighborhoods?
- What infrastructure design standards are appropriate for established urban areas? To what extent should these standards be flexible?
- How should established areas be retrofitted to achieve bicycle, pedestrian, and efficient transit accessibility?
- Who should market transportation alternatives and what are best practices?
- What land use controls can be beneficial to the redevelopment of established areas? Who needs to be at the table for these discussions?
- How can transportation funding be linked to neighborhood priorities?

TOMORROW, TODAY, AND YESTERDAY

Convener and Reporter: Robert M. Winick

Summary of Issues Addressed

Will officials believe that planners can plan for tomorrow if we cannot describe to them what the conditions are today or yesterday?

Summary of Discussion

We initiated the session with each participant discussing what the topic issue meant. The comments indicated a need (a) for credibility and trust of the planners with the officials and (b) for planners to focus more on system monitoring and other indicators of current conditions because the officials are more concerned with today's conditions.

The participants then discussed their experiences with blocks and obstacles to building trust. Several types of blocks and obstacles were identified:

- Conflicting staff inputs and recommendations,

- Receiving different forecast estimates from related corridor studies,

- Misplaced accuracy or false precision (i.e., tons of emission reduction to the nearest one hundredth of a ton),

- Difficulties in succinctly summarizing the results of the planning in nontechnical terms, and

- Having minds already made up.

The group also discussed a few success examples, such as using comparable examples, putting information in terms the officials can better understand, effectively using visuals and graphics, and "attaching" the results to other issues that the officials intensely care about.

Action Items

- Need to move away from just doing longer-range, 20-year plans and focus on shorter-term planning horizons for capital program priorities and operating programs.
- Need to develop informational materials that debunk widely held myths that can otherwise be counterproductive to building trust between staff and officials.
- Apply planning-oriented tools to ongoing monitoring and analysis so as to manage needs in system management and operations planning.
- Refocus ongoing monitoring-program activities to observe, measure, or characterize outcomes of the planning, facilities, and services delivery.
- Develop training programs and professional development opportunities to enable more transportation staff to become more proficient in good communication skills and in better understanding policy and political contexts that are related to their ongoing responsibilities.
- Use more weighted evaluation matrixes in presenting planning results.
- Be more strategic and tactical in selecting the issues that planners really need officials to act on while avoiding crisis modes in which every potential action is labeled extremely critical.

Research Needs

- What techniques are available to expand the planner's toolbox (i.e., high-tech visuals and displays) so as to increase consent and improve the marketing of plans, programs, projects, or operations?
- Are there ways to shorten the turnaround of plan analyses, processes, and development because of the shortening average tenure of officials due to term limitations? How can planners plan more quickly?
- What are the best practices in this area? What approaches appear to be working, and which ones appear not to be as effective? Are we using the most appropriate models and assumptions for the needed scale and scope of analysis and planning?

- What methods and techniques can be used to break down the planning activities into manageable units or increments so that planners can effectively plan interdependently with decision-maker involvement, understanding, and guidance, particularly in the development of land use and multimodal transportation plans? How can cause and effect relationships be made more understandable? Is it important to work with an optimal number and range of options? How can we more effectively aggregate bottoms-up plans in a cooperative manner, yet bring in a discipline and expectation of some pertinent control totals?

HOW TO TRANSPORT LUGGAGE

Convener and Reporter: Diana Carsey

Summary of Issues Addressed

How to transport luggage.

Summary of Discussion

Discussants described the pathway of getting luggage from the hotel to the metro, to the train station or to the airport, to the shuttle, to the car, and to their homes. Issues included weight of luggage and poor engineering of carts for packages and groceries. Both issues tend to discourage people from using carts and result in the use of cars, even when suppliers are in proximity.

Businesses discourage people with luggage (at this hotel, luggage is forbidden on the escalator). Airports restrict areas in which carts can be used so that you have to transfer to a porter, struggle with the bags yourself, or hire another cart.

Lost luggage is the key problem for long-distance travelers. People carry their luggage because they have no faith that it will reach their destination otherwise.

Local transit providers do not provide convenient luggage and package space on their vehicles. Bicycles are a problem in some areas in which the transit service restricts or prohibits the carrying of bicycles on vehicles.

The goal is mobility. If encumbered customers are tired, they will spend less money in your town or store. Take care of their luggage. They will stay longer and spend more money.

Obstacles

- Getting customers from airports to cruise terminals and from trains to homes requires seamless handling and trust that all the people along the path know what they are doing.
- Cost to use third-party carriers.

- Luggage without wheels.
- Physical features and weather.
- No places to store stuff (safety issue for the provider).
- Rules that discourage use of equipment.
- Rules about the size of bags, number of bags, etc.
- No off-site check-in like they have in Tokyo, Stockholm, and London.

Action Items

- Businesses and chambers of commerce need to acknowledge the problem of luggage handling.
- Provide storage for public use.
- Provide luggage carts for public use.

Research Needs

- Design a tracking system (like FedEx) that allows you to send your luggage ahead.
- Establish a chain-of-control method to complement the tracking system.
- Design shopping carts that are stable and that fold up easily and correctly so you can put them on buses.
- In transportation planning, remember to consider package transport in each mode that is analyzed.

NEGOTIATING FINANCIAL ESTIMATES

Convener and Reporter: Janet Oakley

Summary of Issues Addressed

ISTEA first required that long-range metropolitan transportation plans and TIPs be financially constrained so as to bring fiscal discipline and rationality to the transportation planning and programming process. To prepare financially constrained plans and TIPs, MPOs need, at the very least, revenue estimates from state DOTs and transit operators.

TEA-21 now explicitly requires state DOT, MPO, and transit-operator collaboration on the development of financial estimates. This requirement for revenue estimates, as well as the requirement for financially constrained plans and TIPs, has generated considerable controversy and has been resisted by some state DOTs. The opposition to providing or to collaboratively developing financial estimates appears to come from (a) methodology problems that are associated with estimating revenues over a 20-year period, (b) concerns that financial estimates will be interpreted as fixed financial commitments; and (c) a perceived loss of state "control" over resource distribution.

Summary of Discussion

Financial constraint is an important element of the planning process that adds fiscal discipline, credibility, and accountability to the planning, programming, and decision-making process. To financially constrain plans and programs, reasonable and timely estimates of revenues are needed. In nonattainment areas, transportation-conformity requirements also necessitate the "costing out" of projects so as to assess the "reality" of the plan. Moreover, financial forecasts help planners to better understand the "balancing" of investment options and to focus on the cost requirements to maintain and operate the existing system.

Nevertheless, state DOTs have resisted providing this information to MPOs. The reasons for this resistance include (a) lack of methods for financial forecasting of new revenue streams (e.g., from innovative finance techniques) and costs (e.g., M&O costs, toll facilities, ITS maintenance costs); (b) concerns that estimates will be fixed financial commitments; and (c) a perceived loss of control. Current practice varies among the states, but clearly there are examples of collaboration. One state has had success with a "Y'all come" approach in which the state DOT invites MPOs, transit operators, and federal agencies to the table to cooperate in developing revenue targets for planning purposes. Among the barriers to change are institutional history-memory and bureaucratic inertia. There is consensus that tools are needed to increase a state's comfort level with the concept of collaborative development of revenue forecasts.

Action Items

- Establish a pilot program for MPOs within a state to establish a consortium for developing multimodal revenue forecasts for the metropolitan areas of the state.
- Excerpt, repackage, and distribute materials from NTP's financial planning and programming course.
- Conduct a survey of state, transit operator, and MPO financial planning and program management practices.
- Encourage USDOT to facilitate cooperation among state, MPOs, and transit operators in developing and using collaboratively developed financial estimates.
- Conduct a survey of ways that project sponsors are improving their project estimates to avoid cost overruns.

Research Needs

- Prepare and distribute a synthesis of best-good practices on the development of cooperative financial forecasts.
- Develop or adapt methods for "quick response" revenue forecasting.
- Prepare a synthesis of best-good practices on solutions to the institutional and policy obstacles to developing cooperative revenue forecasts.

MULTIMODAL AND INTERMODAL ISSUES

Convener and Reporter: Roger Petzold

Summary of Issues Addressed

Many areas are dealing with the issues of trade-off between the modes and how the modes interact. This session addressed both passenger and freight multimodal and intermodal issues.

Summary of Discussion

- Passenger
 - Need to think of all modes while planning transportation improvements.
 - Need to provide for the easy transfer between modes (multimodal terminals).
 - Must do a better job of communicating needs.
- Freight
 - Need better freight models.
 - Need to get the freight industry involved by talking about short-term project improvement (2 years).

Action Items

- Better M&O of the transportation system will improve the coordination between modes.
- Bundle projects into areawide efforts to reduce the time and cost to produce projects.
- Lower the level of effort to identify multimodal projects (i.e., sidewalk).
- Think multimodal in all projects; evaluate the impact on all modes.
- Do a better job of doing multimodal trade-off at the individual trip level for both passenger and freight.
- Need to provide better information on multimodal trips to customers, both for planning and real-time feedback (i.e., Internet, real-time display at bus stops).
- Need to better coordinate passenger terminal location to better facilitate the transfer between modes.
- Need to better facilitate the transfer between modes.
- Need better multimodal access to airports.
- Need to use pricing more to change transportation patterns.
 - Variable tolls by time of day.
 - Variable parking prices.
 - Port fees by time of day.
- Need to have a short-time frame (i.e., 2 years) for projects if the freight industry is to be effective in its involvement in freight issues.
- Must consider the impact of changing international trade in freight issues.
- Must take more advantages of opportunities.
- Need to identify major trade corridors.

- Need to develop improved freight prediction models at the regional level (i.e., SCAG, Portland, FHWA, NCHRP).
- Need to involve economic planners in freight planning.
- Need to better understand the consolidation of the private transportation companies.

Research Needs

- Better freight models at the regional and national level.
- Better ways to provide passenger information for trip planning and real-time feedback.
- Better ways to do multimodal trade-off.

EXPANDING AND INTEGRATING DECISION-SUPPORT TOOLS

Summary of Issues Addressed

Although many planning tools have been developed, they need to be further enhanced to address cross-modal and multimodal trade-offs, a larger planning context, and expanded goals. They also need to be integrated to provide comprehensive information to make decisions. It is recognized that planning should provide analyses of the potential impacts of decisions in such a way that the decision maker can understand his or her choices and can make the best decision.

The discussion highlighted the need to integrate disparate management and information systems to provide the ability to make decisions among competing interests or programs, or both. The goal is to expand our capabilities and tools for comparing policy alternatives and projects so as to provide better, more informed decisions.

Tools do not need to be quantitative, but we need to have ways to compare disparate alternatives without feeling that they must be reduced to a purely quantitative choice. We are learning to think in terms of relative or comparative effects and of a range of impacts instead of assuming we can determine an exact impact. The discussion of components of the toolbox included the importance of methods and strategies to involve the public and to use the media to educate and collect information.

Action Items

- Inventory planning tools and determine baseline costs.
- Integrate disparate data sets to support decisions.
- Tie together organizational functions such as operations, maintenance, and construction.
- Determine decision-making goals and understand decision-information requirements.

- Involve stakeholders in planning and developing alternatives; gather and disseminate information in new ways (e.g., websites and mass media).
- Focus on locating data for decisions and describe their reliability.

Research Needs

- Develop macroscale tools that can support program allocation and do multiobjective trade-offs.
- Develop methods to work across modal and organizational functions and support internal efficiency measures.
- Identify approaches to integrate national, state, and local databases as required.
- Identify methods to explore impacts of alternatives as they relate to goals of the process.
- Inventory data and their location.
- Identify best practices for constituent education and outreach.
- Catalog public and private data resources and identify barriers to obtaining such information.
- Determine what data are needed to support decisions that consider "new variables" for enlarged planning questions (e.g., freight providers are concerned with travel-time variance and system reliability).
- Identify guidelines for collecting data and common criteria for evaluation.
- Develop an understanding of incremental and cumulative impacts at the project and system levels.
- Determine best practices for visioning activities.

WHO ARE THE CUSTOMERS AND HOW DO WE GET TO THEM?

Convener and Reporter: Randy Walker

Summary of Issues Addressed

- Who is the customer?
- What is the hierarchy of customers?
- What are we trying to sell to our customers?

Summary of Discussion

The gist of this discussion centered on the customer and the product, and there was confusion and differences of opinion on both. It was the consensus that research efforts need to focus on satisfying the customer and listening to customer needs. Other topics of discussion were

- Who is the customer?
- Community users of roads and transit systems.

- Are we marketing wholesale (elected officials) or retail (system users) transit customers?
- People who do not have access to automobiles.
- Land developers who are "promised" transportation.
- The elderly.
- Freight shippers and carriers who must also use the transportation system.
- What is the hierarchy of customers?
- Those who supply the greater amount of the tax dollar through user fees or through other methods. The group, in general, did not believe this was the "right" thing to do, but it is reality.
- Local government agencies; however, these organizations do not always agree on who is the final retail customer.
- What are we trying to sell?
- Accurate decision making and quality information will help our customer.
- Move people or commodities in an efficient and equitable manner.
- Make educated and informed choices on the use of transportation facilities or options.
- Determine which capital transportation projects will most benefit the communities and states where we work.
- Help provide for noncongested roadways and concurrent use of roadways.

Research Needs

- Is the current regulatory scheme still applicable?
- Will the current customer be the customer of the future?
- Are there any synergistic opportunities in regard to moving people and commodities?
- Are we listening to the customer? How can we listen better?
- Is the product that we deliver what the customer asked for?

DESTINATION ACCESS: IMPACTS OF TRANSPORTATION TO AND FROM NATIONAL PARKS AND OTHER PUBLIC LANDS ON LOCAL, REGIONAL, NATIONAL, AND INTERNATIONAL ECONOMIES

Convener and Reporter: Amy Vanderbilt

Summary of Issues Addressed

The group consisted of three federal employees, one retired federal employee now working as a private consultant, and one representative of a nonprofit organization. Issues raised by the group included a gamut of

topics that pertain to transportation and transit challenges of congested metropolitan and popular national park areas, wildlife refuges, and other public lands. There was consensus that field-level managers of national parks and other federal land areas need to obtain a sound working knowledge and expertise of transportation issues and tools within TEA-21.

There is a great need to educate federal land managers about federal land programs and processes, including but not limited to the underutilized Transportation Enhancement Program and the Scenic Byways and All American Roads Programs. Federal land managers should share their 5-year needs list with the state DOT (i.e., roads, health, and safety).

Park general management plans and other master planning efforts need to look beyond boundaries as well as evaluate internal conditions. They also need to include gateway communities (may obtain funding for trails and information centers, among others). Agencies need to complete initial master planning (where necessary) and look at public uses on neighboring lands that complement or conflict with master planning, or both.

Summary of Discussion

The group discussed having federal land managers work closely with state DOT planning offices that fund local rural road projects, that already have recreation plans, and that could be helpful (i.e., already capture vehicle traffic outside federal land units). They recognized that many land management field units do not have adequate staffing to attend planning meetings held by state or metropolitan offices but that close coordination is key to success in obtaining funds from federally mandated program sources.

In addition to state transportation planners, land managers or their representative(s), FTA, and FHWA federal aid personnel should attend these periodic meetings. Funding success will be derived from personal relationships with key transportation personnel instead of from just programmatic knowledge.

Action Items

- Need to involve MPOs near urban parks and refuges. Conversely, MPOs also need to include park units and refuges early in their planning efforts.
- Need to establish ITS on adjacent public lands and within gateway communities.
- Need transit systems in metropolitan areas, wherever congested and popular attractions exist; subsidize where possible to ensure greater use by visitors.
- FHWA needs to ensure training of land management agency administrators, including facilitation of relationship building with state planning offices.

- FHWA and the Federal Lands and Highway Program should facilitate dispute resolution on entry-access roads and hold state-level meetings to aid managers' understanding, options, and role(s) of TEA-21.

- NPS guidebook (prepared by Parsons Brinckerhoff et al., September 1999) and the American Recreation Coalition's tool kit are two examples of new resources to aid land managers with alternative transportation planning.

- Include representatives from other Department of Interior agencies where feasible; share pertinent portions of resource materials with sister agencies.

- Need to include and involve travel and tourism officials (e.g., state travel directors) in transportation planning.

- Transit system issues must be addressed and transit systems must be implemented in a timely manner or visitor experiences at congested park units and at heavily populated metropolitan areas could be destroyed. Other suggestions include eliminating opportunities for private vehicle use, closing gates when carrying-capacity threshold is reached, and experimenting with entry prices.

- Look to other agencies within own department for a cooperative working relationship and possible funding.

- Include U.S. Forest Service in interagency transportation planning.

Research Needs

- Investigate viability of fee-free day (i.e., weekly) as a means to manage visitation; experiment with pricing for entry, transportation, and so forth.

- TRB should evaluate or assess "best methods" of addressing transit shuttle systems and transportation pricing.

- Identify and evaluate carrying capacity for respective park and refuge areas and threshold for management actions to address congestion and transit issues.

- Identify, locate, and provide all MPO names for future contact list (i.e., websites).

- Identify, locate, and provide names, location, and address of all state Scenic Byway and Recreation Trail Program coordinators (i.e., websites).

- Distribute results and products of the TRB Task Force on Transportation Needs in National Parks and Other Public Lands.

- Educate land managers about other TRB and FHWA publications, research, and other services.

- Incorporate pedestrian and bicycle pathways into planning to link multi-jurisdictional destinations and transit systems.

PROVIDING INFRASTRUCTURE FOR NEW DEVELOPMENT

Reporter: Jerry B. Schutz

New development is occurring, largely at the urban fringe, with no provision for the infrastructure needs of a built environment. New development provides its own internal circulation system and connects it to the rural system, resulting in inefficient travel patterns for all modes.

Issues

- Parcel-by-parcel development
- Overloading of the rural regional system
- Indirect travel for all modes.
- Lack of planning
- More costly maintenance
- Failure to follow good basic planning practices
- Lack of planning resources at the local level
- Need to forecast growth as the basis for needs
- Planning environment, growth management, comprehensive planning with growth management, and no comprehensive planning
- Development review by transportation professionals
- Needs of transit friendly development

Action Items

- Need to plan for build-out.
- Need to reserve right-of-way for the collector-arterial system.
- Provide education in basic planning principles.
- State transportation agency support for local agencies.
- Include modal considerations in planning.
- Define accessibility of development areas.
- Preserve the capacity of the existing system through access management and corridor management plans, in a multimodal context.
- Develop the financial resources for the planning and infrastructure needs.

Research Needs

- Develop guidelines to support multimodal infrastructure needs of developing areas.
- Provide examples of best practices.
- Provide examples of worst practices with cause and effect.
- Update the functional classification system, including the incorporation of multimodal needs.

- Where development of multimodal facilities leads to further development or to redevelopment, define the zoning that is needed to support it and the impacts on the regional infrastructure.
- Expand funding methods to address regional infrastructure needs in developing areas.
- Determine total costs for transportation facilities and services in developing areas.
- Quantify total trip generation (including intrazonal) as a result of inefficient development patterns;

include background traffic, which may result from nearby inefficient development.

Priority

The group believed that the lack of a provision for the infrastructure needs of a built environment is very significant and could lead to a reduced use of multimodal options, sprawl, congestion, and reduced accessibility.

CONFERENCE II RESEARCH STATEMENTS

A More Robust Planning Process

TO WHAT EXTENT DO TRANSPORTATION INVESTMENTS RESULT IN ECONOMIC DEVELOPMENT AND GROWTH?

Problem

Many transportation improvement projects are justified on the belief that they increase economic development and productivity. The federal role in transportation investment was originally based partially on the assumption that improved transportation services would promote economic growth. Recent research has both supported and challenged some of these assumptions and has reached, in some cases, contradictory conclusions. Additional basic research is needed to further understand the fundamental relationships.

The recent debate on this issue began with the work of Aschauer in the early 1990s. Aschauer concluded that public capital investments could achieve higher rates of return than could investments in the private sector. A parallel debate has ensued on the travel- and the development-inducing impacts of road projects, with many transportation professionals continuing to maintain that there are no behavioral or economic impacts from road projects. These two arguments are essentially in contradiction, because new economic development will, by definition, generate new travel, and if the justification for a project is to promote economic development, then the project must generate additional travel.

Recent research by Boarnet has attempted to reconcile these viewpoints by estimating equations that suggest that net growth impacts from transportation investments are minimal, while redistributive impacts within a metropolitan region may be substantial. That is, Boarnet concludes that total productivity increases are very small, but economic development is merely redistributed to newly accessible parts of a metropolitan area (often resulting in net increases in vehicle travel, because these areas are generally not accessible by alternative modes).

This issue can have substantial implications for transportation policy. These implications would include how projects are funded, the types of projects funded, and the spatial allocation of funding decisions within a metropolitan area. This debate cannot be disentangled from "Smart Growth" issues, which focus on redeveloping those areas that already have built infrastructure.

Objective

This research would attempt to better estimate the relationships between transportation and economic growth. This work effort should provide funding for at least three projects that will conduct basic research in this area to further the knowledge base of the relationships between public expenditures on transportation and impacts on economic growth. These three

studies could address, for example, specific topics such as

- Level of redistribution of economic development relative to actual increases in productivity;
- Whether location and development decisions are actually influenced by transportation projects and lead to changes in the spatial distribution of investment; and
- Whether redistribution of development generates new (or more) traffic or whether it would have happened elsewhere.

Related Work

The work of Boarnet and Nadiri (which FHWA has funded to extend Aschauer's work) can serve as a starting point for additional research to disentangle these effects.

Urgency/Priority

This work has a high priority because policy makers urgently need a better understanding of these issues. An understanding of economic and distributional impacts of transportation facilities is important as areas grapple with planning for increased sustainability.

Cost

\$450,000 for three projects of \$150,000 each.

User Community and Potential Users

Decision makers are at the federal, state, and local level. Transportation planners and modelers are attempting to measure the costs and benefits of projects.

Potential Sponsors

FHWA, FTA, NCHRP, EPA

Implementation

This research would be classified as enabling research. Actual implementation of the research findings would be considered better decision making with regard to the economic impacts of specific transportation projects and transportation plans. Possible changes in policy on the allocation of transportation funds could result.

Effectiveness

The long-term effectiveness of this research could result in better decision making on the spending of public

funds and on the development of more sustainable urban systems.

Key Words

Economic development, induced travel

—Prepared by Robert Noland

IDENTIFYING EMERGING 21ST-CENTURY USER NEEDS DRIVING TRANSPORTATION SERVICES DEMAND

Problem

The provision of multimodal and intermodal mobility for people, goods, services, and information requires a basic understanding of user needs. User needs are, in turn, driven by an underlying set of technological, demographic, behavioral, and economic factors that have undergone continuing and accelerating change in the 1990s. Current transportation plans are often based on meeting an outdated list of needs that are identified for a limited set of potential users. However, to equitably support a desirable quality of life and environment, a transportation system needs to provide access and mobility when, where, and how it is desired and needed by all segments of society.

Recent research has investigated transportation user needs that are related to such characteristics as age, ethnicity, culture, and income. This information needs to be translated into plans and decisions that reflect the effects of an aging population; immigration and migration; the spread of information technology into education, recreation, employment, and commerce; employment patterns; lifestyles; spatial and geographic location; and age of locales.

Objective

The changing demographic, economic, and commercial lifestyle trends that will determine the services, facilities, and information needed to effectively and efficiently provide mobility and enhance sustainable communities, quality of life, and the environment must be identified. Those trends that will continue and those that will likely emerge in the next 20 to 30 years also must be identified.

Related Work

The Nationwide Personal Transportation Survey, the American Travel Survey, current research on the influ-

ence of ethnicity, culture, age, and income on travel behavior; the Year 2000 National Census

Urgency/Priority

Transportation infrastructure and services last a long time and help set the shape of surrounding communities in concrete, quite literally. Decisions that are made in the next 10 years will persist throughout the remainder of the 21st century, and it is critical that they are based on future trends and changes, not past observations of travel characteristics.

Cost

\$200,000

User Community

MPOs, regional transportation planning agencies, state DOTs, transit operators, ITS developers, cities and counties, technology developers, commercial and residential developers

Potential Sponsors

FHWA, FTA, state DOTs, NARC, ITS America

Implementation

The results of this research could be used by communities, MPOs, and regional transportation planning agencies immediately in developing long-range transportation plans and programs to guide transportation investments; in developing local and regional land use plans; and in developing regional mobility and access goals, benchmarks, and performance measures.

Effectiveness

Transportation plans and programs will provide services that are needed by today's and tomorrow's users, not yesterday's research. Performance measures that deal with use of facilities and services provided, combined with customer-satisfaction surveys, can directly measure how well user needs are being met overtime.

Key Words

Travel demand, user needs, demographic change

—Prepared by Brian J. Smith

FUTURE TRENDS AND EXPECTED CHANGES IN GOODS MOVEMENT

Problem

The growing global economy and institutional changes, such as NAFTA deregulation and just-in-time delivery, are causing major changes in goods movement. In the past, transportation planning has not anticipated major changes in the freight industry and has instead reacted after the fact. Transportation planners need to be able to forecast future trends in goods movement by truck, rail, air, water, and possibly new emerging modes. Only by better estimates of future demands in these areas will transportation planners be able to identify future system needs and the impacts associated with this growing area of demand on various components of the transportation network.

Objective

Major trends and emerging issues that may affect the future destinations, volume, and type of goods movement should be identified. These issues could be institutional, economic, or political in nature. Special consideration should be given to what issues drive the modal choice for goods movement. Improved understanding of the issues that will drive freight movement in the future will allow for better planning for these movements and early identification of impacts and system needs, as well as provide a basis for dialogue on policy issues around mode choice.

Related Work

None known

Urgency/Priority

This research has a high priority because of the increasing concerns over the ability of the transportation system to respond to the needs of shippers in the time frame needed. Increased congestion on individual modal systems and at intermodal transfer points, as well as the dramatic, rapid changes that occur in the freight industry, makes it imperative that we identify future trends before they occur so that we can better plan for needed investments.

Cost

\$200,000

User Community

USDOT, AASHTO, AMPO, freight shippers, rail lines, aviation interests, port authorities

Potential Sponsors

NCHRP, USDOT, AASHTO

Implementation

The results would be used as input to future forecasts of travel demand at the statewide and MPO level. They could also be used at the national and state level as a basis for a policy discussion on the appropriate modal mix for investments to support goods movement.

Effectiveness

The research could be a very effective tool for providing a better basis for understanding changes that occur in freight movement. It would also have the potential for better understanding the policy implications of our various regulatory and tax policies as they relate to goods movement. The measures of effectiveness would be the degree to which goods movement planning accounted for and integrated major changes that occurred in the industry. Another measure of effectiveness would be the extent to which the results were included in travel-demand models and whether a policy dialogue that relates to the institutional and legal environment for goods movement is initiated as a result of the findings.

Key Words

Freight forecasting, trends, goods movement

—Prepared by Calvin Leggett

BARRIERS TO INTERMODAL RAIL FREIGHT**Problem**

Freight movement has grown tremendously over the past decade. Much of this increase in goods movement is being transported by truck. Rapidly growing truck volumes have created problems with roadway pavement conditions, congestion, impacts on neighbors who are adjacent to major roadways, and safety for other motorists. Use of rail freight is generally less disruptive to established communities. Rail freight uses fewer environmental resources and can lessen the demand for additional roadway capacity. The technological capability exists to allow easy movement of trailers by railcar to local delivery areas. The barriers to greater use of rail to serve goods movement are not fully understood, but it appears that the rail freight mode is underused at this time.

Objective

The physical, economic, institutional, and regulatory barriers to more efficient use of intermodal rail freight should be studied. A means to overcome these barriers to goods movement should be suggested.

Related Work

None known

Urgency/Priority

Growing congestion, pavement distress, and safety and environmental concerns that are associated with the growing use of trucks for long-distance freight make it important for us to investigate barriers that prevent rail from being a more competitive mode to serve goods movement.

Cost

\$150,000

User Community

Rail companies, AASHTO, USDOT, port authorities, goods shippers

Potential Sponsors

AASHTO, NCHRP, USDOT

Implementation

Federal, state, and local governments will be able to review their regulations and policies to eliminate unnecessary barriers to greater use of intermodal rail freight. Rail companies will be able to determine which physical barriers can be quickly and efficiently removed to allow them to compete more effectively in the market for long-haul shipping.

Effectiveness

Greater use of rail for long-haul goods movement will lessen the demand for highway capacity, decrease the use of fossil fuels by trucks, lower emissions of some air pollutants, decrease adverse impacts on adjacent neighborhoods, and lessen safety concerns for other motorists. The measure of effectiveness is the relative modal split of goods shipping by truck versus rail.

Key Words

Intermodal, rail

—Prepared by Calvin Leggett

OVERCOMING INSTITUTIONAL BARRIERS TO MULTIMODALISM

Problem

It is essential in today's world of increased congestion and limited resources to address transportation needs so as to consider multimodal solutions in all transportation planning. This consideration will become increasingly more critical in the future. However, many federal, state, and local transportation-planning and transportation-implementing agencies are arranged by mode and therefore have a difficult time in communicating with, planning for, financing, and implementing multimodal transportation improvements.

Objective

This project will evaluate institutional and financial obstacles to multimodalism in the planning process and will identify methods and strategies that have been successfully used to overcome these institutional barriers.

Related Work

None known.

Urgency/Priority

As congestion increases, transportation planning needs to respond by planning for and implementing transportation improvements that best solve existing and future travel needs regardless of funding sources or institutional responsibilities. These improvements cannot be fully considered and implemented without first overcoming the existing institutional barriers.

Cost

\$150,000

User Community and Potential Users

USDOT, state DOTs, all transportation planning and implementing agencies

Potential Sponsors

USDOT, TRB

Implementation

The results could be used to restructure planning processes to reduce modal bias in planning and programming decisions.

Effectiveness

Societal impacts might include more uniform and equitable assessments of all modes of transportation. Possible measures of effectiveness include the evaluation of costs and benefits of recent transportation improvements, independent of mode.

Key Words

Multimodal

—Prepared by Michelle D. Hoffman

ROLE OF PLANNING IN IMPROVING THE RELIABILITY OF TRANSPORTATION SYSTEM PERFORMANCE

Problem

As a matter of necessity, travelers have learned to accommodate a long-standing trend of deteriorating levels of service in the nation's transportation systems. Consistent patterns of increased congestion and travel-time delays have led system users to add a margin of increased time to their estimated times of arrival and departure. To the extent that these delays were predictable, these adjustments have worked.

However, a more confounding trend is deterioration in the predictability of these delays. Studies have shown that more than 60 percent of the highway congestion in urban areas is associated with randomly occurring incidents, ranging from traffic accidents, disabled vehicles, and police activity. Because it can't be predicted, this "nonrecurring" congestion causes the greatest impact on travelers. Because of the financial implications, freight shippers are particularly vulnerable to service interruptions of this type.

Objective

This project addresses the need to improve system reliability through the accomplishment of four objectives:

1. To increase the level of understanding of transportation service reliability by delineating its various dimensions across travel modes, the connections between those modes, user groups, and other parameters;
2. To assess the differential impacts across the various user markets, including freight shippers;
3. To identify M&O strategies that are effective in improving system reliability; and

4. To identify the range of actions by transportation planning processes to plan and program these M&O strategies.

The research will clearly define the dimensions of transportation service reliability and the range of appropriate roles for metropolitan and statewide planning processes to play in developing plans and programs of corrective actions.

Related Work

NCHRP Project 8-35 is now investigating alternative ways of "mainstreaming" consideration of ITS within the planning process. An element of this work involves understanding the range of potential benefits that ITS strategies offer to transportation system performance—including service reliability. However, this project is concerned with ITS only and is not concerned with the broader category of M&O.

Urgency/Priority

This enabling research addresses the most pressing and difficult issue that affects system performance. As such, it is of the highest priority.

Cost

\$200,000

Potential Users

States, MPO, local governments

Potential Sponsors

FHWA, FTA, NCHRP, TCRP, domestic trade councils, shippers associations

Implementation

Recommendations that result from this research could be implemented through development of a number of state and local case study applications that are funded through "challenge grants."

Effectiveness

This research will benefit a broad range of transportation system users across person- and freight-travel purposes. It will take place through greater recognition of the importance of system reliability by transportation decision makers who participate in the planning process. A measure of success will be their

level of action in planning and programming these strategies.

Key Words

Reliability, nonrecurring congestion, incident frequency, service predictability

—Prepared by Charles Goodman

EFFECT OF SYSTEM RELIABILITY ON FREIGHT-SECTOR PLANNING AND DECISIONS

Problem

Reliability can generally be defined as the consistency with which a particular system's input produces an output. For example, a truck dispatched from Point A to Point B will require a different running time each time the trip is made. A measure of the relative consistency of these running times is in part a measure of the reliability of the system. Private freight companies generally consider the reliability of the transportation systems they use in planning operations and in making operational decisions. It is not clear how freight carriers adapt their planning and operations to differing levels of system reliability and how those adaptations affect public transportation facilities. It is also unclear how much public-sector transportation investment and operational spending decisions should be increased to improve system reliability.

Objective

The objectives of the research are to quantify the benefits of improved system reliability to private shippers and carriers and to allow these benefits to be compared to the costs to the public sector to improve system reliability.

Related Work

None known

Urgency/Priority

A key element of planning for freight movement; medium-to-high priority

Cost

\$200,000

User Community

State DOTs, MPOs, local government, freight shippers, carriers

Potential Sponsors

FHWA, FRA, American Trucking Association

Implementation

The results of this research will help quantify the benefits of improved transportation system reliability to the domestic freight industry. Such benefits, if present, could be added to the benefits of improved reliability to users of private vehicles, public transit, and other system users. The results will help public planning agencies evaluate the relative value of investments that would improve such reliability; the value of increasing ongoing management, maintenance, and operations expenses; and the benefit of improved reliability.

Effectiveness

Potential societal impact: greater reliability may translate into lower costs to the freight carriers, which, if applied in a competitive market, should result in lower costs to shippers and other users. Relevant measures of effectiveness: improved reliability of freight movement over short and long distances.

Key Words

Reliability, freight, planning

—Prepared by Tom Brigham

COMPARATIVE BENEFITS OF INVESTMENTS IN MANAGEMENT, OPERATIONS, SYSTEM PRESERVATION, AND CAPACITY EXPANSION

Problem

Investment in M&O by state and local transportation agencies has only recently been eligible for federal funding. It is not often clear whether funding of management, maintenance, and operations is comparatively more or less beneficial than are more traditional investments in system preservation and capacity expansion. More broadly, the problem is the lack of guidelines for investment in these areas.

Similarly, the use of ITS in management, maintenance, and operations is relatively new. The basic question is how beneficial are capital investments in ITS compared with investments in other competing areas, and can guidelines be created for the expenditure of nonfederal operating funds on ITS M&O functions?

Objective

The research should examine and compare the benefits of public investment in management, maintenance, and operations with investment in system preservation and capacity expansion. More specifically, the comparative benefits of investment in each of the five areas should be examined, and guidelines for state and local governments should be prepared.

Related Work

USDOT ITS program assessment, NCHRP 8-35

Urgency/Priority

The availability of federal funding for management and maintenance and for the evolving maturity of ITS suggests that these topics should be given high priority to help state and local governments avoid suboptimal funding allocation.

Cost

\$500,000

User Community

State and local governments, primarily DOTs and MPOs

Potential Sponsors

FHWA, FTA, NCHRP

Implementation

The completed research will help transportation system owners and operators determine optimal investment levels in management, maintenance, operations, system preservation, and capacity expansion.

Effectiveness

Measures of effectiveness would be benefits per dollar of expenditure.

Key Words

Management, maintenance, operations, transportation investment

—Prepared by Tom Brigham

INSTITUTIONAL ISSUES ASSOCIATED WITH ADDRESSING M&O IN THE PLANNING PROCESS

Problem

The traditional role of transportation planning processes has been to develop plans and programs of capital-improvement strategies for addressing areas' pressing economic development, safety, congestion, and other needs. However, capital improvements are becoming increasingly difficult to accommodate within today's fiscal and environmental constraints. In addition, communities increasingly resist new construction.

Transportation decision makers are being called on to address problems of congestion, mobility, safety, and other issues through effective and coordinated approaches to managing and operating their existing systems. The achievement of coordination and cooperation among system operators, as well as with implementers of capital investments, requires interaction among agencies and organizations that are new to the planning process. This will necessitate clear definition and delineation of the role of system operators in the planning process, as well as of planners in the area of systems M&O. A common understanding of the strategies and roles in promoting these strategies is needed for M&O to become an integral element of the planning process.

Objective

This project addresses the need to assemble an inventory and a "good practice" synthesis of institutional arrangements for considering M&O in the transportation planning process. Four project objectives are involved:

1. To increase the level of understanding of the range of M&O strategies;
2. To identify the role of metropolitan and statewide planning processes in planning and programming M&O strategies, in conjunction with capital investments;
3. To identify organizational models for effective coordination among planners and operators; and

4. To disseminate these examples and a "lessons learned" synthesis to a user community of practitioners.

Related Work

NCHRP Project 8-35 is now investigating alternative ways of mainstreaming consideration of ITS within the planning process. This project does not address the broader category of M&O.

Urgency/Priority

This enabling research addresses a key initiative set forth in TEA-21 and represents an important opportunity for improving transportation system performance.

Cost

\$200,000

Potential Users

States, MPO, local governments

Potential Sponsors

FHWA, FTA, NCHRP, TCRP

Implementation

Recommendations that result from this research could be implemented through development of guidance reports, conduct of informational workshops, and award of challenge grants to localities that are interested in experimenting with the approaches in their own locales.

Effectiveness

This research will benefit both transportation planning and implementing agencies through greater recognition of the importance of system M&O in improving system performance and the important institutional partnerships that are needed to realize this potential. Progressive models of cooperation with clear delineation of organizational roles will be developed. A measure of success will be the number of such partnerships that are formed between planning and operations agencies.

Key Words

System operations, transportation systems management, operations planning

—Prepared by Charles Goodman

QUANTIFYING THE BENEFITS OF CONGESTION PRICING FOR COMMERCIAL PRODUCTIVITY

Problem

The benefits of congestion pricing to goods movement are unknown. Until information is made available on reduced congestion and travel times, as well as on the relationship to improved economic vitality due to a more reliable product delivery, it will be difficult to find support for congestion-pricing projects. Research is needed to quantify the benefits of reduced congestion and increased reliability of product delivery on commercial productivity. Additional research should attempt to quantify the degree to which congestion-pricing benefits trips that contribute directly to increased economic production (e.g., delivery of goods and services) as opposed to trips that do not directly contribute to economic productions (e.g., commuting trips).

Objective

The objective of this research is to evaluate and quantify the benefits of congestion pricing on goods movement as it pertains to economic and commercial productivity and to determine what portion of the trips that benefit lead directly to improved commercial productivity.

Related Work

Current evaluation of high-occupancy toll lanes on State Route 91 in California

Urgency/Priority

As congestion increases, goods movement is affected from an economic standpoint. To the extent that the results of this research (quantification of benefits of congestion pricing on commercial productivity) justify implementing congestion pricing, it can be done in a more timely manner.

Cost

\$250,000

User Community and Potential Users

AASHTO, FHWA, potential project sponsors of congestion-pricing projects

Potential Sponsors

FHWA, NCHRP

Implementation

The results could be used in assessing the benefits of congestion-pricing projects and in justifying these projects.

Effectiveness

Societal impacts might include potential user cost savings for truckers and commercial companies. Possible measures of effectiveness include the evaluation of total revenues (user cost savings) versus cost of tolls.

Key Words

Congestion pricing, value pricing, high-occupancy toll lanes

—Prepared by Michelle D. Hoffman and
Neil J. Pedersen

EXPLORE HOW CONGESTION-PRICING PROJECTS COULD REDISTRIBUTE FINANCING RESPONSIBILITY OF TRANSPORTATION IMPROVEMENTS

Problem

Not all costs of transportation improvements are equitably distributed across the user system. Capacity improvements to serve peak-hour trips and truck capacity are often financed by other users in the system. Congestion pricing provides an opportunity to more equitably charge the real costs of providing transportation improvements among all highway users.

Objective

This research will determine how congestion pricing will more equitably distribute the costs for providing transportation improvements to all users of the highway system.

Related Work

Highway cost-allocation studies by FHWA and current evaluation of high-occupancy toll lanes in California

Urgency/Priority

Given that the recently released cost-allocation study by FHWA has heightened the awareness of financing equity

issues among users, it is important to determine the degree to which congestion pricing could address these equity issues.

Cost

\$150,000

User Community and Potential Users

AASHTO, FHWA, potential project sponsors of congestion-pricing projects

Potential Sponsors

FHWA, NCHRP

Implementation

The results could be used in the ongoing debate of cost allocation in financing highway projects.

Effectiveness

Societal impacts might include more equitably allocated financing for highway improvements. Possible measures of effectiveness include the evaluation of how costs are allocated among highway users after congestion pricing has been implemented as compared to before it was implemented.

Key Words

Congestion pricing, value pricing, highway cost allocation

—Prepared by Michelle D. Hoffman and
Neil J. Pedersen

UNDERSTANDING THE LINKAGES BETWEEN TRANSPORTATION SYSTEMS AND SUSTAINABLE COMMUNITIES: EVALUATING ALTERNATIVE PLANS AND POLICIES

Problem

Many communities and metropolitan areas are beginning to grapple with the complex issue of sustainability. How can they effectively balance the competing goals of long-term environmental protection with economic growth and social equity? As various sustainability policies and practices are tested and developed, there will be a need to develop new transportation approaches

and modify existing systems to support long-term sustainability (or at least not to undermine the goals of sustainability policies).

Currently many metropolitan regions and communities are not sustainable due largely to their transportation systems. They fail to address long-term environmental problems (such as land consumption, ecosystem impacts, and carbon emissions) and social equity issues (such as access to basic activities). How can areas move toward a more sustainable future? What are the barriers imposed by the current transportation system and established development?

Objective

The objective of this research is to develop a synthesis of existing sustainability practices and policies, their transportation linkages, and methods to evaluate the sustainability of alternative plans and policies. This can be accomplished by first reviewing available literature on long-term impacts of transportation and urban systems and the likely sustainability outcomes. Case studies of current practices, both in the United States and internationally, can be documented as to their success (or failure) at achieving sustainability goals. A key issue should be to illuminate the transportation programs and policies that complement efforts to achieve greater sustainability. Barriers and conflicts toward achieving stated sustainability goals caused by transportation policies should also be documented.

Evaluation of alternative plans and policies will need to be informed by a community vision of what sustainability means. Techniques for measuring the sustainability of alternatives should also be developed. These techniques can be based on judgments derived from a review of current practices that are likely to lead to more sustainable outcomes. For example, many of the current "Smart Growth" initiatives may be able to serve as case studies of how a community develops a vision for sustainability and evaluates various options.

Related Work

Organization for Economic Cooperation and Development (OECD) may have done some work; TRB's report on sustainability.

Urgency/Priority

This is a high priority research area because many metropolitan areas are trying to grapple with this issue. Research that helps planners clarify the issues and helps them develop more sustainable long-term plans is desperately needed.

Cost

\$200,000

User Community

MPOs, state DOTs, resource agencies

Potential Sponsors

FHWA, FTA, NCHRP, USEPA

Implementation

This research would allow states and MPOs to fund and prioritize alternatives to highway and road projects that lead to long-term sustainability of urban areas. It would allow areas grappling with "Smart Growth" issues to better coordinate the use of transportation funding to meet their goals (and not undermine them).

Effectiveness

The short-term effectiveness of this research could be measured by the development of long-term plans that actually attempt to address sustainability issues by changing regional priorities in transportation-project selection. The long-term effectiveness would be measured by actual sustainable outcomes for regions.

Key Words

Sustainable development, sustainable transportation, sustainable communities

—Prepared by Robert Noland

**CONSIDERATION OF ENVIRONMENTAL
FACTORS IN TRANSPORTATION PLANNING**

Problem

There is increasing interest in developing a better understanding of the environmental effects of the transportation alternatives that are considered during statewide and metropolitan planning. At present, there are few widely accepted macroscale tools, techniques, and methods for assessing the environmental effects of transportation alternatives at a statewide, regional, or corridor level.

In the past, environmental analysis has been performed during project development in which the

microscale level of detail is needed to satisfy multiple regulatory requirements, such as NEPA's Section 106 and Section 404 regulations. Because a high level of detail is not normally available or appropriate at the planning stage, the readily available tools are not useful, and rigorous environmental analyses are avoided. Regional AQ models that are used in the transportation-conformity-analysis process are examples of macroscale environmental analysis tools that are used. There is a need for equivalent tools in other natural social and economic impact areas.

Objective

The objective of the research is to develop user friendly and economical macroscale environmental analysis tools, techniques, and methods for statewide regional and corridor planning.

Related Work

Continuous improvement of AQ emissions models and regional conformity models is ongoing. There is some watershed modeling activity that may have application to transportation planning. Some major investment studies have addressed impact issues at more of a macrolevel than have traditional NEPA studies.

Urgency/Priority

Because very few tools, techniques, and methods are available to analyze the environmental impacts of transportation alternatives during the planning stage, their development and deployment should be a high priority.

Cost

\$750,000

User Community and Potential Users

Local, state, and federal transportation agencies, planning and environmental professionals, local and regional planning organizations, consultants

Potential Sponsors

USDOT, state DOTs, AMPO, AASHTO, USEPA, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, National Marine Fisheries and River Basin Commissions

Implementation

Handbooks and training will be developed and distributed.

Effectiveness

Decision makers and the public will have a thorough understanding of the environmental effects of transportation alternatives so that more informed decisions will be made.

Key Words

Environmental factors and transportation planning

—Prepared by Wayne W. Kober

IDENTIFYING AND COMMUNICATING THE PURPOSE AND NEED OF TRANSPORTATION PROJECTS

Problem

Identifying and communicating the purpose and need of transportation projects are important elements of the planning project development and regulatory permitting process. Purpose and need serves as the foundation of alternatives analysis at both a planning and project development level. Purpose and need statements often are written to support a preconceived notion of the most appropriate solution instead of identifying in an unbiased manner the problem that needs to be solved. When transportation problems are clearly identified, effectively communicated, and understood, a good starting point is established for creating solutions for them. When they are not well established, the alternatives analysis may be off target and a waste of time and resources.

Objective

The objective of the research is to develop tools, technologies, and methods for the identification and communication of project purpose and need during transportation planning and project development.

Related Work

No knowledge of work is underway or has been completed recently.

Urgency/Priority

Because no widely acceptable tools, technologies, and methods are available to identify and communicate purpose and need, their development and deployment are a high priority.

Cost

\$250,000

User Community and Potential Users

Local, state, and federal transportation and regulatory agencies, planning and environmental professionals, local and regional planning organizations; consultants

Potential Sponsors

USDOT, state DOTs, AMPO, AASHTO, EPA, U.S. Army Corps of Engineers

Implementation

Handbooks and training will be developed and distributed.

Effectiveness

Decision makers and the public will have a thorough understanding of the project's purpose and need and will effectively communicate it.

Key Words

Purpose and need, problem statement

—Prepared by Wayne W. Kober

INTEGRATION OF TRANSPORTATION CORRIDOR AND LAND USE PLANNING

Problem

During the development of transportation-corridor-improvement plans and projects, the area's land use planning information is used to help ensure plan and project consistency and compatibility. In areas where land use plans are current, comprehensive, and widely supported, these assessments may be straightforward. In areas where land use plans are outdated and contain gaps, assessing consistency and compatibility is difficult, if not impossible. In addition, if major gaps exist in an area's land use plans, the area is likely to experience undesirable land use changes, which result from a lack of appropriate controls being in place well in advance of implementation of a transportation-corridor-improvement project.

Objective

The objective of the research is to develop tools, techniques, and methods for closing the gaps in land use plans during transportation-corridor-improvement plans and projects.

Related Work

TEA-21's Transportation System and Community Presentation Pilot Program is providing funds to improve land use planning. However, it is unclear whether or not those funds will be used to improve land use planning practices.

Urgency/Priority

In the absence of comprehensive land use plans, both transportation facilities and communities will continue to experience uncontrolled growth and undesirable consequences.

Cost

\$300,000

User Community and Potential Users

Local, state, and federal transportation agencies, planning professionals, local and regional planning organizations, consultants

Potential Sponsors

USDOT, state DOTs, AMPO, EPA

Implementation

Handbooks and training will be developed and distributed.

Effectiveness

Transportation corridor plans and projects and area land use plans will be consistent and compatible.

Key Words

Transportation corridor, land use planning

DEFINING DISPARATE IMPACT IN THE CONTEXT OF ENVIRONMENTAL JUSTICE AND HOW TO ANALYZE IT

Problem

Existing legislation and regulations clearly indicate the need for transportation officials to address the human environment, as well as the natural and physical environment, during the planning and project-development phases of transportation projects. This legislation includes, but is not limited to, the Civil Rights Act of 1964, NEPA of 1969, the Fair Housing Act of 1968, the Uniform Relocation Act, and the U.S. Constitution.

It has been suggested recently by many grassroots-based organizations that the human environment has not been adequately addressed or analyzed by transportation professionals and by decision makers during the transportation planning process and the project development process of many institutions and organizations. At an even higher level, it has been suggested that the various federal funding distributions, which ultimately produce transportation projects and systems by these institutions, have not benefited the different populations of our society equally (i.e., creating a disparate impact). This leads to the need of defining disparate impact(s) under the context of transportation planning (both macroscale and microscale) and project development and to how the gathered information that concerns disparate impact(s) should be analyzed and used.

Objective

This research intends to provide transportation professionals and decision makers with a clear definition and understanding of disparate impact in the context of transportation decisions. This research also intends to provide insight into the type of information and data that is needed and how it should be analyzed to make an informed decision(s) on disparate impact.

Related Work

The Environmental Research Needs in Transportation (*Transportation Research Circular 469*, March 1997) provides a need for research on methods and techniques for identifying and measuring disparate impacts from transport and related case law history. This research has not been funded to date.

—Prepared by Wayne W. Kober

Urgency/Priority

There is a high level of urgency for this research. Nationally, transportation professionals and decision makers are struggling with the definition of disparate impact and how information or data that are related to disparate impact should be analyzed and used.

Cost

\$350,000

User Community and Potential Users

USDOT, FHWA, state DOTs, MPOs, local governments and officials, transportation practitioners

Potential Sponsors

NCHRP, USDOT, FHWA, FTA

Implementation

Ways in which the findings of the proposed research might be implemented include a published research findings circular, a published handbook, a training course (NHI/NTI), or integration into existing training courses (NHI/NTI).

Effectiveness

The societal impacts of this research would be great if the findings are widely integrated and used by transportation institutions and organizations.

Key Words

Disparate impact, disparate impact and environmental justice, transportation, environmental justice

—Prepared by Lori G. Kennedy

METHODS AND TECHNIQUES TO BETTER IDENTIFY TRANSPORTATION ISSUES OF DISADVANTAGED POPULATIONS AND COSTS ASSOCIATED WITH PROVIDING POTENTIALLY DIFFERENT TRANSPORTATION SERVICES FOR THESE POPULATIONS

Problem

Executive Order 12898 on environmental justice, signed by President Clinton in February 1994, has brought to the

forefront for federal officials the need to address transportation issues for disadvantaged populations. These populations include underrepresented populations, low-income populations, and minority populations. This executive order reemphasized the need for professionals to refocus their analyses and decisions on the human environment that is addressed in existing legislation (e.g., the Civil Rights Act of 1964 and NEPA 1969). As a result of this executive order, there is a need to strengthen existing methods and techniques to identify disadvantaged populations and their issues as they relate to transportation, as well as to develop new methods and techniques in identifying these populations.

There have been examples, such as welfare-to-work recipients not having adequate transportation to and from work or to and from day care, that have pointed to a need for more research in this area. Disadvantaged populations often do not actively participate in the transportation planning process, and their transportation issues are often not identified through existing processes.

Objective

This research intends to provide transportation practitioners with solid methods, techniques, and practical examples for identifying a disadvantaged population and their issues as they relate to transportation. The research findings should provide decision makers with a better understanding of how to serve the disadvantaged populations. They will also provide transportation professionals and decision makers with the costs associated with providing potentially varied transportation services for these disadvantaged populations.

Related Work

FHWA recently published a community-impact-assessment handbook and a case studies booklet, both of which touched on disadvantaged populations as they relate to transportation issues. However, specific research on methods and techniques for better identifying transportation issues of disadvantaged populations has not been addressed.

Urgency/Priority

There is a high level of urgency for this research. Nationally, transportation professionals and decision makers are struggling with determining the transportation issues that affect disadvantaged populations and how they can better serve these populations.

Cost

\$350,000

User Community and Potential Users

USDOT, FHWA, state DOTs, MPOs, local governments and officials, transportation practitioners

Potential Sponsors

NCHRP, USDOT, FHWA, FTA

Implementation

Ways in which the findings of the proposed research might be implemented include a published research findings circular, a published handbook or report, a training course (NHI/NTI), or integration into existing training courses (NHI/NTI).

Effectiveness

The societal impacts of this research would be great if the findings are widely integrated and used by transportation institutions and organizations.

Key Words

Environmental justice, disadvantaged populations or minority populations and transportation, costs, transportation, minority populations

—Prepared by Lori G. Kennedy

HOW SHOULD THE EQUITY OF BENEFITS AND DISBENEFITS BE LOOKED AT IN THE PLANNING PROCESS?

Problem

Title VI of the Civil Rights Act of 1964, *Nondiscrimination in Federally Assisted Programs*, requires each federal agency to ensure that no person, on the grounds of race, color, or national origin, is excluded from participation in, denied the benefits of, or subjected to discrimination under any program or activity that receives federal financial assistance. FHWA and FTA are two federal agencies under USDOT that administer federal financial assistance to all state highway departments and transit agencies that are involved in the planning and construction of many of the transportation projects in the United States and that are responsible for ensuring compliance with Title VI. The history of Title VI of the Civil Rights Act of 1964 shows that the legislation was enacted in part because of the many examples cited in which people of color in the United

States were denied equal protection and equal benefits under federal assistance programs.

Executive Order 12898, *Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*, signed by President Clinton in February 1994, requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. USDOT's Final Order on Environmental Justice states that responsible DOT officials will ensure that their respective programs, policies, or activities that will have a disproportionately high and adverse effect on populations protected by Title VI will only be carried out if

1. A substantial need for the program, policy, or activity exists on the basis of the overall public interest; and
2. Alternatives that would have less adverse effects on protected populations either (a) would have other adverse social, economic, environmental, or human health impacts that are more severe; or (b) would involve increased costs of extraordinary magnitude.

Some have suggested that we have not identified adequately the equity benefits and disbenefits of our transportation systems, plans, or projects. Have these benefits of our transportation systems and transportation projects helped one sector of our society more than another? If one or more sector(s) of our society is benefiting from our transportation system and investments more than a protected population under Title VI, does this constitute a disproportionately high and adverse effect on this protected population when federal funding is involved?

Suggestions have been made that the planning process is the time to begin to evaluate the equity of benefits and disbenefits. TEA-21 provides seven broad areas to consider in the planning process. Three of these seven factors are to (a) increase the accessibility and mobility options that are available to people and for freight; (b) protect and enhance the environment, promote energy conservation, and improve quality of life; and (c) enhance the integration and connectivity of the transportation system, across and between modes, for people and freight. Clearly, TEA-21 intends that all people benefit from an enhanced transportation system.

Objective

This research intends to provide transportation practitioners and decision makers with new information on how the planning process should involve and address information that concerns the equity of benefits and disbenefits to different populations of our society from transportation projects.

Related Work

Little research if any has been done in this area.

Urgency/Priority

Equity among disadvantaged populations that are protected under Title VI is an emerging issue in the transportation industry and deserves immediate attention so that practitioners and decision makers may produce more effective plans in their states, regions, and municipalities.

Cost

\$150,000

User Community and Potential Users

USDOT, FHWA, state DOTs, MPOs, local governments and officials, transportation practitioners

Potential Sponsors

NCIIRP, USDOT, FHWA, FTA

Implementation

The findings of the proposed research might be implemented through a published research findings circular, a published handbook, a training course (NHI/NTI), and integration into existing training courses (NHI/NTI).

Effectiveness

The societal impacts of this research would be great if the findings are widely integrated and used by transportation institutions and organizations.

Key Words

Environmental justice, equity and transportation, equity, transportation, minority populations

—Prepared by Lori G. Kennedy

UNDERSTANDING TRAVEL CHARACTERISTICS OF WELFARE RECIPIENTS AND LOW-INCOME INDIVIDUALS

Problem

Planning for the access and mobility needs of welfare recipients and other low-income individuals in travel-

ing to work, health, education, and important community-based support systems requires a thorough understanding of those needs. Key demographic, socioeconomic, job opportunity, and community-support factors contribute to a unique pattern of travel demands that must be understood so that the proper program of transportation services may be developed.

Objective

This project will improve the quality of job-access planning, as well as planning for other mobility needs of welfare recipients and low-income individuals, through development of a richer base of knowledge on key travel parameters that are related to both the traveler and the trip itself. Specific areas of investigation will include

- Traveler demographics (e.g., age, income, household size, car ownership);
- Travel purposes (e.g., jobs, child care, job training, health care);
- Travel characteristics (e.g., days and times of travel, need for intermediate stops);
- Modal access (e.g., accessibility to transit service); and
- Spatial distribution of emerging labor markets for entry-level, low-skilled workers, as well as proximity to transit and highways.

This research could be accomplished through a special national series of demographically targeted household travel surveys, as well as through special tabulations from traditional sources of demographic and travel data, such as the Year 2000 Census and future administrations of the Nationwide Personal Transportation Survey. An immediate deliverable might be the development of a job-access tabulation series as part of the Transportation Planning Package (CTPP) of the Year 2000 Census.

Related Work

Several syntheses have been prepared of case study "best practices" in serving the job-access needs of welfare recipients and low-income individuals. However, these efforts were descriptive only and did not address the underlying factors and causal aspects behind the travel needs that were served.

Urgency/Priority

This enabling research addresses a timely and pressing issue in today's society, truly testing the customer basis of transportation planning. As such, it is of the highest priority.

Cost

\$200,000

Potential Users

States, MPOs, transit operators, local governments, job placement and training coordinators, service contractors

Potential Sponsors

FHWA, FTA, NCHRP, TCRP, DHHS, DOL, HUD, philanthropic foundations

Implementation

Recommendations resulting from this research could be implemented through guidance and best practice reports, as well as through workshops and case study challenge grants.

Effectiveness

This research could provide immediate benefit to transportation planning practitioners, particularly if special tabulations were prepared and distributed as part of CTPP. Beyond that data resource, the modeling community could use the results from the surveys to revisit or recalibrate travel models so as to more effectively capture the travel needs of welfare recipients and low-income individuals.

Key Words

Job access, welfare-to-work, labor mobility, low-income transportation

—Prepared by Charles Goodman

PLANNING FOR EFFECTIVE COORDINATION OF NONEMERGENCY TRANSPORTATION SERVICES

Problem

Studies have shown significant overlap, redundancy, and concurrent holes among a wide range of social service, health, and labor-mobility transportation service providers. The systematic, sequential process of plan and program development of USDOT-funded transportation services contrasts sharply with the transportation provided under the auspices of human services and job training and placement programs. These services are provided in a fashion that is similar to block grants, with little if any coordination among providers. Furthermore, the supporting or catalytic role of the planning process has not been defined.

Objective

This project will improve the base of knowledge and experience in cross-program service coordination by

- Developing operators' guides and handbooks for effective cross-program service coordination, targeted to the recipients of particular program areas, and
- Preparing guidance and "best practice" case studies for transportation planning processes to identify and act on opportunities for greater service coordination.

This research can only be accomplished with the full participation and cooperation of DOT, DHHS, DOL, and HUD, which would constitute an important objective in itself.

Related Work

In support of preparation of joint guidance for service coordination, DOT has funded preparation of an inventory and synthesis of "good practice" in cross-program service coordination. Similarly, DHHS has funded a study of the regulatory differences in transportation-service delivery between DOT and DHHS. However, these efforts stop short of providing procedural guidance to service providers that seek opportunities for more effective coordination. They also do not speak in detail to the possible roles of transportation planning processes in coordinating or facilitating the effort.

Urgency/Priority

This combination of enabling and process research addresses a timely and pressing issue in today's society, as well as an important policy initiative in TEA-21.

Cost

\$200,000

Potential Users

States, MPOs, transit operators, local governments, private transportation service providers

Potential Sponsors

FHWA, FTA, NCHRP, TCRP, DHHS, DOL, HUD, philanthropic foundations

Implementation

Recommendations resulting from this research could be implemented through guidance and best practice reports, as well as through workshops and case study challenge grants.

Effectiveness

This research could provide immediate benefit to transportation planning practitioners and to low-income individuals by increasing the spatial and temporal ranges of their employment and educational opportunities, as well as increasing access to shopping and medical care, to name a few.

Key Words

Transportation service coordination, welfare-to-work, labor mobility

—Prepared by Charles Goodman

SYSTEMWIDE APPROACHES TO PLANNING FOR SAFETY

Problem

Recent research has suggested that some systems of urban form and transportation are more dangerous than other systems. For example, STPP has estimated relationships between sprawl development and pedestrian fatalities. Vehicle fatality rates remain very high at the national level, yet urban transportation planning does not incorporate this concern effectively into the planning process. In addition, many road-expansion projects and those projects that increase traffic flow are often justified on the basis of safety improvements, yet little if any in-depth analysis actually measures the safety benefits of these projects. The need for research into these relationships is critical for a better understanding of how current urban designs and land uses affect both vehicle and pedestrian safety. In addition, the young and the elderly tend to be at greatest risk.

The literature on safety has been engaged in a long debate on the ability of regulatory improvements to actually lead to net improvements in safety. This work dates to Peltzmann's seminal work on compensating behavior in the 1970s. That is, people respond to safety improvements by taking additional risks. For example, Peltzmann showed how various safety improvements in vehicle design led to increases in pedestrian fatalities that offset the reductions achieved in occupant fatalities. Many road improvements also tend to focus on improving occupant safety but may also increase risks taken by drivers.

Objective

Some of these relationships could be better understood by analyzing trends in safety data, such as fatal-

ities and relative severity of crashes. What is the correct denominator to use in determining crash rates? How can one adjust for improvements in medical technology? This research should attempt to accurately measure the risk of driving and walking (and bicycling) and estimate the actual trends in crash rates by level of severity. The measurements should then be correlated with urban design, transportation system design, and other factors, including availability of transit. For example, is it more appropriate to actually decrease flow through traffic-calming projects that enhance safety?

Related Work

Research on pedestrian safety by STPP; research conducted by Charlie Komanoff in New York City

Urgency/Priority

This research should have a high level of priority. Many new projects are justified as safety improvements without a full understanding of the systemwide impacts on safety.

Cost

\$250,000

User Community and Potential Users

Decision makers, transportation policy analysts, urban design specialists, safety advocates

Potential Sponsors

FHWA, FTA, NHTSA, Centers for Disease Control, NCHRP, BTS

Implementation

The results could be used to improve systemwide and land use planning for safety and to improve funding decisions for safety improvements.

Effectiveness

The results could be measured by actual decreases in pedestrian fatalities and vehicle crash rates.

Key Words

Safety, pedestrians

—Prepared by Robert Noland

CREATIVE APPROACHES TO TRANSPORTATION PLANNING

Problem

The transportation planning process is evolving because of public expectations and the need to expand the scope of factors and issues that are considered. New and better approaches to environmental analysis, modal trade-offs, public involvement, and other emerging issues need to be incorporated into the planning process. Several areas around the country (i.e., Atlanta, San Francisco) have taken new and innovative approaches that include new state legislation to these and other elements of the planning process, particularly in nonattainment areas. Planners need to be aware of these innovative approaches and what techniques may be available to help them to address emerging challenges in their planning processes.

Objective

This research intends to review and document new and innovative transportation planning practices around the country. A determination of the relative effectiveness of these techniques and legislation and an evaluation of the transferability of these processes to other states or metropolitan areas will be made.

Related Work

None known

Urgency/Priority

Existing transportation planning processes are not designed to effectively address many of the emerging issues (including new federal mandates) and public concerns. Effective planning will need to be able to address many environmental, social, and investment issues that are currently being raised by public, political, and special interest groups. Knowledge of new techniques to address these issues will enable planners to better respond to the emerging issues.

Cost

\$150,000

User Community

USDOT, AASHTO, AMPO

Potential Sponsors

AASHTO, NCHRP, USDOT

Implementation

The results of this research would provide a set of methodologies and new direction to help decision makers and practitioners who deal with transportation planning address these concerns.

Effectiveness

This research may lead to better plans in some areas. It will decrease the time that is required for local planners to address new issues by providing them with a set of tools to meet new challenges. Effectiveness may be measured by the actual usage of these new techniques in other jurisdictions.

Key Words

Planning, innovative, new techniques, new legislation

—Prepared by Lori G. Kennedy and Calvin Leggett

IDENTIFYING TRANSPORTATION PLANNING NEEDS OF THE FUTURE

Problem

Because transportation planning needs have grown so significantly during the past decade, most transportation research is focusing on addressing these needs. It is equally important, if not more important, to begin identifying the transportation needs of the 21st century and beyond. This can be done through analysis of past, existing, and future transportation, social, economic, and environmental trends, as well as through outlining a vision of our future from a wide range of perspectives.

Objective

This research intends to identify the transportation planning dimensions, issues, and resource needs of the early and middle stages of the 21st century and includes four objectives:

1. To identify a range of futuristic visions for years 2020 and 2050, along with interim milestone points of major transportation needs and innovations. To identify these futuristic views, it would be necessary to

- Interview resource people (visionaries, authors, political strategists) to identify a range of perspectives on the future and on the future of transportation planning;
- Evaluate key demographic, economic, technological, and environmental trends;
- Conduct a literary review; and
- Hold a public forum, if feasible, to achieve public input.

2. To identify the implications of these futuristic predictions on both goods and person movement.

3. To discern the implication of these travel trend visions on future issues and process arrangements for transportation planning.

4. To identify any follow-up research needed on targeted topics that are identified in the previous objective to prepare for the needs of transportation planning in the 21st century and beyond.

Related Work

Not aware of any related work. An important resource would include *2025, Scenarios of US and Global Society Reshaped by Science and Technology*, coauthored by Coats, Mahaffie, and Hines.

Urgency/Priority

Transportation planning needs to respond to the demands and needs of the future instead of the needs of today and yesterday. Transportation improvements need to solve future travel needs of goods and people.

Cost

\$250,000

User Community and Potential Users

USDOT, AASHTO, TRB, state DOTs, all transportation planning and implementing agencies

Potential Sponsors

NCHRP

Implementation

The results could be used in planning for future transportation improvements and technology.

Effectiveness

Society would benefit from an improved transportation planning process that was not just trying to catch up

with and meet the transportation demands and needs but planning for a true future improvement.

Key Words

Future, 21st century, transportation, planning

—Prepared by Michelle D. Hoffman and
Charles Goodman

APPLYING NEW INFORMATION TECHNOLOGY TO IMPROVE THE TRANSPORTATION PLANNING PROCESS

Problem

Integrating social, environmental, and economic concerns into transportation planning and decision making requires melding the results of technical analyses from multiple disciplines. To the general public, who are accustomed to television and telecommunications for information and recreation, the resulting decision-support documents are often arcane and not readily comprehensible. However, transportation plans are intended to serve public needs, to represent the blueprint for expending significant public resources, to profoundly affect the shape and quality of communities, and to require public input and acceptance.

Current and emerging developments in information technology (digital imaging, video, radio, computers, and the Internet) and the public's increasing access to these advances provide the transportation industry with the opportunity to drastically reform and enhance the way in which all stakeholders participate in planning, developing, and delivering transportation facilities and services. In addition, recently emerged technologies offer the opportunity to provide transportation consumers with service information and a better basic understanding of the total system.

Objective

This research would evaluate new and emerging technologies for their potential application in assisting transportation professionals in planning, analyzing, and communicating mobility needs and ways of meeting those needs. The candidate tools include Expert Systems; dynamic linkages, virtual design, and visualization technologies; and such underlying technologies as GIS, global positioning systems, video simulation, and those that support the Internet.

Specific tasks would include

- Identifying current exemplary practices and applications of the tools, both nationally and internationally;
- Categorizing new and emerging technologies and their applicability to the integrated transportation planning process;
- Examining the feasibility and the potential for combining technologies in new applications;
- Examining the potential for deploying these existing and new technologies across the broad spectrum of transportation practices; and
- Recommending training programs for using these tools and techniques.

This work should be documented and should highlight applications, costs, and benefits that are associated with using current and emerging information technologies in the public decision-making arena. Examples of new applications of information technology that may be used in transportation planning include but are not be limited to

- *Electronic clearinghouse on the Internet for transportation research and best practices*—providing access to the most current transportation and related social, environmental, and technical research information, legislation, regulation, policies, and guidelines;
- *Expert systems*—providing guidance and assistance through the process of identifying needs, identifying alternative ways of meeting those needs, and planning and implementing the proper decision-making process;
- *Virtual design and visualization technology*—using computer-aided dispatch, video and digital imaging, and computer simulation to allow project-development teams to “see” alternatives as they are developed interactively;
- *Transportation theater*—combining all the previous examples so as to provide an opportunity for project development teams, decision makers, and the public to see and experience the design, social, environmental, and economic impacts of transportation facilities and services as they would actually be implemented in communities;
- *Electronic planning and environmental documents*—offering a paperless medium for communicating and disseminating information on the social, economic, and environmental costs and benefits of proposed transportation plans and projects; providing a vehicle for soliciting public reaction and constructive feedback; using hot linkages to supporting documents, analyses, and related materials to allow preparation of simply and concisely written documents that would be accessible to the lay public, while providing the in-depth background

that is required to satisfy legal, full-disclosure requirements; and

- *Consumer-oriented information centers, websites, and kiosks*—using available technology and data that are available from service providers, ITS, and traffic management centers to provide consumers with information that would enable them to better use available services and to gain a better general idea of system capability and performance.

Related Work

Similar work has been proposed in previous TRB workshops but has not been funded.

Urgency/Priority

This research supports the decision process, streamlining, efficiency, and public participation envisioned in TEA-21.

Cost

\$300,000

User Community

MPOs, regional transportation planning agencies, state DOTs, transit operators, ITS developers, cities and counties, technology developers, commercial and residential developers

Potential Sponsors

USDOT, state DOTs, MPOs, regional transportation planning agencies

Implementation

State DOTs, MPOs, and regional transportation planning agencies could use the results of this research immediately in developing long-range transportation plans, programs, and projects. Application of this research would be particularly useful in developing stakeholder involvement and consent in large, complicated, controversial, and expensive transportation projects.

Effectiveness

This research responds to the changing ways in which much of society acquires and processes data into decision-support information. New technologies offer the opportunity to simultaneously and interactively design, evaluate, and modify transportation projects and services so that a single project alternative, which

has mitigated environmental and social impacts, is compatible with the community within which it will be located.

Key Words

Information technology, virtual design, virtual reality, the Internet

—Prepared by Brian J. Smith

INTEGRATING NEW ENVIRONMENTAL CONCERNS INTO TRANSPORTATION PLANNING PROCESSES

Problem

Recently, a variety of new environmental concerns has emerged that need to be addressed in transportation planning processes so as to improve the environmental performance of investment strategies. These include but are not limited to

- Recent health determinations about the harms that are associated with fine particulates, generated by either vehicle exhaust or reentrainment of road dust that has been disturbed by vehicular motion;
- Generation of greenhouse gases (such as carbon dioxide and others) that are associated with climate change;
- Water quality in regard to
 - Pollution effects that endanger human, animal, and vegetative life, both from pavement runoff and from reabsorption of air pollutants by standing bodies of water; and
 - Disruption of spawning habitat by transportation projects.
- Habitat and species endangerment and destruction issues on
 - Disruption of migratory travel and breeding patterns,
 - Maintenance of biodiversity, and
 - Habitat encroachment (through physical structures or transportation-related noise and other nuisance).

Objective

To identify the extent of these problems on transportation impacts and to examine the appropriate role for federal guidance and regulation through the transportation planning processes at state, MPO, and local levels.

Related Work

Chesapeake Bay Foundation, OECD, Puget Sound Water Quality Authority, Union of Concerned Scientists, FHWA, TRB (various reports), Schiller (STPP, 1997), British Royal Commission

Urgency/Priority

This project would inform policy and planning reformulation that is aimed at addressing national goals for reductions in greenhouse gas emissions as well as a variety of urgent concerns about the environmental impacts of transportation.

Cost

\$350,000

User Community and Potential Users

Decision makers, policy formulators, regulators, planners, and citizen interests that are involved in transportation at various levels of government

Potential Sponsors

FHWA, NCHRP, EPA, CDC (for human health aspects), F&W, NFS

Implementation

Results of this research would improve policy formulation, planning processes, and regulatory enforcement.

Effectiveness

This research could lead to less human health damages and to less wildlife and vegetation encroachment, endangerment, or extinction. It could lead to improved quality of life, enhanced biodiversity, and lower mitigation costs.

—Prepared by Preston L. Schiller

SURVEY OF INTERNATIONAL BEST PRACTICES IN PLANNING PROCESSES AND IMPLEMENTATION

Problem

Although the United States has often been a world leader in innovation in transportation technology and

freight intermodal processes, it has not been a leader in passenger transportation planning, especially regarding

- Transit-oriented development and compact mixed-use community design;
- Pedestrian and bicycling safety and facility planning and development;
- Creation of passenger rail networks for short, medium, and long trips;
- Passenger intermodal connectivity and information;
- Traffic-flow improvements that do not depend on road expansion; and
- Transit network improvements.

The United States continues to be an industrially advanced country whose rate of growth of driving and personal vehicle ownership is the most accelerated. Even superficially, similar Canadian cities display vast differences in car ownership, modal splits, and miles driven as compared with U.S. cities of similar size. Although all industrially advanced countries are experiencing growth in driving and personal vehicle ownership, their patterns of driving are significantly different. OECD countries (other than the United States and Canada) are generally experiencing increasing intercity driving instead of intracity driving. Also, several European metropolitan regions have been improving the modal share of transit, walking, and bicycling through a mix of investments, planning, and policy making.

Several OECD countries have also developed innovative ways of reducing arterial congestion through the use of rotaries and grade separation for nonmotorized traffic instead of through signalization or road expansion. Other countries have used traffic-calming designs in residential and commercial areas to protect and promote transit and nonmotorized travel. At issue is whether the United States can benefit from the best practices of these countries to slow the growth of driving and to improve the walkability and livability of communities.

Objective

This research intends to develop a synthesis of international best practices for adoption by U.S. planners.

Related Work

OECD, ITE, British Royal Commission, Newman and Kenworthy, Bruun and Schiller, Schiller and Kenworthy, Livable Communities (TRB et al.)

Urgency/Priority

This project would inform policy and planning reformulation that is aimed at addressing national goals for reductions of greenhouse gas emissions, as well as a variety of

urgent concerns about the environmental impacts of transportation.

Cost

\$250,000

User Community and Potential Users

Decision makers, policy formulators, regulators, planners, and citizen interests that are involved in transportation at various levels of government

Potential Sponsors

FHWA, NCHRP, FTA, EPA, CDC, NHTSA

Implementation

The results could be used to improve policy formulation, planning processes, and community livability, as well as savings in infrastructure expense.

Effectiveness

The results could lead to more efficient use of transportation infrastructure, less environmental impact, and improvement in human health through fitness and exercise.

Key Words

International transportation practices

—Prepared by Preston L. Schiller

RESOURCE AND ENERGY CONSUMPTION AND SUSTAINABLE TRANSPORTATION

Problem

Transportation in the United States is associated with much higher levels of energy and resource consumption than is found in most other developed nations, especially in the area of personal transportation. The size of the average personal vehicle, as well as a very high rate of vehicle ownership, indicates very high rates of resource and energy consumption in the production and disposal phases of a vehicle's life span.

Although most persons associate high levels of vehicle ownership and use with high levels of energy consumption—and concomitant air pollution—for their operation, there are other important dimensions of

resource consumption that are either less apparent or not sufficiently addressed. Foremost among these is the amount of space that is consumed for vehicle operation and storage. A refinement of the analysis of vehicle-space consumption has been to include the amount of time a vehicle occupies a unit of space (or area) as an environmental resource in comparisons of resource consumption among various transportation modes.

Objective

This project proposes the development of criteria for analyzing the extensiveness of energy and resource consumption, including space (area) and time, by various modes and by various urban forms. Specifically it calls for

- Hypothetical simulation of energy and resource consumption by various transportation modes and urban forms,
- Case studies demonstrating relevant aspects of the simulations and models that are developed through simulation, and
- Examination of European work in this area by literature review and case studies.

Related Work

Bruun and Vuchic, Newman and Kenworthy, Schiller and Kenworthy

Urgency/Priority

This project would significantly assist in understanding the benefit of alternatives and in developing improved cost-benefit analyses.

Cost

\$200,000

User Community and Potential Users

Decision makers at state and local levels, policy makers

Potential Sponsors

FTA, FHWA, NCHRP, EPA, Department of Energy

Implementation

This project could improve the planning and EIS processes and could lead to better consideration of land use and resource impacts of transportation plans and projects.

Effectiveness

Better understanding of resource utilization by various modes could lead to less land consumption, improved transit ridership, increased walking and bicycling, and lower costs of transportation to providers and consumers.

Key Words

Sustainable transportation

—Prepared by Preston L. Schiller

USING ITS-GENERATED PERFORMANCE DATA IN THE PLANNING PROCESS

Problem

Many ITS strategies routinely collect an extensive array of operational data that describes the performance of transportation systems and their components.

Objective

This project addresses the need to improve system reliability through the accomplishment of four objectives:

1. To increase the level of understanding of transportation service reliability by delineating its various dimensions across travel modes, the connections between those modes, user groups, and other parameters;
2. To assess the differential impacts across the various user markets, including freight shippers;
3. To identify M&O strategies that are effective in improving system reliability; and
4. To identify the range of actions by transportation planning processes to plan and program these M&O strategies.

The research will clearly define the dimensions of transportation service reliability and the range of appropriate roles for metropolitan and statewide planning processes to play in developing plans and programs of corrective actions.

Related Work

NCHRP Project 8-35 is now investigating alternative ways of mainstreaming consideration of ITS within the planning process. An element of this work involves understanding the range of potential benefits that ITS strategies offer to transportation system performance—including service reliability. However, this project is concerned with ITS only and is not concerned with the broader category of M&O.

Urgency/Priority

This enabling research addresses the most pressing and difficult issue that affects system performance. As such, it is of the highest priority.

Cost

\$200,000

Potential Users

States, MPOs, local governments

Potential Sponsors

FHWA, FTA, NCHRP, TCRP, domestic trade councils, shippers associations

Implementation

Recommendations that result from this research could be implemented through development of a number of state and local case study applications that are funded through challenge grants.

Effectiveness

This research will benefit the broad range of transportation system users across person-and freight-travel purposes. This will take place through greater recognition of the importance of system reliability by transportation decision makers who participate in the planning process. A measure of success will be their level of action in planning and programming these strategies.

—Prepared by Charles Goodman

CONFERENCE II RESEARCH STATEMENTS

Development of a Customer- and User-Based Planning Process: Creating a Vision for the Community

WHAT BASIC RESEARCH IS NEEDED TO DEVELOP CUSTOMER-RELATED PLANNING AND TO CREATE A VISION FOR THE COMMUNITY?

Problem

Planning for transportation investments, as well as planning for other projects, is often not user friendly. It is often seeped in jargon that customers and citizens can't understand or relate to. As a result, citizens don't participate in planning, and transportation professionals often cite a lack of effective citizen involvement in the transportation planning process. When the process excludes citizens, it can lead to outcomes that do not reflect the community's values. Similarly, citizens need to be involved in their community's visioning process so they can articulate their preferences for what they would like their community to become and how it should be developed. It is hoped that these preferences will be given careful consideration by the professional planners and are reflected in the plans.

Objective

Citizen participation was a buzzword in planning circles in the 1970s. What has been learned in the past 30 years? What has worked and why? What can be learned from experiences and mistakes of others? The Internet

and the amount of information that is readily available are transforming planning, like the rest of society. New information and communication tools are available, including interactive television, talk radio, computerized mapping of census data, HUD 20/20 software, and GIS. Citizens' expectations for information have also increased.

Related Work

Community-impact assessment: *A Quick Reference for Transportation* was distributed by FHWA in 1996. In 1998, FHWA released *Community Impact Mitigation: Case Studies*. NCHRP Project 25-19, *Evaluation of Methods, Tools and Techniques to Assess the Social and Economic Effects of Transportation Projects*, convened a panel for its 20-month study that includes a literature review, a survey of government agencies, classification, evaluation, a draft handbook, a peer review, and a final handbook (planned completion is November 2000).

Urgency/Priority

Development of customer-related planning is critically needed, given the

- Growing disparity between the rich and the poor,
- Need for civil engagement that is cited by many experts, and

- Need to get approval from the voters for transportation funding.

The electorate is demanding results from publicly funded activities. Many agencies are cutting back staff, which means there is even more pressure to provide them with methods that work. The need for effective citizen participation is imperative, and the field sorely needs models and case studies of best practices to avoid "reinventing the wheel." Citizen participation processes consume a lot of staff time, so finding out the best ways to involve citizens is a prudent use of tax dollars.

Many communities are experiencing drastic changes in demographics (e.g., an influx of immigrants). Other groups may have customs that affect their transportation needs (e.g., Hassidic Jews don't drive on the Sabbath). Certain groups have customs that affect their interactions with those who conduct the transportation planning and hence their participation in governmental processes (e.g., Islamic women are not apt to voice a dissenting opinion to a male in public). The graying of the "baby boomer" generation is likely to create enormous demands for transit and modes that are not automobile dependent in communities that were designed with the automobile as the dominant form of transportation.

User Community and Potential Users

Transportation planners in DOT, state DOTs, MPOs, local jurisdictions, consultants

Potential Sponsors

FHWA, FTA, NCRHP, Fannie Mae

Implementation

All transportation agencies at the state and local level that receive federal funds undertake citizen involvement. Other federal agencies also assess public involvement, so they could benefit from this research as well. Community groups could use the products from this study to learn how to become effective players. They could also learn how to undertake activities that would enhance their community and how to change what they don't like about the effects of transportation on their neighborhood. Consultants could apply this research to their contracts.

Effectiveness

Measures include

- Increase in the number of citizens involved in transportation decisions;

- Increase in their level of participation and duration of the participation (i.e., number of months); and
- Increase in effectiveness of this participation and decrease in the amount of opposition to the project, which could lead to faster implementation.

USERS GUIDE TO THE TRANSPORTATION PLANNING PROCESS

Problem

Often one hears the frustration expressed by the public that the planning process is too complicated or too complex and therefore inaccessible. Often these words merely mean that the person involved does not understand how to access the process. This lack of understanding is often because the planning community uses jargon that is unfamiliar, confusing, and foreign. A critical need exists to translate transportation terminology into everyday language for the public and for elected officials. To do a better job of transportation planning, we need to better educate the general public and elected officials on transportation planning terminology, planning tools used, the length of time involved in the transportation planning process, and when and where public involvement should occur in this process.

Objective

The objective of this research is to develop educational materials for distribution to the general public and to elected officials that clearly and concisely explain the transportation planning process in lay terms. This project would include both the creation of a user-friendly publication, containing high-quality graphics, and a less graphic-intensive document in electronic format for posting on the World Wide Web so that it can be readily downloaded by interested parties.

Such products would "demystify" the transportation planner's jargon so as to make the interaction among citizens, elected officials, and transportation planning professionals more meaningful and rewarding. Relying on a common understanding of the transportation planning process and on language, discussions would be centered around issues instead of on process.

Related Work

STPP's *Citizen Participation Guide*

Urgency/Priority

Such a project is keenly needed and would be invaluable in educating the general public and elected offi-

cials on the nature of the transportation planning process and where their involvement is needed and is important.

Cost

\$60,000

User Community and Potential Users

The general public, elected officials, and transportation planning professionals would use this users' guide.

Potential Sponsors

FHWA, FTA, NCHRP, TCRP

Implementation

The results of the study would be provided to customers, in general, and to elected officials, in particular, through mass distribution of the publication in printed and in electronic format.

Effectiveness

Development of this educational material and its distribution to the general public, to elected officials, and to the transportation planning community will provide a better and more meaningful transportation planning process.

Key Words

Transportation glossary, user handbook

—Provided by Thomas J. Kane

PROMOTING EFFECTIVE PUBLIC INVOLVEMENT IN THE MOST CHALLENGING SITUATIONS

Problem

When transportation planners call for public involvement, the public, in most cases, is unresponsive to the request. The public must understand that they are a vital element of the transportation planning process, and we must find ways to convince them of their important role. We should no longer tolerate empty public hearings and the fear that public input is not important (because they do not understand the planning process) and will slow down the process.

There may be many reasons for the public's lack of interest in involving themselves in the planning process. However, we need to develop new innovative ways to translate and communicate our ideas, as transportation planners, to the public in a way they understand. It is important that we show them, through effective promotion, that they will benefit from the process. We need to sell the public on our product. However, the public needs to be educated on the transportation-planning process, and as transportation planners, we must educate ourselves on the quality of life and cultural issues of the public.

Objective

Through research we wish to achieve an understanding of how we can market our customers to sell or convince them to participate in the transportation process. This participation will be important in understanding our role as the vendor of services and the public's role as an informed consumer of the services that we provide. We all benefit when our customers can share and have input in the transportation planning process.

As transportation planners we need to research ways to increase public involvement in the transportation planning process. We as planners need to better understand the following concepts when planning methods to announce our products and ideas to improve our communities' transportation needs. We should consider such issues as

- *Timing*—We need to time our events so that they are conducive and favorable to the public. We also need to determine, to the best of our ability, when the public should become involved in the process.
- *Location*—We need to be more flexible on where we hold our events.
- *Venue*—We need to take our message to where the people are.
- *Promotion/notification*—Investigate all forms and methods of getting the word out, and translate our message properly to the public. Do not depend on the traditional methods of notification.
- *Accessibility*—Make ourselves more accessible to the community, and ensure we are accessible to every person in the community.
- *Stakeholders*—Identify, support, and communicate to our stakeholders.

We also need to develop and research best practice models that can be used to increase public involvement. We can create new best practices by

- Surveying current programs that are working, including nontransportation programs.
- Assessing the effectiveness of those programs.

- Researching lessons learned from these programs and determining why they did or did not work.
- Researching the cost, time, expertise, and resource requirements of programs that worked or failed—this measure will ensure that we are not reinventing the wheel when we want to develop a plan to “bring people to the table and keep them there.”

Focus the analysis on projects or programs that address these issues:

- Find cost-effective ways to market, sell, or translate our ideas to the public.
- Find the correct method to communicate to the public the importance of regional long-term planning. The majority of the public are concerned with short-term objectives as they relate to their own backyard.
- Ensure that we have involvement from all sides of an issue and not just from those who do not want it in their backyard (NIMBYism).
- Find ways to involve the underrepresented groups in our communities, those who traditionally believe that they have no say in the process.
- Find ways to manage stakeholder turnover.

Related Work

State DOTs handbooks on public-involvement techniques (e.g., Florida DOT)

Urgency/Priority

We as transportation planners need to urgently find creative measures to involve the public in transportation planning. The public is a key element of the process, and failure to include them is unhealthy to any planning process. On the basis of the other issues that are related to the development of customer-based planning, promoting effective public involvement is the number one priority.

Cost

\$250,000

User Community and Potential Users

MPOs, toll and port authorities, transit agencies, state DOTs, federal agencies, transportation consultants

Implementation

When trying to involve the public in transportation planning, MPOs, DOTs, and transit agencies can implement the findings of this research.

Effectiveness

This research will arm governmental agencies with some guidelines and marketing techniques on how to increase public involvement by providing transportation planners with an understanding of the quality of life and cultural issues that face their customers. The most important measure of effectiveness is based on an increased rate of public participation in the planning process.

Key Words

Citizen participation, public involvement, stakeholders

—Prepared by Omar K. Wilson

TOOLS FOR FOSTERING STAKEHOLDER COLLABORATION AND DISPUTE RESOLUTION IN TRANSPORTATION PLANNING

Problem

We have seen a broad movement toward early and continuing public involvement in transportation-investment decisions, which began with NEPA and is further supported and extended by ISTEA and TEA-21. However, balancing ever-increasing transportation needs, fiscal constraints, regulatory compliance, public concern, political influence, and technical integrity often appears overwhelming.

Public-involvement processes that are ostensibly designed to assist decision makers in making hard choices generally tend to pit supporters of one alternative against those of another, soliciting preferences and opinions in ways that force decision makers to side with one position or another. The resulting debate often prevents projects from moving through the approval and implementation process. Collaborative decision processes and conflict resolution techniques that are developed through other disciplines may provide useful approaches for avoiding or resolving these situations.

Objective

This research will

- Review public involvement, decision science, and alternative dispute-resolution literature to identify a variety of collaborative problem solving and conflict resolution techniques that may be useful in the transportation planning arena.

- Identify cases in which these approaches have been used to successfully involve stakeholders in addressing controversial public issues and thus reduce the number of disputes, as well as cases in which dispute-resolution techniques have been needed.

- Analyze these cases to provide insights into their potential application in transportation planning and project-development processes. In this analysis, consider the following:

- Decision-making structures, including roles, responsibility, and authority of various participating entities;
- Formation and composition of stakeholder advisory groups;
- Other methods for representation of various interests in the decision process; and
- Dispute-resolution techniques when communication has broken down.

- Describe and evaluate tools and techniques, including various forms of multiattribute utility analysis, risk assessment, and alternative dispute resolution for

- Developing planning assumptions,
- Developing evaluation frameworks,
- Defining a suitable range of alternatives,
- Screening and evaluating alternatives,
- Selecting a preferred alternative,
- Preparing preliminary and final designs, and
- Developing construction-mitigation programs.

- Prepare a report that summarizes findings and recommends promising approaches that foster collaborative problem solving as a way of minimizing disputes, as well as describing dispute-resolution techniques that can be used when unavoidable conflicts arise.

Related Work

Related work includes rich-decision science and mediation literature that is related to facility-siting cases.

Urgency/Priority

Planning and project development are routinely stopped or slowed as a result of public controversy that is unresolved through traditional public-involvement processes. New approaches are needed to design processes that are effective in achieving implementable solutions.

Cost

\$180,000

User Community and Potential Users

Managers, transportation planners, and public-involvement practitioners of DOTs, MPOs, transit agencies, counties, and cities

Potential Sponsors

FHWA, FTA, NCHRP, TCRP, DOTs, MPOs, transit agencies, cities, counties

Implementation

Transportation planners and public-involvement practitioners could use the report to develop more effective public-involvement processes for controversial plans and projects.

Effectiveness

Application of new tools and techniques should lead to

- Improved credibility of transportation agencies,
- Solutions to transportation problems that better reflect a broad range of public values,
- Reduced cost and duration of plan and project development and implementation, and
- Increased job satisfaction of transportation planners and public-involvement practitioners.

—Prepared by Marcy Schwartz

PUBLIC INVOLVEMENT AND CUSTOMER INTERACTION ANALYSIS FOR TRANSPORTATION DECISIONS

Problem

Understanding how customers are involved in transportation decisions provides invaluable lessons for transportation planners. This is particularly critical in light of public-involvement requirements in most federal legislation and the rise in the public demand for a voice in decision-making processes. Customers are increasingly aware of the role and impact that major transportation decisions have on their lives, and with this awareness has come the desire and need to take part in shaping the outcomes and outputs. Moreover, project-approval processes can be improved by better up-front understanding of likely interactions among various interests, because this can help prevent cost overruns and fragmented project design. An important need is a consistent framework to portray the various components of different decisions and a thorough analysis of outcomes and lessons learned to enable transportation planners to design more effective customer-based processes.

Objective

This research would develop

- Standardized framework for organizing case studies that describe the public-involvement processes and the interaction among stakeholders over the life of decision-making processes in transportation from planning to environmental analysis to design to construction.

- Set of highway- and transit-project cases developed in the standardized framework, which is selected to consider a range of

- Facilities and services that involve siting, expansion, renewal, and removal;
- Degree of community involvement and opposition;
- Geographic locations; and
- Facility cost and pricing.

- Analysis of outcomes and lessons learned for each case and across cases, highlighting the challenges and subtleties of customer involvement in the decision process.

The framework would provide a basis for analyzing and communicating key stages in the decisions and the relationship between the nature of customer involvement and outcomes at each stage and for the process as a whole. Case study analysis provides a clear portrayal of how the positions of interest groups, public-involvement programs, intensity of controversy, and outcomes evolve over time. It is a useful reference for transportation planners in designing and monitoring customer-based planning processes for potentially controversial projects.

Related Work

A variety of models have been developed for presenting cases of governmental actions that can provide a point of departure for this effort:

1. Andrews, R. N. L. Hazardous Waste Facility Siting: State Approaches. In *Dimensions of Hazardous Waste Politics and Policy*, Greenwood, Westport, Conn., 1987.

2. Arnstein, D. A. Ladder of Citizen Participation. *Journal of the American Institute of Planners*, Vol. 35, pp. 216–224.

3. Bingham, G. *Resolving Environmental Disputes: A Decade of Experience*. World Wildlife Fund, Washington, D.C., 1986.

4. Bollan, R. S., and R. L. Nuttall. *Urban Planning and Politics*. Lexington Books, Lexington, Mass., 1975.

5. O'Hare, M., L. Bacow, and D. Sanderson. *Facility Siting and Public Opposition*. Van Nostrand Reinhold, New York, N.Y., 1983.

6. Nelkin, D., and M. Pollak. Consensus and Conflict Resolution. In *Technological Risk* (M. Dierkes, S.

Edwards, and R. Coppock, eds.), Oelgeschlager, Gunn & Hann Publishers, Inc., Cambridge, Mass., 1980, pp. 65–76.

7. Sabatier, P. A., and H. C. Jenkins-Smith. *Policy Change and Learning. an Advocacy Coalition Approach*. Westview, Boulder, Colo., 1993.

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Urgency/Priority

This enabling research is a critical underpinning for needed improvements in customer-based processes. It is necessary to have a common conceptual framework and an understanding of expected interactions and outcomes to improve the practice. This research will also serve as a baseline for building a body of knowledge through comparisons of various cases on this topic over time.

Cost

\$250,000

User Community and Potential Users

State DOTs, transit agencies, MPOs, community groups

Potential Sponsors

FHWA, FTA, NCHRP, TCRP

Implementation

The case studies would be in the form of a guide for those working on current or upcoming projects. They could be widely disseminated (through existing networks and the World Wide Web) to an audience that includes transportation planners, agency officials, and representatives of grassroots community groups.

Effectiveness

This analysis would help those who are involved in public involvement (the public and practitioners) to improve processes and better inform decision making.

—Prepared by Nate Gilbertson

CULTURAL SENSITIVITIES FOR COMMUNICATIONS WITH DIVERSE POPULATIONS

Problem

Many communities are experiencing drastic changes in demographics (e.g., an influx of immigrants). Other groups may have customs that affect their likelihood of participating in outreach efforts at a particular time (e.g., Hassidic Jews don't drive on the Sabbath). Certain groups have customs that affect their interactions with those who conduct the transportation planning and hence their participation in governmental processes (e.g., gender roles in various cultures). Planners need to recognize that the graying of the "baby boomer" generation will cause us to change how we interact with this important cohort. Public outreach meetings with elderly citizens should not be held at night, and materials may need to be in larger-sized type. Because of demographic changes, we need better information on how to interact with these populations and other underrepresented groups in transportation decision making. When the process excludes citizens, it can lead to outcomes that do not reflect the community's values.

Objective

This project seeks to identify groups toward whom transportation planners need to develop cultural sensitivity, including, but not limited to, new immigrants (taking into account immigration patterns), religious groups, the elderly, the disabled, and other underrepresented groups in transportation decision making.

Related Work

This research should start with checking cultural diversity training materials.

Urgency/Priority

The field sorely needs information on how to communicate effectively with emerging subgroups, which may be new to the country or community. Planners may be unfamiliar or uncomfortable working with these groups. Because citizen-participation processes consume a lot of staff time, determining the best ways to involve citizens is a prudent use of tax dollars.

Cost

\$75,000

User Community and Potential Users

Transportation planners in federal agencies and departments, state DOTs, MPOs, local jurisdictions, consultants

Potential Sponsors

FHWA, FTA, NCHRP

Implementation

All transportation agencies at the state and local level that receive federal funds undertake citizen involvement. Other federal agencies also undertake public involvement, so they could benefit from this research as well.

Effectiveness

Results of this project could increase the ability of transportation planners to effectively communicate with affected groups.

Key Words

Cultural diversity, cultural sensitivity, citizen participation, citizen involvement, transportation planning

—Prepared by Nancy Willis

MEASURING THE EFFECTIVENESS OF INTERNET TOOLS FOR SOLICITING PUBLIC INVOLVEMENT

Problem

The Internet and the amount of information that is readily available are transforming planning, like the rest of society. New information and communication tools are available, including interactive television, talk radio, computerized mapping of census data, HUD 20/20 software, and GIS.

Citizens' expectations for information have also increased. As the Internet becomes more and more prevalent in daily life, it has the potential to become a source for reaching out and soliciting public input from individuals in their own homes, on their own time. Such a process can enhance the level of public involvement in transportation decisions by freeing up customers to determine their time and amount of involvement, instead of forcing them to participate in a group discussion at a time selected for the convenience of the transportation agency.

Techniques can vary from the use of e-mail and chat rooms, to websites, to actually soliciting document reviews over the Internet. Generated data can range from planning process, project development, construction updates, weather reports, road conditions, and document review.

Citizen participation was a buzzword in planning circles in the 1970s. What has been learned in the past 30 years? What has worked and why? What can be learned from the experiences or mistakes of others?

As these techniques become more common, questions of equity and functionality must be addressed. For instance, are these techniques biased against participation by certain segments of the community? Or is the information being provided truly understandable and decipherable without face-to-face communications and the ability to ask questions and engage in a dialogue? Only if the transportation community can assure itself that these techniques enhance instead of narrow the process should they become common tools.

Objective

This research will

- Measure the effectiveness of the information that is now being disseminated on the Internet from the perspective of both the user and the provider,
- Consider the full potential of the tool, and
- Develop a user guide for public agencies that are interested in using these approaches.

One of the first things the researchers will have to determine is whether they can rely on existing websites or whether they will have to create some websites that are tailored to various phases of the planning process.

Types of questions that would need to be researched include

- Is the information being looked at?
- What type of feedback has been generated on existing sites—comments, requests for information (response time), and complaint lines?
- What would need to be done to generate data by user type?
- Would this discourage or threaten the user?
- Are certain website designs more conducive than others in ease of use or in generating hits?
- What anecdotal material exists on user-friendly design (e.g., certain home-based users have difficulty accessing different websites)?
- What are the staffing implications of maintaining accurate and current data on the web?

- What information exists on the characteristics of access to the web (e.g., number of households)?

By having a report that provides an assessment of this kind of information, agencies will be better able to tailor the effort they spend on their websites to those that are the most effective. Any fears that this information is only available to a certain segment of the community can be allayed or verified. In any case, agencies will be better able to tailor their public-involvement programs accordingly.

Related Work

Not aware of any specific work on transportation-related websites, but there are numerous articles on the best way to design websites.

Urgency/Priority

This work will become more and more relevant as agencies turn to alternative sources for disseminating information.

Cost

\$50,000

User Community and Potential Users

This information would be relevant to any public agency that needs to inform and solicit input from its customers. At a minimum, this includes state DOTs, MPOs, transit operators, and local governments.

Potential Sponsors

FHWA, FTA, TCRP, NCHRP, ITS America, Microsoft

Implementation

Results could be used to distribute a published report to all states, MPOs, and transit operators so that they can use the lessons learned in distributing information and seeking public input over the Internet.

Effectiveness

Greater use of the Internet can broaden the amount of public involvement at a relatively low cost.

Key Words

Internet, websites, public involvement, citizen participation

TOOLS FOR ASSESSING THE EFFECTIVENESS OF PUBLIC-INVOLVEMENT PROCESSES

Problem

Today, transportation agencies use public-involvement programs to incorporate public input into more and more decisions. Sometimes agencies view public involvement as a way to make better decisions and enhance the acceptability of controversial projects. Other times, legislative and regulatory mandates, such as those stemming from NEPA and ISTEA and reiterated in TEA-21, require public involvement. Whatever the reasons, transportation agencies, decision makers, and the public are spending increasing amounts of time, energy, and resources developing and responding to public-involvement programs. But how can we tell if these public-involvement programs are effective? How should we measure their success? On what basis can we justify a substantial commitment of agency resources to public involvement?

Objective

- Review program-assessment literature to identify a variety of approaches for assessing the effectiveness of public-involvement programs.
- Define potential indicators of success and measures that can be used to assess performance of public-involvement programs against these indicators. In identifying indicators, consider such factors as
 - Accessibility to the decision-making process;
 - Diversity of customers represented;
 - Diversity of views expressed;
 - Opportunities for participation;
 - Integration of concerns;
 - Information exchange;
 - Project or plan efficiency (duration of process);
 - Project or decision acceptability;
 - Mutual learning among participants;
 - Mutual respect among participants;
 - Cost avoidance for affected agencies;
 - Participation time costs for participant;
 - Opportunity costs for participants; and
 - Authority, influence, and emotional costs for participants.
- Incorporate indicators and measures that reflect consideration of different perspectives in the assessment, including the sponsoring agency, other affected agencies, program participants, and nonprogram participants.
- Organize these indicators and measures into one or more assessment tools and pilot test them on a range of public-involvement programs, including those associated with long-range regional planning, corridor plan-

ning, STIP programming, urban project development, and rural project development.

- On the basis of pilot test findings, recommend assessment measures that are deemed most effective for various types of public-involvement processes.
- Prepare a guidebook or toolbox to assist transportation agencies in conducting assessments of their public-involvement programs.

Related Work

- *Assessing the Effectiveness of Project-Based Public Involvement Processes: A Self-Assessment Tool for Practitioners*. TRB Committee on Public Involvement in Transportation, 1998.
- Lach, D. and P. Hixon. Developing Indicators to Measure Values and Costs of Public Involvement Activities. *Interact*, Vol. 2, No. 1, 1996.
- Keever, D. B., and J. Lynott. Evaluation of Public Involvement Associated with the Woodrow Wilson Bridge Project. Presented at the Transportation Research Board Annual Meeting, January 1999.
- Brevard County MPO biennial survey of citizen participants.
- A variety of generic program assessment tools are discussed in business management publications, such as the *Harvard Business Review*.

Urgency/Priority

Performance assessment is increasingly viewed as a key to successful organizational management, especially in times of resource constraint. It is important for agencies to be able to make wise allocation decisions, investing resources in activities that are critical to success in accomplishing the organization's overall mission. At this time, no commonly accepted framework for evaluating investment in public-involvement activities exists. Agencies rely on anecdotal data concerning what types of programs are most successful and when programs are needed. It is important to provide better tools to assist managers in making these investment decisions and to assist planners in determining the characteristics of successful public-involvement programs.

Cost

\$250,000

User Community and Potential Users

Managers, transportation planners, and public-involvement practitioners of DOTs, MPOs, transit agencies, counties, and cities; members of community organizations

Potential Sponsors

FHWA, FTA, NCHRP, TCRP, DOTs, MPOs, transit agencies, cities, counties

Implementation

Planners and public-involvement practitioners could use the assessment tool for

- Training new staff so as to foster consideration of important aspects of public-involvement programming,
- Self-evaluating their processes,
- Evaluating the effectiveness of particular public-involvement approaches and techniques to assist in the design of future programs and to allocate future planning resources, and
- Developing consultant scopes of work for public-involvement services.

Effectiveness

Application of the assessment tool should lead to

- Improved credibility of transportation agencies,
- Reduced cost and duration of plan and project development and implementation,
- More objective resource allocations,
- Justification of public-involvement expenditures, and
- Increased job satisfaction of transportation planners and public-involvement practitioners.

—Prepared by Marcy Schwartz

INSTITUTIONAL BARRIERS TO INTEGRATING PUBLIC INVOLVEMENT

Problem

An agency's level of commitment to public involvement can often be determined by a look at its organizational structure and its allocation of resources. Often the placement of the resources for public involvement in the agency can make or break the public-involvement process. Not only is the internal organization critical, but because various other agencies are involved in the final transportation decision (e.g., federal agencies, state DOTs, transit operators, and MPOs), there are often different interpretations of issues and problems. A clear understanding and communication channels are needed to identify expectations from the public-involvement process.

Objective

This research will

- Identify the barriers that hinder the public-involvement process;
- Assess the relative importance of each of these barriers; and
- Describe ways to overcome these barriers.

We must identify who does the public involvement (DOTs, transit operators, consultants, or MPOs). We must also identify the amount of professional training in public involvement that is needed to provide a common understanding of the transportation planning process and language.

A sample survey to determine staff experience, within the transportation agencies, with public involvement should be conducted. We should also ensure the integrity of the study through a case study approach, including face-to-face interviews. State DOTs, transit operators, and MPOs should be included in the case study.

Items that should be analyzed are

- Staff characteristics within the agency—who, where located in the organization, training, and level of experience;
- Budget—size, who decides;
- Intra-agency barriers—channels of internal communication; and
- Interagency barriers—different interpretation of terminology, credibility, and too many people.

Related Work

Institutional Barriers Related to ISTEA by Bruce McDowell

Urgency/Priority

This project is critical to providing agencies with a clear understanding of their emphasis on public involvement and to providing insights into how they can revamp their organizations to place a greater emphasis on public involvement.

Cost

\$200,000

User Community and Potential Users

The results of this study could be used by state DOTs, transit operators, and MPOs in self-assessing their public outreach efforts and in implementing institutional changes.

Potential Sponsors

FHWA, FTA, NCHRP, TCRP

Implementation

The study findings would be the basis for future workshops and conferences to encourage and help agencies to self-assess their support for public involvement.

Effectiveness

This research could result in better public involvement in future projects.

Key Words

Institutional barriers

—*Prepared by Howard F. Hancock, Jr.*

**INCORPORATING VISIONING INTO THE
TRANSPORTATION PLANNING PROCESS****Problem**

Comprehensive transportation plans often lack a clear indication of the desired future. Reviews of transportation plans sometimes find statements of goals and objectives that are identical word-for-word among plans of different agencies. Plans frequently depict mixes of activities that are virtually identical to current conditions.

Visioning brings the community together so it may arrive at a common understanding of a preferred future. Visioning attempts to articulate what a community wants to be "when it grows up." The vision need not be a dramatic departure from the past. Conversely, it might call for sweeping changes in accordance with the character of the area. The vision will not necessarily be strategic—it will incorporate general desired features but will not rigidly define precise details, because these must be responsive to the unknowable future. The development of a strategic vision must embrace the entire community.

Objective

The proposed research will provide guidance on effective visioning methods at the neighborhood, community, regional, and state levels. It will address how the transportation planning process can be integrated with vision-

ing efforts. It will describe why visioning is important, when it should be applied, and how it should be applied. The research will provide a sample of effective visioning processes that have been applied in transportation and other topical areas. It will include specific guidance on methods of scenario building and will provide specific methods for effective visioning. The research product will be a written report that summarizes all aspects of effective visioning.

Related Work

At the neighborhood level, visual preference surveys have been used to develop consensus on community vision. At the regional level, the Portland, Oregon, metro area has applied visioning techniques. The Project for Public Spaces and the American Planning Association may have prepared materials that are related to successful visioning.

Urgency/Priority

With the emphasis in TEA-21 of livability, visioning is a high priority.

Cost

\$100,000

User Community

MPOs, state DOTs, local governments, transit agencies, FHWA, FTA, HUD, chambers of commerce, business groups, community advocacy groups

Potential Sponsors

FHWA, FTA, NCHRP, TCRP

Implementation

The research findings will be implemented by local governments, community organizations, MPOs, DOTs, and other organizations and will result in a planning process with a clear vision of preferred outcomes.

Effectiveness

This research, when implemented, will result in plans with a much greater sense of direction and will provide a much improved context for transportation planning.

—*Prepared by Ed Mierzejewski*

CONFERENCE II RESEARCH STATEMENTS

Aligning Planning Processes, Decision-Making Institutions, and the Political Process to Meet 21st-Century Challenges

MEASURING THE IMPACT OF TRANSPORTATION SYSTEMS' DECISIONS IN TERMS THAT MATTER TO DECISION MAKERS AND THE PUBLIC

Problem

Transportation decision making traditionally has focused on measurements of capacity and predictions of demand. Political decision makers, however, have a much broader set of interests that are often not addressed by the data that typically inform transportation planning. MPO and transit agency board members have limited access to information that documents the critical relationship between transportation and other elements of a healthy community, including economic, environmental, and overall quality of life. For example, decision makers are rarely provided with economic impact assessments that are associated with transportation decisions, such as estimate of changes in real personal income.

Even data on traffic safety impacts are often not incorporated into transportation decision making. Because such factors are not brought into the mix of decision-making criteria, the full significance of transportation investments is often not comprehended. Priorities can be skewed as investments focus on improvements to volume-capacity ratios but neglect key

community interests. In other cases, key constituencies and potential political allies are not tapped because the implications of transportation decisions have not been demonstrated.

Objective

Research will

- Identify factors that local elected officials value but that are not being produced by the transportation planning process,
- Explore quantitative and qualitative methods and data,
- Identify innovative practices currently used by transportation planners that bring broader community values into the criteria and that inform transportation decision making,
- Identify the use of such factors in nontransportation decision making by elected officials, and
- Focus primarily on the feasibility and the methods for developing such data with secondary consideration given to the communications vehicles that are used to convey such information to elected officials.

Related Work

There have been numerous studies in performance measurement.

Urgency/Priority

High

Cost

\$300,000

User Community and Potential Users

MPOs, state DOTs, transit agencies

Potential Sponsors

USDOT, FHWA, FTA, NCHRP, TCRP, AMPO, AASHTO, APTA

*—Prepared by John Swanson***EFFECTIVELY DEFINING AND COMMUNICATING INVESTMENT TRADE-OFFS AND CHOICES FOR DECISION MAKERS****Problem**

Traditional decision-making tools, like cost-benefit and cost-effectiveness analysis, have long been used to understand trade-offs between multiple investment objectives, usually those that could be quantified and monetized. As those objectives have become more complex and numerous, and political processes have assumed a more prominent role in investment decisions, the traditional methods have less relevance. The consequences of investments are more difficult to define, to explain, and to synthesize into meaningful choices. This handicaps the process of achieving consensus on major decisions.

Objective

This research is a synthesis of current research and practice on techniques to define, array, and communicate investment trade-offs and choices for decision makers. It should define appropriate performance and impact measures and develop frameworks for analyzing and describing the trade-offs among them. These techniques should be effective for multimodal investment alternatives and should accommodate a wide variety of investment objectives and performance and impact measures.

Related Work

There have been numerous studies of performance and impact measures.

Urgency/Priority

The product of this work would have immediate applicability in major investment studies, environmental impact studies, and other locally based decision-making processes.

Cost

\$200,000

User Community and Potential Users

States, MPOs, transit agencies

Potential Sponsors

FHWA, FTA, EPA, NCHRP

*—Prepared by Les Serman***CLOSING THE GAP BETWEEN REGIONAL PLANNING AND POSITIONS TAKEN BY DECISION MAKERS AND THE PUBLIC****Problem**

There is an uneasy feeling among many planners that ultimate decisions are too frequently based on factors other than the technical results of their studies. Examples include (a) federal earmarking; (b) rail transit systems built because local officials wanted their city to become "world class," or citizens advocated transit's quality-of-life benefits-regardless of the project's cost-effectiveness; and (c) new urban highways approved to relieve congestion despite evidence that they will only exacerbate conditions in the long term.

Should planners, therefore, revise their processes to respond directly to the concerns of decision makers and the public, or should they set out to educate them to make better informed decisions? Although the majority of planners believe that the latter is a quixotic endeavor, there is some evidence that suggests otherwise. Congress appears to be responding to FTA's new starts criteria ratings by earmarking rail projects. Several local transit sponsors and citizen groups are supporting less expensive bus rapid transit as an interim step to rail until ridership can be built up. Also, unworthy highway projects that were exposed to public debate in MPOs and other forums are being postponed or dropped.

These measures suggest compromise solutions: planners should reorient their work to meet the needs of decision makers and the public when appropriate, but

they can also be more forceful advocates of the merits of their findings.

Objectives

This project will

- Acquire a better understanding about decision-making criteria at all levels of government through research. This might include case studies; interviews with decision makers, citizen groups, or informed observers in metropolitan areas; and literature reviews, surveys, and analyses.
- Analyze selected planning processes to identify information gaps and assess how the planning processes might have been more responsive to user needs by either developing different information or presenting and communicating available information differently.
- Examine "best practice" decision processes in which planners, decision makers, and citizens were in synch. Focus especially on areas in which information users became more responsive to planning results. What lessons learned in terms of effective strategies can be derived from these experiences?
- Develop recommendations for closing the gap between planning processes and decision making.

Related Work

This is an area in which surprisingly little research has been conducted to date. Texas Transportation Institute did some work on rail transit decision making about a decade ago; before that, Lowell Bridwell did some similar research for NCHRP.

Urgency/Priority

Because TEA-21 has significantly raised transportation funding levels, related planning and decision making will presumably increase proportionally. Thus, the research should be completed as soon as possible.

Cost

Less than \$500,000

User Community and Potential Users

Planners, agency officials, decision-makers at all levels of government, citizen groups

Potential Sponsors

USDOT; FHWA; FTA; NARC; AMPO; NCHRP; TCRP; governors', mayors', and county associations; ACIR; STPP

Implementation

The report recommendations might include strategies for various situations, revisions to the planning processes, training for agency staff, education for decision makers and citizens, and new procedures or better enforcement of existing procedures.

Effectiveness

The cost savings through better decision making on a single major capital transportation investment of \$500 million might be \$200 million or \$300 million.

—Prepared by Julia Hoover

IMPROVING THE LINKAGE BETWEEN DECISION MAKING AND ACCOUNTABILITY THROUGH PERFORMANCE AUDITS AND PROGRAM ASSESSMENTS

Problem

- Transportation operating agencies are increasingly required to measure their performance, identify performance goals, and be held accountable for their attainment of those goals.
- Performance measurement may have the potential to improve the ability of transportation planning to inform and support decision makers.
- Transportation planning is generally held accountable primarily for its procedural integrity; that is, courts and funding agencies scrutinize carefully whether or not decision making adheres to complex administrative and regulatory procedures. The emphasis on procedural integrity instead of results may undermine the relevance of transportation planning analysis to the political and decision-making process.
- Transportation planning has generally been held less accountable for the results of transportation planning decisions: whether projects and plans actually deliver anticipated results. Resources are generally not available for postproject or postplan audits or reviews, because attention goes to preparation of the next required planning document or update.
- As a result, it is often difficult to learn from past experience about what works and what does not work.

Objective

This project would examine the potential for incorporating a performance-oriented approach to transporta-

tion planning. It would canvass performance-measurement initiatives that are related to transportation planning across the United States and in other countries. It would identify successes, failures, and lessons learned by use of surveys, interviews, site visits, or case studies. It would then assess the feasibility and desirability of performance-based transportation planning in the United States. The study would include the examination of model performance measures and barriers (institutional, legal, structural) to the adoption of performance-based planning in the United States, and how such barriers might be overcome.

Related Work

Administrative reform research statement, AASHTO scanning tour on management (April 1999).

Urgency/Priority

High

Cost

\$250,000

User Community and Potential Users

MPOs, state DOTs, regional transportation planning organizations

Potential Sponsors

NCHRP, TCRP, USDOT, AASHTO

—Prepared by Jonathan Gifford

ALIGNING THE PLANNING PROCESS WITH FASTER-PACED POLITICAL CHANGE AND PARTICIPATORY DEMOCRACY

Problem

Elected and appointed officials are relied on to provide the necessary leadership for current and future transportation systems. The trend for their terms of service, on average, has become shorter over time. Concurrent with this trend is the increased use of "ballot initiatives" to resolve policy issues. In general, the desire to accomplish more in less time has created a great sense of urgency on the part of leaders to have better and more

accurate projections and data with which to make more informed decisions.

Objective

One objective of this proposed research is to better identify the role of leadership in addressing transportation goals and decisions and how the trend of shorter terms affects this role. Similarly, this research is needed to investigate how the planning process can better accommodate these decision makers with more timely, reliable, and easily understood information as it pertains to plan analyses, processes, and development. This effort may include identifying how to educate planners of the best practices available and how to "plan more timely." It should also identify the implications of a more rapid, compressed planning process and determine how to better communicate the information.

Related Work

Another research effort that is recommended by this breakout group is the identification or development of better tools, methods, and data-collection techniques for planners.

Urgency/Priority

High

Cost

\$200,000

User Community and Potential Users

Local and state agencies, MPOs

Potential Sponsors

FHWA, TRB, NCHRP

Implementation

The facilitation of the decision-making process to become more responsive will directly benefit all levels of leadership.

Effectiveness

This research could provide more informed and more rapid development and implementation of transportation decisions.

—Prepared by Russell Renaud

REINVENTING TRANSPORTATION PLANNING

Problem

The poor alignment of transportation planning with political processes has become a matter of concern. Planning often requires substantial investment of time and effort. Yet, many decision makers and planners are concerned that the outputs of the planning process are not timely and do not provide information that elected officials and the public in general find useful.

Control over the alignment falls into two spheres: the political process and the planning process. Other research has been suggested to address changes to the political process. The examination of significant changes to the planning process has not yet been addressed.

Objective

- This project would be a “blue sky” examination of how best to organize planning so as to support the political institutions (legislative, executive, and judiciary branches) that are responsible for governing under the U.S. system. The project would “throw away the rule book” and develop, starting with a blank slate, one or a few “ideal” or prototype planning processes that would adequately take into account mobility, accessibility, environmental stewardship, land use, community integrity, economic efficiency, and social equity.

- The project would seek guidance from decision makers, community leaders, and the general public, as well as from the literature, experts in transportation planning, and those outside the traditional planning process. It would examine and assess how other countries organize transportation planning and decision making.

- The project would then develop and describe a few prototype planning processes.

- The project would then compare and contrast with current procedures, statutes, regulations, and practice and draw conclusions about how current practice might be modified or improved to move closer to the ideal. These steps would include participation by a broad range of stakeholders.

Related Work

Research statement on changing the political process

Urgency/Priority

High

Cost

\$250,000–\$300,000

User Community and Potential Users

The entire transportation community could look to these ideals for ideas and opportunities for improving planning processes.

Potential Sponsors

Foundations, NGA, National League of Cities (NLC), Congress

Implementation

Although implementation of an ideal process is unlikely in the short term, focusing on how to improve processes without the constraints of conforming to current norms and requirements can be a useful exercise to help the transportation planning community recognize the overall quality of its current practice.

—Prepared by Jonathan Gifford

DOCUMENTING FOR ELECTED OFFICIALS THE IMPORTANCE OF M&O INVESTMENTS TO PERFORMANCE OF THE OVERALL TRANSPORTATION SYSTEM

Problem

A wide range of technological improvements are emerging with a proven track record of increasing the efficiency of the existing transportation system, collecting on-line information of system performance, and allowing for much better management oversight. Examples of such applications include “Smart Tags” to track product delivery, “Smart Cards” to support seamless transportation services, accident mapping, systems to improve public safety, electronic payment of fare and parking tickets, advanced traveler information systems, traffic-management systems, traffic-signal-control systems, freeway-toll management systems, automated vehicle-locator systems, emergency management and dispatch systems, air safety systems, automated schedule, inventory and work order record keeping, in-vehicle systems, and programs to facilitate the movement of transit through congested areas.

These applications of technologies to M&O activities have enabled some agencies to increase performance of

the existing system; however, their application is not widespread, and they are often overlooked in plan development and implementation processes. Furthermore, many different jurisdictions (state, regional, operating agency) may use different technological systems, thereby delaying implementation of a system-integration strategy. Adoption of a cohesive approach is critical at the metropolitan level and local level, the very agencies that own and operate most of the affected multimodal infrastructure.

There is a need to increase awareness among elected officials on the importance and real benefits of this type of investment and to create the necessary understanding for the need for "interoperability" of linked systems for comprehensive systems management.

Objective

The objective of this project is to review existing case studies of best practice applications to systems M&O at various levels of scale (state, regional, metropolitan, and local). The research will accomplish the following:

- Benefits to M&O activities,
- Identification of obstacles and solutions,
- Extent of interoperability,
- Incentive for cooperation (if any),
- Importance of stakeholders' role, and
- Identification of the extent to which leadership of elected officials played a key role in implementation.

Based on findings from the review of existing case studies, the study will organize and convene a series of focus groups of elected officials. Those meetings will be used to validate the long-term importance of this category of technology application programs and to consider how this type of investment, which crosscuts all modes and programs, can be incorporated into existing and future planning and programming processes.

In addition to recognizing that elected officials are key to integrating IT applications into the entire system, the research should also suggest a means of providing ongoing, reliable information on progress and benefits to key officials and structure the findings to promote collaboration among various governments and agencies.

Related Work

FHWA, FTA activities, ITS America programs, Public Technology Inc. programs, National League of Cities transportation initiatives

Urgency/Priority

Implementation of technological improvements will substantially improve the ability of responsible agencies to manage and operate the transportation system, particularly in metropolitan areas. Successful implementation, which is dependent on achieving an integrated system among many stakeholders, could substantially affect long-range policies and investment decisions. As such, this research is of high priority.

Cost

The cost is \$350,000 for a work program that builds on existing research and best practice information, incorporates focus group sessions and follow-up interviews as appropriate, and identifies existing and proposed guidelines to ensure that this category of investment programs is taken fully into account in the planning and programming process.

User Community

AASHTO, APTA, NHTSA

—Prepared by Frankee Banerjee

FORTY YEARS OF REGIONAL PLANS: CRITICAL REVIEW OF LESSONS LEARNED

Problem

During the past several decades, regional plans and the transportation and planning institutions that implement them have greatly affected both the natural and human-made landscape. More specifically, it has been asserted that planning, which was unable to foresee the connection between environmental quality, land use, and transportation and the importance of crisis issues (i.e., environmental justice, seismic upgrade), has contributed to sprawl and detracted from the quality of life. Unfortunately, there has been no thorough and rigorous look to determine the long-term impacts, both positive and negative, of regional plans and the manner in which institutions implement them.

Objective

The objective of this research is to perform a comprehensive and retrospective examination of regional plans across the country, under the premise

that by doing so we might learn from our mistakes and successes. Even though the research does not need to examine all regional plans, it must be careful to look at a representative sample. The research should provide an exhaustive description of best practices in this area, as well as a summary of all practices used.

The research should also document the benefits gained and the problems encountered from the adoption of regional plans. We would also expect an analysis of how regional plans were affected by institutions, financial constraints, ISTEA, TEA-21 (if possible), and other federal initiatives (i.e., Has there been a significant shift from capacity expansion to system preservation, or are more resources being devoted to transit, pedestrian, bicycle, and other alternative transportation?).

Urgency/Priority

This work would provide a benchmark by which existing regional plans can be evaluated. It would also serve as a guiding document for institutions in the process of reforming their regional plans.

Cost

\$500,000–\$600,000

User Community and Potential Users

Regional planning and transportation institutions, advocacy organizations

Potential Sponsors

FHWA, NCHRP, FTA, AMPO

Implementation

The findings of this research would be used to improve regional plans. Advocacy groups would find this research to be a useful tool for pushing for regional plan reform.

Effectiveness

This research could potentially improve regional plans so that they are more thoughtful, forward looking, and responsive to those who are most affected. Adoption of the best practices described would serve as a good measure of the effectiveness.

—Prepared by Michelle Garland

IMPLEMENTING TRANSPORTATION PLANS: CURRENT PRACTICE

Problem

Plans ultimately must be implemented to achieve the results that are anticipated in creating, conducting, and supporting a planning process. However, the integrity of the planning process is undermined when plans are not translated into action. In some cases, plans are frequently changed through amendments, substituted with an assembled list of projects, or largely ignored. Continued support for planning, the planning process, and systems development requires a successful effort to convert the aspirations contained within plans to real investments.

Objective

The objective of the research is to develop a synthesis of current practice on plan-implementation strategies and practices. Document whether significant damage is done to the planning process when plans are not translated into real investments. Highlight and disseminate cases that illustrate effective problem solving and remedies for plan-implementation issues. Identify strategies for supporting plan implementation that reduce the need to amend plans.

Related Work

AASHTO and TRB have funded substantial work on development of transportation improvement programs. This work needs to be reexamined and extended to focus on how plans can do a better job of supporting program development and of ensuring that programs support the system-development objectives of plans. Related research on early consideration of environmental issues during planning should be examined to identify results that reduce duplication of planning analyses in project development, thus supporting plan implementation. Process improvements from areas such as plan reengineering, public involvement, and financial planning should be considered as possible contributors to plan implementation success.

Urgency/Priority

High priority due to centrality of plan development and potential payoff in expediting project implementation

Cost

\$150,000

User Community and Potential Users

Project sponsors, planning agencies, operating entities, and other organizations charged with identifying and developing plans and programs

Potential Sponsors

FHWA, FTA, AASHTO

Implementation

As a synthesis of current practice, the emphasis should be on developing a wide range of cases that illustrates the breadth of current practice and approaches to problem solving in plan implementation.

Effectiveness

The effectiveness of this research should be assessed in terms of reduced plan changes, greater citizen and policy-maker satisfaction, and improvements in system performance.

—Prepared by Sheldon Edner

ADMINISTRATIVE REFORM AT STATES, MPOs, AND TRANSIT AGENCIES: INTEGRATING ENVIRONMENTAL AND ECONOMIC FACTORS INTO BUSINESS AND INVESTMENT DECISIONS

Problem

Although transportation plans and programs are increasingly required to integrate environmental, economic, and M&O considerations, the administrative structures within transportation agencies too frequently are not designed to foster such integration. NEPA requirements, for example, are sometimes pursued as a separate administrative procedure whose principles have not been internalized into the transportation-investment decision-making process. Similarly, M&O concerns are often administratively separated from planning, although the planning staff is expected to place greater emphasis on ITS, a key M&O tool. Transportation agencies are confronting a growing need for new organizational structures and approaches that can foster more extensive cooperation between departments and agencies whose responsibilities increasingly overlap.

Objective

Research will

- Document recent reforms within the administrative organization of transportation agencies to encourage interdisciplinary and interdepartmental coordination. In particular, the Pennsylvania DOT has been noted as an example of administrative integration between the planning and environmental staff. What was the impetus for such reforms? What have been their achievements?

- Examine the applicability to transportation of administrative reforms in nontransportation public agencies.

- Examine the applicability of recent administrative reform theories and their common themes, such as the focus on performance and results, the application of a market model to political and administrative relationships, and the "reinventing government" reforms. Are such approaches applicable to transportation? Would they provide a framework for improved integration of environmental, economic, and M&O considerations into planning?

Related Work

Related work includes numerous academic studies in the field of public administration. A recent NCHRP report focused on state DOT organizational reforms.

Urgency/Priority

High

Cost

\$300,000

User Community and Potential Users

MPOs, state DOTs, transit agencies

Potential Sponsors

USDOT, FHWA, FTA, NCHRP, TCRP, AMPO, AASHTO, APTA

—Prepared by John Swanson

NEW COOPERATIVE RELATIONSHIPS FOR PLANNING, DESIGN, CONSTRUCTION, OPERATION, AND MANAGEMENT

Problem

A new institutional form is emerging in the planning and delivery of transportation facilities and services—the vol-

untary consortium. These consortia take on a number of forms and are made up of a broad range of participants (depending on their function), including state DOTs, MPOs, toll-road and toll-bridge operators, and police and emergency-response agencies, among others. The key features of these organizations are that they are voluntary, nonmandated, and include participants from a broad range of functional responsibilities. They are sometimes quite informal, with no bylaws or memoranda of understanding, at least for the first several years of their existence.

The appeal of consortia is that the organizations can participate without compromising their autonomy or their accountability to their own constituencies and stakeholders. The range of participation may vary from simple exchange of information (e.g., about planned construction projects) to deliberate coordination of activities (e.g., coordinated construction-project scheduling to minimize disruption). Examples of such consortia include the E-ZPass toll tag found in the eastern seaboard region, TRANSCOM in the greater New York region, TIME (traffic-incident management enhancement) in Wisconsin, Houston Metro, the Alameda Corridor, and the Transit Standards Consortium (for ITS transit standards). Transportation consortia appear to offer a way to bring planning and implementation together.

Objective

The objective of this project is to investigate and carefully document a number of such consortia so as to identify lessons learned, successes, and limitations for transportation planning. The project would consider consortia at several geographic scales, including multi-state regions, state, metropolitan region, and local. It would also consider a range of functional responsibilities that include, but are not limited to, transportation M&O, metropolitan planning, and multimodal planning (involving airports and freight). The project would also examine the applicability of consortia to transportation planning and identify institutional and other barriers to participation by MPOs and other transportation planning institutions.

Related Work

The research should be aware of TCRP's "new paradigms" project.

Urgency/Priority

High

Cost

\$200,000

User Community and Potential Users

MPOs, interest groups, transportation-operating agencies (transit, highway, airport, port), transportation users (i.e., customers)

Potential Sponsors

NCHRP, TCRP, USDOT

—Prepared by Jonathan Gifford

CHANGING INSTITUTIONAL CAPACITY OF PLANNING ORGANIZATIONS: BENCHMARKING PROGRESS

Problem

The transportation planning capacity of transportation organizations is changing in response to legislative, societal, economic, technical, and other related forces. The ability of planning organizations to meet the needs that are generated by these forces is not an established given. MPOs, DOTs, transit agencies, and other transportation organizations with a piece of the planning process have been "forced" to adapt to these forces but have often met the challenge in a piecemeal and intermittent fashion. There is no documented evidence or trend in terms of adaptive success, functions performed, or abilities demonstrated by agencies charged with developing transportation plans. The end product of the planning process is potentially limited by the capacity of these organizations.

Objective

The objective of this project is (a) to benchmark the current and emerging capacity of planning organizations individually and jointly to perform the transportation planning function and (b) to identify limits to and opportunities for process and institutional adaptations to establish enhanced and strengthened planning organizations.

Related Work

Related work includes research conducted in 1993 and 1995 by the U.S. Advisory Commission on Intergovernmental Relations on MPO Capacity and Planning Progress and a TRB synthesis on the impact of ISTEA on small- and medium-sized MPOs. TRB, the National Academy for Public Administration, and AASHTO recently have conducted significant work on changing DOTs. Little comparable work has been done on transit agencies or on other forms

of transportation-operating agencies. Other individual research efforts on changes in planning organizations have been done and need to be considered in this effort.

Urgency/Priority

This is an ongoing research effort that needs to be periodically updated to capture the emerging shifts in organizational capacity.

Cost

\$500,000 every 2 to 3 years

User Community and Potential Users

Executives and board members of planning organizations (e.g., MPOs, DOTs, transit), researchers and analysts of transportation-process reengineering, organizational change consultants

Potential Sponsors

NCHRP, NCTRP, FTA, FHWA, AASHTO, others

Implementation

The work could be segmented by type of organization or focused on the linkages between organizations. Funding could be handled on an intermittent basis (e.g., every 3 years or assembled through a pooled funding strategy or through single organizations, such as AASHTO, FTA, and FHWA).

Effectiveness

Improved capacity to respond to changing circumstances, as demonstrated in timely production of planning products or in the mix of proposed transportation investments, could be used to benchmark shifts in productivity or effectiveness, or both.

—Prepared by Sheldon Edner

NEW OR REFORMED POLITICAL INSTITUTIONS: IS THERE A BETTER WAY TO MAKE PLANNING DECISIONS?

Problem

As we consider the issues to be addressed by 21st-century transportation systems, there appear to be fundamental

disconnects between our planning and the political and institutional context for decision making. Whereas plans are required to be longer term and deal with complex relationships among transportation, the community, the economy, and the environment, our decision makers have short horizons, are easily influenced by special interests, and cannot absorb required volumes of information and legal requirements. Furthermore, our institutional arrangements—from federal to local levels—do not readily accommodate new trends toward multimodal planning, sustainability, regional solutions, collaborative decision making, and more comprehensive planning. MPOs represent perhaps the best hope at the local level, but there is significant variance in their effectiveness, and numerous barriers still exist.

Objective

- Define performance measures to evaluate progress in solving the described problems.
- Identify existing best practice in U.S. institutional and policy solutions through surveys and other methods and in ways that are authoritative instead of anecdotal.
- Identify additional possible solutions by examining selected arrangements in other countries and by sponsoring a series of “think tank” brainstorming discussion groups that draw on broad sectors of society and government. Think about institutions and how they relate to planning in unconstrained ways (i.e., start with a “blank slate”).
- Assess all options to identify the best (and most realistic) options.
- Document these options and develop a distribution plan to the target audiences, including participants in the transportation reauthorization legislation.

Related Work

Related work includes MPO capacity-building research sponsored by FHWA; USDOT-MPO work undertaken by the Kennedy Center (Alan Altshuler); MPO Williamsburg Conference sponsored by FHWA and FTA; research on MPOs by ACIR (Bruce McDowell); and periodic research conducted by STPP. All this information, however, was developed several years ago and is currently obsolete because the planning setting has changed so significantly.

Urgency/Priority

This research is high priority and should be completed in time to serve as input to the debate over the next transportation reauthorization bill.

Cost

\$1 million+

User Community and Potential Users

State DOTs, MPOs, transit authorities, members of the administration and Congress, local government officials (elected and agency), resource agencies, citizen groups

Potential Sponsors

TRB, FHWA, FTA, NCHRP, TCRP, EPA, AMPO

Implementation

Transportation reauthorization legislation; changes in federal, state, and local governments; institutional arrangements

Effectiveness

If the findings serve as a source of inspiration, solid information, and ideas, the research could lead to institutional reform. If only a few changes in local governance are sparked, the research would be worthwhile; if some of the findings were incorporated into national legislation, the benefits could be profound.

—Prepared by Julia Hoover

CONFERENCE II RESEARCH STATEMENTS

Understanding the Current and Future Movement of Freight

OVERVIEW

The following research topics emerged from the first 2 days (April 26 and 27) of the conference. The list has many similarities to the list that is presented in Conference II Workshop Results: Proposed Research Statements (p. 175), but it is not identical. We have refined or more narrowly focused some of the previous topics and have added some new topics. In a few cases, we collapsed or eliminated a previously raised topic, not necessarily because we thought it unimportant, but because we could not adequately articulate the need. Clearly, this summary reflects the knowledge and opinions of the individuals who were assigned to the freight discussion group, and those who take this information to the next step must consider that limitation.

We have grouped the suggested research topics into three categories. Group I topics should be conducted first. They will provide a context of what has already been done, how the freight industry thinks and operates, and how this can be tied together to form a better understanding of the nature and workings of the freight industry as it relates to public-sector transportation planning issues. One reason for doing this initial research is to get ourselves to a point at which we can be more futuristic about the industry, its impacts, and its relation to transportation planning.

Group II topics press further into how this understanding can be used to better integrate freight considerations into transportation planning and into regional land use planning, in particular.

The third group does not necessarily represent lower-priority research topics but instead represent those topics that should perhaps be pursued after the others have been undertaken and after at least some preliminary findings are in. In some cases, there is already substantial research completed or underway in the Group III topics, so a synthesis of research may be a satisfactory first step.

Summary of Suggested Research Topics

Group I: Initial Discovery and Synthesis

Identify and Assemble Resource Documents Much relevant work has been done already. We need to do the homework and assemble the most useful, relevant sources of information through conference proceedings, reports, syntheses, and published methodologies. This effort could also be used to identify those crosscutting issues that may be under investigation in other areas (e.g., technology impacts).

"Quick-Response Enabling Research" Convene workshops (or conduct individual interviews) with

freight-industry representatives to get a quick assessment of what they are currently doing, where they are going, and what they are most concerned about. In addition, ask these same representatives what they expect to get out of their participation in the planning process, out of programs such as TEA-21, and out of other public funding sources. Is there anything about TEA-21 or about other relevant legislation that will restrict the ability of the freight industry to respond to future opportunities or that could restrict the public sector's ability to incorporate freight considerations into planning?

Develop Better Knowledge of the Freight Industry (described in more detail later)

- Need to understand and describe how the industry plans and makes decisions.
- Identify foreseeable changes in the industry, such as those arising from changes in
 - Information systems,
 - Global demographics and economics,
 - Modal technology, and
 - Logistics.

Synthesis of Best Practices We must work at the state and MPO level that sets the standard for integration of freight considerations into transportation and land use planning. Best state and regional transportation plans, intermodal system plans, and intermodal management systems need to be reviewed.

Group II: Integration of Freight Considerations into the Planning Process

Integrating Freight Needs into Regional Land Use Planning (described in more detail later) The freight-related access needs and impacts of different land uses need to be better represented in the land use planning process at the local and regional level. How do freight access needs support or conflict with neotraditional planning, traffic calming, and other planning initiatives? How does the need for proximity to highway, rail, or other modal freight corridors relate to decisions about land use or location of transportation facilities?

Evaluation of Freight Projects (described in more detail later) How should freight projects and programs be evaluated for inclusion in plans and funding? What kind of information is needed to support evaluation? Criteria such as value added, benefit-cost ratios, economic benefits, financial feasibility, and environmental impacts might come into scrutiny.

Group III: Additional Supporting Research Deemed Desirable

Freight Analysis and Forecasting (described in more detail later) As with the February conference in Washington, D.C., there are multiple issues that come under this more general heading of analysis and forecasting. Broadly, these include

- Tools for analysis and forecasting;
- Development of a North American freight-flow model; and
- Standardization of data for freight description, analysis, and forecasting purposes.

More specific research topics may be developed under one or more of these bullets.

Impact of Online Retailing and Related Electronic Commerce (described in more detail later) Will the shift of some portion of retail sales to online services have a measurable impact on goods-distribution patterns and practices? Are there any other forms of commerce that may shift to electronic means with a resulting impact on goods movement?

Small-Package Services (described in more detail later) How are small-package express delivery services affecting traffic circulation and congestion, land use, and other planning concerns? What is the feasibility of using passenger modes to haul freight, such as high-time value or intercity packages?

Intermodal Terminal Access and Capacity Issues (described in more detail later) Although this topic has already been the subject of a previous conference, the implications of access and capacity problems on urban transportation should be explored.

Domestic Waterways

- Practices, trends
- Containerization?
- Future investment
- Focus on the secondary network of domestic waterways

Impact of NAFTA

- Impact to date and anticipated into the future
- Impacts on freight-industry practices and logistics
- Impact on safety
- Impact on congestion on key freight routes

Safety Implications What are the safety implications of current and anticipated trends in the motor carrier industry? Consolidation, increased economic competi-

tion, and shortage of skilled labor all may contribute to a looming safety problem in the industry. Are there comparable issues in the rail, air, or maritime industries?

Environmental Implications How are anticipated future freight volumes and practices likely to affect the environment? Conversely, could foreseeable future environmental quality regulations affect the freight industry? What incentives might be necessary or desirable to elicit a more proactive response from the freight industry to environmental regulations and strategies (e.g., clean fuel vehicles).

It should be noted that the committee agreed not to recommend specific research into the issue of truck versus rail freight shipment from an overall environmental efficiency standpoint, as was suggested by some conference participants. We do not believe there is need for research into which mode is more efficient nor whether public policy should be used to promote one mode over another. We do need to know more about how the freight industry responds to the market, and what the future markets will be like. We can't change the fact that the for-profit freight industry will respond to the markets. Instead, we have to work to improve the ability of our profession to anticipate and respond to changes in the freight industry.

Regulatory System Issues These issues could cover evaluation of both economic and safety regulations, but this committee did not tackle the regulatory question. The group noted simply that there is likely to be continued consolidation in the freight-carrier industry and that this may ultimately lead to calls for more economic regulation (a reversal of recent historic trends).

—Prepared by Steve Pickrell

UNDERSTANDING THE FREIGHT INDUSTRY: TRENDS AND FUTURE CHARACTERISTICS

Problem

Understanding the structure of the freight industry, the factors that motivate logistics decisions, and future economic and technological characteristics of the freight market are important issues in developing transportation planning processes and tools that incorporate freight considerations into transportation planning. The transportation research community has conducted important research on freight planning and analysis tools. There remains a need, however, to better understand the underlying characteristics of the freight movement, how freight decisions affect state and metropolitan trans-

portation systems, and how these decisions should be reflected in the transportation planning process.

Objective

The objective of this research is to examine the freight industry as a provider of service that responds to economic market signals, such as global-international market integration. In addition, the goals of productivity and cost efficiencies lead to technological innovation in service provision (e.g., use of information system technology to improve customer service), institutional arrangements (e.g., third-party logistics providers), and vehicle design, which could influence how the transportation system is used. This research will identify likely areas of innovation in technology and logistics that will occur both in the near term and the longer term and that could have important impacts on transportation system performance and planning.

Related Work

NCHRP has funded several research projects that have identified the operational characteristics of freight movement. For example, these projects have looked at such issues as truck-trip generation, loading and unloading times, hours of operation, and type of vehicle used. In addition, FHWA has produced a manual on freight planning in metropolitan areas. The Travel Model Improvement Program (TMIP) has also created a research track on improving the analysis capabilities of state and metropolitan planners in analyzing freight movements on the transportation system. There has been little work on the more general understanding of how the freight industry works as it relates to transportation planning decisions.

Urgency/Priority

The changing economic and technological characteristics of the freight movement have potentially significant impacts on the performance of transportation systems. Understanding the dynamics of this industry in light of these changes is urgent and of high priority.

Cost

\$250,000

User Community and Potential Users

The potential users of this research include state and metropolitan transportation planners and policy makers. Private freight providers of transportation will also find the results useful for corporate strategic planning. In addition, university researchers will find the results

invaluable for developing new tools and methods for improved decision making.

Potential Sponsors

USDOT, FHWA, NAPA, ATA, FRA, Association of American Railroads (AAR)

Implementation

The research findings will be implemented through their use in the development of state and metropolitan transportation plans, as well in the development of national transportation policy. The ongoing development of models and analysis tools will also incorporate the findings of this research.

Effectiveness

Given the importance of the freight sector to the national economy, the effectiveness of this research lies in the provision of better infrastructure and services for the effective and efficient movement of freight. This implies not only increased productivity for private providers but also system-level efficiencies for state and metropolitan transportation networks.

—Prepared by Mike Meyer

INTEGRATING FREIGHT NEEDS INTO REGIONAL LAND USE PLANNING

Problem

The relationship between transportation and land use planning is beginning to get more attention, especially in states and communities with growth management programs. A common feature of these growth management programs is a requirement to analyze trip generation of proposed land uses and to provide adequate transportation infrastructure to meet the growing demand. However, freight mobility needs are not often included in these analyses.

An explicit consideration of freight mobility needs in the land-use-planning process would address the following issues:

- Rational location within the urban areas of freight-dependent businesses to maximize freight access and minimize neighborhood disruptions;
- Development of freight-related transportation projects that are concurrent with the development of freight-dependent businesses;

- Targeted use of appropriate transportation design standards to facilitate movement of freight, especially within dense urban centers;

- Proactive, instead of reactive, siting of freight transfer, break of bulk, and other supportive public facilities; and

- Avoidance of location decisions that could have expensive transportation retrofit consequences.

Objective

The objective of this research would be to provide local and regional land use planners with tools that are needed to include freight mobility needs in regional growth and local land use decisions. The research should overview the freight-land use relationship, identify and analyze current practices, and develop a best practices guidebook for broad dissemination.

Related Work

Related work is largely unknown. Many states are implementing growth management programs and are probably each individually dealing with how to incorporate freight issues.

Urgency/Priority

The inclusion of freight mobility needs into land use planning is an early and effective way of avoiding costly transportation retrofit projects and negative neighborhood impacts. Because many communities across the country are embracing growth management programs, providing this tool should be of high priority.

Cost

\$200,000

User Community and Potential Users

Potential users of this research include AASHTO, state transportation agencies, FHWA, MPOs, regional planning agencies, local land use authorities (cities and counties), ports, and freight mobility groups.

Potential Sponsors

FHWA, NCHRP

Implementation

This research could be implemented through dissemination of a best practices guidebook and a training course for local and regional land use and transportation planners.

Effectiveness

Measures of effectiveness would include freight-movement efficiency, avoidance of conflicting incompatible land uses, and more efficient use of transportation infrastructure and funding.

—Prepared by Charlie Howard

STRATEGIC MEASUREMENT FOR EVALUATING AND ASSESSING IMPACTS OF FREIGHT-RELATED PROJECTS

Problem

Literature reviews and discussions with freight experts indicate that there is a lack of a measurement tool that can effectively evaluate freight projects or can help rank the projects according to the needs of the geographical location and time.

Objective

The objective of this research proposal is to achieve the following:

- Identify innovative indicators to evaluate and rank freight projects according to the individualistic need of the region(s);
- Include methods to develop freight measures, for example, combining various mathematical and statistical models to include probability and weight factors with the final evaluative equation or tool and to assess the value of the commodity that was moved; and
- Identify an evaluation process that ensures equity to the stakeholders and minimizes externalities.

Related Work

Quantitative methods of establishing criteria for research or project evaluation have been studied by MPOs, such as the Southern California Association of Governments and by state public agencies, such as CALTRANS. Both agencies have studied the use of performance indicators to designate objective and quantitative measures for assessing transportation problems or for setting benchmarking efforts for the region. Cost-benefit analyses have been conducted to quantify congestion, the cost of accidents, and the cost to society for pollution. However, specific measures to measure freight projects and to help prioritize transportation projects have not been formulated. This project attempts to establish a method to create a scale to prioritize projects

for more comprehensive planning, with a specific focus on freight.

Urgency/Priority

There are various freight needs, but the resources are either limited or are diminishing because of possible declining transportation revenues. This research proposes to enhance the mobility, accessibility, reliability, and efficiency of freight movement by identifying and ranking the key contributors to freight mobility and accessibility. The goal is to tackle the more significant problems first, thus attempting to accelerate the search for solutions to make freight movement more customer-based, to benefit the carriers, and to reduce congestion for drivers who share the road with freight carriers.

Cost

<i>Data Needs</i>	<i>Cost</i>
Assuming no empirical data needed	\$200,000
Assuming empirical data needed	\$2 million (based on BTS' quote of \$3.5 million needed to conduct a study involving collection of first-hand data)

User Community and Potential Users

- All public-sector agencies: state transportation agencies, USDOT, FHWA, FTA, and air districts
- Private-sector organizations: auto club, seaports, IANA, airports, railroads, and trucking associations
- Research institutions: TRB, universities, and think tanks
- Nonprofits and joint powers authorities

Potential Sponsors

MPOs, FHWA, FTA

Implementation

The federal government would use the criteria to allocate freight funds by criteria established by using distance, vehicle miles traveled, and ton-miles freight handled by highways.

Effectiveness

- Reduce congestion for freight and passenger vehicles
- Enhance economic efficiency and global competitiveness of goods movement

- Establish long-term sustainable measures for freight movement

—Prepared by Kristine Leiphart

IDENTIFYING FREIGHT FORECASTING GUIDELINES AND METHODS

Problem

Freight-forecasting methodologies lag behind the comparable methodologies for passenger travel at the state and regional level. This is in part because the freight transportation system is in private ownership. However, the future demand for freight transportation will continue to grow and put increasing pressure on the public infrastructure to provide reliable service at reasonable costs.

This research will initially be a review of existing freight-forecasting methodologies and will describe best currently available practices for freight forecasting. On the basis of this review, the research would then propose additional research as needed to develop widely transferable guidelines and methodologies for use by metropolitan, regional, and state planning agencies.

The initial research should include the following steps: (a) review expectations and current status of ongoing research on this topic; and (b) hold discussions with freight carriers, shippers, and intermodal facility operators to better understand how well the current methodologies reflect freight-industry decision making.

Objective

This proposed research to document, synthesize, and improve freight-forecasting procedures will give planners and decision makers a better tool to determine future freight infrastructure needs.

Related Work

TMIP has addressed freight forecasting, as have other programs at the state and metropolitan level. We are not aware of any effort to date to evaluate the current procedures, to identify best practices, and to establish, in some detail, the research need for freight forecasting.

Urgency/Priority

Many regions and states regard freight forecasting as a high priority. Any transportation improvements that

are now desired should consider the freight needs over the next 20 or more years. Those future needs will determine the capacity and type of improvement that is done now.

Cost

\$100,000 for initial review of practices and identification of further needs

User Community and Potential Users

State, regional, and metropolitan planning agencies, freight providers, shippers

Potential Sponsors

AASHTO, NCHRP, USDOT, AMPO, NARC

Implementation

The results of this research effort will be used by metropolitan, regional, and state planning agencies in developing transportation plans and ultimately programs and budgets.

Effectiveness

This research effort will improve the quality of freight forecasts and thereby help to minimize negative impacts from freight transportation improvements, as well as to minimize negative economic consequences that stem from lack of adequate advance planning for freight movement needs.

—Prepared by Ken Leonard

IMPACT OF TECHNOLOGY ON THE WAY COMMODITIES ARE PURCHASED AND DELIVERED

Problem

The Internet and other forms of electronic communication have created instantaneous access to information and real-time customized purchasing power by consumers. In the future, many consumer products will be specified and ordered by the end users before manufacturing. The end user will also identify where the product should ultimately be delivered and what time the delivery will take place. As a result, significant changes will take place throughout the manufacturing, wholesale, and retailing sectors. Speed and reliability will play an even

greater role in the competitiveness of these market places.

The freight transportation environment will undergo significant change so as to service this dynamic market. Many companies in the freight industry will need to customize their services to meet the needs of their customers.

What will this mean to the transportation planner? Is the accessibility in place to handle the possible increases in small-parcel deliveries? Is the capacity (lift and haul) available in the carrier industry to handle the potential increase in shipping activity? How will freight flows change? Should there be support from the government to ensure that the carrier industry keeps pace with the technology changes and becomes a partner and not a bottleneck? What about energy consumption and other environmental issues?

Ultimately, the industry and government need to project the freight movement demands that will be created. To understand the future of this market, one must attempt to predict which commodities will lend themselves to this type of marketplace (e.g., apparel, food, small consumer goods, automobiles).

Objective

A study will be conducted to better understand the impact of e-commerce on the freight transportation marketplace. As a result, the industry can better plan for services and lift and haul capacity, the government can better understand its role in enhancing this marketplace, and the transportation planning community can better understand the future investments and improvements that are needed to ensure speed and reliability of these services.

Related Work

Recent or current work is unknown at this time. Check with colleges and universities that have large transportation and logistics R&D programs and conduct a background search of transportation information databases.

Urgency/Priority

This effort needs to be completed so as to better understand land use and freight-flow issues. In addition, decisions on important planning issues, such as increases in airport capacity, highway construction, and city industrial zone development, are in need of this information.

Cost

\$250,000 (?)

Potential Users

FHWA, ATA, FRA, airlines, NTA

Potential Sponsors

FHWA

Implementation

The findings of the research could be implemented by the freight industry in economic decisions in acquisitions or mergers, in purchases of capital equipment, and ultimately in tailoring of services offered. City and county governments would better understand the infrastructure needs that are necessary to ensure that this type of commerce can successfully take place. Federal and state governments would better understand in what areas public dollars should be spent to enhance this type of commerce and what types of regulatory issues should be addressed.

Effectiveness

Societal impacts should include easing of congestion, better quality of life, and more environmentally friendly transportation services. The understanding of future freight flows should help to ease traffic congestion and to provide accurate information on road construction needs. The procurement of products one wants, and when and where they want it, should enhance the consumers' quality of life. Helping the freight industry understand the new markets should ensure that it makes wise planning decisions on capital equipment purchases. Decisions on fuel consumption and equipment size also would be more effectively made.

—Prepared by Randy Walker

LAND USE AND CIRCULATION IMPLICATIONS OF EXPRESS-PACKAGE DELIVERY SERVICES

Problem

The perception exists that increasing use of express-package delivery services is having or will have impacts on traffic congestion, neighborhood circulation, land use, and other areas of the environment. Wholesalers, retailers, and manufacturers are more frequently using delivery services to improve customer service, reduce inventory costs, or serve other organizational goals.

Objective

This research would identify the current and likely impact of express- and small-package delivery services in several areas of interest, including those just noted.

Related Work

Not aware of any recent or current research into this specific topic.

Urgency/Priority

This proposed research is not a high-priority research topic as compared with other freight topics, yet it would be useful to have a better assessment of the threats and opportunities that are presented by this industry trend. This research goes in hand with research into Internet impacts and freight considerations in land use planning; thus, it could be integrated into one of those research efforts.

Cost

\$50,000–\$100,000

User Community and Potential Users

Research would be potentially useful to those involved in regional land use planning, community planning, urban design, and local traffic circulation planning (including traffic calming).

Potential Sponsors

ITE, APA, FHWA, AMPO

Implementation

A set of guidelines or factors could be developed for use by practicing planners to help them integrate the effect of small-package-delivery services into future land use plans, specific plans, urban design guidelines, and so forth.

Effectiveness

This kind of guidance would help to reduce the impact of trucks on neighborhoods that are not designed to provide the necessary level of truck access. It could potentially help planners reduce future congestion and conflicts that stem from delivery services.

—Prepared by Steve Pickrell

INTERMODAL TERMINAL CAPACITY AND ACCESS

Problem

Existing intermodal terminals in the urban core are landlocked. There is no or very little room for growth and expansion. The environmental and safety impacts on the surrounding communities are increasing as more diesel trucks move containers in and out of the intermodal yards. This will have a higher economic impact as the new particulate standards come on-line.

With the globalization of goods movement, the rail and motor carriers are being challenged to remain economically competitive. This may include pressures to abandon or relocate, or both, some of these landlocked terminals in the urban core.

Yet, the intermodal industry has a huge financial impact on the area's economy, both from pass-through and from terminating freight. The trained workforce is nearby and can easily access the worksite. Collateral development and complementary businesses support the existing yards. Threats to the intermodal terminals are also threats to the surrounding community and economy.

The state DOTs and MPOs are planning and redesigning, in some instances, access routes and key intermodal facility connectors, often without the involvement of freight industry representatives. Because of the importance of location decisions about both the terminals themselves (often privately owned and funded) and the access facilities (generally publicly owned and funded), these two activities need to be better coordinated.

Objective

The objective of this project would be to identify institutional mechanisms to ensure that the concerns of the private-sector intermodal freight handlers and public-sector needs are considered when planning and making infrastructure decisions that might affect intermodal terminals.

Related Work

- *Role of Freight Movement in Transportation Planning*. ISTEA and Intermodal Planning, Irvine, Calif., 1992.

- *Consideration of Freight in the Planning Process*. Transportation Planning, Programming and Finance, Seattle, Wash., 1992.

- *Freight Planning*. Statewide Transportation Planning, Coeur d'Alene, Idaho, 1996.

Urgency/Priority

Since real-time goods movement has become an essential consideration of production, distribution, and warehousing, the need for more efficient, reliable, and cost-effective movement of goods has increased. NAFTA and other free trade agreements, the international production and assembly of finished products, containerization, and highway congestion in urban areas add additional stress on the current transportation system. The challenge is to handle the growth in goods movement while reducing costs and improving reliability.

It is difficult to plan and forecast the systems improvements that will be needed because of gaps in information, proprietary data of the freight industry, and trust and communication barriers between the private and public sectors. Multiple beneficiaries and stakeholders who need to be involved in the planning and forecasting process exist at the national, multistate, and multiple rail corridors.

Another challenge is to operate on differing time frames. One is the immediate operation and logistical time frame of the freight industry, and the other is the long-term capital improvement time frame of the public sector.

Cost

\$100,000

User Community and Potential Users

MPOs, state DOTs, city transportation departments, local economic development groups, chambers of commerce

Potential Sponsors

FHWA, FRA, NCHRP

Implementation

Findings could be implemented in the state and MPO forecasting and planning processes for RTP, STIP, and TIPs.

Effectiveness

Productive research could reduce the societal impacts of intermodal terminal operation or relocation, or both. Measures that focus on truck operations could assess the potential impact to communities from truck movements in the terminal areas. On the location side, measures of jobs or wages created by intermodal terminal operations would help assess the value of retaining operations in existing urban core areas.

—Prepared by Jacky Grimshaw

CONFERENCE II RESEARCH STATEMENTS

Technical Processes, Including Models, Are Unsatisfactory

SOCIOECONOMIC RESEARCH PROGRAM FOR METROPOLITAN AND NONMETROPOLITAN AREAS

Problem

Improvements to travel-demand analyses require detailed socioeconomic and land use data at a small-area level. This requires detailed analysis of demographic characteristics for future year scenarios, as well as base-year benchmarking data. This type of information includes

- Small-area employment by type of employment (industry, occupation);
- Households by owner-renter tenure;
- Households by household size;
- Households by workers in the household;
- Households by income level and poverty status; and
- Households by structure of household (e.g., retired households, no kids; couple with small children); and
- Distribution of population by age, gender, ethnicity, and race.

One concern is the lack of well-distributed practices for socioeconomic forecasting in support of systems-level transportation planning efforts at the metropolitan, nonmetropolitan, and statewide level. Often the process

is one of stepping down statewide population forecasts from the state to the county and then to the travel analysis zone level, with no attention to the other socioeconomic characteristics that are critical in predicting future travel patterns. Other concerns are about the ability to understand current changes in demographic characteristics as they may affect current and future transportation planning activities (e.g., unexpected changes in household composition, labor force, commute patterns, disability patterns, and transit dependency).

Objective

Monitoring Socioeconomic Change Project

This project would analyze socioeconomic changes at the national, state, metropolitan, and nonmetropolitan level by using data from the 1990 and 2000 decennial censuses. These data include Public Microdata Sample (PUMS) Data, standard census tabulations, and data from the American Community Survey (ACS), which was conducted by the Bureau of the Census as part of the census' continuous measurement program. Analysis of ACS data will allow transportation planners at the federal, state, and local levels to track changes in socioeconomic characteristics at various geographic dimensions. Understanding demographic change will be quite useful for federal, state, and local planners and policy makers.

Manual for Detailed Socioeconomic Forecasting Project

The objective of this research is to develop a manual for metropolitan and state demographers to produce the necessary small-area data that are needed in transportation systems analysis. This work is basically a "how to" manual for the production of small-area socioeconomic forecasts. This production may include techniques such as "synthetic population estimation," which uses data from PUMS as well as traditional demographic techniques, such as cohort survival models and input-output models. The manual would discuss the traditional and nontraditional data sources, including the decennial census, ACS, the Bureau of Economic Analysis, and local land use policy surveys. The manual must also include reasons why these data are needed in advanced transportation systems analysis, and what the strengths and limitations of small-area socioeconomic and land use forecasts are.

Cost

Project A: \$150,000 per year; continuing costs would be incurred for the ongoing project on monitoring socioeconomic change. Project B: \$250,000, or about 2 person-years.

User Community and Potential Users

The demographic analyses from this program will be useful to planners and policy makers at the federal, state, and local levels of decision making. Primarily demographers and planners at the state and metropolitan levels would use the forecasting manual.

Potential Sponsors

Project A: BTS, FHWA, FTA; Project B: BTS, FHWA, FTA, NCHRP, TCRP, HUD

—Prepared by Chuck Purvis

TECHNIQUES FOR EQUITY ANALYSIS IN METROPOLITAN TRANSPORTATION PLANNING

Problem

The equitable distribution of transportation services by market segment is an important element of an effective and just transportation planning process. Market segment means the differing groups within the community that may or may not benefit from transportation plans

and programs—transportation "disadvantaged" versus "nondisadvantaged" persons, transit-dependent persons versus not transit-dependent persons, zero vehicle households versus nonzero vehicle households, poverty households versus nonpoverty households, and persons of color versus the majority population.

One concern is a lack of consensus on best practices with respect to analyzing the equity implications of transportation plans and projects. What are the best techniques that transportation planners can incorporate to analyze the incidence of benefits and costs to different market segments? How can these data be extracted from travel-demand forecasting systems? What are the drawbacks and concerns that planners and policy makers may have about an explicit equity analysis that may analyze the "winners and losers" of transport policy implementation?

Objective

This project is a synthesis of best practices in equity analysis in transportation planning, as well as a primer on other methods that the analyst may choose to investigate in terms of performing equity analyses. The primer would discuss the strengths and weaknesses of these techniques and the costs of implementation. An important component is the communication of equity analyses with decision makers and the public, including the communities or market segments, that are affected by the transportation plans and projects.

Cost

\$120,000, or about 1 person-year

User Community and Potential Users

MPOs, state DOTs, citizen groups

Potential Sponsors

FHWA, FTA

—Prepared by Chuck Purvis

ENABLING RESEARCH PROGRAM ON TRAVEL BEHAVIOR

Problem

Travel behavior lies at the core of all procedures to evaluate the impacts of transportation-related programs and policies. A major limitation of current eval-

uation procedures is their inability to consider the behavioral response of users to measures that are aimed at improving AQ, enhancing the quality of urban life, and encouraging efficient modes of travel. Similarly, assessment of the implications of emerging telecommunications technologies, as well as the benefits of information-based measures such as ITS, critically depends on capturing the underlying behavioral processes. There is a need for a sustained program of fundamental research aimed at understanding and characterizing travel behavior in the context of trip makers' activities and time-use patterns.

Objective

The desired output consists of a fundamental understanding of factors and processes that affect travelers' behaviors and responses to policies. It also consists of a set of operational models that would update the models that are presently in use in planning practice and that would form the core of new tools being developed to address the wide range of transportation-related policies and programs. Specific areas in need of priority research include

- Activity-based approaches to travel-demand analysis: time use, activity participation, duration and scheduling, trip chaining, and implications for modal use;
- Behavioral responses to ITS, especially traveler information systems, as well as operational measures such as variable message signs;
- Influence of land use and the built environment on user perceptions and trip making, especially with regard to walking, nonmotorized and transit use, implications for environment and quality of life, and application to neighborhood-level transportation planning approaches;
- User valuation of transportation system attributes (e.g., travel-time reliability, congestion tolls, and safety), and application to the evaluation of transportation alternatives;
- Travel and activity patterns of different socio-demographic groups and implications for policy—for example, the elderly, teenagers, and implications for transportation-system planning and operation and inner-city welfare recipients and implications for welfare-to-work transportation programs;
- Change in travel-demand composition for non-work, weekend, and non-home-based activity pursuits, including recreational, social, shopping, personal business, medical, and leisure travel.

Related Work

Research in travel behavior is conducted by an active international community of researchers from various

disciplinary perspectives. However, much of this research is not directed at the needs of the transportation planning community and has therefore tended to lack direct operational relevance to demand forecasting and policy evaluation. The envisioned enabling research program on travel behavior is intended to mutually reinforce a directed research and application program in transportation planning methods to address current and emerging planning and policy issues.

The most current assessment of related work in several of the areas that are identified under "Objective" can be found in the *Proceedings of the 1997 Meeting of the International Association of Travel Behavior Research*, which was held in Austin, Texas.

Urgency/Priority

This research, which addresses a critical area that cuts across all planning issues and applications, is of the highest priority.

Cost

The program should be funded at the rate of \$5 million to \$10 million per year over a minimum period of 5 years.

User Community

Planners, engineers, and policy analysts at the MPO, local, state, and federal levels; consultants serving these clients; organizations with interest in transportation and environmental issues; university researchers

Potential Sponsors

USDOT, EPA, HUD, NCHRP, NCTRP, NSF

Implementation

Implementation of the products of this program will take place through models and tools that are adopted in planning practice, as well as through knowledge and guidelines that are disseminated through conferences, manuals, short courses, Internet websites, and other media.

Effectiveness

This research could have a huge potential social impact, which would be measured by better quality of life, cleaner air, and more efficient transportation systems and services.

—Prepared by Hani S. Mahmassani

DEVELOPING GUIDELINES TO COLLECT IMPACT AND PERFORMANCE DATA

Problem

The consensus from the preceding conference held in Washington, D.C., was that 21st-century transportation planning should go beyond capacity building and M&Os and consider other key issues such as human factors, safety, environment, justice, and equity. Furthermore, the 21st-century planning should be linked to the political decision process and support community visions. Political leaders should be provided with performance indicators that are relevant to them and can be integrated into their decision-making process, such as the relationships between transportation and the economic growth and environmental health and the overall quality of life of their community. Also, the system should be measured according to user perception of the performance (i.e., information that can address the needs of citizens and their elected officials, instead of the needs of the system).

Objective

The objective of this research is to develop a guidebook on how to collect impact and performance data that can

- Be fed back into the system design and transportation-improvement process;
- Measure customer satisfaction such as user perceptions of system reliability and reactions to variability in travel times and quality of trips;
- Evaluate the extent to which the transportation system provides access to employment, services, and recreation, as well as the connection between access to all transportation modes and neighborhood character (i.e., noise levels, safety);
- Determine the effects on the economy of all decisions that affect the transportation system, including investment, lack of investment, system changes, and service changes;
- Evaluate the effect of the transportation system and decisions that affect it on the environment; and
- Measure the transportation system's energy use and energy consumption by type of user.

Related Work

Conference Proceedings on Information Needs to Support State and Local Transportation Decision Making into the 21st Century, Irvine, Calif., March 1997.

Urgency/Priority

Urgent

Cost

\$200,000 a year for 2 years

User Community and Potential Users

MPOs, state DOTs, citizen groups

Potential Sponsors

FHWA, FTA, BTS, DOE, EPA, DHHS

—Prepared by Pat Hsu

SYSTEM OPERATION CONSIDERATIONS IN PLANNING MODELS

Problem

Modeling tools used in transportation planning practice have limited ability to represent transportation options that do not offer major increases in the physical capacity of specific facilities or segments of facilities. In particular, they have limited sensitivity to operational changes in the transportation system and to measures that rely primarily on modifying the attributes of the system to induce changes in behavior. For example, consideration of a whole range of ITS options cannot be accomplished satisfactorily with existing methods, notwithstanding the potentially significant impact of these options on operational system capacity and quality of service.

In the past, long-range planning did not require special consideration of operational characteristics because the alternatives that were considered and the objectives of interest were not particularly sensitive to operational measures. However, with a broader set of environmental and societal objectives to consider, growing resistance to additional physical capacity expansion, and considerable increases in the potential of operational changes through advanced technologies, planners have a mandate to consider options that derive their effectiveness from operational schemes. As such, planning tools that are responsive to operational considerations and that allow consideration of traditional physical capacity expansion alongside operationally oriented measures must be developed, tested, and implemented.

Objective

The objective of this research is to develop practical computer-based tools to allow planners to evaluate systemwide and localized impacts of transportation options with important operational characteristics in the same framework as traditional major capital-intensive alternatives.

The principal characteristics that differentiate such tools from existing ones include (a) ability to represent the operational changes at a microscale of detail, including walk links and advanced traffic management systems (ATMS) strategies, such as coordinated real-time adaptive signal control and variable message signs; (b) ability to represent user responses to these strategies, including real-time information dissemination; and (c) consideration of time-dependent characteristics of the demand.

Development of these tools requires adaptation of recent generation of dynamic micro-assignment models by enhancing their behavioral basis, developing the ability to interface with existing planning databases, and the capability to provide the performance measures of interest to planning applications.

Related Work

Research in dynamic traffic assignment has been active over the past decade, though much of it has been concerned with the properties of mathematical formulations and the conceptual design of efficient algorithms with limited direct applicability to planning practice. A particularly relevant line of research has adopted a microsimulation-based approach and has resulted in practical tools that have been applied to large networks, primarily to support the design and evaluation of operational and ITS strategies. The DYNASMART-simulation-assignment tool that was developed at the University of Texas at Austin under FHWA funding, primarily for operations applications, is a primary example of this capability. Such models would provide a ready and already-tested basis for developing the required tools for planning applications.

Urgency/Priority

Highest; all MPOs and state DOTs are trying to grapple with these issues.

Cost

\$300,000 per year over 3 years to support methodological development and application in selected metropolitan areas

User Community

Planners, engineers, and policy analysts at the MPO, local, state, and federal levels; consultants serving these clients; organizations with interest in transportation and environmental issues; companies interested in ITS opportunities; university researchers

Potential Sponsors

USDOT, EPA, HUD, NCHRP, NCTRP

Implementation

Implementation of the products of this product will take place through models and tools that are adopted in planning practice, as well as through knowledge and guidelines that are disseminated through conferences, manuals, short courses, Internet websites, and other media.

Effectiveness

This research could have a huge potential social impact, which would be measured by better quality of life, cleaner air, and more efficient transportation systems and services.

INTEGRATION OF CURRENT TRAVEL-DEMAND FORECASTING PROCEDURES WITH DYNAMIC ASSIGNMENT METHODS

Problem

Planning agencies need tools to evaluate the functional and environmental impacts of ITS, the impacts of various operational measures, congestion mitigation approaches, and AQ conformity strategies. Current models that are used in practice do not provide satisfactory capabilities in this regard. Although a new generation of activity-based demand procedures are being developed, along with detailed microsimulation network models, these procedures will require considerable retooling on the part of the agencies and will require a time frame well in excess of the needs of these agencies for responsive methodologies. There is a need to provide near immediate capabilities that reflect current state of the art in network modeling, initially within the existing processes that have been developed over many years for travel-demand forecasting and planning applications.

A promising way to provide such capability is through the adoption of tested and efficient network

assignment models with the ability to represent time-varying characteristics of demand and the dynamics of transportation flows and processes, without the need to dramatically alter the basic framework of the forecasting methodology. Existing dynamic assignment methods need to be adapted and integrated within current procedures as the last step of the four-step process, instead of the current static models that are not responsive to the mentioned considerations.

Objective

The objective of this research is to adapt and integrate existing dynamic assignment models within the four-step demand-forecasting process. This would require research to

- Develop and test ways to take existing output of demand models and generate time-dependent origin-destination information as input to the dynamic traffic-network procedure;
- Develop procedures for the rapid calibration of the supply relationships with readily available data;
- Improve the ability of the dynamic assignment models to consider multimodal transportation alternatives;
- Enhance the network models to produce the performance measures of interest in planning applications; and
- Conduct a full-scale application, validation, and refinement of the integrated methodology.

Related Work

This work will set the stage and facilitate the staged implementation of the next generation of tools under development through TMIP (e.g., TRANSIMS). The dynamic assignment procedures to be considered include simulation-assignment-based procedures that have been developed initially for ITS operational applications (e.g., DYNASMART, which was developed at the University of Texas at Austin). Various other groups have developed capabilities that would be of use to this study.

Urgency/Priority

Very high

Cost

\$250,000 per year over 2 years

User Community

Planners, engineers, and policy analysts at the MPO, local, state, and federal levels; consultants serving the clients; organizations with interest in transportation and

environmental issues; companies interested in ITS opportunities; university researchers

Potential Sponsors

USDOT, EPA, NCHRP, NCTRP

Implementation

Implementation of the products of this product will take place through models and tools that are adopted in planning practice, as well as through knowledge and guidelines that are disseminated through conferences, manuals, short courses, Internet websites, and other media.

Effectiveness

This research could have a huge potential social impact, which would be measured by better quality of life, cleaner air, and more efficient transportation systems and services.

—Prepared by Hani S. Mahmassani

M&O PERFORMANCE INDICATORS

Problem

ISTEA required the inclusion of the M&O budget considerations in MPO and state financially constrained, long-range plans, TIP, and STIP. TEA-21 requires M&O to be integrated into the plans and programs. Although ITS is a big part of M&O, the normal everyday activities must also be addressed. As more MPOs and states begin to use performance measures in the evaluation of their plans and programs, there is a need to develop appropriate measures for M&O in the context of regional plans and programs.

Objective

The research would develop appropriate performance measures for M&O projects.

Related Work

Builds on NCHRP work

Urgency/Priority

Needed now

Cost

\$120,000

User Community and Potential Users

State DOTs, MPOs, cities, counties

—Prepared by Kathy Briscoe

User Community and Potential Users

Transit agencies, MPOs, and state and local governments

Potential Sponsors

FHWA, FTA, NCHRP, TCRP

—Prepared by Ron Fisher

MULTIMODAL EVALUATION**Problem**

Funding decisions for projects frequently have two dimensions: (a) What is the worthiness of the project compared with other projects? and (b) Regardless of how the project compares with other projects, should it be built and funded? Is the benefit-cost ratio greater than one? With the variety of strategies being considered to address transportation problems and the broad scope of planning considerations that are included, approaches are needed that address these two views. Evaluation measures that have already been developed are not suitable across modes, and benefit-cost analysis has been criticized because of the difficulty of identifying and quantifying the complex array of impacts that transportation projects produce.

Objective

This research will review approaches in the United States and abroad that can be used to address the trade-offs of a broad range of transportation alternatives. Research should be conducted to address gaps in the work reviewed. Measures of cost-effectiveness should be explored in lieu of cost-benefit approaches. An overall framework of evaluation and approaches that use multiple measures should be explored. Recommended approaches should be tested with real data for a metropolitan area.

Related Work

A number of studies have addressed evaluation, but there is a need for approaches that address multimodal and multicriteria evaluation.

Cost

\$200,000 over 8 months

METHODS FOR ASSESSING AND INCORPORATING PUBLIC PREFERENCES IN TRANSPORTATION DECISION MAKING**Problem**

A need exists for earlier and more responsive consideration of the values of citizens that are affected by the implementation of transportation projects. It is often important that the preferences of both those citizens and customers that are directly affected by an improvement, as well as those who are only indirectly affected, be included. Transportation-customer preferences for various aspects of service quality, such as reliability, travel time, or convenience, may be key in influencing the appropriate scale of transportation options. Indirect impacts on the surrounding neighborhood—on property values, AQ, or ecosystems—may be key in determining appropriate mitigating actions or other project details.

Improved methods are needed to measure public preference of both types and to have them included earlier in the planning process, not brought in at the final stages of public hearing review and seeking funding approvals. Too often a confrontational coalescing of public concerns may emerge, due in part to incomplete information being made available to the public. Techniques for explicitly seeking the quality-of-service customer preferences of anticipated users of any new, modified, or upgraded transportation facility—covering all applicable passenger modes—should be further refined. Techniques for explicitly seeking the corresponding quality-of-life preferences of those nonusers indirectly affected by the transportation improvement should also be addressed.

Objective

This research

- Will provide transportation planners and engineers with an improved ability to incorporate meaningful feedback, from both users and nonusers, into the transportation planning process;

- May be applicable at the system-planning level but probably may be more relevant at the corridor and project levels; may be most needed at the latter level when an impending transportation improvement may tend to raise fears and concerns among surrounding neighborhood residents, with no prior effort to include them in the design and analysis of alternatives;

- Will provide input to the definition of a more complete set of performance measures for transportation improvements; and

- Will be applicable to both infrastructure improvements and M&O improvements.

Tools to be examined may include market research, customer-satisfaction surveys, or other survey-participatory techniques. A best practice approach may be appropriate to better define the topic, at least initially.

Related Work

Related work will build on prior and ongoing TCRP and NCHRP research projects.

Cost

\$150,000

User Community and Potential Users

MPOs, state and local transportation planning agencies and providers, community groups

—Prepared by D. Stuart

DEVELOPMENT OF A HOLISTIC ECOSYSTEM EVALUATION TOOL

Problem

Transportation planners are statutorily required to evaluate the impacts of transportation projects and systems on a number of natural and human environments, including social, economic, land use, and ecological systems. TEA-21 also contains a requirement to streamline the project-delivery process, which may require some efficiency in the evaluation of environmental impacts. Separate tools exist for individual environmental analyses, but no tools exist for assessing or considering the effects of transportation investments on multiple environments or the cumulative effects of multiple impacts.

Objective

This research will result in the development of methods to integrate separate environmental models or, if necessary, in the development of an entirely new suite of models that will operate together to assess the environmental impacts of transportation projects and systems in a cumulative and holistic manner. The model or method capabilities will include, but not limited to, effects on watershed and water quality impacts, AQ impacts, agricultural and soil-conservation impacts, and other quality-of-life indicators, such as accessibility to jobs, recreation, and energy use. Model input and output data should be capable of representing impacts on a variety of scales, from neighborhood and microscale to regional and urban areas.

Related Work

Related work builds on efforts such as California's comprehensive analyses at the program level.

Urgency/Priority

TEA-21 requires streamlining transportation planning and project delivery by 2001.

Cost

Scoping: \$120,000

Integrating models: \$240,000

New model development: \$480,000

User Community and Potential Users

Federal, state, and local transportation and environmental agencies

TOOLS FOR ASSESSING THE IMPACTS OF NEIGHBORHOOD-SCALE PROJECTS

Problem

Tools are needed for transportation planning at the local neighborhood and community level. Existing aggregated transportation models are not useful in comparing potential effects of varying design alternatives for projects that are designed at a neighborhood scale.

Objective

The objective of this research is (a) to develop a quantitative method for evaluating the potential impacts and

effects of varying design options at a local neighborhood scale and (b) to ensure that the new tools integrate land use and transportation characteristics and are consistent with regional transportation models. Work may also include a synthesis of best practices for qualitative methods in community design.

Related Work

This research will build on related NCHRP work.

Urgency/Priority

Medium priority

Cost

\$180,000 to develop quantitative methods; \$60,000 to produce best practices document on qualitative methods

User Community and Potential Users

MPOs, transit agencies, local jurisdictions

Potential Sponsors

FHWA, FTA, NCHRP, TCRP

—Prepared by Ellen Vanderslice

SENSITIVITY ANALYSIS AND ERROR ASSESSMENT IN TRAVEL-DEMAND FORECASTING MODELS

Problem

Errors and uncertainty are inherent characteristics of long-range travel-demand forecasts, but these characteristics are not fully appreciated by the transportation analyst or by the policy maker. Frequently, the differences in transportation and AQ impacts among alternatives are small enough to raise the question of whether the errors in the forecasts may be larger than these differences. There is a need to understand the nature and magnitude of these errors in forecasts to ensure that decisions are based on meaningful differences.

The problem is how can planners and policy makers cope with the uncertainties that revolve around input assumptions used in the forecasting practice. How can transportation planners better cope with these uncertainties by investing in sensi-

tivity analyses? How can the analyst understand the potential errors in the forecasting process, including compounding errors or "error propagation" among land use, transportation, and environmental impact models?

Objective

The work will produce error estimates for forecasts that result from errors incurred throughout the travel-forecasting process. This includes errors resulting from errors in the input variables as well as those resulting from estimates produced at each stage of the modeling process. Research should identify key input variables and output measures that would bound the area of analysis. This research would be in cooperation with regional MPOs that are interested in error propagation in travel-forecasting models. The research may be oriented toward cumulative errors (e.g., errors compounding at each stage of the process) relative to single-stage errors (e.g., errors that are isolated to a particular model component or input variable).

Cost

\$450,000 over 2 years

User Community and Potential Users

MPOs, state DOTs, local governments, transit operators

Potential Sponsors

FHWA, FTA, NCHRP

—Prepared by Ron Fisher and Chuck Purvis

COMPARISON OF FORECASTED AND ACTUAL TRAVEL IMPACTS

Problem

In the past 10 to 15 years, a number of forecasts have been made for major transit and highway investments, but there has been little analysis of how actual demand and the key input variables that influenced demand (population and employment, levels of service, automobile-operating costs) varied from that forecasted. This kind of analysis is necessary so as to assess the accuracy of forecasts, the nature of the errors, and the ways to improve the accuracy.

Objective

This project will analyze and document forecasted demand and the key input variables for a number of past studies for major transportation investments, and it will suggest ways to improve the forecasting process. To the extent possible, the project will segment input and forecasted variables at a level of detail so that inferences can be made that relate particular errors in the forecasts to input variables or to other modeling assumptions. The selected forecasted data should be the data that were considered to be important in the selection decision for the study of interest. For transit projects, FTA's "New Start" criteria should be considered because they provide the national criteria that are used for distribution of the "New Start" funding.

Related Work

Ten years ago a study with a similar scope of work was completed for 10 transit projects. Because of limited availability of data, it was not possible to conduct the level of in-depth analysis that was necessary to identify causes for errors in the forecasts. This study documented forecasts that were made, in some cases, more than 20 years ago when travel models and experience with forecasts were not as sophisticated as they are today.

Cost

\$400,000 over 2 years

User Community and Potential Users

MPOs, transit agencies, state and local governments

Potential Sponsors

FHWA, FTA, NCHRP, TCRP

Implementation

The results of the research will be distributed to those responsible for making travel forecasts, which should improve forecasting practices and resulting forecasts.

Effectiveness

This research will result in better information on the impacts of transportation alternatives so that more informed decision making can take place.

—Prepared by Ron Fisher

INTEGRATING SIGNIFICANT AND EMERGING EMISSION-FACTOR ELEMENTS WITH TRAVEL-DEMAND MODELS

Problem

Emissions models cannot estimate emissions for input into travel models with the precision and accuracy that are necessary to perform analyses of transportation projects and systems to meet the needs of current and future transportation planning. Although NCHRP has recently conducted research into the development of a new modal emissions model, insufficient emissions test data exist to support it and other advanced emissions model capabilities, especially as new technologies are introduced into the vehicle fleet. Additional basic research needs to be conducted on vehicular emission rates, including particulate matter, for a variety of vehicle classes, operating modes, fuels, ages, and technologies to represent current and future fleets.

Objective

The results of this research will provide emissions data that could be used with advanced current travel-model practices and future activity-based models to provide disaggregate emissions estimates for HC, CO, NO_x, CO₂, and PM at appropriate resolutions for transportation models. Research would provide data that accurately represent the emissions effects of factors that affect engine load, including but not limited to acceleration and deceleration rates, road grade, temperature, and air conditioning effects. The research will provide information on emissions from advanced technology vehicles and also the effects of gasoline formulas and alternative fuels on current and future engine and emission-control technologies.

Related Work

EPA Emission Factors Program, EPA Federal Test Procedure Study, NCHRP-UC-Riverside project, Georgia Tech's emissions model traffic-vehicle-behavior project

Urgency/Priority

High priority

Cost

Year 1—program design: \$240,000

Year 2—testing: \$600,000

Year 3—analyses and results: \$240,000

User Community and Potential Users

Federal, state, and local transportation and AQ agencies; university engineering and planning departments

TECHNIQUES FOR IMPROVING COMMUNICATION WITH COMMUNITY GROUPS AND THE GENERAL PUBLIC

Problem

Experience has shown that the methods by which the benefits and impacts of transportation improvements are presented to affected community groups, public officials, neighborhood residents, and other interested parties can often unduly affect comprehension of actual message content. That is, the written, oral, graphic, pictorial, or other means of communication can too often obscure, or otherwise lend to misinterpretation, the real differences that an alternative improvement is designed to achieve. Improvements in the choice and sophistication of communication techniques by transportation planners should be developed, including improvements in seeking interactive means of dialogue with community participants so as to facilitate step-by-step presentation and absorption.

Improvement in presentation and communication techniques is needed at system, corridor, and neighborhood scales of planning and transportation improvement, but it is particularly needed at the more detailed levels of project definition, when neighborhood residents (for example) can identify more readily with consequences that occur directly in their area. Options to be considered include the development of visual tools and displays that graphically portray transportation information, visual portrayals or simulations of "what things will look like," innovative use of mapping techniques and GIS to display geographic outcomes, visual portrayals of how facilities will perform (for example, simulated traffic densities), expanded use of "what if" scenarios to describe transportation outcomes, application of SIMCITY gaming simulation tools for demonstration of outcomes, and use of the Internet for obtaining citizen feedback.

Use best practice case studies for some communication tools, and use original prototype tool development for others.

Objective

Research will

- Assist transportation planners and engineers in significantly improving dialogue with, and feedback from, affected community residents and the general public;

- Improve the ability of transportation planners and engineers to communicate the results, both positive and negative, both benefits and liabilities, of proposed transportation improvements;

- Be applicable to both infrastructure improvements and M&O improvements;

- Emphasize visual communication methods, including computer-assisted GIS map displays, dynamic simulations, pictorial representations, and Internet links; and

- Include interactive communication methods.

Related Work

This project will build on prior and ongoing NCHRP and TCRP research projects.

User Community and Potential Users

MPOs, state and local transportation planning agencies and providers

Cost

\$250,000

—Prepared by D. Stuart

PACKAGE OF QUICK-RESPONSE PLANNING TOOLS FOR SMALL COMMUNITIES

Problem

Small communities (under 50,000 population), like larger communities, must make decisions about the future of their transportation systems. These decisions, however, are usually made without the benefit of a sound planning endeavor. Although there are a multitude of tools available, they are often more costly and complicated than the small community can afford or use.

What is needed is a comprehensive package of simplified tools that is relatively inexpensive and can be used by local personnel to quickly respond to the needs of the decision makers in making their investment decisions. This package should include transferable parameters that could be used, thus negating the need of extensive data collection.

Objective

The research would bring together existing methodologies and develop simplified planning tools to fill gaps in existing methodologies to produce a package of planning tools that would be used for better investment decisions in small communities.

Related Work

This research builds on current NCHRP work. It expands the handbook developed by TTL.

Urgency/Priority

The package is needed now.

Cost

\$120,000

User Community and Potential Users

Small communities, regional development agencies, small MPOs

Potential Sponsors

FHWA, FTA, NCHRP, TCRP

TIME-USE RESEARCH TO SUPPORT NEW GENERATION OF TRAVEL AND ACTIVITY MODELS

Problem

Transportation researchers (Zahavi, Pas, and Kitamura in the United States) have explored many aspects of using time-use research as a new paradigm for understanding and modeling traveler behavior. One notion, advanced by Zahavi in the 1970s, relates to the findings of aggregate stability of travel time per traveler, or a "travel time budget." Recent research in time use and transport has included investigations of activity scheduling and activity duration. Other researchers have suggested that the dimension of time use may be an appropriate perspective from which to examine the nature and magnitude of induced trip making.

Objective

This work will include the meta-analysis of personal time-use patterns using data from metropolitan household travel and activity surveys that were conducted over the past 20 years. The work will include descriptive analysis of

time-use patterns (i.e., aggregate comparisons and market-segment comparisons). The project would also include exploratory model developments that may serve as the basis for activity-based travel-demand models for application within candidate metropolitan areas. A methods development track for this project would identify the types of quantitative methods (e.g., logit, regression, structural equations, hazard duration models) that might be appropriate for time-use and traveler-behavior research.

Cost

\$300,000 over 3 years

User Community and Potential Users

Travel behavior researchers, MPOs, state DOTs, local governments, transit operators

Potential Sponsors

BTS, FHWA, FTA, NCHRP

—Prepared by Chuck Purvis

INDUCED TRAVEL AND MODE-SUBSTITUTION REACTIONS TO TRANSPORTATION IMPROVEMENTS

Problem

Nontraditional demand analysis and forecasting techniques are needed to estimate net new person-trips, which may be generated by new or improved transportation systems, on a competing multimodal basis. As an aging and in some ways more time-efficient population has more actual discretionary time available, to what extent will travel to new activity opportunities fill that time? In addition, as new infrastructure and M&O improvements to route capacity enable some modes to offer higher-quality service (more reliability, faster travel), what mode substitution patterns might be expected for different discretionary trip purposes? These include service-quality aspects of multimodal trips in which biking or walking, for example, may form essential access-egress components. Mode substitution, in this context, may partly be interpreted as a kind of induced travel for an improved mode, over and above that which might be forecasted with conventional models.

This type of demand analysis would be related to the results of activity-based travel surveys, building on their results. What activity- and travel-choice processes are used

to set priorities among discretionary nonwork, nonpeak, and even non-home-based travel options? To what extent is multipurpose trip chaining a part of increasing the time available for other activity and trip purposes? What are the traveler preferences for the possibility of making longer trips, within a given available time frame, once a faster or more direct modal option is made available?

Objective

This research will

- Improve the ability of transportation planners and engineers to analyze how level-of-service gains are perceived by travelers in terms of new (induced) travel opportunities, including mode substitutions.
- Assist in the analysis of multimodal demand-management implications of desired trip substitutions.
- Include an analysis of how the perceived slowness of public transit for nonwork travel represents a liability for multijourney discretionary transit travel.
- Explicitly consider how intermodal transfers (e.g., bus to rail, walk from parking) affect perceptions of mode substitutability.
- Consider how the concept of daily travel-time budgets affects the potential for induced travel and how these budgets may be changing.

Related Work

This project will build on prior and ongoing TCRP and NCHRP research projects.

User Community and Potential User

MPOs, state and local transportation planning agencies and providers

Cost

\$400,000

—Prepared by D. Stuart

TELECOMMUNICATION AND TRAVEL INTERACTIONS

Problem

Developments in telecommunications are changing dramatically in the manner in which people work, shop, and pursue recreational activities. This in turn has implications

on travel behavior and the location of residences and businesses, as well as on the very structure of the logistics and distribution processes to support the growing role of electronic commerce. Transportation planning for the future must recognize these developments and must attempt to incorporate their implications on the distribution of activities and the structure of the demand for transport.

Objective

The objective of this research is to seek a fundamental understanding of how the developments in telecommunication technologies and associated use of the Internet, mobile computing, and electronic commerce do and could interact with travel behavior and the demand for travel. The research will also develop tools to explore alternative scenarios for land use and transportation demand.

Related Work

Limited work has been taking place on this topic at the University of California at Davis, the University of Texas at Austin, and universities in several countries in Europe and Australia. A dedicated TRB committee has served as a clearing house for this community. However, the focus has been almost exclusively on telecommuting, which is only one limited aspect of the telecoms-travel phenomenon. In the area of telecommuting, the evidence remains quite limited.

Urgency/Priority

Very high

Cost

\$300,000 per year over 3 to 5 years

User Community

Planners, engineers, and policy analysts at the MPO, local, state, and federal levels; consultants serving these clients; organizations with interest in transportation and environmental issues; companies interested in ITS opportunities; university researchers

Potential Sponsors

USDOT, EPA, HUD, NCHRP, NCTRP

Implementation

Implementation of the products of this product will take place through models and tools that are adopted in

planning practice, as well as through knowledge and guidelines that are disseminated through conferences, manuals, short courses, Internet websites, and other media.

Effectiveness

The effectiveness of this research could result in a huge potential social impact, which would be measured through better quality of life, cleaner air, and more efficient transportation systems and services.

STATEWIDE PLANNING MODEL

Problem

At the state level there is a great need to strengthen the link between planning and programming. ISTEA and TEA-21 require that states have a long-range statewide plan and that federally funded projects come from that plan. Yet, the majority of statewide plans are only policy plans. What is needed is a statewide-planning-process model that is comprehensive enough to be multimodal in nature and that measures the desired performance outcomes of the customers.

Objective

The research would develop a computerized model that would produce the outcomes that were necessary for the state to fulfill the planning and programming requirements.

Related Work

This research builds on NCHRP work.

Urgency/Priority

Results are needed in the immediate future.

Cost

\$240,000

User Community and Potential Users

FHWA, FTA, state DOTs

NONMOTORIZED TRANSPORTATION RESEARCH PROGRAM

Problem

There is a strong need for better information and tools for planning for pedestrian and bicycle travel, for evaluating the success of improvements for nonmotorized modes, and for assessing potential effects on nonmotorized transportation of improvements for other modes.

Objective

Measurement of Nonmotorized Transportation

- Develop data-collection methods for automated pedestrian counts.
- Identify improvements to existing data-collection instruments (e.g., Census, National Personal Transportation Study, and BTS) to better capture pedestrian and bicycle trip making.
- Refine activity-based data-collection methods to ensure accurate reporting of nonmotorized trips.
- Develop national statistics on nonmotorized mode share by activity for urbanized areas.

Behavior of Pedestrians and Bicyclists

- Identify the effect of safety improvements, street-scape elements, and pedestrian amenities on pedestrian behavior, including route choice and mode choice.
- Identify factors that are associated with induced travel in nonmotorized modes.
- Conduct a national random sample survey on the importance of pedestrian and bicycle improvements to citizens.

Characteristics of Transportation Systems and Networks With Respect to Nonmotorized Modes

- Develop "quick-fix" methods for incorporating pedestrian and bicycle modes into existing four-step modeling.
- Identify pedestrian and bicycle elements as part of emerging dynamic trip-assignment models.
- Identify environmental and land use variables that are correlated with nonmotorized mode choice.
- Develop indices of potential for pedestrian- and bicycle-trip generation that can be applied to a local or regional system for application in setting project priorities.
- Develop methods and models for project planning at a local neighborhood scale that are consistent with regional models.

—Prepared by Kathy Briscoe

Performance Measures for Nonmotorized Transport

- Identify performance criteria for pedestrian and bicycle facilities.
- Assess the current state of the national infrastructure for nonmotorized transportation.
- Document the state of practice through surveys of state DOTs and MPOs on percentage of newly programmed projects that include pedestrian and bicycle facilities.
- Develop tools for evaluating system connectivity for pedestrian and bicycle travel.
- Develop a best practices manual for pedestrian and bicycle-design guidelines.

Related Work

This research will build on related NCHRP work.

Urgency/Priority

High priority

Cost

This program includes numerous research problem statements as stated in the "Objective." Estimated cost of the total program is \$800,000.

User Community and Potential Users

AASHTO, APTA, MPOs, transit agencies, local jurisdictions

Potential Sponsors

FHWA, FTA, NCHRP, TCRP

—Prepared by Ellen Vanderslice

DEVELOPING PROCEDURES AND TOOLS FOR INVESTING IN TRANSPORTATION ASSETS TO IMPROVE THE OVERALL TRANSPORTATION SYSTEM

Problem

The ability of state, regional, and local governmental organizations to make investment decisions that maximize the use of scarce resources is hindered in part by the lack of tools. Although most governmental units

maintain inventories of at least some of the assets, many do not have condition information for all the assets, and even fewer can relate system performance with investments. Knowing how much to invest in the improvement of one asset over another and the consequent effects of such improvements on the performance of the transportation system in general need to be addressed.

Objective

To develop methods by which transportation actions can be related to transportation system performance and alternative expenditures can be evaluated over system life cycles to determine the most effective investment for the transportation system. The work includes the following separable tasks.

Development of Basic Relationships

The relationship between system performance and investment level needs to be documented. In developing these relationships, the intervening relationship between investments and their effects on the condition of the asset should be identified. Condition and performance relationships also need to be developed for each of the asset categories.

The effectiveness of the transportation system can be determined in many ways. A reasonable framework needs to be suggested to determine how each component of the system fits in. It may not yet be possible to establish one set of criterion but instead several will need to be developed in accordance with the values of the community.

At the national level, significant work has been accomplished on the effects of investment alternatives on pavements (HERS model). For other assets, there is less of an understanding of how investments in one part of the system will affect the overall system. This is partly an issue of developing an agreement on what should be maximized for each asset category. Some exploratory work should look at how investments could be maximized for several asset categories.

Assuming particular performance criteria, identify the appropriate condition data that would need to be collected and inventoried and relate investment levels with outcomes for each category of asset. The next step would be to attempt to use a consistent method to compare investments across asset categories.

Developing Tools

Development of a consistent method to compare investments across asset categories should build on the earlier framework, at least for illustrative purposes. Tool development should include (a) ways to make consistent life-

cycle cost comparisons and (b) methods by which investments in disparate assets can be compared and traded off.

Related Work

This research will build on a condition and a performance report by FHWA and FTA, a NCHRP proposal on developing a manual, and a December 1999 AASHTO conference.

Cost

Program of research: \$5 million over 10 years

User Community

State, regional, and local governments

STRATEGIC DATA RESEARCH: TRANSPORTATION EQUITY

Problem

The consensus from the preceding conference held in Washington, D.C., was that 21st-century transportation planning should go beyond capacity building and M&Os and should consider other key issues such as human factors, safety, environment, justice, equity, and community visions. Unfortunately, current data do not sufficiently support these emerging 21st-century planning goals. To ensure that these goals are addressed with the appropriate tools and adequate data, research is needed to develop a strategy for data development. Instead of attempting to address all of the emerging planning issues, this research concept focuses on one important social issue: transportation equity. By demonstrating the processes that are required to develop the strategy for one specific goal, it is hoped that the results from this research can serve as a road map for analyzing other emerging planning goals for the 21st century.

Objective

This research is essentially to develop a strategy so that 21st-century planning is based on 21st-century data instead of 20th-century data. Specifically, the research will focus on data that are to develop transportation plans so that social equity can be achieved to the fullest extent. This means that transportation plans and programs can be developed in areas where different segments of the community, particularly underprivileged and invisible populations (e.g., the poor, immigrants,

highly uneducated population), will benefit equitably from transportation services. Data needed for equitable planning include, but are not limited to

- Demographic compositions of future populations, particularly the graying of Americans,
- Cohort effect on driving behavior, and
- Impacts of transportation technology and telecommunications on travel behavior and demand for transportation services.

Once data needs are identified, an inventory of the current data sources (i.e., traditional, ITS data, nontraditional) will be developed. This research will then evaluate pros and cons of these data with respect to data quality and data consistency. This inventory will become the baseline to identify gaps in which old data need to be improved and new data need to be collected or acquired.

The second phase of this research will address issues related to (a) data adequacy from the perspectives of data quality, missing data, data imputation, and data consistency and comparability; (b) data collection or acquisition (e.g., household surveys and advanced technologies in data collection); (c) data accessibility and data warehousing; and (d) data integration.

Related Work

- *Conference Proceedings on Household Travel Surveys: New Concepts and Research Need*, Irvine, Calif., March 1995.
- *Conference Proceedings on Information Needs to Support State and Local Transportation Decision Making into the 21st Century*, Irvine, Calif., March 1997.
- *Transportation Research Circular 469: Environmental Research Needs in Transportation*, TRB, National Research Council, Washington, D.C., March 1997.

Urgency/Priority

Very high

Cost

\$250,000

User Community and Potential Users

MPOs, state DOTs, citizen groups

Potential Sponsors

FHWA, FTA, BTS, DHHS

—Prepared by Pat Hu

CONFERENCE II RESEARCH STATEMENTS

Role and Impact of Technology on Transportation

TECHNOLOGY AND ORGANIZATIONS: LEARNING FROM OTHER INDUSTRIES

Problem

Advanced technologies, including ITS, can greatly enhance planning, operating, and managing all elements of the transportation system. These technologies add complexity to the traditional approaches that are taken by agencies responsible for the various transportation components, however. New and different organizational structures and institutional arrangements may be needed to maximize the benefits from advanced technologies. The successful application of advanced technologies to promote a seamless transportation system will involve state DOTs, MPOs, transit agencies, private operators, trucking firms, railroads, airports, airlines, and private-sector vendors. This research will take a fresh look at the organizational structures that are most advantageous to the application of advanced technologies and the institutional arrangements that can help facilitate deployment and M&O of a complex transportation system.

Objective

The objective of this research project is to identify organizational structures and institutional arrangements that foster the introduction and application of new tech-

nologies. This objective will be accomplished through the following tasks:

- *Examine organizational structures and institutional arrangements used in nontransportation industries to foster the introduction and use of advanced technologies*—This activity is intended to take a new look at possible organizational responses by learning from the experiences of other industries, disciplines, and groups. It is envisioned that individuals with expertise in organizational science or related fields will conduct this task. Examples of nontransportation industries that may be examined include international telecommunications, health care, and insurance fields. The assessment will focus on the organizational impacts and organizational responses, including structure, process, human resources, decision making, and communication that accompanies the introduction of advanced technologies. The institutional and legal framework will also be examined. The outcome of this task will be the identification of organizational structures and processes that have been used successfully in other industries to introduce and operate new technologies and that may be transferable to transportation.

- *Identify and document current best practices with organizational structures and institutional arrangements in the transportation field*—This task will include examples of organizational and institutional arrangements that have been used successfully to implement and operate ITS and advanced technologies to improve the M&O of the transportation system. This will include

both public-sector organizations and private entities like CSX Corporation and the airline industry. This task will produce case studies on various approaches that are being used, the advantages and disadvantages of different approaches, and the applications or environments that appear to work best for various techniques.

- *Examine skills and tools that are needed by transportation agency staff*—This task will examine skills that are needed by staff in different transportation agencies to use various types of ITS and advanced technologies. This will include both organizational and management aspects, as well as those skills and tools that are needed for successful use of the advanced technologies themselves. The skill sets that are needed will be identified, and training and professional capacity-building requirements will be developed.

- *Identify and document alternative roles for private-sector participation*—Public agencies are still learning how to deal with private technology vendors and other private businesses to maximize the successful implementation and operation of ITS and other advanced technologies. This task will examine the different roles that the private sector may play, the advantages and limitations of different approaches, the legal and policy issues associated with various arrangements, and the experience from current activities and other industries. Examples of the elements to be included in this assessment are risk sharing, pace of decision making, accountability, schedules, partnering, traditional low-bid contracting, and new business models. The outcome of this task will be examples of new techniques and approaches that may be appropriate for use, as well as examples of existing models.

Related Work

I-95 Corridor Coalition Organization and Operational Options project; other related work unknown

Priority

High

Cost

\$400,000

User Community

FHWA, FTA, state DOTs, transit agencies, toll roads, airport and port authorities, operators of intermodal facilities, local communities, AASHTO, APTA

Potential Sponsors

NCHRP, FHWA, FTA, AASHTO

Implementation

The results of this research could be implemented by individual organizations and by groups of agencies in the same area to enhance the introduction and operation of new technologies.

BRINGING TRANSPORTATION PLANNING ALIVE: USE OF ADVANCED TECHNOLOGIES TO ENHANCE THE INTERACTIVITY OF THE TRANSPORTATION DECISION-MAKING PROCESS

Problem

To obtain meaningful input from the public and policy makers is critical to a successful transportation planning process. It is often difficult to present complex transportation information and alternatives to these groups. This problem may limit the ability to engage the public and decision makers in meaningful discussions and may restrict consensus building. Advanced technologies appear to offer the opportunity to greatly enhance this process.

The Internet, visualization techniques, virtual reality, and simulations represent just a few examples of technologies that may be used to improve the presentation of information and decision choices and allow for a more interactive public participation and decision-making process. Although some of these technologies are being used now, there is still much to be learned about potential technologies, the range of applications, and the impacts of various approaches in participation and decision making. This research will help to fill this void, with particular attention to tools to aid decision making, interaction, and exploration to reach consensus.

Objective

The objective of this research is to identify and evaluate the use of advanced technologies to present transportation information and decision choices to the public and to policy makers so as to enhance the overall planning and decision-making processes. This objective will be accomplished through completion of the following tasks:

- Identify and assess the current use of advanced technologies to present transportation information and decision choices to the public and to decision makers.
- Beyond current practices, identify and assess the potential use of other advanced technologies, including those that provide greater opportunities for an interactive process.

- Identify those technologies and applications that appear to offer the greatest promise to improve the presentation of transportation information and decision choices. A limited number of tests of those technologies and approaches will be conducted and evaluated.

- Summarize the results in guidance and interactive media that provide transportation professionals with the technologies, approaches, advantages, limitations, groups or markets, and other information.

Related Work

This research should be coordinated with the work of the public involvement, transportation planning, and visualization committees of TRB, as well as with other NCHRP and TCRP projects in related topics. In particular, it will build and expand on NCHRP 25-22, *Applications of Existing and Emerging Technologies in Improving the Environmental Process*, with emphasis on interactive, exploratory, and decision-support features.

Priority

High

Cost

\$300,000; tests may add to the cost.

User Community and Potential Users

AASHTO, APA, AMPO, FHWA, FTA, APTA, planners, public-involvement practitioners, decision makers

Potential Sponsors

NCHRP, TCRP, FHWA, FTA

Implementation

The findings of this research project could be moved directly into practice through a number of mechanisms. The final report will be widely distributed to transportation planners; presentations will be given at conferences; training sessions and workshops will be held; and interactive CD-ROMs and other technologies will be used.

Effectiveness

The provision of better information in visual and interactive formats should improve the public-involvement and decision-making process. Ultimately, this project should result in a more informed public, a more open and responsive decision process, and decisions on trans-

portation alternatives that have fuller support from all groups.

USING ITS DATA TO ENHANCE THE TRANSPORTATION PLANNING PROCESS

Problem

Transportation planning has traditionally suffered from a shortage of solid information about the operation of the transportation system and about the decision making of travelers and shippers. This shortage is closely related to the cost and difficulty of acquiring the needed data. Emerging information technology systems, such as ITS, provide an opportunity to collect transportation data that are needed by planners in real time, in larger quantities, and at much lower cost than ever before. However, it is necessary to carefully develop the data collection and analysis protocols to ensure that the most important knowledge is gained from the data that could be made available and that additional data of potentially large value that can be acquired at small incremental cost are also identified.

Objective

The objective of this research is to develop standardized methods for acquiring the most important knowledge about the transportation system that is needed by planners from the data that could be collected with use of ITS technologies. This information should include identification of the most relevant data, the most appropriate sampling approaches to make efficient use of the data, and the best methods for extracting the needed information from a potentially vast pool of data. This can be accomplished by

- Identifying the data requirements of planning organizations and building on work already initiated by FHWA.

- Identifying the intersection of these requirements with data that could be collected by ITS systems. This approach should consider the full range of transportation operational data, including topics such as transit operations, traffic flows and speeds throughout the roadway network, data on use of toll facilities (by means of toll tags), linked trip data through multimodal payment media, and more general highway use data to support Highway Performance Monitoring System (HPMS) needs.

- Not confining the exploration to existing ITS data collection but considering as well extensions that

could provide valuable additional information without significant additional investments.

- Defining the means for reducing this potentially very large volume of data to manageable proportions and retaining the information that is most important for planning use.

Related Work

The national ITS program of USDOT, in association with ITS America, has defined "Archiving Data" as one of the formal ITS user services.

Urgency/Priority

As ITS deployment accelerates, the opportunities for gathering important planning data are growing rapidly. The specification of archival data needs as early as possible can minimize the incremental costs and difficulty of obtaining the needed information. It also shortens the time until this new knowledge becomes available for planners' use.

Cost

\$250,000

User Community and Potential Users

MPOs, city and state DOTs, national transportation researchers in government agencies, universities, consulting organizations

Potential Sponsors

FHWA, FTA, NCHRP

Implementation

Findings could be used to augment designs of ITS systems and to specify how their outputs can be archived for planning use. Planners can then gain the benefits of a much richer source of data than they had previously.

Effectiveness

This research will have a potentially large impact on transportation planning practice by providing a range and fidelity of data that have never been available before. This information could support new model developments and provide much better predictions of the effects of transportation system changes.

—Prepared by Steven E. Shladover

EVALUATION OF BENEFITS PROVIDED BY INFORMATION TECHNOLOGY TO TRANSPORTATION SYSTEM OPERATIONS

Problem

The information technologies that are central to ITS can potentially offer substantial performance improvements to the transportation system. However, the transportation planning databases, models, and processes are not well suited to identifying these improvements. Considerable research is needed to develop the data, models, and planning frameworks for capturing the effects of ITS so that they can be compared fairly with other transportation investments that are being considered in MIS.

Research needs include

- Definition of planning measures of effectiveness that are relevant for comparison of ITS and more traditional transportation improvements, so that the benefits of ITS can be represented fairly and meaningfully (for example, trip-time predictability, reduction of stress on travelers, and opportunities to forgo trips when conditions are particularly adverse).

- Collection and critical review of authoritative data to quantify the effects of ITS operational tests and model deployments under controlled conditions to enable scientific assessments of the net effectiveness of each ITS service and their combinations in integrated systems. In the absence of a concerted effort here, it will not be possible to learn from the mistakes of the past because these mistakes will not be adequately documented or disseminated. The new information that is developed as a by-product of ITS operations should make it possible to improve systemwide operational efficiency and travel times in ways that may not be recognized or captured for evaluation unless we specifically look for them at the system level. Research is needed to quantify the specific benefits that could be gained from sharing the additional system-level information made available by the revolution in information and communications technologies.

Objective

The objective of this research is to modernize the transportation planning process to ensure that improvements in information technology, such as ITS, can be compared realistically and fairly with other more traditional alternatives and that the systemwide benefits of the information technology revolution to transportation operations can be recognized and captured.

Related Work

There should be significant related work on model development, which needs to be coordinated with data collection and the definition of the overall evaluation framework and process. This work needs to be tied to the ongoing evaluations of ITS field operational tests and of Metropolitan Model Deployment Initiative projects, as well as take a critical look at those evaluations to ensure that any negative effects are not overlooked.

Urgency/Priority

This work is urgently needed to ensure that all future transportation investments are selected as wisely as possible.

Cost

This work requires substantial breadth and depth of activity and interaction with multiple other activities. It requires an investment in the range of \$500,000 over several years.

User Community and Potential Users

All decision makers on transportation investments at local, state, and federal levels, DOTs, MPOs

Potential Sponsors

FHWA, FTA, NCHRP

Implementation

Findings should be implemented in evaluations of virtually all future transportation projects in which ITS is or could be one of the alternatives.

—Prepared by Steven E. Shladover

REEXAMINATION OF TRANSPORTATION PLANNING ASSUMPTIONS THAT MAY HAVE BECOME OUTDATED BY TECHNOLOGICAL ADVANCES

Problem

The current transportation planning process has been developed over the past several decades in accordance with a variety of explicit and implicit assumptions and legal and political requirements. Information technology has advanced dramatically

within recent years, and it is likely that it will continue to advance at least as rapidly in the coming years. These advances provide the opportunity for the transportation and communications functions to be treated as part of the same larger system of interactions, instead of being treated entirely separately, as they have been in the past. The transportation planning process and its models do not yet reflect this new opportunity.

ITS represents the integration of information technology with transportation and provides the possibility for improvements in transportation effectiveness that cannot be captured in the existing transportation paradigms. Some examples follow:

- Transportation models traditionally assume that all travelers have perfect knowledge of the impedance of every link in the transportation network, yet this is obviously not correct. ITS can provide information about some parts of the network, but our planning tools do not permit us to evaluate the improvements this makes possible, because they do not represent differences in the available information.

- Automated highway systems can provide dramatic improvements in the volume-delay characteristics of a highway lane compared with conventional highway lanes, but these improvements are not readily represented in transportation planning models.

- Nonrecurrent congestion is probably comparable in scale to recurrent congestion, yet the transportation planning process has no way of addressing it nor of evaluating the effectiveness of ITS services that could reduce its effects (faster incident detection and incident response, incident reporting, collision warning, and avoidance).

These are examples in which new technologies can produce significant improvements to the transportation system, yet our existing transportation planning methods leave us unable to evaluate their effectiveness so that they can be compared with other more traditional alternatives. Intensive research is needed to define how the emerging ITS technologies can be fully incorporated into the transportation planning process, and how their effects can be modeled so that they can be mainstreamed into deployment alongside competing lower-technology alternatives. This research needs to define the functional requirements for the models and other tools that are used to estimate the effectiveness of ITS in the transportation planning process.

Objective

- Take a fresh look at the assumptions of the transportation planning process and its models, both

implicit and explicit, to determine how those need to be revised to ensure that the benefits of modern information technology can be represented effectively.

- Define the changes that need to be made in processes and tools to fully reflect the opportunities provided by ITS information technologies.

- Produce the functional requirements for the new or enhanced models and other planning tools that will be needed.

Related Work

Not aware of any

Urgency/Priority

This is an urgent prerequisite to the mainstreaming of ITS into the transportation planning and programming process, so that ITS alternatives can be given full consideration alongside other alternatives.

Cost

This work requires both breadth and depth of activity and a mix of disciplines. It needs an investment in the range of \$500,000 over several years to do it justice.

User Community and Potential Users

All decision makers on transportation investments at local, state, and federal levels; DOTs; MPOs

Potential Sponsors

FHWA, FTA, NCHRP

Implementation

Findings should be implemented in evaluations of virtually all future transportation projects in which ITS is or could be one of the alternatives.

—Prepared by Steven E. Shladover

TECHNOLOGY SCANNING 2025

Problem

To anticipate technology impacts, planners must be aware of new technology applications and emerging trends that strongly influence transportation. This is true for technologies that affect travel demand, land development and

usage patterns, energy, and emissions. Because particular technology applications may influence more than one of these characteristics, a holistic view of the application or trend is needed. As these trends and applications become significant, additional research may be warranted to further refine and appropriately quantify their influences.

Objective

The objective of this research is to provide a reconnaissance of new technology applications and to identify and evaluate emerging technology trends that influence travel demand, land use, energy, and emissions. These measures would be accomplished through expert panel discussions, workshops, site visits, and other activities as deemed appropriate by the project steering committee or sponsor. This scan should be undertaken every 3 to 5 years and should seek to identify the total transport impacts of technology applications and trends. The scanning activities should be structured to identify follow-up research as needed. The findings of these efforts should also be shared throughout the planning community.

Related Work

NCHRP and FHWA currently sponsor international scanning tours.

Cost

\$150,000 to \$250,000 every 3 to 5 years

Priority

High—in light of the rapid adaptation of information technologies throughout our society and increasing interest in new energy sources.

User Community

Planning practitioners at federal, state, and local agencies, at universities, and in private practice.

Potential Sponsors

NCHRP, TCRP, USDOT, EPA, DOE

Implementation

Findings and recommendations from this research could be disseminated in trade publications and through other means as appropriate. Recommendations for research could refine the issues and quantify influences as appropriate.

Effectiveness

This research could result in more effective adaptation and transfer of technologies and more responsive and visionary planning processes.

—Prepared by Brian Gardner

BEST PRACTICE SURVEY METHODS FOR CAPTURING INFORMATION TECHNOLOGY IMPACTS ON TRANSPORT ACTIVITY

Problem

To understand current usage and to gauge future demand for transportation, transport planners must understand the nature and extent of the impacts of information technology on demand for transport. Current forecasting methods and traditional survey techniques are not well suited for capturing these effects. Surveys are undertaken for monitoring personal travel trends and for developing new travel-demand models. These surveys will need to capture the substitution of telecommunications for travel and the influence of traveler information services. Guidance for developing, implementing, and interpreting information technology survey instruments is needed to accomplish this outcome.

Objective

The objective of this research is to refine existing data-collection tools and to develop new tools as needed to capture the influence of information technologies on person and commodity transport. Some examples follow:

- Evaluate surveys to date that capture information technology influences; synthesize experience with instruments and relevant conclusions from the surveys.
- Develop survey instruments and guidance; pilot them in a survey of an information-technology-rich area.
- Refine the survey instruments and the guidance and disseminate; incorporate guidance and examples into existing manuals and national surveys as appropriate.
- Evaluate information technology influences in the pilot area; develop conclusions and recommend follow-up research as appropriate.

Related Work

Recent surveys have been conducted in Raleigh, North Carolina; Portland, Oregon; and the San Francisco, California, Bay Area. TMIP recently completed a survey manual.

Priority

High—organizations that are planning surveys will need this product.

Cost

\$425,000

Implementation

- Development of survey guidelines and examples,
- Addition of an information technology element in survey efforts, and
- Development of an additional research database using the pilot survey.

—Prepared by Brian Gardner

APPLYING TECHNOLOGY TO IMPROVE TRANSPORTATION SYSTEM PERFORMANCE MEASUREMENT

Problem

Several factors are leading state DOTs and MPOs to carry out transportation system performance measurement. One factor is an increasing customer-service orientation to the planning and delivery of transportation. Such measurement approaches are being used to monitor current, average system performance as well as to forecast indicators of future system performance for average conditions. Another factor is the emphasis that TEA-21 gives to systems M&O. Decision makers, planners, and operators are expected to use the monitoring of variable conditions to improve their decisions, plans, and operations.

In the past, and still often today, extensive use of labor-intensive data-collection programs has been the way to develop data sources for performance measurement. In the future, labor-saving and safer-to-use technologies will be increasingly used. In particular, ITS-related technologies, such as freeway incident-management system detectors, arterial signal-control monitors, automatic transit-vehicle locators, and global-positioning devices on trucks, will be excellent data sources for improved performance measurement.

In some important ways, data sets that are derived from such ITS technologies are fundamentally different from data sets obtained from more traditional sources. Advanced technologies potentially provide a concurrent measurement of system performance over extensive geographic areas, functional systems, and modes—

"simultaneity" in time of observed data. Traditionally, data for planning and performance measurement are collected: (a) continuously in time only for small geographic samples of sites, (b) sporadically in time for a large sample of sites with broader geographic coverage, and (c) independently in time for different modes. There are several research activities that can build on this fundamental difference and that would be valuable in fostering improved performance measurement.

Objective

The objective of this research is to conduct research into use of new technologies to better understand how they can be applied in measuring temporal and spatial variability of transportation system performance. Special attention needs to be given to measuring performance of whole systems as well as to measuring effects on different stakeholder groups who use or are affected by the systems. These measurements include the following specific set of interrelated research activities:

1. Identify a range of performance measures that have been specified by practitioners and select a set of representative ones for study that can be derived from advanced technologies, be applied multimodally, and represent outcomes of transportation system performance.
2. Adapt methods and techniques to help recognize and distinguish differences in spatial and temporal patterns in transportation system use, performance, and impact.
3. Research data sources from advanced technologies that are being used or can be analyzed to distinguish nonrecurrent traffic conditions; transit service disruptions; or loss of schedule adherence from periodic peak, hourly, daily, weekly, and seasonally recurring variations.
4. Provide measured examples to benchmark, for a range of urban areas, the proportional share of nonrecurrent conditions that are relative to the share for periodic recurring variations.
5. Specify interdependencies between various sensors of transportation system use and operational definitions of performance measures (e.g., resulting performance measures are more understandable to decision makers and to customers).
6. Conduct case studies and document examples of the use of advanced technologies to better measure, analyze, or visualize measures of system performance.

Related Work

Research and application efforts have been underway to establish and apply transportation system-performance measures at the national, state, and regional levels, including the following examples:

- NCHRP Project 8-32(2), *Multimodal Transportation: Development of a Performance-Based Planning Process* (also *Research Results Digest* 226, July 1998) and NCHRP Project 7-13, *Quantifying Congestion*;

- TRB Task Force on Performance Measures, including a workshop at the January 1999 Annual Meeting, and preparation for a national conference in the spring of 2000;

- Establishment of an Archived Data User Service as a new user service within the ITS national architecture, which will facilitate the use of data from advanced technologies to applications such as transportation system-performance measurements;

- Research and conferences associated with the development of performance-measurement systems by several state DOTs, including Florida, Minnesota, Washington, and California; and

- Performance-measurement activities of MPOs, such as those in Los Angeles and in Albany, New York.

Urgency/Priority

The establishment of effective transportation system-performance measures is critical to successful M&O of transportation systems as well as in getting the support and understanding of decision makers, customers, and the general public. Researching and learning how to apply new and developing technologies will be essential and vital components of performance measurement.

Cost

\$400,000

User Community and Potential Users

The audience who will receive this research problem statement includes FHWA, FTA, AAHSTO, ITE, APTA, ATA, ITS America, APA, key individual state DOTs that establish performance-measurement approaches, and the TRB Task Force on Performance Measures.

Potential Sponsors

FHWA, FTA, NCHRP, TCRP, ITE, ITS America, individual state DOTs and MPOs

Implementation

The concept of transportation system-performance measurement is an innovative concept that will need to receive widespread implementation nationally in the 21st century. Innovators and lead adopters have been making significant inroads. Dissemination of research on applying technology to improve transportation system-performance measurement, and the successes and lessons learned from such

work, will be important in gaining wider acceptance of the early majority and late adopters of other states, county, and regional transportation providers in doing performance measurement. It will also help the innovators and lead adopters to refine their efforts. Presentations of progress and results should be given at appropriate conferences, in professional capacity-building workshops, and by using multimedia CD-ROMs and other information technologies.

Effectiveness

Effectiveness measures will include (a) the level of participation and involvement in the processes to plan, manage, and operate transportation systems and (b) improved levels of understanding and satisfaction

on the part of decision makers, customers, and the general public. Decision makers' and customer awareness that system managers have a good handle on the current performance of the transportation system will lead to greater confidence and trust that managers can more effectively plan, manage, and operate improvements to the system. Such awareness should also lead to greater support and funding for programs to further improve the transportation system. In addition, there should be improved worker satisfaction and morale, as contributors to the delivery of transportation system performance better understand and appreciate their contribution to the success of the overall enterprise.

—Prepared by Bob Winick

Land Use and Transportation

LAND USE AND TRANSPORTATION PLANNING PROCESS: TWO-PHASE STUDY

There are two phases to this research effort on the land use and transportation planning process:

1. To evaluate existing tools and to determine whether they are effective or sufficient for use by decision makers at all levels in the transportation decision-making process. If the planning tools fall short of this need, a list will be compiled of "next steps or recommendations" for the development of new planning tools that will potentially fill these "gaps."

2. Building on the first phase, the next phase of this research would use the next steps or recommendations and develop improved tools for decision makers to make both informed decisions and to demonstrate the benefits of land use and transportation planning.

PHASE I: EVALUATION OF EXISTING LAND USE TOOLS APPLIED TOWARD TRANSPORTATION DECISION MAKING

Problem

Currently, there is a lack of understanding and information on what tools decision makers need or find useful to educate and inform their constituents of the effects of

land use and transportation planning. There also is a lack of information on the effectiveness of currently available land use planning tools that enable decision makers to make informed transportation planning decisions.

Objective

This research will

- Select five land use planning tools that are currently available, including the Places Three Program, LDR, Parsons Brinckerhoff, and the EPA sketch model for evaluation.
- Identify who are and who are not using the available tools and why.
- Evaluate whether the tools demonstrate and communicate options or alternatives as well as the effects of growth management strategies.
- Determine how the tools are used (i.e., technical analysis, quick resource of information, technical or layperson applied).
- Determine whether the land use planning tools that are currently available are sufficient to meet the needs of decision makers at all levels in the transportation decision-making process.
- If they do not meet the users' needs, determine what gaps exist in the data that are available for the current tools, as well as identify potential sources of data from other agencies for inclusion in new planning tools.

- Develop next steps or recommendations, as part of the project report, that provide guidelines on the needs identified by users that are not being met by available land use planning tools.

Urgency/Priority

There is an immediate need to assess what is available and whether it is effective in the land use and transportation planning process.

Cost

\$100,000

User Community and Potential Users

Decision makers at all levels of the transportation decision-making process

Potential Sponsors

FHWA, FTA, NCHRP, AASHTO, state DOTs

Implementation

The result of this research would be a performance evaluation of the land use planning tools that are now available to decision makers. This evaluation would then determine whether there is a need to improve existing land use planning tools, and if so, develop a set of recommendations or next steps for consideration in the development of new land use planning tools.

Effectiveness

This project could be implemented quickly with definable results in a very short period of time. The results of this project would benefit all those who are involved in land use and transportation planning by providing an assessment of currently available tools, as well as an opportunity to provide input into the development of future planning tools.

—Prepared by Aileen Switzer

PHASE II: DEVELOPMENT OF IMPROVED TOOLS FOR DECISION MAKERS TO DEMONSTRATE THE EFFECTS OF MANAGED GROWTH

Problem

There is a lack of information on what decision makers need to make informed transportation decisions to sup-

port sustainable land use implementation. In addition, an effort needs to be initiated to address what tools are needed by decision makers to inform their constituents of the effects of land use and transportation planning.

Objective

This research will first evaluate the findings of Phase I of the project and determine what were identified as the existing needs and data gaps in current land use planning tools. Analytical tools that best depict land use and transportation planning alternatives and that are both easily used and user friendly should then be developed.

Furthermore, these tools must quickly demonstrate and communicate the options or alternatives that are available and the effects of growth management. The tools should be an interactive toolkit for decision makers that allows them to translate technical information that relates to growth management options into readily understandable options or alternatives.

Urgency/Priority

If a need is demonstrated from Phase I, then Phase II would have an immediate need.

User Community and Potential Users

Decision makers at all levels of the transportation decision-making process

Potential Sponsors

FHWA, FTA, NCHRP, AASHTO, state DOTs

Implementation

This research would develop new land use planning tools that meet the needs that were identified as shortfalls in existing planning tools.

Effectiveness

If implemented, this project would provide a tool that meets the needs of decision makers who are involved in land use and transportation planning to make informed decisions and further educate their constituents.

Key Words

Sustainable land use planning, informed decision making, effectiveness, planning tools, next steps, growth management, data gaps or shortfalls

—Prepared by Alan Bowser and Aileen Switzer

TRANSPORTATION STRATEGIES FOR SUCCESSFUL REDEVELOPMENT OF ESTABLISHED AREAS

Problem

The redevelopment of established areas in urban centers can benefit communities and regions in multiple ways. Redevelopment can reduce or eliminate the need for new development, thereby preserving agricultural lands and open space. A redevelopment strategy can help direct transportation investments to the rehabilitation of existing transportation networks. In aging metropolitan areas, a coordinated strategy of economic redevelopment and infrastructure redevelopment can revitalize communities that need infrastructure improvements, housing development, and economic growth. However, successful redevelopment initiatives often face serious barriers—both economic and institutional—that are major disincentives to both private and public investors.

Developers can face significantly higher acquisition costs; additional construction costs due to siting, design, and zoning standards; higher labor costs; and costs related to brownfields remediation and historic preservation requirements. Likewise, transportation agencies may face increased costs that are related to M&O of existing facilities and significant engineering, space, and design constraints in an attempt to upgrade transportation systems and services. The ability of transportation agencies to add transit service, provide for accessibility, construct bicycle and pedestrian facilities, and so forth is often limited by existing structures and rights-of-way. Furthermore, proposed redevelopment projects must compete for resources with new infrastructure development.

Other barriers may also affect the feasibility of redevelopment. Private developers may have a lack of confidence in the market base for expanded economic activity in the area. Developers may have concerns about an inadequate labor pool or unsafe conditions in older urban areas. Both private developers and transportation agencies must work with local governments, existing residents, and businesses to reach agreements about proposed developments and to raise concerns about public participation and support. Community members may have a variety of opinions about the priorities for redevelopment. Finally, overall coordination of economic redevelopment initiatives with transportation system redevelopment in a particular area may be impeded by ineffective working relationships, conflicting priorities, differing planning and

development time frames, disagreements about financing, and other conflicts among the organizations involved.

Objective

The overall objective of this research is to identify and provide information and strategies to state and local transportation agencies that will support their ability to plan and implement successful infrastructure redevelopment projects. This objective will be pursued through a combination of case studies, tool development, and evaluation of design techniques.

Case Studies and Synthesis of Best Redevelopment Practices and Lessons Learned

Case studies of transportation agencies working with multiple public and private organizations should be conducted to develop and implement redevelopment strategies that coordinate economic and infrastructure redevelopment. The analysis should include an overall assessment of the strengths and the weaknesses of the redevelopment, an assessment of socioeconomic impacts, the use of economic incentives and pricing strategies, and the application of market research techniques. Best practices and case studies of successful uses of transportation infrastructure redesign and development to promote redevelopment of established areas should also be identified.

Planning Tools

Analysis tools and selection criteria should be developed to assist transportation planning agencies in working with communities to identify priority strategies for redevelopment.

Redevelopment Design Strategies and Techniques for Established Areas

The feasibility of establishing flexible design standards for infrastructure development and economic redevelopment in established areas should be evaluated. In addition, design strategies for retrofitting established areas should be developed to achieve bicycle, pedestrian, and transit accessibility.

Related Work

Related studies include *Moving Beyond Pavement* (FHWA-AASHTO), *Portland Street Design Manual*, and FHWA's *Flexible Highway Design Manual*.

Urgency/Priority

Additional information and tools regarding redevelopment strategies are urgently needed to assist transportation agencies and local governments that are considering redevelopment activities.

Cost

Case Study 1: about \$150,000 for 5 case studies
Case Study 2: about \$200,000 for 10 case studies
Planning Tools 3: to be determined
Design Strategies and Techniques 4: \$100,000
Design Strategies and Techniques 5: \$75,000

User Community and Potential Users

The primary users of the products of these research efforts will be state and local transportation agencies and MPOs. Partnering agencies will also benefit, including local governments. Private developers will benefit from an analysis on economic strategies, market research, and design alternatives.

Potential Sponsors

TRB, NCHRP, TCRP, AASHTO, AMPO, NARC, FHWA, FTA, HUD, EPA

Implementation

Proposals in response to this problem statement should include a description of target audiences for application of the research findings, as well as strategies and a work plan for dissemination and training to ensure that the new tools, practices, and information are made available to the intended users. The focus of this dissemination should be state and local transportation agencies and MPOs.

Effectiveness

Proposals in response to this problem statement should include a proposed strategy and work plan to evaluate the effectiveness of this dissemination. This evaluation should include an assessment of the distribution of research findings to appropriate organizations and their direct evaluation of the usefulness of the information and tools provided.

Key Words

Redevelopment, barriers, market research, urban, economic development, infrastructure redevelopment, design standards, flexible design, impacts of redevelopment

—Prepared by Joanne R. Potter

**ANALYTICAL METHOD USING GIS TO
EVALUATE THE POTENTIAL
TRANSPORTATION AND LAND USE
IMPACTS OF NEW LAND DEVELOPMENT,
REDEVELOPMENT, AND RURAL
COMMUNITY DEVELOPMENT****Problem**

Development, redevelopment, and rural community development occur on a case-by-case basis, with little understanding of the overall impact of such development on services, transportation infrastructure, and remaining land uses. GIS can provide comprehensive understanding of potential and future impacts on service needs.

Objective

This project proposes to establish a GIS program and methods for determining potential new development areas (rural and urban) and priority redevelopment areas and to use this GIS program to evaluate the impacts of these potential areas on services, transportation infrastructure, and land use policies. The researcher will select 10 pilot agencies across the country to field test the product as part of the research.

Related Work

The use of GIS to evaluate environmental impacts is a growing field of impact assessment techniques that has application to transportation planning and NEPA.

Urgency/Priority

High in promoting community development and redevelopment in urban and rural areas that are compatible with transportation and other service needs.

User Community and Potential Users

Local government planning agencies, state transportation agencies, regional planning councils, MPOs, FHWA

Potential Sponsors

FHWA, NCHRP, TRB, AASHTO

Implementation

Implementation of this research will have application by states as a part of the transportation planning process

and the NEPA process. A training course should be developed for this application.

Effectiveness

Research should produce better decision making on potential impacts to land use and transportation. It should help to address concerns about secondary and cumulative land use impacts on a community as a result of a development, redevelopment, or a community rural development effort and transportation improvements proposed to serve identified needs.

Key Words

GIS, land use, development, redevelopment, rural, community development, planning, NEPA, environmental impact

—Prepared by Buddy Cunill

CONSIDERING ENVIRONMENTAL AND LAND USE ISSUES AND COMMUNITY VALUES IN THE TRANSPORTATION PLANNING PROCESS

Problem

Traditionally, the transportation planning process has included a transportation demand model that serves to define what types of improvements should be scheduled for enhancing the transportation network of the urbanized area. The current process does not fully consider early in the transportation planning process environmental, land use, and community value issues in selecting transportation improvements.

Objective

The objective of this project is to develop a synthesis report of how state transportation agencies and MPOs are addressing land use, environmental, and community impact issues in the transportation planning phase.

On the basis of the findings of the synthesis report, state DOTs and FHWA should consider ways to revise the transportation planning process so as to fully consider environmental and land use plans, programs, and issues, as expressed by other public and private entities, a part of transportation decision making. In addition, the proposed process should address taking into full consideration the community values of local citizens and community groups in developing a community vision and in defining transportation goals, objectives, and policies

during development of the long-range transportation plan to implement the community vision. These goals and objectives should be based on community value as defined by a broad public outreach and a public involvement program. The program includes a visioning and a community impact-assessment process that defines, at the systems level, potential beneficial and adverse community and land use impacts that result from implementation of the proposed transportation improvement.

At the end of this research effort, FHWA should select five pilot states to implement the proposed revisions to the transportation planning process and to field test the amended process. The pilot states would evaluate the proposed process after a period of time to be decided by FHWA and would report the results to them for process corrections.

Related Work

ISTEA and FHWA have been emphasizing the importance of addressing community values and community-impact assessment through a variety of publications:

- *Community-Impact Assessment in Transportation*,
- *DOT Order on Environmental Justice*,
- *Flexibility in Highway Design Manual*, and
- *Public Involvement Interim Guidance and 1994 Policy Statement*.

In addition, TEA-21 is emphasizing the importance of streamlining the environmental process by moving many environmental issues into the planning phase for early consideration and decision making.

Urgency/Priority

High in promoting streamlining and solving community problems through a collaborative process borne in the planning process and carried out through the project-development process

User Community and Potential Users

State transportation agencies, MPOs, FHWA, federal resource agencies

Potential Sponsors

FHWA, NCHRP, TRB

Implementation

Implementation of the research could be voluntarily applied by states, and the five pilot states identified by FHWA would put into practice the proposed process

that results from the research. Improvements to the planning and NEPA processes could result in streamlining regulations, linking the planning and NEPA processes, improving decision making, addressing secondary and cumulative issues, and forming coalitions for project development to meet mutual needs. FHWA would provide training to states and MPOs on this process.

Effectiveness

Research should produce a process that is community based in its transportation planning effort and that is formed by community visioning and local, state, and federal partnering to address environmental and community problems and concerns. It should result in an expedited process and should increase the level of certainty in project implementation.

Key Words

Community-impact assessment, transportation planning, planning, NEPA, project development, land use, community values

—Prepared by Buddy Cunill

TECHNIQUES TO INCREASE MULTIMODAL ACCESSIBILITY IN SUBURBAN COMMUNITIES

Problem

Since the 1940s, new suburban communities and subdivisions have been designed with the automobile as the primary, and typically sole, mode of transportation. Often there are insufficient connections between developments and types of uses, whether they are public facilities, grocery stores, or local cafés. Even road facilities may not provide adequate infrastructure for alternative modes. Sidewalks may be lacking in some areas or may require the user to switch back and forth to allow for “efficient” traffic circulation. Typically, there are few or no bus shelters or signs that indicate schedules or routes for transit service. Bike lanes may not direct riders to destinations other than to recreational sites.

Because of changing demographics, including the aging of the population, we need to incorporate alternative means of travel and connectivity in the suburbs that can adequately serve demand for nonwork trips and that can reduce overall automobile dependence. Tools are needed for local governments to begin to address the

problems of automobile-dominated uses and often segregated uses within suburban communities.

This project has two sets of priorities to address. The first priority is more broadly to create alternative methods of servicing the nonwork trip in suburban communities (and providing residents with an outlet for increasing their physical activity). Second, where there are growth management initiatives, transportation infrastructure investment is typically given greater priority in previously developed areas. How can we retrofit these areas so that the end result is consistent with community values and supports choice?

Objective

This project will promote a coherent community-oriented planning process that expands the potential for alternative modes to accomplish day-to-day tasks and to allow for connectivity of land uses and modes. The project will investigate, and if necessary initiate and examine, prototypical case studies that demonstrate planning techniques for achievement of better connectivity in the suburbs all around. It will also produce a set of analytical approaches that can be adapted for local use but would be available at a regional level to promote better coordination, accessibility, and less vehicle miles traveled.

The final report will indicate sources, if available, or guidelines and examples of flexible design standards for local adaptation. It will be up to the local government to work with residents in determining appropriate multimodal concepts and design that are consistent with community goals and needs.

Related Work

NCHRP published a report in 1987 on pedestrian and bicycle issues in suburban design titled *Planning and Implementing Pedestrian Facilities for Suburban and Developing Rural Areas*. Steve Smith of JHK was project leader. In 1998, Calthorpe Associates did a report funded through FHWA on the design of efficient suburban activity centers. FTA supported a recent report on pedestrian activity in Boston prepared by America Walks.

Urgency/Priority

Moderately high. A very large proportion of the country lives in suburban areas. While we wait for new urbanist forms of development, retrofitting the suburbs can make a difference for the vast majority of the population. The suburbs represent desirable locations within metropolitan regions, are relatively dense, and are already built. Thus, the dissemination of this work will have a major impact at relatively low cost. As the U.S. population ages,

we need to increase mode options for seniors that continue to ensure a level of self-sufficiency while reducing the driving imperative.

Cost

\$150,000–\$200,000

User Community and Potential Users

Local governments in the suburbs generally, potential redevelopment authorities and community organizations in inner-ring suburbs, state agencies

Potential Sponsors

TCRP, STPP, state DOTs with growth management legislation. There are a number of foundations that may be interested in funding the research and dissemination.

Implementation

MPOs and county governments will disseminate the report as part of a toolbox to coordinate transportation and land use at the local level.

Effectiveness

The societal benefits of the research include

- Involving established communities in identifying improvements that are consistent with a local visioning process and with overall regional goals;
- Providing sufficient case studies, checklists, and techniques to help local governments to institutionalize a process for redesign and for promoting mixed uses and connectivity of modes and destinations; and
- Increasing opportunities for physical activity; reducing reliance on the automobile; reducing isolation of caregivers, children, and the elderly; and increasing transit use.

This research will also result in a number of related activities, as part of a larger effort with local transit agencies. These activities will include

- Allowing bikes on buses,
- Working with the community to assess appropriate transit-stop locations (and shelters where needed), and
- Providing accurate route information and other amenities that will make transit more user friendly and a more obvious choice.

In areas less served by transit, this last effort will result in greater connections to the service that is available.

Key Words

Suburban, redevelopment, multimodal, accessibility, connectivity

—Prepared by Amy Van Doren

FLEXIBLE APPROACHES TO PARKING DEVELOPMENT

Problem

The provision of on-site free parking is one of the key factors in creating automobile-dependent development. In a suburban setting, free parking virtually guarantees that the automobile will rule as the exclusive means of access. In addition, extensive amounts of surface parking create an environment hostile to pedestrian movements and harmful to stream quality because of the amount of paved impervious surface. Minor changes in the location and availability of parking could have major impacts on driving as well as create more pleasant settings.

Objective

This project will identify examples of best practices of public agencies in providing parking to serve new development. The term “shared parking” is used by the Urban Land Institute to describe private developments with three or more uses that are served by a common parking facility. More broadly, the term can describe public parking facilities that are developed to serve several different buildings or blocks. Several innovative communities, including Orlando, Los Angeles, and Pasadena, have developed public parking programs to meet the needs of new development through off-site, in addition to on-site, parking. This project will synthesize the examples, especially in a suburban setting, and describe the approaches taken.

Related Work

The Urban Land Institute's book *Shared Parking*, widely used for private developments especially, is now almost 20 years old. Shoup has done much work on this topic in Southern California. An ITE committee on shared parking produced a report that was mostly a survey of the extent of the practice, with only a few case studies. There is a small task under NCHRP Project 8-36 titled *Parking Modeling Procedures*. None of these, however, offers a sufficient scope that is useful to local officials who desire to incorporate a change to planning and zoning procedures.

Urgency/Priority

This should be a high-priority project so as to provide a practical tool to reduce automobile dependency.

User Community

Local governments, with general support from APTA and FTA

Potential Sponsors

NCHRP

Implementation

The research could be implemented through dissemination to innovative local governments and possibly to state agencies that are supportive of sustainable development.

Effectiveness

This project could be implemented with minimal public support. It can be supported through fees on new development. A community that implements such changes could easily reduce the rate of driving by several percentage points, comparable to that achievable through major transit investments.

—Prepared by Robert Dunphy

**LINKING METROPOLITAN TRAVEL
GROWTH AND SPRAWL**

Problem

The prevailing trend in metropolitan development patterns in the United States has been toward a sprawling pattern of development, in which extensive amounts of land at the fringe have been urbanized, while often closer-in areas continue to lose population. This trend, which is actually more severe in older, higher-density urban areas such as Chicago, St. Louis, and urbanized New York and New Jersey, has been accompanied by disproportionate increases in travel. The debate rages among the critics of what has been characterized in many places, such as in Atlanta, as the "unlimited low-density vision." Other researchers, however, report that this pattern appears not only to meet market demands for housing but also offers a transportation future in which congestion is kept within bounds.

Objective

This project will provide consistent information on patterns of development and on the growth of automobile and transit travel for a cross section of metro areas. Its concurrency with the 2000 Census should supply considerable amounts of local data.

Related Work

An analysis of national data, with data from the Nationwide Personal Transportation Study, was conducted by Dunphy and Fisher, but the database was very limited. Studies of individual areas have been generated in Seattle, Atlanta, Los Angeles, and other places. This effort would make it possible to provide consistent, reliable data for a range of areas—probably all those areas over 1 million in population and a sampling of smaller metros.

Urgency/Priority

Lacking such information, debates over sprawl continue, largely on the basis of rhetoric and individual beliefs.

Cost

\$100,000

User Community

MPOs, state planning, environmental, and transportation agencies, USDOT, real estate organizations

Potential Sponsors

NCHRP

Implementation

Data collection could be carried out through data that are normally available through FHWA's HPMS program, FTA ridership information, and census data, supplemented by local information.

Effectiveness

Better information could not only help inform some of the debates on sprawl but also provide some clearer choices for public policy, including both regulation and differential financing.

—Prepared by Robert Dunphy

INTEGRATION OF TRANSPORTATION CORRIDOR AND LOCAL LAND USE PLANNING

Problem

During the development of transportation-corridor-improvement plans and projects, the area's land use planning information is used to help ensure plan and project consistency and compatibility. In areas where land use plans are current, comprehensive, and widely supported, these assessments may be straightforward. In areas where land use plans are outdated and contain gaps, assessment of consistency and compatibility is difficult, if not impossible. In addition, if major gaps in an area's land use plans exist, the area is likely to experience undesirable land use changes that result from a lack of appropriate controls in place well in advance of the implementation of a transportation-corridor-improvement project.

Objective

The objective of this research is to develop tools, techniques, and methods for closing the gaps in land use plans during implementation of transportation corridor-improvement plans and projects.

Related Work

TEA-21's Transportation System and Community Presentation Pilot Program is providing funds to improve land use planning. However, it is unclear whether or not those funds will be used to improve land use planning practices.

Urgency/Priority

In the absence of comprehensive land use plans, both transportation facilities and communities will continue to experience uncontrolled growth and undesirable consequences.

Cost

\$300,000

User Community and Potential Users

Local, state, and federal transportation agencies, planning professionals, local and regional planning organizations, consultants

Potential Sponsors

USDOT, state DOTs, AMPO, EPA

Implementation

Handbooks and training will be developed and distributed.

Effectiveness

Transportation-corridor plans and projects and area land use plans will be consistent and compatible.

BEST PRACTICES IN METROPOLITAN LAND USE PLANNING AND REGULATION

Problem

Among policy makers, urban planners, and the public, there is general antipathy toward sprawl and something of a consensus about what constitutes good urban form. Good urban form is often characterized as having

- Hierarchy of centers dense enough, with land uses mixed enough, to support alternative modes;
- Reasonable balance of jobs and housing within large subareas;
- Definite limits to its outward expansion; and
- Reasonably contiguous development patterns, but for permanent open spaces that serve public purposes.

While good urban form has been defined and illustrated in several best practice guides, and case study examples abound, how to implement good urban form through public policy initiatives remains largely unresearched. There is no shortage of policy mechanisms: Land use regulations, growth management regulations, financial incentives, public-private partnerships, and infrastructure investments are the general categories, and there are many tools under each. But the effectiveness of these tools in achieving good urban form is unknown.

Objective

The objective of this research is to conduct case studies and analytical studies of major growth management initiatives that are aimed at identifying the goals, strategies, and results, both intended and unintended. Case study sites should be selected to encompass the greatest variety of approaches at both metropolitan and state levels. Orlando might be selected as an example of Florida's growth management at work, Eugene as an example of Oregon's growth management at work, Montgomery County as an example of Maryland's growth management at work, and so forth. Ideally, all growth management states would be represented. The

report will be directed toward local and state officials and will discuss false starts as well as success stories.

Related Work

There are broad-brush reviews of statewide growth management programs by Porter, Nelson, and DeGrove. Policy mechanisms are described and anecdotal evidence of effectiveness is sometimes provided. There are downtown redevelopment case studies published by the Urban Land Institute, Frieden, and others that describe public-private collaborations, financial incentives, and results in qualitative terms. There is a handful of quantitative studies of growth management impacts on densities or on real estate values.

Urgency/Priority

As more and more places strive to manage and redirect growth, contain sprawl, revitalize their central cities, and promote more compact development in the suburbs, it is essential that they be given credible information about the impacts of different policies and programs on all of these concerns. How effective are urban growth boundaries at containing and redirecting growth? What effect do impact fees have on the density of development? The existing literature, mostly anecdotal, provides limited guidance.

Cost

To conduct comprehensive case studies in 10 states and complementary analytical studies would require a budget of at least \$500,000.

User Community and Potential Users

The audience would primarily be state and local governments with the power to implement land use controls. MPOs could use the report as an educational tool and basis for mitigation of development impacts in their dealings with local governments.

Potential Sponsors

TCRP, FTA, APTA, EPA, and HUD would be likely research sponsors. FHWA, AASHTO, and other highway-oriented agencies might cooperate with funding if the project promised slower growth of vehicle miles traveled (VMT).

Implementation

In states with growth management systems already in place, the findings could be implemented directly

through changes in state rules and regulations. Elsewhere, state laws might have to be amended to allow certain policies to be implemented at the local level. Education and training would be necessary to convince local governments to implement the more promising growth management tools.

Effectiveness

Given the dearth of information on the effectiveness of different growth management tools, it is hard to predict the societal impacts of research. If certain tools can be effectively applied to create denser, mixed-use communities, existing travel research suggests that the effect on travel will be significant.

—Prepared by Reid Ewing

IMPACTS OF NEW COMMUNITY AND NEIGHBORHOOD DESIGNS ON HOUSEHOLD TRAVEL BEHAVIOR

Problem

Proponents of neotraditional neighborhoods, transit-oriented developments, pedestrian pockets, mixed-use activity centers, and other compact, mixed-use developments have claimed major reductions in vehicular travel if their concepts are implemented. They have pointed to studies of travel behavior in traditional neighborhoods, traditional downtowns, and other mature and regionally centered places as evidence that their designs will produce the desired results. But new concept developments differ from these mature examples in regional location, surrounding land uses, socioeconomic, and other salient characteristics. We cannot reliably extrapolate performance from these older examples. At this writing, a sufficient number of new concept developments are far enough along in their development to be evaluated directly instead of by analogy.

Objective

This research will conduct definitive travel research on new concept developments that have matured to a point at which travel benefits can be assessed. Quasi-experimental and statistical controls will be used to isolate the effects of design on travel behavior. Established new concept developments such as the Kentlands in Maryland, Mizner Park in Florida, and Fairview Village in Oregon will be compared to comparable conventional developments in the same areas. Household travel surveys—

using questionnaires, travel diaries, and procedures that are designed to maximize trip reporting—will be administered to statistically adequate samples of households in experimental and control developments.

Related Work

The potential for moderate travel demand through changes in the built environment is the subject of more than 40 empirical studies, most of them recent. The range of travel variables that are explained includes trip frequencies, trip lengths, mode shares, and VMT. The range of built-environment variables tested for explanatory power includes density, land use mix, street network design, and “pedestrian-friendliness” factors, all relevant to the new concept designs.

Urgency/Priority

This is enabling research, not urgent but increasingly important as the number of new concept developments increases and as the new urbanist movement becomes more prominent.

Cost

Due to the high cost of travel diary-based research and the need to conduct such research in a respectable sample of developments and controls, this research could easily cost \$1 million.

User Community and Potential Users

Local governments and state DOTs would be the primary audience for this research, because they need to assess the

traffic impacts of new developments and to provide for adequate mitigation. Transit operators could use the research in their service planning. EPA and other air quality agencies might find the research useful in conformity cases.

Potential Sponsors

Highway, transit, or environmental agencies (FHWA, AASHTO, NCHRP, FTA, APTA, TCRP, EPA, and others) would be likely research sponsors.

Implementation

If the new concept developments are found to reduce vehicular travel, they can be given priority by state and local governments through changes in development regulations. Zoning ordinances can be rewritten (and many have been already) to create new zoning districts where these developments are permitted by right. Impact fee and adequate public facilities ordinances can be amended to reduce the traffic impacts of such developments. Public-private partnerships can be established to initiate such developments.

Effectiveness

Positive research findings might accelerate the existing trend (which is slow but perceptible) away from sprawl as the nation's dominant pattern moves toward more compact, mixed-use development.

—Prepared by Reid Ewing

CONFERENCE II RESEARCH STATEMENTS

Professional Development

PROFESSIONAL DEVELOPMENT IN TRANSPORTATION PLANNING

Problem

Many transportation planners have limited knowledge, skills, and ability to perform the wide range of diverse tasks that is involved in carrying out the spirit and letter of ISTEA, TEA-21, and other federal mandates, as well as in carrying out specific operations of the agencies in which they work (state DOT, MPO, RTPA, transit properties, or local jurisdiction).

There is a current backlog of training needs that outstrip the capacity of current delivery systems (e.g., NTI, NHI, universities, and FHWA professional capacity building). The costs, time required, availability of suitable courses, travel expenses, and other factors make the achievement of a fully qualified staff a difficult challenge to agencies and nearly impossible for the smaller planning agencies.

The changing practice, rising expectations, and revisions to legislation will substantially change (elevate) the demands that are placed on planning staff expertise and will exacerbate the problem.

Objective

The objective of this research is to quantify the cost-effectiveness of agencies to be staffed with well-trained and fully qualified transportation planners at all levels

who have received training in the various aspects of transportation. This measure should be explored if poorly staffed agencies are ineffective and inefficient. What are the external and additional costs to the agency and the public at large for inability to perform staff functions at a competent level?

This project may involve case studies that show that well-trained staff could have avoided cost escalations as a result of project and product delay. It could use best practice demonstrations—examples in which consultant costs were incurred to perform tasks that could have been done in-house. Survey work on staff retention and avoidance of replacement costs should be conducted.

Related Work

FHWA has initiated a professional capacity-building program for MPOs. Traditional academic institutions have insufficient time to teach students everything they need to know before graduation; these programs are limited in number. Planning organizations have limited time and resources to devote to professional development. NHI and NTI have developed and delivered training for transportation planning.

Urgency/Priority

This is a serious problem now and will become more severe as planning expectations change.

Cost

Phase 1: Case studies—\$50,000–\$75,000

Phase 2: Best practices—\$100,000–\$125,000

User Community

All federal, state, and local transportation agencies will benefit from this work. The quality of work should increase, the time allotted to advance plans and programs should decrease, and the efficiency and effectiveness of the planning practice will be elevated. The

customers of transportation facilities and services will benefit.

Sponsoring Agencies

USDOT, FHWA, FTA

Key Words

Training, professional development, capacity building

—Prepared by Don Steiger

CONFERENCE II RESEARCH STATEMENTS

Linkages to Other Programs and Outcomes

DEVELOPMENT OF A NATIONAL SHARED-KNOWLEDGE NETWORK FOR SOCIAL AND ENVIRONMENTAL ASPECTS OF TRANSPORTATION PLANNING

Problem

Much time is wasted and effort duplicated in transportation planning because of the lack of knowledge of relevant current and recent transportation research. Several subject-area-limited or limited-access databases exist, such as the Transportation Research Information Service (TRIS) and some privately maintained but publicly accessible databases, but there is no centralized and organized connecting link. The Internet presents the opportunity for creating a much needed database, which is widely and easily accessible, on existing studies and on other research to aid transportation planners in their work.

Objective

The objective of this research is to develop a process that will lead to a user-friendly, accurate, readily updatable transportation planning research database that can be easily maintained with minimal staffing. The database should include both summaries of research and full documents when possible. The website should include links to other websites by subject. The focus of this information network

will be on environmental, economic, societal, and organizational issues as they relate to transportation. Transportation planners will be the primary intended users, but the database will be accessible by all interested parties.

Specific tasks include

- Identifying existing clearinghouses and databases (estimated cost is \$50,000);
- Identifying knowledge gaps and overlaps (estimated cost is \$100,000);
- Convening an expert panel to design the shared-knowledge network with potential to allow for different site hosts, funding sources, and end users (estimated cost is \$150,000); and
- Convening an expert panel to develop an implementation plan for creation and operation of the shared-knowledge network (estimated cost is \$50,000).

Related Work

TRIS, Center for Transportation and the Environment, National Transportation Library, and BTS

Urgency/Priority

High—potential for immediate time and cost savings

Cost

\$350,000 (breakdown given above)

User Community and Potential Users

Federal, state, and local transportation agencies, economic development and environmental agencies, social service institutions, research institutions

Potential Sponsors

AASHTO, BTS, ITE, AMPO, EPA, APTA, Community Transportation Association of America (CTAA), STPP

Effectiveness

Effectiveness measures will include increased outreach opportunities and immediate utility in transportation planning. Measurement of utility could be calculated in hits to website.

Key Words

Transportation information, transportation planning, transportation research, transportation education, transportation database, transportation impacts

INFORMATION SHARING AMONG PLANNING PROCESSES

Problem

There is currently little opportunity or incentive to use common databases for planning and selecting program and infrastructure improvements in urban and rural areas. Transportation agencies, schools, public health organizations, utilities, and businesses tend to use and interpret differing information from a wide variety of sources for planning and decision making. This can lead to recommendations that are not in a common context, faulty conclusions, and less-than-inclusive decisions. There is a need for research that will determine the current practice in use of information and the effectiveness of using common data in coordinating planning processes.

Objective

The objective of this research is to explore potential benefits of and barriers to use of shared information, particularly for planning programs with far-reaching impacts, such as major infrastructure projects and social programs. In the long run, coordination and sharing of common data among planners and decision makers can increase certainty in infrastructure planning scenarios, improve project selection and delivery, and assist in collaborative and consultative decision-making processes.

Task 1 would conduct a synthesis of effective methods for sharing and coordinating information, including the current practice of using GIS databases for local, regional, and statewide planning. Task 2 would survey staff and officials on shared database needs, potential costs, and benefits. Task 3 would conduct case studies on projects and programs in which case studies can provide insight into costs and benefits (including cost avoidance) through use of common information. Task 4 would develop recommendations on development and use of common, coordinated information, including information with a GIS basis.

Related Work

There is increasing awareness at the federal, state, and local levels of the need for a common information base for infrastructure and program planning. A HUD project has assisted local agencies in plotting housing, tax, and land use data on a GIS platform. Another HUD project inventoried local transportation providers as part of the Bridges to Work effort. (An example of the need for the work that was proposed under this project statement is the fact that this information was initially available to FTA.) Other efforts at coordination that are not directly related to transportation are being conducted by the National/State Geographic Information Council and the National 911 Standards Group.

Urgency/Priority

Because potential for cost savings and consensus is significant, there is a critical need for the type of shared and coordinated information that this study would facilitate.

Cost

Task 1—estimated at \$75,000
Task 2—estimated at \$150,000
Task 3—estimated at \$120,000
Task 4—estimated at \$150,000

User Community and Potential Users

Areas that have separate agencies and organizations that conduct planning at a broader level are potential users of this research. This includes dealing with transportation, public health, public services, education, land use, and utilities, among others.

Potential Sponsors

FHWA, FTA, NCHRP, university transportation centers

Implementation

Findings of the proposed research could be used to

- Inform the conformity process;
- Test alternative growth scenarios on the land use side; and
- Jointly plan for infrastructure expansion and consolidation, including utility districts, land use agencies, and state DOTs.

Effectiveness

This research will lead to an increased ability to make effective, informed decisions, not only across modes but also across various public and private sectors that do planning. It can increase levels of certainty and coordination in infrastructure planning and can lead to increased inclusion in the planning process.

Key Words

Data, transportation planning, social, environmental, public policy, information, coordinated decision making, GIS

RURAL PARTICIPATION IN TRANSPORTATION DECISION MAKING

Problem

Rural areas have unique transportation issues, but they have little information on these issues, few tools to quantify the issues, and little involvement in the transportation planning process. Rural areas, in general, do not have formal participation in the transportation planning process as do urban areas through MPOs. It is assumed that rural transportation issues will be defined in STIP on the basis of input from local officials, state DOT staff, and other informal methods. Many rural officials have little knowledge of the formal planning process, have limited staff, and have no tools to quantify issues. As a result, many rural areas do not feel their transportation needs are well understood, and they are at a disadvantage in getting resources to address these needs.

Many transportation issues are unique to rural areas. These issues include

- Aging rural population with a greater need for public transportation;
- Closing of rail facilities and track closure;
- Aging transportation infrastructure;
- Fringe urban development;

- Decreasing population;
- Greater reliance on motor freight;
- Desire to support economic development; and
- Tourism (National Park Service, Bureau of Land Management, and others).

These trends are redefining the need for rural transportation planning.

Section 1204 of TEA-21, which addresses rural transportation planning, indicated to many rural officials that they had no formal involvement in the transportation planning process and that there is limited understanding of their needs.

Many states have effective rural transportation planning efforts, both formal and informal. New technology is giving us more flexibility in how, when, and where we work and how we spend our leisure time. Rural areas more than most rely on transportation services to get to jobs and get to leisure activities. In the future, the challenge will be how to better understand the wide range of transportation needs, and how do we address those needs in the transportation planning process.

Objective

The objective of this research is to define an effective method for rural communities to effectively address transportation issues and to develop multimodal tools to quantify those needs.

The products from this research should include

- A synthesis of rural transportation issues and case studies of how different rural areas are addressing transportation issues,
- Effective ways for rural areas to participate in the transportation planning process and development of a community vision, and
- Development of multimodal tools and methods to quantify and analyze rural transportation needs.

Related Work

The work plan for the Red River Transportation Study (North Dakota, South Dakota, Minnesota, Iowa, and Nebraska) is currently being developed to look at transportation needs in specific areas.

Urgency/Priority

The research is needed to support the implementation of TEA-21—Involvement of Local Elected Officials.

Cost

\$400,000

User Community

The users of the research will be rural planning officials, rural elected officials, statewide planners, tribal planners, and LTAP centers to better understand the need of rural communities.

Potential Sponsors

FHWA, FTA, NCHRP

Implementation

The key to implementation is an effective education effort that ensures that (a) everyone is more aware of rural transportation issues, and (b) new tools have been developed to quantify and define transportation needs and to explain how those needs can be included in STIP.

Effectiveness

This research will better direct the limited resources for transportation in rural areas so that they can be used more effectively to enhance the rural economy and quality of life.

Key Words

Rural planning, rural transportation, local officials, TEA-21, growth management, planning

—Prepared by Roger Petzold

DETERMINING AND PLANNING FOR THE IMPACTS OF TOURISM ON TRANSPORTATION INFRASTRUCTURE

Problem

Tourism has become a major industry nationally and an economic development base for many regions. While the economic benefits of tourism—job creation and expansion and diversification of the local tax base—are clear, the attendant costs are often less obvious, and the burdens of the impacts are neither well identified nor quantified. One of the major associated effects of an increase in tourism is the need for enhanced transportation facilities and services. The range and the financial cost of such transportation facilities and services can vary widely according to such factors as geographic location, nature of the tourist attraction, and the level of demand on existing transportation services and facilities.

Tourism marketing and development efforts often occur without meaningful integration with regional transportation planning, often resulting in such overwhelming traffic congestion that it can ruin a region's feature or features that serve as the tourist attraction in the first place. The situation outside Yosemite National Park is one such example. The growing attraction of rural areas and seasonal attraction locations present differing sets of problems. The inherent transportation-capacity problems of limited-access ski resort areas, for example, create different kinds of challenges to transportation planning. Natural constraints and environmental concerns affect both economic development and transportation plans. Large influxes of tourists in rural areas may generate demands for new transportation infrastructure and services that ultimately conflict with community goals.

Continuing increases in leisure time and disposable income are expected to fuel sustained growth in tourism in this country, in both remote and relatively yet undeveloped areas and in major metropolitan areas with the transportation infrastructure already strained by existing demand. There are obvious questions about how much certain areas can handle in increased tourist traffic and who should pay for new infrastructure and services that will be needed to support travelers from outside a region.

In many instances, the chief beneficiaries of tourism benefits are not the same populations that bear the brunt of the traffic congestion that may accompany a surge of tourists. "Gateway" communities may reap the economic advantages of tourism, but communities on the way to these gateway communities may receive few, if any, of the benefits, but they are still expected to bear a major share of the costs. Increased tourism raises these and other financing, equity, and sustainability issues that should be studied in depth to promote effective, equitable, and comprehensive economic development and transportation planning.

Objective

This project will study the transportation impacts and transportation needs that are associated with tourism and will provide an information base and methodologies for

- Analyzing regional and local tourism potential and transportation capacity to support it;
- Determining the extent and location of the impacts and benefits; and
- Developing comprehensive planning techniques that will lead to equitable and sustainable economic development, land use, and transportation plans to support tourism goals.

The research plan should include the following:

- Synthesis of existing research on the effects of tourism on transportation (local and national systems) and on economic development;

- Projected growth in tourism in all regions and evaluation of capacity of existing transportation infrastructure and services to serve anticipated demand, including identification of peak travel volumes, off-peak volumes, and capacities needed for both;

- Survey of local attitudes toward tourism growth, including distributive impacts on community and natural environments;

- Identification of traditional and innovative transportation systems with potential to serve tourist destinations with minimal adverse impacts; and

- Evaluation of prospects for implementation of such services and infrastructure, costs, financing methods, and degree of local support for such services and infrastructure.

Related Work

To be found in synthesis of existing research

Urgency/Priority

High—Many of the transportation services and infrastructure projects that will be necessary to support expected tourism-related development have not even been identified, much less incorporated into regional and national transportation planning. Because of the long lead time in implementing such transportation services and infrastructure, a national assessment of anticipated tourism demand, existing and needed transportation supply, and development of the appropriate analytical tools for local planners to use should be initiated as soon as possible.

Cost

\$100,000–\$150,000; time for research and completion of report is estimated at 18 months.

User Community and Potential Users

Federal and state economic development, commerce, tourism, labor, transportation agencies (e.g., FTA, FAA, FHWA, U.S. Department of Commerce, U.S. Department of Labor, HUD, National Park Service, Bureau of Land Management), private organizations (e.g., Council for Urban Economic Development, U.S. Conference of Mayors, U.S. Chamber of Commerce, APTA, hospitality industry groups)

Potential Sponsors

FHWA, FTA, FAA, U.S. Department of Commerce, U.S. Department of Labor, HUD, BLM, National Park Service

Implementation

Results from this project could be used to develop state and local transportation plans and economic development plans. Information and methodologies that are developed could help state transportation agencies plan for traffic management, including optimal use of existing capacities and gauging the need for additional capacity. User-benefit assessment could help agencies determine cost-sharing strategies. Findings and methodologies could help agencies to determine optimal travel capacities, bearing in mind environmental, community, and other potentially adverse impacts.

Effectiveness

Acquiring more complete knowledge of the ramifications of tourism can lead to more sustainable and beneficial planning.

Key Words

Economic development, leisure time, travel, tourism, gateway communities, rural tourism, seasonal tourism

ANALYSIS OF NETWORK CONNECTIVITY FOR BICYCLING AND WALKING

Problem

For people in many communities, opportunities to bicycle and walk are perceived to be limited to certain routes and to certain facilities. The lack of sidewalks, high volume-high speed roadways, or the lack of access across a bridge often represent gaps in the “network” that preclude the choice of bicycling or walking for many potential travelers. Little is now known on how various users perceive the lack of access or network connectivity. Also, there are no good tools for conducting network analysis to identify where gaps currently exist. There may be exponential benefits to increased connectivity. There may be a critical need for a network to be useful for certain types of trips or activities.

Finally, there is a need for techniques by which to forecast the potential demand if a particular gap, such as a bridge, were eliminated by providing for easy access by bicycles and pedestrians. Some critical gaps in the bicycle-pedestrian system may remain open because projects in these corridors face barriers, such as crossing a river or a rail line, constriction of right-of-way by existing development, existence of sensitive habitat, or restrictions of historical or archeological sites. Completion of the network in these instances would

entail high financial and processing costs. However, the project would be worthwhile were the benefit equally large.

Objective

Tasks include

- Synthesizing developed criteria for assessing the utility of various routes or facilities to accommodate various classes of bicyclists and pedestrians;
- Developing sketch planning procedures for determining where gaps exist in the current system of routes or facilities;
- Developing techniques for finding high-level "attractors" of bicycle and pedestrian trips and the level of network that services the attractions (examples may include schools and recreation facilities); and
- Developing techniques for assessing the potential demand (e.g., increases in bicycling and walking) that would result from the elimination of such gaps or barriers.

There may be an opportunity to assess the effect of closing critical gaps in the bicycle-pedestrian network. Examples of critical gaps may include a major bridge for a limited-access highway (closed to bicycle-pedestrian traffic) for which there is no other alternative route within the corridor or a grade-split crossing of a rail line by a limited access highway.

Related Work

Work exists on criteria for accommodating bicycle and pedestrian facilities. There may be some work on the influence of network gaps on pedestrian trips (possibly a study in San Antonio). There are models that are used to estimate use of proposed bicycle and pedestrian facilities (and related mobility and AQ benefits from reduced vehicle trips). Some states may be performing before and after counts for transportation-enhancement projects.

Urgency/Priority

This research is necessary for better understanding bicycle-pedestrian modeling and the development of assumptions and criteria for bicycle-pedestrian investment. It also would contribute to an understanding of network development and intermodal connectivity.

Cost

Task 1 could be a synthesis of existing research, with an expert panel to assess existing techniques and to promote preferred tools. Cost is \$50,000 to \$75,000. Task

2 would review single case studies for different types of urban geographies or for three to six total case studies. Cost is \$100,000 to \$125,000. Task 3 could include a survey of potential examples of projects in process, data collection for before and after counts of bicycle-pedestrian movements along the corridor and elsewhere in the system, and before and after ridership and pedestrian surveys. Cost is \$200,000 to \$250,000. Task 4 is similar to Task 1. Cost is \$50,000 to \$75,000.

User Community and Potential Users

This research would be of immediate use to states, MPOs, and local agencies. It also would be of interest to bicycle-pedestrian organizations, park and recreation planners, and health organizations.

Potential Sponsors

FHWA

Implementation

Tasks 1 and 2 could result in reports being developed for print or Internet distribution. Task 3 would require support by state or local agencies. There may be outreach opportunities by piggybacking on the opening of the new facility that is associated with the data collection in this task. Task 4 could result in a report or brochure for use by a wider public audience.

Effectiveness

Results of this research could improve the effectiveness of transportation-enhancement projects and could aid agencies that use CMAQ funds for bicycle and pedestrian system development by better quantifying the benefits.

Key Words

Bicycle, pedestrian, networks, connectivity

REVISITING VISION IN THE PLANNING PROCESS

Problem

Does the planning visioning process aid process continuity and linkage from the transportation plan to project development? For example, a community undertakes a visioning process, reaches consensus on the community's

future, and develops a plan using criteria that supports the vision. Over time, conditions change. New leaders are elected. The residents who participated in the visioning process move. The result: the public and decision makers have a reference. Projects were developed by a thoughtful, engaging, visible, and documented planning process years earlier. Where assumptions and community vision continue, projects move forward without disruption. Where conditions may change that result in new assumptions or visions for the community, projects are reassessed. In another community that did not start with a visioning process; years later there is no context for why a project is included in the plan. Projects may be delayed for lack of support, then expedited only to be delayed again, leaving many people frustrated with the constant flip-flop of the process.

Objective

The objective of this research is to look critically at the temporal link in the planning process. There may be identifiable factors in the planning process that will influence events downstream during project development. There also may be events outside the planning process that are necessary for continuity through project development. Factors may include levels of community involvement during initial plan development, the adoption of a vision statement, the level of community consensus, the development of project-selection criteria that is based on an agreed vision, the level of change in institutions as a result of the process, or the level of continued involvement by the public and decision makers after plan adoption. External factors, such as the level of change in the community or economic shifts, may also have strong impacts on the temporal link from plan to project implementation.

Research methods may include (a) use of case studies; (b) a time series or comparable case analysis of changing professional and public perceptions of planning techniques; and (c) a survey of multiple examples, with statistical analysis isolating the effect of specific planning techniques or external changes.

Research results may point to better project-delivery techniques (streamlining), more accurate anticipation of planning outcomes, greater continuity in decision making, and more meaningful engagement of stakeholders.

Related Work

Planning to policy: historical review, lessons learned from 40 years of transportation plans; customer-based planning: how to keep people at the table, best practices use of the visioning process; land use: historic review of plan implementation and effect of new

"fads," such as neotraditional planning and strategic (midcourse correction) planning.

Urgency/Priority

The visioning process is generally considered good planning practice. However, vision planning also costs more, requires more effort, and takes more time. This research would provide an evaluation of the visioning process to determine if and when the effort is worthwhile.

Cost

- Low: \$75,000 to \$100,000 for preparing case studies from two or three areas, with use of existing documents and with one or two follow-up telephone interviews.

- Medium: \$125,000 to \$150,000 for a comparable case test (either two similar communities, one of which undertook a vision planning process and one did not, or two similar communities, both of which undertook a vision planning process, but subsequently one underwent rapid change, and one was static).

- High: about \$225 for a broad-based, historical survey of planning activities, with a multivariate statistical analysis to test the significance of specific approaches.

User Community and Potential Users

This research may be of interest to a range of groups involved in vision planning: APA, ICMA, League of Cities, and universities.

Potential Sponsors

FHWA

Implementation

Publish paper or post on the Internet; presentation materials.

Effectiveness

The results of this research would aid MPOs with the planning process. The research also may assist other types of planning bodies, from local planning agencies to multistate resource agencies.

Key Words

Vision planning, project delivery, community involvement, transportation plan

Participants in the Conferences

CONFERENCE I—WASHINGTON, D.C.

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Bruce Ahern	Port Authority, Allegheny County	Debbie Burly	American Association of State Highway and Transportation Officials
Karen Akins	Trans-Texas Alliance	David G. Burwell	Rails-to-Trails Conservancy
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		Chuck Collett	National Association of Home Builders

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Sheldon M. Edner	Federal Highway Administration	Barna Juhasz	Federal Highway Administration
Cleon Edwards	West Harlem Environmental Action, Inc.	Thomas J. Kane	Des Moines Area Metropolitan Planning Organization
Lee Epstein	Chesapeake Bay Foundation	Deborah Katz	Washington Regional Network
Gary Erenrich	Hagler Bailly	Kathleen Kelly	AC Transit
Richard C. Feder	Port of Authority, Allegheny County	Lori G. Kennedy	Kissinger Campo & Associates
Sharon Feigon	Center for Neighborhood Technology	Larry M. King	Pennsylvania Department of Transportation
Tim P. Fischesser	St. Louis County Municipal League	Ronald F. Kirby	Metro Washington Council of Governments
Ronald T. Fisher	Federal Transit Administration	Wayne W. Kober	Pennsylvania Department of Transportation
John W. Fuller	University of Iowa	Bob Kochanowski	Southwestern Pennsylvania Commission
Sean B. Furniss	U.S. Fish and Wildlife Service	Michael F. Lawrence	Jack Faucett Associates
J. B. Gaines	Walt Disney Imagineering	Calvin W. Leggett	North Carolina Department of Transportation
Joni Gallegos	National Park Service	Kenneth J. Leonard	Wisconsin Department of Transportation
Brian J. Gardner	Federal Highway Administration	Tom Lewis*	Walt Disney Imagineering
Kara Gerry	Delaware Valley Child Care Council	Ysela Llort	Florida Department of Transportation
Jonathan L. Gifford	George Mason University	Stephen C. Lockwood	Parsons Brinckerhoff
Timothy J. Gilchrist	New York State Department of Transportation	Timothy J. Lomax	Texas Transportation Institute
Charles R. Goodman	Federal Transit Administration	Shirley M. Loveless	Transportation Planning Consultant
Stephen Grimm	Federal Railroad Administration	Joseph M. Maestas	Federal Highway Administration-New Mexico Division
Jacquelyne Grimshaw	Center for Neighborhood Technology		
Joseph W. Guyton	HNTB Corporation		
Jane Hardin*	American Association of Retired Persons		
John S. Hassell	LMRC/Carmen Group		

* Unable to attend

Hani S. Mahmassani	University of Texas-Austin	Peter E. Plumeau	Chittenden County
Gary E. Maring	Federal Highway Administration		Metropolitan Planning Organization
Joan P. Martin	AC Transit	Rick Porter*	National Association of Home Builders
Ronald D. McCready	Transportation Research Board	Joanne R. Potter	Cambridge Systematics (Federal Highway Administration)
Bruce D. McDowell	InterGov	Richard Price	Association of Metropolitan Planning Organizations
Ryan McKenzie	Cleveland State University	Robert J. Puentes	ITS America
Bonnie McKeown	Corridor H Alternatives	Michael A. Replogle	Environmental Defense Fund
Patricia V. McLaughlin	Moore Iacofano Goltsman, Inc.	Denise M. Rigney	U.S. Environmental Protection Agency, Region III
Adolfo Mendez	1000 Friends of New Mexico	Elizabeth Riklin	Federal Transportation Administration
Michael D. Meyer	Georgia Institute of Technology	Thomas F. Rossi	Cambridge Systematics Inc.
Gerald K. Miller	Metro Washington Council of Governments	Elliott G. Sander	New York University
Brian Mills	North Cass County Commissioner (Missouri)	Paul D. Schneider	Federal Highway Administration
Michael Mittelholzer	National Association of Home Builders	George W. Schoene	Federal Highway Administration
Melissa Neeley	Texas Department of Transportation	George E. Schoener	Federal Highway Administration
Lance A. Neumann	Cambridge Systematics	Jerry B. Schutz	Washington State Department of Transportation
Mark Norman	Institute of Transportation Engineers	Marcy Schwartz*	CH2M Hill
Robert M. O'Loughlin	Federal Highway Administration	James Scott	Transportation Research Board
Wende A. O'Neill	Bureau of Transportation Statistics	Gerald W. Sears	Virginia Department of Transportation
Janet P. Oakley	American Association of State Highway and Transportation Officials	Peggy M. Shepard	West Harlem Environmental Action
Mario Oropeza*	Houston-Galveston Area Council	Ruby A. Siegel	Systra Consulting, Inc.
Anthony J. Ossi	Federal Transit Administration	Mark E. Simons	U.S. Environmental Protection Agency
Joel Palley	Federal Railroad Administration	Chris H. Sinclair	SAIC
Thomas Palmerlee	Transportation Research Board	Sarah J. Siwek	Sarah J. Siwek & Associates
David A. Pampu	Denver Regional Council of Governments	Frederick C. Skaer	Federal Highway Administration
Neil J. Pedersen	Maryland State Highway Administration	Brian J. Smith	California Department of Transportation
Theresa S. Petko	Michigan Department of Transportation	Miles H. Sonstegaard	University of Arkansas
Susan B. Petty	Federal Highway Administration	Franklin D. Spann	Federal Highway Administration
Roger G. Petzold	Federal Highway Administration	Robert G. Stanley	Cambridge Systematics, Inc.
Henry L. Peyrebrune	Transportation Consultant	Cheryl Stecher	Franklin Hill Group
Susan G. Pikrallidas	American Automobile Association	Lawrence D. Steiger	California Department of Transportation
Alan E. Pisarski	Consultant	Les Sterman	East-West Gateway Coordinating Council
		Robert W. Stout	Federal Transit Administration
		Jennifer S. Straub	Northern Virginia Transportation Commission

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John R. Swanson	Association of Metropolitan Planning Organizations	Montie G. Wade	Texas Transportation Institute
G. Alexander Taft	Wilmington Area Planning Council	Jerome Walcott	Commission on Catholic Community Action
Stacy N. Tate	Federal Highway Administration	Randy W. Walker	Oak Ridge National Laboratory
John V. Thomas	U.S. Environmental Protection Agency	Dwayne E. Weeks	Federal Transit Administration
Dennis L. Tice	Iowa Department of Transportation	Donald H. Wells	Virginia Department of Transportation
Mary Lynn Tischer	Iowa Department of Transportation	John Z. Wetmore	Perils for Pedestrians
	Volpe National Transportation Systems Center	Juanita S. Wiczorek	Dover/Kent County Metropolitan Planning Organization
Angel O. Torres	Environmental Justice Resource Center	William C. Wilkinson	Bicycle Federation of America
David Valenstein	Federal Railroad Administration	Ben E. Williams	Federal Highway Administration
Amy Van Doren	National Transit Institute	Michael A. Williamsen	Illinois Department of Transportation
Amy B. Vanderbilt	National Park Service	Nancy S. Willis	National Neighborhood Coalition
Frank Vespe	Scenic America	Omar K. Wilson	PNC Bank
Martin Wachs	University of California—Berkeley	Robert M. Winick	Motion Maps, LLC

CONFERENCE II—IRVINE, CALIFORNIA

Frances T. Banerjee	City of Los Angeles Department of Transportation	Brian J. Gardner	Federal Highway Administration
John Bosley	Washington Council of Governments	Michelle L. Garland	Surface Transportation Policy Project
Alan T. Bowser	Automobile Club of Southern California	Jonathan L. Gifford	George Mason University
Thomas B. Brigham	Alaska Department of Transportation and Public Facilities	Nathan P. Gilbertson	New York University—ICIS
Katheryn Briscoe	Minnesota Department of Transportation	Charles Goodman	Federal Transit Administration
Deborah A. Buchacz	American Association of State Highway and Transportation Officials	Jacquelyne Grimshaw	Center for Neighborhood Technology
David G. Burwell	Rails-to-Trails Conservancy	Randy Halvorson	Minnesota Department of Transportation
David H. Clawson	American Association of State Highway and Transportation Officials	Howard F. Hancock	Virginia Department of Transportation
Buddy Cunill	Florida Department of Transportation	Michelle D. Hoffman	Maryland State Highway Administration
Robert T. Dunphy	Urban Land Institute	Julie H. Hoover	Parsons Brinckerhoff
Sheldon M. Edner	Federal Highway Administration	Charles E. Howard	Washington State Department of Transportation
Reid H. Ewing	FEHR & Peers Associates	Patricia S. Hu	Oak Ridge National Laboratory
Ronald T. Fisher	Federal Transit Administration	Brigid Hynes-Cherin	BHC Trans
		Thomas J. Kane	Des Moines Area Metropolitan Planning Organization
		Lori G. Kennedy	Kissinger Campo & Associates

Wayne W. Kober	Pennsylvania Department of Transportation	James Scott	Transportation Research Board
David Kuhen	Federal Highway Administration	Steven E. Shaldiver	University of California-Berkeley
Paul Larrousse	Metro Transit	Mark E. Simons	U.S. Environmental Protection Agency
Calvin W. Leggett	North Carolina Department of Transportation	Brian J. Smith	California Department of Transportation
Kristine L. Leiphart	Southern California Association of Governments	Kirk Spang	Trans Imp Plng-North Cheyenne TERO
Kenneth J. Leonard	Wisconsin Department of Transportation	Lawrence D. Steiger	California Department of Transportation
Ysela Llort	Florida Department of Transportation	Kathleen E. Stein	Howard/Stein-Hudson Associates, Inc.
Stephen C. Lockwood	Parsons Brinckerhoff	Les Sterman	East-West Gateway Coordinating Council
Shirley M. Loveless	Transportation Planning Consultant	Darwin Stuart	Chicago Transit Authority
Hani S. Mahmassani	University of Texas-Austin	John R. Swanson	Association of Metropolitan Planning Organizations
Ronald D. McCready	Transportation Research Board	Aileen I. Switzer	Wisconsin Department of Transportation
Deb L. Miller McKinzie	HNTB Corporation	Mary Lynn Tischer	Volpe National Transportation Systems Center
Patricia V. McLaughlin	Moore Iacofano Goltsman, Inc.	Katherine F. Turnbull	Texas Transportation Institute
Michael D. Meyer	Georgia Institute of Technology	Amy L. Van Doren	National Transit Institute
Edward A. Mierzejewski	University of South Florida/Center for Urban Transportation Research	Ellen Vanderslice	Portland Pedestrian Trans Program
Robert B. Noland	U.S. Environmental Protection Agency	Martin Wachs	University of California-Berkeley
Mark Norman	Institute of Transportation Engineers	Randy W. Walker	Oak Ridge National Laboratory
Neil J. Pedersen	Maryland State Highway Administration	Richard A. Weaver	American Public Transportation Association
Roger G. Petzold	Federal Highway Administration	Richard J. Weiland	Weiland Consulting Company
Henry L. Peyrebrune	Transportation Consultant	William C. Wilkinson	Bicycle Federation of America
Steven M. Pickrell	Cambridge Systematics	David G. Williams	Oregon Department of Transportation
Joanne R. Potter	Cambridge Systematics	Nancy S. Willis	National Neighborhood Coalition
Charles L. Purvis	Metropolitan Trans Commission	Omar K. Wilson	PNC Bank
Russell Renaud	Division of Environmental Analysis	Robert M. Winick	Motion Maps, LLC
Preston L. Schiller	Sierra Club	Albert C. Witzig	F.R. Harris, Inc.
Marcy Schwartz	CH2M Hill		