Charting a New Course in Transportation

Transportation Strategic Planning Seminars

John A. Volpe National Transportation Systems Center
Cambridge, Massachusetts

January 1993

U.S. Department of Transportation
Research and Special Programs Administration

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Table of Contents

Background and Introduction

In support of the Department's Strategic Planning effort in the Office of the Secretary, the Transportation Strategic Planning and Analysis staff of the John A. Volpe National Transportation Systems Center conducted a series of eight one-day seminars during the month of December 1991 in Cambridge, Massachusetts, Washington, D.C. and Kansas City, Missouri.

The purpose of these meetings was to update and expand the Department's knowledge and understanding of conditions in the overall transportation environment and recent developments affecting transportation in the United States and internationally. Attendees at the seminars included representatives from major transportation users, providers and suppliers; state and local government agencies such as state Departments of Transportation and Metropolitan Planning Organizations (MPOs); academics and other transportation experts and analysts; and officials from the Volpe Center, the Office of the Secretary and the various Department of Transportation operating administrations.

Four seminars were organized on market areas, and four seminars on cross-cutting themes. For each seminar, participants were sent an "Issue Paper" suggesting topics for the meeting, along with background information and suggested key questions for each of these topics. These Issue Papers were prepared by the Volpe Center staff, solely for the purpose of suggesting important issues which seminar participants might be interested in pursuing during the meeting.

A non-governmental transportation authority served as facilitator for each seminar meeting. The facilitators introduced each session, posed questions, and chose participants to speak. The Department of Transportation is grateful for the helpful and professional service each facilitator rendered in this seminar series. The facilitators were:

Cross-Cutting Issues:

International Competitiveness	Dr. James Ling
Technological Innovations and Human Factors in Transportation	Prof. Thomas Sheridan
Intermodal Passenger and Freight Transfer	Ms. Carol Colman
Energy, Clean Air and Other Environmental Factors	Ms. Nancy Rutledge-Connery

Market Areas:

Freight Transportation	Prof. John Meyer
Urban and Suburban Transportation	Prof. Robert Paaswell
Intercity Passenger Transportation	Prof. Alan Altshuler
Rural Transportation	Mr. Larry Harmon

This publication presents summaries of these eight strategic planning seminar. The "Background" section for each major issue is exerpted from the Issue Paper distributed to attendees prior to the session. The "Seminar Discussion" section for each major issue is a summary of the general flow of the discussion on that major issue and of the thoughts and comments that arose in that session. This report, therefore, does not reflect the policies or positions of the Department of Transportation.

Introduction

If there was a dominant theme at the recent series of seminars hosted by the John A. Volpe National Transportation Systems Center, it was that business, the public and all levels of government face a new world in transportation, one in which quick technological fixes are far less important than innovative ideas and new thinking across the board.

While the United States boasts one of the best transportation systems in the world, a growing set of international and domestic demands challenges the system at every level. Changes in the global marketplace are forcing private companies to squeeze efficiencies out of an aging transportation infrastructure. Meanwhile, federal, state, and local governments must grapple with new ways of doing business themselves: working more effectively across the modes of transportation; creating new mechanisms for coordinated actions and policies; balancing market forces against other goals of good public policy; and finding new ways to work hand-in-hand with the private sector through partnerships and other cooperative efforts.

As one seminar participant put it, the U.S. transportation community needs a whole new vision of the role of transportation in the economy. The old approach to transportation centered on building infrastructure, obtaining funds, and meeting basic safety and other legal and regulatory requirements. Today, the perspective has to encompass providing mobility, service, competitiveness and good management, in addition to addressing public concerns about the environment, energy and accessibility for all Americans. A top-to-bottom revolution in thinking is exactly what may be required. "It's as if we need to take a 'time-out' to take stock of the current situation and problems before jumping in with new solutions," another added.

A new piece of legislation has gained the attention of nearly everyone working for U.S. transportation: the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), signed by the President on December 18, 1991. That law does express a revolution for transportation. It states that "it is the policy of the United States Government to encourage and promote development of a national intermodal transportation system in the United States to move people and goods in an energy-efficient manner, provide the foundation for improved productivity growth, strengthen the Nation's ability to compete in the global economy, and obtain the optimum yield from the Nation's transportation resources."

A new focus on "intermodalism" has the potential not only to improve the "door-to-door" delivery techniques that just-in-time management of inventory has fostered in freight transportation, but also to bring about better passenger services and even a number of social benefits in the areas of reduced traffic congestion, energy usage, and

environmental impact. At the same time, many of the obstacles to greater connections between modes of transportation for both freight and passengers are institutional rather than technical or structural. Rivalries and overlapping responsibilities among public agencies, financial constraints in both the public and private sector, and questions about who should fund intermodal projects can all forestall or delay progress.

The gains in transportation in the 1980s can be traced to initiatives to respond to the promises of increased competition, deregulation and time-based manufacturing; improved cooperation among carriers and modes and between carriers and their customers; increased investment in maintenance and rehabilitation of systems and vehicle fleets; application of information technology; and improved safety, energy efficiency and environmental performance. But much work remains to be done.

Connecting the Modes: The New Priority

Transportation suffers worldwide from the segregation of individual modes, one participant said. And the costs of improved links between modes have been significantly underestimated. So far, the private sector has been leading the way in connecting the modes and taking advantage of the benefits of each mode. Of course, businesses' livelihoods depend upon it. The United Parcel Service (UPS) puts 2,000 trailers daily on railroad flat cars, and "we use all the modes," a company representative said. UPS wants maximum cooperation between the modes in providing service, as well as public policies that permit and encourage that coordination.

For its part, the public sector is also coming around. Port authorities are pursuing better connections between railroads and docks, as well as improved truck access, but such initiatives are expensive, a port authority official stated. There are also efforts to accommodate passengers better by providing more effective access to service and easier transfers between the modes -- mass transit connections to airports, for example.

While redesigning and retrofitting existing infrastructure to add intermodal connections is expensive, better planning in the future could improve interconnectivity from the start. One government contractor cited the possibility of new airports, for example, that might be built on remote sites outside congested population centers. Such facilities might handle more passengers and larger aircraft, like the proposed National Aerospace Plane. They would also have to rely on ground transportation connections to get people to and from the new sites.

At present, however, much remains to be done to connect existing facilities and modes of transportation. To date, freight shippers have been most successful. Their secret: using information and information technology to crack the tough scheduling questions, while employing managers or agents to oversee shipments from point to point.

According to one shipper, the advantage freight shippers have over passengers is that freight shippers not only know the origin and destination, but also can turn over cargo to someone who can take care of arranging and managing every step involved in moving the shipment between the two locations. A business that is shipping freight doesn't necessarily care how a package or container gets to its destination -- as long as it gets there on time at an acceptable price. But passengers make their own transportation decisions, and generally each individual has to take responsibility for arranging and making transfers between the various modes of transportation. Unless they go to a travel agent, individual passengers have no one to provide the same service -- and even travel agents do not cover every link between origin and destination.

Lest public policy experts make the mistake of assuming that better information can solve all the problems in transportation connections, one official cautioned that there are still infrastructure problems that information alone cannot resolve. Even from the standpoint of operations, there is more than one entity involved in an intermodal movement, usually different modes and different public agencies. If additional facilities or structures are needed to provide connections, one public official acknowledged, "We end up focusing on who should pay for an improvement in the system rather than how to best serve the passengers' needs."

Another public official admitted that freight providers are private and often have the flexibility to be more innovative than public sector providers of passenger transportation. Part of that innovation involves working more closely with customers. By doing so, truckers have improved their own internal efficiencies and cut their logistics costs. This, in turn, helps keep down the prices truckers charge their customers. "I'm now timing my drivers and counting packages per hour moved, just like UPS -- which is a model to us all," one manager said.

The U.S. Postal Service straddles the freight and passenger transportation systems. In addition to road and rail, it uses commercial aircraft for moving mail, and these flight schedules are passenger-driven. Thus, an unplanned schedule change can disrupt a ground connection. During holidays mail bags can be kept off a flight so the airline can handle more passengers and their baggage. This gives the Postal Service a special interest in how the modes are connected -- and what alternatives are available at any given moment.

For passengers, convenience seems to be one of the most important measures of successful transportation. For that reason, it is difficult for mass transit to compete with automobiles. The connection between airlines and mass transit systems is an example of this situation. One attorney explained that airport authorities often derive a significant portion of their total profits from car rental agencies and parking lots. Thus, it is not in the airport's interest to help facilitate convenient connections between airlines and mass transit. The result: these connections are not encouraged, and people drive their own cars or rent them at the airport.

And there are other obstacles to better connections through mass transit. The planners talking about building a "maglev" system (a magnetically levitated train) to serve the Orlando airport found they might have difficulty arranging smooth

baggage transfers between the airline, the maglev train and the point of destination for arriving passengers. The reason: they were told they could not alter the three-letter code on airplane baggage to indicate an airport-maglev connection because airport codes are governed by international agreement. And, when they asked about checking bags at the Maglev station rather than inside the airline terminal for departing passengers, airport security said no.

In some passenger services, like Carnival Cruise Ships, bags are checked from the airport to the traveler's room on board. This is accomplished by a "third party" who takes care of both passenger and baggage. Such third parties could be the model for a new type of service in the whole intercity travel market.

In many respects, such services are not simply a matter of convenience. New York City has realized that a more friendly means of getting from one mode to another could benefit its tourism industry. The city has established expedited airport van service from the downtown Manhattan air terminal to the East River Ferry and on to the airport, and is talking about developing a direct "train to the plane" to carry air travelers between downtown and La Guardia and Kennedy airports. Twenty years ago, said one railroad representative, no one expected intermodal third parties to grow. It happened in freight; why not for passengers? He added, "I would pay more as a passenger if it were available."

Another participant pointed out that in Europe it is possible to make a long journey in which every public transportation leg is safe, non-threatening, and has a station-master if one needed help. To achieve the same goal in the U.S., systems designers have to bring the logic of door-to-door service from freight transportation to the passenger side.

While the U.S. may now have superb segments of a good system, it does not yet have a superb system. Overall, whether passenger or freight, there are still problems in connecting the modes. Some participants put the blame on the institutions involved rather than on technical or regulatory barriers. Another contended that there are regulatory and technical barriers, but they could be overcome if there were the institutional will to do so.

Whatever the reason, lack of connectivity can hurt not only domestic business, but also U.S. international competitiveness. For instance, Conrail has ten rail terminals in the New York City area, but none is convenient to the seaport. In contrast, cargo in Halifax, Nova Scotia can go directly from ships to trains, and Halifax is now competing with the Port of New York for ship traffic. Moreover, the Canadian government assisted Halifax in making this competition possible.

The move toward greater intermodal connectivity in the United States seems to be gaining steam. Dade County, Florida, for instance, is planning a multi-modal center outside its airport, which will be connected to the airport via a "People Mover" -- with parking, rental cars, transit and Amtrak all available. A key fact in making this possible: Dade County controls all the places in the intermodal chain.

A transportation official from Massachusetts provided another example -- the South Station rehabilitation project in Boston -- only the chain of command was not nearly so simple as Dade County's. He explained that the project required the involvement of nine

different government agencies, including the Massachusetts Port Authority (Massport). While there were many institutional hurdles to overcome, South Station now links Amtrak, commuter rail, subway, local and commuter bus and taxi services: an impressive feat of integration in a heavily congested city.

Besides institutional hurdles, the other stumbling block involves money -- who is going to pay for a project that connects and benefits more than one participant? The same Boston official recounted that the Massachusetts Bay Transit Authority wanted to move the airport station stop for its Blue Line subway to Logan Airport terminal. Massport liked the idea of an improved subway connection, but wouldn't pay for the move. The state legislature wanted Massport to pay, so they came to an impasse and the subway station is still a 5 to 10 minute bus ride from the airport.

Similarly, a New York/New Jersey Port Authority official cited the Van Wyck Expressway, which is important for access to the New York airports. The state wanted the Port Authority to pay to improve the Expressway, since the airports operated by the Port Authority would be major beneficiaries.

Part of the answer to surmounting institutional and economic barriers lies in the new emphasis on intermodalism in ISTEA. As this area receives more attention and some funding is made available, new answers to old problems may be found. Many of them will involve some form of public-private cooperation, as in the success of vans and limousines serving airports where there are no convenient mass transit connections. In order to succeed, these van and limousine companies have to be given convenient access by the airport -- and that means public-private cooperation.

The Merging of Information and Infrastructure

"I find it depressing that even here in Boston," one regional transportation official remarked, "we have Amtrak, which has the intercity service and also runs our commuter rail service, but you can't call one place for information. If you live in Wellesley [a Boston suburb served by commuter rail], you can't find out how to get to New York City by train and do it on one ticket. Even within the rail mode, where there is the same operator, there's no intermodalism."

This official's complaint represents another aspect of the intermodal challenge: Beyond simply connecting the modes, how do you use information and information technology to make them operate as though the different modes and carriers were one? On the simplest level, there is the issue of making useful information available. For a consumer, one telephone call should ideally be all it takes to get the answer to any question about available transportation, including the physical condition of a highway or schedules and weather at airport, bus and train terminals.

Another participant pointed to Europe, particularly Germany, saying "There's a single book that describes all the public transportation and the schedule for a

given town. They've done that for years and years, and institutionally they know how to support that -- and they have market uses for it." Some suggested that the United States should also have centralized sources for such information.

Participants noted that a lot of work is being done on the design, development and exploitation of an "information infrastructure" made possible by electronic data interchange, or EDI. In essence, this involves overlaying an information infrastructure onto the physical transportation infrastructure, with the goal of enhancing and expanding the availability of safe and reliable transportation operations.

In fact, one participant pointed out that there is a blurring of the boundaries between vehicle and infrastructure in transportation. For example, the so-called "smart cars and smart highways" -- or Intelligent Vehicle Highway Systems (IVHS) -- is being designed to allow smoother traffic flows, reduce collisions, and help people avoid congestion through the use of computers in the vehicles and roadway. In such a system, you can no longer consider separately the driver, the vehicle, and the instrumented highway, since they are all linked to the same information base and are interacting in real time. This implies that the design, development and operation of the infrastructure (traditionally the government's responsibility) and the vehicles (historically produced by the private sector and operated by private individuals or companies) will have to be viewed as an integrated system designed, built and operated cooperatively by both the public and private sectors.

But could such an improvement in transportation capacity and performance lead to more congestion if it encourages freight shippers and passengers to use the transportation system more? One issue in Europe, an industry representative explained, is that just-in-time manufacturing may be forcing inventories out of warehouses and onto the transportation system, especially into trucks, which increases road congestion. Some Europeans predict that the result may be that transportation gridlock will block economic growth. Some participants saw the same thing happening in Tokyo, and predicted that it will happen in the Northeast United States and at some ports, too.

Other participants, however, doubted that the same thing would occur in the United States, especially since travel distances are so much greater and industrial activity is not as concentrated as in Europe. A UPS representative explained how his company has changed its operations and even locations to accommodate just-in-time management. UPS, he said, is building additional warehouses at its hubs to keep vehicles' road time to a minimum. The company also tries to convince manufacturers to locate close to these hubs, further limiting the distances traveled for deliveries. Thus, just-in-time can actually relieve congestion in some instances.

Added an industry analyst, if we resolve our congestion problems before other countries do, that will give us a competitive advantage. In fact, said a university researcher, the U.S. infrastructure is quite good compared to Japan or Europe with a few exceptions, such as high-speed rail. The problem he cited is that the United States tends to invest a lower percent of its Gross Domestic Product (GDP) in infrastructure than our competitors. This investment gap will catch up with us, he added, and could have a detrimental effect on our productivity.

The Market for Data

One of the most common topics raised in these groups was the lack of reliable, up-to-date statistics that are needed for understanding and making decisions in many transportation-related areas. As one regional government representative said, "We are data rich, but information poor."

There is a need to process, analyze, and convert available transportation data into useful information for planners and decision-makers, including shippers, travelers, and operators. In fact, transportation data services could emerge as an important field and become a critical part of an overall information infrastructure in transportation.

One participant suggested that there is a real market niche here that could be exploited using off-the-shelf technology. On-request information on transportation services, including various options, costs, and logistics for point-to-point transportation for people and goods, could be used at all transportation nodes and hubs.

"Frankly," said one industry representative speaking about passenger statistics, "we don't have a database to talk from except as it's reported through the air system. Amtrak doesn't have to report publicly; the bus systems don't have to report publicly -- only air. Until we have data to look at transportation, I don't know how you do the rest of the analysis."

Another official told of a recent effort to try to gather information on passenger travel data bases. They were quite limited, he said, and there wasn't even enough quantitative data to do the analysis his office was attempting. "There is a need for better and more detailed quantitative tools," he added.

City transportation planners also lack the right data. We can count the number of passengers traveling and collect figures on hotel occupancy, one said, but we do not know the cause and effect relationships. This situation seems to apply equally to freight and passenger movement.

One government official cited the example of what he called the "intercity passenger distribution system," which he maintained is too often looked at as separate parts of a whole, as opposed to a unified and coherent system. "Right now, both at the federal level and more so at the state level, when we talk about more flexibility being given to transportation monies available to the states, both levels are going to need tools to help them assess the questions we've been kicking around, and we don't have those tools. We don't have the tools, the mechanisms, the models. We don't have much of a capability for assessing intercity passenger demand or supply and how they interact." He concluded by stating that this area should be a top priority, especially at the national level, "because that's the only way it's going to get started."

Joining the chorus, another participant noted that there is good railroad data on freight traffic, except for transfers to and from railroads at intermodal links, and there is good water-borne freight data. The big gap is truck data, which represents a whopping 80 percent of all U.S. freight traffic. Data on urban commuting, including origin, destination, modes and transfers, is also spotty and out-of-date.

Besides these issues related to traffic volumes and travel patterns, there is also a lack of critical data in the growing field of human factors research -- how people use and interact with transportation -- which is critical to safe as well as comfortable and efficient operation

of all transportation vehicles and systems. "Most of the data that we use in the human factors field is data that was generated during World War II," one scientist remarked. "And since that time, the level of support for the development of this kind of data has declined severely."

When the issue of whether the government should gather such data came up, a reporter asked the scientist why the government should do it and not, say, Ford or Nissan. The scientist's response: this type of data needs to be gathered over the long haul -- the payoff will not come in two to three years, but rather in 10 to 15 years. And that, he maintained, requires a government organization with long-range perspective.

Human factors data from World War II, others pointed out, was generated through the government's military labs. At present, Wright-Paterson Air Force Base has begun a project to pull human factors data together. But, they added, some sort of national interchange of data is what is really needed to identify what we know and what information we need to gather to have a true national database that characterizes our human performance.

"We spend much money on data collection," one public official admitted, "but do we ask the right questions?" There are, of course, plenty of questions, but this official, like other participants, believed that both government and the private sector need to go beyond gathering data for specific, proposed projects, and move toward collecting data on a regular, system-wide basis.

Whether the subject is human factors or travel or infrastructure, there seems to be a demand for cooperation and sharing of data between government and private sector. The only pitfall, one participant pointed out, is the problem of privacy issues in some areas of data collection and exchange.

Private and Public Sector Roles in Transportation

One goal of government policy should be to help public and private sector decision-makers at all levels to make sound, informed choices of where to invest in transportation for the future. ISTEA provides many new opportunities to use surface transportation money and authority in innovative ways, one participant said. If the new ideas work, then we benefit.

A government official pointed out that the federal government does very little planning for projects; the states do most of that. What role should the Federal government play, then? Should it support state and local governments and businesses as the appropriate ones to make investment choices? Should it encourage them to invest? Should it make funds available for alternative options, in order to promote competition? Should it lay out a plan for a new transportation system, as it did with Interstate Highways?

A university researcher had a quick reply to the last question: While the Interstate Highway System was a success, it would be a mistake to copy it again. Rather than adding new pieces to our crumbling infrastructure, we need to do a better job of maintaining and managing what we have.

According to other participants, the new legislation could have some unintended consequences. For instance, said one researcher, how can we develop a national transportation policy when the federal level collects transportation funds and simply hands them out to states and localities? Yet, as a government official pointed out, this is happening at a time when the economy is becoming global.

Joining the fray, an industry representative said, "The NTP [National Transportation Policy] tried to create a 'vision,' which is often lacking in government, but what happened to strategic planning down in the agency? Is there a vision? Hell no! The Japanese show much more vision in their infrastructure investment. The FAA took 3 years to develop an R&D plan and had to be compelled by Congress. They don't know the meaning of strategic planning, and you cannot compete without a vision of competition."

At another session, a participant pointed out that the average tenure of federal and state officials is much shorter than the timetable required for planning, developing and implementing new transportation systems or improvements to the infrastructure. But another participant warned that government should not get into the game of choosing particular transportation systems or technologies or areas of R&D to promote. This kind of government policy can hurt competitiveness and get in the way of achieving the long-term goals, especially for small companies. A premature government decision to favor one technological alternative over another could easily cut short valuable work by companies that are investing in developing other alternatives.

A researcher agreed that there were plenty of bad government subsidy decisions. But, he countered, if we don't make some choices about where to put U.S. investments, we will end up losing. An industry representative made a similar point: "We need a credible industrial policy to support our trade policy. Industrial policy means government support for industrial development, including certain industries." The researcher countered that, rather than industries, the government should tackle the issue directly by choosing specific technologies, and accept the fact that some mistakes will be made along the way. But, he added, this will require political leadership.

"Letting 100 technologies bloom," noted another, "is very expensive. In other countries where there has been government support, they are trying to find alternative ways of supporting technology development than sinking the amounts of money into them that they have in the past. It's going to be harder and harder to let 100 technologies bloom. We're going to have to do a much better assessment of what the promises are along the way."

"Technology is never born full grown," a university representative added. "We have to sit back and have a longer-term vision of things. I can't help but observe when we see a lot of these high-speed rail initiatives at the state level, that the technology that is chosen or the technologies that are competing are invariably foreign-produced technologies."

To the issue of whether or not the United States should let other countries develop technology and then buy it, one participant explained that not all the information and technical understanding comes to you when you buy technology. You lose the benefits of the learning process that comes when you develop technology yourself. Another participant added that once the human capital and knowledge involved in developing technology are lost, they are very hard to regain.

As in other fields, there is a need for improved technology transfer to the transportation sector and within transportation itself -- from government labs to commercial applications, from military transportation systems to civil and commercial products and services, and from mode to mode. An example of the latter would be applying air traffic control and management technologies to surface transportation modes.

As one researcher pointed out, transportation has historically had a large public sector segment, so the real question involves what the government can do better than the private sector without harming the private sector. Added a financial official, the government should be non-interventionist except in areas such as safety and environmental regulations.

One university researcher saw a role for both the private and public sectors. He stated that the government should look at enabling technologies, such as the development of integrated networks and better methods of tracking shipments. To make sure the private sector can play its part, the government should also continue its deregulation policies and stimulate the growth of free trade, while at the same time focusing attention on information and communications technologies.

But a financial representative pointed out that the U.S. government's role can be complicated. If we take service and manufacturing industries separately, the government can intervene to promote technologies that help manufacturing, but how can it best help service industries without resorting to subsidies? The government must decide whether to help one or the other, or both.

A university representative countered that you cannot choose between manufacturing or service sectors. From a technology and industrial policy standpoint, a technology is critical when it affects our ability to develop other technologies and apply them to promote economic growth. This is a more important government goal than efficiency. To the extent that other countries promote these technologies or restrict trade without similar U.S. actions, the United States suffers.

Technology Fixes: Only Part of the Answer

In the session on clean air, energy and the environment, there was wide agreement that government should avoid the temptation of trying to rely on technology fixes alone. Technology may appear to offer a solution in the short term. However, there is generally a need for broad, coordinated mechanisms involving public awareness and federal, state and local cooperation, as well as social, economic or regulatory changes that would help support technical solutions.

One environmental project manager stated, "I think we have to get away from the perspective that technology is going to solve all our problems -- I think that's part of the problem. As we look at transportation issues, too many of them are being assumed away by the advent of new and improved technology, like compliance with the Clean Air Act."

This manager pointed to examples like the "California car" and reformulated fuels, proposed as means of attaining clean air goals. These alone, he added, are not going to accomplish what we want in terms of air quality for the future. "I think there has to be a comprehensive look at behavior, incentives and disincentives, and at something other than technological fixes for transportation problems." A regional transit manager agreed. "It's kind of the old thing," he said. "We've got some technology that's a solution; now let's go find a problem that it will solve."

Other times, technology is not to blame -- bad policy is. One transit chief said, "We're building rail in Los Angeles. Professionals don't think L.A. is the best place to put rail, yet the politics and policy at the city planning commission sort of fueled this project . . . the glamour of building rail. We wanted to be a big name city. We were the only big name city that didn't have rail; therefore, I think it kind of justified itself . . . In the bigger picture, it wasn't a solution to meet a transportation problem. It was an issue of image."

Proposals to invest in new technology should come out of solid research and analysis. And policy must take into account not only the glamorous, cutting edge technology, but also the smaller-scale incremental improvements that might be all that is needed in some areas. A university representative stated, "There's no question that there is a pool of technology that can be tapped to address these transportation problems. By and large, I would argue that these would result in useful marginal improvements in the current transportation system." But, he continued, "at the same time, we can do a lot to improve present technology. We don't seem to emphasize very much, as in the Japanese model, for example, continuous incremental improvements in the systems we already have. That is something we should emphasize, not to mention some of the longer-term, riskier, breakthrough, high-tech solutions."

He, like others, stated that there have to be institutional mechanisms designed to nourish technological innovations not in isolation, but within the broader context -- what the country needs, what else is happening to society and the economy, and how all the other factors come together in transportation.

International Playing Field

The international market is getting more and more important for transportation and the whole U.S. economy. The U.S. approach has been to try to open foreign markets to U.S. companies and to achieve a "level playing field" in terms of government trade barriers and subsidies. As one researcher noted, there's a new definition of "level playing field": "If they carry a big stick, we will, too." In other words, if other countries are going to use subsidies and tariff barriers and other policies that promote their industries and businesses, then the United States may have to take a more aggressive stand in order to defend U.S. interests. It was the combination of business interests and Congress that forced the administration to take up some sticks over the past few years.

Another university representative suggested that maybe the United States should not promote the spread of better transportation methods overseas, like UPS and Federal Express expanding in Europe. Why contribute to the efficiency of our competitors, he asked. The first researcher answered that the basic logic for international trade is that everybody benefits from improvements in efficiency, in the same way that we have benefitted when foreign trading partners have bought computers (often U.S.-made) to manage their businesses. He added that neither the U.S. nor foreign governments have clean hands regarding "level playing fields". For instance, Airbus claims that as a European company trying to sell its aircraft in the United States, it is facing a market dominated by two established U.S. manufacturers. In addition, the U.S. does not allow foreign airlines to buy surplus gates as U.S. airports and compete with U.S. airlines.

Another participant pointed out that the sheer size of the U.S. air travel market is an engine of liberalization in world aviation. Foreign airlines want so much to serve that huge U.S. market that we have great leverage to convince other countries to open up their markets. One industry representative warned that we should not be misled by Europe's talk of market "liberalization": the European market is not as "liberal" as we might think, especially when it comes to protecting their airlines. He added that U.S. aviation developed with close ties between aircraft builders and airlines, whereas the European system revolves around ties between those groups and government. This actually gave U.S. aircraft builders an advantage in being able to understand and serve their customers' needs; however, the Europeans may be learning to do the same.

Many industries see themselves as international companies, and they can be hurt when the U.S. government takes bilateral positions that constrain the growth of an efficient worldwide transportation system, explained one industry official. A government official, however, saw things differently: the government uses different combinations of bilateral and multilateral approaches, depending upon the case. For example, European Community (EC) negotiators are sometimes less flexible than individual country negotiators and thus progress in an EC forum is often slower and harder than in a bilateral forum. On the other hand, EC bureaucrats can often be more "liberal" than the separate national governments.

Competitiveness and National Security

One of the major single users of the nation's freight transportation assets is the Department of Defense. Desert Storm highlighted some of the shortfalls in airlift and sealift, and it brought into question legislation that dates back to World War I and World War II. Many of the laws on the books covering maritime transportation were designed to ensure that the Defense Department would have adequate transport in a crisis or war.

One example is the Jones Act, which prohibits non-U.S. flag carriers from carrying cargo between U.S. ports. One recent report estimates that the Jones Act may cost the United States $4 to $10 billion each year for the sake of enabling U.S. shippers to earn an extra $600 million in annual profits. Some participants thought modifications to the Act were long overdue. Others were just as adamant that we should keep some U.S. flag ships.

One distributor argued that the commercial sector should not be forced to support national security requirements by paying more to ship cargos on U.S. ships, which generally have higher costs. An industry representative, however, disagreed, saying that a lack of sufficient U.S. flag ships "may hurt the U.S. in war time. We should keep some U.S. flag ships." A Department of Defense official added, "The Defense Department needs flexibility to respond to presidential decisions. We are heavily dependent on commercial assets. Will they be available if they are under non-U.S. flags?" At a time when the United States is reducing the level of its military forces stationed overseas, this official suggested that national security needs may mean an even greater reliance on private sector shipping in the future.

There was a time when national security concerns eclipsed commercial considerations. Today, however, international competitiveness and modal efficiency are just as important, if not more so.

Transportation Disadvantaged: Will They Slip Through the Cracks?

Many people with disabilities, as well as poor and elderly residents who cannot themselves drive, do not have the same mobility as other people. The Americans with Disabilities Act (ADA) has added many new guarantees of accessibility. In addition to access for wheelchair travelers that most modern transit systems provide, the new law calls for other requirements, such as vision and hearing adaptations. As one transportation official stated, the Act will cost older transit systems "megabucks" and affect their operations. He suggested that we will have to come to grips with how to balance accessibility against costs in transit. And the law applies not just to bus and rail transit, but also intercity trains and buses, stations and other facilities.

What is not often realized is that many of the elderly people the ADA was designed to help live beyond the reach of the public transportation system. In fact, there is a whole group that is encompassed by the term "transportation disadvantaged."

One regional transportation official explained that rural areas typically have proportionally more elderly and poor people than do urban areas, which increases the demand for rural transportation services. If these areas are not adequately served by transportation, then rural populations could end up moving to cities, which would only add to urban congestion.

Another regional transportation official stated that "in many of the social service programs, funding for transportation has been cut. Dollars have been shifted to other parts of the budget for the aging. As a result, there is a greater number of poor users placing demand on the system." In effect, the official added, "'dumping' of formerly state-financed individuals, who are no longer subsidized, onto the transportation system, is occurring." The bottom line: when social service agencies pull their funding away from transportation, the elderly lose mobility. Unless these changing conditions are addressed, some participants suggested, the transportation disadvantaged may indeed slip through the cracks.

"In the past three years," said a representative from Greyhound, "there has been a reduction in bus service from 22,000 points to 8,000 points nationwide. It is difficult to get a handle on demand for intercity bus service because it serves the most transportation disadvantaged, and that is not a vocal constituency. If bus is to play a continuing role, it will need public support in the future."

A regional transportation planner added, "In Kansas, there has been a decline in Greyhound bus service. Sometimes the demand is not there to support lines. But by that same token, the demand will not be present if the service is not good. If the only time that the bus stops in a town is at one o'clock in the morning, the demand is not going to be very great." In fact, he continued, the demand could increase if the service were better.

Native Americans represent another group that has special problems due to the remote locations of reservations. One Native American transportation official explained that people must travel 30 to 40 miles to get basic supplies and staples. "The Navajo Nation does not own any of its roads," he said. "They are owned either by the Bureau of Indian Affairs (BIA) or the state or federal governments. The BIA is now charged with assisting the Navajo in managing their transportation." To illustrate the problem, he cited one example. On the reservation, he noted there are only 2,250 miles of paved roads. Another 5,900 miles are dirt roads. And, when it comes to connectivity, there are no interstates on the reservation.

Overall, when it comes to rural areas, a number of trends have placed very different demands on the transportation system. Since 1960, for instance, off-farm income has accounted for 40 to 55 percent of the net incomes of farm households. Rural economic development has also placed a premium on the ability to ship and receive products and raw materials. And then there is the aging population and other groups with special transportation requirements, like Native Americans.

Transportation and the Environment: A Constructive Relationship?

One message that came out of a session on environmental issues is that environmental requirements aren't always the enemy of the transportation industry. In fact, one industry official pointed out that being a safe and environmentally responsible corporate citizen can actually pay dividends, because many users choose products or services for these reasons. He noted that we can export these advantages as well. An airline representative added that the big airlines are buying cleaner and quieter aircraft, which are better environmentally and will also boost their efficiency and competitiveness.

On the other hand, a number of participants expressed frustration at the way laws prescribe exactly how to achieve environmental goals, rather than allowing industry to find the best and most cost-effective ways to get to these goals. For instance, one trucking executive claimed that while technology is helping the trucking industry in clean air, the real polluters are the cars, not trucks. "Our engines are more fuel-efficient and have cleaner exhausts than ever, but please let us keep making diesel engines cleaner rather than forcing us to use methanol/ethanol fuels, which are much less efficient. Let us choose which technology to use."

Current laws can actually stifle innovation and yield simplistic or politically popular "solutions" that are less effective and more expensive than other approaches would have been, one participant noted. They can also lead to a focus on quick technological "fixes" intended to avoid the difficulties of institutional or behavioral change. He pointed to seeking still cleaner automobile engines and requiring double-hulled tankers as measures that are relatively ineffective and excessively expensive.

Fair and responsible application of environmental laws was also an issue. One maritime director complained, "There is too much unfair use of environmental concerns to stop legitimate infrastructure projects. We need to show the direct links between specific actions and the specific costs associated with them. Are regulations really cost effective? Are we educating the public accurately about the real costs of each environmental regulation? Will we stay internationally competitive with these restrictions?"

Costs also come into play when looking at the transportation market itself and its effect on the environment. One participant argued that, when environmental effects are taken into account, the automobile is grossly underpriced while transit is grossly undervalued. "Are markets offering what people want or are people just accepting what is available?" he added. "People just won't accept transportation being priced at its true cost -- but maybe this would be more acceptable if they trusted more how it will be managed and what it will be used for."

In another session, participants addressed the link between new transportation technologies and the environment. For example, in Intelligent Vehicle Highway Systems, where does clean air come into the picture? Will more cars moving more efficiently, by using information, lead to more traffic and more pollution? One participant answered that clean vehicles and clean fuels are needed in conjunction with IVHS.

Beyond the technology issues and the costs of doing business, some said that when it comes right down to it, we still have to consider behavioral changes in conjunction with all of the efforts to clean up the

environment. And that will involve new ways of doing business, not just in the private sector, but in the government and in every community and household as well.

New Thinking: Transportation Moving Toward the Next Century

From all the discussion and debate, one thing became very clear by the end of the sessions: the changes taking place in the transportation arena are challenging much of the way we have looked at transportation issues in the past. Success in the future will depend on how effectively the United States adapts to many new realities.

No single factor such as transportation determines a nation's competitiveness. If we can't export steel any more, why not export UPS and Federal Express? The U.S. economy is changing, and so must our mix of competitive goods and services. Our primary goal should be to promote long-term U.S. economic growth.

Other areas demand new thinking as well. Some participants urged the Department of Transportation to define "telecommuting" and its associated technologies as another mode of transportation. Not surprisingly, this movement may be starting on the West Coast. "I know for a fact in California," one journalist stated, "telecommuting is perceived as part of the mission of the highways. It might be an interesting thing for the federal government, when it talks about transportation policy, to raise the question of whether telecommuting and helping states and large companies, particularly in suburb-to-suburb commuting, is a priority."

An industry representative added that there is a telecommuting project in at least one university she advises. And Congress, in the recent transportation legislation, has mandated that the Department of Transportation study telecommuting. One regional transportation administrator also pointed out that 22 million out of 120 million workers are working at least part-time at home. The projections for the year 2000 suggest that the number will climb to 30 million workers who are telecommuting -- "and that's not only people in their homes but also corporations providing office centers in residential areas." One scientist cautioned, however, that the technology for telecommuting may not be "quite there" yet. He suggested that, as was the case with personal computers, only after "ease of use" is achieved will large numbers of people "convert."

The way we look at technology itself is also part of the new thinking that seems to be catching on. Rather than the "quick fixes" and the issue of picking technological winners and losers, some participants pointed to a concept they called "technological readiness." In essence, one project director described this as "technology timing, the readiness of the technology to move in and be applied and do some good rather than having to go through a testing phase." In addition to this issue of readiness, she added that two other

aspects are important for the timing to be right for a new technology. First, the technology must be attractive from the demand side; the emphasis must not be just on the supply side. And second, money must be available.

An industry representative added that we have to focus on the building blocks of technology as well. "You don't just walk up and say, 'Here's a maglev system and I'm promoting a maglev system.' There are many building blocks contributing to that technology." She added that frequently technology is oversold in a "finished systems" sense as opposed to "undersold in development of the building block technologies that contribute to that system." This, she said, was the greatest flaw in our approach to transportation technology today.

On the money issue, one government official noted that for political reasons, technology is often sold "as something that's ready to go out the door tomorrow." He contended that so-called technology winners are picked too early, because they need wide visibility and identification in order to get the money needed to move forward. But, he explained, such decisions then limit our ability to shift over to a more effective technology if the "winner" doesn't pan out.

The way government does business in transportation has also changed. Recent legislation has transferred much transportation decision-making from the federal to the regional, state, and local levels to enable more flexible allocation of resources. At the same time, the "bottom-up" community demands for new and efficient transportation systems and infrastructure must still be balanced against "top-down" guidance from government. For instance, if the proposed high-speed rail and Maglev technologies are to be integrated into the national transportation network, there must be national coordination and consistent designs, with common safety and performance standards.

There are other technologies and other factors involved as well. As one participant put it so aptly, "I've been doing a diagram of all the factors that impact an efficient transportation system, both domestically and internationally as a way of supporting U.S. economic development. . . . I've got one box for efficiency and nearly a dozen things that detract from achieving that objective, things like safety regulations, environmental regulations, security regulations, economic regulations, politics and diplomacy, competition policy, standards, equity and fair play. This would be an academic modeler's delight -- or perhaps nightmare."

We do not yet fully understand how these forces work together, or how much they may work against each other. Transportation is indeed complicated. Transportation is part of every life, every industry and business. And in the future, transportation will live up to its definition -- it will certainly be dynamic, exciting and challenging -- surely a bold new world.

List of Acronyms

ADA	Americans with Disabilities Act
ADP	Automated Data Processing
APC	American Presidents Company
ATC	Air Traffic Control
ATFI	Automated Tariff Filing and Information
BAT	Best Available Technology
BIA	Bureau of Indian Affairs
BPT	Best Possible Technology
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CAFE	Corporate Average Fuel Economy
CNS	Communications, Navigation and Surveillance
CRAF	Civil Reserve Air Fleet
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
EC	European Community
EDI	Electronic Data Interchange
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GAO	General Accounting Office
GATT	General Agreement on Tariffs and Trade
GIS	Geographic Information System
GDP	Gross Domestic Product
GNP	Gross National Product
GPS	Global Positioning System
HAZMAT	Hazardous Material
HHS	Department of Health and Human Services
HOV	High Occupancy Vehicle

ISTEA	Intermodal Surface Transportation Efficiency Act
IVHS	Intelligent Vehicle Highway System
JIT	Just-In-Time
MAGLEV	Magnetic Levitation
MARAD	Maritime Administration
MPO	Metropolitan Planning Organization
NASA	National Aeronautics and Space Administration
NHTSA	National Highway Traffic Safety Administration
NTP	National Transportation Policy
PRT	Personal Rapid Transit
RDT&E	Research, Development, Test and Evaluation
R&D	Research & Development
RSPA	Research and Special Programs Administration
RTAP	Rural Transportation Assistance Program
TGV	Train a Grande Vitesse
T&L	Transportation and Logistics
UMTA	Urban Mass Transportation Administration
UPS	United Parcel Service
UTC	University Transportation Centers
VMT	Vehicle Miles Travelled
VNTSC	Volpe National Transportation Systems Center

Chapter 1: Transportation and International Competitiveness

Introduction

There has been increasing public concern expressed in recent years about the competitiveness of U.S. industry and the American economy as a whole within the world's economic and trading systems. This concern has been reinforced by such factors as the substantial trade and balance of payments deficits during the 1980s, the recent economic recession, and the perceived loss of manufacturing jobs in several sectors - from textiles and clothing to steel and automobiles - as a consequence of mounting foreign imports. There is also a parallel debate among economists over the specific contribution of the U.S. transportation system, and especially the state of the physical infrastructure, to this apparent loss of competitiveness. Further, there is concern among the U.S. providers of transportation equipment and services, such as the commercial aircraft industry and ocean shipping companies, over the long-term health of their enterprises in the face of apparent subsidies directed by non-U.S. governments to competing foreign companies.

In response to these issues, the Volpe National Transportation Systems Center hosted a seminar on the topic of "Transportation and International Competitiveness" in Cambridge, MA on December 2, 1991. Attendees included representatives from major U.S. manufacturing and export companies in transportation and other fields, state trade promotion agencies, the World Bank, academic experts, and the Departments of Commerce and Transportation.

Topics suggested for discussion at the seminar included: the impact of global economic competition on U.S. industry, the globalization of the transportation sector, the impact of international trading blocs, the state of the U.S. transportation infrastructure and its relation to competitiveness, and the role of various levels of government in promoting the competitiveness of U.S. industry. Specific observations and common themes raised in the discussion are summarized below.

The views that follow in the "Seminar Discussion" sections were expressed by individual participants in the course of the discussion, and do not necessarily reflect the policies or positions of the Department of Transportation.

MAJOR ISSUE

Global Economic Competition

Background

Improvements in transportation and telecommunications have played a crucial role in integrating the world economy over the past several decades, thus paving the way for the globalization of industry and intensifying international competitiveness. In the new global marketplace, with the increasing adoption of just-in-time (JIT) manufacturing practices by many firms to reduce inventory costs and improve overall producivity, greater emphasis is being placed on timeliness, quality and reliability in the delivery of goods and services. In order for U.S. industries to become more competitive internationally in this environment, they must be able to rely on a high-quality transportation system that is efficient, safe, reliable, quick and flexible.

In response to these pressures, providers of transportation services have to undergo revolutionary changes to meet the changing logistical and transportation needs of industrial as well as service firms worldwide. In this context, intermodal developments have become increasingly crucial to the smooth functioning of industries in a competitive worldwide economy. For example, railroads have had to tailor their services to meet the changing needs of the individual manufacturers and suppliers. They have begun to join forces with trucking firms to gain greater flexibility and door-to-door delivery capability. Ship-to-rail intermodal

exchange of cargo has also been a central issue on the agenda of all major U.S. ports for many years. It is well recognized that efficient linkage of the two modes of transportation, the ocean vessel and linehaul rail, is a critical competitive factor. Transportation service providers have also increasingly applied the benefits of automation to their operations, in order to reduce costs and improve service quality. Such innovations as global satellite tracking and location, automated inventories and cargo management systems, and paperless transactions are all expanding rapidly among these firms.

Key questions include:

- *What are the strengths and weaknesses of the U.S. transportation system in the international marketplace?*
- *Are there any obstacles to further developments of this system that would help enhance U.S. competitiveness?*
- *What are the opportunities for joint public/private action to improve the U.S. transportation system and help strengthen U.S. international competitiveness?*

Seminar Discussion

The U.S. is now firmly entwined in a highly competitive global economy, and governmental policies on domestic and international issues can no longer be divorced from each other. It was suggested that transportation 'competitiveness' has five components which embrace

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both domestic and international perspectives:

1. the efficiency of the domestic U.S. transportation system;
2. the competitiveness of U.S. carriers in international markets;
3. the competitiveness of U.S. transportation equipment manufacturers in international markets;
4. the competitiveness of U.S. consulting, engineering and construction companies in international markets; and
5. the strength and competitiveness of the technology sector of the U.S. economy.

Aircraft Assembly Line - Courtesy: Boeing Commercial Aircraft

As can be expected, different observers assign different relative values to these components. One reason for these different opinions is that there is no universally accepted definition or measure for evaluating a nation's 'competitiveness.' Candidates suggested at the meeting included: economic growth, promoting the growth of high technology, market share, quality of life, standard of living and customer satisfaction.

There are incidental benefits from developing technologies within the U.S. that are not transferred to us when we buy high-technology products from non-U.S. sources. These include promoting a more skilled domestic human capital base and being able to apply these technologies to other parts of the U.S. economy. For example, an industrial representative described how that company was developing its own test facilities in a key area, even though current European facilities were the best in the world, in order to retain within that company the key knowledge and skills base in this process. The company management feared that, once abandoned, these skills would never be regained and the company would become permanently dependent on non-U.S. sources for this service.

U.S. aerospace representatives were very worried that direct foreign government subsidies and support for their competitors would, in the long term, damage U.S. competitiveness. As a result, they strongly favored much more active U.S. government support for the U.S. aerospace industry.

MAJOR ISSUE

Globalization of Transportation Industries

Background

Globalization of industrial competition also encompasses the globalization of competition within the transportation industry itself. A case in point is the airline industry. There currently exists considerable excess capacity in the industry worldwide, which is one reason that combined airline losses approached $2.7 billion on international services alone in 1990.

The industry is already undergoing significant consolidation. This includes a rapid growth in strategic alliances and part ownership arrangements among airlines from various nations. Meanwhile, major new policy issues and questions are emerging. These include, for example, the acquisition of certain U.S. airlines by foreign airlines, reciprocal international landing and takeoff arrangements involving domestic and foreign airlines, interconnection rights, and the ability to post ticket agents and baggage handlers at local airports.

In this context, disagreements have arisen concerning the growing presence of U.S. airlines in Europe. One issue is the acquisition of the Heathrow services (i.e., its takeoff and landing "slots") of Pan Am (by American Airlines) and TWA (by United Airlines). Similar issues are likely to arise in the future as foreign-owned airlines may seek to acquire certain U.S. airlines or may simply want greater access to the internal U.S. market.

Key questions include:

- *What are the advantages and disadvantages for the U.S. of this trend towards consolidation?*
- *What principles and policy guidelines should govern future attempts by foreign companies to acquire U.S.-owned transportation companies?*
- *Are there any changes in U.S. antitrust laws and other regulations that should be considered in order to provide U.S. industry with the flexibility to enter into various agreements or partnerships to retain and enhance its international competitiveness?*
- *In what other respects can government assist in ensuring the health and competitiveness of the U.S. transportation industry?*

Seminar Discussion

Several participants suggested that improvements in other countries' transportation infrastructure may lead them to be more competitive *vis a vis* U.S. industry. However, the general consensus was that many U.S. companies are well positioned to exploit improvements in foreign transportation systems. Therefore, the U.S. had an interest in promoting such transportation improvements anywhere in the world, both for the general benefits they bring and because competitive U.S. firms, many of which are multinational themselves, can take advantage of these improvements and thus increase their market share and revenues.

Many of the recent transportation-related gains by U.S. industry are due to improvements in such fields as logistics and internal organization and procedures. Increasingly, transportation is becoming fully integrated into the production process and service companies are becoming 'total logistics providers' by vertically integrating. Thus, the U.S. transportation industry is now extremely competitive compared to the rest of the world.

One company's internal analysis suggested that 40% of its cost savings in shipping are from transportation cost reductions, and 60% are from improved internal efficiencies in the logistics system. For example, only one part-time person is now needed to purchase truck services, compared to eighteen full-time personnel in 1980.

MAJOR ISSUE

International Trading Blocs

Background

The 12-member European Community is well on its way toward becoming a large, free trade bloc with a population of 325 million people. The North American free trade zone of the United States, Canada and Mexico will also most likely become a reality very soon. Meanwhile, it is speculated that Japan will create a similar regional economic grouping in East Asia which will rival these European and North American free trade zones.

However, there is growing concern that just when fundamental economic and technological forces have been ushering in a new era of global economic integration, these and perhaps other regional economic blocs may instead lead to widespread protectionism, building walls around larger economic units which have the effect of fencing out the rest of the world. Such a development in the future would have far-reaching implications for international transportation.

The types of international conflicts and policy issues that may emerge once such large trading blocs become established are illustrated by the recent complaint by Airbus Industrie to the European Commission that British Airways has breached the European Community's competition rules by buying American-made Boeing 777 airliners with General Electric engines, instead of Airbuses. The Airbus complaint alleges that British Airways collaborated with Boeing and General Electric to win special discounts and preferential terms. British Airways, however, counters by stating that the order was awarded purely on commercial merit.

Key questions include:

- *What are the implications of the emergence of large trading blocs for the transportation sector?*
- *What are some of the major transportation-related international policy issues that are likely to arise?*
- *What types of international mechanisms might be best to deal with these issues?*

Seminar Discussion

In response to other nations' policies, some participants believed that the U.S. general goal could be to promote freer world trade even though some U.S. interests will be hurt in the short term. In pursuing this goal, it was suggested that the U.S. use retaliatory measures and threats to open overseas markets to the U.S. and further guarantee a 'level playing field'. It was recommended that the U.S. government focus on the issue of 'fair play' in the international market, and begin to promote economic growth through positive policies, rather than having primarily a regulatory emphasis.

An important contradiction was suggested: as domestic transportation manufacturers and providers improve their products and cut transportation and logistics costs, they are still facing greater international competition due to external factors, such as foreign government subsidies for competing goods and services. This is compounded by the U.S. inability to respond to rapid world changes with coherent macroeconomic, trade and transportation policies.

It was noted that it is difficult for the U.S. government to formulate a uniform trade or industrial policy

due to the conflicting interests among various U.S. sectors and interest groups, and the open nature of our society. For example, many U.S. cities and tourism promoters favor less civil air regulations, but airlines see such actions as a threat to their current market shares. Yet since other countries are pursuing such policies, it was suggested that the U.S. develop an effective response. In this context, participants applauded the DOT for taking strong action recently to give U.S. ocean carriers more access to East Asian seaports by threatening retaliation, and recommended that this approach be expanded to the general benefit of U.S. companies.

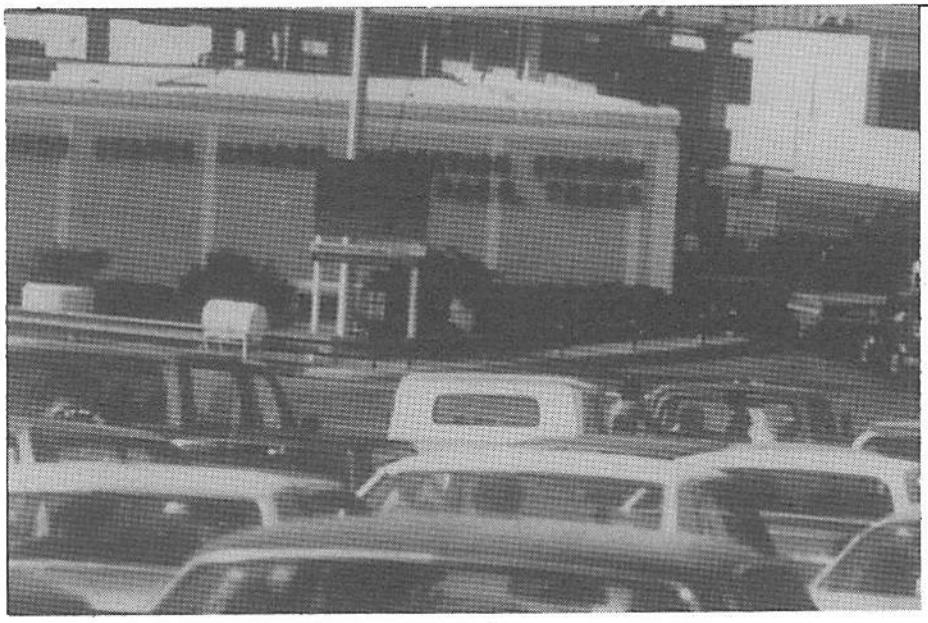
U.S. trade negotiators use a mix of bilateral and multilateral tools, and participants agreed that this practice should continue. The Department of Transportation (DOT) is increasingly adopting the bilateral approach because of frustration in multilateral fora such as the General Agreement on Tariffs and Trade (GATT). One senior official is said to have commented recently that multilateral meetings tend to lead to results that reflect the 'least common denominator.' In addition, the sheer size of the U.S. market gives us greater leverage in bilateral talks, especially in airline negotiations.

There are, however, short-term disadvantages to using bilateral tools, even if they lead to long-term advantages. Several participants warned that bilateral negotiations can reduce trade in the short term by restricting the movement of goods (through tariffs and quotas) and constraining the development of more efficient worldwide transportation connections.

Concern was also expressed that the U.S. government was not sufficiently active in negotiating international safety and environmental standards. As a result, U.S. industry interests may not be sufficiently reflected in the results, which could compel U.S. exporters to adopt new and more costly procedures based on other nations' regulatory concepts.

Because of the importance of these considerations to U.S. industry, there was general support for a significant increase in DOT international activities, in order to support U.S. transportation-related industries to compete more effectively in the world market. These industries include both the manufacturers of transportation equipment (aerospace, automobiles) and the providers of transportation services (airlines, shipping).

An ironic observation was made that U.S. competitiveness may slip further as other nations adopt our 'enlightened' deregulation policies. The U.S. is also 'exporting' its efficiency gains as companies such as UPS expand to non-U.S. markets and form alliances with non-U.S. companies. Thus, U.S. industry needs to look at such areas as infrastructure improvements and operations and management techniques for further productivity improvements.



El Paso Border Crossing - Courtesy: U.S. Customs Service

MAJOR ISSUE

State of the Infrastructure

Background

There is a general notion that the existing U.S. transportation infrastructure is in need of major renovations in order to meet acceptable service levels. It has been pointed out that investment in rehabilitation and maintenance has lagged over several decades. The proportion of the gross national product (GNP) the U.S. invests in basic infrastructure has been lower than that of several of our major international competitors. One recent estimate suggests that about 1/3 of the non-Interstate arterials are believed to be deteriorated or deteriorating. Nearly 1/2 of all bridges are considered structurally deficient or functionally obsolete. The maintenance backlog of many large city transit systems is considered to have reached a near crisis point.

This situation becomes particularly striking when viewed against the backdrop of the recent debate on the importance of transportation infrastructure investment to the nation's productivity performance, economic growth and competitiveness. Central to this debate has been the argument that there is a strong link between national investment in public capital stock, such as highways and bridges, and national productivity performance. These observations have elicited considerable skepticism from some professional economists.

There is also evidence that this situation has begun to turn around recently, and that investment in infrastructure is beginning to increase. Nevertheless, a number of basic issues and questions on the relationship between basic infrastructure and economic performance remain.

Key questions include:

- *What types of infrastructure investments are important for international competitiveness?*
- *What should be the priorities and how should they be established?*
- *Who should make the needed investments?*
- *What specific examples can be cited to illustrate the linkage between infrastructure investment and international competitiveness?*

Seminar Discussion

In general, the U.S. transportation system is good; yet many view our economic performance as lagging behind our major competitors. The reasons for this contradiction deserve some thought. The ongoing debate among economists on the relationship between infrastructure investment and economic productivity and growth was discussed. Even though the U.S. infrastructure is quite good compared to other countries (with a few notable exceptions such as high-speed rail), the U.S. invests a lower percentage of GDP in infrastructure than do our major competitors. General support was expressed for increased infrastructure funding, but each project should still be assessed on its own merits and not approved simply because of the generally low level of infrastructure funding.

There was general consensus that other developed countries suffered even more from transportation inefficiencies and congestion than did the U.S. In both Japan and Western Europe, for example, JIT was perceived as adding more trucks to the road network at a high social and economic cost.

MAJOR ISSUE

The Role of Government

Background

Other industrialized countries have vigorously pursued industrial policies, through heavy subsidies of various technology initiatives, to enhance their global competitiveness. This has been particularly evident in the case of transportation technologies. In contrast, the U.S. government generally does not fund the development of civilian technologies. U.S. support for science and technology has been traditionally limited to funding basic research, as well as carefully selected advanced research and development (R&D) activities of various mission agencies such as defense, space and health. More recently, however, a shift appears to have taken place in the government's role in the area of civilian technologies, away from "precompetitive" or "generic" technologies to encompass "enabling" technologies. There is currently considerable debate on the proper role of government in developing civilian technologies.

Two major examples of major public support for transportation technologies overseas are Airbus Industrie in Europe and the Intelligent Vehicle Highway Systems (IVHS) programs in both Europe and Japan. In these cases, major overseas competitors have much more actively pursued creating a comparative advantage in transportation-related, high-technology areas while the United States held back, partly to debate the role that the government should play. Similar situations also exist in other areas of transportation, including high-speed rail, commercial space, and innovative automotive production technology.

Airbus: The dominant position of the United States in civilian aircraft technology has been successfully challenged by Airbus Industrie, a consortium of British, French, German and Spanish aerospace companies created in 1970. After many years and the infusion of about $10 billion of public investment, by 1987 Airbus had delivered $21.9 billion worth of commercial aircraft and had a backlog of $12 billion in orders. A main conclusion of a recent study of the U.S. civilian aircraft industry by the MIT Commission on Industrial Productivity was that both Boeing and McDonnell Douglas, the two remaining and still worldwide dominant U.S. aircraft producers, now face serious foreign competition in a dramatically changed market environment that has reduced their technological edge.

For many years, there has been a simmering conflict between the United States and the European Community over aerospace subsidies, focusing directly on Airbus Industrie. The U.S. government has recently intensified its charges that the Airbus consortium receives unfair support from the respective governments backing it and that this poses a significant long-term threat to U.S. competitiveness in the civilian aircraft industry.

IVHS: In the area of IVHS, the United States is a relative latecomer. European countries and Japan have already embarked upon major programs in this area. The major European initiatives include DRIVE (a $130 million effort over five years) and PROMETHEUS (close to $800 million over eight years). In addition, a number of other projects have been launched under the EC's EUREKA initiative. Meanwhile, in Japan, two major

IVHS projects have recently been brought together under the Vehicle Information Communication System (VICS) program.

Summary of Major Points:

Transportation and International Competitiveness

- The U.S. is firmly entwined in a highly competitive global economy, and transportation is a major factor in the nation's economic success.
- There is no general agreement on how to define and evaluate U.S. 'competitiveness' economic strength' and 'national interests' in this area. Candidates include: overall economic growth, high-technology growth, market share, quality of life, standard of living, and customer satisfaction.
- Several of the nation's major competitors offer significantly higher levels of public support to their companies than does the U.S. government. However, there is no consensus on how the government can best respond to this challenge and promote U.S. competitiveness in transportation. Suggestions range from increased privatization and deregulation to a formal 'industrial policy' offering government support for certain key technologies and industries.
- The U.S. transportation system in general is among the world's best, although some areas need attention. The U.S. in recent years has been investing proportionately less in infrastructure than our competitors.
- Many U.S. companies are highly successful in world markets and, in fact, are ahead of overseas competitors in innovations such as package delivery. To continue to succeed in global markets, they need effective transportation here and overseas, as well as access to markets. Thus, it may be in the U.S. interest to encourage transportation improvements anywhere in the world, along with continued expansion of free trade.
- Increased attention to international activities by the Department of Transportation, such as in trade negotiations, research and technology, could improve the ability of U.S. transportation industries to compete in the world market.

By contrast, until quite recently U.S. efforts have been relatively low-scale and quite dispersed (e.g., Santa Monica Freeway Smart Corridor Demonstration Project, PATH, HELP, TRAVTEK, GUIDESTAR). However, IVHS has recently been made an integral part of national transportation policy and a substantially enlarged IVHS initiative was included as part of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. Also, the recently established "IVHS America," a national nonprofit public/private scientific and educational organization, is expected to play an important leadership role in the creation of a national IVHS program for safer, more economical, energy efficient, and environmentally sound highway system in the U. S. through R&D, testing, and implementation of advanced technologies.

Key questions include:

- *What should be the role of government in the development of advanced transportation technologies?*
- *What criteria should be employed in deciding which specific technologies the government should support?*
- *What types of joint public/private arrangements would best foster U.S. competitiveness?*

Seminar Discussion

Some participants expressed the view that the U.S. government should develop a 'long-term strategic vision' of the role of transportation in the economy. The traditional view focused on factors such as safety, national security and efficiency. A new view would focus more on mobility, energy usage,

environmental impacts and economic competitiveness, and should be institutionalized through legislation and multi-year funding commitments.

One obstacle to the development of such a vision was said to be the lack of a commonly accepted definition of U.S. long-term national interest. The absence of such a definition hinders the formulation of effective policies. Suggested definitions included "promoting long-term U.S. economic growth" and "promoting critical technologies" which contribute to this growth.

The National Transportation Policy (NTP) was commended for laying out a 'strategic vision' at the national level, but there was some skepticism expressed that this vision has extended downward into the Department itself. In addition, the negative impact of rapid turnovers in senior governmental positions on long-term planning was discussed. It was agreed that given this reality, the private sector had a responsibility to 'keep the flame alive'. One private sector participant suggested that companies sacrifice some of their parochial interests to the federal level in the interest of developing such a long-term plan that reflects the overall national interest. Another well-received recommendation for responding to this concern was to formulate an approved national policy statement and then guarantee multi-year funding for the programs included in it. This would limit the impact of the inevitable changes in politically appointed senior government positions.

It was suggested that the government encourage flexibility and innovations in the economy, even if some of these individual experiments turn out to be failures, as well as greater user/provider cooperation. These roles now supersede the earlier emphasis on the government as 'referee' between users and providers.

There was criticism of several 'carryover' aspects of this 'government as referee' role in transportation. These included: inadequate certification procedures for new technologies such as tiltrotor aircraft, problems with Department of Defense applications of export controls to high-technology U.S. products that restricted overseas sales, a reluctance to spend larger amounts from the transportation trust funds to expand and improve the domestic infrastructure, and time-consuming paperwork requirements for rates, tariffs and duties.

There was concern expressed that the government could actually hinder the R&D process by approving a particular approach too early and thus inhibit development of alternatives. This could be seen as an anti-competitive practice. In contrast, other participants recommended that the government choose specific technologies to support and demonstrate, accepting the fact that a few mistakes are inevitable.

Deregulation of the transportation industry, especially in air, road and rail, was judged as a success and should be pursued further, for example in shipping. There was significant support for amending or repealing the Jones Act limitations on use of non-U.S. flag vessels for shipping between U.S. ports. Some participants also felt that many subsidized ocean freight companies could probably survive without subsidies, but they will not be spurred to improvements while they remain subsidized. It was also pointed out that the overall economic costs of subsidizing are often higher than the profits

accruing to the subsidized companies.

Rather than hindering competitiveness, stricter safety standards and environmentally sensitive transportation procedures can be a competitive advantage for U.S. companies. One major exporter commented that being a safe and environmentally responsible corporate citizen can be an advantage, because many users are specifically looking for such considerations when they choose a product. However, other industry participants demurred from this observation, pointing out that noise policies were inhibiting both airport and even aircraft manufacturing operations at many U.S. locations.

Chapter 2:
Technological Innovations and Human Factors

Introduction

New and expanded capabilities are being asked of our nation's transportation system. While increases in mobility and reductions in congestion are major goals, there is also concern that such goals be attained in a manner which preserves the environment, promotes energy conservation, improves the overall quality of life, and costs as little as possible.

Technology, and the interaction of technology and people, offer some productive avenues for addressing these goals. In fact, a number of advanced transportation-related technologies are now at various stages of study, development and implementation. A partial listing of these includes: magnetic levitation (Maglev), Intelligent Vehicle Highway Systems (IVHS), information and telecommunications technologies; satellite-based communications, navigation and surveillance systems; alternative fuel vehicles, novel aircraft (tiltrotor) and commercial space transportation systems. However, as these technologies become more complex and more expensive, new challenges arise. For example, will we apply advanced technologies effectively to assist communities and individuals in solving transportation and related problems? The role of the various levels of government in promoting, facilitating, and perhaps choosing these technologies, may need to be redefined. There is concern that many of these new technologies will ultimately be bought from our foreign competitors, rather than developed within the U.S. And assuring that the users and operators of these new systems are adequately trained and equipped to manage them safety and effectively will also be a major undertaking.

In response to these issues, the Volpe National Transportation Systems Center hosted a seminar on the topic of "Technological Innovations and Human Factors in Transportation" in Cambridge, MA on December 3, 1991. Attendees included transportation users, service providers, manufacturers, experts and policymakers.

The topics suggested for discussion included: the promise of technical solutions to transportation problems, the question of a U.S. technology gap in transportation, new institutional relationships to foster innovation, the social and economic context for transportation innovations, the potential for technology transfer, and human factors in transportation technology. Observations and common themes raised in the discussion are summarized below. The views that follow in the "Seminar Discussion" sections were expressed by individual participants in the course of the discussion, and do not necessarily reflect the policies or positions of the Department of Transportation.

MAJOR ISSUE

Technical Solutions to Transportation Problems

Background

Opinions differ concerning the role and value of advanced technologies in dealing with current transportation needs. Technology offers long-term solutions, but pressing near-term nationwide transportation problems such as congestion will need to be addressed quickly. The large scale of the problems and the considerable costs for their resolution offer daunting challenges to all levels of government. Revolutionary near-term technical solutions are not likely, because novel transportation systems must be extremely reliable and safe and must undergo extensive operational testing. In addition, operating and maintenance costs and demand levels are critical factors in the decision to adopt specific technologies.

IVHS is an excellent example of potential near-term technological innovation. Known also as "smart cars/smart highways," IVHS will integrate a myriad of advanced technologies -- including computers, electronic sensors and telecommunications -- to assist the driver in such tasks as route selection, night driving and accident avoidance. IVHS is claimed to represent an "information infrastructure" for achieving the most efficient utilization of the existing "physical" infrastructure. Other expressed IVHS benefits include improved mobility, energy

conservation, environmental preservation and enhancing U.S. technological competitiveness. Nevertheless, even experts are divided on whether IVHS will revolutionize surface transportation, or whether it will simply make today's highway congestion problems somewhat more tolerable.

Key questions include:

- *How important are new technologies to solving current transportation problems?*
- *What are the limits of such "technological fixes?"*
- *How can technological innovations best become practical solutions to current and anticipated problems?*
- *What criteria are needed to guide public and private decisionmaking on investment in new technologies?*

Seminar Discussion

Seminar participants identified major needs that offer opportunities for innovation in transportation. For example, congestion mitigation could be sought through a combination of new technology implementation, economic incentives and a concerted public education campaign regarding the economic and environmental costs of current transportation systems. The application of transportation innovations could create multimodal choices and intermodal efficiency,

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with mobility, energy and environmental benefits. These innovations could also help achieve customer-centered, quality public transportation services by providing modern, integrated, convenient, efficient and cost-effective transportation systems.

There is a need to process, analyze, and convert available transportation "data" into "useful information" for transportation planners and customers. This is both technologically feasible and relatively inexpensive to accomplish. The potential exists, in fact, for a strong "transportation data services" value-added business, providing both the delivery of real-time travel information and a range of analytical products. These applications could help to balance the modal usage distribution; improve mobility, traffic flow and productivity; and relieve urban congestion.

The use of available advanced information technologies, services and products -- such as interactive menus, touch-activated screens, audio/video combinations of geographic information systems (GIS) maps and informative messages, and on-line utilization of transportation data bases -- could enable users to make informed choices of transportation options. Such systems and services could be installed at major travel locations such as airports, transit stations and hotels. Although the potential demand for this service seems to exist, this market niche has not yet been heavily exploited by public or private transportation services providers. It was suggested that overnight delivery and parcel companies were good examples of successful innovations in transportation which exploited unmet demand.

There was a general consensus that the opportunity exists to design and implement an "information infrastructure," coupled to and enhancing the use of the physical transportation infrastructure, to enable safe and reliable operation of increasingly automated transportation systems. Information and communication networks linking shippers, service providers and users could both complement conventional transportation, and also offer an alternative to it via the expanded use of telecommuting, teleconferencing, fax transmissions, videophones and electronic data interchange (EDI). These applications could realize immediate environmental, energy and productivity benefits. It was also suggested that the federal government should adopt telecommuting and related technologies as an explicit transportation alternative.

MAJOR ISSUE

Is There a U.S. Technology Gap in Transportation?

Background

The U.S. is a leader in aerospace technologies, products and markets, as well as in selected automotive technologies such as trucks. However, there is mounting evidence that the U. S. lags behind Japan and various European countries in many other transportation innovations, including IVHS, high-speed intercity rail service and Maglev systems.

The persistence of this apparent "innovation gap" could have serious long-term implications to future U.S. competitiveness. Moreover, this gap could undermine our capability to develop technological options for addressing growing transportation problems in ways that are particularly tailored to U.S. conditions.

In the case of IVHS, U.S. efforts have been relatively recent, low-scale, and quite dispersed when compared with the large-scale technology development programs in Europe and Japan. However, IVHS has recently been made an integral part of the National Transportation Policy (NTP), and included as a substantially enlarged initiative in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). Also, the recently established IVHS America, a national non-profit public/private scientific and educational organization, is expected to play an important leadership role in the creation of a national IVHS program.

Similarly, a number of alternative advanced high-speed conventional rail and magnetically levitated trains are already in operation or in the advanced testing stages abroad, but there are none now operating in the U.S. As a result, the leading contenders for a number of proposed state and regional high-speed intercity passenger transportation initiatives in the U.S. are foreign systems. These include the French TGV ("Train Grande Vitesse"), the Swedish Fastrain, the German ICE and Italian ETR 500 trains, as well as German and Japanese Maglev prototypes. One major issue is whether the U.S. market potential justifies investing in an "American" technology development, and whether importing these existing high-speed rail systems for near-term applications would preclude U.S. efforts to develop even more advanced concepts.

Key questions include:

- *What are the changing roles of the government and the private sector in fostering technological innovations and in stimulating strategic technology development?*
- *How serious is the perceived U.S. "innovation gap" in transportation?*
- *What are its consequences and what concrete steps can be taken to close this apparent gap?*
- *On which technologies should the U.S. public sector focus its own research and development (R&D) efforts?*

Seminar Discussion

There was a consensus that improved technology transfer to the transportation sector is needed. Such transfers could come from government labs to commercial applications, or from military transportation systems to civil products and services such as the tiltrotor. There could also be transfers between modes, such as from aviation air traffic management and control

technologies to surface transportation. This transfer would require the identification and targeting of dual-use technologies with the greatest promise for commercial application. It would also require a number of institutional and organizational innovations involving cooperative public/private sector efforts.

This process would benefit from institutionalizing low-cost technology transfer in the near term for broader application of advanced technologies to transportation. This broader application of technologies would require improved and expanded interagency coordination and closer links between the public sector, private sector and academic researchers. The existing Universities Transportation Centers (UTC) and Small Business Innovation Research (SBIR) programs within DOT could serve as a nucleus for expanding this linkage.

There is a perceived need to balance the "top-down" approach to transportation infrastructure and technology demonstrations with "bottom-up" demands for technological solutions. The new ISTEA of 1991 transfers much transportation decisionmaking from the federal level to state, regional and local authorities. The goal of this change is to enable the resource allocation process to be more responsive to local requirements. However, there is an inherent danger that locally developed and implemented solutions may not be consistent with broader, national needs. For instance, if the many proposed high-speed rail and Maglev projects are to be integrated into a national transportation network, rather than remain partial solutions to local and regional problems, then policy coordination and coherence in design criteria, safety and performance standards are needed at the national level.

One innovative suggestion regarding government's approach to facilitating transportation innovations was to treat new infrastructure by analogy to the "open architecture" and "parallel computing" concepts in personal computing. This approach entails definition of a "platform infrastructure," such as a road or multipurpose guideway, on which alternative candidate technology systems, or diverse vehicles, can be accommodated. This approach would allow parallel development and assessment of competing technologies to be performed before specific systems are chosen for full-scale implementation. For instance, it was suggested that various Maglev and high-speed rail systems be tested in operational environments, to assess their potential suitability to wider markets.

Tiltrotor - Courtesy: Bell Helicopter Textron

MAJOR ISSUE

Institutional Relationships and the Technology Application Gap

Background

Traditionally, in the U.S., market forces have been relied upon to give private firms the incentive to conduct applied R&D and to commercialize new products and processes. The government's role has been to support basic research and to fund applied R&D only as needed to meet specific mission agency requirements. In the case of the DOT, this would cover such functions as air traffic control (FAA) and search and rescue operations (U.S. Coast Guard).

This traditional role of the government has been changing in recent years, partly due to the pressures of the intensifying international competition. It has also been argued that a basic shift in the "innovation paradigm" has been occurring, which has exposed weaknesses in the dominant postwar "big science" approach to technological innovation. The new model for innovation emphasizes closer public/private relationships such as joint investments, while still retaining competition in the marketplace. Emphasis is placed on incremental perfection and application of known technologies, rather than on pursuing large-scale technological breakthroughs.

Several major academic studies in recent years have concluded that organizational and institutional factors are important causes of the relative slowdown in technological innovation in the U.S. and the deterioration in our international industrial performance. These include, for example, a lack of cooperation within companies, between companies and their suppliers and customers, and between the private sector and the public sector. Moreover, it is suggested that the fundamental paradigm shift in the innovation process was led by Japan and Germany, leaving the U.S. behind. It has also been suggested that the secret of Japanese industrial success was not technological prowess, but organizational superiority. Specifically, Japan has evolved a fundamentally different and new production system and innovation process which have changed the dynamics of international competition.

These findings have significant implications for fostering technological innovations in transportation in the U.S. They also suggest a new view of the government's role in both achieving and more widely diffusing innovations through new institutional arrangements, including public/private partnerships. In addition, the issuance of a new National Technology Policy last year, and identification of National Critical Technologies (including some for transportation) hold the promise for more coherent governmental policies and programs, more focused federal support, and broader returns for federal R&D investments.

Key questions include:

- *What public and private institutional changes are required to encourage both the rapid implementation of existing technologies and the development of longer-term technological innovations in transportation?*
- *Are there major technical, legal or regulatory obstacles impeding these innovations?*
- *What are the major opportunities for both intergovernmental and public/private cooperation to*

further technological innovations?

- *What can be done to reduce the risks and uncertainties inherent in the innovation process?*

Seminar Discussion

The existence, extent and implications of a "technology gap" in transportation equipment and services between the U.S. and its foreign competitors, primarily Japan and Western Europe, was discussed. Participants shared the view that transportation-related technologies are transnational, and their development is driven by global market potential. Examples from aerospace and automotive industries led to the recognition that by lagging in the development and adoption of advanced technologies, the U.S. could lose future options for economic growth and may never regain lost market shares.

The issue of "technology readiness" and technological "building blocks" in transportation was debated. Critical ingredients cited for the successful development and implementation of advanced transportation systems included suitable manufacturing and construction capability, timing to meet the need, existing and induced demand, public and political support, and affordability. It was noted that the relative lack in the U.S. of this orderly and evolutionary technology development process in transportation makes it doubtful that we could in the near future "leapfrog" foreign high-speed rail and Maglev offerings with new, U.S.- developed systems.

Stringent technological and operational requirements also apply to transportation vehicles and infrastructure elements. Extensive operational testing is required to certify a transportation system that satisfies all these requirements for both national and international markets. This raises the cost associated with the entire research, development, test and evaluation (RDT&E) process.

There was agreement that the U.S. should learn from both foreign and domestic success stories in advanced technology development to enhance transportation sector competitiveness in global markets. However, it appeared that the Japanese MITI or EC Airbus consortia models, which involved direct public subsidies to targeted key industry sectors, would not be acceptable in the U.S. At the same time, the recently promulgated National Technology Policy could be translated into federal policies and programs and implemented by public/private partnerships to encourage the development of new transportation systems.

MAJOR ISSUE

The Social and Economic Context for Transportation Innovation

Background

Efficient transportation of people and goods is essential to the nation's social and economic health. Yet technological innovations in transportation are unique in terms of their scale, risk, institutional context and cross-cutting effects. Transportation systems often represent large-scale investments requiring significant resources with long time horizons. This means that the risks associated with these investments are particularly high when relatively new technologies are involved. These systems are also geographically dispersed, with a multiplicity of users and stakeholders. Thus, it can be especially difficult to satisfy all of these interested parties at the same time.

The large scale, complexity and riskiness of new projects, along with other factors such as mounting public concern over safety and environmental impacts, may have led transportation decisionmakers in the past to favor proven technologies rather than novel systems. The substantial cost of new technologies has also led to increasing emphasis on such decision factors as life-cycle costing, prototyping, operational testing, safety certification and especially demand projections.

Key questions include:

- *How important are technological innovations to U.S. transportation needs, as compared to managerial, operational and institutional factors?*
- *To the extent that public transportation decisions contain a bias against longer-term, higher risk investments and are impacted by tight fiscal constraints, what steps can be taken to change this pattern?*

Seminar Discussion

The advisability of instituting a systems approach as "best practice," both technically and institutionally, to transportation innovations was discussed. It was noted, for example, that increasing automation blurs the conventional boundaries between the vehicle and the infrastructure. In IVHS, for instance, one can no longer separately consider the driver, the vehicle, and the instrumented highway, since they will be essentially interacting in real time. This implies that the infrastructure, traditionally the government's responsibility, and the vehicles, historically produced by the private sector, must now be viewed as an integrated system. The implication for IVHS is that it ought to be designed, built and operated cooperatively by both public and private sectors.

Greater recognition should be given to the critical importance of institutional innovations in the transportation sector. This is especially important given the "bottom-up" process of garnering community and political support for costly novel technology developments, such as Maglev and high-speed rail. The need to balance and blend the interests of numerous stakeholders requires that explicit recognition be given to all institutional partners and processes, in order to reach consensus. The continued development of the personal rapid transit (PRT) system "Taxi 2000" in Chicago, Seattle and other locations was discussed as an illustration of this factor.

There was wide agreement that "technology fixes" alone cannot

resolve transportation problems. Better coordination of federal, state and local regulatory and economic mechanisms would, however, facilitate the successful application of technological solutions. For example, such economic tools as congestion pricing, tax credits for transit use and penalties for driving and parking private cars downtown would encourage the implementation of new technologies such as electric cars. In conjunction with increased use of mass transit, these vehicles could contribute to the attainment of environmental, mobility, energy and "quality of life" benefits.

The issue of whether, and when, laws and regulations drive transportation innovations, rather than inhibiting their adoption or raising their cost, was discussed. No consensus was reached, as examples illustrated that regulations could either hinder innovations by freezing in existing technologies, or spur them if permitting a range of innovative solutions. Most participants believed that legislative and regulatory requirements often stimulate innovative solutions to pressing transportation problems. For example: corporate average fuel economy (CAFE) standards led to more efficient internal combustion engines, the Clean Air Act led to catalytic converters for emissions control on motor vehicles, safety belt and crashworthiness requirements led to air bags, noise limits on aircraft led to both hush-kits in the near term and to quieter and more efficient aircraft engines in the long term, and oil pollution legislation is encouraging double-hulled oil tanker designs. In many cases, in fact, technological solutions are already available, and legislation mandating or promulgating performance or design standards merely spurs their implementation by requiring the application of "Best Available Technology" (BAT) or "Best Possible Technology" (BPT).

A study of the impact of regulations on innovations which analyzed the interactions between transportation legislation and regulations and available technologies would be a useful document for decisionmakers. For instance, the California "electric cars and buses" laws may not be enforceable because the practical battery technology to meet the stated goals does not yet exist. Even though U.S. auto manufacturers have teamed up with the Department of Energy in a "battery consortium," the goal of doubling battery performance and halving cost may remain elusive in the near term. Thus, it was felt that such projects are often expedient technical fixes tied to legislated implementation timetables, and may not be strategically important.

MAJOR ISSUE

The Potential for Technology Transfer

Background

A long stream of recent transportation innovations represents cases of technology transfer from the military to the commercial sector, from one mode to another, or from one application to another. Examples include: the jet aircraft, radar, supersonic civilian transport plane, tiltrotor aircraft, heads-up display and Global Positioning System (GPS) navigation (military to commercial); adapting radar technology from aviation to surface and ship-to-shore vehicle traffic systems (between modes); and the potential of amorphous silicon photovoltaic cells in developing hydrogen-powered cars (between applications).

The ambitious IVHS plans would not be possible without the transfer and integration of technologies such as mobile telecommunications, advanced informatics, hand-held GPS receivers and electronic maps. Computer visualization and data compression are aiding air traffic controllers to locate a plane on their crowded monitors. Increasing use of telecommuting and teleconferencing could offer an effective strategy for reducing ground and air traffic congestion.

With the growing convergence of military and civilian technologies, a general issue concerning technological innovations in transportation is what strategies should be followed to foster dual-use technology development, as well as faster and broader diffusion of technology. A related issue is what practical steps can be taken to expedite technology transfer to the transportation sector from other civilian agencies such as the Department of Commerce and the National Aeronautics and Space Administration (NASA). The budget for the NASA Aeronautical Science and Technology R&D program alone is about double the entire FAA Research, Evaluation and Development (RE&D) budget, and comparable to the entire DOT R&D budget.

Key questions include:

- *What are some of the major opportunities for the transfer and commercialization of technologies related to transportation and logistics?*
- *How can these potential opportunities best be realized?*
- *Does direct R&D investment in transportation technologies and application yield greater return than technology transfer efforts?*
- *What key initiatives can the government pursue to expedite technology transfer to the transportation sector?*
- *Are public R&D funds being directed to the projects with the greatest potential payoffs?*

Seminar Discussion

The emergence of new relationships and public/private roles and responsibilities in addressing transportation needs was noted. A range of state-based initiatives designed to improve mobility, access or economic efficiency by involving the private sector, with or without federal participation, was mentioned. It was suggested that the National Technology Policy, while not an industrial policy *per se*, leans toward removing antitrust barriers to the formation of industry consortia and encourages the formation of public/private partnerships. The "IVHS America" model was mentioned as a promising example of these partnerships. However, some industry representatives stated

that remaining barriers to private consortia -- including antitrust, product liability and tax laws and trade controls -- must be removed in order to facilitate the commercialization of innovative transportation applications such as IVHS.

A need was expressed for a broad set of transportation R&D policies, closely coupled with other strategies (such as regulations, economic and tax mechanisms and public education) for facilitating the adoption of technological innovations on a wide scale. The federal government has traditionally been reluctant to pursue an industrial policy, even though the transportation sector has experienced market failures which required government intervention, such as Amtrak and Conrail. The traditional government role of performing basic R&D through advanced testing and prototyping, however, is changing. This change can be seen in the promotion of public/private partnerships, the 1990

Summary of Major Points

Technological Innovations and Human Factors

- Many opportunities exist for technological innovations to solve transportation problems, in such areas as mitigating congestion, improving mobility and intermodal efficiency, and attaining energy and environmental goals in transportation.
- However, technology "fixes" alone cannot totally solve these problems. Institutional, social, behavioral and economic factors are all likely to be important parts of prospective solutions.
- The historical role of the government in research and development and technology is changing, but no consensus exists on what it should be in the future. For example, the exact relationship between successful technological innovations and legislation and regulatory requirements is unclear.
- There is a need for expanded transportation technology transfer from governmental and military research to the civil and commercial sectors, as well as from one mode to another. The development of a long-range, coherent 'vision' for technological innovations that could be relatively immune from short-term political influences would assist in this process.
- Transportation data should be more effectively processed, analyzed and converted into information that can be used by transportation planners and customers.
- More data and research is needed into human factors issues in transportation. In addition, human factors, systems engineering and high-level modeling and simulation should be integrated into a more comprehensive capability to develop and assess advanced transportation systems.

National Technology Policy, and the identification of a Critical Technologies roster for enhanced federal funding. No consensus emerged regarding the extent to which federal technology policy in transportation ought to be strategic, rather than more responsive, adaptive and closer to market applications.

The issues of balancing the public good versus private or parochial interests, and of public/private participation in decisionmaking and cost-sharing in the development of new infrastructure were also discussed in this context. It was proposed that transportation infrastructure and services are primarily a public good, since they must equitably provide access and mobility. It was also suggested that the high cost and large scale of transportation projects often requires government participation to breed confidence and to encourage private investment, especially in the current stringent investment climate. However, just as the costly and publicly subsidized Concorde aircraft services only a small and affluent market niche, certain advanced technologies such as Maglev could also become the purview only of the few travellers able to afford it.

An important government role in transportation is to "validate" and certify new technologies, from the point of view of safety, reliability, and other performance envelopes. This would be a key role in assuring the success of IVHS technologies. Once the government has "validated" the safety and operability of the new technologies, then traditionally conservative industries (like automotive and aviation) could rapidly apply and commercialize them without fear of product liability or regulatory constraints.

A need was expressed for a long-range, coherent vision and road map for technological innovations in transportation. It was suggested that DOT could play a leadership role in this area. If a vision of our common transportation future and a statement of its fundamental contributions to the national productivity and economic well-being is clearly and forcefully articulated, then private sector and Congressional support would follow.

A key related element is institutional commitment and continuity. Because the average term of political appointees is much shorter than that required for planning and implementing new transportation systems, it is often difficult to maintain support for expensive, long-term projects. A possible way to avoid these discontinuities is to enact legislation which commits the multi-year outlays needed to complete such projects.

MAJOR ISSUE

Human Factors Issues for New Technologies

Background

Human factors research is a cross-modal area increasingly critical to the safety and efficiency of transportation systems. It addresses the application of psychology and physiology to human operation of advanced and complex transportation systems, and includes such elements as the modeling of human control and decisionmaking functions and the optimal design of displays, controls and software. The three distinct but interrelated categories of human factors efforts are ergonomics, or design for efficient use by humans; the optimal allocation of roles and responsibilities between humans and machines; and workforce training needs for safe systems utilization.

The need to achieve greater efficiency, as well as mounting concerns over transportation safety and security, have focused attention on human factors. To design transportation systems that minimize or altogether avoid operator errors, both the practical limitations of human performance as well as ergonomic design principles need to be better understood. Increasing automation of transportation systems operations raises a number of questions relating to human factors. For example, the future air traffic control environment will make the controller rely increasingly on computers to resolve conflicting aircraft flight patterns. Airport security personnel will also depend on increasingly complex machines and on enhanced training for bomb detection. But who will be liable in case of an accident?

Key questions include:

- *Will human factors be a major limiting factor to future technological innovations in transportation?*
- *In designing safe automated transportation systems, how should we plan for such factors as human reaction times, drowsiness, fatigue and attention span, information overload and stress?*
- *Should humans be able to override an automated system?*
- *What programs should the government develop to expand human factors research and to educate its work force and the public on human factors issues?*

Seminar Discussion

It was the general consensus that the integration of human factors and systems engineering disciplines is needed to fuse "people" and "technology" in advanced transportation systems. For example, human factors experts should be included early in the design and evaluation process for new technologies. It was also suggested that human factors criteria be explicitly included in the certification process for new transportation equipment.

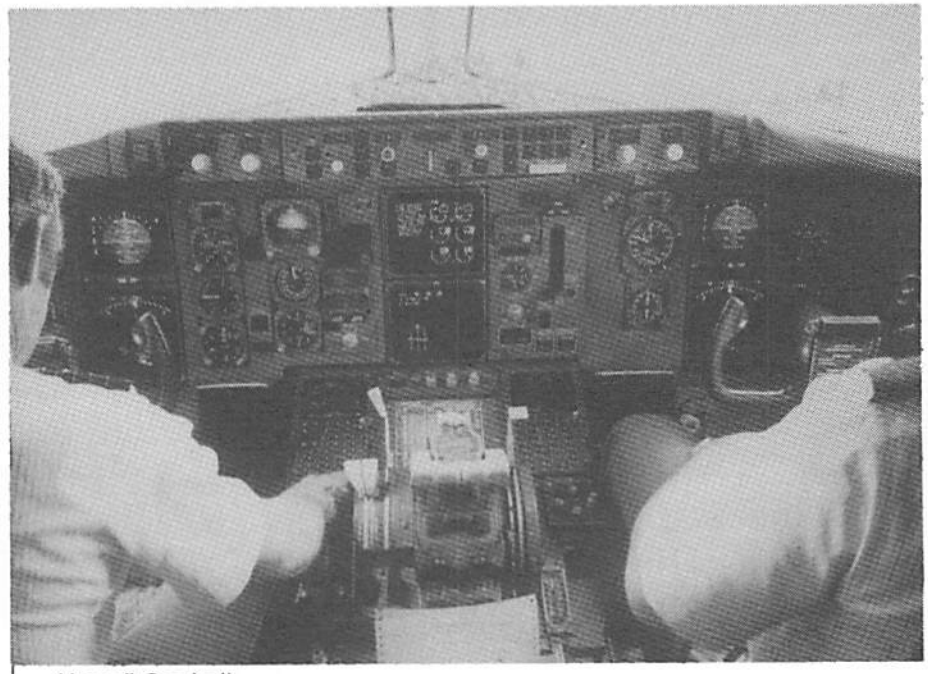
The lack of a coherent current data base on human factors, containing such elements as performance parameters for normal and accident conditions, the cognitive maps and mental models of operators, and perception needs for older users, was decried. It was stated that this lack hampers the ergonomic design and development of systems tailored to specific users, such as aircraft pilots and aging drivers. It was suggested that DOT has both the opportunity and vested interest to take a leadership role in establishing a "National Database on Human Factors," and perhaps could cosponsor with other federal agencies a "National Institute on Human Factors" that would

assemble and integrate national and international data from public, private and academic sources.

The opportunity also exists to exploit advances in high-level modeling and simulation techniques for performing system analyses. This promises to revolutionize prototyping and testing of new transportation concepts and systems by enabling early evaluation of options and selection of the most promising technologies. Such practices could substantially cut both the cost and the typical time span from concept to application, which can take from 10 to 20 years for sophisticated transportation systems.

The role of advanced simulations was debated. Proponents of the "let 100 technologies bloom" approach felt that the unique safety and reliability requirements for transportation necessitates extensive operational testing before implementation. In this process, it was stated that "we can afford a few mistakes," such as the Morgantown, WV PRT system. It would appear that for safe and reliable advanced transportation systems, simulations are necessary but not sufficient to validate and select workable design concepts. Full-scale testing and operational experience are needed to assure that unanticipated problems are uncovered and addressed before revenue service commences.

The successful design and implementation of advanced transportation systems and infrastructure require judicious role definition and better decisionmaking partitioning between humans and information systems. The increasing reliance on information systems in evaluating decision options can appear to relegate people to secondary functions, rather than supervisory and control roles. It was stressed that designers and developers of new transportation systems should allow humans and machines each to do what they do best. In an ideal design, both the human operator and the computer would complement and mutually enhance each other's functional capabilities.



Aircraft Cockpit

Chapter 3:
Intermodal Passenger and Freight Transfer

Introduction

The ability of the transportation system to provide for the efficient flow of people, goods, and services is critical for meeting our national economic needs. Competition within and between various modes of transportation has provided efficiency improvements over the years. However, one area which has not received much attention is intermodal connectivity: the transfer of passengers and freight between modes.

A truly intermodal "system" encompasses the "door-to-door" movement of passengers and freight via multiple modes of transportation from various points of origin to various destinations. The best intermodal systems are flexible, taking advantage of the most economic modes of transportation that are capable of meeting customer needs for speed and reliability. Efficient intermodal systems for passengers and freight are particularly important in an era of intensifying international competition.

The Volpe National Transportation Systems Center hosted a seminar on the topic of "Intermodal Passenger and Freight Transfer" in Cambridge, MA on December 4, 1991. Attendees included representatives from regional planning organizations, state Departments of Transportation and Port Authorities, federal and Congressional agencies, transportation equipment and service providers, transportation users, academic experts and transportation consultants.

The topics suggested for discussion included: the demand for intermodal transportation services, trends in the supply of intermodal freight services, requirements for effective intermodal transfer, and policy challenges to improving connectivity. Observations and common themes raised in the discussion are summarized below. The views that follow in the "Seminar Discussion" sections were expressed by individual participants in the course of the discussion, and do not necessarily reflect the policies or positions of the Department of Transportation (DOT).

MAJOR ISSUE

The Demand for Intermodal Transportation Services

Background

Fundamental changes have been occurring over the past decade in the way customers view transportation. The goal of major manufacturers is to incorporate transportation into a seamless logistics system that provides for a smooth, continuous flow of material from suppliers through manufacturing processes to the ultimate customer. Management of logistics systems requires real-time tracking of material in transit and just-in-time (JIT) deliveries at each link. As a result, customer requirements for transportation information have escalated substantially. Similar information needs have emerged in wholesale and retail trade to reduce expensive storage and inventory investment costs. Depending on the weight, volume, value of cargo, and the costs of door-to-door service, shippers choose among a variety of combined marine, rail, truck and air services.

Key questions include:

- *What new freight and passenger services are being demanded, now and projected for the future?*
- *Are there fundamental differences in the intermodal considerations for passenger and freight transportation?*
- *What factors drive the demand for intermodal services?*
- *What major obstacles exist to satisfying this demand?*

Seminar Discussion

There was general agreement that the "intermodal industry" is already developing, especially in freight, and linking the various modes together. This is happening regardless of any significant governmental actions or policies on intermodalism. One participant cited the examples of the Disney World infrastructure in Florida and the development of road-rail terminals in Chicago as examples of this occurrence outside of any governmental initiatives.

One reason for the development of freight intermodalism is the strength of user demand, particularly from companies seeking to reduce their total transportation and logistics expenses and provide faster and more efficient delivery service for their products. A single freight user may have a large volume of business and thus considerable market power. Suppliers have to provide door-to-door service by the most efficient combination of modes in order to retain the user as a client.

A distinct pattern of intermodalism is emerging through progressively closer cooperation among shippers, transportation providers and third parties, including freight forwarders. Participants commented that various shipping lines and third parties are leasing equipment and terminals as part of a broader development to build an intermodal network, based on the railroads, without investing large amounts of cash in infrastructure construction or equipment purchases. Better management of terminals, cargo and information flows is also becoming

Participants

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a crucial aspect of improved intermodal operations.

Further, the implications of JIT manufacturing for intermodalism were addressed. The general question was raised as to whether the increased number of vehicles on the road, due to the wider adoption of JIT by industry, clogs the transportation system. One participant remarked, for example, that a parcel delivery firm received more parking tickets in New York City than did any other transportation provider. To accommodate JIT, this firm is building additional warehouses at its hubs to reduce both the total number of vehicles and the amount of time they spend on the roads. As part of this effort, the firm is also trying to convince its manufacturing customers to locate closer to these hubs.

Massport Dock

MAJOR ISSUE

Trends in the Supply of Intermodal Freight Services

Background

As a result of the deregulation of the railroad and trucking industries since the late 1970s, competition has increased significantly in the surface freight transportation market. Railroads have reduced excess capacity and improved yard and linehaul operations through the consolidation and abandonment of unprofitable lines. The trucking industry has also undergone a process of consolidation and restructuring through bankruptcies, mergers and acquisitions. An important development has been the growth of trucking firms offering premium door-to-door services, concentrating on high-density traffic corridors.

In the past decade, a new "intermodal" industry has emerged that takes advantage of rail's line-haul economies and trucking's door-to-door capabilities. This industry is partly an outgrowth of the land bridge unit trains that railroads offer for rapid movement of containers between ports and destinations. What tipped the balance in favor of domestic intermodal rail was the introduction of "double-stack" flatcars that greatly increased train haulage capacity. Lower costs, together with improved schedule performance, allow rail links to compete favorably on long hauls with all-highway shipments.

Over the past decade, the explosive growth of double-stack shipments is a good indicator of the rise in intermodalism. Services are available through shipping lines, container/railcar leasing firms, railroads, trucking companies, and third parties such as freight consolidators and forwarders. Most of the large shipping lines and railroads have formed divisions or subsidiaries to focus on the intermodal market. Recently, however, compacts between companies in the transportation industry are being drawn more and more frequently as a means for capturing market share while allowing each company to manage the business it knows best.

A recent and related important development has been the globalization of express package delivery services. The marketplace has become intensely competitive: however, one feature of developments in the worldwide market is the pivotal role played by U.S. firms.

The success of international cargo containerization illustrates both the complexity of transportation networks and the potential for productivity gains. In today's global economy, international shipments often call for containers from overseas suppliers to be unloaded at a port, transferred onto specialized trailers for the journey to a rail transfer facility, loaded on double-stack flatcars for long-distance line-haul, and then transferred to trucks for delivery to the final destinations. Such an operation can involve almost any combination of public and private ownership of infrastructure, handling equipment, and rights-of-way, as well as services provided by local governmental authorities and private enterprises.

The key to success lies in the smooth management of the total door-to-door shipment process through the various stages and transfer points. In this context, it has been demonstrated that a systems approach which integrates various modes can improve both the costs and quality of transportation services. Three major changes in the transportation environment have made the creation of such networks

possible: 1) deregulation; 2) advances in business information systems and communications; and 3) engineering improvements in materials handling facilities. Related developments have produced improved container ships, special-purpose railcars, and terminal handling equipment improvements that have contributed to further efficiencies in intermodal operations.

Key questions include:

- *How good is the current intermodal infrastructure?*
- *Are there certain modes or geographic areas in which the problems are most evident?*
- *Are there regulatory or technological barriers that impede efficient intermodal services?*
- *What are the implications for public/private partnerships in the provision of both the required intermodal infrastructure and the services themselves?*

Seminar Discussion

The impact of intermodalism on the various freight modes is clearly apparent, especially within the past few years. For example, one shipping participant commented that his firm put 2,000 truck trailers onto railroad flatcars each day, and was now in fact a major Western railroad's largest single customer. Another participant noted that truck, commercial aircraft and Amtrak were all used for that organization's shipments.

Although the U.S. freight intermodal system has developed rapidly, there are still gaps. Among the more significant gaps mentioned were: direct railcar access to docks at seaports; efficient connections between Western and Eastern railroads in such key terminal cities as Chicago, St. Louis, Memphis and New Orleans; and modernizing intermodal facilities in larger and older U.S. urban areas, such as New York City, where little undeveloped land is now available and the resulting infrastructure costs are high. One participant noted, for example, that ten rail terminals exist in that metropolitan area, but that only one of them is convenient to the docks.

Three constraints on railroads to the further growth of container and double-stack business were cited. They are: the poor quality of highway connections to rail terminals, the low overhead road bridge clearances over rail lines, and difficulty in coordinating with passenger service sharing the same tracks. None of these issues is either easy or inexpensive to resolve.

Some other countries are heavily involved in public support for intermodal facilities. For example, one participant noted that the Canadian government has assisted the development of transportation connections at the port of Halifax, Nova Scotia. Halifax is now winning business away from older U.S. East Coast ports. Port Authorities are responding to this competition by pursuing better road and rail connections to their docks, which is quite expensive. Because these projects do not meet the conventional 'rate of return' formulas used to evaluate projects, however, bond revenues will not always be available to fund them.

MAJOR ISSUE

Requirements for Effective Intermodal Transfer

Background

A number of obstacles stand in the way of greater intermodal connectivity. Some of these are structural, the end result of modal choices and investments made over many decades. Decisions made in the past, that favored particular modes without being explicitly concerned with how the different modes can best be efficiently integrated, are increasingly proving to be inadequate. These obstacles are also institutional in nature, owing much to the distribution of power and responsibility in our decentralized governmental system. Rarely are they technology-related.

Although much of the debate recently has centered on access to airports or water ports, the problems and the obstacles are both much broader and more pervasive. Nevertheless, two specific examples are illustrative.

***Airport Access:** Ground access to airports is a pervasive problem which may soon affect airline hub choices and markets. Transit access to major airports has been particularly deficient. Highway access has also had its share of problems. Although most major airports are within ten miles of an interstate highway or a primary arterial, this does not guarantee good highway-to-airport access because of pervasive congestion problems, particularly during peak commuting times. There are other causes of congestion as well, including inadequate curb space, cruising vehicles and inadequate or poorly allocated parking.*

***Port Access:** Ship-to-rail and ship-to-trucking transfers have been a focus for discussion in major U.S. ports for many years. Many ocean carriers increasingly worry about infrastructure and "land connectivity" issues, rather than such traditional concerns as berth access, handling equipment or stowage.*

Key questions include:

- *What are the basic requirements for smooth, effective intermodal transfers?*
- *What opportunities exist for further improvements in both passenger and freight transfer services? What are the most serious problems?*
- *What are the key underlying reasons for these obstacles at the national, regional and local levels?*

Seminar Discussion

Participants were unanimous in concluding that intermodalism is far more advanced in the area of freight than in passenger transportation. There are many causes of this disparity, including economic, institutional and infrastructure factors. For example, the profit motive provides sufficient built-in incentive for greater freight intermodalism. Customers of freight transportation usually do not care how the transportation function is performed, as long as it meets their desired goals for cost, quality, timeliness and reliability. Thus, freight service providers are motivated to take a more comprehensive systems view of the process.

By contrast, passenger transportation typically involves more than one entity or mode in a single journey, but no single service provider in the process is responsible for, or directly benefits from, determining and managing the 'optimal' journey. As one participant noted, the consequence is that service providers tend to become preoccupied with the

question of who should pay for any connectivity improvements, rather than focusing on how best to serve the customer's total needs.

For example, it was noted that the Van Wyck Expressway in New York City is a necessary link to the airports, but the State of New York may not be able or willing to pay for any improvements on it. Instead, the state is looking to the Port Authority to help fund such work, because it is a direct beneficiary from the improvements. The state also faces a severe financial and budgetary situation. Other participants gave similar examples of how the lack of agreement between different agencies retarded infrastructure projects.

Traditional third party providers such as travel agents may assist individual passengers in their trip plans. However, they may fail to cover every link between a given origin and destination, and can do little to induce the various modes to work more closely together. For example, one participant commented that travel agents have no incentive to sell mass transit tickets to their customers, because they receive no commission from such sales. Although some cruise ship lines will cover transfers by both passengers and their baggage between modes, this may be possible only because the company earns sufficient profit from its total service package to cover these additional costs. It was also noted that this gap has led many larger companies to develop their own in-house capabilities to arrange 'door-to-door' business travel for their own employees.

Even the dissemination of additional information to potential passengers is not a guaranteed means of improving passenger connectivity. One participant stated that much effort went into distributing information about local transit services to travel agents around the U.S. and in other countries. However, little evidence was found that this information made much difference to individual traveller's plans. Another problem noted is that planning organizations often lacked both enough data and the right data for evaluating the state of passenger connectivity. Passengers and hotel occupancy can be counted, for example, but that data does not elucidate the cause and effect relationships between the various factors that affect travellers' plans.

Several participants suggested that differences between freight and passenger connectivity may stem in part from the fact that freight transportation is mostly privately owned or controlled, while passenger transportation depends largely on the use of public infrastructure even though the service providers may be private. Thus, the institutional framework for passenger transportation tends to be complicated.

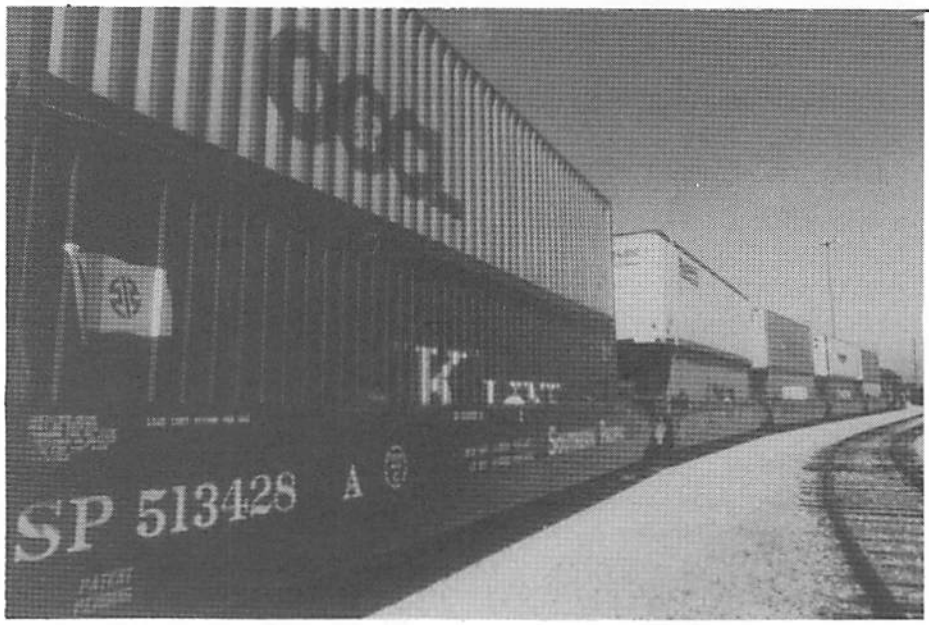
There are several major entities on the passenger side, such as airports, which may benefit financially from not improving connectivity in certain spheres. One participant recounted the numerous difficulties that arose during the planning for a new ground passenger transit project to link an airport with a nearby resort area. Among the problems encountered, most of which are still to be resolved, were: accommodating transfers and through-ticketing of baggage from aircraft to the transit system; resolving potential liability issues over lost baggage; checking and security screening for aircraft baggage at the transit stop located away from the airport; incorporating purchasing the transit ticket with the airline ticket; and actually locating

the transit stop within the airport terminal itself.

One of the major explanations for this perceived hostility by airport management to transit systems may be that such connections threatened to cut into the substantial revenues the airport derived from rental car agencies and parking facilities. This revenue flow also serves as the basis for issuing bonds for additional funding for airport activities. Thus, airports can actually earn more money for themselves by not having good intermodal passenger connections. In contrast, other companies, especially in freight, earn more money by providing customers with such connected services. Participants also offered examples of opposition to new ground passenger proposals in several parts of the U.S. by competing modes, including private toll roads and airlines.

There are additional obstacles to the development of effective ground access to airports. For example, many passengers arriving at airports have widely dispersed final destinations. This makes it difficult to guarantee sufficient ridership to support major investments in transit connections. Transit agencies have difficulty in guaranteeing that funding is available for transit construction at the specific point in an airport's planning process where such a financial commitment is needed. In addition, it was noted that airports in such large urban areas as New York City and San Francisco were experiencing considerable recent growth in limousine and shuttle van ridership. For example, these services now claim more than one-half of the volume of trips between New York airports and a suburban Connecticut county. In contrast, such services now account for only about 10% of the total volume of trips between Logan Airport and the Boston suburbs.

This situation suggests a strong potential market for third parties to offer passengers such



Double-stack train - Courtesy: Southern Pacific Transportation Company

"door-to-door" trip planning and ticketing services, just as many companies do for freight shippers. To accomplish this, it was suggested that systems designers should bring the "logic" of door-to-door service from the freight side to the passenger side. Several participants commented that they would personally be willing to pay more as travellers for such a convenience.

Participants agreed that the major barriers to greater intermodalism in the U. S. seemed primarily to be institutional rather than technical or structural. As one participant commented, "the infrastructure problem is between our ears!" At the same time, several states are now pursuing new intermodal surface transportation plans. One participant pointed out that in his state, fifteen different agencies drafted a joint transportation plan aimed at alleviating metropolitan traffic congestion. In his perception, what brought these agencies together was a shared perception of a serious problem that could only be successfully solved by collective planning and action by all participating agencies. This perception then generates the "institutional will" to resolve these problems.

An additional point of discussion related to the impact of government regulations such as the Americans with Disabilities Act (ADA), which strengthened passenger accessibility requirements for older transit systems, paratransit services and added requirements for accommodating disabilities such as vision and hearing. One participant suggested that these new requirements will actually offer wider benefits to a much larger number of passengers beyond those who may be more specifically targeted, by creating a more 'user-friendly' and information-rich environment at the terminals. However, another concern raised is the potential high cost to older transit systems of meeting these provisions.

The issue of whether the U.S. lags behind other countries in having a well-integrated transportation system was raised. It was generally observed that, particularly in passenger transportation, intermodalism seems to work better in Europe because more options exist from which one can choose. It is more common in Europe, for example, to ticket oneself along with one's baggage from origin to destination.

However, several participants cautioned against assuming that other nations had solved the connectivity problems. It was noted, for example, that the new passenger rail terminal is located one mile away from Charles de Gaulle Airport near Paris. Also, the Narita Airport outside Tokyo was cited as a classic example of how not to plan effective intermodal passenger transfers. It is also doubtful that the American public would tolerate the high level of centralized decision-making authority pervasive in these other countries.

One participant observed that, given its size and complexity, the U.S. has an "amazing" transportation system. Nevertheless, there are many problems that need to be addressed. Overall, it was suggested that the U.S. has superb segments of a system, but that it is not yet a well-connected system, especially for passengers.

MAJOR ISSUE

Improving Intermodal Connectivity - Policy Challenges

Background

The National Transportation Policy (NTP) states that a major aim of federal policy is to "improve intermodal connections by:

- *Fostering an environment in which state and local governments and the private sector give greater priority to transportation facilities and improvements that close critical gaps in the national network; and,*
- *Working with public and private transportation interests to identify needs for improved connections and to plan, design, and put in place improved facilities and enhanced transfer techniques between transportation modes and carriers."*

These objectives are reflected in the recent Intermodal Surface Transportation Efficiency Act of 1991, or ISTEA. The legislation states:

"It is the policy of the United States Government to encourage and promote development of a national intermodal transportation system in the United States to move people and goods in an energy-efficient manner, provide the foundation for improved productivity growth, strengthen the Nation's ability to compete in the global economy, and obtain the optimum yield from the Nation's transportation resources."

Both the NTP and the ISTEA support shifting transportation planning and decisionmaking responsibilities from the federal government to state and local governments, giving an expanded role and increased authority to Metropolitan Planning Organizations (MPOs). Improving intermodal connectivity presents formidable challenges to these public bodies. A wide variety of agreements among agencies and private owners of both infrastructure and service companies will be needed. At the same time, private industry is challenged to use new information technologies and operating methods to form intermodal service networks and improve the quality of services needed to meet customer demands.

Problems of funding, zoning, traffic, and environmental impacts will require leadership and initiative to resolve. The situation provides new opportunities for innovative solutions, including new forms of public/private partnerships. Clearly, a nationwide interchange of ideas and experience is needed.

Key questions include:

- *What changes are needed in our overall approach to achieving a truly effective intermodal system?*
- *What do these changes suggest in terms of new public sector roles and responsibilities at the various levels?*
- *Who should have ultimate responsibility for ensuring intermodal connectivity?*
- *What planning tools and skills are available to address intermodal issues?*

Seminar Discussion

Attendees were briefed on the provisions of the new ISTEA. Several provisions of the Act were described as marking a significant expansion in federal interest in and support for intermodalism. In addition to the statement of policy at the beginning of the Act, notable provisions included: authorization for a new Office of Intermodalism

Summary of Major Points:

Intermodal Passenger and Freight Transfer

- User demand has driven intermodalism in freight services to a much greater extent than in passenger services. This may be due to the fact that both providers and customers of freight services are more likely to be private firms more clearly responsive to market forces and competitive demands. Thus, intermodal developments have occurred for freight, with or without specific governmental initiatives or support.
- Although intermodalism is more developed for freight transportation, there are still gaps on the freight side, for example, in connecting rail services to some port facilities and in developing new connections among modes in highly congested urban areas.
- Many of the obstacles to greater connectivity for both freight and passenger services are institutional, rather than technical or structural. The overlapping responsibilities and rivalries among various public agencies, the financial constraints on public and private parties, and questions about who should appropriately fund intermodal facility projects all can delay or forestall progress on intermodal improvements.
- Better intermodal connectivity can provide social benefits that are hard to quantify and include in conventional rate of return calculations. However, these benefits -- including reduced traffic congestion, energy usage, or environmental impacts -- can be real and significant, and should be included in the decision-making process.
- There is a significant need for more and better data, more accurate and comprehensive planning and analytical tools, and better data processing and information management capabilities. Without these resources, it is difficult to determine the total costs and benefits of intermodal options and to make better investment decisions.
- The delegation of much authority to the state and local governments and to MPOs -- a major aspect of the ISTEA -- will significantly affect the decision-making process for transportation projects, including intermodal projects.
- The ISTEA also reflects a new and more positive federal role in promoting intermodal activities by providing funding flexibility, technical assistance, support and information for the state and local authorities to apply in planning and decisionmaking.

reporting to the Secretary of Transportation; statistics and funding for collecting data, including data on intermodal traffic; inclusion of ground connections, such as port access roads, among the facilities that can be designated part of the National Highway System for priority funding; new flexibility for state and local governments to use federal funds for highway, transit or rail projects; and an expanded role for MPOs and requirements for states and MPOs to prepare a series of management plans, including an intermodal management plan.

Many federal agencies are working together to analyze intermodal issues. At the encouragement of U.S. ports, DOT began a land-side access study in 1990 involving five operating administrations (Maritime Administration, Federal Highway Administration, Federal Railroad Administration, Federal Transit Administration and Research and Special Programs Administration). The study was designed to cover such topics as physical limits in rail and road access at ports and terminals, institutional issues pertaining to coordination among public agencies, labor agreements and information processing requirements. The 1992 Aviation Reauthorization Bill also stresses greater intermodalism, including improved ground access to airports and increased funding to ensure the construction of the necessary ground facilities.

The general issue of the role of the government in fostering and enhancing intermodalism was discussed at several points during the seminar. One participant argued that developing greater connectivity in the transportation system is a "public good," similar to promoting clean air, national defense and public health. That is, there are positive benefits to the whole society rather than to any particular user. Among these potential benefits are reductions in energy usage, adverse environmental impacts and traffic congestion, and a more effective nationwide transportation system. However, because these benefits are hard to quantify, they often do not appear in the financial calculations used by state and local authorities to select projects.

The expanded role of the MPOs under ISTEA was discussed in some detail. One participant commented that he had not been a strong supporter of MPOs in the past because of their lack of political authority and participation by relevant political officials. MPOs have historically not had control over funding. Instead, they have had to bring together various groups with separate funding sources, each of which had specific restrictions on its use. Under ISTEA, however, there is expanded authority for MPOs and much greater flexibility in the use of these funds. The Act also expands the role of MPOs in comprehensive planning, incorporating transportation, congestion, pollution and land use issues in the process. Participants speculated that this greater authority will lead MPOs to reconsider their membership and to become more accountable, as public scrutiny grows.

There was universal agreement that more and better data on the traffic carried by the U.S. transportation system is needed, particularly to identify gaps and opportunities in intermodal transportation services and inefficiencies caused by the lack of effective transfer capabilities. Many types of transportation data are being collected at the present time, such as individual passenger airlines and freight companies compiling limited data on their own

customers. However, this information is not consolidated into a single widely accessible database.

In addition, there are significant gaps in the current data collection effort. One participant noted the paucity of freight data from the trucking industry, which accounted for 80% of all U.S. freight traffic. Further, it was noted that all data now being collected are based on the existing transportation system, and must be used with caution as a basis for planning for the future. Although much money is now being spent on data collection, the right questions are not being asked. Thus, it is difficult to identify patterns and deficiencies with any certainty. Data should also be presented in a form that decisionmakers can comprehend and appreciate.

There was also general agreement that better information management and data processing capabilities are needed. The analytical models now in use for forecasting and simulating traffic flows were developed more than a decade ago, before recent advances in methodology. These models, therefore, are based on past behaviors and conditions, and do not incorporate 'social' factors such as concerns about pollution and energy usage or new requirements such as the Clean Air Act. These models need to be updated. In this regard, several participants suggested that the public sector could play a very helpful role in improving data collection and information systems and modeling capabilities.

Support was expressed for continued federal support and funding for transportation demonstration projects that apply new technologies. As one participant pointed out, these projects provide a highly useful service by gathering data and by allowing new technologies to be tested before wide-scale implementation. They are thus a valuable contribution to the education process for decisionmakers. It was suggested that decisionmakers will not care about a solution until they are convinced that a major problem exists. Thus, information and an education process are crucial.

In this context, it was also recommended that the public sector should be careful not to enact policies that stifle the innovations and creativity of the private sector in responding to transportation needs. One participant commented that the private sector comes up with better ideas, yet the public sector has a more accurate vision of overall social goals to be met by transportation. Thus, if the federal government chose a particular technology or standard too early in the development process, it could inhibit further research on other technologies that may have more positive applications in the long term.

Chapter 4:
Energy, Clean Air, and Other Environmental Factors

Introduction

The U.S. transportation system not only determines our mobility, but is also tightly linked to a number of other national goals, including environmental preservation, the perceived quality of life, energy efficiency and economic competitiveness. Within the past two decades there has been a dramatic increase in efforts to assure that transportation activities achieve an acceptable balance in costs and benefits in all of these areas. A partial list of specific 'non-transportation' issues which can arise from a decision on a transportation project or system includes the potential impact on air and water quality; land use patterns; energy usage; noise and related "nuisance" factors; natural and cultural resources such as wetlands, endangered species and historical sites; and the presence and treatment of toxic wastes and other hazardous materials. Addressing all of these areas and achieving a proper balance is a difficult undertaking now facing all levels of government, including local, national and international.

The varied and complex interactions among these factors make it difficult to reach agreement on transportation proposals. Different groups, sectors and industries often have widely varying interests and perspectives. There is often limited communication between transportation planners and engineers, and agencies and groups concerned with environmental quality. Responsibilities for various aspects of energy and environmental policy are distributed among many agencies at all levels of government. There are also large gaps in the basic data and technical understanding needed to assist in developing strategies to enable a decision on a transportation project to optimize these numerous social goals.

The Volpe National Transportation Systems Center hosted a seminar on the topic of "Energy, Clean Air and other Environmental Factors in Transportation" in Cambridge, MA on December 10, 1991. Attendees included representatives from state Departments of Transportation and Port Authorities, federal agencies, environmental groups, transportation equipment and service providers, academic experts and transportation consultants.

The topics suggested to the group for discussion included: the adequacy of technical understanding of these issues; economic and related impacts of these factors on transportation; balancing transportation and environmental goals; alternatives for reducing motor vehicle emissions; and environmental constraints on infrastructure construction. In addition, participants were provided with a "Background Paper" (reprinted at the back of this section) along with the "Issue Paper" for this topic.

Observations and common themes raised in the discussion are summarized below. The views that follow in the "Seminar Discussion" sections were expressed by individual participants in the course of the discussion, and do not necessarily reflect the policies or positions of the Department of Transportation (DOT).

MAJOR ISSUE

The Adequacy of Technological Understanding

Background

In most cases, the chain from an activity such as transportation to an adverse environmental consequence, such as impairment of human health, is complex and not precisely quantifiable. Yet, given the substantial potential societal costs of control measures and the great amounts of time and effort often required to resolve conflicts, a complete and accurate technical foundation for policies is a necessary precondition for developing solutions which are effective, acceptable and efficient.

The effect of the automobile on air quality provides a good example of this situation. Relatively good data does exist on the emission characteristics of existing vehicles. However, accurately assessing the environmental effects of any type of vehicle requires combining this data with other information such as usage rates, dispersion models based on atmospheric physics and chemistry, population distribution data, and knowledge of the health effects of various gases and materials. Because of the different types of data and the complex interactions involved, as well as the relative uncertainty associated with some of these factors, the accuracy and utility of the resulting analysis is frequently a subject of considerable debate and disagreement.

Key questions include:

- *What advances in scientific understanding, data, analytical models and tools, and related areas are most critical to establishment of a solid*

foundation for transportation-related environmental policies, legislation and regulation?

- *To what degree do current gaps of this nature impede the formulation and implementation of sound policies?*
- *Is recent transportation-related environmental legislation -- such as the Clean Air Act Amendments and the Oil Pollution Act -- soundly based in terms of current technical understanding?*

Seminar Discussion

Transportation decisionmakers often find themselves, in the words of one participant, "data rich, but information poor." Inadequate or incomplete data and analysis often leads to inefficient and sometimes ineffective approaches in areas such as environmental standards being incorporated into laws. For example, several participants commented that not enough is known about the chain connecting transportation, emissions, air quality and health effects to determine if our current policies will really help to meet the desired goals, and whether they are as cost-effective as they could be. Atmospheric chemistry is very complicated, and what is known now is not often used in the legislative process. Most of the models and data originated in the 1970's, but different questions are now being asked and different tools are needed. For example, the current transportation models were

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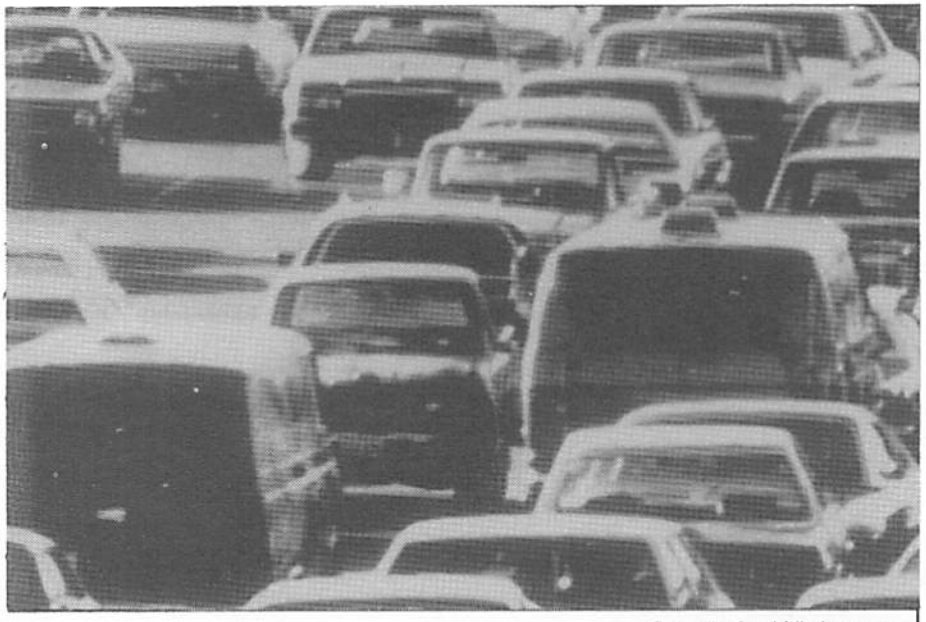
not originally developed with application to air quality issues in mind.

One academic participant observed that many of the current laws are based more on design, rather than performance, specifications. These tend to dictate to responsible agencies how to do it, rather than simply stating what is to be accomplished. This stifles innovation and often yields simplistic "solutions" which may be politically popular but are less effective and more expensive than other approaches would have been. Further, this often leads to a focus on "quick technological fixes" intended to avoid the difficulties of institutional or behavioral change. Often, however, such as with motor vehicle emissions, the "easy" improvements have already been implemented and further progress in this area is likely to be both modest and costly.

There was general agreement that the Clean Air Act Amendments incorrectly focus on vehicle-miles-travelled (VMT), rather than on emissions, as the measure of achievement of air quality goals. VMT is a poor gauge for air quality. It has been chosen as the basis for regulation, however, because it is relatively easy to measure. Originally the Clean Air Act addressed air quality directly, but that did not work because the measures taken were inadequate. As a result, we now have mandated approaches based on other measurements which are less precise and meaningful. In fact, one participant suggested that just as it was determined that GNP and energy consumption are not tightly linked, mobility and VMT may also be separable. Thus, there are several different ways by which transportation efficiency can be measured.



Congested Highway

Several participants noted that the most productive environmental legislation defines the desired outcomes and monitors achievement of those goals, without specifying how to do it. Leadership is needed, but leaders must explain the rationale for their decisions rather than simply 'browbeat' others into acceptance.

One participant complained that often the problem is defined as how to meet demand without considering that changing demand could be an equally valid solution. In this view, standards are not the best approach. Instead, we should "internalize externalities" by incorporating into each decision its true costs to society and the environment, and then let users make their own decision and pay the consequent price. Because of a reluctance to make users pay the real costs, however, we too often turn to technological fixes, which frequently are not effective in all situations or for all users.

MAJOR ISSUE

Economic and Related Impacts of Environmental Factors on Transportation

Background

The adverse impacts of measures to mitigate environmental and energy concerns go well beyond the direct expenses associated with implementation. The result may include substantial impacts on employment levels and the competitiveness of particular industries. For example, the Oil Pollution Act imposes substantial requirements on the petroleum industry. The accelerated phaseout of relatively-noisy "Stage 2" aircraft will cost U.S. airlines billions of dollars in replacing current aircraft and engines. Severe constraints on the use of the private automobile could be seen as significantly reducing quality of life for many individuals, as well as reducing mobility and increasing costs. The mechanics of achieving and monitoring compliance may impose many burdens in addition to direct cost on both the private sector and on state and local governments.

Similarly, benefits -- in terms of improved quality of life as well as specific transportation improvements -- can be very difficult to quantify. For very long-term issues, like global warming, conventional economic analysis may not be adequate. Further, costs, benefits and other impacts can fall disproportionately on different segments of society and on different geographic regions.

Key questions include:

- *Do current environmental and energy policies affecting transportation give adequate consideration to consequences that are particularly difficult to quantify?*
- *How can the less tangible aspects of "quality of life" be captured in policy formulation and implementation?*
- *Does recent transportation-related environmental legislation, such as the Clean Air Act Amendments and the Oil Pollution Act, have particularly strong adverse economic impact (disproportionate to the benefits) on particular industries, localities, levels of government or segments of the population?*
- *Is the institutional process within which policy is developed adequate to ensure effective consideration of indirect and qualitative evaluation factors?*

Seminar Discussion

Several participants commented that the impacts of environmental regulation are complicated, extending to many industries and elements in the lives of communities and households. Often, people do not have sufficient information about the whole range of impacts to make informed choices. For example, one participant observed that the cost to the Northeastern U.S. for heating oil will be significantly increased by the new legislative requirement for double-hulled tankers; however, the effectiveness in terms of reducing oil spills may be very limited. If more complete information about the total costs and benefits of various choices were available, society might be able to develop better solutions. Approaching transportation issues from a system level, rather than an individual item level, will encourage multiple goals and interests to be included in the process.

Participants also stressed the importance of starting to think about transportation decisions in fundamentally different ways, and

of redefining the mission of transportation agencies, i.e., to create a "paradigm shift" in thinking and values. Some recommended new ways of thinking were: making improvements in the environment a principal transportation goal; devising "win-win" options that will encourage changes in user behavior; and abandoning the traditional, linear-thinking view that more demand inherently requires more supply. Such changes cannot be imposed by a 'mega-agency'. Rather, planning should be seen as an ongoing activity with an ever-changing and often indistinctly-defined objective, rather than as a 'one-shot' event. It is important to have a range of choices available, so that as many participants as possible can satisfy their own, personally-defined collection of needs.

Several participants noted the weakness in the traditional tendency to seek a product, i.e., a technological fix, to solve perceived transportation problems. It is equally important, if not more so, to look at the *process* as well as the product. As in organization management and manufacturing, focusing on the process, rather than on the product, is often more productive. There is already a constituency for change, and paradigm shifts can occur very rapidly. For example, several participants suggested that it should be possible to move from "protecting" to "enhancing" the environment within transportation decisionmaking, and to use pricing to create value rather than to capture it. By doing so, transportation policy would be based on the goal of improving the environment, rather than simply minimizing the adverse environmental impacts.

The seeds for these changes do exist, and need to be cultivated. Many examples of successful paradigm shifts were discussed. These included: public utilities shifting to setting reductions in consumption as corporate goals and adopting innovative pricing strategies to encourage customers to reduce usage; the growing acceptance among both the public and businesses of the benefits of recycling resources; and the nationwide change in attitude towards the consequences of cigarette smoking.

Other participants gave additional transportation examples. Seattle has instituted new policies for parking, free bus service and additional bicycle and pedestrian facilities. Boulder has recently adopted a policy of zero VMT growth within the city. The New Jersey state government is trying to encourage development where infrastructure is strong and discourage it elsewhere. In Florida, infrastructure must be in place prior to approving development of an area.

It was suggested that one of the most basic purposes of transportation is to make and support 'places' where we live and work: we must focus on this end, to which transportation is a means. Our infrastructure and transportation systems should be consistent with this sense of 'place'. Achieving this goal will depend on both the democratic process at work at local levels, as well as the consequences of personal decisions made by transportation users. One participant commented that environmental controls are said to be driving business away from southern California. Another participant suggested, however, that it may be the undesirable environment, and not the controls themselves, which discourages people from wanting to live and work there.

MAJOR ISSUE

Balancing Transportation and Environmental Goals

Background

The many and varied aspects of environmental quality and energy conservation are linked in numerous ways, and often conflict with one another and with other societal values. For example, the development of automobile engines which are both fuel efficient as well as 'clean' is more difficult than meeting either challenge separately. Forced reduction of automobile usage would affect some individuals and groups far more adversely than others. Market-oriented approaches such as a petroleum or carbon tax or other forms of demand management could create serious inequities in mobility between income groups.

Balanced and integrated strategies to achieve environmental preservation and energy conservation goals must be crafted with full awareness of transportation's role in supporting the economy and providing personal mobility. A satisfactory resolution will require that involved agencies and interested parties be able to attain an understanding of these multiple objectives. It is counterproductive to see environmental concerns as obstacles to providing transportation. Just as industry is learning to design quality into products and manufacturing processes, rather than culling out the rejects later, environmental considerations must be inherent to all transportation decisions.

Key questions include:

- *How might institutional responsibilities and relationships be recast to facilitate integration and coordination of environmental and energy policies with each other and with other transportation objectives?*
- *Is the present allocation of responsibilities among various levels of government, within the separate agencies of each level, and between the public and private sectors satisfactory?*
- *Can the policy development process be refined in a manner which emphasizes negotiation and compromise among the many stakeholders, rather than confrontation and resort to pure political strength?*

Seminar Discussion

There was agreement on the importance of focusing our efforts on our goals. It is possible for environmental improvement actions to become ends in themselves, without regard for the other consequences of these actions. Mobility is also not an end in itself, but it is of sufficient importance that many persons do not want to accept significant restrictions on the amount of mobility available to them. Further, in the long run the issue is not mobility *per se*, but rather land use decisions and access by individuals to the desired range of goods and services. Thus, it is crucial that processes and institutions be considered, and that the needs and desires of the transportation consumer and the general public be included.

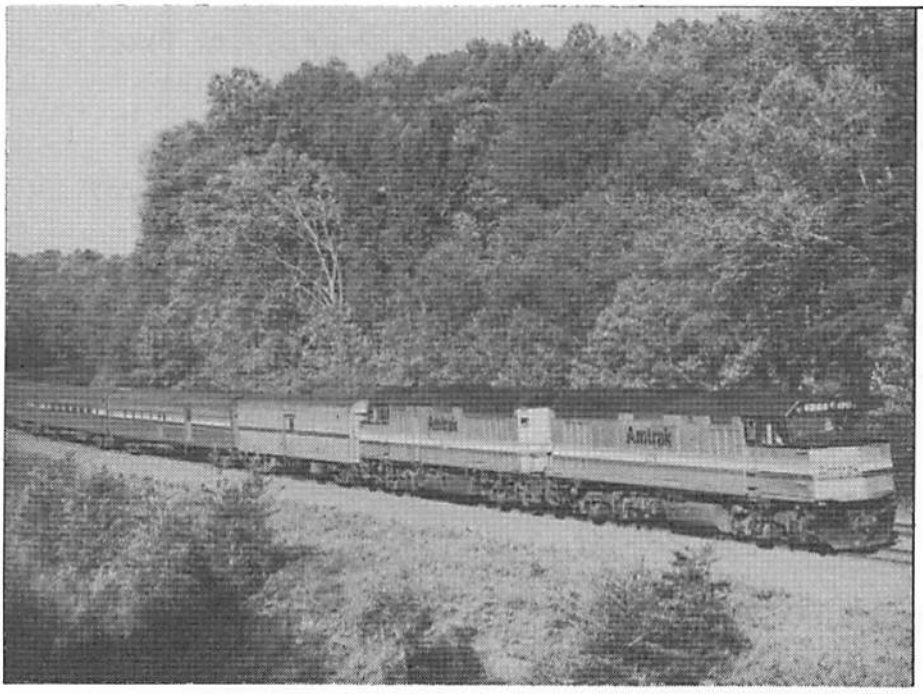
A transportation consultant noted that one of the difficulties in setting commonly-accepted goals is the existence of differing perceptions of risk and time frame. Current procedures and approaches force an emphasis on making decisions on individual projects, rather than applying a more comprehensive, overall transportation or urban system planning approach.

Several participants commented that the normal approach to transportation projects is piecemeal: there is a need to treat transportation and environment at a system level to rationalize and integrate policies. Pessimism was expressed, however, at the ability of such agencies as state Departments of Transportation or Federal Highway Administration (FHWA) to lead this change to a system-level, environmentally-positive approach, because their culture and function focus on meeting relatively narrow, immediate and real needs.

As one participant commented: "trying to treat transportation problems by building highways is like treating obesity by loosening your belt". However, it was recognized that it is very difficult to get decisions made that will allow public agencies to move forward on new ideas and focus on providing transportation and mobility. One participant observed that making these kinds of ideas work requires 'selling the vision' so that the public understands and accepts the benefits that will result from the policies, as has begun to happen in areas such as recycling.

Even though state Departments of Transportation may require statewide plans, with local plans in conformance, there are inherent obstacles to comprehensive planning. For example, one participant complained that state governments cannot easily assume land use decisions from local authorities. In addition, the tenure of state transportation chiefs tends to be only about two years on average, and their staffs are typically engineers and not land use planners. As one participant commented: "we need an institutional setting in which we can function--we don't have it now."

Some participants judged decentralization of decisionmaking authority to be an advantage, because it gives flexibility to develop solutions to suit local circumstances. On the other hand, there are institutional barriers to finding these solutions. As one participant observed, only local



Amtrak - Courtesy: National Rail Passenger Corporaton

authorities can address land use issues, which are critical aspects of transportation planning. Placing land use authority in regional agencies is difficult, because local property owners and businesses often do not accept the idea. In fact, it was mentioned that an attempt of this nature was recently voted down in California.

Regardless of the level of land use authority, a number of overlapping, single-purpose agencies are still involved in the planning and decision-making process. For example, there are few models of true joint planning between agencies with air quality, land use planning and transportation responsibilities. Further, it was noted that local approaches do not necessarily yield a good transportation system from the national perspective. One participant predicted, for example, that the rising level of frustration in many localities over airport noise issues will continue to cause disagreements on this issue with the Federal Aviation Administration (FAA).

The delegation of responsibilities to state and local levels included in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 was generally applauded, although several participants noted that transportation funding remains inadequate. One suggested method for increasing funds was through a higher gasoline tax at the local level. Another problem cited by several participants is that ISTEA gives more incentive to metropolitan regions to establish a more comprehensive vision of transportation, but the Clean Air Act requires spelling projects out in great detail. It then can become difficult to implement the vision when authorities will have to quantify details of each project, establishing a purely project-oriented perspective.

There was consensus that additional research is needed, particularly in the area of institutional processes and policy formulation. It was noted that the U.S. DOT spends far less on this topic than do the U.S. Army Corps of Engineers or Environmental Protection Agency. FHWA has very limited environmental research funds, and those are not typically used for institutional and policy projects.

MAJOR ISSUE

Alternatives for Reducing Motor Vehicle Emissions

Background

A broad spectrum of means exists for reducing the contribution of motor vehicles to degraded air quality. The most direct approach is technical, and is often relatively invisible to motorists (beyond a possible modest cost). Technical means to achieve these goals include improved vehicle technology as well as reformulated or alternative fuels. Other approaches seek significant change in the behavior of the driving population, such as encouraging the purchase of electric vehicles, shifting to car pooling and transit, relocating residential and employment areas, telecommuting, and restricting parking and vehicle access to urban centers.

Technical approaches may seem easier, but previous successes leave relatively little additional gain from this method. In contrast, achieving changed behavior can yield substantial benefits, but the degree of success is uncertain and ultimately subject to the political process. Laws which are sufficiently unpopular will ultimately be changed or repealed. The cost and disruption of providing substantial upgrades to public transit can be very large, and the actual impact on air quality may be modest. The means used to change behavior can also raise many questions of equity, particularly when free-market pricing or taxing methods are used to encourage preferred behavior.

Key questions include:

- *Do current policies and plans, particularly with respect to Clean Air Act requirements, strike a reasonable balance between technical and behavioral approaches?*
- *To what degree are these various approaches likely to be successful in terms of popular acceptance and environmental improvement?*
- *How can congestion mitigation and environmental preservation objectives best be harmonized?*
- *Will people be willing to pay the price required for cleaner air?*

Seminar Discussion

The United States is highly dependent on the automobile. Even though the automobile is an excellent means of transportation for many purposes, there is great vulnerability in this 'monoculture' approach. One participant cited the analogy to the disastrous consequences of 19th Century Ireland's dependence on the potato as a food staple.

There was general agreement that major demographic and societal changes are now occurring within the United States, and that the transportation community is generally not well equipped to assess how these changes could affect travel demand. There is very limited understanding of how travelers (particularly motorists) will respond to economic incentives or disincentives, more or improved transportation options, and mandated constraints on mobility. Even where information exists, transportation agencies may not be aware of it. This lack of understanding of behavioral matters causes many public agencies to avoid overt attempts to affect travel behavior. In addition, many transportation officials and members of the public believe that the job of transportation is to meet demand, not to manage demand by rationing capacity or making consumers pay to have their travel demands met.

It was suggested that traffic congestion itself can act as a useful

planning and regulatory tool. That is, congestion compels individuals to make behavioral changes such as choosing alternate travel modes or finding substitutes to travel itself. From this perspective, building more highways will only encourage more undesirable behavior, i.e., the use of private automobiles instead of mass transit. Other possible strategies discussed to enhance environmental goals were expansions of high-occupancy vehicle (HOV) lanes and telecommuting.

Intelligent Vehicle-Highway Systems (IVHS) concepts are often advanced as ways to reduce emissions by reducing congestion. One participant, however, suggested that these technologies should not be energetically pursued, since they could delay the adjustments in driving patterns that may be inevitable at some future point. A recent study, for example, concluded that the use of IVHS systems in Tokyo to inform drivers of less-crowded alternate routes actually contributed to a decline in mass transit use and increased congestion on a greater number of roads than previously.

On the other hand, using congestion as a regulatory strategy can be very inefficient for the society as a whole. For example, it was noted that road congestion near a seaport negatively affects both local commuters and freight shipments, imposing separate but significant streams of social costs. Even if shippers or drivers were willing to pay to avoid congestion in this example, there may be no effective short-term option. This is because the frequently strong level of local opposition to building significant additional highways often delays or even terminates such projects.

Some economists advocate charging users of the transportation system for the costs they impose, particularly in relation to the congestion and environmental impacts of their actions. Some pricing strategies can affect vehicle emissions by, for example, charging people higher fees for operating higher emission vehicles, or metering road use and charging drivers by the mile. Several participants suggested, however, that many people may not accept transportation being priced at its true cost unless they have greater trust in how the revenue will be managed and used. For example, toll roads offer the opportunity to charge drivers the true costs for using the automobile. While many people do not like paying tolls to use a roadway, drivers have often proven to be wiling to pay tolls if they are getting a high-quality, less-congested highway in return.

An additional suggested application of this strategy is to increase aircraft landing fees during peak hours. The advantage of this method is that the cost is not directly visible to passengers as a personal charge against them. Thus, although congestion pricing is not generally popular, it could be both acceptable and useful in some situations.

A similar debate is going on about the effect of environmental regulation on jobs. Some participants pointed to direct effects of meeting tougher environmental requirements on current producers and users of higher emission motor vehicles. Others noted that some studies suggest additional jobs will be created to develop and produce new products and methods of meeting the requirements. From early experiences, it appears that U.S. companies may generate new business, including markets in other countries, by developing products and services that effectively meet both environmental and transportation goals.

One issue raised is whether the transportation 'marketplace' is offering what people want, or are people just accepting what is available? One current problem discussed is that automobile use is underpriced and transit is undervalued, and that the value of mobility for elderly citizens is often not adequately appreciated. But behavioral changes cannot be achieved by imposing new policies on users against their wishes. Greater public education will be needed to gain acceptance for using additional pricing strategies in transportation.

Summary of Major Points

Energy, Clean Air and Other Environmental Factors

- There is a strong need for new thinking on environmental issues: current efforts are typically not sufficient. This new thinking would incorporate and integrate the following perspectives:
  - Cross-Modal and Intermodal
  - Cross-Agency
  - Cross-Government
  - Public-Private
  - System Level
- Purely technological approaches to environmental issues are limited in potential and often ill-advised or poorly designed. There are serious flaws in the "quick technological fix" approach.
- The most effective solutions to transportation problems for the future may in many cases focus on better management of existing infrastructure, rather than on construction of new infrastructure. Better utilization of facilities may involve changes in patterns of use and behavior, driven by perceived costs. Thus, the full social costs and benefits of actions related to transportation and environmental quality must be identified to the fullest extent possible, to provide a sound basis for decisions on policy and selection of approaches to implement.
- There is a growing awareness of the role of transportation in meeting multiple social goals, including environmental, energy and land use concerns as well as the traditional emphasis on mobility.
- Roles and responsibilities among various agencies and levels of government involving the environment and transportation are often complicated and confusing, or even inappropriate relative to the expertise and resources of the parties. This leads to overlaps, gaps, conflicts, and poor overall results judged from the perspective of overall regional or national goals.
- In almost all areas of transportation and environmental analysis, data, information and tools are inadequate for effective planning and evaluation of options and their effects, including technical, economic and behavioral aspects. More and better data and tools would be highly beneficial.
- Goals, actions and costs relating to the public good and to private interests must be carefully separated and delineated.

MAJOR ISSUE

Environmental Constraints on Infrastructure Construction

Background

Construction of transportation infrastructure, such as highways, airports and rail lines, invariably generates concerns over environmental quality issues such as wetlands loss, destruction of habitat, land use, runoff of contaminants, and the resulting noise levels. Regardless of possible long-term overall environmental benefits, major infrastructure projects are sometimes delayed, canceled, or never even initiated because of the daunting and very time-consuming environmental review process. On the other hand, the substantial potential environmental effects of the construction process and future intended use of the infrastructure clearly warrant close scrutiny to assure that environmental damage is avoided, mitigated, or at least fully weighed against other societal needs and anticipated environmental benefits.

Key questions include:

- *How well do current project review processes balance environmental concerns with the need for new or expanded infrastructure?*
- *Is the major problem with the outcome of the process, or with the time and effort required?*
- *What kinds of process changes would be most beneficial?*
- *Can the U.S. have a fully adequate transportation infrastructure without necessarily making significant compromises to environmental standards and goals?*

Seminar Discussion

Transportation is increasingly being called on to achieve environmental objectives, as well as mobility, safety and economic development goals. Yet the traditional decision-making process for transportation projects tends to be narrowly-focused on the cost of a project and its effectiveness at meeting travel demand. For example, several participants mentioned the conventional criticism of state Departments of Transportation as being mired in a 'road-builder' mentality that has a view of the world "4 lanes wide and 200 miles long." From that perspective, environmental considerations such as clean air, preservation of wetlands and enhancement of the quality of life are all potential impediments to obtaining the maximum mileage of new pavement out of every dollar invested.

Several participants stressed that energy and environmental concerns should not be seen as constraints to achieving transportation goals. Rather, they should be considered as integral parts of meeting these goals. One consequence of not sufficiently including these concerns in transportation decisionmaking, noted one participant, is that our society has steadily reduced the diversity and range of available transportation options. As a result, the only practical or even possible choice in many circumstances is the private automobile. A second participant suggested that the National Transportation Policy itself is not really a 'mode-neutral approach' because it inherently accepts the existing patterns that favor the automobile.

It was noted that a continual thread within the history of many recent transportation projects is conflict between those seeking a pristine environment and those who support unfettered mobility. It is important to stress that there are physical and financial limits on our ability to

achieve multiple goals, and that hard choices with both positive and negative consequences must often be made. In short, we have to accept the fact that there are limits. For example, if the nation invests a relatively small amount in infrastructure, then it is unrealistic to expect that one could live a significant distance from work and expect a quick and convenient daily commute.

Background Paper
Energy, Clean Air, and Other Environmental Factors

Introduction

Transportation, one of the most pervasive and varied of societal activities, has exceptionally strong ties to the nation's energy use and environmental quality. Approximately 40% of U.S. energy consumption --including 3/4 of petroleum use -- is directly or indirectly for transportation functions. Highway vehicles are the largest single contributors to air pollution, and it has been asserted that more land is now devoted to the automobile than to housing. Oil spills are a particularly vivid reminder of our heavy use of petroleum and the potential environmental costs of that dependence. In turn, the range of transportation services and the way we treat them is strongly affected by society's attempts to avoid environmental degradation and reduce energy consumption. The Clean Air Act Amendments of 1990 and the Oil Pollution Act of 1990 are two key recent actions taken by government in the interest of environmental preservation. The continuing national debate over federally-imposed automobile fuel-efficiency standards reflects similar concerns. Preservation of the ecological functioning of wetlands has sometimes complicated or even precluded construction of new transportation infrastructure. Noise and other land use concerns have long been contentious issues that have limited responses to airport congestion.

Relevant Transportation Data

Some basic data can provide perspective on issues associated with transportation, environment and energy. About 27% of the nation's total energy consumption is used directly for transportation. The share reaches 40% when one includes energy used *in*directly by transportation, primarily associated with manufacture of vehicles and construction, maintenance and operation of transportation infrastructure.

Most of this consumption is in the form of petroleum-based fuels, with the result that direct use for transportation accounts for 73% of petroleum use. The distribution among different modes of transportation is shown in the figure at right, which displays the percentage of total transportation energy consumption -- generally comparable to petroleum use and emissions --associated with each mode. The predominance of highway motor vehicles is immediately evident. Passenger transportation accounts for roughly 2/3 of the total direct use. Further, the major portion of the indirect consumption mentioned above is also associated with the manufacture of highway vehicles and maintenance of roads. (The "Other"

category encompasses military energy transportation use and off-highway farm and construction equipment.)

The dominance of the highway modes is a natural consequence of the degree to which they provide for U.S. passenger and freight transportation needs. About 90% of annual passenger-miles are by road motor vehicles, with most of the remainder by air. Rail and transit together contribute less than 2%. With respect to freight, trucks provide approximately 30% of the annual revenue ton-miles. This is slightly more than either rail or water, and significantly more than pipeline.

In terms of environmental impacts, it is also noteworthy that approximately 2/3 of the vehicle-miles travelled are on urban roads, although they only comprise about 20% of the national highway system. At this very high level of aggregation, the urban system has a loading six times greater than rural, in regions that -- by definition -- are where most people live. In specific urban areas, the "transportation density" can be much greater. On the other hand, rural areas often include substantial quantities of relatively fragile natural resources, such as wetlands and watersheds.

Trends in these data are mixed. During the last decade, the passenger car population and average vehicle-miles per car both increased at about 2% per year, while the truck population grew at a 5% annual rate. Not surprisingly, energy consumption for trucking increased at a rate of approximately 5%, whereas the annual change for automobiles was only 0.3%. Presumably the larger passenger car population and greater average mileage was compensated by the increasing percentage of more fuel-efficient cars in the fleet.

However, this effect is not as great as it might have been, since cars are being kept on the road longer. In 1970, 50% of the nation's automobiles were older than 4.9 years, but by 1989 this value had risen to 6.5 years. This is significant for emissions, since older cars were produced to meet less-stringent standards and may have deteriorated with age.

The nature of environmental problems changes with time, particularly with respect to air quality. For example, measures already in place --such as existing vehicle emission standards -- will have increasing impact as older cars are removed from the fleet. On the other hand, some regions are experiencing substantial population growth, while others are relatively stable. It is important to match potential solutions to the circumstances that will prevail when they are realized, which do not necessarily reflect the present situation.

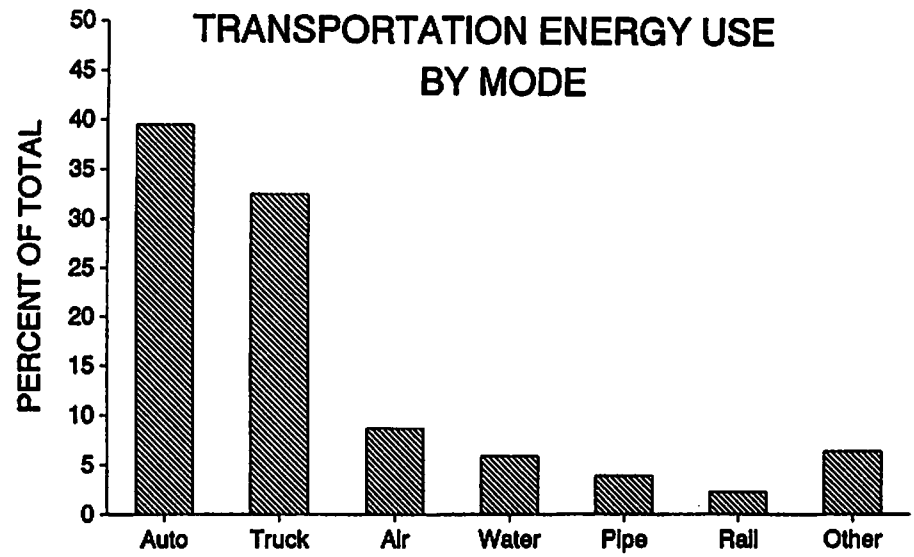


Figure 1: Transportation Energy Use by Mode

Institutional Considerations

Many parties have critical roles in environmental and energy policy. At the federal level, governmental responsibilities for environmental and energy matters are widely dispersed. Energy policy is formally developed and implemented by the Department of Energy (DOE). Air quality is basically within the purview of the Environmental Protection Administration (EPA). Wetland considerations are addressed principally by the Army Corps of Engineers. Within the Department of Transportation, at least five separate organizations have major responsibilities. The National Highway Traffic Safety Administration (NHTSA) implements automobile fuel efficiency standards; the U.S. Coast Guard has major responsibilities with oil transport; the Research and Special Programs Administration (RSPA) is responsible for transportation of hazardous materials; the Federal Highway Administration (FHWA) has significant environmental responsibilities with respect to the road system; and the Federal Aviation Administration (FAA) deals with aviation noise.

However, much of the responsibility for assessing and controlling environmental impacts and for carrying out Federal mandates resides at the state and local level, where many additional regulations are generated in response to local situations and values. In many cases it is ultimately up to the private sector, as exemplified by vehicle manufacturers and transportation companies, to implement government requirements, often at considerable expense to themselves and the public. A wide range of public interest groups reflect the viewpoints of the many affected segments of the population. These groups often play a major role in negotiating resolutions of specific environmental issues.

Environmental actions are increasingly determined on the international stage. Truly global phenomena, such as buildup of greenhouse gases and upper-atmospheric ozone depletion, are being addressed by world bodies. Agreements on these issues are then implemented by each nation.

Recent and Continuing Events

One of the most significant recent events in the environmental arena was the passage in late 1990 of a sweeping set of amendments to the Clean Air Act (CAA). These amendments place substantial responsibilities for implementing and monitoring environmental policy on the Secretary of Transportation or the Department's operating administrations. Strong emphasis is placed on the need for local and regional planning authorities to develop and implement plans for transportation projects that will conform to plans to improve air quality. The CAA specifically calls for cleaner engines and fuels; local areas are also expected to achieve the goals by adopting demand management techniques and providing more energy-efficient transportation options to reduce automobile use.

Responding to similar concerns, in late 1989 the Los Angeles-area South Coast Air Quality Management District adopted a long-term plan for improved air quality. This plan includes a wide range of measures, some relatively drastic, involving technology, land

use planning, major transit investments, parking controls and ridesharing incentives. Several northeastern states are adopting California's automobile emission limits, which are more stringent than current Federal standards. California has also recently issued standards that will require cleaner, but more costly, gasoline.

International concern over possible significant global warming, caused to a substantial degree by carbon dioxide and other motor vehicle emissions, continues to increase. However, firm conclusions concerning the magnitude and timing of this phenomenon and the best ways to respond to it have remained elusive.

Enactment of the Oil Pollution Act of 1990 (OPA) was given special impetus by the *Exxon Valdez* spill in Prince William Sound. This legislation provides for increased liability for shippers, establishes hull thickness and double-hull requirements for tankers, and mandates a national emergency contingency plan for removal of spilled oil from navigable waterways and harbors. Some oil companies have responded to public concerns and liability risk by converting to double-hull ships in advance of the legislated schedule.

As a result of concerns over U.S. dependence on foreign oil, the potential for spills in transporting oil, and concerns with global warming, the debate over mandated corporate average fuel economy (CAFE) standards for passenger cars and light trucks has sharpened. Legislation has been introduced by some members of Congress in the last two sessions that would require an increase in the CAFE standards for automobiles from the current 27.5 MPG to 40 MPG by the end of the decade. Opposition to this standard is based on concerns over its technical feasibility, vehicle safety and cost implications, and impacts on U.S. competitiveness in that market.

A broad national policy of no net loss of wetlands has recently been articulated. However, the clash between development, including transportation infrastructure, and preservation of wetland areas and other wildlife habitats has sharpened. One focus of this issue is whether the Arctic National Wildlife Refuge and coastal regions should be opened to oil exploration. It has also been suggested that a more restrictive definition of wetlands should be imposed.

The Federal Aviation Administration recently issued new aircraft noise rules calling for phasing out "Stage 2" commercial aircraft and making transition to quieter planes by 2000. The rules also constrain the process by which communities can impose noise restrictions on new local airport operations. Estimates of the cost of phasing in the newer aircraft vary widely depending upon key assumptions, but the price will certainly reach billions of dollars.

Chapter 5: Freight Transportation

Introduction

The demand for freight transportation, as well as the specific types of freight services needed, are directly affected by such factors as demographic trends, changes in the national and international economies, and the impact of deregulating major segments of the transportation industry. As a result, freight transportation has been changing rapidly over the past decade. Many new developments, such as the applications of new technologies and procedures, the growing importance of containerization and intermodal connections, and the consolidation of various providers into larger, vertically-integrated organizations, have been apparent in these years. This rapid change among users and providers of freight services, however, has not always been accompanied by parallel changes in the role and activities of the public sector at the local, state and federal levels.

The Volpe National Transportation Systems Center hosted a seminar on the topic of "Freight Transportation" in Cambridge, MA on December 11, 1991. Attendees included representatives from major U.S. manufacturing and consumer products companies; freight service providers from the trucking, railroad and airline sectors; state port authorities and Departments of Transportation; and logistics analysts and academic experts.

Topics suggested for discussion at the seminar included: changes in user demand for freight services; the various responses by freight providers to these user demands, including consolidation, new technologies, containerization and intermodalism; and the role of the various levels of government in facilitating freight transportation. Observations and common themes raised in the discussion are summarized below. The views that follow in the "Seminar Discussion" sections were expressed by individual participants in the course of the discussion, and do not necessarily reflect the policies or positions of the Department of Transportation (DOT).

MAJOR ISSUE

Changes in User Demand

Background

Intensified international economic competition, the declining importance of the manufacturing and mining sectors, and the importance of the 'service' economy will all have significant impacts on the demands for freight transportation services in the future. These trends are further stimulated by the growing role of the high-technology sector of the U.S. economy, as well as by the wide-scale adoption of the latest production and distribution methods, such as just-in-time (JIT) manufacturing. Another innovative business practice that impacts freight transportation is the concept of 'logistics chaining.' Logistics chaining can be defined as the development for a user, or even by a user, of an integrated freight service which can move goods continuously from door-to-door rapidly and reliably by as few 'hands' as possible. Not only can this reduce costs and improve efficiency, it can also add to profits by cutting the size of the inventories for both components and final products which must be kept stored at any one time.

As a result of these trends, it can be anticipated that the importance of smaller, lighter-weight and higher value-added goods will grow in comparison to bulk cargo and large-volume, relatively low-value goods. Speed, safety and reliability will become more significant factors in the future freight transportation market. However, bulk shipments should not be ignored. Since they are often the primary material from which other products are

manufactured (as, for example, with coal, agricultural products, metal ores and wood), there will be equivalent pressures to cut the costs and increase the speed involved in shipping these products as well.

One of the major single users of the nation's freight transportation assets is the U.S. Department of Defense (DOD). The most recent experiences of Operation Desert Shield/Desert Storm have resulted in a number of 'lessons learned' which the Department is still in the process of evaluating. For example, the extent of the effort needed to move all necessary cargo halfway around the world further confirmed the military's dependence on civilian assets. This was especially evident in the case of merchant ships, aircraft, and even freight containers. This also raises the important question of whether the U.S. government still controls, or can guarantee adequate access to, sufficient and preferred logistics assets to meet these requirements in the case of an even larger mobilization. The movement, already well underway within the Defense Department's logistics sector, towards containerization of as much freight as possible, was further stimulated by this event. Finally, innovative technologies were tested. One of the most notable of these was the application of satellite-based global positioning and communications capabilities to track and pinpoint the location of shipments. Many of these Desert Storm lessons are equally applicable to civilian freight. This is especially true concerning the importance of adequate carrying capacity, the application of new technologies, and the advantages of containerization.

In summary, as freight transportation users are becoming

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more demanding in their requirements, the many operators and suppliers of these services will be compelled to respond positively in order to retain their market share. This response has taken, and will continue to take, many forms. Among the most notable of these activities are consolidation within the freight industry, the application of new technologies, and the expansion of intermodal and containerization capabilities. These issues will be discussed further in the following sections.

Key questions include:

- *To what extent are the transportation and logistics portions of total business expenses and operations becoming a hindrance to successful competition?*
- *What specific characteristics does a user look for in choosing a transportation provider?*
- *How successfully are freight transportation providers adapting to changing user demands?*
- *How can Defense Department requirements be best accommodated within the changing freight industry?*

Seminar Discussion

A uniform view emerged from the participants that transportation and logistics (T&L) are merging into a single discipline--to manage and track both components and final products from point of origin to point of final sale. The primary goal of this process is to minimize both the financial cost and the time involved in the overall production and distribution process. In turn, this trend contributes directly to a company's competitiveness, market share, revenues and profits, i.e., to "success." Examples of this trend include JIT and "Seamless Logistics" techniques.

Both freight users and providers are operating under the same economic pressures to cut costs and improve efficiency. Thus, both sides are actively pursuing means of improving the total transportation and logistics process. For example, many U.S. manufacturers now organize their production on the JIT concept. Retailers are also shifting to JIT stocking. The result is a larger number of shipments of smaller quantities of items because inventory limits have been drastically reduced. Providers are shifting increasingly to such techniques as around-the-clock operations, closer scheduling, and constant monitoring of shipment and vehicle location, in order to maximize asset utilization and lower total costs.

International developments are a major stimulus to these trends, particularly the need to keep U.S. products competitive on the world market. Given the rapid development of new production techniques in this country, U.S. products should remain competitive as long as T&L remains efficient.

Manufacturing remains an important sector within the American economy, and maintaining its international competitiveness will benefit U.S. economic growth. It was pointed out that manufacturing's share of total gross national product (GNP) was still 22% in 1990, compared to 24% in 1945. Bulk items such as coal, lumber and grain are also important U.S. trade items which have significant freight transportation requirements that must be taken into account.

MAJOR ISSUE

Provider Response - Consolidation and New Technologies

Background

As can be expected, the growing competition from both non-U.S. and U.S. businesses in general is paralleled by intensified competition between the various modes and services of the U.S. freight transportation industry itself. One major form that this competition has taken is an increase in marketing agreements and 'strategic alliances' between U.S. and non-U.S. freight operators. For example, Sea-Land Services has recently concluded an agreement with Frans Maas, a Dutch transport company, to link their North American and European operations. Similar agreements also include Asian freight companies, particularly in ocean shipping.

Within the U.S. itself, there has also been considerable activity towards 'rationalizing and restructuring' individual companies into multi-service providers. CSX and Norfolk Southern are but two examples of this trend. In addition, companies are concluding agreements between traditionally rival modes. The Santa Fe Railroad and J.B. Hunt Transport, a trucking company, have developed the 'Quantum' service, in which goods are shipped from West Coast ports to the Midwest by rail and then transferred to trucks for delivery to the final destination. These and similar examples represent the growth of 'vertical integration' in the freight industry within either a single company or in a formal agreement between two or more firms.

In addition to changes within freight companies, some major freight users are undertaking increasing proportions of their transportation and logistics business 'in-house' and reducing reliance on outside suppliers. In some cases, the shipper enters into agreements with a limited number of freight companies to provide certain services based on agreed criteria. Deregulation has also expanded the ability for shippers (especially railroads) and users to incorporate various 'trade-offs' into contractual commitments, which has led to an expanded variety of such relationships. This has two consequences: it reduces the total number of supplier companies with which the user needs to deal in meeting its freight requirements; and it further intensifies the competition among providers to meet user requirements.

An additional significant consequence of these trends is to compel many smaller or less efficient freight operators to be absorbed into larger companies or to be forced out of business. In other cases, smaller firms choose to focus on a more defined market niche in which they can develop a competitive advantage, as can be seen in the case of many regional railroads and local trucking companies.

Another response of freight providers to intensified competition is to exploit the advantages of new technologies in making their services cheaper and more effective. Among the many examples of this trend are the following:

- *satellite tracking of ships, trucks and railcars;*
- *automated logistics and inventory management systems;*
- *electronic data interchange (EDI) and bar coding of goods;*
- *Intelligent Vehicle Highway System (IVHS) applications to commercial vehicles, such as automatic toll recording, automatic vehicle identification, and weigh-in-motion; and*

- *U.S. Customs Service introduction of the Automated Tariff Filing and Information (ATFI) system as a move towards the 'paperless processing' of international shipments.*

Various modes and individual companies have embraced these and similar technological tools to varying extents. However, the impact in general has been felt by virtually all aspects of the freight industry. There is no reason to assume that their application will diminish in the future.

Key questions include:

- *Has the increasing concentration of major freight services into fewer and larger companies been a help or a hindrance to improved freight services?*
- *How effectively has new technology been applied to freight transportation?*

Seminar Discussion

Major trends in user demand have led to closer cooperation between both users and providers of freight transportation, and between different provider modes. Several examples were mentioned of users and providers acting as management consultants for their customer 'partners,' in order to assist them in organizing their internal operations more efficiently. Users are also developing comprehensive, longer-term agreements for freight services, with specifically-defined responsibilities, delivery schedules and performance measurements.

Growing cooperation between providers can be seen in the number of strategic alliances between modes, such as between the Santa Fe Railroad and J.B. Hunt Trucking Company to offer combined road and rail 'door-to-door' freight service. American President Company and CSX were mentioned as representing the growth of large, vertically-integrated transportation providers that can offer more than one mode of service -- ocean ship, rail, truck, freight forwarding and even logistics management -- from within a single corporation.

However, gaps in communications sometimes remain between the modes, even within the same company. Some participants described experiencing a lack of understanding within one of the company's modes of the services and conditions offered by other modes within the same organization.

Innovations such as the application of automated data processing (ADP) and modern communications technologies, have been of significant benefit to freight transportation, and participants encouraged their further expansion. For example, mobile telephones enable dispatchers to stay in constant contact with truck drivers and track the exact location of each shipment on a real-time basis. It was agreed that those providers that are the most successful in implementing such innovations will gain more business as a result.

MAJOR ISSUE

Intermodalism and Containerization

Background

One of the most successful freight innovations in recent years has been the application of intermodalism and containerization. Although these are relatively recent phenomena, they have had a profound impact on the freight industry. This trend started with the 'Land-bridge' concept in 1970s, in which the major western railroads were involved. Container shipments from Asian exporters to West Coast ports were loaded onto special trans-continental trains, which were able to compete against all-water freight routes to locations in the middle of the U.S. and the East Coast. The latest aspect of this service has been double-stack rail service, in which a larger volume of containers can be carried by each train. Although this development also started on the West Coast, double-stack service from East Coast ports has also commenced within the past two years.

Nearly all modes and services have been affected by these developments. In particular, ocean shipping lines, ports and rail services have invested in these capabilities and taken advantages of the resulting cost savings. The most recent trend has been the adaption into several trucking companies of the overall door-to-door network. To date, however, the impact has been primarily on international as opposed to domestic freight.

Containerization and intermodalism can be seen as reinforcing both the responsiveness of the freight industry to user needs, as well as the consolidation of freight activities into fewer, larger service providers. The U.S. government has also acknowledged the importance of these developments. Both the 1990 National Transportation Policy (NTP) and the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 included language supporting the further development of intermodalism. However, there is some question as to the extent of specific assistance the government should provide to promote intermodalism.

Key questions include:

- *How significant has intermodalism and containerization been to overall freight activity?*
- *How much will their share of total volume grow in the future?*
- *What are the prospects for domestic containerization?*
- *Which users and providers have been the 'winners' from these trends?*
- *Which have been the 'losers'?*
- *How much, and how successfully, has government generally aided the growth of intermodal and container services?*

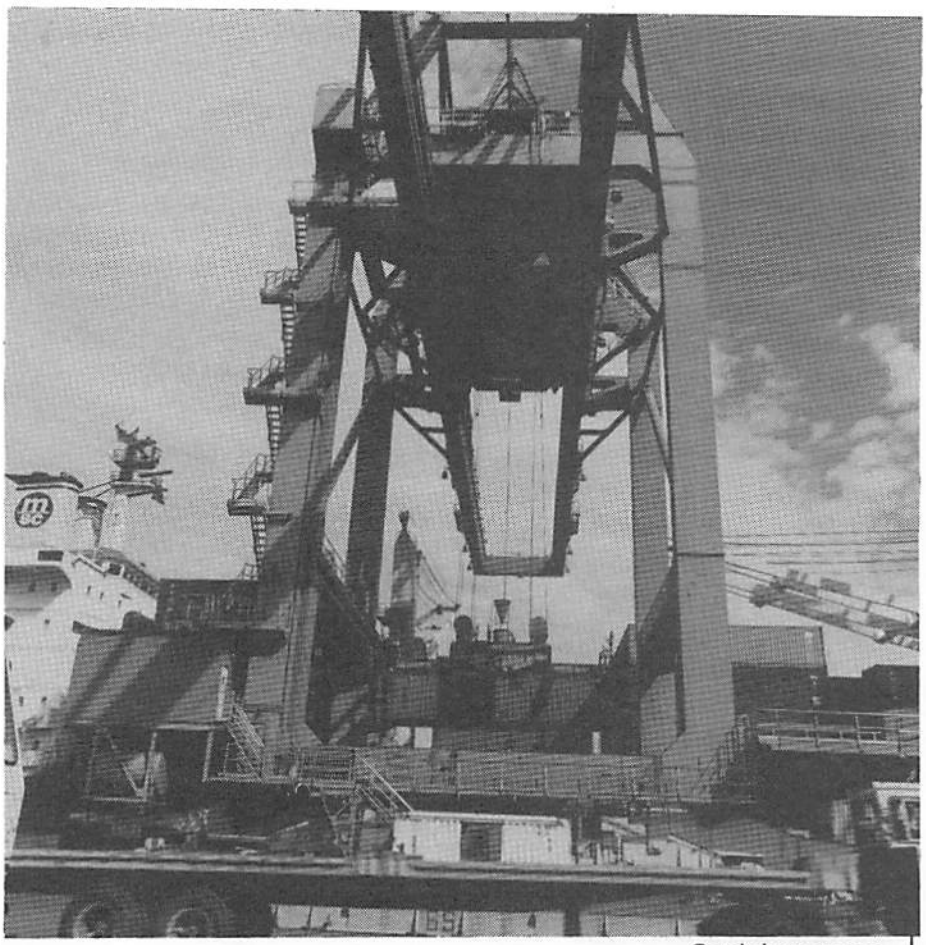
Seminar Discussion

For freight shippers and transportation companies, "intermodal transportation" has come to mean using a combination of truck and rail or truck, rail and ship to get goods from origin to destination. Several attendees observed that rail-truck intermodal service, when done properly, "acts just like trucks." This was considered by many as a major potential advantage of intermodalism, since users experience the same convenience and timeliness that they have come to expect from trucking alone.

The shift towards containerization benefits U.S. manufacturing in the international market. This is

because containers have become the norm in the world market for mainly manufactured goods. Thus, a much higher volume of non-U.S. freight is already containerized than in the domestic U.S. freight market. This means that successful adoption of containerization will enable these U.S. firms to compete more effectively against non-U.S. companies.

It was mentioned that the U.S. DOT has only recently shown a public interest in intermodalism, through former Secretary Skinner's frequent emphasis on the subject and the inclusion of intermodal elements within the ISTEA. Hope was expressed that this interest in intermodalism will expand to the state and local levels, and that the U.S. DOT will continue to play an important role in promoting intermodalism and developing the physical links between modes.



Container crane

Participants were encouraged by the new focus of the ISTEA on the promotion of intermodalism, as seen in the prominence of the term in the law's title as well as the creation of a new Office of Intermodalism reporting to the Secretary of Transportation. The new Bureau of Transportation Statistics authorized by this legislation could also play a beneficial role in compiling, analyzing and disseminating important information about the nation's transportation system. Thus, the ISTEA was seen as giving the DOT the opportunity to encourage a national perspective, to gather and disseminate data, and to provide funding in support of specific intermodal projects.

Several participants, however, were skeptical of the real benefits that would accrue from the ISTEA, especially since the funding allocation and project approval processes will remain heavily 'politicized.' There was also concern that allowing state and local levels to make major transportation project decisions will deter the creation of a truly efficient *national* transportation system, especially for freight.

MAJOR ISSUE

Government Policy

Background

The impact of government policy on the freight industry in the past decade has been profound. Starting with the airlines in the late 1970s, deregulation of freight transportation continued with the 1980 Staggers Act and Motor Carrier Act which dealt with the railroad and trucking industries, respectively. Recent observers have assessed the effect of deregulation as accelerating the 'shakeout' and consolidations of the industry by significantly intensifying competition between both companies and modes. Some observers have commented that the primary impact of deregulation has been to lower costs and improve efficiency for the users of freight services. Others, especially from inside the industry, claim instead that the cost to freight suppliers has been too high. As evidence of this view, these individuals point to the increased bankruptcies, growth in operating expenses, and declining profits of many freight companies since deregulation.

When viewed as a whole, the role of government policy, including the extent of regulations, is extremely complex. One example of this complexity is the long-standing 'road versus rail' dispute. Railroads have complained that other modes who can benefit from federal Trust Fund revenues, particularly roads but also air, have an unfair competitive advantage over the rail system. This disagreement is also reflected in the publicity over the recent suggested changes to truck weight limits and allowing longer-combination vehicles in more states. Various modal operators also complain about the additional costs and restrictions imposed by the lack of uniform standards and regulations across all levels of government (federal, state and local) as well as the need for formal U.S. adoption of international standards affecting freight transportation.

In addition to the traditional regulatory role, legislation and governmental actions increasingly reflect a general growth in national concerns over 'quality of life' issues. This is most evident in laws both directly and indirectly reflecting environmental protection and the use of fossil fuels. This can be seen in such recent development as the Clean Air Act Amendments, complaints over airport noise, concern for wetlands preservation, the lengthy and costly environmental impact statement (EIS) requirements process for building new infrastructure (or even rehabilitating or improving existing infrastructure) and complaints over diesel exhaust pollution.

The impact of these concerns is augmented by growing sensitivity over the potential for spills during the shipment of oil and hazardous materials (hazmat) and worries over how best to dispose safely of the nation's mounting accretion of solid wastes. Both hazmat and solid waste shipments are significant future growth areas for freight. In 1990, for example, U.S. railroads had $525 million in revenues from this business.

Key questions include:

- *Has deregulation of freight transportation gone far enough?*
- *Are there inherent differences between the policies of the various levels of government (federal, state, local) that are hindering effective freight operations?*
- *What will be the overall impact of increasingly stringent environmental legislation on the freight industry?*

Seminar Discussion

The deregulation of the late 1970s and early 1980s in air, trucking and especially in rail was a major stimulus to improved freight services and reduced costs. Deregulation gave carriers new flexibility and incentives to "squeeze out" excess capacity, labor and equipment. This permitted rationalizations and consolidations, and allowed for more targeted contractual and business agreements between users and providers. One estimate presented at the session was that the total share of GNP represented by transportation and logistics fell from 8% in the late 1970s to only 6.4% in the early 1980s, primarily as a result of deregulation.

It was pointed out, however, that these improvements came primarily in the early 1980s, and the efficiency of transportation has stabilized since then. Concern was also expressed that increasingly stringent environmental and quality of life legislation and regulations may drive this amount back up to about 7% by the end of the decade.

One participant suggested that similar advantages could come in domestic ocean shipping through modifying or repealing the Jones Act, which requires the use of U.S. flag vessels for waterborne freight between U.S. locations. The restrictions have particular effects on shipments between the mainland U.S. and Alaska, Hawaii or Puerto Rico. Several participants questioned the cost effectiveness of the Jones Act to the overall U.S. economy, as well as the extent to which the Act was necessary to meet military shipping needs. On the other hand, there is a strong and vocal constituency to maintain the Act, and the Defense Department still needs to be able to access sufficient private-sector transportation assets to support Presidential decisions in times of national emergency. There was also concern expressed about the impact of the U.S. Shipping Act of 1984 on U.S. foreign trade shipments.

Aside from deregulation, many participants expressed the opinion that government in general has not been keeping up with the rapid freight transportation changes in the private sector over the past 10 to 15 years. Government agencies at both the federal and state levels are perceived as still compartmentalizing their treatment of each individual mode and not regularly communicating with each other. There is a lack of uniform or comprehensive planning of infrastructure development and usage from more than one mode's perspective.

Differing experiences with state and local governments were mentioned. One participant discussed the problems his regional railroad company encountered in making state and local government agencies aware of the negative impact on rail freight service of lowering overhead bridge clearances over railroads. In contrast, a non-federal government participant described how his jurisdiction was adapting its standards in areas such as overhead bridge clearances specifically to accommodate higher double-stack container train service.

The significant variances between the standards and regulations issued by different federal and state agencies, and between federal and international standards and regulations, were criticized. All of these variances hinder efficient freight transportation and damage U.S. economic competitiveness by promoting delays, restrictions and higher costs that freight users are forced to bear. The variances in

Summary of Major Points:

Freight Transportation

- Transportation and logistics are merging into a single discipline - 'T&L' - to manage and track the movement of a firm's components and final products from origin to final destination. The goal is to minimize the cost and time associated with this process and enhance the firm's competitiveness and profitability.
- In response to this development, users and providers are cooperating much more closely with each other to develop a unified T&L system, which can profoundly affect both parties' operations and organization. Providers are also more frequently cooperating among themselves through business agreements, strategic alliances and actual mergers of previously competing modes within one company.
- Intermodalism, containerization and the application of new technologies in data processing and communications are major contributors to these developments.
- The deregulation of most parts of the freight industry in the late 1970s and early 1980s was a major stimulus to improved service and reduced costs. There is room for further deregulation to allow shippers and customers to benefit from provider competition.
- In general, government agencies have not kept pace with the rapidly evolving freight industry. There is a perceived need for all levels of government to coordinate their activities more effectively, in order to avoid retarding effective freight services.
- Among the potential trends of most concern to freight users and providers are the condition of the U.S. transportation infrastructure, intermodal connectivity at key links, and the impact of restrictive environmental legislation on freight operations.

freight regulations between the states, in areas such as truck size and weight restrictions, make it difficult for freight providers to operate uniformly over wide areas. There is substantial support for uniformity of standards and regulations and uniform government transportation policies at all levels. Specific issues still to resolve included antitrust immunities, cabotage, customs user fees, harbor maintenance fees, and the filing of rates, tariffs and contracts.

Among the concerns expressed for the future of freight transportation were the state of the infrastructure, especially congestion on urban roads and access to seaports; and the impact of more stringent environmental and quality of life legislation. On the first issue, it was mentioned that both Japan and Western Europe have recently noticed that JIT has led to increased traffic congestion as more trucks are added to the road system. As a result, there is discussion in these nations about reducing or amending JIT in order to reduce this congestion. It was suggested that this same concern may soon arise in densely-populated U.S. regions, such as the northeast. One response suggested to this concern was to shift to off-hour and 'unmet' deliveries in urban areas, especially at nighttime. Several automobile companies now deliver spare parts to their dealerships in this manner.

Participants also expressed concern over the lack of adequate road

connections for truck traffic to both seaports and airports and the congestion on narrow urban roads that resulted. State and local governments should be more aware of the need for suitable urban locations for intermodal facilities, such as road-to-rail transfer sites, when making land use decisions.

Freight providers at the session also expressed concern that several environmental proposals, while well-intentioned, would have the effect of reducing efficiencies. One example was a possible requirement that trucks switch to fuels other than diesel, instead of permitting the industry to continue improving diesel engines themselves. There were also several complaints at the use of environmental regulations for the purpose of stopping legitimate infrastructure projects. It was suggested that project supporters should respond by pointing out the direct links between decisions to cancel projects and the real costs associated with them (increased transportation costs and reduced local economic growth).

GM Heavy Truck - Courtesy: Volvo/GM Heavy Truck

One possible response mentioned was that the private sector work actively with state and local agencies, including Metropolitan Planning Organizations, for the approval of infrastructure projects that benefit freight. This is particularly important under the ISTEA, which transfers both significant funding and decision making power to these agencies.

The participants generally agreed that the U.S. and Canada have the best basic infrastructure in the world. And the North America Free Trade pact will be a potentially major economic stimulus, especially by allowing more effective competition with an economically-united Europe. To take full advantage of this development, however, it was urged that the U.S. focus on making major improvements in the freight bottlenecks that do currently exist at U.S./Canadian and U.S./Mexican border crossings, especially at bridges. It was also pointed out that the Mexican shipping industry could become an effective, low-cost supplier to U.S. users, if Free Trade agreements include transportation providers.

Chapter 6:
Urban and Suburban Transportation

Introduction

Several important changes have occurred in the overall environment for urban and suburban transportation in recent years. One of the most significant of these changes has been the completion of three pieces of major legislation that will have a direct impact on the nation's transportation. These are: the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991; the Clean Air Act Amendments of 1990 (CAAA); and the Americans with Disabilities Act of 1990 (ADA). Each of these laws alters the environment within which transportation planning, funding and operations takes place. In addition, each law changes the institutional relationships among the various governmental and non-governmental organizations charged with meeting the nation's transportation needs.

Perceptions of the role of transportation in the nation have also been affected by the visible growth of congestion, particularly on urban and suburban roads. A number of broad social and economic trends are contributing to this congestion problem. These include the growing movement of residents and jobs to the suburbs, the impact of two-income families, and the continued rise in automobile ownership levels. All of these trends place additional strains on the existing physical transportation infrastructure, which has not been expanding at a sufficient rate to accommodate these changes. There is also increasing interest in assuring that the nation's transportation system can reduce this congestion while at the same time attaining non-transportation goals such as environmental enhancement, economic growth and competitiveness, and energy conservation.

In the active debate over these multiple goals, a number of near-term and long-term strategies for the future of our transportation system have been advocated. For example, numerous transportation providers are studying or actually applying low-cost, "off-the-shelf" technologies and market-based demand management techniques, such as congestion pricing and improved management practices, on existing systems. In addition, a number of new and innovative technologies with potential applications to transportation, such as Intelligent Vehicle Highway Systems (IVHS) and magnetic levitation (Maglev), are being researched.

In response to these issues, the Volpe National Transportation Systems Center organized a seminar on the topic of "Urban and Suburban Transportation" in Washington, D.C. on December 13, 1991. Attendees included representatives from transit operators, Metropolitan Planning Organizations (MPOs), regional and municipal transportation and other government agencies, the General Accounting Office, transportation consultants and academic experts.

Topics suggested for discussion at the seminar included: the urban and suburban transportation environment, near-term mobility strategies, and long-term mobility improvements. Specific observations and common themes raised in the discussion are summarized below. The views that follow represent the opinions of the individual participants, and do not reflect the policies or positions of the Department of Transportation (DOT).

MAJOR ISSUE

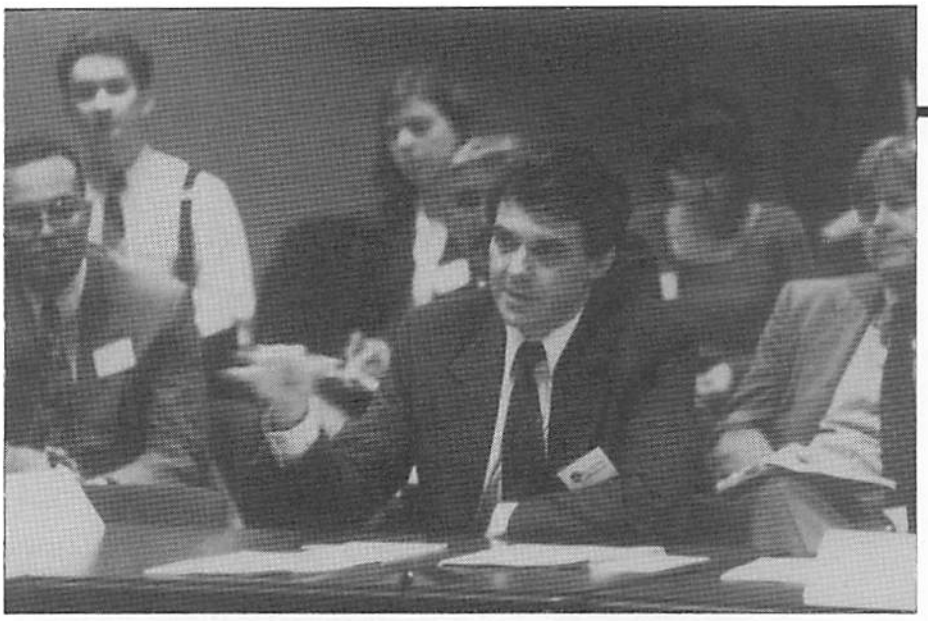
The Urban/ Suburban Transportation Environment

Background

Many significant changes have occurred in the overall environment for urban and suburban transportation since March of 1990 when the President released the Secretary of Transportation's National Transportation Policy (NTP). By far, the most significant events have been the completion of three pieces of major legislation that will have a direct impact on the Nation's transportation infrastructure. This legislation will affect virtually all Americans who drive, use public transportation, manufacture transportation equipment, construct transportation facilities, and provide transportation services. All three of these laws implement national goals for transportation. Their full impact will not be interpreted and fully understood nationwide for sometime to come.

The ISTEA legislation of 1991 extends and significantly modifies the previous Surface Transportation Assistance Act. It provides more decision-making authority and more flexibility in the use of Highway Trust Funds to state and local governments. It provides for development of a National Highway System complementing the interstate system with a network of arterials. It emphasizes connectivity among transportation modes and provides for increased research in safety and in advanced transit and highway technologies.

The other legislation important to transportation will also have far-reaching effects. The Clean Air Act Amendments of 1990, or CAAA, place strict regional controls over



air quality that will challenge local governments in many areas. The Americans with Disabilities Act of 1990, or ADA, acknowledges that accessibility to public transportation is a civil right and will make fixed-route public transportation fully accessible for passengers with a much broader range of impairments than are currently accommodated. It will also expand services to individuals who cannot use existing routes.

Key questions include:

- *What are perceived as the major impacts of the ISTEA on the various levels of government?*
- *What mechanisms are needed to inform and educate decision-makers at these various levels about their new authority and options under the Act?*
- *What state and local institutional actions will be required for compliance with the CAAA?*
- *What will be the impact of the ADA on transit budgets and operations?*
- *What changes in the growth of congestion have occurred as a result of changes in lifestyles and workforce and shifts in demographic, employment, or land use patterns?*
- *What is the outlook for local sources of funds for highway and transit infrastructure improvements?*
- *What approaches have been most successful in improving the adequacy of local funds?*

Participants

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Seminar Discussion

Seminar participants confirmed that current trends in the urban and suburban transportation environment continue to increase the problems identified and addressed in the Department's National Transportation Policy (NTP) process in 1989 and 1990. Congestion on urban and suburban highways is increasing. Although slowed by the recession, movement of businesses and residences to the suburbs shows no sign of long-term abatement. In spite of innumerable strategies, the market share provided by public transportation continues to decline, as does automobile occupancy during commuting hours. These trends in transportation reflect national demographic and economic trends: an increase in population migration to "automobile age" metropolitan areas, increasing demand for personal mobility, a continuing shift to a service economy, and increasing automobile ownership levels.

Implementing ISTEA

As major stakeholders, seminar participants were familiar with the details and day-to-day development of the ISTEA. Their comments throughout the meeting reflected concern over how the Act can be implemented effectively, rather than disagreement with its content or objectives. Except for general requirements for planning coordination, their perception is that the Act does not prescribe strategies or road maps for the actions that will be required. The consensus was that some time would be needed to assess the full impact of the Act, including the adequacy of its funding provisions.

One issue that emerged quickly during the discussion related to the NTP theme on maintaining the nation's transportation infrastructure. The perception of several participants was that an increase in Highway Trust Funds should not be allowed to reduce efforts to find new and innovative sources of local funding. The state of the infrastructure is troubling to most transportation professionals, and it is becoming clear that the needs and the costs for rehabilitating highways -- and especially bridges -- have been significantly underestimated. It was mentioned that in one major city, 75% to 80% of the transportation budget is spent on infrastructure repair, and that amount is only meeting about 25% of current needs.

Perceptions of the current transportation environment are that existing institutions and processes are not equipped to deal with the decisions that will have to be made and the programs that will need to be implemented to reduce congestion, comply with environmental requirements, and meet future needs for urban and suburban transportation. For example, participants recognized that inherent competition and conflicting interests exist between suburban and central city governments, and between highway construction and transit activities. These kinds of competing interests cannot be resolved by the planning community alone. New forums and processes will need to be created for communities to be able to reach essential agreement on priorities.

Major changes in traditional institutions and their roles will have to be made during the next few years. Several agencies suggested the need to rethink their missions and went so far as to suggest "time out" to do some strategic planning.

MAJOR ISSUE

Near-Term Mobility Strategies

Background

The twin imperatives to respond to the clean air legislation and to reduce congestion in many urban areas will not wait for construction of new transit systems, implementation of advanced IVHS technologies, or a new generation of very low pollution vehicles. Many techniques and strategies are available virtually "off-the-shelf" to contribute fairly rapidly to improved urban and suburban mobility and environmental quality. In many situations the cumulative result of these approaches can provide substantial relief in the near term. Isolated examples have demonstrated the effectiveness and safety improvements that can be achieved with sophisticated computer-based traffic controls and management strategies. Where appropriate, high-occupancy-vehicle (HOV) lanes, electronic toll collection and one-way tolls, and similar means can have real impact. Improved accident and incident management can be highly beneficial. Demand can be affected through numerous management initiatives: encouragement of flexible working hours, carpooling, and telecommuting; improved facilities for biking and walking; parking constraints; and congestion pricing in some form.

Key questions include:

- *What kinds of near-term improvements in highway physical configuration and traffic control systems can be initiated to mitigate congestion?*
- *What is the potential for early applications of IVHS technologies?*
- *How important are increases in vehicle occupancy or reductions in vehicle miles travelled for relieving congestion or meeting air quality goals?*
- *What low-cost, near-term policies (congestion pricing, parking management, HOV lanes, trip reductions, tolls, etc.) appear to be the most effective measures for increasing vehicle occupancy?*
- *What institutional obstacles must be overcome to implement these policies?*
- *How much testing and demonstration of the above techniques is needed before they can be put to broad use?*
- *What kind of technical assistance in these techniques would be most helpful to local agencies?*

Seminar Discussion

Some capacity improvements available today can help improve mobility and alleviate urban and suburban congestion in the near term. These techniques include HOV lanes, better connections and traffic management systems, and some IVHS technologies. It is anticipated that the near-term benefits of IVHS will include traffic monitoring and control for corridors with major congestion problems, better information for drivers, improved safety, and improved productivity for bus fleets and commercial vehicles.

There are fundamental questions as to who will take the initiative to implement and operate most of these programs. Planning agencies point out that they are not set up to be operators. Most congestion management systems will involve a mix of state, county, city and town government services and rights-of-way ownership. Many of the congestion management systems

Highway with bus lanes

will introduce electronic technologies that are not now familiar to public works departments, and will require the involvement of overlapping municipal services such as law enforcement and emergency services. New departments and new or revised state legislation and local ordinances could be required in virtually every affected city.

One participant called attention to the fact that all of the institutions necessary to build and repair infrastructure are already in place. This is not true, however, for implementing demand management strategies or increasing vehicle occupancy rates.

Another participant suggested that successful transportation improvement programs could be described in terms of four overlapping phases: Political Planning, Transportation Planning, Implementation, and Operations. All too often, the importance of the first of these phases is unrecognized. In some cases, political planning is not addressed at the right time in the process.

Transportation planners from several regions reinforced the growing importance of local politics and the almost infinite variations in size, function, and authority that exist among local government bodies. When special interest groups and neighborhood associations are added to this list, even the best transportation plans can be stopped or delayed for years. Although the ISTEA recognized the need for citizen participation, seminar attendees emphasized the value of beginning the political planning process early.

The diversity of local institutions, transportation needs and constraints precludes development of a model "political planning process." However, participants affirmed that DOT could provide useful technical assistance in strategic planning methods and could help to disseminate the experiences of successful programs to wider audiences.

Several participants commented that traffic congestion is not always bad. This is because congestion can be interpreted as a sign of economic

success, and a certain level may be acceptable as an incentive to users to make different modal choice decisions.

Market-Based Approach to Transportation

Participants indicated a strong interest in market-based congestion management methods, as opposed to outright regulation or restrictions. These methods use a variety of tolls and fees to provide drivers with options to pay extra for superior speed and/or convenience. Some recent examples that were discussed include: sale of access to surplus HOV lane capacity, vehicle registration fees based on mileage, and van pooling initiatives. Some of the advantages of a market-based approach are: it is adaptable, i.e., more responsive to rapid changes in transportation demand; it brings a much wider group of local interests into the planning process; it is amenable to private investment; and it allows closer relationships between user costs and benefits.

Currently, some transit agencies manage or coordinate a variety of programs for ridesharing, van pooling, bus pooling, paratransit, and special services for the disabled. Some transit agencies also have taken the lead in introducing demand management and congestion pricing methods. The objectives of most transit-operated programs are much broader than reduction of highway congestion. They are aimed at producing the most regional mobility for the tax dollar -- providing transportation for transit-dependent people without needing new transit or highway infrastructure, or additional fixed-route bus service.

The above methods represent potential low-cost means for near-term improvements in congestion and air quality. Most are compatible with a market-based approach, in that they provide trips at a lower cost to travelers who are willing and able to use HOVs. Although transit operators and MPOs are aware of these techniques, however, in the past they have lacked the local political consensus to put them into use.

Local agencies are ahead of the federal government in market-based approaches, but are proceeding on a trial-and-error basis. It was commented that there is no federal five-year plan for development of regional planning tools based on transportation economics and the costs of various forms of private and public transportation.

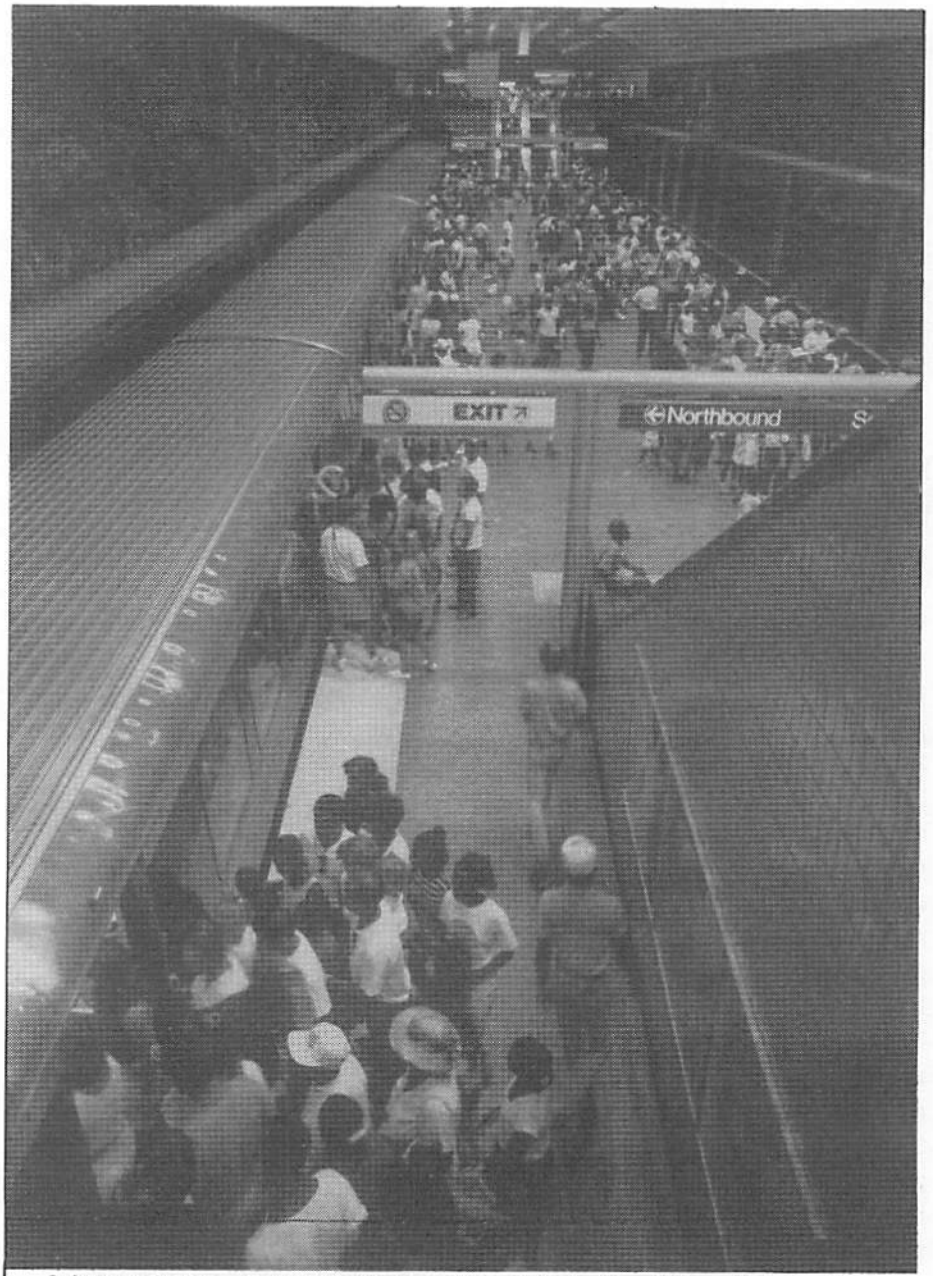
Because of the multiple objectives of transit, it was suggested that it may be necessary to separate the costs of societal goals for regional mobility (services to elderly and disabled riders and access to housing, health services, education, and employment) from fares based on supply and demand in an open market. Currently available urban transportation planning tools do not incorporate the true costs and benefits of trips by various means, nor the regional economics of transportation.

In addition, transportation planning tools were criticized for not reflecting lifestyles, values, employment, and shopping patterns that exist today (suburban business and industry, two-income families, women in the workforce). Some parameters in these models are based on data from an long ago as 1968. Participants also warned against collecting excessive and unnecessary data. Instead, it is important first to determine data

needs carefully and then collect only the needed data, preferably through existing systems and procedures.

Impact of Air Quality Provisions

Several participants stated that, next to congestion, the enforcement of air quality provisions will have the greatest effect on urban/suburban transportation in the near future. They noted that air quality standards are controlled by federal and state agencies that do not have responsibilities for the nation's transportation system or economic competitiveness. Appropriate forums and processes for balancing public demands for transportation and for air quality will need to be developed. Because cities vary so widely in air quality conditions, demographic and geographic factors, transportation systems and governmental structures, there is no common approach for resolving conflicts.



Subway station - Courtesy: Metropolitan Atlanta Rapid Transit Authority

MAJOR ISSUE

Long-Term Mobility Improvements

Background

In the long term, many solutions for the problems of congestion and environment will be based on advanced technology. Demand for increased, high-quality mobility will be met by new systems, typified by such prospects as automated road networks, advanced guideway systems and people movers. Among the major issues currently facing the transportation community is the adequacy of advanced planning tools, including those that project future demand. The selection and funding of research and development projects, including the role of the Federal government, are unsettled issues. The role of the private sector, not only in research but in the ownership and operation of transit systems, continues to be a major issue.

Key questions include:

- *Are available planning tools sufficiently accurate for long-range infrastructure investment decisions?*
- *For air quality decisions?*
- *What changes are needed to improve existing models?*
- *Is sufficient data available?*
- *When can improvements from implementation of advanced IVHS systems be expected to have positive effects on congestion and air quality?*
- *Are telecommuting and teleconferencing likely to have a significant long-range impact on congestion and air pollution problems?*
- *How may needs for intermodal connectivity (highways, transit, airports, intercity rail and advanced systems) be balanced among modal interests and local priorities?*
- *What are the principal obstacles to private financing and acquisition of infrastructure?*
- *What approaches appear to be the most successful?*
- *What are the prospects for advanced high-speed transit systems?*
- *In what applications can such systems be most cost effective?*
- *How can the processes for planning and acquisition be accelerated for highway and transit investments?*

Seminar Discussion

On a long-term basis, IVHS can provide area-wide, real-time traffic management, optimal routing, significant increases in highway capacity, and significant reductions in accident rates. A number of participants, however, questioned whether the real benefits of such features as real-time traffic advisories are worth the investment costs, and whether the benefits of in-vehicle systems will really be available to lower income commuters. Others contend that IVHS will simply increase capacity, attract more traffic to existing facilities, and encourage people to maintain current driving patterns.

To IVHS proponents, the biggest current obstacles to technological improvements are institutional, consisting of procedures and regulations that inhibit private-sector participation in technology development. These proponents argue that IVHS technologies are by no means intended to be the sole solution to congestion problems. IVHS technologies are likely to provide a wider range of routing and mobility choices for urban travelers, enabling changes in values and behavior. They will improve the

safety and efficiency of both passenger and freight transportation. However, planners noted that significant increases in overall highway system capacity can compound air quality problems, and that cleaner vehicles and fuels may have to be introduced in parallel with IVHS technologies.

Summary of Major Points:

Urban and Suburban Transportation

- Urban and suburban traffic congestion can be expected to increase in the future, due to the continuation of current economic, demographic and social trends.
- Time is needed to assess fully the impact of the ISTEA on each level of government, but concern does exist over how effectively and how rapidly the Act's new provisions can be implemented.
- Institutional roles and relationships can impede the reduction of congestion and the implementation of new technologies; "new thinking" is needed on how to develop more effective institutional interactions for the future.
- There is considerable interest in applying relatively low-cost, available demand management strategies such as congestion pricing, HOV lanes, automated toll collection, flexible work hours and car pooling to mitigate the effect of congestion. However, the multiplicity of government authorities involved in land use, transportation and planning complicates the successful implementation of such strategies.
- The existing urban planning tools are obsolete and do not reflect the latest data, ADP capabilities or lifestyle changes (such as continued growth of suburban areas, mounting concern over environmental issues, two-income families and new CAAA and ADA mandates).
- New transportation-related technologies such as IVHS hold the promise for solving many congestion problems. However, a more comprehensive answer to congestion will also require fundamental changes in values and behavior on the part of transportation users.

Land Use

Land use continues to be defended as a private property right, subject to free market forces and controlled almost entirely by local governments under the principle of home rule. In the nation's early days, transportation was the leading force in shaping land use. In recent years, transportation has tended to follow and support development, even though many tend to see highways as a cause of suburban spraul. For the long term, the most important factors affecting transportation will likely be land use and economic development patterns.

Seminar participants from all levels of government noted the difficulty of determining the full costs of suburbanization. Buyers of homes and businesses in outlying areas benefit from lower property costs, but at the same time introduce an added burden on transportation in older areas when they commute to urban destinations. Suburb-to-suburb congestion is especially difficult to assess. Where new transit systems have been constructed, only a fraction of the values added to real estate and businesses by these systems are being captured by current methods. Much more research needs to be done in the dynamics of transportation and land use.

Recently, transportation planners have grown more optimistic about regional land use planning and the acceptance of transportation as an essential component of planning and zoning decisions. Planning participants cited voluntary agreements among communities on open space and zoning. Such cooperation has come about slowly, however, and still varies widely from state to state.

Telecommuting

Telecommuting is desired by many workers and some employers. It is consistent with emerging family lifestyles and values, but has only begun to realize its potential. Proponents estimate that 15 to 20% of the workforce could telecommute, although some may not want to and only a very few would telecommute full time. The outlook is favorable, however, for telecommuting to grow, and to contribute to important reductions in rush-hour travel and some reduction in the total number of trips.

Behavioral Change

Participants agreed that long-term goals for efficient, intermodal transportation systems cannot be realized without fundamental changes in the way urban citizens view and use transportation. Although it may support behavioral changes, technology alone cannot solve problems of congestion and air pollution. Some participants saw encouraging signs of change in societal values and behavior, as evidenced by the alacrity with which young people accept environmental preservation and recycling programs. Participants felt that conserving trips, ridesharing, and saving energy could meet with similar success if introduced early enough in schools.

Participants generally concurred that it is up to existing institutions to attempt to create a system of realistic pricing for the use of public infrastructure and services. If urban transportation could be market-based, special efforts to modify behavior would not be necessary.

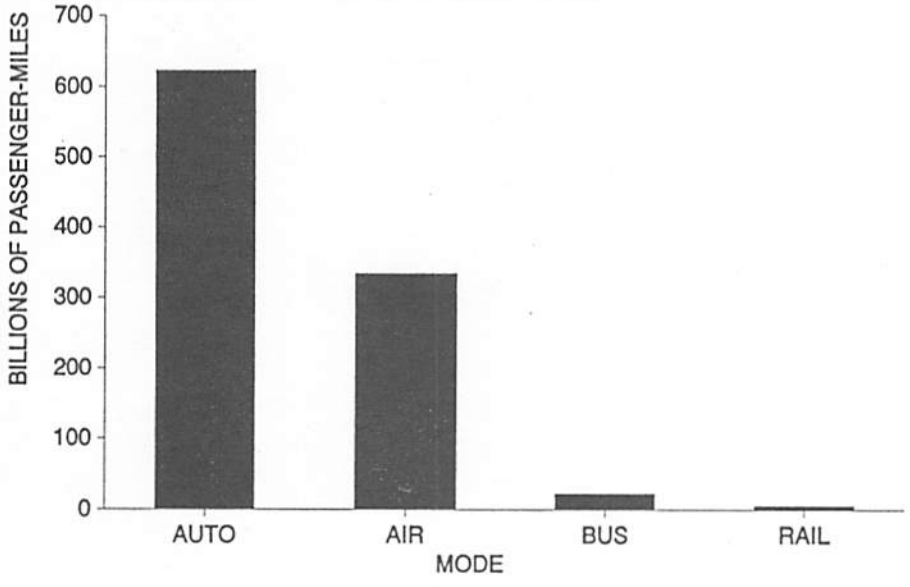
Chapter 7:
Intercity Passenger Transportation

Introduction

As suggested by the chart in Figure 2, intercity passenger transportation in the United States is primarily provided by the private automobile for shorter distances, and by air for longer trips. Past investments in the Interstate Highways and the airport/airspace systems, achieved predominantly through user fees and trust funds, have made possible a very high level of intercity mobility. Although not large in terms of passenger-miles, rail and bus modes are very significant to certain parts of the intercity travel market. Buses provide transportation to many destinations not served by any other public transportation mode, as well as offer a lower-cost alternative to air for travelers who place a lower value on time. Particularly in the Northeast Corridor, Amtrak similarly serves a large fraction of the intercity passenger market for public transportation, even competing strongly with airlines between Washington and New York City.

Figure 3 emphasizes the segmentation of mode choice by distance, illustrating the total dominance of private automobile for trips below roughly 400 miles. It also indicates that bus and rail provide a substantial portion of public-mode intercity transportation, even for relatively long trips, capturing a substantial portion of that market for distances below several hundred miles. Other segments of the market are also important. Business travelers, for example, typically value time relatively highly and often travel by air, even for short trips. Non-business trips are much more likely to be via bus or rail, or by car for two or more people traveling together. The differences in service characteristics such as trip time,

Figure 2. Approximate Annual Passenger-Miles by Mode



departure frequency and cost are so great that in many cases the various modes compete only to a very limited degree; each serves a relatively separate market segment.

In general terms, the U.S. intercity passenger transportation system is unmatched in the world. However, there have been recent concerns that this system requires improvement. For example, congestion is a growing problem in both road and air travel, especially during peak demand hours in urban areas and at major hub airports. Many observers worry that the available options for travelers to and from rural areas has been decreasing. In addition, over the past decade a number of major air and bus carriers have suffered substantial economic losses and even bankruptcies, and Amtrak remains dependent on public subsidies to continue providing intercity rail service. Finally, the potential promise of both additional infrastructure construction and the application of new technologies, such as magnetic levitation (Maglev) and high-speed rail, would require major investments of money at a time when governmental budgets are strained and private funding cannot be guaranteed.

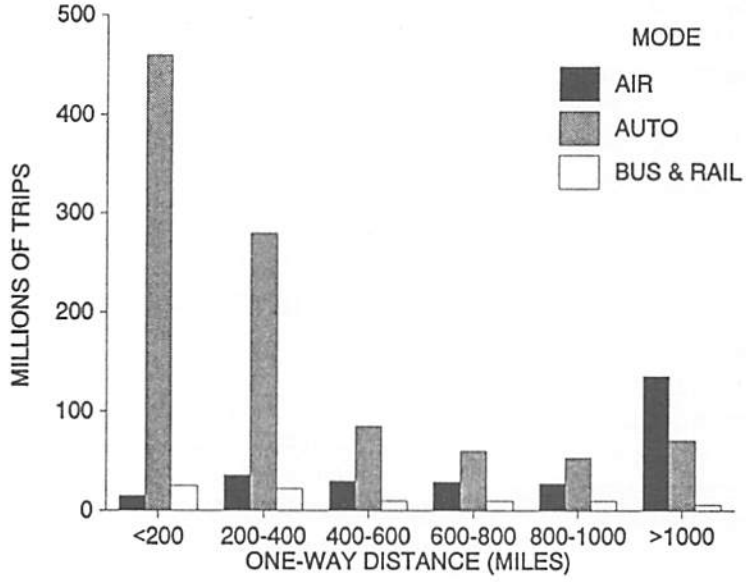


Figure 3. Approximate Annual Trips by Mode and Distance

In response to these issues, the Volpe National Transportation Systems Center organized a seminar on the topic of intercity passenger transportation in Cambridge MA, on December 16, 1991. Attendees included representatives from regional planning organizations, state Departments of Transportation, federal and congressional agencies, transportation equipment and service providers, academic experts and transportation consultants.

The intercity passenger transportation topics suggested for discussion included: current performance and economic health of the industry, the expected future market, future capacity, the potential role of high-speed surface systems, the importance of integration with urban mass transit, and safety and security issues. Observations and common themes raised in the discussion are summarized below. The views that follow in the "Seminar Discussion" sections were expressed by individual participants in the course of the discussion, and do not necessarily reflect the policies or positions of the Department of Transportation (DOT).

MAJOR ISSUE

Current Performance and Economic Health of the Industry

Background

The U.S. Interstate Highway system and the domestic aviation network are unmatched in the world in offering a high degree of personal mobility and ease of movement over such a large area at reasonable cost. At the same time, it has become a common complaint that air travel in the U.S. is prone to congestion, delays and unreliable service. Intercity automobile trips, too, can suffer from congestion at particular times and locations. Options may be few for travelers to and from rural areas.

Airlines have experienced substantial upheaval during the last decade while adjusting to the rigors of a deregulated marketplace; several major carriers are currently in bankruptcy. The industry as a whole has suffered large losses for the past two years, and now faces the necessity for enormous investment to upgrade fleets and meet noise regulations. The world air travel market is becoming highly competitive. The bankruptcy of Greyhound symbolizes the difficulties of the intercity bus business, and Amtrak, while hopeful about the long-term trend, continues to require a large subsidy.

Key questions include:

- *How well is the current intercity passenger transportation system working?*
- *How well does the system serve special subsets of travelers, such as the business and military communities, disabled people, rural residents, elderly individuals, low-income groups and visitors from overseas?*
- *What are the principal factors affecting performance?*
- *Are there limitations of the physical infrastructure, institutional framework, or regulatory environment that lead to structural or financial weakness?*
- *Are the industry problems now being experienced merely the consequences of a brief economic downturn, or do they carry more ominous long-term implications?*
- *What will be the impact on U.S. air carriers of a much larger international market served by global "mega-carriers?"*

Seminar Discussion

One participant suggested that, as predicted in a recent Transportation Research Board study, an oligopoly has developed in the intercity passenger transportation industry, especially in commercial aviation. In spite of current difficulties, including several major bankruptcies and significant financial losses in the past two years, the major airlines are actually in relatively good financial condition at present.

Based on a prediction of rising fares through the 1990s, one participant anticipated a 5% to 7% annual return on investment for commercial airline companies over the decade. This matches the projected figures for other U.S. industries. Even if capacity and revenue passenger miles remain relatively flat, as several participants expect, cost pressures on the airlines are likely to be more than matched by increasing fares. Still, it was agreed that predicting the future is a highly uncertain exercise -- it is possible to make a good argument for almost any result.

MAJOR ISSUE

Expected Market

Background

The size and nature of the market for intercity transportation is evolving rapidly. Driven by national and world demographic changes, globalization of economies, and more complex and interdependent business relationships, intercity air travel increased during the 1980s at a rate significantly higher than population growth. On the other hand, this pattern could change, at least for some market segments. Telecommunications-based substitutes, such as video conferencing, electronic mail networks and facsimile, could have a significant effect on the total market. The Department of Defense (DOD) is a major customer for intercity passenger service, and the military downsizing and other changes could yield significant changes in demand. More generally, travel for both business and pleasure is highly sensitive to the economic environment. Some analysts see the likelihood that the decade of the nineties will be an economically difficult period, with the U.S. pressed both by international competitors and by actions to deal with domestic concerns such as health care, education, environment and a troubled financial system. Any significant increase in petroleum costs would also have a sharp impact on transportation costs and ridership.

Key questions include:

- *What will be the size and nature of the intercity passenger*

transportation market in the next decade? Upon what assumptions are these predictions based and how uncertain are they?

- *Which market segments will grow, and which will be stable or in decline?*
- *What parts of the overall passenger transportation system will be most challenged in meeting future demand?*
- *How significantly will telecommunications alternatives affect demand for business travel?*

Seminar Discussion

The intercity travel market is poorly defined at present, due to a lack of both comprehensive travel data and tools that can project a system-wide view. The only satisfactory data is for air travel, and even this does not reveal reliable information on such factors as trip purposes, the mix of individual and group travel, the length of stay at destinations, and so on. This gap in information often makes it difficult, from the public policy perspective, to assess accurately either travel demand or supply. Other obstacles to accurate long-term travel forecasting include the unpredictability of such key factors as the state of the economy and the national sense of well-being.

It is possible that increasing telecommunication capabilities will ultimately have a significant impact on business travel, reducing the burden on airports with heavy short-haul business traffic. For example, the two current Boston-New York air shuttle services might shrink to one.

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Regardless of these inherent difficulties, most observers could agree that intercity travel demand is expected to rise through the 1990s at an average rate of about 3% to 4% annually. The highest growth is projected in international travel. Increasing access to European markets is likely to be beneficial to U.S. air carriers, due to their traditional strength in this market segment. However, the overall travel base is so large that even modest growth means a large number of new travellers will be seeking to use the transportation system.

This anticipated growth will especially affect certain airports, including those which have only domestic service. Much of the growth is expected to be in the form of charter flights, in which the intercity journey is packaged along with lodging, local transportation and recreational activities. Thus, good opportunities exist for the growth of third-party contract services to assemble and market these packages to travellers.

One participant noted, "whenever USAir fares got $10 below Boston, air traffic into Worcester went way up." In the same context, it was suggested that one clear lesson from the People Express experience was the sensitivity of travel demand to cost. As that airline's history showed, low airfares can generate very substantial new ridership, as well as draw existing travellers from bus and rail service.

On the other hand, it was suggested that the expected cutbacks in defense force levels and funding will cause military travel to decline by about 25% in the next four years. Much of this travel is provided by chartered bus and air carriers on contract to the government. In fact, it was mentioned that about 90% of the total military lift capacity comes from the commercial sector.

Because of this heavy reliance on private companies, DOD planners are concerned about the potential for foreign ownership of domestic airlines and the possible impact of this development on the availability of aircraft under the Civil Reserve Air Fleet (CRAF) program. CRAF provided the bulk of the passenger aircraft needed to deploy U.S. troops to and from the Persian Gulf during Operation Desert Shield/Desert Storm.

MAJOR ISSUE

Future Capacity

Background

The Interstate Highway system is virtually complete. Airport expansion is difficult to accomplish, and new airports are quite rare. The cost of airline fleet upgrade and replacement will be a major burden on capital availability. Although there is considerable interest in high-speed rail and magnetic levitation systems for improved intercity travel, progress has been slow and such systems appear relevant to only a modest subset of total U.S. needs. Even if the 1990s experience only limited economic growth, demographic and other changes are likely to require substantial new capacity in at least some markets. Given that some elements of the system appear to be near practical capacity already and that major infrastructure can require more than a decade to plan and construct, adapting to change and growth will be a serious challenge.

Key questions include:

- *Will the U.S. have adequate intercity passenger transportation capacity to meet basic economic and mobility needs in coming decades?*
- *Are there specific areas of infrastructure weakness (airports, highways, rail systems) or special transportation services of special concern in this regard?*
- *What would be the consequences of inadequate capacity?*
- *How would travelers and system operators respond?*
- *How serious would significant capacity constraints be?*

Seminar Discussion

There was general agreement that the basic steel and concrete infrastructure -- such as highways and airports -- is unlikely to expand significantly in the future due to financial and environmental constraints. Thus, it will be necessary to focus on better maintenance and management of the existing infrastructure. It was also suggested that the application of technological advances to this process might contribute up to 20% in additional capacity, but probably no more than that. In addition, it will be important to keep as many options open as possible, and to make more and better information available to encourage optimal use of the transportation system.

There was discussion of the proposed new large-capacity commercial aircraft that major manufacturers now have on the drawing board. These aircraft will be entering service in increasing numbers during this decade, and could contribute to a possible doubling of the world's commercial aviation fleet. It was predicted that these aircraft, which will primarily be used on international routes, will "eat up the demand" for increased air travel during the 1990s.

Due to mounting airport congestion problems, the growth of "second airport" proposals for major metropolitan areas is anticipated. There was general agreement that a second major airport is a poor solution to capacity constraints, and can create other problems. It was suggested that a better strategy is to enhance existing small, regional airports to carry short-haul traffic, which would free up major airports for longer flights. For example, it

was pointed out that major satellite airports work well in an area such as Los Angeles, since the population is both large and dispersed. In this context, there is much to be said for a low-cost, single-runway airport located near where a large number of people live.

Some public subsidies have gone to every mode of passenger transportation, including highways, air, rail and bus service. The real issues to resolve are: how much the subsidy should be, how the subsidy should be provided, and what would society lose by not subsidizing this service. For example, it was agreed that constraints on intercity passenger transportation capabilities can yield social costs in several respects, with increased airport and road congestion being only one of them. However, it was also suggested that individual travellers could make better decisions in this regard if these public subsidies, including those received by the private automobile, were visible and explicit.

One suggested means of making this subsidy explicit would be an overall transportation tax. Further, it was suggested that the proceeds of this tax be turned over to a private corporation -- an "Infrastructure, Inc." -- which would leverage that income to construct and operate transportation infrastructure.

Highway interchange

MAJOR ISSUE

The Potential Role of High Speed Surface Systems and Technology

Background

Driven partially by airport congestion and examples overseas, there is currently considerable interest and activity in upgrading U.S. corridor rail service and constructing very high-speed rail or Maglev-based systems for heavily traveled routes of the order of one hundred to several hundred miles in length. Driven in part by concerns over U.S. competitiveness as well, the recently passed Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 declares it to be official policy "to promote the construction and commercialization of high-speed ground transportation systems" by various means, including support for research and development (R&D) and demonstration of advanced technology. Approximately one-half billion dollars is to be made available from the Highway Trust Fund for these purposes during the next six years, and other funding sources are authorized as well. Two programs would be initiated: the National Magnetic Levitation Prototype Development Program, intended to produce a prototype Maglev system at least 19 miles in length by 1998; and the National High-Speed Ground Transportation Technology Demonstration Program "to measure and evaluate such factors as the public response to new equipment, higher speeds, variations in fares, improved comfort and convenience, and more frequent service."

Actual construction costs of any intercity high-speed ground system, whether rail or Maglev, would be very large, and the likely level of ridership -- diverted from air and highway, as well as new riders -- remains a subject of considerable uncertainty and debate. Both cost and potential attractiveness to riders increase significantly with speed; very high-speed systems are likely to be more expensive to ride and attract a different segment of the market than conventional rail. Construction of new systems also must overcome obstacles related to land availability, environmental impacts of construction and operation, and limited access to capital for long-term investments of uncertain outcome.

One approach being tried in various regions of the country is encouragement of private ventures or public/private partnerships which might draw some return from development associated with the presence of a new transportation system. Examples can be found in Florida, California and Texas, although none have yet reached the implementation stage. One constraint is that in construction of a specific transportation system or element of infrastructure, private and public entities ultimately have different objectives. The private sector is concerned with the return on investment, whereas the public sector is more interested in societal benefits and mobility. Thus, their values and timeframes can differ widely.

Key questions include:

- *Do anticipated capacity constraints on air and highway transportation systems suggest a widespread need for alternative high-performance surface systems, or will existing infrastructure -- perhaps managed and used more effectively -- be sufficient for the foreseeable future in most regions?*
- *How formidable are the practical obstacles (environmental, land availability, etc.) to construction of new systems, particularly in relatively urbanized corridors?*

- *In terms of intercity transportation needs, is there more to be gained from upgrading existing infrastructure to support moderate-speed, low-fare rail service, or from constructing new premium-priced, very high-speed rail or Maglev systems which could compete with air travel? Or are these two approaches complementary?*
- *Are current data and analytical demand estimation models adequate to support major private and public decisions concerning construction of high-speed surface systems?*
- *What would be the effect of high-speed surface transportation systems on airport capacity problems?*
- *How strongly would they draw ridership from people who would otherwise travel by automobile?*
- *How well can private-sector and public-sector goals be meshed in partnerships to develop transportation infrastructure?*
- *In what situations do the interests of the two sectors (public and private) most closely overlap?*

Seminar Discussion

Participants generally agreed that new high-speed ground transportation systems are likely to require public investment. As part of this process, it will also be necessary to define carefully the proper public role. For example, what elements of such a new system most resemble public utilities and should be provided and managed publicly, and what aspects of the system could be turned over to the private sector?

In addition, any system that receives a public subsidy, even if it provides a valuable service for the public, could be perceived by other private carriers as unfair competition. The large air carriers may not feel threatened by such systems, but the opposition of Southwest Airlines to the Texas high-speed rail proposal was given as evidence that smaller regional airlines may certainly see such systems as definite competition to their existing markets. The fact that this competition becomes a public issue can then affect the decision about whether to give these new systems public financial support.

In addition, a large airline can cross-subsidize its routes that compete with high-speed ground service by undercutting fares on such corridors while raising fares in other corridors where the only competition is other airlines. The introduction of extremely low air fares by People Express in the late 1970s may have had much to do with the decline in Amtrak's northeastern Metroliner ridership in those years. In France, the decision was made not to lower the Paris to Lyon fares of Air Inter, the government-owned domestic airline, when the Train a Grande Vitesse (TGV) was introduced between these two cities in 1981. This allowed the TGV to capture most of that market away from air service. It is unclear whether major airlines would permit the same reduction in their high-volume U.S. shuttle markets in the face of similar competition from a new high-speed ground alternative.

High-speed rail proposals face many challenges in the United States. The high costs of constructing new infrastructure and the long-term and uncertain nature of the payback require a large market willing to pay high ticket prices to make such

systems economically viable. At relatively short distances (less than 200 miles) it is extremely difficult to compete with the private automobile. Thus, it is questionable whether high-speed rail has a real likelihood of economic viability in the U.S. without public construction and/or operating subsidies. In addition, the process of obtaining governmental approval can be lengthy. The uncertainties associated with introducing any new and undemonstrated technologies, such as Maglev, further increase investor reluctance to back such systems. On the other hand, high-speed rail's perceived environmental, energy usage and congestion benefits could also affect policy decisions.

It is also important to maintain a modal balance in intercity service, so that viable choices are available to different segments of the market. In this context, a real problem can develop if a "bandwagon" philosophy develops around a particular technology. This can be fed by the tendency of technologists and other boosters to present an unbalanced view of the benefits of the new technologies they advocate.

Intercity buses serve an important niche. They do not compete well with private automobiles at distances below about 150 miles. However, their relatively low fares -- which can be one-half the rail fare and less than one-fifth the air fare -- enable them to compete strongly in certain high-volume markets such as Boston-New York. Riders are largely middle class, and often students. The military is a considerable customer, using primarily charter buses from thousands of small, and very small, companies. Intercity buses are also expected to continue to serve an important role as feeders to airlines.

The problem of access by new high-speed rail and especially Maglev systems to downtown urban areas looks very difficult to resolve. The French indicate that downtown access is a key advantage of their TGV network, which can follow conventional roadbed (at reduced

Summary of Major Points:

Intercity Passenger Transportation

- Overall, the U.S. has the best intercity passenger transportation system in the world, although some aspects of it could be improved.
- Construction of substantial new infrastructure for intercity passenger transportation in the near term is doubtful, given financial and environmental constraints. This means that expanded capacity will depend on better maintenance and use of the existing infrastructure, as well as the application of new technological advances within the general systems that now exist.
- In spite of the poor financial performance of many carriers, the major airlines are in relatively good economic health, and they should improve further in the 1990s due to both rising demand and higher fares.
- Air, automobile, rail and bus each serve an important segment of the intercity market, and each will probably survive in the next decade.
- High-speed surface systems could significantly increase the capacity to move people. However, the many hurdles such systems face suggest that only a few proposals are likely to be viable, probably primarily those in densely-travelled corridors.
- Improvements in connectivity between intercity passenger transportation and urban transit systems would benefit the overall travel market; however, there are significant obstacles to this process.
- More and better data on the intercity travel market are needed, in order to make the best decisions about future investments and approaches to expanding capacity.

speeds) to reach existing urban railroad terminals. Other factors generally not present in the United States also contribute to the success of high-speed rail in France. These include strong exercise of governmental land-taking (eminent domain) powers, an excellent urban transit system, expensive gasoline, and relatively unattractive and expensive domestic short-haul air service. Intercity bus service can also be constrained by downtown access problems. Creation of high-occupancy-vehicle and bus lanes on urban access roads is very beneficial in that regard.

Thus, there are major questions to be resolved in assessing the role of high-speed surface systems in intercity transportation. First, it must be demonstrated that sufficient demand exists in a sufficient number of corridors for a system to be financially viable. Second, the trade-off in costs and benefits between incremental upgrade of existing infrastructure (relatively low cost, but limited performance) and construction of new systems (substantially higher cost and serious problems in acquiring right-of-way, but better performance) must be considered. In one project after another, the pattern has been that cost estimates escalate and ridership projections shrink as the actual implementation of a system gets closer.

This problem is compounded, as mentioned earlier, by both the current lack of adequate data to support these comparisons as well as the inherent difficulties in projecting future ridership. Thus, careful thought should go into identifying particular markets. It is quite likely that high-speed ground systems will prove to be feasible in only a few corridors.

In addition to new high-speed ground concepts, some people suggest tiltrotor aircraft as a potential major intercity passenger service provider. Tiltrotor is intrinsically more expensive than conventional aircraft technology, due to its technical complexity. However, tiltrotor ground support costs can be lower than for conventional aircraft, because the airport facility itself can be much smaller. Thus, it is possible that total trip cost for tiltrotor may be competitive. This technology is also being explored at a modest level abroad. There is a potential global market for tiltrotor, but it is not judged as large enough to justify a completely private development program. Thus, it is likely that government will have to participate in tiltrotor development to assure success.

One constraint on implementing new passenger technologies is the uncertainty resulting from lags in developing a safety regulatory framework that accommodates the novel aspects of the new proposed systems. This can affect high-speed rail, Maglev and tiltrotor service. It was mentioned that the DOT is currently developing standards for these modes.

MAJOR ISSUE

Integration with Suburban Transit and Other Modes

Background

For many users of public intercity transportation, the usefulness of the public system depends on the adequacy of the urban and suburban transit systems which serve intercity terminals. Any significant diversion from highway travel to high-speed ground systems is likely only where local transit is well developed and effective; good public transit is an important element to the success of foreign rail systems. Airport parking and traffic-generation issues are likely to become more constraining, particularly as an element of clean air programs. The recently passed ISTEA provides both encouragement and funding flexibility for metropolitan areas to undertake improvements in intermodal transfer.

Key questions include:

- *To what degree is the efficiency and level of service of public intercity passenger transportation systems diminished by limitations of urban transit connections at major terminals?*
- *How important are institutional issues in constraining the integration of intercity and local transportation systems?*
- *Are there particularly illuminating U.S. examples of success in this area?*

Seminar Discussion

Even when major urban transit systems exist in a city, coordination with intercity service is a problem. A participant complained that in one city, "even with Amtrak running [both the intercity and] commuter rail service, I can't get schedule information or a single through-ticket by making just one phone call." It appears unlikely, however, that U.S. intercity carriers will invest in improving the connections to urban transit systems, as has happened in several European cities, because the additional market potential that could be tapped is not large enough. For example, it was pointed out that Amtrak received little benefit from either the Baltimore-Washington International Airport stop or the Philadelphia airport shuttle service.

Another area where a significant information gap can exist concerns highway access to airports. Some potentially useful services such as suburban limousines are, in one participant's words, "economically fragile." If not enough people know about the existence of these services and cannot easily access them, they will not survive.

Another obstacle is that travel agents are neither equipped nor motivated to provide detailed information on local public transportation. One suggested means of making such information more readily available to the public would be for bus companies and transit agencies to provide schedules and information to a master database which could act as the transportation equivalent of a '911' phone connection. However, there was no consensus that a lack of information for travelers represents a serious current problem. In general, it was concluded that most travellers probably know, or can easily find out, what they need to know.

MAJOR ISSUE

Safety and Security

Background

Compared to the rest of the world, the U.S. enjoys an enviable record in transportation safety and security. Nonetheless, each major accident that occurs renews concerns that congested conditions, industry financial weakness and competitive pressures, changing workforce characteristics, abuse of drugs, introduction of automation and other new technology, and other factors may have significantly reduced the margin of safety. The catastrophic consequences of terrorism have led to increasingly thorough and sophisticated countermeasures, but at substantial expense, to counter an uncertain level of risk.

Key questions include:

- *Are there any areas in which significant improvements in the safety of U.S. transportation systems can be expected for a reasonable effort?*
- *Are any current changes or trends likely to yield significant future safety problems that should be addressed in advance?*

Seminar Discussion

The military is particularly concerned with the safety of small carriers, especially for bus service. Military traffic managers deal with more than 4,000 individual companies, some of which are very small. Compliance by these companies with drug testing and hours-of-service rules is uncertain. In fact, the military discovered that some companies did not even know that these rules existed. The potential problem is serious. For example, one major bus company turns down 60% of all job applicants because of drug problems. However, overall bus travel remains the safest mode of intercity transportation.

Chapter 8:
Rural Transportation

Introduction

Changing demographics and economics, in conjunction with the low population densities characteristic of rural areas, are altering the availability of transportation services to rural America.

Elderly people who are unable to drive are becoming an increasingly large portion of the population in rural areas, while at the same time the provision of public transportation in such thinly populated areas is more difficult than in areas that are more densely populated. Aside from the automobile, intercity bus service is often the only way that rural inhabitants can reach other parts of the country, or rural areas can be reached by visitors. Yet many rural areas are growing even more isolated as intercity bus service is reduced.

Freight transportation is vital to both industry and agriculture for the shipment of raw materials and finished products to domestic and international markets. The makeup of freight services to rural areas is shifting, with rail service decreasing and truck service increasing. Not surprisingly, these changes have been accompanied by far-reaching effects on rural communities.

In response to these observations, the Volpe National Transportation Systems Center organized a seminar on the topic of rural transportation in Kansas City, MO on December 17, 1991. Attendees included representatives from state Departments of Transportation, Native American committees, freight users, intercity bus service providers, transportation organizations, university transportation centers and transportation consultants.

The topics suggested for discussion included: the rural transportation environment, the adequacy of local passenger transportation, the adequacy of freight transportation, and access to intercity passenger transportation systems. These subjects reflect the issues of personal mobility and economic prosperity of the rural population and the accessibility of both rural people and products to world markets. Observations and common themes raised in the discussion are summarized below. The views that follow in the "Seminar Discussion" sections were expressed by individual participants in the course of the discussion, and do not necessarily reflect the policies or positions of the Department of Transportation (DOT).

MAJOR ISSUE

The Rural Transportation Environment

Background

In recent decades, the rural economy has grown considerably diversified in terms of its products and needs. In 1989, the U.S. Department of Agriculture's Economic Research Service found that only 29% of the nation's 2,443 non-metropolitan counties could be classified as farming-dependent, while 27% were classified as manufacturing. Moreover, since 1960, off-farm income has accounted for 40% to 55% of the net incomes of farm households.

These trends have placed very different demands on the transportation system. Local mobility is needed as families become more dependent on the goods, services, and employment opportunities provided by the community at large. The economic development of rural areas relies on the ability to ship and receive products and raw materials. The community itself must have access to intercity passenger and freight transportation systems for the commerce and communication which is a necessary component of viability in modern America.

Several new pieces of legislation will have major impacts on the overall environment for rural transportation. The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), which extends and significantly modifies the previous Surface Transportation Assistance Act, provides more decisionmaking authority and more flexibility in the use of Highway

Trust Funds to state and local governments. It provides for development of a National Highway System complementing the interstate system with a network of arterials. It emphasizes connectivity among transportation modes and provides funding for intermodal transfer improvements and for increased research in safety and in advanced transit and highway technologies.

The second legislation important to rural transportation is the Americans with Disabilities Act of 1990 (ADA). It acknowledges that accessibility to public transportation services is a civil right. It requires fixed-route public transportation to be made fully accessible for passengers with a much broader range of impairments than are currently accommodated. It will also expand services to individuals who cannot use existing routes.

These laws implement national goals for transportation. Their full impact on rural transportation will not be interpreted or fully understood nationwide for some time.

Key questions include:

- *What are perceived as the major impacts of ISTEA and ADA on state, county, and municipal governments?*
- *What are the most important steps these authorities can take to benefit from the new funding provisions in ISTEA?*
- *What planning tools and data sources are available for optimizing investments in rural transportation?*

Participants

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Seminar Discussion

Although population in rural areas is on the decline, the percentage of elderly living in these areas is increasing. Not surprisingly, a significant portion of the total demand for public transit in rural areas comes from the elderly and the physically disadvantaged. While public transit is vital for these groups, reduced population and therefore reduced tax revenues make it difficult to raise the local share of funds for transportation programs and projects. Yet without such services, there may be no other transportation options available for these groups.

As rural populations move towards urbanized areas, rural transportation services sometimes decline. In the few rural areas that are experiencing growth, existing roads must serve as the equivalent of urban arterials. The structure and capacity of these roads, however, are often insufficient for the amount of stress brought by this increased traffic. For example, many rural state highways have seen a decrease in auto traffic, but an overall increase in volume due to the growing number of trucks on these roads, partially caused by cuts in rail services.

Rural Transportation Planning

ISTEA introduces new flexibility into transportation planning by increasing the authority of the Metropolitan Planning Organizations (MPOs). Although few of the seminar participants had an opportunity to review the ISTEA thoroughly before the meeting, it was agreed that the apparent flexibility of the legislation will be beneficial for cities with an MPO. The question was raised, however, about what resources for planning were available in rural areas. Discussion revealed that the smaller scale of rural communities poses unique problems for transportation planners and providers, yet there is no established equivalent of the MPO to represent these communities. While some participants recommended that the federal government provide a framework in which states could create the equivalent of rural MPOs, others warned against mandating a uniform nationwide structure for these organizations.

In this context, it was suggested that a change in federal rule-making is needed to take the smaller scale and resources of many rural facilities into account. For example, Clean Water Act standards require that a small rural airport serving perhaps as few as two ten-seat planes per day follow the same procedures for waste water treatment as do major urban airports handling millions of passengers annually.

Native American representatives expressed a desire for increased road, bridge and planning funds, as well as inclusion in state transportation planning and eligibility for U.S. Department of Transportation training programs in construction planning and engineering. State Department of Transportation representatives would also benefit from additional resources to help make intelligent decisions regarding resource allocation among modes and the provision of special services for particular population segments, such as the elderly.

The Need for Coordinated Transportation Services

Institutional coordination is a key component for the provision of cost-effective passenger and freight transportation in both rural and urban areas. Comments from seminar participants reflected the need for more integrated intergovernmental and interagency coordination. Federal requirements for planning coordination have not resulted in coordinated services. There are currently more than one hundred separate federal programs that address passenger transportation. Examples of voids, overlaps and unnecessary categories in these programs were recounted. It was suggested that a more coherent public policy at the federal level for both passenger and freight transportation would help to alleviate this situation and the current modal separation it fosters.

Transportation should also be considered in conjunction with other public programs in order to balance costs and benefits. For example, as funds for U.S. Department of Health and Human Services (HHS) entitlement programs are reduced, the transportation portion of these funds is often cut in order to maintain the core service. Seminar participants used the term "dumping" to describe this reduction in transportation provided by these HHS-funded programs. Yet transportation is closely linked to the successful delivery of social services such as health care in less-populated areas. It is important to decide what services are most important to the community and how to manage them effectively.

New Long-Term Roles for the Federal Government in Rural Transportation

With the ISTEA, a great deal of responsibility and authority for decision-making will be moved to state and local government agencies. However, a continued role for the federal government will remain in nationwide, interstate, and international issues. A nationwide transportation program can address issues such as rural transportation economics, research and development, information dissemination, and technology transfer. The Department of Transportation's Rural Transportation Assistance Program (RTAP) and Technology Transfer programs are good models which could be enlarged and expanded. Continued dialogue between the Department of Transportation and transportation users and providers could be maintained through regular meetings with national associations such as the Community Transportation Association of America, National Association of Counties and National Industrial Transportation League.

MAJOR ISSUE

Adequacy of Local Passenger Transportation

Background

Beyond the growing numbers of Americans with special transportation needs, another aspect of changing demographics is the geographic dispersal of this special-needs community, especially the burgeoning elderly population. Most people age in place, in the houses that they already own. Given this fact, estimates indicate that the number of people over the age of 65 in rural areas will double by 2020. At present, about one-third of the trip requirements for the transit dependent are in non-urbanized areas. But those areas have been receiving only about five percent of the service.

A fundamental aspect of this changing situation is the fact that Americans have become more dependent on the automobile with each successive generation. By the turn of the century, over 90% of all elderly people (and 98% of the males) will have been licensed to drive and will have made life style decisions based on access to the automobile.

Health care delivery is a particularly important aspect of rural transportation needs. The centralization of health care facilities causes a growing problem. There are a variety of public and private transportation providers to service these facilities; yet, they are often uncoordinated and, at times, redundant.

Key questions include:

- *Can rural transit be expected to approximate the levels enjoyed in urban areas?*
- *What are the expectations for frequency and convenience of services?*
- *What level of rural transportation service is a public sector responsibility?*
- *How are federal, state and local interests to be balanced?*
- *Can additional or improved services be obtained by further coordination among public agencies?*
- *What is the outlook for privatizing or 'contracting out' rural transit services?*

Seminar Discussion

As with urbanized areas, one of the factors that restrict rural passenger transportation is shortage of funding. Participants agreed that many transportation services supported by Federal Transportation Administration (FTA) Section 18 (Formula Grant Programs for Areas Other Than Urbanized Areas) and Section 16 (b)(2) funds do not have enough operating money. As a result, services often have to be cut back. It was also pointed out that rural economies are heavily dependent on effective transportation. Thus, declines in these services could actually aggravate urban congestion by accelerating the migration of additional rural populations to urban areas.

Another factor that influences the provision of rural passenger transportation is regulations that are insensitive to the smaller sizes of rural transportation operators. The regulatory demands that often accompany such funds -- such as drug/alcohol testing, section 13(c) labor rules, and commercial licensing -- may prevent practical, low-cost solutions to transportation problems and often increase the burden borne by those providing transportation services. To the

many small rural operations that consist of only one or two employees, the imposition of such regulations may make the difference between continued operation and bankruptcy. These burdens may offset any benefits derived from the ISTEA.

For Native Americans, the quality of roads on reservations is a serious concern. The sparseness of the population frequently requires inhabitants to travel thirty to forty miles for the most basic of products and services. The Navajo Nation, for example, has only 2250 miles of paved roads, while 5900 miles of road are unimproved dirt.

Chippewa van

MAJOR ISSUE

Rural Freight Transportation System Efficiency

Background

The increasingly significant non-farm industry in rural areas relies on transportation to obtain raw materials and ship products, as do manufacturing and other forms of economic activity in metropolitan areas. Moreover, farm production also relies on transportation to a greater degree than has historically been the case because refrigeration and other advances have substantially expanded their markets geographically. Efficient access to international markets is increasingly important.

At the same time that changes in rural economies have increased the demand for freight transportation, the transportation system has evolved in ways that reduce service. In recent years, railroads have eliminated many light density or highly seasonal lines and concentrated service on lines with higher volumes of traffic to make more economical use of their investment in plant and equipment. In addition, many of the route authority requirements that had constrained truck competition have been removed, allowing motor carriers to fill rural freight transportation needs.

At least two facets of the problem remain, however. First, the sudden shift from reliance on rail to trucks, particularly for dense products such as grain, has caused a more rapid deterioration of road and bridge structures. Second, for some activities which require more than seasonal movements, truck shipment may be inadequate. In such cases, rural areas are not able to attract industries in competition with locations which offer a higher frequency and volume of freight transportation services.

There has been a market response to the loss of rail service in rural areas brought about by the rationalization of the systems of the major rail carriers. Regional rail systems have picked up some of the traffic abandoned by the national railroads as unprofitable. For example, there are now nearly 500 short-line railroads in the U.S., many of which are in rural locations. These lines, established sometimes with public sector support, are providing competitive rail service to many rural communities which otherwise would have lost this capability.

Where they are successful, regional and short-line railroads often provide a service more sensitive to the needs of the particular shippers they serve. However, short lines, in particular, have benefitted from rail and rolling stock made economically available through the rationalization of the larger systems. When that process has finally run its course, the capital costs for short-line operations may change in ways that will pose new problems for rural freight service.

Key questions include:

- *How well is the freight transportation system serving rural areas?*
- *Are there specific gaps and weaknesses damaging to the economy of rural areas?*
- *How critical are short-line and regional rail system to rural freight transportation?*
- *How well integrated are rural rail, barge, inland marine and highway systems.*
- *Are intermodal facilities adequate?*

Seminar Discussion

Freight transportation services have been on the decline in rural areas. In rural states, a large volume of freight traffic is evident, but little transportation service is actually provided to local communities themselves. Much of this traffic is just passing through these communities bringing goods to other destinations. Thus, the needs of rural communities often "fall through the cracks." The cost of providing services to these areas has to be covered in some way.

The decline in rural rail freight service has brought far-reaching effects. For example, when a railroad closes a branch line, there is often an increase in point-to-point transport by trucks to and from the grain elevators. The trucking firms may charge higher rates, and elevators may have to lower their prices to compensate for the increased transportation costs. There is also unanticipated road wear around the elevator, due to the shift from railcars to trucks for very heavy bulk products like grain. As a result, the need for public investment in infrastructure maintenance increases.

In addition, rail provides service from grain elevator to port, thus providing direct access to world markets. As major sources of commodities for export, rural areas are significant contributors to the positive side of the nation's trade balance. If shortcomings in rural transportation increase costs, the competitive position of rural products in international markets will be adversely affected. This harms both rural economies and the nation's international competitiveness.

To meet national goals for a competitive intermodal freight system, some states may have to expand considerably their rail programs, and an improved national transportation network for international and domestic efficiency may have to be developed. On the other hand, federal policy and programs should not distort the market.

In addition, adequate transportation systems do not exist to handle the safe transport of toxic waste through or near rural communities and Native American reservations. Funding is needed to establish programs for the control of toxic waste spills and accidents in these areas.

Courtesy: U.S. Department of Agriculture

MAJOR ISSUE

Access to Intercity Passenger Transportation Systems

Background

The nation in general has experienced a steady growth in commerce and communication that is met in part by increasingly sophisticated national transportation systems. The Interstate Highway System, a growing international air transport system and, to a lesser extent, bus and rail passenger systems place most Americans scant hours from commercial and cultural centers. Metropolitan areas are generally well integrated into many, if not all, of these systems. Rural areas, on the other hand, often lack direct access to any of these systems. The result of this lack of access is twofold: first, residents of these areas feel and become lesser participants in the national agenda; and second, these rural areas cannot attract economic activity in competition with areas that can offer better access to these systems.

Airline deregulation has had a mixed impact on rural areas. Many communities never had service and still do not. Some communities benefitted from deregulation through the substitution of more frequent service in smaller, but more appropriately sized, aircraft. Other locations, however, lost direct service to some points and are now served only through a hub. In general, aviation does not provide high-quality, direct service to many rural communities.

Intercity bus and rail passenger service has declined substantially. The major rail service decline began in the immediate post war years, although it has largely stabilized through the current Amtrak system. Amtrak service is based on the needs of larger urban markets, and generally provides very limited service to rural areas. Scheduled intercity bus service had for some time been the most frequent and reliable connection to the national transportation system for many rural communities, but has been in a long period of decline.

Key questions include:

- *How well are national intercity passenger transportation systems serving rural areas?*
- *Are there specific gaps and weaknesses that are damaging to the economy or quality of life of rural areas?*
- *Are the economics of rural intercity passenger transportation such that reliance on market forces alone cannot provide adequate services?*
- *Are public funding sources necessary?*
- *If so, how should they be targeted and implemented?*

Seminar Discussion

Prior to the deregulation legislation of the late 1970s and early 1980s, the United States had redundant transportation systems. Many regions enjoyed multiple transportation options from which to choose. Rural passengers, for example, were often served by intercity bus service, commuter aircraft and rail.

In many instances, however, the increased flexibility to change routes and the lower profit margins that accompanied deregulation have eliminated these choices in small markets such as rural communities. For example, in the past three years Greyhound Bus Lines has reduced its service from 22,000 points to 8,000 points nationwide. Consequently, many rural regions are seeing a reduction in efficient

Summary of Major Points:

Rural Transportation

- Among people in the rural transportation field, there is a sense of optimism regarding the ISTEA and the benefits it can bring.
- Freight transportation plays a very important role in rural areas, particularly in moving agricultural goods to market and bringing in needed materials and supplies. Effective freight movement makes a critical contribution to U.S. international competitiveness by helping to carry U.S. agricultural products to overseas markets.
- In the area of rural passenger transportation, the most critical needs appear to be in serving the 'transportation disadvantaged,' including elderly citizens, people with disabilities, poor and isolated households, and Native American communities.
- There is a need for greater intergovernmental and interagency cooperation in planning, funding, research and development, and technology transfer, to help meet rural transportation needs.
- In rural areas, having effective options to choose from for both freight and passenger transportation services is very important for businesses, households and communities to maintain the necessary connections to other communities and markets, preserve the standard of living, and support economic health and future growth opportunities.

connections to the intercity passenger transportation system.

Some seminar participants suggested that intercity bus service may only play a continuing role in the country's transportation system if it receives public financial support. It was pointed out that because intercity buses serve a less vocal constituency -- the most transportation disadvantaged -- it is difficult to quantify demand. Improvements in service, however, could also stimulate user demand in small rural markets.

State laws which prohibit the use of state funds to support private, for-profit organizations often make public funding for intercity bus service difficult. Suggested solutions to this problem included direct subsidies to users and funding for capital equipment. The "Rural Connection" program provided a way to link rural public transit with the remaining intercity bus service in rural areas. Smaller rural transit services may also be able to use ISTEA funds to align their schedules with those of intercity bus lines along main routes.

One participant also suggested that the Interstate Highway system should be expanded through Native American reservations to connect these communities and to act as a potential stimulus to their economic development and growth.

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