

GAO

Report to the Secretary of
Transportation

December 1989

**TRANSPORTATION
INFRASTRUCTURE**

**Reshaping the Federal
Role Poses Significant
Challenge for Policy
Makers**





United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-237967

December 28, 1989

The Honorable Samuel K. Skinner
The Secretary of Transportation

Dear Mr. Secretary:

Over the next few months the Congress will begin deliberating on the reauthorization and funding of possibly \$90 billion for a 5-year federal highway and mass transit program. As traffic congestion escalates and highways and bridges continue to exhibit significant deficiencies, there is considerable debate about the appropriate government role in and type of funding for surface transportation programs. These programs are designed to provide federal funding assistance to state-administered programs. To stimulate discussion among principal participants and search for a consensus on reshaping the nation's surface transportation programs, we held a seminar entitled "New Directions in Surface Transportation Infrastructure" on June 20, 1989. This seminar brought together 19 nationally known transportation authorities representing the major segments of the surface transportation infrastructure industry.

While the focus of our seminar was to exchange ideas and opinions about the key issues associated with reauthorizing federal surface transportation programs, the insights obtained are also relevant to the formulation of a national transportation policy. Accordingly, we briefed your National Policy Team Director and other senior transportation officials on the issues discussed at the seminar, including (1) the nation's increasing traffic congestion problems and deteriorating transportation infrastructure, (2) the appropriate federal role and funding mechanisms, and (3) opportunities to look beyond single-mode transportation boundaries. We have synthesized these key issues in this report to you.

Results in Brief

Two specific surface transportation problems—traffic congestion and road and bridge deterioration—received near unanimous mention as priorities facing the nation now and in the decade to come. To address these problems our seminar experts believe that policy makers must focus on ways to maximize and prolong the life of existing transportation resources through improved management techniques and applied research.

Unfortunately, this change in commuting patterns is outpacing the ability of mass transit and existing roads to support current travel demands. As work destinations become more scattered in the suburban areas, it is increasingly difficult for public transit to meet the needs of commuters. Moreover, greater numbers of commuters who drive are competing for the use of the roads. FHWA statistics showed that the number of workers had risen from 59 million in 1950 to 110 million in 1986.

To help alleviate congestion, experts agree that emphasis must be placed on maximizing the transportation resources already in place. FHWA reported that 62 percent of all congestion resulted from nonrecurring delays such as accidents and disabled vehicles. Incident management systems, designed to quickly identify and remove traffic disruptions, could, by some estimates, reduce traffic congestion by 50 percent. Another option is the Advanced Vehicle Highway System, which equips motorists with electronic monitoring devices for use in communicating timely traffic information. Motorists can then alter their routes to avoid congestion. Federal efforts to reduce congestion, however, are hampered by the uncertainty of the sources and amounts of funding for such efforts, according to one of our recent reports.¹

Significant Deterioration of Roads and Bridges Is Occurring

Now that construction of the Interstate component of the federal-aid highway system is nearing completion, the battle facing the nation is to maintain and preserve this system, according to the Executive Director of the American Association of State Highway and Transportation Officials. Nationally, FHWA reported, pavement and bridge deficiencies affect almost 12 percent of the Interstate and over 45 percent of the nation's bridges. However, focusing on the average national pavement and bridge conditions obscures the considerable variance in conditions from state to state. For instance, according to FHWA, the percentage of deficient rural Interstate pavement ranges from 0 to 42 percent in the states. Likewise, the percentage of deficient bridges among states ranges from 6 to 61 percent.

Although FHWA reports that some progress has been made in addressing these problems on an aggregate level, highways and bridges continue to exhibit deficiencies. For instance, while the total number of deficient bridges has declined overall since 1982, the number of deficient bridges

¹Traffic Congestion: Federal Efforts to Improve Mobility (GAO/PEMD-90-2, Dec. 5, 1989).

Transportation experts explained that the first tier could provide federal funding for highways of national significance.³ The second tier could provide funding for other federal-aid highway and bridge programs through block grants.

Block grants allow states to identify and address their own unique surface mobility requirements. Given the changing needs of the nation's transportation system, block grants can be an appropriate alternative if funding is adequate and strategic planning is appropriate to the nature and size of the problem, according to the Chief Operations Officer and General Manager, Southeastern Pennsylvania Transportation Authority. But he sees the downside of block grants as being inadequate funding. In 1985 we reported that, under seven block grant programs, states obtained greater authority to set program priorities, yet states generally received fewer federal funds than under the former categorical programs.⁴

Transportation block grants are currently being tested in five states. Authorized by Section 137 of the Surface Transportation and Uniform Relocation Assistance Act of 1987, the demonstration program allows five states greater administrative and funding flexibility for several federal programs.⁵ We are reviewing this demonstration and expect to issue a report in the spring of 1990.

Interest in Toll Financing Is Growing

Current revenue sources are not expected to meet projected transportation needs. In 1987, federal, state, and local highway revenues totaled \$66.5 billion, but current estimates of future highway needs are as high as \$117 billion annually. Given these projections, alternative funding strategies, such as tolls, are being viewed with mounting interest. The proponents of toll financing claim that tolls represent an exact form of pay-as-you-go financing. Other experts disagree, citing tolls as a form of double taxation because users already pay fuel taxes to fund highway construction and preservation. Other drawbacks to toll use cited by FHWA and highway users' representatives are the delays and increased fuel consumption caused by waiting at toll plazas.

³There are differing opinions about which highways constitute those of national significance. The American Association of State Highway and Transportation Officials defined such highways as those that interconnect states and major population centers.

⁴Block Grants Brought Funding Changes and Adjustments to Program Priorities (GAO/HRD-85-33, Feb. 11, 1985).

⁵Participating states are Minnesota, Texas, Rhode Island, New York, and California.

respond effectively to growing congestion. Intermodal transportation planning and investment would allow for trade-offs and interactions that could result in transportation needs being more effectively met.

It is no longer possible for the nation to make transportation investment or planning decisions in a vacuum, according to a spokesperson for the American Public Transit Association. This official believes that the nation is not being well served because of the "separateness" in transportation planning, programming, allocation of funds, construction, and maintenance activities. Further, he said that there are too many categories of funds driving independent decisions, which leads to too few trade-offs and too little flexibility in how the money is spent.

The Executive Director of the American Association of State Highway and Transportation Officials underscored the need to recognize the reliance of the transportation modes on each other, because no one mode can meet the nation's diverse transportation requirements. He said that state and federal planners must take into account the individual capabilities of each mode, and how the modes relate to each other.

Transportation planners must also consider the environmental impacts of transportation policies. Forecasters predict that the number of miles motorists travel will continue to increase, resulting in greater emissions of environmentally damaging gases. Air pollution created by emissions is a serious problem in many metropolitan areas. Finding solutions to this problem must be given more attention.

The Congress is considering solutions to environmental problems caused by vehicles through the deliberations on the reauthorization of the Clean Air Act. The act and its amendments require the Environmental Protection Agency (EPA) to establish air quality standards for air pollutants, set deadlines by which the standards must be met, and allow EPA to impose economic sanctions for failure to meet deadlines. In a January 1988 report on EPA's efforts to reduce ozone levels, we recommended that the Congress amend the Clean Air Act to recognize the diversity of factors that contribute to ozone problems and specify the conditions under which economic sanctions would apply.⁹

⁹Air Pollution: Ozone Attainment Requires Long-Term Solutions to Solve Complex Problems (GAO/RCED-88-40, Jan. 24, 1988).

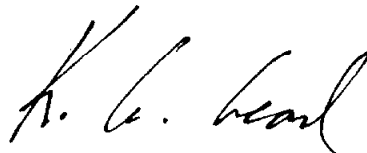
increasing the transportation system's effectiveness and productivity. Therefore, future needs assessments and resource commitments must traverse organizational boundaries and modal lines.

Appendix I lists the seminar participants, the organizations they represent, and the panels on which they served. Appendixes II, III, IV, and V discuss highway congestion, pavement and bridge deterioration, the future federal highway role, and transportation intermodalism, respectively. A companion volume to this report, Transportation Infrastructure: Panelists' Remarks at New Directions in Surface Transportation Seminar (GAO/RCED-90-81B), presents the panelists' remarks.

We plan to send this report to appropriate congressional committees, seminar participants, and other interested parties.

Should you require additional information on this report, please call me on (202) 275-1000. Major contributors to this report are listed in appendix VI.

Sincerely yours,



Kenneth M. Mead
Director, Transportation Issues

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Abbreviations

ATAC	American Transportation Advisory Council III
AVHS	Advanced Vehicle Highway Systems
CO	carbon monoxide
DOT	Department of Transportation
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
GAO	General Accounting Office
HOV	high-occupancy vehicle
NAAQS	National Ambient Air Quality Standards

**Appendix I
Objectives, Scope, and Methodology**

Figure I.1: Participants in “New Directions in Surface Transportation Infrastructure” Seminar

Panel 1: Transportation Overview	<p>Lester P. Lamm, President, Highway Users Federation for Safety and Mobility</p> <p>Richard D. Morgan, Executive Director, Federal Highway Administration (FHWA), U.S. Department of Transportation (DOT)</p> <p>Thomas B. Deen, Executive Director, Transportation Research Board, National Academy of Science</p> <p>Francis B. Francois, Executive Director, American Association of State Highway and Transportation Officials</p> <p>Jack R. Gilstrap, Executive Vice President, American Public Transit Association. Robert G. Stanley, Deputy Ex. Dir., Policy and Programs is substituting for Mr. Gilstrap.</p>	Panel 3: Recasting the Federal Government’s Role	<p>Louis J. Gambaccini, Chief Operations Officer and General Manager, Southeastern Pennsylvania Transportation Authority</p> <p>Kevin E. Heanue, Director, Office of Planning, FHWA, DOT</p> <p>Bruce D. McDowell, Director, Government Policy Research, Advisory Commission on Intergovernmental Relations</p> <p>Charilyn Cowan, Group Director, Capital Resources, National Governors Association</p> <p>Gerald A. Donaldson, Associate Director for Highway Safety, Center for Auto Safety</p>
Panel 2: Federal-Aid Highway System Preservation and Research Needs	<p>T. Peter Ruane, President and Chief Executive Officer, American Road and Transportation Builders Association</p> <p>E. Dean Carlson, Associate Administrator for Engineering and Program Development, FHWA, DOT</p> <p>Martin F. Fitzpatrick, Jr., Administrator, Office of Transportation, U.S. Department of Agriculture</p> <p>Damian J. Kulash, Executive Director, Strategic Highway Research Program</p>	Panel 4: Innovative Highway Financing Through the Use of Tolls	<p>H. Joseph Rhodes, Director, Office of Policy Development, FHWA, DOT</p> <p>Ralph L. Stanley, Chief Executive Officer and Chairman of the Board of Directors, Toll Road Corporation of Virginia</p> <p>John Archer, Managing Director, Government Affairs, American Automobile Association</p> <p>John J. Hassett, former Executive Director, International Bridge, Tunnel & Turnpike Association</p> <p>Robert E. Farris, Vice President, Policy Division, American Trucking Associations</p>

forecasted for the year 2005.¹ The bottom line, according to the American Public Transit Association's representative, is that "We are losing the battle for mobility."

Some areas are experiencing a particularly acute growth in traffic congestion. According to the President of the Highway User's Federation, traffic has grown on the average of 6 percent per year for the past 10 to 15 years. Statistics in the 1989 FHWA Status Report show that while urban Interstate congestion rose 5 percent between 1985 and 1987, congestion on rural Interstates rose from 8 percent to 17 percent over this same period. Future growth, according to FHWA officials, should continue the same trend. By the year 2005, the officials project that freeway delays will more than quadruple in areas with populations over one million, but will increase by 1,000 percent in areas with populations of less than one million.

Congestion Growth Stems From a Multitude of Reasons

In a recent report we noted that congestion growth results from a variety of factors, including the suburban employment boom, a shift in employment commuting patterns, and an increased number of vehicles on the roads.² Changes in the nation's demographic profile have severely altered the nation's surface mobility needs. These alterations, in many instances, have placed demands on the nation's transportation systems that current facilities are unable to meet, thus inhibiting the ability of Americans to travel efficiently and expediently. Some of the significant demographic changes that have contributed to this congestion include booming suburban employment opportunities, changing use of highways, and growing numbers of system users.

Suburban employment growth, triggered by corporate development and relocation in suburban metropolitan areas, has significantly altered the patterns of the nation's commute. According to a recent report by the Institute of Transportation Engineers, in the early 1980's nearly 60 percent of all office space in the United States was located in urban centers, with the remaining 40 percent located in the suburbs. Today the opposite is true. The rising cost of downtown office space, the need for more room to expand, and a desire to be closer to a pool of trained workers have all fostered the surge of corporate suburban relocation. In 1987, nearly 60 percent of all employment destinations were located outside

¹Traffic Congestion: Trends, Measures, and Effects (GAO/PEMD-90-1, Nov. 30, 1989).

²Ibid.

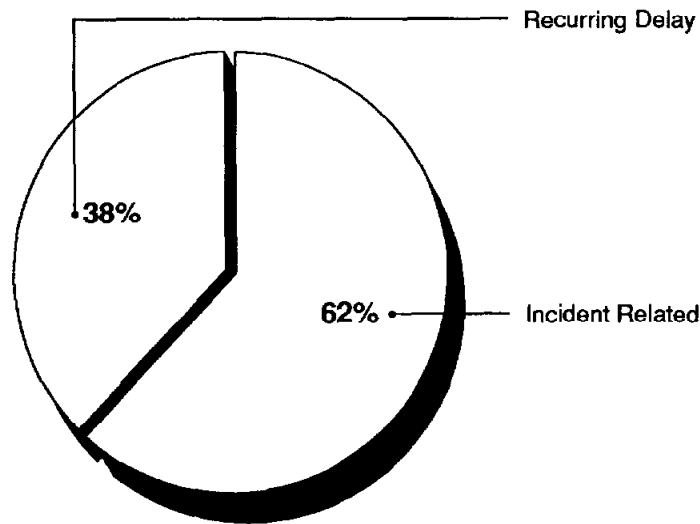
operating at or above design capacity; any further traffic growth—as predicted—will have an immediate and direct effect on congestion levels.

The Institute of Transportation Engineers also attributes traffic congestion to a failure of alternative transportation mechanisms—namely, mass transit—to parallel current patterns of movement. When the majority of jobs were located in the central cities, public transit could collect commuters at suburban centers and transport them effectively to the central business district. Today, however, with the vast proportion of commuter trips ending as well as beginning in dispersed suburban locations, this type of transit increasingly fails to meet the commuter population's needs. The American Public Transit Association representative raises the point, however, that the nation needs a commitment to "a greater reliance on all forms of high-occupancy, shared-ride services." He adds that these services, "must be tailored to meet demands of specific markets in specific locations"

The changing use of the nation's highways has also fundamentally altered the nature of the traffic problem. As explained in the Institute of Transportation Engineers' report, the Interstate system was originally designed as an inner-city bypass, providing routes for interstate travelers to avoid the congestion of urban metropolitan traffic. The actual effect of these bypasses, however, was to stimulate residential and commercial growth outside these highways as real estate costs soared within the loops. Interstate travelers no longer avoid the metropolitan congestion; rather, they must now compete with the local business commute, recreational traffic, and daily shopping and school transportation.

An escalating number of vehicles only exacerbates the congestion problems already existing on the roads. According to FHWA's Annual Highway Statistics, Americans operated an estimated 184 million cars, trucks, and buses in 1987, up 30 percent from a decade ago. Not only are households purchasing and operating more vehicles, but they are operating them more during peak traffic periods. According to FHWA, currently 110 million workers vie for use of American transportation systems to travel to and from employment destinations, compared with 59 million in 1950. Alan Pisarski, in a report entitled *Commuting in America*, attributes much of this commuter boom to the explosive growth of jobs following World War II and the unprecedented number of women entering the labor market. Between 1950 and 1987, 30 million women entered the workforce compared to 20 million men. By 1987, women constituted 42 percent of the workforce compared to only 28 percent in 1950.

Figure II.2: Delay Due to Incidents in 1984



Source: J. A. Lindley, U.S. Department of Transportation, FHWA, as cited in *Traffic Management for Freeway Emergencies and Special Events*. Transportation Research Board Circular, Number 344, January 1989.

The critical aspect for incident management, according to FHWA officials, is rapid restoration of normal highway operations. Freeway incident detection and management systems consisting of some combination of television surveillance, roving tow or service vehicles, and motorist-aid call boxes could identify these incidents and rapidly dispatch highway patrol and emergency equipment to the scene. The Institute of Transportation Engineers reported, based on a study of Los Angeles' incident-caused congestion, that its freeway electronic surveillance project reduced the average duration of lane blockages during incidents from 42 minutes to 21 minutes. With this type of system, travel time during congested periods could potentially decrease between 10 and 45 percent.

In a review of federal efforts to reduce traffic congestion, we found that the Department of Transportation provides assistance in a number of ways—financial, planning, technical, and research—to improve mobility. Federal efforts include adding roadway capacity, managing existing capacity more effectively, and developing new “smart” highway technologies.³ While acknowledging these activities, we noted the need for a more integrated federal approach toward improving mobility, especially on the Interstate system. The report also highlighted the importance of

³Traffic Congestion: Federal Efforts to Improve Mobility (GAO/PEMD-90-2, Dec. 5, 1989).

Pavement and Bridge Deterioration Continue to Plague the Nation's Highways

The Executive Director of the American Association of State Highway and Transportation Officials said that "Our nation's highways are the cement that binds together all other transportation modes." Now, with construction of the largest federally funded component of the federal-aid highway system—the Interstate system—nearing completion, one battle facing the nation is the maintenance and preservation of the entire federal-aid system. This system includes approximately 849,000 miles of roads and 576,000 bridges. Although some progress has been made in improving their condition, a significant number of the nation's roadways and bridges are fraught with serious weaknesses. And while the problems permeate the nation's roads as a whole, the condition of pavement and bridges varies significantly from state to state. These conditions result from a number of factors, including heavy traffic weight and volume, weather, and routine aging. Technological advances aimed at extending pavement life and designing vehicles that cause less damage to roadways may help to prevent or mitigate system damage. Additionally, to ensure that maintenance and preservation needs are given the attention they warrant, some transportation experts advocate building more incentives into federal programs for these efforts.

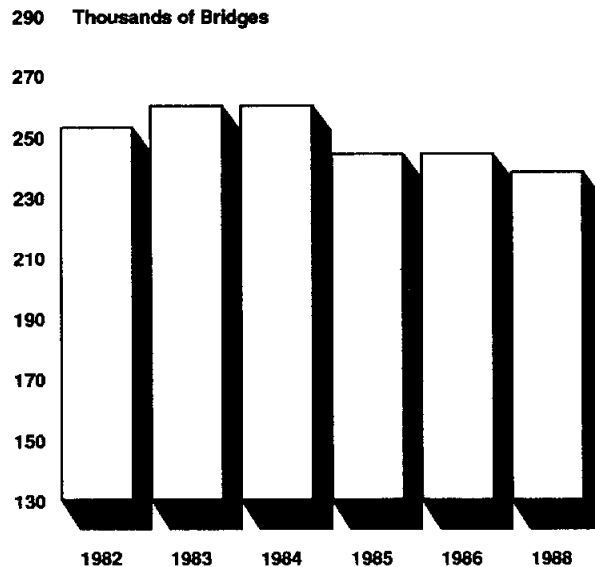
A Significant Amount of Pavement Is Deficient

Since 1982, some progress has been made in mending the disrepair plaguing the nation's roadways. Yet, according to FHWA's Associate Administrator of Engineering and Program Development, the nation still faces significant pavement needs. The President and Chief Executive Officer of the American Road and Transportation Builders Association cites FHWA statistics that show that nearly 12 percent of the Interstate system is deficient. In addition, the Association's representative reports that 5.5 percent of urban roads, 6 percent of rural roads, and 11 percent of secondary roads are also deficient. The American Transportation Advisory Council (ATAC) III, an informal coalition of individuals, business organizations, and associations concerned with the future of local transportation, reports FHWA projections that by the year 2000, 41,000 miles of Interstate, 334,000 miles of arterials, and 636,000 miles of collector routes will need capital improvements in order to maintain serviceability. (FHWA defines arterials as routes that function primarily to move large numbers of people and vehicles quickly from one place to another and that are characterized by long-distance travel, high volumes, and higher speeds. Collectors gather vehicles from local roads and streets and funnel them to the arterials.)

Similar to congestion, pavement deterioration afflicts every road system across the country, but the degree of deterioration varies considerably

Appendix III
Pavement and Bridge Deterioration Continue
to Plague the Nation's Highways

Figure III.1: Total Deficient Bridges,
1982-88



Note: Pursuant to the Surface Transportation and Uniform Relocation Assistance Act of 1987, FHWA's reporting requirement changed from annual to biennial.

Source: FHWA's 1989 Highways and Bridges Status Report.

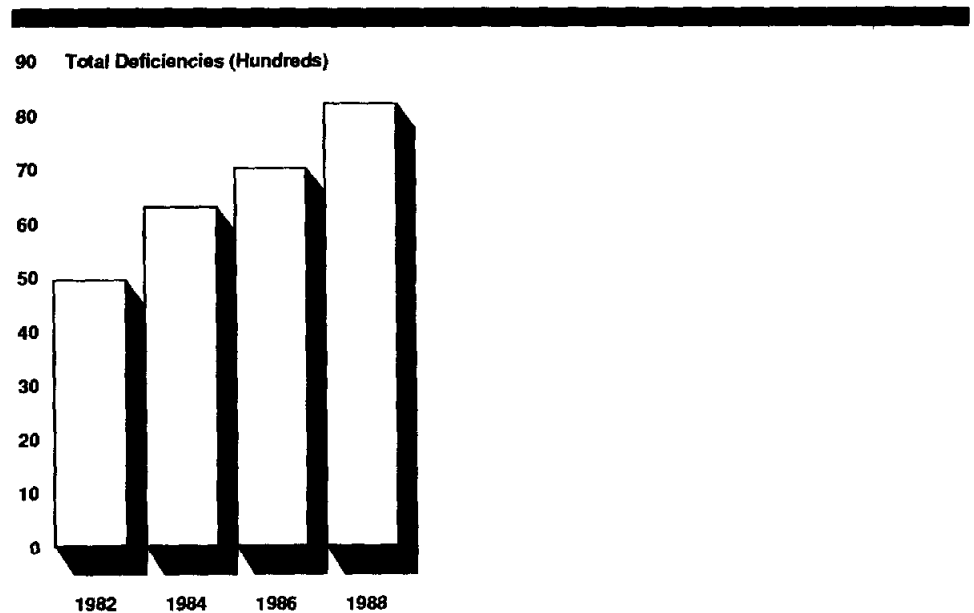
Even though the number is decreasing, the Executive Director of the American Association of State Highway and Transportation Officials projects that approximately 200,000 bridges will still need repair, rehabilitation, or replacement by the turn of the century.

These figures, however, obscure part of the story. Although the net change in bridge deficiencies has been on the positive side, some systems still face significant decline. Although FHWA statistics show that the total number of deficient bridges (e.g., federal-aid and non-federal-aid bridges) has decreased, the total number of deficient bridges on the federal-aid system has increased.⁴ From 1982 to 1988, deficient off-system bridges decreased from 183,551 to 161,165. Bridge deficiencies on the federal-aid system, however, increased from 69,645 to 77,192 over the same period. Figure III.2 compares the federal-aid deficient bridges with the off-system deficient bridges.

⁴The nation's roadway network is composed of nearly 4 million miles of state and local roads, of which 848,756 miles constitute the federal-aid system and are eligible for federal assistance.

Appendix III
Pavement and Bridge Deterioration Continue
to Plague the Nation's Highways

Figure III.3: Number of Deficient Interstate Bridges, 1982-88



Source: FHWA's 1989 Highways and Bridges Status Report.

Similar to pavement deficiency variations, the number and percentage of deficient bridges vary significantly by state. FHWA's 1989 Highway and Bridge Status Report identifies the national average of deficient bridges on the federal-aid system to be approximately 28 percent, but the percentage of deficient bridges among states ranges from 6 to 61 percent. Similarly, deficiencies on off-system bridges vary by state, ranging from 11 to 79 percent deficient. The percent of all off-system bridges classified as deficient is 53 percent.

Factors Contributing to Pavement and Bridge Deterioration

The Executive Director of the Strategic Highway Research Program claims that America's roads suffer huge amounts of damage because the volume and weight of traffic traversing the existing pavement exceed the ability of the pavement to withstand these loads. In addition to these factors, the use of chemicals on roads and severe weather conditions have caused the system to deteriorate in some places faster than projected, according to ATAC III.

Even with average wear and tear, the Executive Director of the American Association of State Highway and Transportation Officials claims that aging roads and bridges demand routine repair and maintenance. He said, "We must recognize the laws of engineering, which tell us that

The Federal Highway Role for Tomorrow

The cornerstone of federal highway involvement has been construction of the Interstate Highway System. Now, with system construction approaching an end, the federal role must be reexamined. To do this, a historical examination of highway program objectives and the federal role is needed.

National Objectives Require a Federal Role

A common thread throughout some panelists' presentations was recognition of the fact that the federal role must be revisited, since it can no longer be supported by the standard bearer of Interstate construction. Tracing the history of federal highway involvement, the President of Highway Users Federation for Safety and Mobility noted that, since 1916, the federal role has emphasized capital investment, that is, federal money distributed to states and local governments to help them administer capital investments in roads. Since 1956, federal effort has focused on building the Interstate Highway System. The Federation President described that job as almost over, as funds distributed within the next few years will be used to close the remaining gaps in the Interstate Highway System. According to FHWA, 98.8 percent (over 42,291 miles of the total 42,795 miles) of the system was open to traffic as of June 30, 1989. For the remaining system miles, 397 miles were under construction while another 107 miles were in various stages of preconstruction development.

Now is an appropriate time, according to the Executive Director, American Association of State Highway and Transportation Officials, to rethink the mission of federal surface transportation programs. No clear path leads to a future program. However, the Vice President of the Policy Division, American Trucking Associations, recognized that the nation is at a critical crossroads in its transportation history. He summarized the situation by noting that "Many avenues are open to us. We must choose the next route carefully, for we'll set a course that may well guide us for the next 3 to 4 decades as the Interstate program has since 1956."

One future course may essentially focus on maintaining the surface transportation network already in place. For instance, the former Executive Director, International Bridge, Tunnel and Turnpike Association, envisions a future program that will be more in the nature of a shoring-up, fix-it-here, fix-it-there, type of plan, far less dramatic and inspirational than the Interstate construction program.

yielding national benefits can be provided with greater efficiency by the federal government, as opposed to local or state units of government carrying out duplicative programs independently.

Block Grants Would Realign the Federal Role

Instead of the current practice of spreading federal aid among numerous categorical programs, the American Association of State Highway and Transportation Officials advocated a redesigned federal program. In a 1985 report, A New Focus for America's Highways, the Association proposed a program delineating highways of national importance. To clarify what was meant by highways of national importance, the Association report explains that, in addition to local roads and streets, the American highway system is composed of two basic networks: (1) those highways of importance nationally that serve to interconnect the states and major population centers and (2) those highways of primary importance to state and local governments that interconnect smaller cities and feed the highways of national importance, and which serve farms, factories, and the growing mobility needs of metropolitan areas. The Association stated that federal funds should be concentrated on the first basic network—highways of truly national importance. For the second basic network, the Association suggested a block grant program be established.

Federal transportation officials told us a two-tiered highway and bridge program is under consideration. As an FHWA official remarked, a two-tiered, post-Interstate program could provide funding through the first tier for highways of national significance,¹ and funding for the second tier through a block grant for other federal-aid highways and bridges.

Block grants authorize federal aid for a wide range of activities within a broadly defined functional area. Transportation block grants could provide greater funding and administrative flexibility to state and local officials. Block grants allow states to identify and address their own unique surface mobility requirements. Given the changing needs of the nation's transportation system, block grants can be an appropriate alternative if funding is adequate and strategic planning is appropriate to the nature and size of the problem, according to the Chief Operations Officer and General Manager, Southeastern Pennsylvania Transportation

¹There are differing opinions about which highways constitute those of "national significance." The American Association of State Highway and Transportation Officials defined such highways as those that interconnect states and major population centers.

data and program compliance information. We are currently reviewing the block grant demonstration project. As of late 1989, the five states have been in the program for periods ranging from approximately 7 months to 2 years. We expect to report on state experiences with this block grant program in the spring of 1990.

Expansion of block grant programs is a possibility. The Director of Government Policy Research, Advisory Commission on Intergovernmental Relations, articulated his personal view that FHWA's current block grant program should be expanded by combining and giving to state and local governments all federal aid for construction, maintenance, and operation of highways, buses, and rail transit facilities and equipment.

Support for Toll Financing Is Growing

One area of agreement for many transportation experts is that a greater funding commitment is required from all levels of government and the private sector to meet the funding challenges of the future. The American Association of State Highway and Transportation Officials estimates that, through the year 2020, combined spending by federal, state, and local governments must increase from its current level of roughly \$66 billion to \$81 billion annually, simply to keep the current highway and public transportation system "as is." Further, the Association estimates that to improve the system to accommodate expected growth will require an annual investment of \$117 billion. FHWA estimates that the Interstate 4R program, which funds activities to preserve Interstate highways and is the second largest federal highway program, will need roughly twice its current annual authorization level of \$2.8 billion to maintain overall conditions into 2005. Likewise, the Primary system, the third largest federal-aid highway program, will need more than double its current annual authorization level of \$2.3 billion.

Predictions of such an enormous funding shortfall have led to an increased interest in expanding the use of tolls. In 1987, over \$2.3 billion was collected from tolls on highways, bridges, and ferries, according to FHWA. Nonetheless, federal policy has generally prohibited states from imposing tolls on new or existing federally funded roads.³ Some transportation experts are questioning the wisdom of continuing this policy, given the need for highway expansion in a tight budget environment.

³These exceptions permit the use of federal money to construct toll bridges and tunnels and their approaches on the federal highway network, as well as approaches to toll roads that have been incorporated into the Interstate system.

FHWA and the International Bridge, Tunnel, and Turnpike Association cited a number of advantages commonly associated with tolls. Specifically, the International Bridge, Tunnel, and Turnpike Association's policy statement on the expanded use of the toll concept describes the user-pay principle embodied in toll projects as an equitable allocation of the cost because it places "the burden of paying for (transportation) services directly upon those who use them." Another advantage cited included the fact that, in some cases, toll financing allows completion of highway projects more quickly than is possible through existing federal and state programs. Further, toll financing moves the maintenance and operation cost out of the public highway budget as toll agreements usually require funds to be allotted for inspection, operation, maintenance, and debt service.

Highway user representatives—American Trucking Associations and the American Automobile Association—believe that tolls are a form of double taxation because motorists already pay federal gasoline taxes into the Highway Trust Fund for road construction and maintenance. The Managing Director for Government Affairs, American Automobile Association, characterizes toll financing as changing highway funding from a "pay as you go" system, based on fuel taxes already collected, to a "build now, pay now, and pay later" system where the responsibility for funding highway maintenance and construction is paid by toll charges on highway users' future trips.

FHWA and highway users agree that drawbacks to toll use are that delays are experienced and fuel consumption is increased while vehicles wait in line at toll plazas. As a representative from the American Automobile Association stated "drivers do not want their daily commute or holiday travels to be a series of stops and starts or long frustrating waits to pay tolls." However, the spokesperson for the International Bridge, Tunnel and Turnpike Association countered that toll collection delays will be mitigated by innovative technology under development such as the automatic vehicle identification system and other related electronic means of classifying, tracking, and controlling the movement of trucks, buses, and cars. Our spring 1990 toll pilot program report will identify whether innovative collection methodologies were implemented for any of these projects.

funds could not be used to build truck/rail piggyback terminals and federal airport money could not be used to build access roads to air terminals. Iowa officials believed that, overall, their planning had a narrower focus because federal programs were single-mode oriented.

The federal-aid highway program is a federally assisted, state-administered program that operates through the distribution of federal funds to states. As we reported in our 1987 Transportation Management Review, the Department of Transportation was established to provide a framework for coordination between transportation modes. However, the different transportation modes have maintained much of the independence that was theirs before the Department's creation over two decades ago.

It is no longer possible for the nation to make transportation investment or planning decisions in a vacuum, according to the Deputy Executive Director of Policy and Programs, American Public Transit Association. More specifically, he described the problem with current policy and programs as "separateness." The Congress, state transportation officials, transit agencies, and other transportation industry organizations make investment decisions in different ways. The American Public Transit Association's Executive Director of Policy and Programs believes that the nation has such a degree of separateness in its surface transportation planning, programming, fund allocation, construction, and maintenance activities that it is not being well served. He said there are too many categories of funds driving independent decisions, which leads to too few trade-offs and too little flexibility in how the money is spent.

We recognized the need to implement an intermodal strategy in our November 1988 transition report.² We stated that the Department of Transportation must address the aging of much of the nation's transportation infrastructure, rapid growth in demand (with attendant congestion and costly delays), and severe fiscal constraints imposed by accumulated federal deficits. We concluded that now, more than ever before, there is a need for integrated national transportation planning to ensure sound investments of scarce resources and an efficiently operating intermodal system.

We further stated in this November 1988 report that the need to implement an intermodal strategy is not well served by the Department's practice of preparing only separate needs studies for highways, bridges, mass transit, and airways. These transportation modes share common

²Transition Series: Transportation Issues (GAO/OCG-89-25TR, Nov. 1988).

unique problems to be solved. In other words, the Executive Director said that state and local governments must be free to work with each other to devise specific solutions and federal programs must recognize and provide for this needed flexibility.

An intermodal framework has to be guided by the problems being addressed. In response to a question, the President of the Highway Users Federation for Safety and Mobility stated that the first consideration is to identify the problems and then identify a set of programs to take care of the problems. He views congestion as a serious problem begging for a greater degree of intermodalism than the nation has ever had. He said his organization is proposing a program that would make federal money available for whatever class of transportation improvement is warranted to relieve congestion at the local level, whether that be new highway construction, new transit construction, traffic signal improvements, or other transportation system management activities.

Environmental Factors Must Be Considered in National Transportation Policy

No discussion of tomorrow's transportation plans can be complete without addressing the growing public concern about the potential impact of transportation policies on public health and the environment. Traffic congestion is not just a transportation problem but an environmental one, since vehicle emissions are one of the chief causes of air pollution. Although the Environmental Protection Agency (EPA) is the federal entity charged with setting national air quality standards, its decisions and those made by the Department of Transportation are interconnected. Therefore, both agencies' policies need to be aimed at reducing the ill effects of pollution.

Transportation and the Environment Inextricably Linked

Responding to the problem of air pollution, several panelists contend that as the nation considers proposals for expansion of highways and other transportation systems, environmental considerations must be carefully weighed. The Executive Director of the Strategic Highway Research Program summarized the seriousness of the challenge by stating that

"[Our highway system] carries more than 90 percent of our industrial output and our personal travel; . . . it accounts for a sixth of the Gross National Product. This means that highways are intertwined with many other important concerns: international competitiveness, regional growth, motor carriers, motor-vehicle producers, other modes of transportation, land development, the environment, and national health and safety. Because of many important consequences of our highway system,

been least successful in its efforts to attain the standard for ozone.⁶ While progress has been made in reducing ozone levels, most metropolitan areas have yet to meet the national safe ozone level established by EPA. In July 1989, EPA released data showing that 101 out of the 247 air quality control regions across the country—mostly major metropolitan areas representing about 75 million people—failed to meet EPA's ozone standard. This represented an addition of 37 new areas to the ozone nonattainment list.

Carbon monoxide (CO) is a colorless, odorless, poisonous gas produced by the incomplete burning of carbon in fuels. According to EPA, two-thirds of the nationwide CO emissions are from transportation sources, with the largest concentration coming from highway vehicles. When inhaled, CO enters the bloodstream, disrupting the delivery of oxygen to the body's organs and tissues. EPA reported in July 1989 that 44 out of 247 air quality control regions failed to meet the carbon monoxide standard, although this represented a decrease of 8 areas from the previous listing.

Although improved automobile design has helped new automobiles meet their targets for reduction of hydrocarbons, carbon monoxide, and nitrogen oxides, according to the Congressional Research Service, forecasts are now showing that vehicle-related emissions of hydrocarbons, nitrogen oxides, and particulates will begin to rise again toward the middle or the end of the next decade, despite the continued phasing-out of older, dirtier cars and the entry into service of cleaner heavy-duty vehicles.⁷

Opportunities Exist to Achieve Air Quality Goals

The Executive Director of Policy and Programs for the American Public Transit Association argued that with increased vehicle-miles traveled and the resulting growth in emissions of greater concern, it is essential that future national transportation policies promote significant increases in the use of high-occupancy, shared-ride vehicles. He believes this concept includes everything from car pool, van pool, and other shared-ride services to the most capital-intensive heavy-rail investments.

⁶Urban Ozone and the Clean Air Act: Problems and Proposals for Change, A Staff Paper from Office of Technology Assessment of "New Clean Air Act Issues," April 1988.

⁷David E. Gushee, Clean Air Act Issues: Motor Vehicle Emission Standards and Alternative Fuels, Congressional Research Service Issue Brief (IB86140), July 28, 1989.

**Appendix V
Transportation Intermodalism Must
Be Addressed**

deadlines based on the severity of their ozone problem and (2) specifies the conditions under which sanctions will apply and the extent to which EPA has discretion in applying such sanctions.¹¹

In response to concerns that the Department of Transportation and the Environmental Protection Agency are inadequately addressing the impacts of transportation and highway programs on air pollution, we are examining how these agencies implement Section 176(c) of the Clean Air Act in three metropolitan areas.¹² This section prohibits federal agencies from approving activities, including highway projects, that do not conform to states' plans for controlling emissions. We expect to issue our report on how section 176(c) is being implemented in early 1990.

¹¹ Air Pollution: Ozone Attainment Requires Long-term Solutions to Solve Complex Problems (GAO/RCED-88-40, Jan. 26, 1988).

¹² These areas are Denver, Colorado; Phoenix, Arizona; and Los Angeles, California.

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Technical innovations may also provide relief from air pollution generated by automotive vehicles. The Transportation Research Board representative stated that any reasonable air quality strategy must include investment in research. He pointed out that efforts to improve air quality, such as improved vehicle emission control devices, alternative fuels, higher mileage vehicles, and improved fueling stations, will all receive increased attention. He added that although in some areas more intrusive strategies impinging on travel demand and lifestyles may also be required, improved technology must play a leading role.

Legislative and policy strategies to combat air pollution will also continue to be shaped. The Congress is currently considering strategies to control air pollution from automotive vehicles through deliberations on the reauthorization of the Clean Air Act. In January 1988, we reported on EPA's efforts to reduce ozone levels and found that three locations⁸ did not reach planned air quality reductions because control measures were not implemented, enforced, or as effective as anticipated.⁹ In addition, we found instances in which identified deficiencies in these areas' ozone control programs were not corrected, indicating that EPA's oversight was not as effective as it should have been. We also reported that while we believe a construction ban is the mandatory penalty for areas in nonattainment after the attainment deadline passes, EPA disagrees. EPA maintains that its Administrator does not have to impose the ban if an area fails to meet the standard by the legislative deadline as long as the area has an approved plan and has made reasonable efforts to implement it.

Although the Clean Air Act allows EPA to impose economic sanctions on areas not meeting congressionally established deadlines for reducing ozone levels, we noted in our 1988 Transition Series on environmental protection issues that the use of sanctions has been controversial, and on two occasions the Congress prohibited EPA from applying them.¹⁰ Additionally, we stated that a new ozone policy is needed for reducing ground-level ozone to environmentally safe levels. We also recommended in our 1988 report on ozone that the Congress needs to develop, with EPA's input, a legislative framework that (1) establishes a strategy that places localities into different categories and sets different attainment

⁸These areas were Charlotte, North Carolina; Houston, Texas; and Los Angeles, California.

⁹Air Pollution: Ozone Attainment Requires Long-Term Solutions to Solve Complex Problems (GAO/RCED-88-40, Jan. 24, 1988).

¹⁰Transition Series: Environmental Protection Agency Issues (GAO/OCG-89-20-TR, Nov. 1988).

innovations in the highway sector may significantly affect other national priorities.”

An American Public Transit Association representative believed that the issue of increased travel is more than a mobility challenge: it is a major environmental challenge. Likewise, the Executive Director of the American Association of State Highway and Transportation Officials emphasized the importance of integrating transportation planning and decisions with factors such as clean air goals and concerns about global warming. The Executive Director of the Transportation Research Board, National Academy of Sciences, noted that transportation policy makers must succeed in convincing a concerned public that new transportation projects will not just add to existing air quality problems. He argues that improvement in environmental quality will also reduce one of the perceived negative aspects of expanded transportation infrastructure.

Motor Vehicle Usage Increasing Air Pollution Levels

Cars and trucks emit hydrocarbons (a complex mix of unburned and partially burned fuel components), carbon monoxide, nitrogen oxides, and particulates (soot-like particles also resulting from incomplete fuel combustion) into the atmosphere. Ozone, a primary component of smog, is formed when hydrocarbons react with nitrogen oxides in the atmosphere. While ozone in the upper atmosphere shields the earth from harmful ultraviolet radiation given off by the sun, high concentrations of ozone at ground level are a major health and environmental concern. Ground-level ozone has been linked to reduced lung functions, which affects breathing and causes symptoms such as coughing and chest pain.

The Clean Air Act Amendments of 1970 required EPA to identify the highest levels at which air pollutants will not endanger public health and to establish air quality standards at or below these levels.⁵ The 1970 Amendments also set deadlines by which the standards must be met and allowed EPA to impose economic sanctions for failure to comply with the act.

The Office of Technology Assessment reported in April 1988 that of the six pollutants for which standards have been established, the nation has

⁵The six pollutants for which the EPA administrator established National Ambient Air Quality Standards (NAAQS) are ozone, lead, sulfur dioxide, particulates, nitrogen dioxide, and carbon monoxide. The 1970 Clean Air Act Amendments required EPA to establish NAAQS to define the level of air quality that is expected to be maintained throughout the nation.

problems, such as their capital investment needs and limited ability to respond effectively to growing congestion. The Department's separate modal approach, however, precludes effective intermodal ranking of needs and development of an integrated transportation strategy. Further, we reported that intermodal planning cannot be achieved simply by combining the various needs studies, as they differ in material respects. For instance, some studies take into account only those needs eligible for federal funds, and others consider all needs. As a result, combining the studies could paint a misleading picture and would be of little help in setting expenditure priorities and exploring low-cost service delivery alternatives.

The Department's separate modal approach can also hide intermodal needs. State surveys by the American Association of State Highway and Transportation Officials disclosed an annual requirement of about \$1 billion to properly connect airports, harbors, and railheads to the nation's highway and transit systems. Yet, the Association's Executive Director reported these are requirements that are not in anyone's program. An illustration of inadequate linkage was reported in our Transportation Management Review.³ The example we reported was a bridge that was constructed at the cost of \$1 million, but was not used for at least 2 years due to lack of connecting roadways.

In highlighting the transportation problems facing rural America, the Administrator of the U.S. Department of Agriculture's Office of Transportation noted that the problems are not neatly compartmentalized along modal lines, political boundaries, or levels of government. Rather, he said, the solutions are to be found through greater cooperation among the different levels of government, between the public and private sectors, and across modes.

The Executive Director of the American Association of State Highway and Transportation Officials underlined the need to recognize the reliance of the transportation modes on each other, because no one mode can meet the nation's diverse transportation requirements. He said state and federal planners must take into account the individual capabilities of each mode, and how the modes relate to each other. He cautioned, however, that there is no one transportation solution that fits all conditions when state diversity is considered. He explained that state and local officials must be able to design transportation solutions to fit the

³Department of Transportation: Enhancing Policy and Program Effectiveness Through Improved Management (GAO/RCED-87-3, Apr. 13, 1987).

Transportation Intermodalism Must Be Addressed

Transportation services are essential to economic growth. We reported in our Transition Series that transportation accounts for 15 percent of the national employment and 25 percent of the cost of the goods we buy.¹ The Executive Director of the American Association of State Highway and Transportation Officials stated that all members of the transportation community must ensure that there is a national transportation network that meets interstate and interregional transportation requirements. Members of the transportation community described economic development as limited in those states which are unable to provide the highway, rail, and transit services needed to move people and goods efficiently. Transportation policy makers need to increasingly recognize that choices made about one mode of transportation may have a serious impact on another mode. Decisions about building highways, for example, must be weighed against consideration of alternatives such as mass transit. In addition, transportation policies must be made with an understanding of their consequences for the environment.

Multimodal Transportation Needs

Discussion about transportation planning from a “multi-modal” perspective has been ongoing. A little over a decade ago, we reported that a primary reason why intermodal planning is in the early stages of development is that federal capital and operating programs have been modally oriented.¹ Many federal and state officials told us that “programs drive the planning.” Federal legislation has created separate air, highway, rail, and transit implementation programs. To only a very limited extent does the legislation permit state and local grantees to spend program dollars on other than the specified mode.

For example, as we noted in our 1978 report, the Iowa Department of Transportation typified the way state agencies conducted their transportation planning activities. Iowa had statewide plans for the individual air, highway, and rail modes and established priorities for each mode separately. Iowa officials acknowledged their orientation to date had been single mode. Why? First of all, to receive federal funds, they had to meet federal modal program requirements. Second, they believed the lack of flexibility in federal capital programs inhibited them from intermodal coordination. For example, they told us that federal highway

¹Transition Series: Transportation Issues (GAO/OCG-89-25TR, Nov. 1988).

¹Making Future Transportation Decisions: Intermodal Planning Needed (CED-78-74, March 16, 1978).

Yet, others argue tolls are a form of double taxation and exacerbate congestion problems.

Restrictions on federal funding of toll projects date to when building a network of public highways was a major goal. At that time, toll roads were regarded as contrary to this goal because they were not public. The proprietors of these largely privately owned and operated facilities exercised monopolistic powers with limited federal control. Recently the Congress enacted a toll pilot program that permits federal funds to be used to build toll projects in nine states.⁴ The projects are aimed at increasing non-Interstate system capacity. The states are required to fund the majority of the project because the 1987 Surface Transportation Act authorizing the program stipulates that the federal-funding share may not exceed 35 percent; this is in contrast to the typical 75 percent federal share for non-Interstate construction.

We are currently reviewing the toll pilot program and expect to issue a report in the spring of 1990. Our initial work indicates only three of the nine states have started construction of their projects.⁵ The other six states are in various stages of planning or are in the process of selecting the project they want to include in the program.

The International Bridge, Tunnel, and Turnpike Association spokesperson believes the Congress should encourage states to explore public and private partnerships to fund highway programs. Private toll facilities have been rare—only 30 of the 210 toll facilities nationwide are owned by private firms or individuals, according to a Congressional Budget Office December 1985 report, Toll Financing of U.S. Highways. The state of Virginia, however, recently rethought its position on private funding of toll facilities. Virginia is permitting a private company to apply to build and charge tolls on an extension of an existing toll road—the Dulles Toll Road. The Chief Executive Officer and Chairman of the Board of Directors for the company planning the Virginia toll road extension believes toll roads, however, are not applicable for all highway building situations. Rather, he said, there is a “niche market” for private toll roads if sufficient private capital exists and travel corridors are so crowded that people will choose to pay a toll to avoid the congestion.

⁴The 1987 Surface Transportation Act authorized a seven-state program and identified five states for participation—California (Orange County), Texas, Pennsylvania, Florida, and South Carolina. The remaining two states, Delaware and Colorado, were selected by the Secretary of Transportation. Two more states, Georgia and West Virginia, were added by subsequent appropriations acts.

⁵Georgia, Delaware, and Pennsylvania have started construction.

Authority. However, he sees adequate funding as the Achilles heel of block grants.

As explained by the National Public Works Council in its February 1988 report entitled The Nation's Public Works: Defining the Issues, most block grants have been accompanied by reduced funding levels, expanded roles for state governments in determining spending priorities, and reduced roles for local governments. The report noted that an evaluation of block grants indicated that the budget cuts often are passed through to beneficiaries, and that state governments have generally done a good job of administration.

We reported similar findings in our report on Block Grants Brought Funding Changes and Adjustments to Program Priorities (GAO/HRD-85-33, Feb. 11, 1985). The report stated that

“under block grants, states obtained greater decision-making authority to set program priorities and determine the use of funds than they had under the prior categorical programs. At the same time, federal appropriations to states under the block grants were generally less than under the former programs. In addition, states' increased programmatic discretion was tempered in some cases by legislative requirements that states continue to fund former grantees or allocate specific percentages of block grant funds to particular program areas.”

A block grant demonstration is currently being tested in five states.² This demonstration was authorized by Section 137 of the Surface Transportation Act of 1987. It allows up to five states to test approaches for combining, streamlining, and increasing the flexibility of the administration of several federal programs. In essence, the participating states can pool money from three previously separate program areas. A key objective of the demonstration is to place as much responsibility as feasible with state and local governments.

The Director of FHWA's Office of Planning believes the five states are not taking the maximum advantage of the flexibility in the current block grant demonstration because states see it as a limited-duration project. He also noted that some people have the impression that a program is being phased out when it is consolidated into a block grant. The Associate Director for Highway Safety, Center for Auto Safety, however, has other concerns. He believes that block grants will lead to (1) reduced federal oversight; (2) less accountability; (3) reduced uniformity in health and safety goals, and methods for achieving them; and (4) less

²Minnesota, Texas, Rhode Island, New York, and California.

In designing a future program, there is a need to recognize that highway issues have changed over time. As the Executive Director of the FHWA noted, the highway issues the nation has faced in the past are not the same as those it must face today. With the Interstate issue changing from a construction completion issue to a rehabilitation issue, FHWA's Executive Director commented that the problems of urban and suburban mobility will emerge as a major issue as demand grows, population increases, and travel patterns change. Recognizing these changes, he posed the question, "What should be the federal role in the highway program?"

Before deciding on the appropriate federal role, it is important to review existing federal highway objectives. The Executive Director of FHWA outlined these objectives. He explained that there is a Constitutional basis for federal involvement in highways: national defense and interstate commerce. He also made note of three other objectives for federal involvement.

First, the Executive Director mentioned the issue of equity. In the absence of federal involvement, extreme polarization of the transportation system would prevail, a condition the nation cannot afford. Federal involvement ensures equity in the distribution of resources and in the number of highways in the less wealthy states that are necessary to meet the needs of interstate commerce.

Second, he noted the need for uniformity. A certain amount of uniformity is necessary in the form of highway system standards and safety. A driver must be able to expect, when crossing a state line, that the same type of highway will exist on one side of the line as on the other. (Responding to a need for some uniformity in highway design from state to state, the American Association of State Highway Officials prepared design standards in 1941 for several classes of highways. The Association has since expanded and upgraded these design standards. The standards have been approved by FHWA for application on federal-aid highways and are the specific controls for the design of such highways. A state, however, may use its own standards if the Federal Highway Administrator determines such state standards are in reasonable conformity with the Association's standards.)

Third, FHWA's Executive Director noted that efficiency is obtained through federal involvement in certain areas. He said certain things are done quite well at the federal level and should remain federal responsibilities. For example, FHWA reported that long-term highway research

transportation facilities deteriorate and wear out, and that they must be maintained and periodically rehabilitated." A representative from the National Council of State Legislatures testified before Congress in 1987 that inadequate funding for maintenance has greatly contributed to the state of physical deterioration of the nation's bridges and roads. The tendency, he adds, has been to put money in the most visible place—something new.

According to the Chief Operations Officer and General Manager for the Southeastern Pennsylvania Transportation Authority, states might defer maintenance because it is difficult to dramatize "the crisis" of maintenance needs. He adds that needs that are not visible or irritating to motorists have difficulty attracting a constituency. A report by the National Council on Public Works contends that, ultimately, delay and postponement of maintenance result in the need for premature rehabilitation, rebuilding, or replacement. The council goes on to advocate providing incentives to encourage attention to needs facing the nation's infrastructure, including deterioration of pavement and bridges.

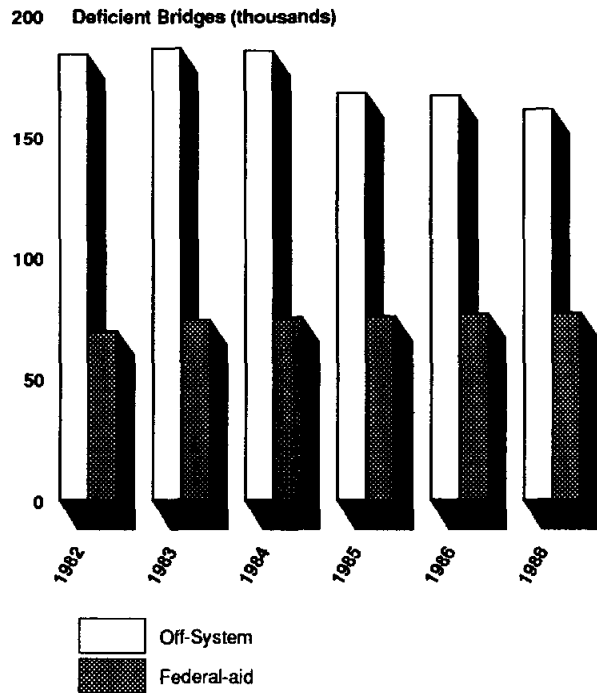
Deterioration May Also Be Prevented or Mitigated Through Technology

The Executive Director of the Strategic Highway Research Program argues that increasing truck traffic on the nation's highways will increase pressure on pavements and heighten the need for improvement in pavement technology. The Strategic Highway Research Program, founded in 1987, targets its energies to identifying and developing technologies to solve critical pavement and structural problems on the roadways. A significant effort has been made to assess the long-term performance of various pavement structures given different maintenance programs, traffic loads, climate factors, and soils. The Strategic Highway Research Program is conducting similar studies on other system materials, including asphalt, concrete bridge components, and highway cement and concrete.

According to the Executive Director of the Transportation Research Board, another technological development that could lessen the damage to the highways is the Turner Truck. This vehicle is designed to allow a higher gross truck weight by distributing the weight of the truck over more axles. This results in a greater number of contact points between the truck and the road, but less weight impact at each one. The projected effect is less wear and tear on highway pavement.

**Appendix III
Pavement and Bridge Deterioration Continue
to Plague the Nation's Highways**

Figure III.2: Comparison of Deficient Bridges, Federal-Aid and Off-System, 1982-88



Note: Pursuant to the Surface Transportation and Uniform Relocation Assistance Act of 1987, FHWA's reporting requirement changed from annual to biennial.

Source: FHWA's 1989 Highways and Bridges Status Report.

Additionally, FHWA's Associate Administrator for Engineering and Program Development adds that the number of deficient bridges has increased on the Interstate portion of the federal-aid system. The FHWA Status Report shows an increase in deficient Interstate bridges from approximately 4,900 in 1982 to almost 8,200 in 1988. (Fig. III.3.)

between states. FHWA reports that nationally, in 1987, 11.5 percent of all rural and urban Interstate roads were deficient.¹ However, focusing on this national average obscures the profound differences between states. Actual differences in rural Interstate deficiencies among states range from 0 to 42 percent, according to FHWA. Likewise, the range of pavement conditions on urban Interstates varies considerably by state. The national average is 11.1 percent, but states' pavement deficiencies range from 0 to almost 46 percent.

Thousands of Bridges Need Repair or Replacement

Along with deteriorating pavement, over 40 percent of the nation's bridges need repair and rehabilitation, according to the American Road and Transportation Builders' President. The National Bridge Inventory provides information on the status of all highway bridges in the United States. In 1984, the inventory identified as deficient over 260,000 bridges in the then-current inventory of 574,000 bridges. Of these, over 140,000 were structurally deficient, and approximately 120,000 were functionally obsolete.² In total, the two categories represented over 45 percent of the total bridge inventory. In a 1988 review we identified some inadequacies in states' practices of identifying and tracking deficient bridges, possibly resulting in miscounts of 5 to 15 percent. Some of the miscounts overstated the number of deficient bridges, whereas others understated the number of such bridges. Consequently, even allowing for miscounts, significant numbers of deficient bridges exist.³

Statistics in FHWA's 1989 Highway and Bridge Status Report show that bridge deficiencies have declined from over 260,000 in 1984 to the 1988 figure of approximately 238,000. Figure III.1 shows the number of deficient bridges for 1982 through 1988.

¹FHWA assigns Interstate pavement a numerical value ranging from 0 to 5, reflecting poor pavement condition at the lower end of the scale and very good pavement condition at the higher values. "Deficient pavement" receives a rating of 2.5 or less.

²FHWA defines a "structurally deficient" bridge as one that has been restricted to light vehicles only, is closed, or requires immediate rehabilitation to remain open. If a bridge is not found to be structurally deficient, it is then checked to determine if it is functionally obsolete. A "functionally obsolete" bridge is one that no longer meets the usual design criteria for the system of which it is an integral part. These criteria include load-carrying capacity, clearance, or approach roadway alignment.

³Bridge Condition Assessment: Inaccurate Data May Cause Inequities in the Apportionment of Federal-aid Funds (GAO/RCED-88-75, May 1988).

Appendix II
Congestion: A National Problem

stable levels of federal funding to invest in transportation systems management and the evaluation of potentially effective advanced technologies.

Relief Sought Through More Efficient Uses of Existing Highway Resources

The Executive Director of the Transportation Research Board of the National Academy of Sciences said that "Given the difficulties of expanding the nation's road infrastructure in urban and suburban areas, technology that provides the basis for more efficient use of existing infrastructure must be a part of any future strategy." Several strategies under current development and experimentation include Advanced Vehicle Highway Systems (AVHS), high-occupancy vehicle lanes, and incident management systems.

AVHS links the electronics of the road with that of the vehicles traveling upon it. This coordination, commonly referred to as a "smart" system, can communicate real-time traffic and congestion information via in-vehicle computers to "smart" cars. The driver can use this information to avoid congestion by traveling lesser used links of the system or, in the worst case, turning back and trying later. According to the representative from the Transportation Research Board, Europe and Japan are making major investments in the development of AVHS, and interest is growing rapidly in this country for undertaking a similar program.

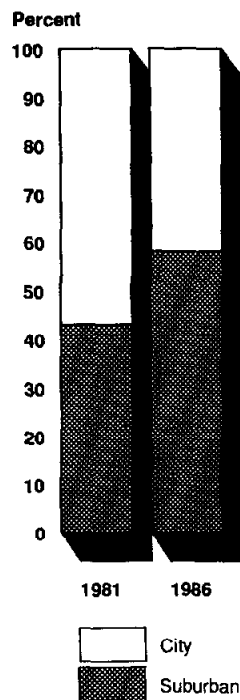
Some technology is fully developed and simply needs implementation. For example, technology exists for a variety of freeway control systems, including capacity to sense, meter, and communicate information to motorists. Vehicle manufacturers are currently experimenting with adding electronic and other information devices such as cellular phones, fax machines, and radar-type proximity devices to new vehicles. Other countries are already providing visual displays of travel advisory information through car radio systems.

Designating special traffic lanes, access ramps, and parking privileges for high-occupancy vehicles during peak travel hours also has potential for facilitating traffic movement. FHWA officials report that HOV facilities are exceeding the ability of regular freeway lanes to move people at significant reductions in travel time. Since the late 1960's, HOV systems have been proliferating rapidly.

The Associate Administrator of Engineering and Program Development for FHWA emphasizes that over 50 percent of vehicle miles traveled under congested conditions result from incidents, including accidents, disabled vehicles, and other nonplanned traffic obstructions. More specifically, 62 percent of urban freeway congestion in 1984 was due to incidents, according to an FHWA spokesperson at a Transportation Research Board conference in January 1988 (see fig. II.2).

the downtown core in surrounding suburban areas. Figure II.1 shows the change in urban employment locations over the 5-year period, 1981-86.

Figure II.1: Distribution of Urban Employment Locations, 1981-86



Source: Institute of Transportation Engineers, "Toward a Policy for Suburban Mobility," 1986.

FIWA statistics predict that this suburban job growth trend will continue. FIWA recently reported that 67 percent of all new jobs are located in suburban metropolitan areas.

The Institute of Transportation Engineers explains how this suburban employment boom translates into traffic patterns that contrast sharply with previous commute patterns. Instead of a radial suburb-to-downtown commute, the more prevalent pattern is circumferential—suburb-to-suburb. Congestion results, according to the Institute, because the road systems were designed to serve commuters traveling from outside the city to an inner-city business district. Road networks connecting suburbs were not constructed with the intent of supporting a high volume of daily business commuters. Most of these suburban road networks are

Congestion: A National Problem

Transportation experts agree that congestion of the nation's highways is one of the most critical issues facing this and future administrations. Highway experts expect traffic, overcrowding, and congestion to escalate at the same rate of growth experienced over the past 30 years. This situation is caused by a variety of factors, including the suburban employment boom and an increased number of vehicles competing for use of the roads. Specific actions can be taken to improve the situation by effectively reducing traffic congestion and improving mobility. One remedy for congestion may be sought in better management and use of existing resources. Such techniques may include high-occupancy vehicle (HOV) lanes, which encourage shared ridership, and incident management programs, which reduce traffic delays caused by highway incidents.

Traffic and Congestion Continue to Grow at an Alarming Pace

Burgeoning traffic is a national occurrence, according to the President of the Highway Users Federation. He quotes FHWA Traffic Volume Trends statistics, which confirm that highway traffic has tripled since 1956. One means of gauging traffic growth is by counting vehicle miles traveled. Employing this measure, the FHWA 1989 Status Report on the Nation's Highways and Bridges reports that national travel in 1987 totaled 1.92 trillion vehicle miles, an 8.4 percent increase since 1985.

With this travel increase comes increased congestion. The Executive Director of FHWA, in testimony before the House Appropriations Committee, reported that in 1987 over 65 percent of urban Interstate travel during peak travel periods—rush hour—occurs under congested conditions. This is significantly higher than the 1983 figure of 54 percent. And the outlook for the future is equally grim. The Deputy Executive Director for Policy and Programs of the American Public Transit Association projects that in the next 30 years, as much new traffic will be added to roadways as was added in the past 32 years. The President of the Highway User's Federation anticipates that, in some areas, this doubling will occur by the year 2000. FHWA calculates that, in 1985, motorists on U.S. freeways endured 722 million hours of delay, a number that is expected to reach 3.9 billion by the year 2005, if no mitigating actions are taken. Although in a recent review we recognized that FHWA may be underestimating the implementation of such mitigating actions (such as expanded freeway capacity), calculations based on less conservative assumptions still resulted in an approximate 300 percent increase in traffic delay

Objectives, Scope, and Methodology

With the upcoming reauthorization and funding of possibly \$90 billion for a 5-year highway and mass transit program beyond 1991, key surface transportation issues are being identified and discussed. To help focus discussion and try to reach a consensus on key issues, we convened a panel of transportation experts to discuss issues we believed to be of interest to the Congress and the focus of deliberations on the future of surface transportation programs. The forum we chose was a 1-day seminar that brought together 19 nationally acclaimed transportation authorities from all levels of government and from the private sector who represent, develop, use, and evaluate the various systems that comprise the nation's highway network. The seminar was held on June 20, 1989, at our headquarters building in Washington, D.C.

The seminar, "New Directions in Surface Transportation Infrastructure," consisted of panelists' presentations and roundtable discussions held during four panel sessions. The presentations addressed (1) a general overview of critical transportation issues; (2) the federal-aid highway system preservation and research needs; (3) recasting the federal government's role, including a discussion of block grants; and (4) innovative highway financing through the use of tolls.

The following chart lists the panelists, the panels on which they served, and the organizations they represent.

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Observations

There is no panacea to address all transportation problems. The problems vary from one location to another and, even when problems are shared, the magnitude of any particular problem varies among and within states.

The twin issues of congestion and deterioration will continue to be among the nation's most serious surface transportation problems. In order to maximize the current surface transportation network, investment in research and development of new technologies is vital to relieving the nation's overburdened highways and prolonging the life of the highway system in which the nation has already invested billions of dollars. Investment in and preservation of surface transportation systems is also essential to the nation's economic growth and productivity.

We believe, as articulated by one of the seminar panelists, that the remedies to the nation's transportation problems certainly are not solely the responsibility of the federal government. Increasingly, there is a need to recognize that state and local officials are often in the best position to identify and respond with the most effective solutions to their unique transportation problems. However, helping develop a sense of vision and direction for the future of this country in terms of transportation is clearly part of the federal role. We believe that the Transportation Secretary's forthcoming national transportation policy can help to provide the needed direction to guide future transportation decisions.

In developing a transportation blueprint for the future, it will be important for the Congress and the Department to determine how to use limited federal dollars to meet the enormous projected transportation needs. This may require the adoption of new funding mechanisms, such as innovative uses of block grants and toll financing. We are currently evaluating both of these strategies.

As previously reported, we continue to believe that greater coordination and cooperation among the different transportation modes is needed to ensure the prudent investment of scarce transportation dollars and to improve mobility.¹⁰ However, the transportation community finds federal funding mechanisms and organizational structures in place that reinforce the more traditional single-mode focus. We believe multimodal planning, coordination, and management offer great potential for

¹⁰Department of Transportation: Enhancing Policy and Program Effectiveness Through Improved Management, (GAO/RCED-87-3S, July 24, 1987) and Transition Series: Transportation Issues (GAO/OCG-89-25TR, Nov. 1988).

In the past, federal policy generally did not allow states to impose a toll on new or existing roads built with federal funds. The 1987 Surface Transportation and Uniform Relocation Assistance Act initiated a toll pilot program that waived this restriction for a limited number of toll projects. Nine states are participating in this program, which we are reviewing. Other states are also reconsidering long-held positions opposing the introduction of tolls. Further, Virginia, in looking for innovative traffic solutions, passed legislation in 1988 that allows private funding for toll roads.

Transportation Intermodalism Must Be Addressed

Intermodal planning is defined as the serious examination of trade-offs and interactions between competing and complementary transportation modes, such as highway and mass transit. Present funding mechanisms and organizational structures, however, are geared to individual transportation modes.

We have reported on the separate modal orientation of federal transportation programs.⁶ In describing a typical state transportation department in terms of what it plans for and why, we noted the state had planned for air, highway, and rail modes individually and established priorities for each mode separately. State officials acknowledged their orientation had been single mode. They attributed their inability to use federal funds for intermodal connections largely to inflexible capital funding requirements: for example, airport money cannot be used to build roads accessing air terminals. In essence, the state officials believe their planning had a narrower focus because federal programs were implemented through single modes. This modal orientation continues; as we noted in our 1987 Transportation Management Review, the different modes of transportation continue to maintain their independence.⁷

In a November 1988 report, we recognized the need to implement an intermodal strategy at the federal level.⁸ We stated that this need is not well served by the Department of Transportation's practice of preparing only separate needs studies for highways, bridges, mass transit, and airways. These transportation modes share common problems, such as capital investment needs, that outstrip available funds and limit ability to

⁶Making Future Transportation Decisions: Intermodal Planning Needed (CED-78-74, Mar. 16, 1978).

⁷Department of Transportation: Enhancing Policy and Program Effectiveness Through Improved Management (GAO/RCED-87-3S, July 24, 1987).

⁸Transition Series: Transportation Issues (GAO/OCG-89-25TR, Nov. 1988).

on the federal-aid system has grown. The Executive Director of the Strategic Highway Research Program suggested that the nation's roads also suffer substantial damage because pavements have not been designed to withstand the weight and volume of today's traffic. Beyond the deterioration caused by routine aging, use of chemicals on road pavements and severe weather conditions have also caused the system to deteriorate faster than projected in some geographical areas.

Deferral or neglect of routine maintenance may also contribute to pavement and bridge deterioration. The Chief Operations Officer and General Manager for the Southeastern Pennsylvania Transportation Authority believes that maintenance is deferred because of the difficulty in dramatizing the "crisis" of maintenance needs. He adds that only when a bridge collapses or some other tragedy occurs do people see the accumulation of maintenance needs that should have been addressed long before the catastrophe. Further, a report from the former National Council on Public Works contends that postponing maintenance results in the need for premature rehabilitation, rebuilding, or replacement. The Council advocates a national strategy that incorporates strong incentives to ensure adequate maintenance.²

Attention is turning toward research that focuses on methods to preserve and extend pavement life. Researchers are designing pavement structures that are better able to withstand the weight and volume of present and expected future traffic. Since 1987, the Strategic Highway Research Program has been assessing the long-term performance of various pavements given different maintenance programs, traffic loads, climate factors, and soils.

Needed: A Redefined Federal Highway Role

Of the Interstate system's 42,795 miles, 42,291 miles (or 98.8 percent) were open to traffic as of June 1989, according to FHWA. The federal highway role has centered on capital investments, with the Interstate system being the dominant investment. Now that construction of this system is nearing completion, the time is right to reexamine the federal role. One possibility for realigning federal and state responsibilities that transportation experts are discussing is a two-tiered funding approach.

²The Council was established by the Public Works Improvement Act of 1984 (Public Law 98-501) to assess the state of the nation's infrastructure. The Council concluded its work with publication of a final report in 1988, Fragile Foundations: A Report on America's Public Works.

Construction of the Interstate Highway System—the nation's largest federally funded highway component and the flagship of the highway network—is winding down. Consequently, transportation experts agree that the focus of the federal highway role needs to be reexamined. One possibility cited for altering the federal role is the establishment of a two-tiered funding system. The first tier would fund—through one or more separate, categorical programs—highways considered of national significance; the second tier would provide states with greater discretion for responding to their specific transportation needs by consolidating numerous categorical programs into a block grant. Further, many transportation experts believe that current federal, state, and local revenue sources cannot meet the nation's ever-expanding transportation needs and that innovative funding strategies must be considered. Some of these experts suggested that one way to raise additional revenue is through the use of tolls.

Transportation experts also agreed that better coordination of and cooperation among the different transportation modes is needed to improve overall mobility. As a spokesperson for the American Public Transit Association noted, the nation is not being well served by the modal "separateness" in its transportation planning, programming, allocation of funds, construction, and maintenance activities.

Traffic Congestion Is Widespread and Demands Attention

The mobility of Americans is being jeopardized as traffic congestion levels continue to escalate at an alarming rate. Between 1983 and 1987 alone, the percentage of rush hour travel under congested conditions on urban Interstates has increased from 54 percent to 65 percent. This growth in congestion stems from a number of factors, including escalating numbers of vehicles and drivers, a shift in employment from urban to suburban areas, and the inability of current public transit and road systems to meet the needs of today's commuters. And the outlook for improvement is grim. Federal Highway Administration (FHWA) forecasters predict that if no mitigating actions are taken, by the year 2005 the nation will spend 3.9 billion hours annually sitting in gridlocked traffic.

Rapidly changing commuting patterns have contributed significantly to the congestion problem. Until recently, the traditional work trip began in the suburbs and ended in the central business district. This pattern is quickly approaching obsolescence as major employers opt for the less expensive land development costs in suburban areas. In 1987, 60 percent of all employment destinations and 67 percent of all new jobs were located in suburban metropolitan areas.

