

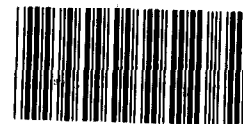
GAO

Report to the Committee on Public
Works and Transportation, House of
Representatives

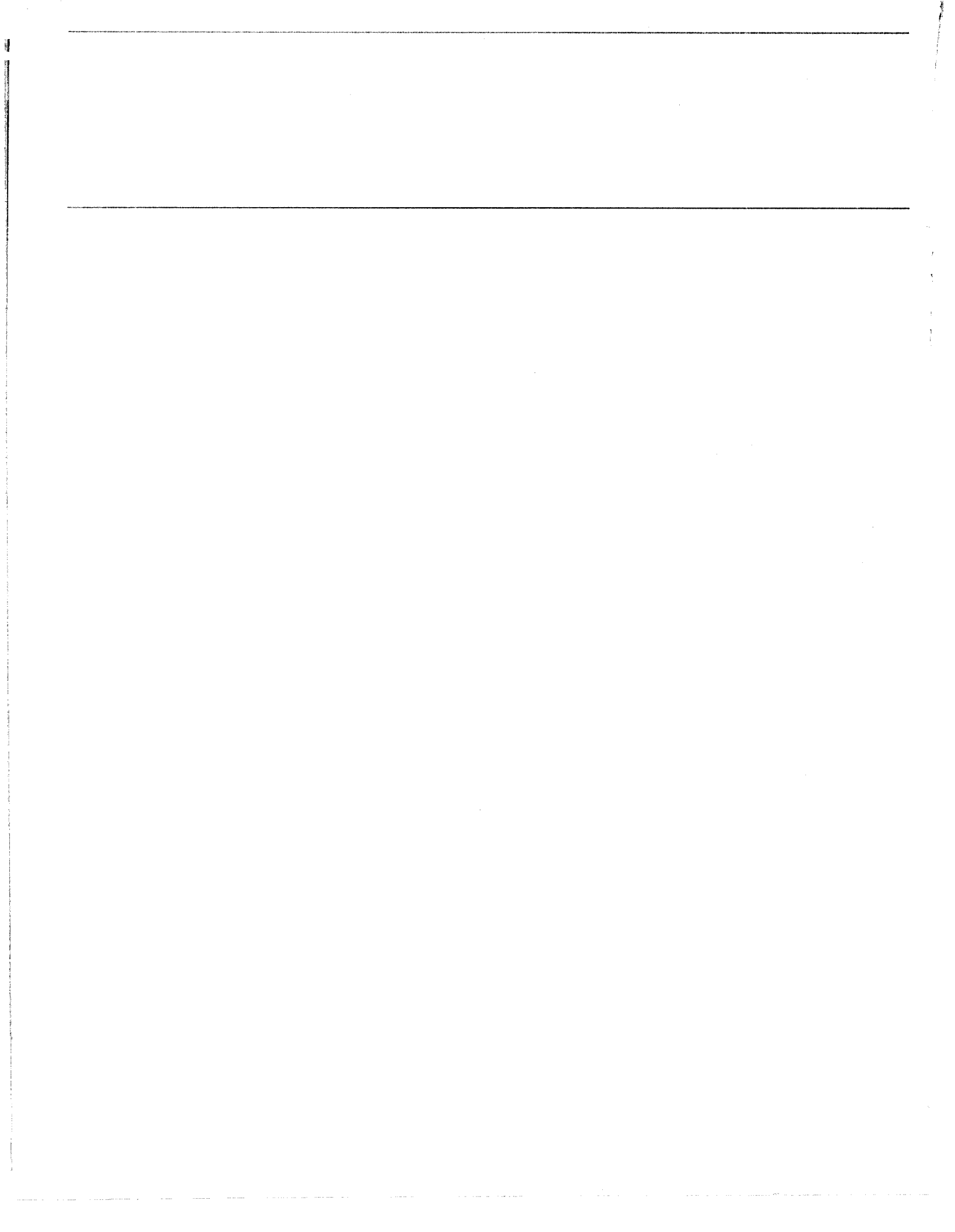
August 1991

TRANSPORTATION INFRASTRUCTURE

Preserving the Nation's Investment in the Interstate Highway System



144703





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

**Resources, Community, and
Economic Development Division**

B-243705

August 2, 1991

The Honorable Robert A. Roe
Chairman, Committee on Public Works
and Transportation
House of Representatives

The Honorable John P. Hammerschmidt
Ranking Minority Member
Committee on Public Works and
Transportation
House of Representatives

In response to your request and subsequent agreements with your offices, this report addresses the condition of the Interstate Highway System and federal and state efforts to ensure its preservation.

As agreed with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies to the Secretary of Transportation; the Administrator, Federal Highway Administration; the heads of the state highway agencies mentioned in this report; and other interested parties. We will make copies available to others upon request.

This report was prepared under the direction of Kenneth M. Mead, Director, Transportation Issues, who may be reached on (202) 275-1000. Major contributors to this report are listed in appendix II.

A handwritten signature in black ink, appearing to read 'J. Dexter Peach'. The signature is written in a cursive, flowing style.

J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

Over the past 33 years, a central focus of the federal-aid highway program has been the construction of the Interstate Highway System. Although the Interstate represents only 1 percent of all roads, it carries 21 percent of the nation's vehicular traffic. As the Congress considers reauthorization of the federal-aid highway program, an important goal will be ensuring the preservation of this \$130-billion capital investment.

The House Committee on Public Works and Transportation requested that GAO examine (1) the condition of the Interstate system and the outlook for future preservation needs and (2) the factors that influence Interstate pavement deterioration and federal and state efforts to ensure adequate maintenance of the Interstate system.

Background

Preservation of the Interstate Highway System is a shared federal and state responsibility. States are responsible for Interstate maintenance, which includes preventive maintenance, such as sealing cracks and joints, and corrective maintenance, such as patching potholes. Federal funds can be used for resurfacing, restoring, and rehabilitating highways to extend their pavement service life. Reconstruction—the fourth eligible activity in the federally funded Interstate 4R Program—includes removing and replacing the road when it reaches the end of its service life, as well as lane-widening to enhance Interstate capacity.

States are required under current law to maintain all roads constructed with federal funds. The Federal Highway Administration (FHWA), in the Department of Transportation (DOT), monitors state Interstate maintenance efforts, administers the Interstate 4R Program, and reports on the condition and future capital investment requirements of the Interstate system.

Results in Brief

FHWA reports that over 40 percent of all Interstate pavement is rated in fair or poor condition. The outlook for future preservation of the Interstate is not encouraging because (1) DOT projects that Interstate conditions are not expected to improve even if 4R funding levels are substantially increased, (2) Interstate capacity-enhancement needs will increasingly compete with preservation needs, and (3) DOT has not established goals for minimum acceptable Interstate pavement conditions or a strategy for achieving these goals.

State maintenance practices and FHWA oversight are not ensuring adequate maintenance of the Interstate Highway System. While numerous

factors affect Interstate conditions, GAO found significant maintenance backlogs that could affect the integrity of Interstate roadways and structures and the safety of users in four of seven states reviewed. FHWA certified that maintenance efforts in the four states were adequate. However, GAO questions the basis for such certifications because FHWA has not developed measurable standards defining what constitutes adequate maintenance.

Principal Findings

Meeting Future Interstate Preservation Needs

DOT projects that funding well beyond current and proposed levels is needed to maintain 1989 Interstate conditions. At that time, 42 percent of Interstate pavement was rated in fair or poor condition. The system also faces the need for new capacity. In 1989 DOT projected that about 50 percent of the 4R funding required between 1987 and 2005 would be used for lane-widening—a departure from historical spending trends. Increasingly, these two important needs will compete for the same federal funds. To encourage Interstate preservation, DOT's reauthorization proposal would allow a 90-percent federal matching share for resurfacing, restoration, and rehabilitation projects and a 75-percent share for reconstruction and lane-widening projects, except for construction of high-occupancy vehicle lanes, which would continue to receive a 90-percent federal matching share. However, given the competing demands between capacity and preservation projects and the wide latitude that states have to select and program federal-aid projects, DOT has no assurance that states will adequately attend to Interstate preservation.

Needed Interstate Maintenance

Four of the seven states that GAO reviewed had significant maintenance backlogs in areas that states are entirely responsible for funding. Backlogs in these areas could affect the integrity of Interstate roadways and structures and user safety. For example, over a 5-year period, one state did not perform the timely painting and maintenance of bridges required to maintain their structural integrity and safety. The extent of unmet Interstate maintenance needs nationwide is not known. While FHWA does collect data on state Interstate maintenance expenditures, it does not compare these data to state investment requirements or assess the progress that states are making in achieving adequate Interstate maintenance nationwide.

Interstate pavement deterioration is caused principally by vehicles and the environment. All pavement deteriorates with age and use, and resurfacing and reconstruction must be performed eventually. However, studies have consistently shown that this costly work can be delayed with adequate and timely preventive maintenance. GAO found that the Interstate 4R Program can discourage states from funding preventive maintenance by providing a 90-percent federal funding share for resurfacing, rehabilitation, and reconstruction, but no federal funds for preventive maintenance. As a result, states tend to give higher priority in programming state funds to projects with a 90-percent federal contribution.

GAO found weaknesses in FHWA's oversight of state maintenance activities. FHWA has rarely applied sanctions and has not established measurable standards for what constitutes adequate maintenance. In addition, FHWA inspectors conducted only limited inspections in one state and did not adequately follow up on observed maintenance deficiencies in four other states.

Matters for Congressional Consideration

In reauthorizing the federal-aid highway program, the Congress may wish to consider

- directing the Secretary of Transportation to (1) establish goals for the condition of the Interstate Highway System, (2) monitor state progress in meeting those goals, and (3) require minimum investment levels in Interstate preservation projects on a state-by-state basis where Interstate pavement conditions fall below DOT's condition goals;
- expanding the eligibility parameters of the 4R Program to include preventive maintenance activities directed at preserving the life of Interstate pavement; and
- directing the Secretary of Transportation to report to the Congress on Interstate maintenance investment requirements and expenditures nationwide and on progress in achieving adequate Interstate maintenance and preservation.

Recommendations to the Secretary of Transportation

GAO recommends that the Secretary of Transportation direct the FHWA Administrator to work closely with the states to develop measurable standards by state for maintaining the Interstate Highway System. GAO also makes recommendations for improving FHWA inspection and oversight procedures.

Agency Comments and GAO's Evaluation

DOT did not concur with the report's conclusions, recommendations to the Secretary, or matters for congressional consideration because it did not believe that GAO had presented supporting evidence sufficient to justify major changes in the federal-aid highway program. DOT cited a number of provisions in its reauthorization proposal supporting and emphasizing Interstate preservation.

After considering DOT's comments, GAO continues to believe that the findings presented warrant the report's conclusions and recommendations and that increased attention is needed to preserve the nation's investment in the Interstate system. GAO believes that its recommendations complement DOT's efforts to emphasize Interstate preservation. For example, DOT proposes that the Secretary be provided with the authority to require a state that is not adequately maintaining its Interstate highways to program funds for Interstate work. GAO believes that in fairness to the states, such determinations would need to be guided by measurable maintenance standards that would provide states, as well as DOT, with equitable benchmarks for measuring success. The full text of DOT's comments and GAO's response is included in appendix I.

State officials in California, Florida, Louisiana, Missouri, and Michigan generally concurred with the report. However, California, Florida, and Missouri officials expressed concern with expanding federal eligibility to include preventive maintenance activities, which are traditionally managed by the states, and Ohio and Pennsylvania officials disagreed with some descriptions of their maintenance programs. GAO found the state suggestions helpful and has made the appropriate technical corrections.

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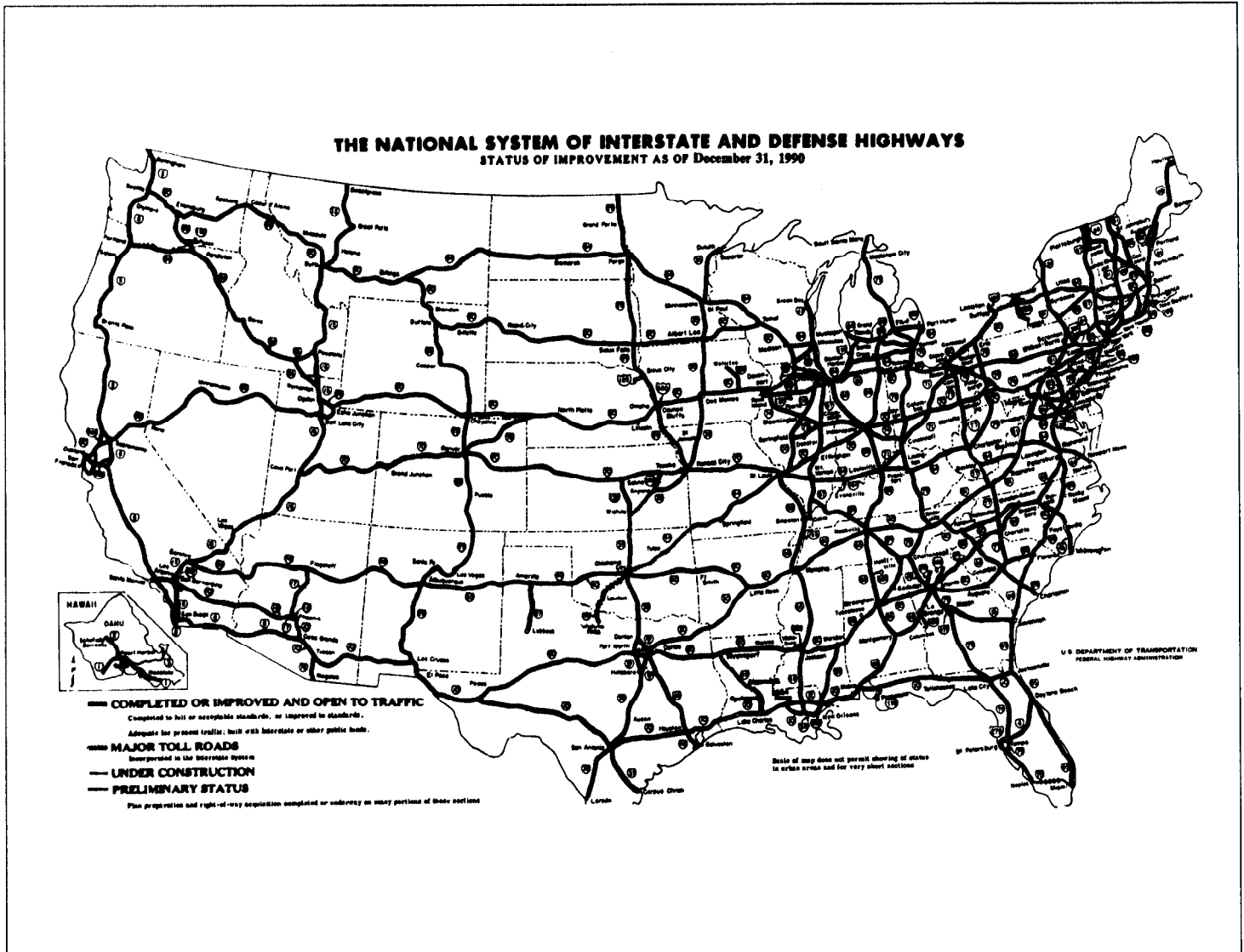
Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
CBO	Congressional Budget Office
DOT	Department of Transportation
FHWA	Federal Highway Administration
GAO	General Accounting Office
HPMS	Highway Performance Monitoring System
IRI	International Roughness Index
TRB	Transportation Research Board

Introduction

The Interstate Highway System plays a dominant and vital role in the nation's transportation network and in its economy. The system spans over 44,000 miles; it connects major cities, allows movement of goods and services, and serves the national defense. Although the Interstate system represents only 1 percent of the nation's road mileage, Interstate routes carry 21 percent of the nation's vehicular traffic. The Federal-Aid Highway Act of 1944 authorized construction of the Interstate Highway System, and the Federal-Aid Highway Act of 1956 provided for federal funding of 90 percent of highway construction costs. Construction of the Interstate, the focus of the federal-aid highway program since 1956, has cost around \$130 billion. With the system nearly complete, the focus of the federal-aid highway program will shift toward new priorities. One important consideration in a new federal-aid highway program will be ensuring preservation of this substantial federal investment.

Figure 1.1: The Interstate System



Source: FHWA.

Interstate Preservation: A Shared Responsibility

Maintenance is defined in 23 U.S.C. 101 as “preservation of the entire highway, including surface, shoulders, roadsides, structures, and such traffic control devices as are necessary for its safe and efficient utilization.” Preservation of the Interstate Highway System consists both of state-financed maintenance and of more capital-intensive resurfacing,

rehabilitation, and reconstruction activities, which are eligible for federal assistance. Over time, Interstate preservation has evolved into a shared federal and state responsibility. The Federal Roads Act of 1916 required the states to adequately maintain rural post roads built with federal assistance and first prescribed a role for the federal government in overseeing and monitoring these efforts. This relationship continued with the authorization of the Interstate system. The Federal-Aid Highway Act of 1976 allowed federal funds to be used for resurfacing, restoration, and rehabilitation projects on Interstate highways that were 5 years old or older, creating the Interstate 3R Program. The Federal-Aid Highway Act of 1981 eliminated the 5-year requirement and allowed federal funds to be used for reconstruction projects, creating the Interstate 4R Program.

State Maintenance Responsibility

State-financed maintenance is generally corrective or preventive. While the definition of maintenance varies from state to state, for the purposes of this report, corrective maintenance is defined as those activities that keep pavements, structures, drainage facilities, and traffic control devices in good condition by repairing defects as they occur. Typical activities include repairing potholes, removing snow, mowing grass, removing debris, and repairing and replacing guardrails. Preventive maintenance is planned and generally cyclical. It is intended to arrest light deterioration, retard progressive failures, reduce the need for routine maintenance and service activities, and extend the useful life of pavements. Early in a pavement's life, preventive maintenance can retard the normal aging processes, prevent the intrusion of moisture, and inhibit the development of slippery surfaces. Typical activities include sealing cracks and joints between pavement slabs, repairing joints, and sealing bridge decks.

The Federal Responsibility: Oversight and Preservation

The Federal Highway Administration (FHWA), in the Department of Transportation (DOT), implements and oversees the federal-aid highway program. FHWA oversees Interstate construction, monitors and inspects state Interstate maintenance efforts, and administers the Interstate Resurfacing, Restoration, Rehabilitation, and Reconstruction (4R) Program. FHWA's division offices in each state are the primary contact with the state and local transportation agencies and are directly responsible for approving and inspecting Interstate construction and 4R projects and carrying out oversight responsibilities.

Resurfacing, restoration, and rehabilitation projects primarily rehabilitate existing pavement at various stages of its useful life, thereby extending its service life and enhancing its safety. Even well-maintained roads require these capital investments during their service lives. Eventually, a roadway reaches the end of its service life and must be reconstructed. Reconstruction involves removing and replacing the road, rather than extending the life of an existing road surface. Reconstruction can also include projects that widen or add new lanes to existing Interstate roads.

Federal funding for the Interstate 3R and 4R Programs increased from \$175 million a year under the Federal-Aid Highway Act of 1976 to \$2.8 billion a year under the Surface Transportation and Uniform Relocation Assistance Act of 1987. The Congress also increased the federal matching share of Interstate 3R and 4R projects, from 75 percent in 1976 to 90 percent in 1981. The amount of Interstate 4R funding that each state receives is determined by an apportionment formula that considers the Interstate mileage and Interstate vehicle miles traveled in each state; individual state rehabilitation needs are not a factor in determining the funding that a state receives.

Reauthorization of the Federal-Aid Highway Program

The currently authorized federal-aid highway program expires on September 30, 1991. DOT's proposed 5-year reauthorization measure would restructure the federal-aid highway program into an essentially two-tiered system. The first tier, the National Highway System, would encompass approximately 150,000 miles, including the Interstate Highway System and a portion of the primary highway system. Interstate programs, such as the 4R Program, along with other categorical programs, would be merged into a new National Highway Program. The second tier, encompassing the existing urban and secondary systems and the remaining portion of the primary system, would be funded by a new block grant program called the Urban/Rural Program.

During consideration of the reauthorization of the federal-aid highway program, Members of Congress, state government representatives, and transportation interest groups expressed concerns that the condition of the Interstate Highway System was not improving, that state maintenance was not adequate, and that Interstate preservation investment needs far exceeded existing and proposed funding levels. Reauthorization of the federal-aid highway program provides the Congress with the opportunity to address many of these concerns.

Objectives, Scope, and Methodology

In a letter dated August 4, 1989, the Chairman and Ranking Minority Member, Committee on Public Works and Transportation, House of Representatives, requested that GAO examine several issues relating to the condition and investment requirements of the Interstate Highway System. We reported our results in testimony before the Committee's Surface Transportation Subcommittee on April 24, 1990.¹ Following this testimony, the Committee requested that we conduct audit work in additional states and examine (1) the condition of the Interstate system and the outlook for future preservation needs and (2) the factors that influence Interstate pavement deterioration and federal and state efforts to ensure adequate maintenance of the Interstate system.

To report on Interstate pavement conditions, we used information reported by FHWA from 1981 to 1989, the most recent year available. This information was obtained from FHWA's Highway Performance Monitoring System (HPMS), the only source for nationwide data on the condition of the nation's highways. We did not independently verify the accuracy of the HPMS data.

To evaluate future Interstate preservation needs, we reviewed DOT's 1989 highway needs report and subsequent information prepared by FHWA, and we interviewed FHWA officials and other transportation experts. We also examined information prepared by the Congressional Budget Office, American Association of State Highway and Transportation Officials (AASHTO), National Council on Public Works Improvement, Highway Users Federation for Safety and Mobility, and other transportation organizations.

To identify the factors that influenced pavement deterioration, we synthesized available scientific literature, relying primarily on studies conducted by and for the Transportation Research Board, Federal Highway Administration, and American Association of State Highway and Transportation Officials. In addition, we searched computer literature and interviewed FHWA and state highway officials and other transportation experts and organizations.

To examine federal and state efforts to ensure adequate Interstate maintenance, we visited seven states—California, Florida, Louisiana, Michigan, Missouri, Ohio, and Pennsylvania. We selected these states to provide geographic balance and a variety of pavement conditions and Interstate usage. These states account for over 22 percent of the total

¹Preserving The Interstate System (GAO/T-RCED-90-68, Apr. 24, 1990).

Interstate lane-miles and 34 percent of the vehicle miles traveled. To assess maintenance efforts and the extent of maintenance deficiencies in the seven states, we examined state maintenance budgets and programs and reviewed FHWA division office inspections and reports for calendar year 1989, the last complete year for which data were available, as well as FHWA and state annual certification reports. We interviewed state transportation officials, FHWA division inspectors and managers, and FHWA headquarters officials, obtaining estimates on the extent of unmet maintenance needs, their causes and costs, and options to ensure the performance of needed maintenance. To evaluate the quality of FHWA oversight, we reviewed applicable regulations and guidance, examined FHWA inspection reports, and discussed the content and methodology of these reports with FHWA headquarters officials and division office inspectors and managers.

Our review was conducted from October 1989 to September 1990, with updates through April 1991, in accordance with generally accepted government auditing standards. DOT and officials in the seven states we visited reviewed a draft of this report. DOT provided formal written comments, while state government officials provided unofficial comments. The full text of DOT's comments and our response is included in appendix I.

Interstate Pavement Condition and Future Preservation Needs

Although the condition of the nation's Interstate pavement varies from state to state, FHWA reports that over 40 percent of all Interstate pavement is rated in fair or poor condition. Furthermore, the outlook for future improvement in Interstate conditions is not encouraging.

According to DOT, conditions are not expected to improve, even at substantially higher 4R Program funding levels. In addition, DOT projects that Interstate capacity enhancement funding needs will increasingly compete for the same limited pool of funds as Interstate preservation needs. DOT has not established goals for minimum acceptable Interstate conditions, and states will continue to have wide latitude in selecting and programming Interstate 4R projects. Therefore, DOT has no assurance that states will, in selecting federal projects, adequately attend to Interstate preservation needs.

The Condition of the Interstate Is Not Improving

Every year FHWA and the states report on the condition of the pavement on the Interstate Highway System. FHWA classifies Interstate pavement into three broad categories—good, fair, and poor—based on the roughness of the ride and on surface defects, such as pavement ruts and cracks. According to FHWA guidance, good pavements provide a first-class ride and exhibit few, if any, signs of surface deterioration, although pavements may begin to show signs of rutting, minor cracks, spalling, and slight surface deterioration. Fair pavements provide a noticeably inferior ride to that of new pavements, may be barely tolerable for high-speed traffic, and may be in need of resurfacing. Surface defects found on fair pavements include rutting, a few joint failures, faulting, cracking, and some pumping. Poor pavements have deteriorated to the point that they are in need of resurfacing or reconstruction. These pavements provide an uncomfortable ride, requiring reduced driving speeds, and they have excessive bumps, depressions, or holes.

FHWA's data on Interstate conditions are derived from the Highway Performance Monitoring System (HPMS). According to FHWA officials, these are the only available data on national Interstate pavement conditions that can be used to track and compare Interstate conditions nationwide on a year-to-year basis. These data do not, however, record the severity and extent of maintenance deficiencies, the resources required to improve conditions, or progress in improving Interstate maintenance. Furthermore, because state officials subjectively judge the rideability of various highway segments, FHWA officials cautioned that standards can vary between states and that FHWA's report should not be used to compare conditions of individual states. However, according to FHWA officials, FHWA is encouraging states to adopt the International Roughness

Index (IRI) for measuring Interstate conditions. The IRI employs special equipment that digitally records pavement conditions, removing the element of individual subjective judgement. According to FHWA officials, use of the IRI will allow pavement conditions over time and between states to be measured objectively and compared.

FHWA's data show that no overall improvement was made in the condition of the Interstate Highway System during the 1980s. While FHWA's data have revealed a decrease in the amount of pavement rated as poor since 1983, they have also recorded an increase in the amount of pavement rated as fair. Consequently, the amount of pavement classified as either fair or poor—pavement that may provide a barely tolerable ride at high speeds—has remained relatively constant at just over 40 percent. The percentage of pavement classified as fair or poor varies widely among states, from less than 13 percent in five states to over 73 percent in seven states. Between 1983 and 1989, the percentage of good pavement also remained relatively constant, although about 1,800 new miles were added to the Interstate during this period. Interstate ratings during this period are shown in table 2.1.

Table 2.1: Interstate Pavement Condition, 1983 to 1989

Year	Interstate rating			
	Good	Fair	Poor	Poor and fair combined
1983	57	29	14	43
1985	59	30	11	41
1987	58	31	11	42
1989	58	33	9	42

Source: GAO analysis of HPMS data.

Although the year-to-year changes are proportionally small, they are nonetheless cause for concern. While all Interstate pavements are aging and will eventually reach the end of their service lives and require reconstruction, deterioration accelerates when pavement reaches fair condition. Pavement deterioration can be caused by numerous factors, which are discussed further in chapter 3. Deteriorated Interstate pavement carries with it a number of social and economic costs; it increases vehicle maintenance costs and requires reduced driving speeds, which increase air pollution and fuel costs. These costs increase substantially as pavement deterioration accelerates. As we reported in 1979, a DOT study estimated fuel consumption to be about 34 percent higher for

vehicles traveling on badly broken asphalt road than for vehicles traveling on high-quality pavement.¹

Meeting Future Interstate Preservation Needs Is Questionable

Interstate 4R capital preservation treatments, such as resurfacing and rehabilitation, can restore fair or poor pavement to good condition. In fact, FHWA officials attributed the decline in the percentage of pavement classified as poor between 1987 and 1989 to states' use of 4R funds to rehabilitate poor pavement. However, the outlook for future improvement in the condition of the Interstate system is not encouraging. Interstate conditions—even at substantially higher federal-aid funding levels—are not expected to improve beyond 1989 levels because (1) future Interstate 4R investment requirements significantly outstrip current and proposed funding levels and (2) Interstate capacity enhancement will increasingly compete for the same limited pool of funding as Interstate preservation. In addition, DOT has no goals for minimum acceptable Interstate pavement conditions nationwide.

Future Investment Requirements Outstrip Funding

According to data provided by FHWA's Office of Policy Development in April 1991, maintaining 1989 conditions on the Interstate Highway System would require all levels of government to invest an average of \$8.7 billion a year (in constant 1989 dollars) in the Interstate 4R Program through the year 2009. Improving conditions—that is, eliminating capital backlogs and meeting accruing preservation and capacity needs—would require \$15.8 billion a year. These projections assume a 2.5-percent annual growth in national vehicle miles traveled. Assuming that the federal government will contribute 79 percent of the total investment by all levels of government,² the required average annual federal contribution would be \$6.9 billion to maintain 1989 conditions and performance. To improve conditions and performance beyond 1989 levels, \$12.5 billion would be required.

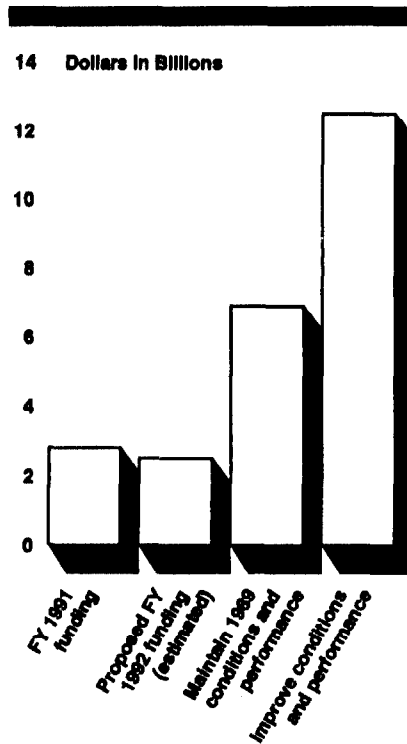
These capital investment requirements significantly exceed current and projected funding levels. The Interstate 4R Program was funded at \$2.8 billion in fiscal year 1991. The amount proposed in fiscal year 1992

¹Excessive Truck Weight: An Expensive Burden We Can No Longer Support (GAO/CED-79-94, July 16, 1979).

²In 1989, federal capital expenditures represented 79 percent of Interstate capital expenditures by all levels of government, according to FHWA's Office of Policy Development. Although the federal 4R project matching share is currently 90 percent, the lower overall federal contribution reflects states' practice of conducting state-financed capital projects on the Interstate in concert with federally funded projects.

cannot be precisely determined because, under DOT's reauthorization proposal, the 4R Program would be merged with other activities into the National Highway Program. While it is difficult to predict how states will respond to the new flexibility permitted under the proposed program structure, FHWA projects that states will use between \$2.1 billion and \$2.5 billion of the National Highway Program's proposed \$7.7-billion fiscal year 1992 authorization for activities funded in fiscal year 1991 under the Interstate 4R Program. This amount is less than the \$2.8 billion provided in fiscal year 1991. Figure 2.1 compares these funding levels with FHWA's projected Interstate capital investment requirements.

Figure 2.1: Interstate 4R: Annual Funding Versus Annual Investment Requirements



Investment requirements are in constant 1989 dollars

Source: Office of Policy Development, FHWA.

DOT's data show that even if funding is assumed well beyond current and proposed levels, conditions on the Interstate would not improve over conditions in 1989 when 42 percent of Interstate pavement was in fair

or poor condition. Furthermore, DOT has not established goals for minimum acceptable pavement conditions or a strategy for improving pavement conditions. As a result, even under the most optimistic funding assumptions, no improvements in Interstate conditions are expected.

Capacity Needs Will Increasingly Compete With Preservation Needs

Some transportation experts believe that congestion could become the number one surface transportation problem in the 1990s and remain so into the 21st century. The nation's growing congestion problem is most pronounced on the Interstate system. According to data developed by FHWA's Office of Policy Development, the percent of peak-hour travel on the urban Interstate system that occurred under congested conditions grew tremendously during the 1980s, from 55 percent in 1983 to nearly 70 percent in 1989. As a result, the Interstate Highway System faces an enormous need for new capacity, particularly in densely populated urban areas. In 1989 DOT estimated that about 50 percent of 4R investment requirements between 1987 and 2005 would be needed for "major widening"—that is, adding lanes to a highway segment. While major widening is the most prevalent form of capacity enhancement, minor widening and reconstruction projects that add or widen lanes also increase Interstate capacity. According to an FHWA official, if these projects are considered, as much as 65 percent of future 4R funding could be required for projects to enhance Interstate capacity. As a result, preservation and capacity enhancement, two important goals of the federal-aid highway program, will increasingly compete for the same limited pool of funds.

DOT's projection, if borne out, would represent a significant departure from historical spending trends. Although, in general, 4R spending on major widening has steadily increased, it has consistently represented a small proportion of 4R expenditures, commanding less than 1 percent of program funds in fiscal year 1981 and only 13 percent in fiscal year 1989. But preservation needs are also great. In 1989, DOT estimated that between 21 and 28 percent of the projected future 4R Program investment requirements were to address the backlog of capital needs that already existed on the Interstate system, excluding accruing needs.

Recognizing that preservation needs could be shortchanged, DOT's reauthorization proposal would set the federal cost share for preservation and most capacity projects at different levels under the National Highway Program. The proposal would provide a 90-percent federal matching share for resurfacing, rehabilitation and restoration projects and a 75-percent share for lane-widening and reconstruction projects,

except for construction of high-occupancy vehicle lanes, which would continue to receive a 90-percent federal matching share. In addition, DOT's proposal would provide the Secretary with new authority to require states to program funds to bring their Interstate highways up to adequate condition if the Secretary finds that a state is not adequately maintaining its highways. Also, DOT is requiring states to develop pavement management systems for roads on its National Highway System. The purpose of these systems is to allow states to identify deteriorating pavement and improve them in a cost-effective manner before they deteriorate to the point of concern. While these are important steps, states have, and will to continue to have, wide latitude to select and program 4R projects according to their needs. DOT does not provide guidance to the states on balancing Interstate preservation and capacity-enhancement activities.

Conclusions

In 1989, 42 percent of the Interstate system was rated in fair or poor condition. DOT estimates that even at substantially increased 4R funding levels, Interstate conditions will not improve beyond 1989 levels. Furthermore, Interstate 4R Program resources will increasingly be used to respond to the growing congestion problem, which some transportation experts believe could become the number one surface transportation problem in the 1990s and remain so into the 21st century. But Interstate pavement conditions are not improving, and substantial funding will be needed just to address the Interstate preservation backlog, excluding accruing needs.

Increasing competition between capacity enhancement and pavement preservation raises concerns about preserving the federal investment in the Interstate Highway System. DOT recognizes the importance of Interstate preservation and proposes a higher federal matching share for preservation projects over most Interstate capacity projects. However, in light of competing preservation and capacity demands, additional steps may be needed to ensure that the substantial federal investment in the Interstate system is protected. While it is important to preserve the discretion that states have to select and program 4R projects to meet their particular needs, we believe that a federal framework is needed to monitor progress and evaluate the success of state and federal efforts to preserve the Interstate system. The use of clearly established goals for Interstate pavement conditions and a strategy for achieving these goals would provide states, as well as DOT, with equitable benchmarks for measuring success. Such goals and criteria would also provide an overall

framework for protecting the substantial federal investment in the Interstate system.

Matters for Consideration by the Congress

In reauthorizing the federal-aid highway program, the Congress may wish to consider directing the Secretary of Transportation to (1) establish goals for the condition of the Interstate Highway System, (2) monitor state progress in meeting those goals, and (3) require minimum investment levels in Interstate preservation projects on a state-by-state basis where Interstate pavement conditions fall below DOT's condition goals.

Agency Comments and Our Evaluation

DOT did not concur with the conclusions and matters for congressional consideration presented in this chapter because it did not believe that we had presented enough supporting evidence to justify major changes in the federal-aid highway program. The Department believes that our findings overstated condition problems on the Interstate system and disagrees that Interstate capacity needs will increasingly compete with Interstate preservation needs. DOT stated that its reauthorization proposal—including the provision to establish a higher federal matching share for preservation projects than for most capacity projects—supports and is designed to accomplish adequate preservation of the Interstate system.

According to DOT, our use of FHWA's HPMS data showing that 42 percent of the system is in fair or poor condition is misleading and substantially overstates the problem. DOT said that new condition categories were under consideration for use in its 1991 biennial highway needs report to the Congress and that use of these categories would more accurately show that the percentage of Interstate pavement providing a barely tolerable ride declined between 1983 and 1989. When we performed our review, DOT had not published condition ratings using the new categories; we requested, but were not provided with, a copy of DOT's draft 1991 highway needs report. Therefore, we used the same classifications that DOT has used to report Interstate conditions to the Congress since 1981. However, we believe that using the new categories as DOT suggests could present an overly optimistic picture of the condition of the Interstate system. DOT would combine poor pavement with pavement in the lower half of the fair category to show that the amount of Interstate pavement providing a barely tolerable ride decreased during the 1980s. However, this classification would also combine pavement in the upper half of the fair category with pavement rated as good. We believe that

this classification could convey the misleading impression that the upper half of the fair pavement—pavement nearing the need for resurfacing—was no more cause for concern than pavement rated in good condition.

DOT also disagreed that capacity needs would increasingly compete with preservation needs for Interstate 4R resources, noting that only 13 percent of 4R expenditures in fiscal year 1989 were used for major widening. However, we reached this conclusion after reviewing data that DOT presented to the Congress in its 1989 highway needs report, The Status of the Nation's Highways and Bridges: Conditions and Performance. DOT itself concluded in its testimony before the House Appropriations Committee on the Department's fiscal year 1990 budget that capacity projects were commanding an increasing share of Interstate 4R projects. DOT's projection that about 50 percent of Interstate 4R investment between 1987 and 2005 would be needed for capacity-enhancing "major widening" explicitly recognized that 13 percent of actual fiscal year 1989 4R Program expenditures were used for major widening.

Finally, DOT disagreed with our matters for congressional consideration because it did not believe that the findings we presented justified the program changes we proposed. We believe that the establishment of Interstate pavement goals and a strategy for achieving them is warranted and well supported by the projection of increasing competition between capacity and preservation needs, and by the relatively high proportion (42 percent) of the Interstate system that is in fair or poor condition and requires significant investment to maintain or improve conditions. DOT cited its own legislative proposals emphasizing Interstate preservation and stated that if implemented, our matters for congressional consideration would result in FHWA, not the states, directing the selection of federal-aid highway projects. We believe that DOT's proposal recognizes the importance of Interstate preservation. We also believe that it is important to preserve the discretion that states have in selecting and programming 4R projects to meet their particular needs. However, clearly established goals for Interstate pavement conditions and a strategy for achieving them would provide a much needed framework to monitor progress and evaluate the success of state and federal efforts. This framework would complement DOT's proposed initiatives and would provide states, as well as DOT, with equitable benchmarks for measuring success. Although DOT believes that our matters for consideration would result in FHWA directing state projects, DOT's own proposal would provide the Secretary with new authority to require a state to program funds to bring its Interstate system up to adequate condition if

the Secretary found that the state was not performing adequate Interstate maintenance. The full text of DOT's comments and our response appears in appendix I.

Federal and State Maintenance Efforts Need Improvement

Progress in maintaining the Interstate Highway System, a state responsibility, has been mixed. The principal factors that cause pavement deterioration are vehicle weight and the environment. Available research indicates that preventive maintenance is a cost-effective means of slowing pavement deterioration caused by these factors and can delay the need for costly 4R resurfacing and rehabilitation projects.

However, four of the seven states we reviewed had significant maintenance backlogs in areas that could adversely affect the structural integrity of roadways and bridges and the safety of the motoring public. Although FHWA certified that maintenance in these states was adequate, it had not developed measurable criteria or standards for assessing the adequacy of state maintenance. Weaknesses in FHWA's inspection process further weakened its oversight of state maintenance efforts. For example, FHWA inspectors conducted only limited inspections in one state and did not adequately follow up on observed maintenance deficiencies in four other states.

Although officials in all four states with maintenance backlogs cited a lack of resources as the primary reason, we found that the Interstate 4R Program can provide a disincentive for states to fund maintenance. Since all states have limited resources, they must choose among competing priorities. The 4R Program can affect how states make their priority choices by funding such capital-intensive preservation activities as resurfacing and reconstruction at a 90-percent federal matching share and by not funding preventive maintenance, which is entirely state funded. This can be an important factor in how states decide among competing priorities. States are strongly motivated to select highway projects with a 90-percent federal contribution because of the substantial economic benefits that the influx of federal funding provides. In all seven states we reviewed, matching federal funds was a major priority of the state transportation program.

The 4R Program provides a further disincentive for states to fund maintenance because unaddressed maintenance items will eventually deteriorate to a point requiring capital-intensive, federally eligible preservation treatments, such as resurfacing and reconstruction. Whereas maintenance is financed by the state and should be performed every 2 to 5 years, resurfacing and reconstruction are funded 90 percent by the federal government and need to be performed only every 10 to 20 years. Although FHWA must annually certify whether states have adequately maintained the Interstate system and can withhold federal-aid project

approvals and funding if they do not, FHWA has rarely applied such sanctions for inadequate maintenance.

Vehicles and the Environment Cause Pavement Deterioration

Vehicle weight and the environment are the principal factors causing pavement deterioration. Heavy vehicles, in particular, contribute to pavement deterioration because as vehicle weight increases, the rate of pavement deterioration increases substantially. The 1962 American Association of State Highway Officials (AASHO) Road Test established that highway damage increases exponentially as axle weight increases. The test found that even though an 80,000-pound truck weighs as much as 20 automobiles, the truck has the same effect as 9,600 automobiles. Although nearly three decades old, the AASHO Road Test is the most accepted and widely used method of analyzing the effects of vehicle loads on the nation's highways.

Vehicle weight is the principal cause of "rutting," or grooves in the wheel path on asphalt pavement. This condition allows water to remain on the road surface, leaving pavement surfaces slick and motorists more susceptible to accidents. Federal legislation has permitted larger and heavier vehicles to travel on the Interstate Highway System. The Federal-Aid Highway Act amendments of 1974 increased the maximum truck weight per single axle from 18,000 to 20,000 pounds. These provisions were enacted to provide economic benefits, enhance productivity, and save energy. FHWA estimated that the 1974 amendments' weight provisions could reduce a highway's life from 20 years to 16.4 years, even accounting for the reduced number of trips a larger truck would need to make. The 1982 Surface Transportation Assistance Act also increased truck length and width and required states with lower limits to adopt the federal weight, length, and width standards.¹

Environmental factors, such as water and temperature, also contribute to Interstate pavement deterioration. Water may enter pavement by infiltrating cracks and joints or through groundwater. Pavement with water infiltration deteriorates more rapidly than dry pavement; the 1962 AASHO Road Test recorded damage rates of up to 50 times greater. Another study that used an FHWA computer model to compare the lives of highways with good, fair, and poor drainage capabilities

¹At the time the 1982 law was enacted, 3 states had lower weight limits, 14 states had more restrictive length standards, and 40 states had more restrictive width limits.

projected that poor drainage reduced pavement life up to 20 percent.² Temperature changes cause pavement damage and can affect user safety. For example, hot weather draws out the oil in asphalt pavement (known as “bleeding”), reducing the pavement’s skid resistance. The freezing and thawing of roadbed soil—commonly known as the “freeze/thaw cycle”—can seriously damage pavements, depending on the drainage capabilities of the pavement and how quickly the thaw takes place. Freezing and thawing pressures cause cracks and stress on concrete pavement that can, if unattended, eventually lead to its deterioration.³

Maintenance: A Cost-Effective Way to Slow Deterioration and Extend Pavement Life

Our review of applicable research has shown that preventive maintenance can slow the rate of pavement deterioration from environmental conditions and vehicle weight, thus extending pavement life. Preventive maintenance is generally cyclical and extends pavement life; corrective maintenance repairs defects as they occur. Both are state funded. Preventive maintenance is also cost effective; it is less costly than corrective maintenance and much less costly than 4R-funded resurfacing and reconstruction.⁴ Although all pavement deteriorates with age and use and the more expensive preservation techniques must be performed eventually, major 4R work can be delayed with timely preventive maintenance. For example, table 3.1 shows the costs per mile of different preservation activities contained in a Utah Department of Transportation study.⁵

²Stimulating Pavement Performance Under Various Moisture Conditions, Transportation Research Record, 849, Transportation Research Board, 1982.

³Highway Technology: The Structure for Conducting Highway Pavement Research (GAO/PEMD-88-2BR, Nov. 13, 1987).

⁴As discussed in chapter 1, pavement resurfacing and rehabilitation are activities that extend the service life of existing pavement, while reconstruction involves removing and replacing the road rather than rehabilitating the existing road surface.

⁵Selection of Pavement Maintenance Activities, Utah Department of Transportation, Research and Development Unit, No. FHWA/UT/88/1 (Salt Lake City, Utah: June 1988).

Table 3.1: Comparison of Preventive Maintenance With Corrective Maintenance and Preservation Costs

Type of maintenance	Cost per lane-mile
Preventive maintenance	\$8,000
Corrective maintenance	28,000
Minor rehabilitation	140,000
Major rehabilitation	290,000
Reconstruction	600,000

Source: GAO analysis of Utah Department of Transportation data.

We identified research concluding that preventive maintenance extends pavement life. One study showed that sealing cracks can extend the service life of asphalt and concrete pavements by about 5 years. Also, AASHTO's 1986 Guide for Design of Pavement Structures estimated that resealing joints, using high-quality sealants and good construction techniques, typically extends service life by 4 to 10 years or more.

Failure to perform needed maintenance is costly. Although the more expensive preservation techniques must be performed eventually, they can be delayed with timely preventive maintenance. But delaying preventive maintenance increases the severity of surface defects, leading to higher rehabilitation costs. For example, the Utah study concluded that when the state deferred \$7 million in preventive and corrective maintenance costs in one year, it increased the costs of future preservation projects by \$42 million. A 1986 DOT Office of Inspector General report examining state highway management practices in another FHWA region reached a similar conclusion, finding that three of four states reviewed had not adequately maintained concrete pavement to preclude deterioration from water. The report concluded that if the three state highway administrations had performed adequate and timely preventive maintenance, planned federal-aid projects costing \$88.3 million to rehabilitate these pavements could have been reduced or deferred.

Needed Maintenance Not Performed

Four of seven states reviewed—Louisiana, Michigan, Ohio, and Pennsylvania—had significant maintenance backlogs and did not perform various kinds of needed maintenance, such as sealing joints and cracks, painting and repairing bridges, patching concrete pavement, and repairing guardrails. These maintenance deficiencies can cause structural damage to the Interstate, shorten the life of roadways, and create safety problems. For example, if pavement joints and cracks are not filled with sealant, water may intrude beneath the pavement, shortening

its life. Similarly, if bridges are not painted, they may rust, and the weakened bridge structure may pose a safety hazard.

The extent of unmet Interstate maintenance needs nationwide is not known. Although FHWA does collect data on state Interstate maintenance expenditures—in addition to the pavement condition data discussed in chapter 2—we found that these data were not reliable because information from many states was missing or incomplete. In 1980 FHWA reported missing or incomplete data from 28 states and the District of Columbia. While this situation has gradually improved, in 1989 FHWA reported missing or incomplete data from 11 states and the District of Columbia. In addition, FHWA does not compare state Interstate maintenance expenditures to state investment requirements, as it does for 4R capital investment requirements. As a result, it has no mechanism for evaluating the progress states are making in achieving adequate Interstate maintenance nationwide.

Officials in the four states with unmet maintenance needs said that maintenance backlogs have existed for many years and estimated that substantial resources would be needed to eliminate or reduce them. Ohio's Chief Maintenance Engineer said that an annual funding increase of about \$10 million per year for the next 5 to 6 years would eliminate Ohio's Interstate maintenance backlog; Ohio expended \$14.5 million on Interstate maintenance in 1989. According to Michigan's Assistant Deputy Director for Highway Operations, an annual increase in the gasoline tax of 2 cents over the next 3 years is needed to reduce Michigan's maintenance backlog. A report prepared by the Pennsylvania Department of Transportation estimated that the state's Interstate maintenance backlog was \$14 million in 1989; Pennsylvania expended \$20.3 million on Interstate maintenance that year. However this report also noted that other deferred maintenance items have deteriorated beyond the point at which maintenance would be cost effective and will require rehabilitation and reconstruction under the 4R Program. Pennsylvania estimated the cost of these deferred items at \$1.2 billion. Louisiana officials did not know how much money would be needed to correct unmet maintenance needs.

Three of the states we reviewed—California, Missouri, and Florida—were able to meet most of their Interstate maintenance needs. According to officials in all three states, the principal reasons included consistent funding levels and state legislative support for departmental maintenance programs. In addition, Florida and California officials credited climatic conditions—Florida has warm temperatures statewide, while

California's colder climates are limited to its mountain regions. Both states therefore seldom experience the effects of the freeze-thaw cycle that accelerates pavement deterioration. Also, both states allocate little maintenance funding for snow and ice removal equipment and services. Consequently, Florida and California officials believe, their states are able to allocate more funding for preventive and corrective maintenance programs than states with colder climates. In comparison, Michigan allocates about 20 percent of its highway maintenance budget for snow and ice removal; Michigan is one of the four states reviewed with maintenance deficiencies.

Officials in the four states with maintenance deficiencies cited lack of resources as the primary reason for deferring maintenance needs. While these states considered maintenance important, they had limited resources and had to choose among competing program priorities. For example, Louisiana increasingly used revenue generated from the state's gasoline tax for other state programs outside of the transportation department. FHWA found in 1986 that the state cut maintenance personnel by 23 percent in 18 months and the budget for maintenance supplies by 34 percent over 3 years. Louisiana has since enacted a state constitutional amendment prohibiting the use of transportation trust funds for nontransportation purposes. Pennsylvania officials told us that because of other priorities, the state's maintenance program during the 1970s consisted of limited repairs only. According to the officials, that situation has since changed and Pennsylvania is meeting its accruing maintenance needs, but the \$1.2 billion backlog of restoration needs still exists.

4R Program Provides Disincentive for States to Fund Maintenance

Although officials in all four states attributed their maintenance backlogs primarily to lack of resources, we found that the Interstate 4R Program can provide a disincentive for states to fund maintenance. Since all states have limited resources, they must choose among competing priorities. The 4R Program can influence states' choices by providing a 90-percent federal funding share for such capital-intensive preservation activities as resurfacing and reconstruction, and no federal funds for preventive maintenance. State-financed preventive maintenance must be performed regularly every 2 to 5 years, while 4R-eligible

resurfacing and reconstruction treatments need be performed only every 10 to 20 years.⁶

The availability of a 90-percent federal contribution can significantly affect state choices among competing priorities. States are strongly motivated to construct highway projects with a 90-percent federal contribution because of the substantial economic benefits that the influx of federal funding provides. The Congressional Budget Office (CBO) made the following observation about the Interstate construction program in 1982:

The 90-percent federal contribution provides a substantial incentive for states to expand their participation independent of their actual transportation needs. This occurs because construction activities themselves generate jobs, which, in turn, generate additional retail and other economic activity, and ultimately result in increased state tax revenues by virtue of enhanced employment, both direct and indirect. As a result, apart from the value of the roads itself, the Interstate program provides significant economic returns through its stimulation of local construction activity and indirect increases in related economic activity.

According to state officials in all seven states, matching federal funds is a major priority of their state transportation programs. We found that in three of these states, the legislature had codified these priorities into state law. Michigan's state highway law states that "Priority for funding obligation shall be given to capital projects for which federal funds have been authorized." Pennsylvania law states that the state transportation Secretary "shall do all . . . things necessary and proper in order to obtain the benefits afforded under the provisions of . . . act(s) of Congress providing Federal aid for highway purposes." California law states that "Funds in the State Highway Account shall be programmed, budgeted and expended to maximize the use of federal funds. . . ."

The 4R Program can provide a further disincentive for states to fund maintenance because unaddressed maintenance items eventually deteriorate and require federally funded 4R preservation projects rather than state-funded preventive maintenance. For example, as mentioned earlier, Utah found that deferring preventive and corrective maintenance by \$7 million increased the cost of future rehabilitation projects by \$42 million. Utah's cost to address those needs through the 4R Program

⁶FHWA regulations require that 4R projects have a minimum service life of 8 years. However, according to AASHTO, highway rehabilitation and reconstruction projects have, under current design standards, a 10- to 20-year life.

would have been \$4.2 million, compared with \$7 million through preventive maintenance. Even though preventive maintenance would clearly have been more cost effective, Utah's costs would have been 67 percent higher. Pennsylvania has a substantial maintenance backlog that has deteriorated to the point that maintenance is no longer cost effective and will require \$1.2 billion in 4R projects. Ohio transportation officials estimated that accumulated deferred maintenance needs account for 10 to 15 percent of some 4R projects.

Conducted for the Transportation Research Board (TRB) in December 1989, a survey of state transportation department chief executive officers and principal highway maintenance officers confirmed that state highway agencies generally gave higher priority to, and placed greater emphasis on, obtaining federal funds than on funding preventive maintenance.⁷ Although the survey indicated strong support among state officials for preventive maintenance as a cost-effective measure, 90 percent of those surveyed said that they would not turn back federal funds in order to use the state matching portion for maintenance. The survey concluded that while maintenance enjoyed wide support, it is not able to compete effectively for funding with other activities because its benefits are poorly defined. The survey also found that preventive maintenance funding is often reduced in times of fiscal restraint.

Improved Federal Oversight Needed

FHWA is responsible for monitoring state maintenance activities and ensuring that states adequately maintain the Interstate Highway System. However, FHWA has not established measurable criteria or standards for determining what constitutes adequate maintenance. As a result, FHWA has certified as adequate maintenance in states where we found significant unmet maintenance needs. We found that states are developing measurable maintenance standards which FHWA could use in its oversight efforts. We also found weaknesses in FHWA's oversight of state maintenance activities; FHWA conducted only limited inspections in one state and did not adequately follow up on observed maintenance deficiencies in four other states.

⁷Evolution and Benefits of Preventive Maintenance Strategies, Transportation Research Board, National Cooperative Highway Research Program, Synthesis of Highway Practice, No. 153 (Dec. 1989).

The Federal Oversight Responsibility

The federal government has had a role overseeing state maintenance on the federal-aid highway system since the Federal-Aid Road Act of 1916. The Surface Transportation Assistance Act of 1978 mandated that guidelines be established for ensuring the maintenance of the Interstate system. As a result, DOT promulgated regulations in 1980 requiring the states to (1) develop an initial Interstate maintenance program and (2) annually certify that it is adequately maintaining the Interstate Highway System in accordance with this program. To verify this self-certification, the FHWA Maintenance Review Manual, first developed in 1977, provides guidance to FHWA division engineers to assist their inspection and reporting efforts. The manual describes how to develop an inspection program and the types of field inspections needed to document the extent and severity of deficiencies. The manual emphasizes the need to follow up to ensure that identified deficiencies are corrected, particularly safety-related deficiencies. On the basis of the inspection findings, the division administrator must determine whether the state should be certified as having adequately maintained the Interstate. Sanctions for noncompliance are provided in 23 U.S.C. 116 and 119; the Secretary may withhold approval of federal highway projects statewide or withhold approval of projects for specific cities, counties, or other political or administrative subdivisions within the state. The Secretary may also reduce a state's next highway apportionment by 10 percent.

Certification Process Lacks Measurable Standards

Although DOT and the states must annually certify that states have adequately maintained the Interstate system, FHWA has no measurable criteria or standards defining what constitutes adequate maintenance. Four of seven states in our review had significant unmet maintenance needs, but FHWA still certified them as providing adequate Interstate maintenance. According to FHWA officials, because conditions and practices vary widely among states, FHWA division engineers must be permitted wide latitude in determining adequacy. However, the lack of measurable standards limits the degree to which FHWA can ensure that states adequately maintain the Interstate system.

In 1986, for example, FHWA inspections documented 39 different types of structural and safety-related maintenance deficiencies in Louisiana, including pavement blow-outs, poor skid-resistant surfaces, unsealed joints, ruts, and damaged guardrails. On December 31, 1986, Louisiana's Secretary of Transportation stated that he was unable to certify that the state was adequately maintaining the Interstate Highway System. FHWA subsequently imposed sanctions—the only time, according to FHWA officials, that it has done so on a statewide basis—by suspending approvals

of certain agreements and authorizations, such as approval of a consultant agreement for preliminary engineering and right-of-way authorizations. However, FHWA's Louisiana Division Administrator said that he did not believe FHWA could have imposed sanctions without federal criteria, had the state itself not failed to certify it was providing adequate maintenance. FHWA certified the Louisiana program in 1988 and 1989 after the state authorized an additional \$10 million for Interstate maintenance and began efforts to earmark state gasoline tax receipts for highway maintenance. However, FHWA had no standard for measuring the Louisiana program's adequacy and in both years concluded that maintenance was satisfactory "within the constraints of available resources." When we visited Louisiana in March 1990, we found that it still had substantial maintenance backlogs in the areas discussed above. However, FHWA officials believe that the additional funding Louisiana has recently authorized will improve maintenance conditions in the near future.

In 1986 DOT's Office of Inspector General recommended establishing quantifiable national maintenance standards. FHWA stated at that time that national standards were undesirable because they would reduce the agency's flexibility in determining state compliance. In 1987 the Congress directed the Secretary of Transportation to have the National Academy of Sciences study the feasibility of national maintenance guidelines. However, according to an FHWA official, this study was not undertaken because funds were not subsequently appropriated for it.

We found measurable maintenance standards in use in one of the states we reviewed. The Florida Department of Transportation's Maintenance Rating Program, created in 1985, compares actual highway pavement and maintenance conditions with a set of performance criteria. For example, the criteria stipulate that no potholes will be greater than 1/2 square foot in area and 1-1/2 inches deep, and that 90 percent of all concrete highway slabs statewide will have no unsealed cracks wider than 1/8 of an inch. After comparing actual conditions to these performance criteria, the rating program produces a "score" representing the percentage of the highway system that meets the department's standards. The Florida department established a goal of 80 percent of inspected pavement meeting these standards as a measure for judging the success of its maintenance program. In fiscal year 1989, Florida's rural and urban Interstate systems received scores of 84 and 81, respectively. FHWA's Florida division inspectors use the Maintenance Rating Program—in conjunction with their own maintenance inspections—to

evaluate Florida's Interstate maintenance efforts. Florida officials said that other states have expressed interest in developing a similar system.

Sanctions Have Been Rarely Applied

Although federal-aid highway legislation provides for sanctions that the Secretary may apply against states that do not adequately maintain the Interstate, these sanctions have rarely been applied. According to FHWA officials, the Secretary's prerogative to withhold 10 percent of a state's highway apportionment for the following year has never been invoked, and the withholding of project approvals has only been invoked once on a statewide basis, in Louisiana. While FHWA officials stated that project approvals have been withheld more often on a localized basis, FHWA had no data on the frequency with which, or the extent to which, this sanction has been utilized.

In 1981 we reported that DOT and FHWA believed that sanctions should only be applied when highways become unsafe or unserviceable and not as a penalty for failure to perform needed maintenance or as a mechanism to encourage adequate maintenance. We also reported that FHWA officials viewed sanctions as counterproductive and undesirable because they would result in funds being withheld from the states.⁸ During our current review, FHWA headquarters and division managers reiterated that sanctions should be applied only as a last resort and are, in general, an undesirable and ineffective means of achieving Interstate maintenance goals. These officials viewed insufficient state resources as one of the principal causes of poor maintenance practices and concluded that sanctions would do nothing to address this problem and could actually exacerbate it. In addition, FHWA officials stated that sanctions are difficult to impose because FHWA lacks measurable criteria for determining when to impose them. Furthermore, FHWA headquarters and division managers said that preserving the Interstate system requires a federal-state partnership and that sanctions, by their punitive nature, are a counterproductive means of achieving shared goals. These officials stated that informal contacts between state and federal officials are a more expeditious and effective means of encouraging states to fulfill their maintenance responsibilities.

DOT proposes revising the system of sanctions now in place. DOT's reauthorization proposal would repeal the existing 10-percent withholding provision because, according to an FHWA official, it is unlikely

⁸Deteriorating Highways and Lagging Revenues: A Need to Reassess the Federal Highway Program (CED-81-42, Mar. 5, 1981).

that this sanction would ever be used. The proposal would retain the Secretary's authority to withhold project approvals and add a new provision. If it is found that a state is not adequately maintaining the Interstate, the Secretary could require the state to program the amounts needed to bring the system to adequate condition from its National Highway Program apportionment. FHWA officials stated that this process would be further defined in a future rule-making action.

Weaknesses in FHWA Inspection Efforts

FHWA could improve its oversight of states' Interstate maintenance efforts. The FHWA Maintenance Review Manual requires each FHWA division to inspect state Interstate maintenance efforts and to follow up to ensure that deficiencies, particularly safety-related deficiencies, are corrected. The inspection findings are a pivotal element of the division administrator's annual certification that a state has adequately maintained the Interstate. We found that FHWA conducted only limited inspections in one state and did not adequately follow up on observed maintenance deficiencies in four other states.

The FHWA Ohio division's inspection program was limited. Inspections conducted in 1989 consisted primarily of windshield inspections—observations made from a moving vehicle in conjunction with official travel. FHWA's manual recognizes this procedure as an inspection method if it is used in conjunction with other types of inspections. We found that Ohio had a significant backlog of unmet maintenance needs that had existed for some time. However, FHWA division officials said that they were unaware of this backlog. According to the division officials, their limited evaluation was in response to a July 1989 FHWA headquarters memorandum that, they stated, had directed them to refocus their monitoring efforts and reduce their oversight of Interstate system maintenance. However, FHWA headquarters officials stated that the memorandum was not intended to result in reduced oversight of Interstate maintenance.

The FHWA Maintenance Review Manual stresses the need for following up to ensure that states take corrective action in response to reported deficiencies, particularly safety-related deficiencies. However, it does not prescribe the specific follow-up system to be used. Our review of 1989 inspection reports in four states indicated that maintenance deficiencies had not been resolved in about 80 percent of the inspections. In most cases, the deficiency was not adequately resolved because division engineers considered the issue closed after receiving verbal assurances from state personnel that corrective action would be initiated. In other

cases, records indicated no follow-up at all. About 40 percent of these unresolved deficiencies were safety related—such as missing signs and signals, damaged guardrails, and improper median crossings. FHWA division managers in these states said that they were unaware of insufficient follow-up and stated that management review procedures would be implemented to ensure that deficiencies were resolved in a timely manner.

Conclusions

It is in the federal government's interest to protect its \$130-billion investment and ensure the preservation of the Interstate Highway System. The outlook for improvement in the system's condition is not encouraging, and maintenance backlogs are a contributing factor. Maintenance deficiencies accelerate the need for 4R-funded preservation treatments to prevent further pavement deterioration. While state and federal officials agree that preventive maintenance is a cost-effective means of extending pavement life and preserving the system, the current structure of the federal highway program can discourage states from employing the more cost-effective strategy. The upcoming reauthorization of the federal-aid highway program affords the Congress the opportunity to address this structural disincentive.

A policy that relies on Interstate maintenance sanctions would be ineffective in obtaining improvements in state maintenance practices. FHWA has been largely unwilling to employ sanctions, and we do not believe that sanctions would contribute to overcoming the structural disincentive now existing in the 4R Program for states to perform adequate preventive maintenance. Interstate maintenance sanctions can and should provide an essential and potentially effective tool for obtaining, when necessary, a state's compliance with its Interstate system responsibilities. But for sanctions to be credible, they must be based on measurable standards.

In the absence of measurable standards defining what constitutes adequate maintenance, we question FHWA's having certified as adequate the maintenance efforts in the states in which we found significant unmet needs. Developing measurable maintenance standards would more clearly delineate the states' responsibilities to the Interstate Highway System, greatly assist FHWA's efforts to ensure that these responsibilities are fulfilled, and provide a measurable basis for imposing sanctions when needed. While a single, national standard might provide uniformity in conditions and rideability on the Interstate system across state lines, it would be difficult to develop and might be excessively

rigid, given the varying climates, resources, maintenance practices, and Interstate vehicular traffic between states. These standards must be flexible and are, therefore, best developed at the state level, as some states are doing. DOT's proposal to require states to use National Highway Program funds to bring inadequately maintained Interstate roads to adequate condition has potential for obtaining improvements in Interstate conditions. In fairness to the states, such determinations should be guided by measurable maintenance standards. Without a measurable standard of what constitutes adequate maintenance, FHWA might not utilize this provision any more than it has the existing sanctions.

We believe that expanding the eligibility of the federal-aid highway program to include certain preventive maintenance activities that directly extend Interstate pavement life would best help meet the goal of preserving the substantial federal investment in the Interstate Highway System. This expanded eligibility would give states much needed flexibility to select, from among the entire range of preservation activities, the most appropriate and cost-effective preservation treatments without the artificial constraints of federal funding eligibility. Initially, expanding federal-aid eligibility will increase the demands on limited Interstate 4R funds. The extent of this increased demand is unknown because the extent of unmet Interstate maintenance needs nationwide is unknown. But expanding eligibility will provide the states with the opportunity to use federal funds to perform cost-effective preventive maintenance that may be being deferred today. Effective preventive maintenance delays the need for costly rehabilitation and resurfacing projects and could ultimately delay or save federal preservation expenditures.

Improving maintenance of the Interstate Highway System will also require an appreciable improvement in the quality of FHWA oversight over state maintenance practices. We believe that a continued and enhanced program of Interstate system inspection and oversight is needed to ensure the adequacy of state maintenance and protection of the substantial federal investment. We recognize that conditions and resources in different states require different levels of FHWA review and oversight. However, FHWA can enhance the quality of oversight by better defining a minimum expected level of inspection and follow-up by its division offices.

Matters for Consideration by the Congress

In reauthorizing the federal-aid highway program, the Congress may wish to consider

- expanding the eligibility parameters of the 4R Program to include preventive maintenance activities directed at preserving the life of Interstate pavement, and
- directing the Secretary of Transportation to report to the Congress on Interstate maintenance investment requirements and expenditures nationwide and on progress in achieving adequate Interstate maintenance and preservation.

Recommendations to the Secretary of Transportation

We recommend that the Secretary of Transportation direct the FHWA Administrator to take the following actions:

- The Administrator should work closely with the states to develop measurable standards for maintaining the Interstate Highway System. These standards should become a part of FHWA's inspection and oversight processes for judging the adequacy of state maintenance on the Interstate.
- The Administrator should revise the FHWA Maintenance Review Manual to specify (1) the desired level of detail for conducting inspections and for reporting inspection results and (2) the procedures for following up on identified deficiencies, particularly safety-related deficiencies.

Agency Comments and Our Evaluation

DOT did not concur with the conclusions, recommendations to the Secretary, and matters for congressional consideration contained in this chapter because it did not believe that we had presented enough supporting evidence to justify major changes in the federal-aid highway program. The Department stated that existing directives and DOT's proposed reauthorization legislation are sufficient for FHWA to oversee state maintenance of the Interstate Highway System, and that expanding the eligibility of the Interstate 4R Program is premature in the absence of substantive information that doing so would improve the condition of the Interstate system.

According to DOT, although we indicated that several states have significant maintenance backlogs, we failed to define maintenance backlogs and explain whether they have affected the safety, rideability, or life of the pavement. We do not agree with this assessment. Our discussion of the nature and extent of unmet maintenance needs was based on FHWA's own inspection reports, as well as state DOT reports and discussions with

state officials. We provided examples to show how the types of maintenance deficiencies we found can affect the integrity of pavement and structures and the safety of highway users. We did not quantify how these maintenance deficiencies affected pavement life, as DOT suggested, because FHWA does not collect the data on state maintenance needs necessary to conduct such analysis.

DOT stated that our report suggested that states were deferring preventive maintenance in order to qualify for additional 4R funds. While we believe that a disincentive exists for states to fund preventive maintenance, we clearly recognize that federal funding to the states is relatively fixed by apportionment formulas, and we have made appropriate revisions to the final report to clarify this point. DOT also stated that maintenance funding has significantly increased nationwide since the 4R Program began in 1976. However, as we discussed in this chapter, we found that FHWA's financial data base on state Interstate maintenance expenditures was insufficiently reliable to make such a determination because data were missing or incomplete from many states.

The Department disagreed that measurable criteria are needed for FHWA to determine whether state maintenance practices are adequate. According to DOT, states have Interstate maintenance guidelines, in accordance with the Surface Transportation Assistance Act of 1978 and subsequent regulations, and existing guidance is sufficient for FHWA to carry out its oversight responsibilities. We disagree with DOT's evaluation. Although states are required to have maintenance guidelines, only one of the seven states we visited had measurable maintenance standards. FHWA guidance contains instructions to its field inspectors on the mechanics of conducting and reporting Interstate maintenance inspections. However, this guidance does not contain standards defining what constitutes adequate maintenance for the purposes of determining whether states are adequately maintaining the Interstate.

DOT believes that expanding the eligibility of the 4R Program to include certain preventive maintenance activities is premature, since ongoing research will more adequately assess the relationship between extended pavement service life and preventive maintenance. DOT stated that it will consider program changes when the results of this research are complete. However, the principal research effort to measure the relationship between preventive maintenance and pavement service life is the Long Term Pavement Performance study being conducted by the Strategic Highway Research Program. This is a 20-year study designed to evaluate pavement performance over its life-cycle. According to an FHWA

official, the results of the preventive maintenance studies will not be known for 10 to 20 years. Reauthorization of the federal-aid highway program in 1991 provides a timely opportunity for the Congress to effect program changes that could better direct federal resources to the areas of greatest need. We believe that the consensus of existing research—that preventive maintenance is effective in extending pavement life—and our findings on Interstate maintenance provide sufficient basis to justify expanding the eligibility parameters of the 4R Program.

While all four states with maintenance backlogs agreed that these backlogs existed, Ohio and Pennsylvania officials questioned our characterizing them as significant. We made corrections to the final report to more accurately portray the size of Pennsylvania's maintenance backlog. Both states provided state-funded Interstate maintenance expenditure and backlog data (shown earlier in this chapter) that we believe support characterizing these states' maintenance backlogs as significant. Florida, Missouri and California officials expressed concern with expanding 4R Program eligibility because they believed that it would lead to prescriptive federal requirements governing their maintenance programs and limit their flexibility in managing what is traditionally a state program. We believe that such concerns will be mitigated if the states take the lead in developing measurable standards for judging the adequacy of Interstate maintenance efforts. The complete text of DOT's comments and our response appears in appendix I.

Comments From the Department of Transportation

Note: GAO comments supplementing those in the report text appear at the end of this appendix.



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June 5, 1991

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Director, Transportation Issues
Resources, Community, and Economic
Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Mead:

Enclosed are two copies of the Department of Transportation's comments concerning the U.S. General Accounting Office draft report entitled "Transportation Infrastructure: The Outlook for Preserving the Interstate Highway System Is Not Encouraging".

Thank you for the opportunity to review this report. If you have any questions concerning our reply, please contact Martin Gertel on (202) 366-5145.

Sincerely,

for Paul Wain
Jon H. Seymour

Enclosures

Department of Transportation
Reply to General Accounting Office Draft Report of May 24, 1991, on
Transportation Infrastructure: The Outlook for Preserving the
Interstate Highway System is Not Encouraging

Summary of GAO Conclusions and Recommendations

The House Committee on Public Works and Transportation requested that the GAO examine (1) the condition of the Interstate System and the outlook for future preservation needs, and (2) Federal and State efforts to ensure that the Interstate System is adequately maintained, and (3) the factors that influence Interstate pavement deterioration.

The GAO reported that:

1. Interstate conditions are not expected to improve even if 4R funding levels were substantially increased,
2. Interstate capacity enhancement needs increasingly will compete with preservation needs, and
3. The Department has not established goals for minimum acceptable Interstate pavement conditions or a strategy for achieving those goals.

Additionally, the GAO reported that State maintenance practices and Federal Highway Administration (FHWA) oversight are not ensuring that the Interstate Highway System is adequately maintained. The GAO contends that the Interstate 4R program (which includes work that is substantial in scope, extends the service life of the facility or component thereof, and/or enhances safety and/or replaces or renovates a failed component of the highway facility which has served its useful life) provides a disincentive for States to fund preventive maintenance.

Based on these findings, the GAO recommends that the Secretary of Transportation direct the Federal Highway Administrator to work closely with the States to develop minimal standards, by State, for maintaining the Interstate Highway System. These standards should become a part of FHWA's inspection and oversight processes for judging the adequacy of State maintenance on the Interstate.

Summary of Department of Transportation Position

We do not concur with the report because the evidence presented by the GAO does not adequately support its conclusions and recommendations and presents a misleading picture of the condition of the Interstate Highway System.

POSITION STATEMENT

The Condition of the Interstate System

The GAO's conclusions and recommendations are based on the finding that the condition of the Interstate is declining. However, the data the GAO uses to support its finding are misleading.

See comment 1.

See comment 2.

The GAO obtained its data on pavement condition ratings from the FHWA's Highway Performance Monitoring System (HPMS). Previous needs reports, which are based on data from the HPMS, have described pavement condition in three broad categories of good, fair, and poor. These descriptions are based on Present Serviceability Rating (PSR) where 5.0 is the best possible pavement condition and 0.0 is the worst possible condition. For Interstate pavements, good pavement condition is described as having a PSR of 3.6 to 5.0, fair pavement is 2.6 to 3.5, and poor pavement is 0.0 to 2.5. For non-Interstate pavements, good pavement condition is described as having a PSR of 3.6 to 5.0, fair pavement is 2.0 to 3.5, and poor is 0.0 to 1.9. These descriptions are not intended to define pavement condition in terms of ride quality, but are intended to provide a general indication of the point where pavement improvement actions should be taken.

The HPMS Field Manual contains a description of pavement conditions to enable the States to visually determine PSR. This description includes a verbal characterization of five categories of pavement condition, and applies to all classes of highways. In the Field Manual, the descriptions indicate that pavement between 0.0 and 1.0 is very poor, 1.0 to 2.0 is poor, 2.0 to 3.0 is fair, 3.0 to 4.0 is good, and 4.0 to 5.0 is very good.

The purpose of the description in the Field Manual is to aid the States in rating pavement condition for reporting HPMS sample sections. The description of the fair category (PSR 2.0 to 3.0) in the Field Manual includes the following sentence: "The riding qualities of pavements in this category are noticeably inferior to those of new pavements, and may be barely tolerable for high speed traffic."

The FHWA believes it would be more accurate to use "poor" plus "low fair" which, in the case of the Interstate would include everything at or below PSR 3.0, when characterizing pavement that provides a "barely tolerable ride." The amount of Interstate pavement rated at PSR 3.0 or lower has been declining throughout the 1980's, from 28.6 percent in 1983 to approximately 25 percent in 1989, not increasing as the GAO's use of the total "fair" category would suggest.

See comment 3.

Acceptance and use of the 42 percent figure leads the GAO to several conclusions, including:

1. Preventive maintenance has declined and, as a result, the Interstate pavement condition has declined.
2. Additional preventive maintenance could reduce capital investment requirements.
3. FHWA's oversight of State maintenance practices has been lax.
4. The Interstate 4R program matching requirements encourage States to allow facilities to deteriorate, resulting in suboptimal investment patterns.

See comment 4.

The DOT believes that the GAO's figure of 42 percent substantially overstates the problem. We believe the GAO has not provided evidence to support their findings even though comprehensive databases are available with which to conduct such analysis. In the absence of such information, we believe that the conclusions are unwarranted.

See comment 5.

All Interstate pavements are aging and significant mileage was put in place within a relatively short period of time in the late 1960's and early 1970's. The fact that they are wearing out is not a cause for program indictment. The Administration's reauthorization proposal recognizes the need to preserve the Interstate System. It (1) significantly increases funding available to the proposed National Highway System, which includes the Interstate System, (2) proposes matching ratios that encourage Interstate System preservation rather than added capacity, and (3) requires pavement management systems in each State for the National Highway System.

One purpose of pavement management systems is to allow States to identify "high fair" pavements before they deteriorate to the point of concern and to improve them in a cost effective manner. Additional funding, combined with this management oversight, should enable States to continue to improve Interstate pavements.

In addition, the States are now reporting the International Roughness Index (IRI) in addition to the PSR as a part of the Annual Highway Performance Monitoring System data submittals. The IRI provides a more consistent, objective, and comparable measurement of pavement roughness among the States and, combined with pavement distress data, will allow the States and FHWA to more effectively determine Interstate System construction and/or maintenance needs.

Interstate Maintenance

See comment 6.

The GAO's overall discussion of highway maintenance appears to confuse maintenance activities with more capital-intensive activities such as 3R/4R type of work. As defined in 23 U.S.C. 101, maintenance is the "...preservation of the entire Highway..." and does not include activities like "upgrading shoulders" (p.12). The GAO also fails to make this distinction in their discussion of 3R/4R program and funding levels (p. 23). This confusion in the definition of "maintenance" as it relates either to program eligibility, actual State funding practices, or to resulting system condition and performance, needs to be clarified before any clear assessment of program adequacy can be made.

Now on p. 21.

See comment 7.

Additionally, the GAO found that the States are not performing needed Interstate maintenance. While the GAO indicates that several States have significant maintenance backlogs, they fail to define what a maintenance backlog is and explain if these backlogs have affected the safety and rideability of the pavement, or if the pavement life was adversely affected. At least in one State identified by the GAO, the maintenance backlog consists of both routine maintenance costs as well as costs for 3R/4R work.

Appendix I
Comments From the Department
of Transportation

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See comment 8.

The GAO also reported that the Interstate 4R program provides a disincentive for States to perform preventive maintenance. The GAO does not provide any evidence to support their conclusion that States have deferred preventive maintenance in order to qualify for Federal 4R funds. This would seem to contradict the most recent data that indicates that spending on maintenance by all levels of government has experienced a steady upward trend since the beginning of the 4R program in 1976.

The amount of Federal funds provided to States is substantially fixed based on apportionment formulas. The selection of projects does not affect the total amount of Federal funds provided. It would be pointless for the States to avoid preventive maintenance in the hopes of garnering additional Federal-aid.

See comment 9.

Additionally, the report states that the Federal-Aid Highway Act of 1981 further expanded the Federal role by allowing Federal funding of reconstruction activities. It also states that previously these activities had been entirely State financed (p. 12). We do not agree with these statements.

Now on p. 13.

These activities were part of the Interstate completion estimate and were added to the 3R program to get them out of the Interstate Completion Program. The Federal share for 3R was increased when these "construction" components were added so that the States explicitly would not be encouraged to skew their funding to the 4th R (reconstruction).

FHWA Oversight

See comment 10.

Finally, the GAO believes there are weaknesses in FHWA's oversight of State maintenance activities primarily because the FHWA has not established measurable, national criteria or standards for what constitutes adequate maintenance. The GAO believes that without measurable criteria, the FHWA does not have a basis for determining whether maintenance is adequate. The DOT does not agree. The GAO has not established a need for definitive, national criteria in addition to the existing agency directives on FHWA maintenance inspections and programs. The FHWA believes that these directives provide sufficient guidance for devoting resources to maintenance adequacy determinations and will continue monitoring the States' Interstate maintenance through a program of regular inspections.

MATTERS FOR CONSIDERATION BY THE CONGRESS

The GAO suggested that when reauthorizing the Federal-aid highway program, the Congress may wish to consider directing the Secretary of Transportation to:

- o establish goals for the condition of the Interstate Highway System;
- o require minimum investment levels in Interstate pavement projects on a State-by-State basis where Interstate pavement conditions fall below DOT's condition goals, and monitor State progress in meeting those goals;

- o expand the eligibility parameters of the 4R Program to include preventive maintenance activities directed at preserving the life of the Interstate pavement; and
- o direct the Secretary of Transportation to report to the Congress on Interstate maintenance investment requirements and expenditures nationwide and on progress in achieving adequate Interstate maintenance and preservation.

DOT Position

See comment 11.

The GAO's suggestion to establish goals and minimum investment levels is based on their belief that capacity needs will increasingly compete with the preservation aspects of the 4R program (reconstruction, rehabilitation, resurfacing, and restoration). Without additional evidence, we do not believe that GAO's conclusion is a basis for developing a major change in the Federal-State relationship. If this suggestion were implemented, the FHWA, not the States, would direct the selection of the projects. The GAO also notes that in spite of increased spending from 1981 through 1989, the amount of funds directed towards capacity enhancements still only constituted 13 percent of all 4R expenditures in FY 1989. This would seem to contradict their conclusion that capacity needs will compete with preservation.

See comment 12.

See comment 13.

Additionally, the DOT believes that the GAO's suggestion for expanding the parameters of the 4R program to include preventive maintenance is premature in the absence of any substantive evidence that it would improve the condition of the Interstate. We have, in place, both basic and applied research efforts to more adequately assess the relationship between extended service life and corrective pavement maintenance. If the results indicate that life-cycle pavement costs can be substantially benefitted by program changes, DOT will carefully weigh and recommend appropriate legislative and program changes.

GAO RECOMMENDATIONS

The GAO recommends that the Secretary of Transportation direct the Federal Highway Administrator to:

1. Work closely with the States to develop minimal standards for maintaining the Interstate Highway System. These standards should become a part of the FHWA's inspection and oversight process for judging the adequacy of State maintenance on the Interstates.
2. Revise FHWA's Maintenance Manual to require a consistent level of effort by the division offices when physically inspecting the Interstate Highway System. The manual should specify (1) the desired level of detail for conducting inspections and for reporting inspection results, and (2) the procedures for following up on identified deficiencies, particularly safety-related deficiencies.

DOT Position

See comment 14.

The GAO's recommendation that the FHWA develop minimal standards for maintaining the Interstate would be similar to the existing requirements of 23 U.S.C. 109 (m) that require the Secretary of Transportation to develop "...guidelines describing criteria applicable to the Interstate System in order to ensure that the condition of these routes is maintained at the level required by the purposes for which they were designed."

This requirement created a great deal of concern among the States when the FHWA initiated rulemaking to implement it. The primary concern of the States was that maintenance guidelines should be developed by the States and not the FHWA since the States are the responsible party for all maintenance. The States feared that the establishment of Federal requirements for maintenance would significantly increase their tort liability. The final rulemaking agreed with the States' arguments and allowed each State to develop guidelines for maintenance of the Interstate System.

States have developed adequate Interstate maintenance programs that have been approved by the FHWA. The FHWA will continue Interstate inspections to ensure that the States are fulfilling their maintenance programs.

See comment 15.

The DOT strongly supports the preservation of the Interstate and has included a number of provisions in the reauthorization legislation designed to accomplish that, including:

1. A higher Federal matching share for 3R purposes (and the "removal" of the 4th R--reconstruction--from this higher match into the National Highway Program (NHP) construction category which is funded at 75 percent).
2. A requirement that all States implement a pavement management system.
3. A new provision that will require a State to program the amounts needed from its NHP apportionment if it is not adequately maintaining the Interstate System.

The following is GAO's response to the Department of Transportation's (DOT) comments contained in a letter dated June 5, 1991.

GAO Comments

1. DOT states that it does not concur with the conclusions and recommendations contained in chapter 2 because they are predicated on the finding that the condition of the Interstate system is declining. However, we did not, in the draft provided to DOT or in the final report, conclude that the condition of the Interstate system is declining. We reported that, according to data that DOT has provided to the Congress, overall Interstate conditions, as reflected by the amount of pavement classified as fair or poor, did not improve during the 1980s. We further concluded, on the basis of DOT's 1989 highway needs report and subsequent information developed by FHWA's Office of Policy Development, that the capital investment required to either improve or maintain current Interstate conditions outstrips current and proposed funding levels.

2. We obtained data from FHWA's Highway Performance Monitoring System (HPMS) and reported the Interstate conditions using FHWA's official categories for classifying Interstate conditions—good, fair, and poor. DOT suggests that we use new pavement condition categories; FHWA officials said that these new categories would be used in the 1991 biennial highway needs report to the Congress, which was under review by the Administration when we conducted our review. These new categories divide the fair category (2.6 to 3.5 PSR rating) into two new categories, "low fair" (2.6 to 3.0) and "high fair" (3.1 to 3.5). DOT has not published condition ratings using these categories, and during our review we requested, but were not provided with, a copy of DOT's draft 1991 needs report. However, on the basis of the explanation contained in DOT's letter, we believe the new categories could present a misleading and overly optimistic picture of the condition of the Interstate system. DOT would combine pavement in the upper half of the fair category ("high fair") with good pavement, and pavement in the lower half of the fair category ("low fair") with poor pavement, to show that the amount of Interstate pavement providing a barely tolerable ride decreased during the 1980s. This classification conveys the impression that "high fair" pavement is no more cause for concern than pavement rated in good condition. But "high fair" pavement is nearing the need for resurfacing. According to AASHTO's Guide for Design of Pavement Structures (1986), Interstate pavement in the 2.5 to 3.0 PSR range ("low fair") is in need of resurfacing. Since pavement deteriorates rapidly once it reaches fair condition, "high fair" pavement is nearing the need for resurfacing. In addition, "high fair" pavement is in noticeably worse condition than

good pavement. DOT's data show that "high fair" pavement increased nearly 17 percent from 1983 to 1989—possibly signaling an acceleration of rehabilitation needs on the Interstate system.

3. DOT states that our having accepted that 42 percent of the Interstate system is in fair or poor condition has led us to four conclusions. However, DOT's presentation of our conclusions is inaccurate. We did not conclude that the condition of the Interstate has declined as a result of a decline in preventive maintenance. As we discuss in chapter 3, multiple factors influence pavement conditions, including vehicle weight and the environment. We have revised chapter 2 to reflect this. Also, we reached no conclusions as to whether state-funded preventive maintenance had improved or declined over time. We found that preventive maintenance is a cost-effective means of slowing pavement deterioration caused by multiple factors and can delay the need for costly 4R resurfacing and rehabilitation projects. This finding is based on the consensus of numerous pavement studies conducted by TRB and others. We also did not base our conclusion that weaknesses existed in FHWA's oversight of state maintenance practices on the fact that 42 percent of the nation's Interstate pavement is in fair or poor condition. We reached this conclusion by reviewing FHWA inspection plans, procedures, and reports and discussing them with division engineers and managers in seven FHWA division offices. Our conclusions are further supported by the lack of such inspections and reports in Ohio. Finally, we did not base our conclusion regarding the disincentives in the federal 4R Program on the fact that 42 percent of the nation's Interstate pavement is in fair or poor condition. The basis of this conclusion is discussed further in comment 8.

4. DOT's letter suggests that we did not examine available comprehensive data bases to more accurately determine the condition of the Interstate system. We examined data generated by FHWA's Highway Performance Monitoring System (HPMS), the only data base for measuring Interstate pavement conditions and comparing national conditions from year to year and the basis of the data that DOT reports to the Congress on the condition of the Interstate Highway System. Since receiving DOT's letter, we have confirmed with FHWA's Highway Needs and Investment Branch Chief that no other data bases on the condition of the Interstate system were available for our review. This official stated that this comment was intended to convey DOT's belief that we should have examined financial data bases that reflect federal projects and investment levels by state. We were aware of these data bases but did not use them in the

report because they do not record state investment in preventive maintenance, the severity and extent of maintenance deficiencies, the resources required to improve conditions, or progress in improving Interstate maintenance.

5. We have revised the final report to reflect, as DOT notes, that FHWA is encouraging states to use the International Roughness Index (IRI) and is requiring states to develop pavement management systems for use on the National Highway System. We recognize—in the draft provided to DOT and in the final report—that all pavement deteriorates with age and use; this recognition does not represent an “indictment” of the federal program. We disagree with DOT’s contention that funding proposed for the National Highway System will “significantly increase” funding for Interstate preservation. The amount of funding proposed for Interstate preservation by DOT in fiscal year 1992 cannot be precisely determined because, under the Department’s reauthorization proposal, the Interstate 4R Program would be merged with other activities and it is difficult to predict how states will respond to the new flexibility. However, FHWA’s Office of Policy Development projects that states will use between \$2.1 billion and \$2.5 billion of the National Highway Program’s proposed \$7.7-billion fiscal year 1992 authorization for those activities now funded under the Interstate 4R Program. This amount is less than the \$2.8 billion provided in fiscal year 1991.

6. DOT states that our report appears to confuse maintenance with the more capital-intensive Interstate 4R type of work because we included “upgrading shoulders” as an example of state-funded preventive maintenance in chapter 1 of the draft report. We agree that this term is more descriptive of a federally eligible 4R project and have deleted it from the final report. We have used the definitions of preventive and corrective maintenance contained in a survey conducted for the Transportation Research Board (TRB) in December 1989 entitled Evolution and Benefits of Preventive Maintenance Strategies. During our review, FHWA officials told us that no one single federal definition for state-funded maintenance exists because states define maintenance differently. For example, some states define it as all activities that are not initial construction, while others limit the definition to snow, ice, and litter removal. Maintenance is defined in 23 U.S.C. 101 as “preservation of the entire highway, including surface, shoulders, roadsides, structures, and such traffic control devices as are necessary for its safe and efficient utilization.” Capital-intensive preservation activities receive federal funding. We have referred to these activities—resurfacing, rehabilitation, restoration and reconstruction—by those terms to avoid confusion

with preventive and corrective maintenance activities that are entirely state funded.

7. Our conclusion that four of seven states had substantial maintenance backlogs was based on evidence presented by state transportation department engineers and managers and our examination of inspection reports prepared by FHWA division engineers in seven states. State officials and FHWA's inspection reports provided data on the nature and extent of deficiencies, the impact of deficiencies on structures and safety, and the resources required to correct deficiencies. We did not quantify how these maintenance deficiencies affect pavement life, as DOT suggests, because FHWA does not collect the data on state maintenance needs that are necessary to conduct such analysis. The four states cited in our report also reviewed a draft of this report and agreed that maintenance backlogs exist. DOT correctly notes that, in the draft report, we aggregated the cost of deferred restoration and preventive maintenance backlogs in Pennsylvania. In the final report we separated these two classes of costs.

8. We have revised the final report to correct any impression that states were deferring preventive maintenance in order to qualify for additional 4R funds. We recognize that federal 4R Program apportionments are based on a state's Interstate mileage and Interstate vehicle miles traveled, not on a state's maintenance practices or the condition of its Interstate highways. The issue is one of state resources—because all states have limited resources, they must allocate state funds among many competing priorities. Our field work in the seven states, as well as studies conducted by CBO and for TRB, revealed that a major priority of the state transportation programs was to select highway projects with a relatively high federal contribution because of the substantial economic benefits that the influx of federal funding provides. DOT seems to recognize this preference in its reauthorization proposal. The Department proposes funding Interstate preservation at a higher federal matching share than Interstate capacity enhancement (except for construction of high-occupancy vehicle lanes) to encourage states to select preservation projects over capacity projects. DOT states that maintenance funding has increased nationwide since 1976. However, this statistic refers to spending by all levels of government on all roads, including local roads. We examined FHWA's data on state maintenance funding on the Interstate but found that they were not reliable because data from many states were missing or incomplete. In 1980 FHWA reported missing or incomplete data from 28 states and the District of Columbia. While this

situation has gradually improved, in 1989 FHWA reported missing or incomplete data from 11 states and the District of Columbia.

9. DOT notes that Interstate reconstruction activities received federal assistance before 1981 under the Interstate construction program. In the final report, we have deleted the statement that these activities had been entirely state financed before 1981.

10. Our conclusion that measurable maintenance standards are needed was based on our finding that although four of the seven states we visited had significant unmet maintenance needs, FHWA had certified that these states were providing adequate Interstate maintenance. In the draft provided to DOT, we did not, as its letter states, conclude that "definitive national criteria" were needed. To the contrary, we explicitly recognized that a national standard might be excessively rigid and that standards are best developed at the state level, as some states are doing. DOT states that existing directives "provide sufficient guidance for devoting resources to maintenance adequacy determinations." However, these directives provide no definition of adequate maintenance to assist division managers in determining whether a state has an adequate state maintenance program. In discussing this recommendation with cognizant FHWA headquarters officials, we asked how FHWA determines that a state is providing adequate maintenance in the absence of measurable criteria. One official said, "I know it when I see it." Establishing minimum criteria for adequate maintenance appears needed under DOT's own reauthorization proposal. The proposal states that "if the Secretary finds that a State is not adequately maintaining the Interstate System, the Secretary will require the State to program amounts from its National Highway Program apportionments to bring the Interstate System up to adequate condition and keep it in that condition." As a matter of fairness, states should have the benefit of a measurable standard delineating what is expected of them under this proposal.

11. Establishment of Interstate pavement goals and a strategy for achieving them is warranted by the 42 percent of the Interstate system that is in fair or poor condition and by DOT's projection that little prospect exists for improving Interstate conditions. Protecting the substantial federal investment in the Interstate system is clearly in the national interest. We believe that clearly established goals and a strategy for achieving them are needed to provide a framework for monitoring and measuring the progress of federal and state Interstate preservation efforts. DOT believes that our matters for congressional consideration would entail a major change in the federal-state relationship that would

result in FHWA, instead of the states, selecting projects. However, DOT's own reauthorization proposal would provide the Secretary with new authority to require states to program funds to bring the system up to adequate condition if the Secretary finds that a state is not adequately maintaining the Interstate. We believe that this proposal recognizes the importance of Interstate preservation efforts, but that Interstate condition goals and a strategy for achieving them are needed to establish an equitable benchmark for both DOT and the states to measure the progress of these efforts.

12. Our conclusion that capacity needs will increasingly compete with preservation needs was based on data developed by FHWA and contained in DOT's 1989 highway needs report to the Congress, The Status of the Nation's Highways and Bridges: Conditions and Performance. DOT estimated that about 50 percent of Interstate 4R Program investment requirements between 1987 and 2005 would be needed for capacity-enhancing "major widening." DOT made this projection while also explicitly recognizing in the highway needs report that 13 percent of actual Interstate 4R Program expenditures in fiscal year 1989 were used for major widening. In addition, in testimony before the House Appropriations Committee on the Department's fiscal year 1990 budget, DOT, noting that no improvements were made in Interstate conditions between 1985 and 1987, stated that "this is attributable in part to State prioritization of capacity improvements over pavement improvements." FHWA's Office of Policy Development provided data showing that the percent of peak-hour travel on the urban Interstate system that occurred under congested conditions grew tremendously during the 1980s, from 55 percent in 1983 to nearly 70 percent in 1989. DOT recognized the emerging capacity problem in its reauthorization proposal by proposing that states receive a higher federal matching share for Interstate resurfacing, rehabilitation, and restoration projects than for Interstate capacity enhancement projects (except for high-occupancy vehicle lane projects).

13. We discussed ongoing pavement research studies with the office of FHWA's Associate Administrator for Research, Development and Technology, TRB, and the Director of the Strategic Highway Research Program (SHRP). The principal research effort to measure the relationship between preventive maintenance and pavement service life is SHRP's Long Term Pavement Performance study. We agree that this study has great potential to add substantially to existing knowledge of the relationship between preventive maintenance and extended service life.

However, it is a 20-year study, designed to evaluate a number of pavement performance issues over the life cycles of selected pavements. According to an FHWA official, the results of the preventive maintenance studies will not be known for 10 to 20 years. Reauthorization of the federal-aid highway program in 1991 provides a timely opportunity for the Congress to effect program changes that could better direct federal resources to the areas of greatest need. We believe that the consensus of existing research—that preventive maintenance is effective in extending pavement life—and our findings on Interstate maintenance provide a sufficient basis to justify expanding the eligibility parameters of the 4R Program at this time.

14. In 1980, following passage of the Surface Transportation Assistance Act of 1978 (and the provision DOT cites in its letter), DOT required each state to develop Interstate maintenance guidelines and to certify adequate maintenance of the Interstate annually in accordance with these guidelines. While these guidelines and annual updates contain useful information on state maintenance budgets and program priorities, they do not contain measurable standards for evaluating what constitutes adequate maintenance. We agree that standards are best developed at the state level, as some states are doing. While increased risk of liability is a question that should be resolved between FHWA and the states, we do not believe that this question alone should prevent states from establishing measurable maintenance standards. As we reported, we found measurable maintenance standards in use in Florida since 1985 and were informed that other states were developing similar systems.

15. We believe that DOT's proposals to provide a higher federal matching share for preservation and to require states to develop pavement management systems and adequately maintain the Interstate are important steps toward the goal of preserving the Interstate. We have reviewed our report to ensure that it fully reflects these proposals.

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