

GAO

Report to the Chairman, Subcommittee
on Government Management,
Restructuring, and the District of
Columbia, Committee on Governmental
Affairs, U.S. Senate

February 1997

TRANSPORTATION INFRASTRUCTURE

Managing the Costs of Large-Dollar Highway Projects





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

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

B-270823

February 27, 1997

The Honorable Sam Brownback
Chairman, Subcommittee on
Government Management, Restructuring,
and the District of Columbia
Committee on Governmental Affairs
United States Senate

Dear Mr. Chairman:

In response to the request of the former Chairman of the Subcommittee, this report addresses the Federal Highway Administration's oversight of large-dollar highway projects.

As agreed with your office, 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; and other interested parties. We will also make copies available to others upon request.

If you have any questions concerning this report, please contact me at (202)512-2834.

Sincerely yours,

A handwritten signature in cursive script that reads "John H. Anderson, Jr.".

John H. Anderson, Jr.
Director, Transportation Issues

Executive Summary

Purpose

Each year, the federal government distributes nearly \$20 billion to the states for the construction and repair of the nation's highways. To meet the nation's transportation needs, states are planning or building large-dollar projects to both replace aging infrastructure and build new capacity. These large-dollar projects represent a substantial investment of federal and state funds. Moreover, because the Department of Transportation projects a \$16 billion annual shortfall in funding from what is needed just to maintain the condition and performance of the nation's highways at the 1993 level, it is essential that highway projects be well managed to ensure that costs are accurately estimated and controlled and that federal and state funds are efficiently used.

Concerned about reports of increases in the costs of ongoing large-dollar highway projects, the former Chairman, Subcommittee on Oversight of Government Management and the District of Columbia, Senate Committee on Governmental Affairs, asked GAO to assess the effectiveness of the Federal Highway Administration's (FHWA) oversight of the costs of large-dollar highway and bridge projects. The Subcommittee defined large-dollar projects as those projects with a total estimated cost of over \$100 million. In particular, the Subcommittee asked GAO to (1) determine if large-dollar highway projects experience cost growth, (2) identify how FHWA approves large-dollar highway projects and agrees to their costs, and (3) identify how FHWA ensures that project costs are controlled and that federal funds are efficiently used. GAO also presents information on practices to manage the costs of projects that are being used in some of the six states that GAO visited and, because of the upcoming reauthorization of highway programs in 1997, observations on the federal role for managing the costs of large-dollar projects.

Background

Because FHWA does not maintain a national database that would provide the total number of active federal-aid projects with a total estimated cost of over \$100 million, GAO reviewed environmental impact statements that had been filed with the Environmental Protection Agency between 1988 and 1993 to identify 30 active projects that were receiving federal funds. These projects were estimated initially to cost between \$101 and \$695 million and were in various stages of development.

A highway or bridge construction or repair project has four stages: (1) planning, (2) environmental review, (3) design and property acquisition, and (4) construction. After an initial cost estimate is developed for the overall project in connection with the environmental

review stage, a large-dollar project is usually divided into smaller, more manageable, segments for design and construction. The federal government generally provides funds for 80 percent of the total costs of a federal-aid project. While states are responsible for planning, selecting, designing, and constructing the project, FHWA is responsible for ensuring that applicable federal laws and regulations are met and for approving the expenditure of federal funds.

The extent of direct oversight by FHWA for a project depends on its cost, location, and type of work. Generally, FHWA has “full” oversight responsibility for new construction or reconstruction (replacing rather than rehabilitating a road) projects on the National Highway System with an estimated cost of \$1 million or more.¹ This oversight includes approving design and construction specifications, periodically inspecting construction sites, and formally accepting completed projects. States have the authority to exempt other projects from this type of oversight. FHWA oversees and administers funding for federally aided projects through its 52 division offices, located in each state, the District of Columbia, and Puerto Rico.

Results in Brief

Cost growth has occurred on many of the large-dollar highway projects that GAO examined. However, the amount of and reasons for increases beyond the initial cost estimates on large-dollar highway projects cannot be determined because data to track this information over the life of projects are not readily available from FHWA or state highway departments. GAO developed limited data showing that as of August 1996, costs on 23 of 30 ongoing projects initially estimated to cost over \$100 million had increased from their initial estimates, while estimates on 7 projects had decreased or had remained the same. However, determining if some portion of the cost increases on those projects GAO reviewed could have been minimized is difficult because of the lack of reliable data.

FHWA’s project approval process consists of a series of incremental actions that occur over the period of years required to plan, design, and build a project. FHWA approves the estimated cost of a large-dollar project in segments when those project segments are ready for construction, rather than agreeing to the total cost of the project from the outset. By the time FHWA approves the cost of a large-dollar project, a public investment

¹Designated in 1995, the 160,000 mile National Highway System, consists of the Interstate Highway System and other principal arterial routes that serve major population centers, international border crossings, national defense requirements, and interstate and interregional travel needs. Other highways and roads make up the 4 million miles of roads in the United States.

decision may have effectively been made because substantial funds will already have been spent on designing the project and acquiring property, and much of the increases in the project's estimated costs will have already occurred. While many factors can cause costs to increase, GAO found several factors that worked together to increase costs beyond the initial estimates for projects in the six states visited: (1) initial estimates are preliminary and not designed to be reliable predictors of a project's cost, (2) initial estimates are modified to reflect more detailed plans and specifications as a project is designed, and (3) a project's costs are affected by, among other things, inflation and changes in scope to accommodate economic development that occurs over time as a project is designed and built.

Cost containment is not an explicit statutory or regulatory goal of FHWA's "full" oversight. As such, FHWA has done little to ensure cost containment is an integral part of the states' project management. FHWA influences the cost-effectiveness of projects by its review and approval of design and construction plans and through daily interaction with state departments of transportation. Some states GAO visited have initiated project management practices that focus on cost containment. These practices include preparing, early in a project, estimates that better represent what the project's total cost might be, establishing goals for project cost performance, and tracking progress against these goals. However, FHWA has not been proactive in working with states to evaluate these practices and disseminate information on them to help other states enhance their cost management practices. Moreover, because of the reauthorization of highway programs in 1997, the debate has already begun on the appropriate federal role in funding and overseeing federal-aid highway projects, particularly those that receive substantial federal funds.

Principal Findings

Cost Growth Has Occurred on Large-Dollar Projects; but Data Are Limited

FHWA does not track the cost performance of large-dollar projects because its information system for highway projects is designed to record funds obligated for segments of federally funded projects, rather than to capture complete project-related estimates and costs. In addition, although some states have systems that can potentially be used to track cost estimates and reasons for cost increases over the life of a project, FHWA and state

officials told GAO that states do not maintain this information, and none of the states that GAO contacted did so.

Because data were not available, to obtain an indication of the extent of large-dollar projects' cost growth, GAO identified 30 active projects receiving federal funds whose total costs were estimated to exceed \$100 million. GAO developed data showing that 23 of the 30 projects had costs that increased beyond the initial estimates. These increases ranged from 2 to 211 percent, with about half of the projects' costs increasing by more than 25 percent. Cost estimates on the remaining seven projects either decreased or remained the same.

FHWA Approval Process Is Incremental

When FHWA agrees to the estimated cost of a project segment, a substantial investment of federal funds to design and acquire property for that segment may have already occurred. For example, \$1.3 billion, or about 13 percent, of the estimated \$10.4 billion cost of the Central Artery/Tunnel project in Boston, Massachusetts, is for the design and property acquisition stages of the project. Property acquisition can also substantially affect the public. One new construction project, I-105 in California, displaced 18,200 people before construction could begin.

In addition, most of the cost growth that occurs on a project happens before construction begins. For example, costs on the nearly complete I-595 project in Maryland have increased by over \$200 million from the initial cost estimate—from about \$188 million to about \$390 million. State officials provided data showing that about \$160 million of that \$200 million increase—around 80 percent—occurred before the construction stage. One reason for cost increases is that while initial cost estimates are developed in connection with the environmental review stage, a complete estimate of the total costs of a project is not an objective of the environmental review. Rather, estimates developed at this stage are limited and are not intended to be reliable predictors of a project's total cost or financing needs. They are based on a "rough footprint" that identifies the type of highway or bridge and the number of lanes and interchanges and are rough estimates based on historic per-mile costs and square footage costs for that state. Also, costs increase during the design process as preliminary design concepts are refined into detailed plans and specifications. For example, detailed soil investigations and environmental testing can reveal engineering or other problems that were not known earlier and that can substantially increase costs. Furthermore, because a large construction project takes several years to progress through the

environmental and design stages to construction, its costs can increase as changes occur to address, among other things, increased economic development and environmental or other new laws. Projects may also be “stretched out” to accommodate federal and state funding cycles, thus increasing costs if for no other reason than the effects of inflation.

FHWA’s Oversight of Large-Dollar Projects Does Not Focus on Cost Containment

The primary goal of FHWA’s oversight is to ensure that federal-aid highway projects managed by state departments of transportation meet applicable federal safety and quality standards. In this capacity, FHWA influences the cost-effectiveness of projects and can increase or decrease project costs. For example, in Arkansas, FHWA’s suggestion that the state use smaller drainage structures on the U.S. 71 new construction project reduced the project costs by about \$2.6 million. Conversely, FHWA’s request that Massachusetts upgrade the design for tunnel reconstruction on one segment of the Central Artery/Tunnel project to meet interstate speed and safety design standards added \$46 million to the project’s costs.

With no statutory requirement to focus on project costs, FHWA has generally not established requirements nor encouraged states to put management procedures or mechanisms in place to contain costs. In 1995, however, the Secretary of Transportation announced that, for any project estimated to cost over \$1 billion, state highway departments would be required to develop a finance plan describing the total cost of that project and the sources of funding over the life of the project. Such a plan helps to focus attention on project costs so that decisions can be made to reduce costs or to obtain additional financing if costs increase. To date, the requirement has applied only to the Central Artery/Tunnel project in Boston, Massachusetts, and to the reconstruction of Interstate 15 in Salt Lake City, Utah. GAO is currently reviewing the most recent Central Artery/Tunnel project finance plan to determine how funding shortages will be addressed. A finance plan has not been completed for the I-15 project in Utah.

GAO found several positive practices that states had initiated to focus more specifically on containing project costs. These practices included improving the quality of initial cost estimates, establishing cost performance goals and strategies, and using external review boards to approve cost increases. Although it disseminates information to state departments of transportation on a wide variety of technical and research topics, GAO found that FHWA does not evaluate and disseminate among all the states information on their best cost management practices. Being

more proactive in this regard could provide states with strategies that could contain project costs and promote more cost-effective project management.

Moreover, while specific cost management practices will certainly not preclude all increases in project costs, they could help foster a culture that emphasizes cost containment without impinging on safety or quality. They could also give states an early warning of the need to develop cost control or financing solutions before problems occur. For example, while GAO is currently assessing the progress made by the Central Artery/Tunnel project to achieve its cost containment goals, the project's most recent finance plan stated that managing the project to cost performance goals has allowed the project to emphasize cost control on a day-to-day basis, control proposed changes, and identify potential cost increases early.

Observations on the Federal Role in Project Cost Management

As reauthorization of highway programs approaches in 1997, debate has already begun about the federal role in funding and overseeing highway projects. Some argue that the federal role should be reduced by returning the majority of revenues from federal gas taxes back to the states, which would give states more flexibility in using these revenues and reduce the cost and time involved in complying with federal requirements. Others believe that continuing the existing federal role is appropriate to ensure that the national objective of preserving our interconnected highways is accomplished.

Ultimately, the Congress and the administration will decide on the most appropriate federal role in large-dollar highway projects. Cost management of these projects is just one part of the federal government's role. If appropriate, expanding that part could take the form of requiring the states to enhance their cost management practices by using some of the same strategies some states already use, such as establishing baseline cost estimates as well as goals and strategies for cost performance. Such strategies have the potential to promote more effective and efficient use of limited federal and state highway dollars and control the cost growth that could adversely impact the funding available for other projects. A more active role for FHWA in overseeing state management of project costs is another scenario. FHWA's involvement could help to ensure the reasonableness of cost estimates and financing plans as well as the progress in meeting cost performance goals.

Recommendation

GAO recommends that the Secretary of Transportation direct the Administrator, FHWA, to work with the states to evaluate information on the best state practices concerning cost management and to disseminate this information to all states to enhance their ability to manage costs on large-dollar highway projects.

Agency Comments

We provided copies of a draft of this report to DOT and FHWA for their review and comment. FHWA officials who reviewed the draft, including the Associate Administrator for Program Development, generally concurred with the information contained in the report and agreed with the recommendation

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Abbreviations

AASHTO	American Association of State and Highway Transportation Officials
DOT	Department of Transportation
EIS	environmental impact statement
FHWA	Federal Highway Administration
FMIS	Fiscal Management Information System
GAO	General Accounting Office
ISTEA	Intermodal Surface Transportation Efficiency Act
NHS	National Highway System
NEPA	National Environmental Policy Act
OMB	Office of Management and Budget
PS&E	plans, specifications, and estimates
STIP	Statewide Transportation Improvement Program

Introduction

Under the federal-aid highway program, billions of dollars are distributed annually to the states for construction and repair of highways, bridges, and other activities. Federal funding is channeled through federal-aid projects—a state enters into a project agreement with the federal government for the planning, design, or construction stages of a highway project. In these agreements, the federal government agrees to pay for a portion of the project as specified in law—usually 80 percent—while the state agrees to provide the remaining needed funds and to undertake the project in accordance with applicable federal laws, regulations, and standards. The Federal Highway Administration (FHWA) oversees the state’s management of these projects and administers funding through its 52 division offices located in each state, the District of Columbia, and Puerto Rico.

The Focus of the Federal-Aid Highway Program Has Changed

From 1956 until the early 1990s, the focus of the federal-aid highway program was construction of the 44,000 mile Interstate Highway System—now a component of the National Highway System.² The Interstate Highway System was built on a “cost-to-complete” basis—projects received federal funding annually through the Interstate Construction Program based on the estimated costs of building the specific projects needed to complete the Interstate System. State highway departments were required to build the system in accordance with federally-endorsed design and construction standards. FHWA exercised “full” project oversight over interstate construction projects, approving design and construction specifications, periodically inspecting construction sites, and formally accepting the final product.

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) brought about major changes to the federal-aid highway program. The Congress acknowledged that the Interstate Highway System was nearly complete and authorized final funding for the Interstate Construction Program which was distributed in fiscal year 1995. Consequently, because this category of project-specific funding is no longer available, most projects receiving federal aid compete within a state for other categories of federal funding that are provided by formula annually to each state.

ISTEA also changed the nature of federal oversight. Prior to ISTEA, FHWA had begun to move away from “full” oversight, which focused on specific projects, to oversight of each state’s ability to manage and oversee

²Designated in 1995, the 160,000 mile National Highway System consists of the Interstate Highway System and other principal arterial routes that serve major population centers, international border crossings, national defense requirements, and interstate and interregional travel needs.

construction projects. ISTEA devolved even greater authority to the states by allowing a large number of projects to be exempted from “full” FHWA oversight. As a result, generally new construction projects or reconstruction projects—removing and replacing the roadway instead of rehabilitating existing pavement—on the National Highway System with an estimated cost of \$1 million or more require “full” FHWA oversight.³ Appendix I describes in greater detail the legal requirements and states’ choices concerning federal oversight of highway projects.

Within the “full” oversight category, FHWA realized the need to be more involved on very costly projects. As a result, the Secretary of Transportation announced in February 1995 that FHWA would require states with federally assisted projects estimated to cost over \$1 billion to submit a finance plan to FHWA describing the costs of the project and how it would be financed. At that time Massachusetts was the only state required to submit a finance plan, for the Central Artery/Tunnel project. FHWA is now requiring a finance plan from Utah for the reconstruction of Interstate 15 in Salt Lake City. However, as of December 1996, FHWA had not provided guidance to the states on what stage of a project a finance plan is required or the factors that should be included in the plan.

A Continued Need Exists for Large-Dollar Projects

Although the Interstate Highway System is substantially complete, states continue to plan large-dollar projects to meet highway reconstruction and new capacity needs. Some of these projects can involve substantial federal and state funds. For example, between 1988 and 1993, the states filed 38 draft environmental impact statements with the Environmental Protection Agency for projects estimated to cost more than \$100 million. As of 1994, over 24 percent of bridges on the Interstate System were structurally or functionally deficient, meaning they required significant maintenance or were not sufficiently wide or high enough to serve the current traffic demand. Reconstruction or replacement can be expensive—for example, a project to replace the Woodrow Wilson Bridge and adjacent interchanges on Interstate 95 near Washington, D.C., is estimated to cost around \$1.5 billion.⁴

³A preexisting provision of law—certification acceptance—allows states to avoid full review of projects not on the Interstate Highway System by a certification by the state if FHWA finds that projects being carried out under state laws, regulations, directives, and standards will accomplish the policies and objectives of federal law.

⁴Because the Woodrow Wilson Bridge is a federally owned bridge, it will be managed differently than a conventional highway project that receives federal aid. However, it illustrates the potential costs for future projects to replace bridges. The estimated cost of replacing the bridge alone, without any of the work on the interchanges, is over \$400 million.

FHWA estimates that around 35 percent or 15,000 miles of the nation's 40-year old Interstate Highway System is in poor or mediocre condition and will require reconstruction immediately or within the next 5 years. In Utah, reconstructing and widening of Interstate 15 is estimated to cost more than \$1 billion. In addition, many states and regions are planning new capacity. For example, in passing ISTEA in 1991, the Congress found that many regions of the nation were not adequately served by the Interstate System or comparable highways and identified 21 high-priority corridors to be developed on the National Highway System to help meet the demands for increased capacity. Also, some states continue to sponsor ambitious infrastructure development programs. For example, Arkansas is constructing U.S. Route 71 throughout the state; the next phase—from Texarkana to Fort Smith—is now estimated to cost \$1.4 billion. Most of these large-dollar projects are new construction or major reconstructions of highways on the National Highway System and will fall under “full” FHWA oversight.

How to Build a Federal-Aid Highway

Applying for and receiving federal reimbursement designates a project as federal-aid. A state has wide latitude in defining a project throughout the four stages of project development—planning, environmental review, design and property acquisition, and construction. Once planning and environmental review are completed, large-dollar projects are frequently divided into smaller, more manageable segments for design and construction. For example, if a state is building a 20-mile highway, it may apply for federal funds for the planning and environmental review for the entire 20 miles as one federal-aid project, while breaking the project into four 5-mile segments for the design and construction stages. In this report, “project” is used to refer to an entire project, while “segment” refers to a portion of that project.

FHWA has a role throughout the four stages of the project development process; this role ranges from approving a state's long-range transportation plan to approving a change to a specific construction contract. Chapter 3 provides the details about FHWA's role for each of the stages.

Planning Stage

Each state is required through ISTEA and earlier authorizing legislation to prepare both a statewide long-range transportation plan and a short-range statewide transportation improvement program (STIP). The long-range plan identifies the state's transportation needs and proposed projects for at

least the next 20 years, but may not identify specific projects. For example, while the plan may discuss a highway corridor that is likely to become heavily congested within the next 15 years, it may not identify a specific solution. In contrast, the STIP covers a shorter timeframe—usually 3 years—and describes specific projects or project segments, including the scope and estimated costs. FHWA requires the states to identify sources of financing that will adequately fund both the statewide transportation plan and the STIP.

Since October 1993, FHWA and the Federal Transit Administration have jointly implemented a new planning tool—the major investment study—to assist state and local transportation decision makers as ISTEA shifted more of the transportation planning and decision making to the state and local level. The major investment study is used where states are considering high-cost and high-impact transportation alternatives. State and local transportation officials use this tool to evaluate multi-modal alternatives to a transportation problem and provide the necessary information to further define specific projects or segments that need to be included in the STIP. This process can occur prior to or in conjunction with the environmental review process.

Environmental Review Stage

Before detailed plans and designs for a proposed highway can be developed, the state's highway agency must first identify and assess the environmental consequences of alternative proposals and make this information available to public officials and citizens, as required by the National Environmental Policy Act (NEPA) of 1969. For projects that will significantly affect the environment, NEPA requires the preparation of an environmental impact statement (EIS), which, among other things, identifies project alternatives and the environmental mitigation efforts required for each alternative and allows an opportunity for public comments. Before the project can proceed to the design and property acquisition stage, FHWA must approve the EIS and issue a record of decision that, among other things, describes the preferred alternative and why it was chosen.

Design and Property Acquisition Stage

After the preferred alternative is selected, a large-dollar project is generally broken into multiple segments. Engineers then prepare design plans and specifications for each segment, including such features as type and thickness of pavement, the width of shoulders, and the placement of noise walls. These plans and specifications include a listing of necessary

materials and construction methods and are prepared in sufficient detail to allow a contractor to construct the project. The specifications are also used to develop a project segment cost estimate precise enough to predict federal and state financial obligations and to effectively review and compare construction bids received.

Construction Stage

After completing the design stage, the state advertises for bids to construct that segment of the project. Once the state has received bids from construction contractors, it awards the construction contract, usually to the lowest responsive bidder. After the contract is awarded, any changes that require changing the scope of the original contract or significantly increasing costs are usually documented in a change order.

Objectives, Scope, and Methodology

Concerned about increases in costs of ongoing large-dollar highway projects, the former Chairman of the Senate Subcommittee on Oversight of Government Management and the District of Columbia, Committee on Governmental Affairs, asked us to examine cost growth on large-dollar projects and the federal government's oversight of them. Specifically, we were asked to (1) determine if large-dollar highway projects experience cost growth, (2) identify how FHWA approves large-dollar highway projects and agrees to the costs, and (3) identify how FHWA ensures that project costs are controlled and that federal funds are efficiently used.

To determine if large-dollar projects experience cost growth, we examined data prepared in 1995 by FHWA at the request of the Senate Subcommittee on Oversight of Government Management and the District of Columbia, Committee on Governmental Affairs on the cost performance of 20 ongoing highway construction projects in 17 states. Estimated total costs for these projects ranged between \$205 million and \$2.6 billion per project. FHWA identified these projects as those with the largest cost increases from the initial cost estimate for the total project.

Because FHWA had specifically chosen the 20 projects that had experienced a large percentage of cost growth, we wanted to examine a universe of large-dollar projects where we did not know whether their costs had increased. Therefore, we examined cost growth on 38 additional projects that had an environmental impact statement filed between January 1, 1988 and October 1, 1993 and had an initial cost estimate of more than \$100 million. For these 38 projects located in 19 states, we surveyed FHWA officials to determine the current cost estimates for the individual

projects, eliminated 8 projects either because the project had not been undertaken or was undertaken without using federal funds, and determined how much costs had grown since the initial estimate on the remaining 30 projects in 15 states.

We obtained information on the reasons for cost growth from FHWA and from state departments of transportation on seven projects. Five of these projects were on the list of 20 projects that FHWA had provided information on to the Senate Subcommittee on Oversight of Government Management and the District of Columbia. These projects were U.S. 71 in Arkansas, I-105 in California, I-595 in Maryland, M-59 in Michigan, and U.S. 183 in Texas. In addition, we examined the I-90/I-93 Central Artery/Tunnel project in Massachusetts and the I-880 Cypress Viaduct reconstruction project in California. We selected these projects to provide geographic diversity and to include a mix of large-dollar new construction and reconstruction projects at various stages of completion. To obtain information about information systems at state highway departments for tracking the projects' costs, we discussed state practices with state transportation officials in the six states we visited and in Colorado, Indiana, Iowa, Maine, Minnesota, Nebraska, Oregon—states identified as having advanced project information systems.

To identify how FHWA approves large-dollar projects and agrees to costs and to identify how FHWA ensures that the costs of projects are controlled and that federal funds are efficiently used, we reviewed federal laws and regulations and interviewed FHWA officials in Washington, D.C., and the six states visited. We also reviewed project documentation at FHWA and the states we visited as well as their regulations and procedures. We discussed the states' project development process and FHWA's role with state transportation officials. We also interviewed FHWA and state transportation officials about federal and state initiatives to contain costs and help ensure efficient use of highway funds and discussed dissemination of state practices to other states and FHWA offices.

We performed our work from May 1996 through December 1996 in accordance with generally accepted government auditing standards.

Data to Track Cost Growth Not Readily Available, but Costs Grew for Many of the Projects for Which We Collected Data

The amount of and reasons for cost increases beyond the initial cost estimates for large-dollar highway projects cannot be determined because data to track this information over the life of a project are not readily available from FHWA or state highway departments. FHWA's information system for highway projects records funds obligated for segments of projects that are federally funded rather than recording complete project-related costs and estimates; it also does not document the reasons for cost growth. Furthermore, FHWA officials said states do not track cost increases from the initial estimate or determine the reasons for these increases as part of normal project management; this was supported by highway officials in 13 states. However, limited data shows that cost growth has occurred on many of the large-dollar projects for which we collected data.

Data on Large-Dollar Projects Are Not Readily Available

FHWA's information system for highway projects—the Fiscal Management Information System (FMIS)—cannot be used to determine the amount of and reasons for cost increases on large-dollar highway projects. FMIS records the obligation and subsequent expenditure of federal funds for specific project segments rather than recording total cost estimates or tracking total project costs over the life of a project. This way of recording obligations allows FMIS to only capture project data for segments where a state uses federal funds. For example, if a state highway department uses state funds to design a project and does not request federal funds until construction, then FMIS will not capture those earlier costs associated with the design stage.

In addition, FMIS records a project's segments as separate projects and does not link them to the total project unless the states provide additional data for each segment. For example, on projects with multiple segments, states must enter data from related projects—such as state, project number, and appropriation code—for each segment. On large-dollar projects with many segments, this process can be cumbersome. FMIS also records projects that use multiple federal highway funding categories as separate projects. For example, if two categories, such as the Bridge Program and National Highway System, are used for a single project segment, then FMIS considers that segment to be two separate projects. Officials said that FHWA is currently considering modifications which may improve FMIS' ability to link related projects.

According to FHWA officials, states do not track estimates of total project costs and the reasons for cost growth. In addition, the 13 states we talked

to—the 6 we visited and the 7 others we contacted—do not track this information as part of normal project management. Since most large-dollar projects are financed by segment, some state officials did not see the benefit in tracking cost growth of total project costs.

Because neither FHWA nor the states track estimates or record the reasons for changes in project costs, FHWA manually reconstructed this information from the project files at either FHWA's division offices in the states or at state highway departments to respond to a request from the Senate Governmental Affairs Committee, Subcommittee on Oversight of Government Management and the District of Columbia. In September 1994, the Subcommittee asked FHWA to identify the 20 largest highway projects nationwide that had experienced the greatest amount of cost growth from their initial cost estimates. In April 1995, FHWA provided this information on 20 projects in 17 states whose estimated total costs ranged from \$205 million to \$2.6 billion and whose increases ranged from around 40 percent to nearly 400 percent.⁵

However, the information FHWA provided on the reasons for these cost increases—the only such data available that we could find—was often incomplete and generally unreliable. FHWA was not able to provide information on the reasons for cost growth on 2 of the 20 projects.⁶ Reasons for cost growth on another project included the caveat “wild guess only.” On the 18 projects for which FHWA reported reasons for cost growth, it did so in 74 different categories, which made a comparative analysis of projects in different states nearly impossible. For example, FHWA reported the amount of cost growth attributable to inflation in 7 states, but the amount of cost growth attributable to inflation in the remaining 11 states could not be determined from the data provided. Also, the amount of cost growth attributable to increases in scope on the 18 projects could not be determined from the data provided.

Many Large-Dollar Highway Projects Experience Cost Growth

Data that we collected show that while cost growth has occurred on 23 of 30 large-dollar projects, about half of the projects had increased more than 25 percent. We identified all projects estimated to cost more than \$100 million (38 in all) with draft environmental impact statements filed with the Environmental Protection Agency between 1988 and 1993. Thirty

⁵This excludes one outlier. One project reported cost growth of 1,530 percent over the original EIS cost estimate. Cost growth over a supplemental EIS cost estimate prepared in 1988 was 120 percent.

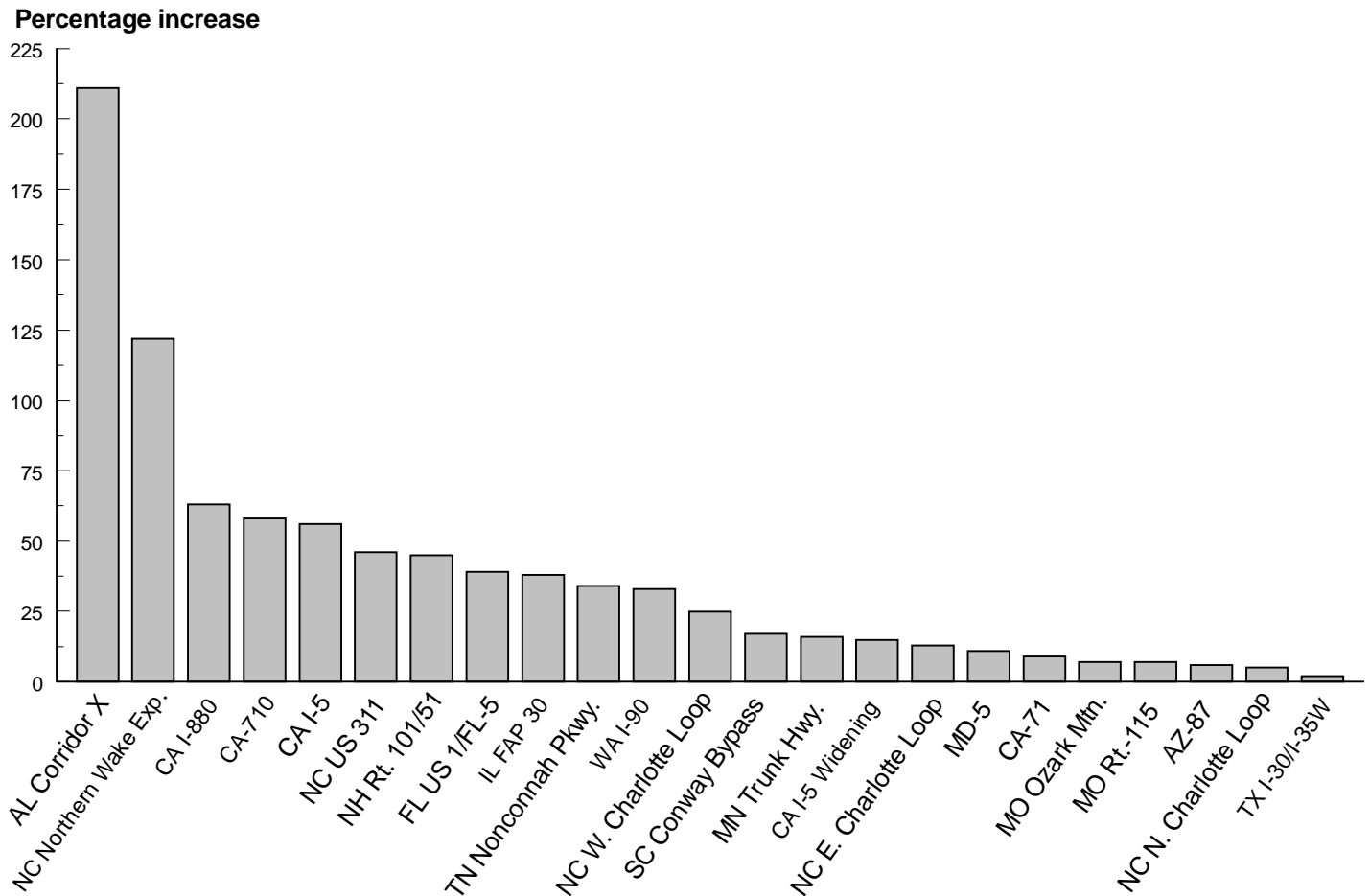
⁶FHWA stated that data was not available for one project and could not be reconstructed for the other project because the scope had significantly changed after the initial estimate.

Chapter 2
Data to Track Cost Growth Not Readily
Available, but Costs Grew for Many of the
Projects for Which We Collected Data

of those projects in 15 states are still active and receiving federal funds. We found that current estimates on 23 of the 30 projects had increased, while estimates on 7 projects decreased or remained the same. As shown in Figure 2.1, cost increases on the 23 projects that experienced cost growth ranged from 2 to 211 percent, with about half of the projects increasing by more than 25 percent. Of the seven projects for which estimates decreased or remained the same, estimates for three decreased by less than 10 percent, estimates for three decreased by more than 25 percent, and estimates for one remained the same. Because neither FHWA nor the states keep data on reasons for cost increases, we could not identify the reasons for increases or decreases.

Chapter 2
Data to Track Cost Growth Not Readily Available, but Costs Grew for Many of the Projects for Which We Collected Data

Figure 2.1: Cost Increases on Projects Over \$100 Million, 1988-93



Source: FHWA division offices and GAO analysis.

In addition to information received from state highway departments about cost increases on the 30 projects, our recent work on two large-dollar transportation projects also demonstrates significant cost increases beyond the initial estimate. For example, we reported that the Central Artery/Tunnel project in Boston, Massachusetts, which was originally estimated to cost \$2.6 billion in 1985, is now estimated to cost \$10.4 billion

at completion.⁷ In addition, reconstruction of the Cypress Viaduct in Oakland, California, which was originally estimated to cost \$695 million as of 1991, is now estimated to cost \$1.1 billion at completion.⁸

Some State Systems Could Capture Cost Performance Data

Although the states we talked to are not tracking cost performance information over the life of projects, we found that some state highway departments have information systems that could be modified or linked with other systems to track cost estimates, cost growth, and reasons for cost growth. For example, the American Association of State Highway and Transportation Officials (AASHTO) in conjunction with more than 20 states developed TRNS•PORT, a transportation information management system.⁹ Although originally developed to analyze bids to detect bid collusion, TRNS•PORT has since been expanded to include cost estimating, proposal development, contract award, and construction management. Thirty-one states are currently using the system. Further, other states have purchased cost-tracking systems from software developers.

We contacted officials in 11 of the 31 states that use TRNS•PORT and they said they do not use the system to track cost estimates, actual costs, and reasons for cost growth over the life of the project as part of normal project management. Some officials we talked to said they do not track this information because they are not sure of the benefit. However, other officials we spoke with plan to modify TRNS•PORT or link it with other information systems to track this information in the future.

⁷Transportation Infrastructure: Central Artery/Tunnel Project Faces Continued Financial Uncertainties (GAO/RCED-96-131, May 10, 1996).

⁸Emergency Relief: Status of the Replacement of the Cypress Viaduct (GAO/RCED-96-136, May 6, 1996).

⁹TRNS•PORT was previously named the Bid Analysis Management System.

FHWA Approves Projects Incrementally and Agrees to Costs at Construction

The FHWA project approval process consists of a series of incremental actions that occur over the period of years needed to plan, design, and build a project. There is no federal approval of, or agreement to, the total cost at the outset of a project; rather, FHWA approves the estimated cost of a large-dollar project in segments when those segments are ready for construction. However, by the time FHWA approves the costs of a large-dollar project, a public investment decision may have effectively been made because substantial funds will already have been spent on project design and acquiring property and much of the increases in the project's estimated costs will have already occurred. While many factors can cause costs to increase, we found several factors that worked together to increase costs beyond the initial estimates for projects in the six states visited: (1) initial estimates are preliminary and not designed to be reliable predictors of a project's cost, (2) initial estimates are modified to reflect more detailed plans and specifications as a project is designed, and (3) a project's costs are affected by, among other things, inflation and changes in scope to accommodate economic development that occurs over time as a project is designed and built.

FHWA Approval Process Is Incremental

FHWA approval of a project or a segment occurs incrementally throughout the planning, environmental review, design and property acquisition, and construction stages. During the planning stage, FHWA approves concepts that identify new projects that are needed. According to FHWA officials, the agency acts in partnership with the states to identify these needs. For example, FHWA may participate in a major investment study that identifies the need for additional highway capacity to relieve congestion in a particular corridor or approve a state transportation plan that identifies a proposed highway project or segment. However, FHWA officials emphasize that the agency's participation in planning and approval of state transportation plans does not constitute approval of a specific project or segment or commitment on the part of the federal government to finance it.

In the environmental approval stage, FHWA approves an EIS and issues a record of decision describing, among other things, the preferred alternative and why it was selected. In the record of decision, FHWA approves the location and layout of the specific project and documents the environmental mitigation efforts required to design and build it. The record of decision also allows a state to apply for and receive federal reimbursement to design the project and acquire the property needed to build it. Although cost estimates are included in the EIS, these estimates

are used only to compare alternatives. FHWA's issuance of the record of decision does not constitute approval of the costs estimated for the selected alternative or a commitment by the federal government to finance the project.

During the design stage of a project under "full" FHWA oversight, if a state wants to use design standards other than the federally-approved AASHTO design standards, FHWA must fully approve all exceptions to ensure that safety and quality features are not adversely affected. FHWA must also approve all property acquisition, including the cost of the property, and ensure that the legal requirements regarding persons relocated by highway projects are satisfied.¹⁰ In addition, FHWA may have formal approval at selected points during the design stage, as specified by the state. For example, in one state FHWA formally approved designs when the plans were 30 and 90 percent complete, while in another state FHWA participated with state officials for the most part informally throughout the design stage. FHWA approval of property acquisition actions is a commitment of the federal government to finance the cost of acquiring the property; however, this decision, as well as design exceptions and other actions taken during this stage does not constitute approval of the costs of constructing the project or a commitment by the federal government to fund it.

After the design stage is complete, the state prepares a bid package consisting of the plans, specifications, and estimates (PS&E) for each project segment for FHWA's approval. This document contains the detailed design plans and list of materials needed for a contractor to construct the project segment as well as a detailed cost estimate. The cost estimate in the PS&E becomes part of the project authorization—the agreement between FHWA and the state that permits the project to go out for bid. According to FHWA officials, FHWA's approval of the PS&E and authorization begins the process of FHWA's agreeing to the costs of the project segment. The project authorization is considered a contractual commitment by the federal government and thus FHWA's agreement to finance the project

¹⁰These requirements are contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, and FHWA is required to ensure the act is followed whether the project is exempt from direct oversight or not.

segment.¹¹ However, the cost of the project segment is not established until bids are received and a contract for the work is awarded. Once the state receives the contractor's bids, FHWA reviews them to ensure the bid process was fair and competitive and formally concurs with the state's decision on who to award the contract to. FHWA's concurrence includes agreement to the contract price and thus its concurrence to the project segment's cost. A project agreement is then executed between FHWA and the state to identify the location, scope, and estimated cost of the project segment, the conditions of the state's acceptance of federal funds, and the amount of federal funds to be obligated.

During the last stage, construction, FHWA periodically reviews the progress of construction. FHWA must also review and approve "major" contract change orders that change the scope of the work or exceed a certain dollar threshold. This threshold is not specified in federal law or regulation and varies by state. If the costs of the project segment increase and exceed the ceiling in the project agreement, FHWA must approve the increase upon a request from the state for an amendment to the agreement. As construction proceeds, progress payments are submitted by the state and approved by FHWA. When construction is complete, FHWA conducts a final inspection and certifies through final acceptance that the project was constructed in reasonable close conformance with the PS&E and subsequent changes. At that time the state submits to FHWA the project segment's final voucher—the request for reimbursement for all costs for that project segment. These costs may include some incurred through minor change orders that FHWA did not review and approve. FHWA's approval of the final voucher allows the state to receive full and final federal reimbursement for all project segment costs specified in the project agreement.

Substantial Federal Investments Can Occur Before Construction

Although FHWA does not approve the estimated cost of a project segment or agree to finance it until construction is ready to begin, a substantial investment of federal and state funds can occur on a large-dollar project before this approval occurs. FHWA's approval of a record of decision in the environmental process allows a state to request and receive federal reimbursement to design the project and to acquire the property needed to

¹¹There are some exceptions. For example, in an advance construction project, the state begins the project using state funds only with the intent of converting the project to a federal-aid project at a later date. To preserve this option, the project segment must meet the same federal requirements and be processed through a project agreement in the same manner as other federal-aid highway projects. However, the state cannot receive federal reimbursement until the project is formally converted to a federal-aid project. Until this conversion occurs, FHWA's approval of an advance construction project does not constitute its commitment to finance the project segment.

build it. These activities must be completed before construction on a project segment can begin.

On a large-dollar project, design activities can be substantial. Large-dollar projects may require the services of a design consultant and several years to design. For example, on the Central Artery/Tunnel project, construction segments have averaged almost 3 years, but taken up to 6 years, to design. Design activities are estimated to account for nearly \$900 million (about 8 percent) of the total estimated cost of the project. In addition, all property needed for a project must be acquired before FHWA can approve a project for construction. Large-dollar projects—both new highway construction and reconstruction projects that add lanes—can require that substantial amounts of property be acquired for highway rights-of-way. Property acquisition can be costly. To add lanes to M-59 in Michigan, property acquisition costs were about one-half of the nearly \$300 million that was estimated for total project costs. Property acquisition can also result in a substantial impact on the public. One new construction project—I-105 in California—displaced 18,200 people and required the state to acquire 5,800 housing units. Michigan’s M-59 project displaced 136 residences and 69 businesses.

Most Cost Growth Occurs Before Construction

While FHWA’s data systems do not track project costs over time, FHWA and state officials in states we visited agreed that most of the cost growth that occurs on projects happens before construction begins. For example, costs on the nearly complete I-595 project in Maryland have increased from an initial cost estimate of \$188 million to about \$390 million. However, state officials provided data showing that about \$160 million of that \$200 million increase—around 80 percent—occurred before the construction stage.

While many factors influence project costs, we found several factors that worked together to increase costs for projects in the six states we visited: (1) initial estimates are preliminary and not designed to be reliable predictors of a project’s cost, (2) preliminary design concepts are refined into detailed plans and specifications as a project is designed, and (3) the length of time to progress through the environmental, design and property acquisition, and construction stages.

Initial Cost Estimates Are Not Reliable

An initial estimate for the total cost of a project is generally developed at the outset of a project in connection with the environmental review

process. However, developing a complete project cost estimate that reliably predicts a project's total cost is not the objective at the environmental stage. The purpose of the initial cost estimate is to compare project alternatives; as such, the purpose is to develop cost estimates to the same level of specificity so all project alternatives can be evaluated on an equal basis. The estimates we reviewed did not factor in the time required to construct a project and thus did not include the effects of inflation. As officials in one state highway agency told us, it is not important to have an accurate cost estimate, but rather to ensure that assumptions used for all the alternatives' estimates are the same.

According to FHWA and state highway officials, initial cost estimates are preliminary and based on a "rough footprint" of the proposed project alternatives that broadly identifies the type of highway or structure to be built, the alignment, and the number of lanes and interchanges. Alternatives are based on generally no more than 30 percent of design. Cost estimates are calculated based on historic state data on the per-mile cost of highways, square-footage cost of bridges and other structures, and per-acre cost of land. Preliminary data specific to the project may also be included, particularly where environmental impacts are expected, such as wetlands mitigation and restoration.

FHWA has no requirements for preparing cost estimates. We found that each state we visited used its own standards or methods and database for compiling estimates during the environmental review stage. As a result, the estimates we reviewed differed substantially in the cost categories they included. For example, one state we visited included the costs of designing the project while two others did not.

Project Costs Are Greatly Refined During the Design Stage

During the design stage, costs can increase as preliminary project concepts are refined into the detailed plans and specifications needed by a contractor to construct a project segment. For example, per-mile highway costs are revised to reflect more detailed pavement design specifications, such as describing the thickness of the pavement needed, while detailed ground surveys reveal the exact grade of the highway. Per-acre costs to acquire property are replaced with detailed real estate appraisals establishing a fair market price.

In refining the "rough footprint" during the design stage, cost estimates are also refined and can increase—sometimes substantially. In two of the states we visited, soil structures were found to be insufficiently stable to

support the highway structures originally planned. For example, on the U.S. 71 project in Arkansas, soil problems were identified by detailed testing performed during the design stage—no soil borings had been drilled for the initial estimate. The state had to build an additional bridge because unstable soil made supporting the highway with fill dirt, as originally anticipated, difficult.

Although the initial cost estimate identifies environmental mitigation costs, the extent of the mitigation for some projects in the states we visited was not known until testing for the detailed design was done. On the reconstruction of I-880 in California, the state's EIS had identified the need to clean up hazardous material sites along the highway's alignment. However, drilling and testing for hazardous materials during the design stage revealed the presence of more contaminated soil and groundwater than had been expected. The costs of controlling and disposing of these contaminants increased the cost of this project by about \$40 million. In Maryland, a noise study was performed for the EIS to estimate the need for and costs of soundwalls for the I-595 reconstruction project. However, more detailed noise readings taken during the design stage affected the size and length of the required soundwalls and added \$2.6 million to the project's costs.

Project Development Occurs Over Time

Large-dollar highway projects usually take a number of years to move through the environmental, design and property acquisition, and construction stages. Compounding the time involved is the approach most states use for allocating funds. This approach funds projects over several budget years as states apply limited federal and state funding to numerous highway and bridge projects concurrently. This incremental funding approach may result in all projects being "stretched out," thus increasing individual project costs if for no other reason than the effects of inflation.

Stretching out a project also means that there is more time for land costs to increase, planned economic development to occur, and the passage of environmental or other laws or regulations that could increase the project's costs. One or more of these factors resulted in increased costs on 6 of the 7 projects we reviewed. For example, increased property acquisition costs accounted for the majority of the cost increases on two projects—U.S. 183 in Texas and M-59 in Michigan. State highway officials said that property acquisition costs increased beyond what had been initially estimated because land values increased before the acreage was purchased, either because of market conditions or due to development.

In the six states we visited, the scope of each project changed to varying degrees to accommodate future development that was not anticipated when the initial cost estimate was made. In Maryland, project costs increased by nearly \$27 million to add or modify lanes and interchanges to accommodate unanticipated growth in traffic, including increased traffic generated by a research center that was planned after the initial cost estimate was prepared for I-595. FHWA officials said modifying the ongoing project was more cost-effective than making changes after the project was built. Before construction was complete on I-105 in California, a decision was made to add a transitway in the highway's median, which added about \$320 million to the project's cost. Part of the increased cost for some changes in scope, such as additional lanes or interchanges, was caused by the need to acquire additional property for the right-of-way.

In two states we visited, increases in environmental mitigation costs occurred due to changes in law or regulations. For example, Maryland enacted a new storm water management law that required the state highway administration to control storm water runoff on projects so that discharges to rivers and streams would not increase. To comply with this law, the state had to design and construct storm water management ponds for runoff from the I-595 project which added nearly \$60 million to its cost. In Texas, a new state regulation added requirements for protecting a local aquifer from pollution. The state highway agency subsequently designed water treatment facilities to filter roadway and storm water runoff from project sites crossing the protected area. These additional features cost an estimated \$21 million.

Controlling Costs Is Not a Focus of FHWA Oversight

FHWA's primary goal on projects where it has "full" oversight is ensuring that the applicable safety and quality standards contained in law and regulations are met. Cost management and cost containment are not explicit statutory or regulatory goals of FHWA's oversight or part of its organizational culture. As a result, FHWA has few requirements that ensure cost containment is an integral part of large-dollar highway project management. FHWA influences project costs through its review and approval of design and construction plans, and through day-to-day interaction with state departments of transportation. We found several cost management practices that states had initiated to improve highway project management and to focus more specifically on containing project costs. These practices included improving initial project cost estimates, establishing goals for project cost performance, and tracking the progress of projects against such goals. However, FHWA has not been proactive in working with states to evaluate these practices and disseminate information on them to help other states enhance their cost management practices. Moreover, as debate begins on the reauthorization of highway programs in 1997, a range of roles exist for FHWA's oversight of large-dollar projects.

FHWA's Primary Oversight Emphasis Is Safety and Quality

On projects where it exercises "full" oversight, FHWA's primary focus is to help ensure that the applicable safety and quality standards contained in laws and regulations for the design and construction of highway projects are met. For example, in reviewing design plans, FHWA engineers use their best engineering judgement to determine whether the design of the roadway meets the AASHTO standards for speed, lane and shoulder width, and pavement design. FHWA engineers review safety features, such as guardrails, and whether unobstructed "clear zones" and roadway lighting are sufficient. If designs do not meet the standards, FHWA must approve exceptions to the design submitted by the state.

According to FHWA officials, controlling costs is not a goal of their oversight. They did emphasize, however, that ensuring that projects are designed and constructed in a cost-effective fashion is an integral part of engineering judgement. In the six states we visited, we found several examples where FHWA's influence resulted in states adopting more cost-effective approaches that decreased project costs. FHWA's review of the design for constructing U.S. 71 in Arkansas showed that smaller drainage structures could be used to accomplish the same objective at a lower cost. The state subsequently used the recommended smaller drainage structures on the project and saved about \$2.6 million. In

reviewing Maryland's plans to construct new noise walls on an existing interstate highway, FHWA noted that the state was also planning to widen the road a few years later and, in most instances, the walls would have to be moved, and its foundations destroyed and rebuilt to accommodate the widening project. FHWA recommended that the state construct the walls at the location envisioned for the widening project. State officials resisted because it would require additional expenditures in the short term to acquire the property needed. FHWA contended this approach was not cost effective and informed the state it would only fund construction of the walls one time. The state adopted FHWA's approach which, according to FHWA officials, saved about \$3 million.

FHWA's review of design and construction plans can also result in increased costs to meet federal standards for highway projects. In Massachusetts, FHWA contended that the state's plans for reconstructing an existing tunnel on a segment of the Central Artery/Tunnel project did not meet applicable Interstate speed and safety design standards. The modifications agreed to by the state and FHWA added about \$46 million to the project's cost. In Texas, FHWA denied the state's request for a design exception to retain an existing twin bridge structure on the U.S. 183 reconstruction project because it did not meet design speed safety standards. Replacing the structure added \$4 million to the cost of the project.

An FHWA official also stated that the availability of funding itself is an incentive for states to control costs. Since the end of the Interstate Construction Program and the specific earmarking of funds for Interstate projects, the states have an incentive to control costs themselves because needs generally outweigh available funds.

FHWA Has Few Formal Project Cost Management Requirements

While FHWA's formal review of safety and quality issues provides opportunities to influence states' cost management of highway projects, FHWA has no mandate to encourage or require practices to contain costs of large-dollar highway projects. Unlike direct procurement programs, such as Department of Defense weapons procurement, that have specific cost management requirements, the federal-aid highway program is a federally assisted, state-administered partnership. As a result, FHWA has few requirements that ensure cost containment is an integral part of state highway project management.

Several initiatives already underway at the federal level are designed to help the federal government manage its operations and projects in a cost

effective way. The Vice President's National Performance Review in 1993, for example, identified widespread concern about the need for the federal government to better manage the planning, budgeting, and acquisition of fixed assets and suggested improvements. Furthermore, the Government Performance and Results Act of 1993 generally requires that federal agencies target resources and develop specific, measurable goals and plans to achieve them. For federal agencies acquiring large-dollar capital assets such as buildings, equipment, and information systems, the Office of Management and Budget (OMB) requires cost containment practices. OMB requires federal agencies to prepare baseline cost and schedule estimates and to track how well actual costs and schedules perform against that baseline. If actual costs or schedules exceed the estimate by more than 10 percent, agencies are required to report the reasons for this to OMB and to identify corrective actions to bring the project back within its baseline costs or schedule. If estimates indicate these baseline goals are not achievable, the agency may revise them with OMB approval. However, it must continue to report the original baseline as well as the new goals. These requirements apply to programs managed by and acquisitions made by federal agencies and not to federally assisted state programs. Nevertheless, these cost management concepts could be an appropriate model for management of large-dollar highway projects.

One federal requirement that many state officials cited as a formal cost containment mechanism is value engineering. As defined by federal statute, value engineering analysis is a systematic review by a team of persons not involved in the project to provide suggestions during the design stage to reduce costs while maintaining or improving the project's quality. Since the mid-1970s, FHWA has encouraged states through guidance and training to perform value engineering on federally aided projects and has required its use on projects it directly administers on federal lands. However, FHWA has never required the states to perform value engineering on highway projects that receive federal funds. In 1993, FHWA reported that only 7 states had active value engineering programs accounting for over 70 percent of all value engineering studies nationwide while limited programs in 27 other states accounted for the remainder. In 1995, the Congress required that all projects on the National Highway System that have an estimated total cost of \$25 million or more be subject to value engineering analysis. FHWA has not yet issued guidance to the states to implement the law.

Since 1995, FHWA has become more involved in the cost management and oversight of the Central Artery/Tunnel project in Boston, Massachusetts.

FHWA has required the state to prepare and periodically update a plan that identifies the costs of the project and how the state intends to successfully finance it to completion. In 1996, at FHWA's request, the state began tracking the cost performance of the project against its cost estimate and providing a monthly report to FHWA. FHWA has also required the state to provide up-front state funding or bonding authority for the full value of the contracts it plans to finance over a period of years to help to ensure that revenue sources will be sufficient when bills come due. FHWA officials told us that the Central Artery/Tunnel project is unique because of its \$10.4 billion estimated cost and the substantial funding shortfalls projected over the next few years. In October 1996, FHWA also required a finance plan for the I-15 reconstruction project in Salt Lake City, Utah. FHWA officials said they would determine the appropriate level of involvement on other projects on a case-by-case basis, according to each project's costs and financing needs.

Some State Management Practices Focus on Cost, but Best Practices Are Not Being Shared

Some of the states we visited had practices in place similar to some elements of the OMB federal requirements to help control a project's costs and its overall cost-effectiveness. These practices included (1) improving the quality of initial cost estimates, (2) establishing cost performance goals and strategies, and (3) using external review boards to approve cost increases. However, FHWA has not been proactive in disseminating information about these practices among states.

Quality of Initial Estimates Can Be Improved

Two of the six states we visited are seeking to improve the quality of their initial cost estimates to make them more representative of the final costs of projects. Officials in Maryland told us that their goal was to ensure that initial estimates differed from the final costs by no more than 10 percent. To help achieve this goal, initial cost estimates included contingency factors to account for cost increases that usually occur as a project is designed. For example, Maryland would include a 35 to 40 percent contingency in the estimates for bridge and other structures to account for changes that might arise from detailed design studies done after the initial estimate. However, because the state did not track and report costs and cost increases from the start of a project to its completion, we could not verify whether the state was meeting its goal or assess the validity of the contingency factors used.

California has instituted a series of project management practices, including a process to improve the quality of its initial project cost estimates. According to the state's guidelines,

"The reliability of project cost estimates at every stage in the project development process is necessary for responsible fiscal management. Unreliable cost estimates result in severe problems [and] . . . affects [the state highway administration's] relations with . . . the Legislature, local and regional agencies, and the public, and results in loss of credibility."

The state's guidance provides a detailed methodology to help control cost increases. For example, the state develops a project study report to help it avoid unforeseen items of work before a project proceeds into the final design phase. The guidance describes cost categories that should be included in an initial cost estimate, such as the length of a project, inflation, and overhead, as well as a 25 percent contingency as a proxy for future unknown costs.

According to FHWA officials, the accuracy of an initial project cost estimate compared to the final project cost is directly related to the amount of design. As discussed in chapter 3, additional environmental and engineering studies are conducted during the design stage, removing uncertainties and allowing for a more accurate cost estimate. This can, however, create a dilemma for state transportation departments because the state must look at several alternatives during the environmental process. Developing all alternatives to a higher level of design can be costly. If federal dollars are used to support the environmental process, the NEPA implementing regulations require that all alternatives be designed to the same level because designing one project to a higher level could prejudice the selection process.

Establishing Cost Performance Goals and Strategies

One of the six states we visited, Massachusetts, established specific cost performance goals in 1995 for the design and construction phases of the \$10.4 billion Central Artery/Tunnel project. Project officials set two goals: (1) limit increases in the estimated cost of construction during the "final design" process to zero,¹² and (2) limit cost increases during the construction phase to 7 percent of the contract's bid value.

To accomplish the latter goal, the state instituted a "design-to-cost" program, under which contractors design their segments of the project

¹²In the Central Artery/Tunnel project, the state's management consultant does "preliminary design," up to about 25 percent of design. A design contractor then does the "final design" phase for the remainder.

within an agreed baseline budget for the construction cost. The design contractor is required to submit periodic interim designs as well as a final design. If an estimate in any of the submittals exceeds the agreed baseline budget (assuming that the state has not requested changes to the contract), that contractor is required to redesign the project—at the contractor’s own expense—so that the estimated construction cost remains within the baseline budget. Project officials and contractors told us that the design-to-cost program has generally made them much more cost-conscious. They said this approach has been particularly helpful on a large project like the Central Artery/Tunnel project in which multiple state, local, and federal agencies review—and can influence—the project’s designs.

In 1996 we reported that Massachusetts did not have a formal program or specific strategy to limit cost increases during the construction phase and that experience with the design-to-cost program had been limited and the results mixed.¹³ The state has recently initiated an action plan to control construction costs, and we are currently assessing the state’s progress in meeting its design and construction cost containment goals for the project.

**Entities Outside State
Highway Administrations
Review Highway Project
Costs**

Two of the six state highway administration programs we examined were subject to state external review boards—organizations outside state highway administrations that review and approve cost increases. Michigan had an external review board for certain changes to all state contracts, including change orders over \$100,000. California’s transportation expenditures were governed by an independent transportation commission that approved all projects, budgets, and changes; any change in a project cost exceeding 20 percent required the commission’s approval. Officials from both states stated that they scrutinize potential cost increases more closely to avoid appearing before the review boards. However, we found that when a change was brought before the independent entities, cost increases were rarely denied because, according to state officials, the additional costs had been thoroughly examined by the state and were deemed necessary.

In Maryland, the highway administration uses a post-project consultant review to evaluate cost increases on projects. According to state officials, the consultant examines all project change orders over \$100,000, identifies common problems that caused costs to increase, and makes

¹³Transportation Infrastructure: Central Artery/Tunnel Project Faces Continued Financial Uncertainties (GAO/RCED-96-131, May 10, 1996).

recommendations to avoid these costs in future projects. For example, in response to one of these reviews, the state required more soil sampling at an earlier stage for all of its highway projects to try and control cost increases attributed to not having a good understanding of the soils.

FHWA Does Not Proactively Disseminate Cost Management Information

FHWA has many different mechanisms for disseminating information to state departments of transportation, such as written guidance, technical conferences, training classes, case studies on best practices, a web site on the Internet, as well as letters and memorandums. Through these channels, FHWA disseminates a range of technical information and best state practices on a wide variety of topics, including highway research results, successes with the Major Investment Study Process, and computer software to compare projects from different modes, such as air and rail, for investment decisions.

FHWA has used these mechanisms to encourage some initiatives that have the potential to improve the cost-effectiveness of highway projects. For example, FHWA has promoted and gathered information on states' experiences with management initiatives, such as design/build, warranties, and partnering, and shared this information with other states. Warranties have been used on a limited basis to hold a contractor more accountable for the work performed, thereby improving quality and reducing maintenance costs. In partnering, the state and contractor sign a list of common goals, such as to construct the project with no loss of time due to accidents, before construction begins. Officials in several states told us that partnering has proven useful to reduce contractor claims and law suits as well as bring the job in on time and within budget.

While FHWA's dissemination network is in place and is being used to share information, we found that FHWA has not actively evaluated the project management practices in the states discussed above and used its network to highlight "best practices" for other states. For example, a California official told us that while the state is sharing information on its efforts to improve the quality of initial project cost estimates with other states, FHWA has not asked for information on the state's program. In Maryland, where outside consultants were providing reports on the causes of cost increases in completed projects, FHWA did not receive copies of those reports.

Conclusions and Recommendation

Although FHWA disseminates information to state departments of transportation on a wide variety of technical and research topics, GAO

found that FHWA does not evaluate and disseminate information on state best cost management practices among all states. Being more proactive in this regard could encourage states to undertake cost management strategies that have the potential to promote cost-effective project management and result in more effective use of limited federal and state highway dollars.

To enhance states' ability to manage costs on large-dollar highway projects, we recommend that the Secretary of Transportation direct the Administrator, FHWA to work with states to evaluate and disseminate information on best state practices concerning cost management to all states.

Agency Comments

We provided copies of a draft of this report to DOT and FHWA for their review and comment. FHWA officials who reviewed the draft, including the Associate Administrator for Program Development, generally concurred with the information contained in the report and agreed with the recommendation.

Observations

The nation's highways and bridges are vital to its economy and national defense. Because of limited resources available to build and maintain them, it is essential that highway and bridge projects be well managed. Because large-dollar projects generally take longer to build and usually have more significant environmental and community impacts than the majority of federal-aid highway projects, they have greater potential to experience substantial cost increases and lengthy construction delays. These cost increases can potentially overwhelm other highway projects and erode the already limited funds available to meet overall highway needs. Effective project management related to containing costs can help ensure that cost growth resulting from schedule delays and other factors are minimized and that our transportation capital investment dollars are spent wisely and efficiently.

As reauthorization of the federal-aid highway program approaches in 1997, discussion has already begun on how the federal programs should be structured and what the federal role should be. Balancing the states' desire for flexibility and more autonomy with the federal role of ensuring that taxpayers get the most bang for their federal dollar, as well as safe, quality highways, is difficult. FHWA's "full" oversight approach does not focus on management of highway project costs. In contrast, cost management requirements promulgated by OMB for the federal government on its own large-dollar projects are very specific. Further, from a broader perspective, the federal government has been moving in the direction of managing programs by establishing goals and measuring performance through such initiatives as the Government Performance and Results Act of 1993.

Ultimately, the Congress and the administration will have to decide on the appropriate federal role. Cost management of large-dollar projects is just one part of a federal role in highway projects. Changing that part, if appropriate, could take the form of requiring states to improve their cost management practices by using strategies that some states already have in place. Such strategies have the potential to provide a cost-conscious discipline as well as an early warning of possible problems. For example, improving the quality of a project's initial cost estimate so it more reliably represents the total costs of a project could provide a more realistic baseline from which to track costs and finance large-dollar projects, particularly where multiple sources of financing are used.

Some states have tried improving initial cost estimates by including contingencies to represent potential future unknowns—the cost increases that typically occur during the design phase as preliminary concepts give

way to detailed engineering plans needed to construct the project. Collecting data on common problems experienced by projects could provide a basis for establishing such contingencies as well as provide real-time information on which managers could make decisions about project changes that could impact costs. Another way to improve initial estimates is to do a more detailed project design at the environmental phase. While this approach removes some of the uncertainties that can only be addressed through the detailed design stage, it more than likely would not be feasible for many projects because of the cost. Further, this approach can work at cross purposes with an environmental process that seeks to see all alternatives equally considered.

Once an initial cost estimate is developed, establishing cost performance goals based on this estimate and a strategy to accomplish them would make cost awareness and cost containment an integral part of how states manage a project over time. This does not mean that an initial cost estimate cannot be increased if contingencies were not sufficient to cover increases generally expected through design changes; however, any change and reason for it should be agreed to. Strategies, such as those being used on the Central Artery/Tunnel project, have the potential to improve accountability for cost increases and create a culture where cost control is part of day-to-day activities.

Increased federal oversight of state management of project costs is another way to look at a federal role. Such actions as establishing standards for cost estimates, including what elements should be included; evaluating the reasonableness of cost estimates and finance plans; and monitoring cost growth and financing could help to ensure that the large-dollar highway projects are being effectively and efficiently managed.

Oversight of Federal-Aid Highway Projects

Under federal law, federally aided highway projects are managed and constructed by the 52 state highway departments in the 50 states, Puerto Rico, and the District of Columbia, in accordance with state and federal law, subject to the inspection and approval of the Secretary of Transportation. The Secretary's responsibilities have been delegated to the Federal Highway Administration (FHWA). Federal law and regulations detail FHWA's inspection and approval responsibilities; as discussed in chapters 1 and 3, this "full" FHWA oversight includes approving planning and environmental review documents; reviewing design and construction specifications; approving plans, specifications, and estimates (PS&Es); periodically reviewing construction in progress; and inspecting and approving the completed project.

In 1973 the Congress added a provision to the law entitled certification acceptance. As subsequently amended, this provision permits FHWA to discharge its oversight responsibilities to the states for any projects that are not constructed on the Interstate Highway System by accepting a state's certification that projects being carried out under state laws, regulations, directives, and standards will accomplish the policies and objectives of federal law. FHWA may allow either partial or complete exemption of project processes under certification acceptance, and FHWA must still approve certain aspects of the project, such as planning and highway safety.

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) devolved even greater authority to the states by allowing a larger number of projects to be exempted from "full" FHWA oversight. Sections 1016(b) and (d) provided the following:

- Projects that are not constructed on the National Highway System (NHS) would be designed, constructed, operated, and maintained in accordance with state—rather than federal—laws, regulations, and standards.
- A state can request that FHWA no longer review PS&Es for any project not constructed on the NHS or for any NHS projects estimated to cost under \$1 million. After receiving any such request, FHWA may undertake such reviews only if requested to do so by the state.
- A state may, on a project-by-project basis, waive FHWA review of PS&Es on any NHS project that involves resurfacing, restoration, or rehabilitation (but not reconstruction),¹⁴ if the state certifies that all work will meet the standards approved by FHWA.

¹⁴Resurfacing, restoration, and rehabilitation refers to maintaining an existing roadway or bridge, while reconstruction involves tearing down and replacing an existing roadway or bridge.

The only projects that would not fall under the ISTEA exemption provisions are new construction or reconstruction projects on the NHS that are over \$1 million. However, because certification acceptance applies to any projects that are not constructed on the Interstate Highway System, the only projects which must unconditionally be constructed under “full” oversight provisions are Interstate construction or reconstruction activities over \$1 million.

In January 1992, the FHWA Executive Director issued guidance to FHWA’s field offices that interpreted and implemented ISTEA’s exemption provisions. This guidance stated that states electing to use ISTEA’s exemption provisions would be exempt from FHWA’s oversight of design activities, PS&E approval, concurrence in award, and review of construction activities. The guidance also directed FHWA field personnel to strongly encourage states to avail themselves of the ISTEA exemption provisions.

According to a 1995 FHWA report, most states have availed themselves of ISTEA’s oversight exemption options. In the case of non-Interstate NHS projects over \$1 million, 32 out of 52 state highway administrations construct these projects under full FHWA oversight while 20 do so under certification acceptance. Additional information on the number of states choosing these provisions is provided in Table I.1.

Appendix I
Oversight of Federal-Aid Highway Projects

Table I.1: States' Use of Full Oversight, Exemption, and Certification Acceptance Provisions

Oversight options	Interstate Construction Program
Full oversight	All (required)
NHS 3R (exempt project-by-project)	N.A.
Non-NHS and NHS < \$1M (entire program exempt)	N.A.
Certification acceptance	N.A.
Total	N.A.

**Appendix I
Oversight of Federal-Aid Highway Projects**

NHS-Interstate System				NHS-Not part of Interstate				Non-NHS
New/reconstruction		Resurfacing, restoration, and rehabilitation		New/reconstruction		Resurfacing, restoration, and rehabilitation		
>\$1 million	<\$1 million	>\$1 million	<\$1 million	>\$ 1 million	<\$ 1 million	>\$ 1 million	<\$ 1 million	
All (required)	14	19	13	32	8	14	7	2
N.A.	N.A.	31	4	0	0	25	2	0
N.A.	36	0	33	0	34	0	35	46
N.A.	0	0	0	20	10	13	8	4
N.A.	50	50	50	52	52	52	52	52

Note: The Interstate Highway System columns do not include Alaska and Puerto Rico, which have no Interstate Highway System routes. Totals for projects not located on the Interstate Highway System reflect the 50 states, the District of Columbia, and Puerto Rico.

N.A. = Not applicable.

Source: FHWA.

Additional Actions by FHWA

In 1991, just prior to the passage of ISTEA, FHWA adopted a Statement of Operational Philosophy in response to their reduced role in overseeing federal-aid highway projects as well as their increasingly limited staff resources. This statement recognized FHWA’s increased focus on areas of greatest risk and the need to devolve more direct project oversight activities to states. It stated in part, that

“ . . . it is FHWA’s policy to increasingly rely on the State transportation agencies to adequately perform and/or provide management and oversight of detailed, project-related activities. In keeping with this policy, the use of process review/product evaluation procedures will be the agency’s primary mode of operation in carrying out all of its program oversight responsibilities . . . [This] does not however, preclude the use of other program monitoring techniques including project-specific activities when appropriate.”

Process review/product evaluations are broad based reviews of state highway administration operations conducted by FHWA in cooperation with state officials. These reviews range widely in topic from pavement rideability testing to assessing how frequently contract schedules are met. FHWA’s division offices develop multiyear plans to review various areas of operation, emphasizing potential high-risk areas.

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