United States General Accounting Office

GAO

Report to Congressional Requesters

May 1988

BRIDGE CONDITION ASSESSMENT

Inaccurate Data May Cause Inequities in the Apportionment of Federal-Aid Funds

GAO/RCED-88-75

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

Resources, Community, and
Economic Development Division

B-226936

May 20, 1988

The Honorable Quentin N. Burdick
Chairman, Committee on Environment
and Public Works
United States Senate

The Honorable Glenn M. Anderson
Acting Chairman, Committee on Public
Works and Transportation
House of Representatives

The Honorable James B. Sasser
United States Senate

In response to your requests, this report evaluates the accuracy of the National Bridge Inventory and the possible effects that inaccuracies in the inventory may have on the apportionment of Highway Bridge Replacement and Rehabilitation Program funding.

We are providing copies of this report to the Secretary of Transportation; the Director, Office of Management and Budget; and other interested parties.

This work was performed under the direction of Kenneth Mead, Associate Director. Other major contributors are listed in appendix VIII.

J. Dexter Peach
Assistant Comptroller General

inventory. Errors in one state's data can also affect all other states' shares of program funds.

FHWA was unaware of most of the errors in bridge data and inconsistencies in state data collection and reporting practices which GAO found. This points to the need for better FHWA and state management controls.

Principal Findings

Inadequate FHWA Controls Over States' Inventory Data

GAO found that FHWA has not established the necessary management controls and oversight of its field offices to assure that its field staffs examine states' controls over bridge inventory data. As a result, FHWA field offices have not been able to detect and correct systemic weaknesses in states' data collection and reporting methods. (See ch. 2.)

In the three states selected for this review—California, Massachusetts, and Indiana—GAO found errors in bridge records that changed the deficiency and eligibility status for 5 to 15 percent of the bridges in these states. (See ch. 2.) Most of the errors GAO found were due to either missing or outdated data, or untimely bridge inspections. Some of these errors would tend to overstate the actual number of deficient and eligible bridges, while others would understate the number of such bridges. Because states did not have the data necessary to determine the eligibility and deficiency status of all of these bridges, GAO could not quantify the net effect of errors found in the states' inventories.

Varying Levels of Bridge Deficiencies Not Distinguished

The national bridge inventory contains insufficient data to allow FHWA to distinguish between those bridges requiring total replacement or rehabilitation and those bridges needing only remedial improvements. FHWA officials say that they cannot accurately determine how many deficient bridges can safely serve existing traffic demands with improvements short of replacement or rehabilitation because few states have the information to make such an analysis and/or such data are not currently required in the national bridge inventory. In its annual report, however, FHWA estimates that there are over 50,000 such bridges in the nation. FHWA has presented a framework for a bridge management system to the states and is optimistic that if states adopt systems within this framework, they will have the type and quality of bridge data needed to determine their specific bridge needs. (See ch. 2.)

- provide cost-to-improve estimates corresponding to the various categories of deficient bridges and prescribe an appropriate method for states to use when estimating the cost to replace and rehabilitate their deficient bridges; and
- exclude from the apportionment data base bridges that do not need replacement or rehabilitation.

Agency Comments

The Department of Transportation (DOT) disagreed with GAO's recommendations. (See app. IV.) DOT proposed several alternative actions that it believes, if adopted by the states, should improve both the accuracy of states' bridge inventories and the quality of their cost-to-improve estimates. GAO believes that while the actions may address problems in states' inventory practices, they do not eliminate the need for DOT's oversight of states' practices.

DOT said that the national cost-to-improve estimate should reflect the total cost to improve all of the nation's bridge deficiencies. GAO agrees, but also believes that it is important for DOT to distinguish between the varying levels of bridge deficiencies and their associated costs. However, unlike the cost-to-improve estimate, GAO believes the apportionment data base should exclude bridges that do not need total replacement or rehabilitation. Including such bridges in the apportionment data base leads to inequities in the distribution of bridge program funds.

California said that GAO did not convincingly demonstrate that errors in the states' inventories were systemic in nature. California noted that GAO reported that only a few of the 90 national inventory items were in error on a recurring basis. (See app. VI.) GAO's review focused on the 19 data items that materially affect eligibility and deficiency status. GAO found that the weighted error rate for these items changed the status of 5 to 15 percent of the bridges sampled in the 3 states reviewed. GAO demonstrated a more systemic problem in states' inventory practices in its review of individual data items. GAO found a range of 2 to 73 percent of states' bridge records contained errors in individual data items.

Indiana commented that GAO's report substantially assesses the status and needs of the nation's bridges and suggested that states' adoption of bridge management systems may provide a tool to better determine specific bridge needs. (See app. V.) Massachusetts noted several actions that it has taken since GAO's review to bring its inventory into compliance with National Bridge Inspection Standards. (See app. VII.)

Appendix VII: Comments From the Massachusetts Department of Public Works 64
Appendix VIII: Major Contributors to This Report 66

Tables

Table 2.1: Bridges With Errors That Changed Their Eligibility and/or Deficiency Status 19
Table II.1: Estimated Number of Load-Posted (L-P) Bridges that States Do Not Intend to Rehabilitate 45
Table II.2: Estimated Number of Bridges With Errors that Changed Their Eligibility and/or Deficiency Status 45
Table II.3: Estimated Number of Bridges With Missing NBI Data 46
Table II.4: Estimated Number of Bridges With Outdated Average Daily Traffic (ADT) Counts 46
Table II.5: Estimated Number of Indiana Bridges With Untimely Inspections 46
Table II.6: Estimated Number of Bridges Considered Deficient in Indiana 46

Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ADT	average daily traffic
BMS	bridge management systems
CALTRANS	California State Department of Transportation
DOT	U.S. Department of Transportation
FHWA	Federal Highway Administration
GAO	General Accounting Office
HBRRP	Highway Bridge Replacement and Rehabilitation Program
NBI	National Bridge Inventory
RCED	Resources, Community, and Economic Development Division

maintain written inspection reports and a current inventory of all federal-aid bridges. The states were authorized to use federal-aid highway administration and planning funds for training inspectors, collecting and maintaining the inventory, and conducting bridge inspections.

The Federal-Aid Highway Act of 1970 (Public Law 91-605), established the Special Bridge Replacement Program. Under the act, the Secretary of Transportation, in consultation with the states, was to inventory and classify all federal-aid bridges located over waterways and topographic barriers according to their serviceability (how well they serve their traffic), safety, and essentiality for public use. Using these classifications, the Secretary was to assign each bridge a priority for replacement. When the states applied for assistance to replace a bridge under the program, the Secretary could approve federal participation if the priority system showed the bridge to be eligible.

The Surface Transportation Assistance Act of 1978 (Public Law 95-599) extended and expanded the Special Bridge Replacement Program to what is currently known as the Highway Bridge Replacement and Rehabilitation Program (HBRRP). Rehabilitation[2] rather than complete replacement of bridges was permitted for the first time, as was funding eligibility of bridges not on the federal-aid system. HBRRP funding was also greatly increased over previous authorizations.

Program Administration and Responsibilities

The Secretary of Transportation has delegated administration of the National Bridge Inspection and Highway Bridge Replacement and Rehabilitation programs to FHWA. FHWA administers the programs through a headquarters Bridge Division office, 9 regional offices, and 52 division offices—1 in each state, the District of Columbia, and Puerto Rico. The Bridge Division office is responsible for developing and recommending program policies, regulations, instructions, and procedures; monitoring and evaluating program effectiveness; and providing technical guidance. The regional offices supervise division office operations, monitor and evaluate division office performance, and provide technical guidance to division offices.

The division offices, each headed by an administrator, are responsible for the day-to-day operations and monitoring of the inspection and replacement/rehabilitation programs. Their responsibilities include

[2]According to the act, rehabilitation means major work necessary to restore the structural integrity of a bridge as well as work to correct a major safety defect

- the structural condition or waterway adequacy[3] is in an intolerable condition requiring a high priority of replacement or immediate repair or replacement.

Similarly, FHWA defines a bridge as functionally obsolete if, although structurally sound, it is no longer adequate for the road it is on and the traffic it serves. According to FHWA, this category includes bridges that are

- load-posted because the original design capacity is less than the current legal limit in the state[4] or
- obsolete because the deck geometry (e.g., the bridge is narrower than the road it is on), clearance, or roadway alignment no longer meets the criteria for the highway system.

In determining the number of bridges falling into this category, for purposes of the annual report, FHWA classifies a bridge as functionally obsolete if the states' bridge inventory data show that

- the deck geometry, underclearances, or approach roadway alignment is in an intolerable condition requiring a high priority of repair or replacement, or immediate repair or replacement or
- the structural condition or waterway adequacy requires a high priority of repair.

If a bridge is both structurally deficient and functionally obsolete, FHWA classifies it as structurally deficient.

To determine eligibility for HBRRP funding, FHWA uses a mathematical formula designed to evaluate various factors in states' bridge inventory data which are indicative of a bridge's ability to remain in service in its present condition. The formula's three general factors and their relative weights in the formula are: structural adequacy and safety, 55 percent; serviceability and functional obsolescence, 30 percent; and essentiality for public use, 15 percent. After evaluating the data, FHWA assigns a sufficiency rating to each bridge. The sufficiency rating ranges from 0 to 100; a rating of 100 represents an entirely sufficient bridge, and a rating of 0 indicates an entirely insufficient bridge

[3]Waterway adequacy is defined as an evaluation of the stream's current or potential adverse effects on the bridge

[4]Legal limit refers to the weight carrying capacity that the state establishes for that segment of the highway system

We then subjected the entire 575,000 bridge inventory to appropriate tests designed to determine whether definitions FHWA supplied for various categories of bridges were correctly applied to the data base. Definitions of various categories of bridges and the programming statements we used in our computer analysis of the NBI data base were presented to FHWA systems and program staff in order to verify their accuracy. They confirmed the accuracy of our programs. We also examined the impact of states' inventory practices on their estimates of the cost to improve deficient bridges and the subsequent impacts on FHWA's estimate of the cost to improve all of the nation's deficient bridges.

FHWA uses its Bridge Division's NBI system as a basis for its annual report to the Congress and for apportioning funds to the states. The NBI contains approximately 100 different data items descriptive of each of the nation's 575,000 bridges.[5] The Department of Transportation's (DOT) Transportation Computer Center (TCC) maintains the data base. At our request, TCC supplied computer-generated copies of the NBI as of August 1985 and December 1985. These months were chosen because the December version is used to generate the statistics in the annual report to the Congress and the August version is used to apportion funds to the states.

In addition to analyzing the NBI, we examined bridge inventory practices in three states—California, Indiana, and Massachusetts—to determine if the states' procedures for collecting and reporting bridge inspection data resulted in a current, complete, and accurate NBI data base. These states provided a geographic cross-section of the nation and displayed a wide range of characteristics: the number of bridges in the state relative to other states (7th, 11th, and 36th, respectively) and the ratio of deficient bridges in the state (15 percent, 47 percent, and 25 percent, respectively). FHWA agreed that the specific states and the number of states we selected would provide an adequate basis for evaluating states' bridge inventory practices.

We verified the accuracy of a random sample of bridge records in each of the three states by tracing individual bridge data items back to source documents (such as inspection reports and bridge plans) maintained in each state. The statistically projectable samples of bridges included 150 of the 22,303 bridges in California, 125 of the 17,603 bridges in Indiana,

[5]For purposes of replacement and rehabilitation programs and inspections, FHWA defines a "bridge" as a structure erected over an obstruction, such as water, having a passageway for traffic measuring at least 20 feet in length

Comments on a draft of this report were received from DOT, as well as the Indiana, California, and Massachusetts transportation agencies and are included as appendixes IV, V, VI, and VII, respectively, in this report. We performed our review between June 1986 and October 1987, in accordance with generally accepted government auditing standards.

The NBI Contains Insufficient Data to Allow Determination of Bridges Needing Only Remedial Improvements

FHWA's NBI system does not capture data that would allow FHWA to identify how many deficient bridges can be fixed without costly rehabilitation or replacement. FHWA, recognizes that some functional and structural deficiencies can be minimized through actions short of rehabilitation or replacement, such as the use of traffic control devices and/or load-posting. In its seventh annual HBRRP report, FHWA noted that 51,000 of the 108,000 functionally obsolete bridges in the NBI are obsolete only because of their deck geometry. Deficiencies in deck geometry are a contributing cause of accidents and other traffic problems.

FHWA also indicated in the report that some bridges with geometric deficiencies may be good candidates for traffic control devices, such as roadway striping, signs, signals, and crash cushions, rather than structural improvement. Our analysis, however, indicated that the NBI does not contain information, such as accident data, seasonal traffic flows, or truck traffic, that would enable FHWA to identify which geometrically deficient bridges could be improved with traffic control devices rather than total rehabilitation or replacement.

Similarly, FHWA notes in the HBRRP annual report that while 136,000 bridges classified as structurally deficient may have deteriorated to the extent that they cannot carry the load for which they were originally designed, with proper load-posting they can safely serve existing traffic. Again, however, FHWA does not report how many of these structurally deficient bridges have problems that could be remedied without costly rehabilitation or replacement.

FHWA's Bridge Management Branch Chief told us that FHWA is not able to identify how many deficient bridges could be fixed without rehabilitation or replacement using the current NBI data base. According to the Division Chief, very few states have the information needed to identify such bridges in their inventory and such data are not required in the NBI.

FHWA is optimistic, however, that states will be able to identify which bridges can be improved with remedial repair work once they adopt a comprehensive bridge management program that FHWA is currently proposing to states. FHWA's proposed bridge management program suggests that improvements in the type and quality of bridge data collected and managed at the state level will enable states to make realistic estimates of critical bridge needs and identify options for improvement other than replacement or rehabilitation.

are, in our opinion, inadequate to assure consistent reporting of inventory data by all states. Without accurate and consistent bridge data collection and reporting methods being used by all states, FHWA is not in a position to accurately report to the Congress the status of the nation's bridges.

Errors in the NBI Affect Determination of Bridge Eligibility and/or Deficiency Status

To assess the accuracy of data that states submit for the NBI, we validated data as of October 1985 for a random, statistically projectable sample of bridges in California, Indiana, and Massachusetts. (See table 2.1 for sample size.) We validated data taken from source documents (e.g., inspection reports, bridge plans, and traffic count reports) by cross-checking the information for the 19 NBI data items[2] that materially affect a bridge's deficiency and eligibility status against the data in state source documents. If a data item in the NBI differed from data on the source documents, we counted the difference as an error. Where we found errors or where more current and/or accurate information was available, we recalculated the sufficiency rating and deficiency status to determine whether the bridge's eligibility and/or deficiency status was affected. In 5 to 15 percent of the bridge records in our samples, we found errors that actually changed a bridge's status. These percentages are projectable to the total number of bridges in each state.

Table 2.1: Bridges With Errors That Changed Their Eligibility and/or Deficiency Status

State	Number of bridges in state	Sample size	Number of bridges in sample with errors	Percent of sample with errors
California	22,303	150	8	5 3
Indiana	17,603	125	19	15 2
Massachusetts	4,896	140	15	10 7

Note See appendix II for the estimated number of bridges with errors in each state, the corresponding sampling errors, and the 95-percent confidence limits for each error estimate

As shown in table 2.1 and appendix II, the eligibility and/or deficiency status changed for an estimated 5.3 percent, or 1,182 of the 22,303 bridges in California.[3] Similarly, the status changed for an estimated 15.2 percent, or 2,676 of the 17,603 bridges in Indiana when we recalculated the sufficiency rating and deficiency status using more current and

[2]The NBI is composed of 90 data items that identify and describe the structural condition of a bridge See appendix I for the 19 items that we assessed in testing the accuracy of the NBI.

[3]The estimated percentage of bridges has been rounded from 5.33; therefore, the 1,182 bridges differ slightly from the estimated number of bridges with changed status shown in appendix II.

- inconsistencies between the NBI and source documents.

Missing NBI Data

Sufficiency ratings, as previously noted, are used to determine whether a bridge is eligible for program funding for replacement or rehabilitation. The data used in calculating the sufficiency rating include factors such as structural safety, essentiality for public use, serviceability, and functional obsolescence. When a state does not provide FHWA data for the key items used to calculate the sufficiency rating, FHWA's computerized data update system automatically inputs a value equivalent to the optimum value for the missing items when it receives states' inventory data for input into the NBI. For example, the load capacity, which is used to assess the structural safety of a bridge, is a key item used to determine a bridge's sufficiency rating. Substituting a high load capacity value or the design load capacity for a missing load capacity has the effect of increasing the "safety" of a bridge, even if the bridge could not, in fact, carry the heavier or design load. Since the sufficiency rating also determines whether a bridge is eligible for replacement or rehabilitation funding, a substituted high value could also preclude a bridge needing replacement from eligibility for replacement funding and, instead, make it only eligible for rehabilitation funding. According to FHWA, as of December 31, 1985, the eligibility status of approximately 15,000 bridges had been calculated by FHWA using substitute values for missing NBI data. Of these bridges, about 12,000 were determined ineligible for HBRRP funding.

Our work in California, Massachusetts, and Indiana showed that these states had not provided FHWA data for the NBI for key items affecting the sufficiency ratings for a wide range of bridges in their states. In Indiana, state officials did not supply such data for approximately 2 percent of the bridges. California's Department of Transportation (CALTRANS) officials did not supply such data for 15 percent of its bridges. In Massachusetts, 38 percent of the bridges had missing data for one or more of the items affecting sufficiency ratings.

We also found instances of states, rather than FHWA, substituting values for such items before they submitted their inventory data to FHWA for the NBI. For example, according to a CALTRANS official, when the plans for a bridge were not available to be used as source documents for determining the load-carrying capacity of bridges in California, state bridge inspection engineers administratively assigned values for the relevant bridge data elements. Specifically, state officials assigned a load capacity value after considering factors such as the bridge's design year, the

believed other concerns such as timely inspections were of higher priority.

A Massachusetts' public works official, aware that ADTs were not always updated, noted that the department's traffic division rather than the bridge maintenance division is responsible for updating traffic volumes and should, but does not, have direct access to the NBI computer system. The FHWA division noted in its 1985 management review of Massachusetts that the state's inventory, in general, needed improvement and recommended that the public works management establish a more active internal monitoring system to assure the state's conformance with its NBI responsibilities. The division engineer told us that public works officials have repeatedly told him that they would correct problems noted by FHWA. FHWA regional office officials told us that the region relies on its division offices to determine the accuracy of states' NBI data.

We discussed the outdated ADTs in Indiana with the state Chief of the Bridge Inspection and Inventory Section, who told us that he did not believe that untimely ADTs were a serious problem because ADTs are not related to the condition of bridges. As previously noted, however, we believe a current ADT is important to accurately rate a bridge's condition.

Untimely Bridge Inspections

National Bridge Inspection Standards require that "each bridge be inspected at regular intervals not to exceed two years...." We found wide variations in states' compliance with the required inspection frequency.

For example, the Massachusetts' Department of Public Works has not been in full compliance with the 2-year inspection cycle. FHWA reported, in August 1986, that 14 percent of the bridges in the state's inventory were not in compliance with the 2-year inspection requirement. FHWA established a July 1987 target time frame for Massachusetts to achieve full compliance with the 2-year requirement. According to a Massachusetts FHWA Division bridge engineer, the state public works department did not meet the July time frame and FHWA withheld HBRRP funds until October 1987 when the department provided FHWA a plan, including milestones, for bringing Massachusetts into compliance with bridge inspection frequency requirements. As of February 1988, FHWA division officials were not able to tell us whether Massachusetts had made progress in meeting the milestones in its plan.

field and regional and division offices when they find less than desirable bridge program practices.

Although our review of bridge records in California, Massachusetts, and Indiana and discussions with FHWA officials in the regional and division offices preceded the fiscal year 1987 program management reviews, FHWA had conducted management reviews in all three states in 1985 prior to our review. In the three states visited, we found little evidence that FHWA regional offices had developed comprehensive methods that would assure identification of states' inventory problems. It appeared from our reviews that regional offices depend almost entirely on their division offices to review states' inventories.

In California, for example, FHWA regional office officials told us that the regional office, along with the appropriate division offices, generally conduct management reviews annually. Prior to our visit in the latter half of 1986 and early 1987, the region's most recent review of California was in 1985. Scheduling problems caused the cancellation of the 1986 review, according to the regional bridge engineer. Our examination of the results of FHWA's review, however, showed that the field offices did not perform internal control reviews of the states' systems for collecting inventory data.

According to the Regional Deputy Administrator, FHWA officials would generally view problems with inventory data on individual bridges detected during field inspections as indicators of systemic problems. However, FHWA officials did not identify the systemic problems of missing data and outdated ADTs, which (as discussed earlier) were common problems in California.

Our examination of the FHWA regional office's review of Massachusetts' bridge program activities found that the regional office does not have the procedures in place to detect and assure that states correct the types of problems disclosed by our review. As stated earlier, regional officials told us that they rely on their division offices to assure the accuracy of inventory data. While the division office conducts reviews of the state's data management practices, it has not been successful in identifying the types of errors we found in Massachusetts' inventory that affected the eligibility and deficiency status for about 11 percent of the bridges in the state.

FHWA's division office in Massachusetts noted in 1985 that the public works department needed to improve its inventory and recommended

Although Indiana did use the edit/update program to check for errors in bridge records, Indiana transportation officials did not correct all errors and inconsistencies identified before resubmitting the data to FHWA. Indiana officials could not explain why all of the errors were not corrected and indicated that FHWA never contacted them about the outstanding errors.

We applied the edit/update program criteria to the samples of bridges in the three states we visited. In all three states, we found errors that should have been detected, but were not, by the edit/update program. The program should have identified errors, including inappropriate coding of a bridge structure type, incorrect appraisal and condition ratings for bridges, that caused inaccurate determinations of eligibility and deficiency status, and incorrect coding of bridges as open, posted, or closed. We attribute the persistence of these errors to human oversight.

The Annual Cost-To-Improve Estimate Is Not a Reliable Indicator of Bridge Needs

FHWA's annual report to the Congress provides an estimate of the total cost of replacing or rehabilitating all bridges classified as deficient and eligible for HBRRP funds. FHWA derives this estimate using states' estimates of improvement costs for all bridges in the state needing improvement. Our review of the methods used by California, Massachusetts, and Indiana to determine the costs to improve their bridges indicates that the reliability of FHWA's estimate is lessened by inconsistencies in states' estimations of bridge improvement costs and by incomplete local cost data bases. Limited FHWA guidance to states on methods for estimating costs also contributes to the lack of uniformity in states' reporting. Based on our reviews of methods used by the states, it is questionable whether FHWA can provide the Congress with a reliable cost-to-improve estimate.

While we were able to identify problems in states' methods for estimating improvement costs and problems in their bridge data bases that affect FHWA's ability to provide an accurate improvement cost estimate, we were unable to determine what the national cost-to-improve estimate should have been. We believe, however, that without a uniform system for reporting estimated rehabilitation and replacement costs, the Congress does not have accurate information upon which to make funding decisions for improving the nation's bridges.

on whether it is a replacement or rehabilitation project. The unit cost data are based on contract bids received during calendar year 1982. According to CALTRANS' Senior Bridge Engineer, although the unit cost figures were last updated in 1982, they are still accurate for use in estimating costs to improve bridges at the time of our review.

Indiana bases its cost information on engineering estimates for state-owned bridges scheduled for replacement or rehabilitation. Unlike California's estimates that are based on historic data, Indiana's estimates are based on engineers' estimates of the cost of replacing or rehabilitating structures that are included in the state's bridge improvement plan for future work. Consultants hired by local governments prepare cost estimates for locally owned bridges.

In Massachusetts, cost-to-improve data are not supplied for the NBI. In the early 1980s, the department of public works developed estimates based on a bridge's square foot deck area at an average cost of $1,000 per square yard. The individual responsible for this task input the data for only a few weeks before leaving and no one was selected to replace him. FHWA's Division Bridge Engineer for Massachusetts was informed of the loss of personnel and instructed the department to input zeros in place of estimates. This was still the practice in Massachusetts at the time of our review. Because Massachusetts does not supply cost-to-improve estimates, the national estimate prepared by FHWA would not be representative of Massachusetts' bridges.

We also noted that FHWA's Recording and Coding Guide allows states to include maintenance and minor repairs in their cost-to-improve estimates, even though the HBRRP program only authorizes funding for replacement and rehabilitation.

Conclusions

In creating HBRRP, the Congress directed the Secretary of Transportation and the states to inventory all bridges and identify bridges that are unsafe because of structural deficiencies or functional obsolescence. The authorizing legislation also directed the Secretary to determine eligibility for HBRRP funding after considering those bridges that are most in danger of failure. In our opinion, FHWA has not effectively carried out either of these mandates.

FHWA's annual report on the status and condition of the nation's bridges is a primary source document cited by the Congress and other policy decisionmakers when commenting on the nation's bridge needs. Based

using it. Even if the states made full use of FHWA's current version of the program, the program would not be able to detect many of the errors, such as outdated data, disclosed by our manual record reviews.

Although we were unable to determine an accurate cost-to-improve estimate, we believe that FHWA's cost-to-improve estimate included in the annual report is inaccurate. FHWA's estimate is based on the full cost to rehabilitate or replace deficient bridges when only minor, less costly improvements, such as the use of traffic control devices, signs, or roadway striping, could make a bridge safe. FHWA also includes in its cost estimate bridges that states have no intention of replacing or rehabilitating.

We believe that the national cost-to-improve estimate should reflect the total cost to improve all of the nation's bridge deficiencies. However, in order to provide the Congress a more meaningful basis for program policy and funding decisionmaking, FHWA should distinguish in its annual report the varying levels of bridge deficiencies and the associated costs. In addition, we believe that the Congress and others who refer to the HBRRP report would be better served by a more accurate presentation of bridges in need of replacement, rehabilitation, or relatively inexpensive improvements so as to better focus limited federal funds on those bridges that pose the greatest threat to public safety.

Recommendations to the Secretary of Transportation

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

- Establish a management oversight program, which would include guidance to the states, as well as an internal control process to assure the accuracy, completeness, and timeliness of states' bridge inventories.
- Require states to report the data that would enable FHWA to identify in its annual report varying levels of bridge deficiencies. At a minimum, states should identify deficiencies in three categories: those bridges that need relatively inexpensive improvements such as traffic control devices, those bridges that need total replacement or rehabilitation, and those bridges that the states do not intend to replace or rehabilitate.

The FHWA Administrator should provide cost-to-improve estimates corresponding to the various categories of deficient bridges. The Administrator should also prescribe an appropriate method(s) for states to use when estimating the cost to replace and rehabilitate their deficient bridges.

that not every deficient bridge may need to be replaced, and states may appropriately improve bridges that do not meet DOT's definition for a deficient bridge. DOT noted that the decisions regarding whether or not a bridge will be improved rest with individual states and localities. DOT said that to require states to report data that would enable DOT to identify bridges that states do not intend to improve is unrealistic because decisions regarding which bridges should be improved can only be made at the state and local government level, after their consideration of a variety of factors, such as resource availability and analysis of the relationship between reduced user costs (e.g., accidents, delays, detours) and the cost of the improvements.

We did not intend that DOT identify such bridges independently of the state and local governments. We recommend that the states, at a minimum, distinguish for DOT those bridges that need total replacement or rehabilitation, and those that only need less costly repair. The bridge management system that DOT is suggesting that states implement should help states identify such bridges. DOT should obtain the data from the states to report these two categories of bridge deficiencies. In the course of our review, state transportation officials responding to our survey were able to identify bridges that they do not intend to improve, the third category of need we recommmend that DOT report.

Further, the HBRRP legislation states that DOT should consider those bridges most in danger of failure. DOT said that in recognition of this congressional directive, it is considering changing eligibility thresholds for HBRRP funds to postpone consideration of functionally obsolete bridges, thereby placing greater emphasis on bridges with structural safety and load-capacity problems. We believe that DOT can assure that greater attention is given to bridges most in need of improvement by distinguishing in its annual report between bridges that need total replacement or rehabilitation and those that require less costly improvements.

In responding to our recommendation that it prescribe methods for states to use in developing cost-to-improve estimates, DOT indicated that its new Recording and Coding Guide, now in draft, provides a computer program method that states may want to use in order to generate more consistent cost estimates. While DOT's proposal that states use this program may reduce the incidence of inconsistencies in estimating costs that we found, it is not clear that the guide will fully implement our recommendation by also suggesting a method for states' use in identifying the costs associated with varying levels of bridge deficiencies.

Actions Needed to Eliminate Apportionment Process Inequities

In establishing the highway bridge program, the Congress intended that a fair and equitable distribution be made of HBRRP funds. The Congress established an apportionment formula that allocates HBRRP funds based on each state's relative share of the total national cost of replacing or rehabilitating deficient bridges. The ratio of each state's total needs, expressed in dollars, to the national need, is the state's relative share. The HBRRP legislation assures that every state receive at least 0.25 percent but not more than 10 percent of the total funds available.

Computation of the annual apportionment of HBRRP funds requires data on each state's total square footage of eligible, deficient bridges and unit replacement and rehabilitation costs (i.e., cost per square foot). FHWA requires that information on the square footage of each bridge contained in the NBI to be updated biennally by the states via inspections. The square footage of a bridge could change if, for example, a bridge was replaced with a larger bridge.

Because the HBRRP legislation requires an annual determination of unit replacement and rehabilitation costs for the apportionment, FHWA collects the cost-per-square-foot data through an annual survey of the states. Unlike the cost-to-improve estimates that states submit to the NBI for individual deficient bridges (which FHWA accumulates to arrive at a national cost-to-improve figure), states compute a weighted average rehabilitation and replacement cost per square foot for each of four bridge categories[1] for the apportionment process. Therefore, each year FHWA requests, through its field offices, data on each state's weighted average construction costs for each category.

FHWA makes a number of adjustments to the bridge data submitted by the states for the apportionment. FHWA deducts from the inventory data, bridges that (1) are already funded for replacement or rehabilitation, (2) have selected coding inconsistencies in the bridge record indicating an error in the NBI data (although none of the errors we found were detected), and (3) had been replaced or rehabilitated within the last 10 years. By making these adjustments, FHWA reduced the fiscal year 1986 apportionment base by approximately 42,200 bridges.

Erroneous and outdated bridge data, however, directly affects each states' count of its deficient and eligible bridges and ultimately the

[1]The categories are (1) bridges on the federal-aid system eligible for replacement, (2) bridges off the federal-aid system eligible for replacement, (3) bridges on the federal-aid system eligible for rehabilitation, and (4) bridges off the federal-aid system eligible for rehabilitation.

The principal item requiring oversight has been the cost information submitted annually by the states for use in the apportionment process. FHWA has required its field offices to assure the correctness of these data. Specific guidance, however, has not been provided to the field offices in terms of what they should be alerted to.

Undue Field Reliance on FHWA Bridge Division

The principal review of NBI data for the apportionment is that done by FHWA headquarters Bridge Division. The division's checks, however, do not address the quality of states' efforts to maintain good data and can only detect some, but not all, systemic problems.

For example, during the fiscal year 1986 apportionment process, the Bridge Division identified a problem that it addressed with a quick fix rather than a long-term cure. The division learned that the state of Georgia had arbitrarily lowered the substructure ratings for its timber bridges without reinspecting them and had then recorded the lower ratings in the NBI. Had FHWA not noticed the changes, the sufficiency ratings for these bridges would have decreased, causing an increase in the number of deficient and eligible bridges in Georgia. The total square footage then used by FHWA to calculate Georgia's apportionment base would have increased the prior year's apportionment base by approximately 4.7 million square feet. FHWA projected that the additional square footage would have increased Georgia's fiscal year 1986 apportionment by 85 percent over its $30.7 million fiscal year 1985 apportionment.

Since the apportionment process was already underway by the time FHWA noticed the lowered substructure ratings in Georgia, FHWA subtracted from Georgia's apportionment base the 4.7 million square feet associated with the bridges with lowered ratings. FHWA then arbitrarily subtracted the total square footage of deficient timber bridges in any other state that had reported a similar decrease from the prior year's substructure ratings, regardless of whether the bridge had actually been inspected. According to a FHWA Bridge Division official, FHWA believed that in order to meet apportionment deadlines, and to be fair to all states, this correction was the most appropriate. We believe that while FHWA's remedy addressed the Georgia problem, it may also have adversely affected other states that followed FHWA guidelines for inspecting and reporting changes in the condition of bridge substructures. Without examining every other state's inventories for fiscal year 1985 and 1986, we were not able to determine the extent that other states were affected

were corrected. Our analysis of Massachusetts' computation of its cost per square foot for federal-aid replacement, however, detected a significant mathematical error that understated Massachusetts' total cost-per-square-foot estimate. The error was not detected by FHWA. In computing the cost per square foot for federal-aid replacement, the state public works officials made a mathematical error that resulted in an $85.36 cost per square foot, when the correct cost was $102.02. This error, if corrected and if all other conditions were held constant, would have increased Massachusetts' fiscal year 1986 apportionment of $47.73 million by approximately $1.7 million.

In California, FHWA did not examine the underlying data for the state's cost submission thus it did not detect unauthorized costs that had been included by the state. FHWA stipulates in its instructions to the states that only costs related to the bridge itself should be used when computing unit cost data for apportionment purposes. California had included mobilization costs[3] that FHWA's instructions specified should not be included in the unit costs. CALTRANS officials told us that they have always included this cost item, believing it to be a valid bridge-related cost. We brought this matter to the attention of the FHWA division bridge engineer in California who told us that he was unaware of the state's inclusion of mobilization costs and reiterated that such costs should not be included. He said that he would follow-up this matter with the state.

Our analysis indicated that if all other factors in the apportionment process had remained constant, California received $5 million more in its fiscal year 1986 apportionment than it would have had it complied with FHWA's criteria. California's apportionment for fiscal year 1986 was $58.86 million.

Redefinition of Apportionment Base

As noted in chapter 2, FHWA's annual report does not disaggregate the various types of deficiencies that are associated with deficient bridges. We have found that thousands of the 240,000 deficient bridges can be improved with actions short of total replacement or rehabilitation. For instance, FHWA should not include in its total cost estimate of replacement and rehabilitation, bridges

- with marginal problems requiring minor repair work,

[3]California defines mobilization as consisting of preparatory work and operations, including movement of personnel, equipment, and supplies to the project site, and all other work and costs incurred prior to beginning work on site.

fall in this category. FHWA's definition of a deficient bridge for apportionment purposes, however, does not make distinctions among the various types of bridge deficiencies. The bridge inventory does not collect the information needed to make these distinctions. Thus, bridges with problems that can be remedied through alternative actions continue to be included in the needs base for apportionment even though states may choose to exercise less costly improvement alternatives.

Our review also indicated that states may also be apportioned funds on the basis of closed bridges that are no longer needed. Because the NBI does not contain information on when and why a bridge is closed, we could not determine how many of the closed bridges were, in fact, not needed. In the fiscal year 1986 apportionment process, FHWA requested its field staff to identify closed bridges that were closed before the HBRRP program was created in 1979 or because they lacked economic justification for replacement. These bridges are not eligible for HBRRP funding. FHWA officials were not able to tell us how many closed bridges met this criteria.

Conclusions

FHWA has little assurance that HBRRP funds are equitably apportioned to the states. Our examination of three states' inventory and reporting practices showed that errors and inconsistencies in state's data submitted for apportionment can significantly affect a state's share of bridge funds. Although we were unable to quantify the effect on the fiscal year 1986 apportionment, such errors ultimately impact all states' shares of the apportionment. FHWA has also not defined its apportionment criteria to limit the base to bridges actually needing funds for rehabilitation or replacement.

The errors that we found along with inconsistencies in state practices that further impacted on apportionment were largely undetected by FHWA's regional and field division staffs. This indicates that FHWA had not adequately delineated the oversight responsibilities of its field staffs with respect to apportionment. Poor oversight was due, in part, to the lack of guidance to field offices on the types of tests and examinations that they should make of the NBI to fulfill those responsibilities.

The equity of the apportionment process may also be adversely affected by FHWA's criteria for what constitutes a deficient bridge. FHWA's present criteria is too broad to assure that bridges that do not require rehabilitation or replacement are excluded from the apportionment base. This can also cause an imbalance in the apportionment by allowing states with

The issue is not whether mobilization costs are a legitimate cost of construction, as CALTRANS has stated. Rather, the issue is whether mobilization costs can be considered by the states when developing unit cost data for the apportionment process. In its instructions to states for developing unit cost data for the HBRRP apportionment process, FHWA stipulates that only costs related to the bridge itself should be used. Further, costs related to such items as utility relocation, contingencies, mobilization, or other similar work not specifically for the bridge should not be included. Despite these instructions, CALTRANS included these costs in its unit cost data. Therefore, we reaffirm our conclusion that, if all other factors in the apportionment data base remained constant, California received $5 million more in its fiscal year 1986 apportionment of $58.86 million than it would have had it complied with FHWA's criteria.

As noted in chapter 2, FHWA has not established the necessary management controls and oversight of states' bridge inventory practices. Although cost data collected by the states for the apportionment base are not included in the NBI, the square footage associated with bridges determined deficient and eligible—based on states' input into the NBI—is used for the apportionment. Therefore, the internal controls program which we recommended that FHWA adopt, should assure that errors or inconsistencies in states' inventory data used for the apportionment are also identified.

Sampling Errors for Selected Variables in States' Bridge Inventories

We reviewed a statistical sample of bridges in California, Indiana, and Massachusetts. Each estimate developed from the sample has a measurable precision or sampling error. The sampling error is the maximum amount by which the estimate obtained from a statistical sample can be expected to differ from the true universe characteristic we are estimating. Sampling errors are usually stated at a certain confidence level—in this case 95 percent. This means, the chances are 19 out of 20 that, if we reviewed the records of all the bridges in each state, the results of such a review would differ from the estimates obtained from our sample by less than the sampling errors of such estimates.

At the 95-percent confidence level, our maximum sampling errors do not exceed plus or minus 9.2 percentage points for any state. In other words, the chances are 19 out of 20 that key estimates describing the eligibility and/or deficiency status for each state will be within 9.2 percentage points of the corresponding (true) universe characteristic. Tables II.1 - 6 show the computed estimates, sampling errors, and 95-percent confidence limits.

Table II.1: Estimated Number of Load-Posted (L-P) Bridges that States Do Not Intend to Rehabilitate

	L-P bridges w/no cost estimate	Bridges states do not intend to fix (percent)	Sampling error	95-percent confidence limits	
				Lower	Upper
All Respondents	20,979	4,322 (20 6%)	1.930 (9.2%)	2,392 (11.4%)	6,252 (29 8%)

Table II.2: Estimated Number of Bridges With Errors that Changed Their Eligibility and/or Deficiency Status

State	Number of bridges in state	Number of bridges in the state with errors (percent)	Sampling error	95-percent confidence limits	
				Lower	Upper
California	22,303	1,189 (5.33%)	799 (3.6%)	390 (1.7%)	1,988 (8.9%)
Indiana	17,603	2,676 (15 2%)	1,104 (6.3%)	1,572 (8 9%)	3,780 (21 5%)
Massachusetts	4 896	525 (10.7%)	247 (5.1%)	278 (5 7%)	772 (15 8%)

Process for Calculating Replacement and Rehabilitation Cost Per Square Foot

Unit Cost Factor	How Calculated
Federal-Aid	
Replacement	Average of 1982, 1983, & 1984 unit costs.
Rehabilitation	70 percent of federal-aid replacement cost.
Off-System	
Replacement	Cost submitted by state (if not greater than federal-aid replacement), or federal-aid replacement cost (if cost submitted is greater than the federal-aid replacement cost), or 80 percent of the federal-aid replacement cost (if no off-system replacement cost was submitted), or 80 percent of the federal-aid replacement cost (if the cost submitted was less than 80 percent of the federal-aid replacement cost)
Rehabilitation	70 percent of the off-system replacement cost

DEPARTMENT OF TRANSPORTATION
REPLY TO GAO REPORT OF FEBRUARY 17, 1988, ON
BRIDGE CONDITION ASSESSMENT: INACCURATE DATA
MAY CAUSE INEQUITIES IN APPORTIONMENT OF FEDERAL-AID FUNDS

Summary of GAO Findings and Recommendations

The GAO found that (1) the National Bridge Inventory (NBI) contains insufficient data to allow the Federal Highway Administration (FHWA) to distinguish between those bridges requiring total replacement or rehabilitation and those bridges needing only remedial improvements, (2) the FHWA has not established the necessary management controls and oversight of i field offices to assure that its field staffs' examine States' controls over bridge inventory data, (3) the FHWA's $51 billion estimate of the cost to replace or rehabilitate deficient bridge is questionable, and (4) inequities in the apportionment of brid funds among States are introduced initially because there are errors in the States' counts of deficient and eligible bridges a because the FHWA does not exclude from the apportionment data ba bridges that can be corrected without replacement or rehabilitat

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

- establish internal controls and a management oversight progr including guidance to the States designed to assure the accuracy, completeness, and timeliness of bridge inventory a apportionment cost data;
- require States to report the data which would enable the FHWA to identify in its annual report varying levels of bridge deficiencies;
- provide cost-to-improve estimates corresponding to the variou categories of deficient bridges and prescribe an appropriate method for States to use when estimating the cost to replace and rehabilitate their deficient bridges; and
- exclude from the apportionment data base bridges that are not in need of replacement or rehabilitation.

Summary of Department of Transportation Position

The DOT does not agree with the majority of the GAO recommendations, particularly those concerning the need to identify various levels of improvements for all deficient bridges. Based upon a review of the report, the DOT recommends that the following comments be considered and incorporated into the final GAO report.

they would with the most current values. However, this effect is quite small since the sufficiency rating formula is purposefully structured to emphasize bridge safety.

The combination of the new Coding Guide, recent changes in the instructions for bridge unit cost data reporting, pending final rule on changes in the NBIS, improved edit/update and report generator capability and on-going FHWA field review of randomly selected bridge sites should more than adequately satisfy the GAO concerns regarding NBI data accuracy and currency.

GAO Recommendation:

Require States to report the data which would enable the FHWA to identify in its annual report varying levels of bridge deficiencies.

DOT Comment:

The GAO draft report strongly suggests that bridge needs reported by the FHWA are erroneous because they include some bridges which bridge owners will never improve. Bridge needs as reported in the FHWA/DOT reports to Congress represent the costs to improve all deficient bridges. Deficient bridges impose costs upon the public through detour costs, accident costs, delay costs or other costs associated with limited mobility, limited pay loads and a less than desirable level of safety. Regardless of whether deficient bridges are improved, the public incurs the costs. The main reason that bridge owners elect not to improve all bridges which are deficient is not that they do not want to, but rather resource limitations will not allow them to.

A narrow bridge located on a heavily traveled main highway might be considered highly deficient due to high user costs, whereas the same bridge, located on a low traffic volume local road, might be considered entirely adequate. Furthermore, the cost-effectiveness of improving a bridge depends on how much user costs are reduced in relation to the cost of the improvement.

States and local governments must make decisions on which bridges to improve based upon resource availability from all sources, priority ranking of bridges and maximizing incremental benefit-cost determinations on a network level rather than an isolated evaluation of individual bridges.

For the FHWA to require States to report data which would enable the FHWA to identify which bridges will never be improved is not realistic - primarily because of variations in resources available to individual States and local governments, priority delineation of important highway networks which can only be done on an individual State and local governmental level and the fact that some bridge improvements are driven by local political concerns as much as "real" priorities.

GAO Recommendation:

Provide cost-to-improve estimates corresponding to the various categories of deficient bridges and prescribe an appropriate method for States to use when estimating the cost to replace and rehabilitate their deficient bridges.

DOT Comment:

The FHWA through the years has sent out instructions and suggestions concerning cost-to-improve estimates. In 1984, a memorandum was sent to all field offices emphasizing the need for accurate and complete cost-to-improve estimates. The FHWA also suggested that the States may want to use a computer program similar to that developed by Georgia to generate consistent estimates.

The new Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges will contain a suggested method which any State or local bridge owner can conveniently use. It can be generated using a simple computer program.

The FHWA procedure of expanding average costs per bridge for those with estimated improvement costs in the NBI to encompass all bridges eligible for HBRRP funding is valid, provided the sample of bridges with costs is large enough for statistical purposes. Because the sample is based on cost data provided for 200,000 bridges, the cost estimates are valid.

GAO Recommendation:

Exclude from the apportionment data base bridges that are not in need of replacement or rehabilitation.

DOT Comment:

The current method of estimating the costs to improve all bridges eligible for HBRRP funding is valid for the reasons described above. It should also be noted that the Nation's bridge needs are somewhat underestimated by this process because some categories of bridge improvements are not eligible for HBRRP funding. Such improvements are however eligible for Interstate 4R, Primary, Urban and Secondary funding. For example, if a bridge has only inadequate bridge rail, inadequate vertical clearance or is lacking adequate pier protection against errant waterborne vessels, it will not be eligible for HBRRP funding unless it has other major deficiencies. In addition, in the Eighth Annual Report to Congress on the HBRRP, the DOT reported that more than 15,000 deficient bridges were not included in the estimate of needs because their sufficiency ratings were more than 80.

Comments From the Indiana Department of Highways

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

STATE OF INDIANA

INDIANAPOLIS

INDIANA DEPARTMENT OF HIGHWAYS
100 North Senate Avenue
Indianapolis, Indiana 46204-2249

Room 1101, State Office Building
317-232-5533

March 28, 1988

Mr. Kenneth M. Mead, Associate Director
U. S. General Accounting Office
Resources, Community and Economic Development Division
Washington, D. C. 20548

RE: Comments on U.S.G.A.O. Draft Report "Bridge Condition Assessment"

Dear Mr. Mead:

In response to your letter of February 17, 1988, we have reviewed the draft report "BRIDGE CONDITION ASSESSMENT: Inaccurate Data May Cause Inequities in Apportionment of Federal-Aid Funds" prepared by your office and concerning the accuracy of the National Bridge Inventory (NBI) and the equity of the Highway Bridge Replacement and Rehabilitation Program apportionment process.

We feel that the draft report substantially assesses the status and needs of the nations bridges, the levels of consistency of NBI bridge data and apportionment methods.

Following are our comments concerning several areas which your report addresses. As stated in your report, the national bridge inventory contains insufficient data to allow the Federal Highway Administration (FHWA) to distinguish between those bridges requiring total replacement of "major" rehabilitation and those needing only remedial improvements.

"Comprehensive" bridge management systems, such as "FHWA proposed bridge management system", may provide an additional tool to better determine specific bridge needs. Several states, some at considerable financial expense have independently developed bridge management programs, and it would be likely that they would be reluctant to adopt a new program. It seems states which have developed BMS have used different approaches, particularly in prioritizing their needs. Some use considerable additional bridge condition data, safety needs, user needs, cost benefits and etc., and others may essentially consider users cost benefits, and/or others agency cost benefits.

See comment 1

Unless all the states collect and record certain specific bridge information/data to be reported in the NBI, it would appear that BMS would not improve on the inequities in the apportionment process.

An Equal Opportunity Employer

In summary, if current expectations go beyond the original intent of the NBI Standards to provide for the safety inspection and the identification of those bridges which are structurally deficient or functionally obsolete and potentially pose a dangerous threat to the traveling public, it is obvious that the present program falls short. Although the program has served well in the identifing our major bridge needs and in funding their rehabilitation and/or replacement, perhaps only comprehensive bridge management system programs could provide the required detailed and/or realistic information for bridge needs management.

Sincerely,

John P. Isenbarger
Director

JPI:JST:blr

load-carrying capacity. Indiana's system ties the appraisal rating for structural condition almost exclusively to the inventory rating (a load-capacity rating), which resulted in ratings that, when applied to FHWA's definition for a deficient bridge, result in an overstatement of deficient bridges.

Also the draft report places particular emphasis on the non-currency of Average Daily Traffic (ADT) data and although it contains the admission that the effect of this data error was not quantitatively tested, the report at page 34 concludes that "using outdated ADT information . . . could significantly (emphasis added) impact the rating thereby affecting the eligibility status of a bridge". Without question, the bridge sample tested in California contained an embarrassingly large percentage of bridges with outdated ADT's and that fact should not be suppressed in the report. However, had your agency tested the sensitivity of this isolated data error, your conclusions might have been quite different. To establish an HBRRP candidate bridge, "Structural Deficiency" (SD) and/or "Functional Obsolescence" (FO) precondition any use of the "Sufficiency Rating" (SR) and ADT is a part of neither of these pre-requisite definitions. Outdated or even missing ADT data cannot therefore affect the "eligibility status" of a bridge. Even for eligible bridges throughout the SR range of 0 to 80, increasing ADT by as much as 20%, typically has only a marginal impact (in the order of 2 points) on a recomputed SR. It would therefore be somewhat of a rarity if an eligible bridge crossed the SR 50 threshold thus changing its rehabilitation vs. replacement qualification.

See comment 1.

Perhaps the most disturbing aspect of the draft report is the characterization (see BACKGROUND, Executive Summary) that program candidate bridges are "unsafe because of structural deficiencies or functional obsolescence". It must be as inconceivable to you as it is to us that any bridge owner or operating agency would permit a bridge to remain in service knowing it to be "unsafe". HBRRP eligible bridges as defined and annually reported to Congress, simply scope that segment of the nation's bridges that: 1) have needs varying from total replacement to rehabilitation, 2) represent both immediate and deferable priorities, and 3) span the short-term to long-term considerations necessary to perpetuate a usable transportation infrastructure. If only known "unsafe" bridges were to be reported, the list would contain just those shown by NBI Item 41 as "Closed". Contrary to the report's conclusions, it is not inappropriate to identify bridges whereon interim actions such as roadway striping, signs, signals, crash cushions, posting, etc., might ameliorate an urgent need to repair or rehabilitate. These bridges represent legitimate future system needs and as levels of service requirements change with time, their usability will not be assured if allocations address only temporary solutions.

See comment 2

The GAO appears to have overreacted to the errors they have found. Certainly these and other errors should be corrected, but since those noted in the report do not appear to be systemic in

The following are GAO's comments on CALTRANS' letter dated March 7, 1988.

GAO Comments

1. Contrary to CALTRANS' statement, we found that we could not identify bridges that are unsafe and pose a threat to public safety using national bridge inventory data. We also found that the inventory contains insufficient data to allow the department to distinguish between deficient bridges requiring total replacement or rehabilitation and those needing only remedial improvements. Distinguishing the varying levels of bridge deficiencies would enable the department to consider those bridges most in danger of failure.

2. Our report does not conclude that it is inappropriate to identify bridges for which interim actions, such as roadway striping, signs, signals, etc., might ameliorate a problem. Rather, we endorse the need for such identification of bridge needs and recommend that DOT, in its annual report, distinguish deficient bridges by various categories, such as those requiring minor improvements and those requiring total replacement or rehabilitation. DOT's current method of reporting does not distinguish between these categories.

3.) The Department is in full compliance with the N.B.I.S. requirement to inspect each of its bridges every two years. In addition it has taken on the task of inspecting all municipally owned bridges in the interest of public safety and to assist them in meeting N.B.I.S. requirements. Item 1 above has dealt with the problem of out dated average daily traffic items and the Department will now rely on district bridge inventory personnel to perform this task, not our traffic section as indicated in the report.

4.) The F.H.W.A. Regional Office has taken action as noted in your report and in addition has not compromised in the development of the Commonwealth's Bridge Inspection Program. You will be pleased to know that many of the conclusions and suggestions offered in the G A O draft report are target goals of the F.H.W.A. which are clearly needed.

The Commonwealth of Massachusetts, Department of Public Works is receptive to constructive criticism and will implement suggestions which will assist in its goal of reaching full compliance with the National Bridge Inspection Standards (N.B.I.S.). This Office also supports any endeavor to improve the effectiveness of the bridge inspection program. In this sense it has been a rewarding experience dealing with your organization and I will continue to assist you in this matter of highway management.

It is the Department's understanding that the results of this investigation are for an objective national report and trusts that the subject draft report will remain restricted as indicated in your letter. I look forward to reviewing the final G A O report as soon as it becomes available. In the interim, if you need any further information please call Mr. Joseph Hegarty at (617) 973-7742.

Sincerely,

Jane F. Garvey
Commissioner

Requests for copies of GAO reports should be sent to:

U.S. General Accounting Office
Post Office Box 6015
Gaithersburg, Maryland 20877

Telephone 202-275-6241

The first five copies of each report are free. Additional copies are $2.00 each.

There is a 25% discount on orders for 100 or more copies mailed to a single address.

Orders must be prepaid by cash or by check or money order made out to the Superintendent of Documents.

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

Official Business
Penalty for Private Use $300

First-Class Mail
Postage & Fees Paid
GAO
Permit No. G100

Major Contributors to This Report

Resources, Community and Economic Development Division, Washington, D.C.	Kenneth Mead, Associate Director, (202) 275-1000 James R. Hunt, Group Director Jacquelyn L. Williams, Assignment Manager Austin J. Acocella, Advisor Walter L. Allen, Evaluator Thomas E. Slomba, Social Science Analyst Sandra M. Emrick, Advisor Shirley Perry, Writer-Editor
Office of the Chief Economist, Washington, D.C.	David Gross, Economist
Chicago Regional Office	Clement F. Preiwisch, Evaluator-in-Charge Stewart O. Seman, Senior Evaluator Ruthann R. Balciunas, Technical Advisor Gary L. Petrovich, Evaluator Leslie Chapman-Cliburn, Writer-Editor
Boston Regional Office	Thomas McGrane, Regional Assignment Manager Ralph D'Agostino, Senior Evaluator
San Francisco Regional Office	Richard A. Sheldon, Regional Assignment Manager Karen E. Buonaiuto, Senior Evaluator Ellen M. Kotler, Evaluator

U.S. G.P.O. 1988-201-749:80111

Comments From the Massachusetts Department of Public Works

The Commonwealth of Massachusetts
Executive Office of Transportation and Construction
Department of Public Works
Office of the Commissioner
Ten Park Plaza, Boston 02116-3973

March 30, 1988

Kenneth M. Mead
Associate Director
Unites States
General Accounting Office (G.A.O.)
Washington D.C. 20548

Dear Mr. Mead:

Re: Result of G.A.O. audit of M.D.P.W. Bridge Inspection Program as part of national report to Congress.

This is in response to your letter Dated February 17, 1988 and attached draft report titled " BRIDGE CONDITION ASSESSMENT ".This is the result of a G A O audit conducted in this office from November 1985 to May 1987.

As stated in Chapter 1 on page 20 of the introduction to the draft report, the data used is not current. It must be noted that data used in 1986 was obtained from a two year bridge inspection cycle dating back to 1984 and many of the items discussed in the report can now be shown to be in compliance with the National Bridge Inspection Standards.

Chapter two of the report deals with 1) inaccurate, 2) missing, 3) out dated data and 4) lack of federal supervision to the bridge inventory program.

1.) Inaccuracies: The Department has conducted four separate workshops for its bridge inspectors and inventory personnel over the past year in order to correct these deficiencies. Also we are implementing the F.H.W.A. cross check computer program which will aid in sorting out inconsistencies in our bridge inventory file.

2.) Missing Data: A major effort is being made to provide a load capacity rating for all state and municipally owned bridges. This information will be included in the bridge inventory. The F.H.W.A. is insistent on the development of a bridge management program and the replacement cost items will be necessary for compliance. The workshop explained in item 1 above will also contribute to rectify these and other items with missing data.

nature, it may be that inordinately large federal and state resource commitments would be necessary to only marginally improve the overall quality of bridge data. The blanket indictment of the Federal Highway Administration and the states implied in both the report title and the Executive Summary, is not very firmly supported in the body of the report.

The NBIS as it is now administered by the FHWA, would, with some relatively minor changes, be a very manageable system and in a program level sense, able to provide reliable estimates of aggregate national needs and appropriate apportionments. Perhaps the most effective change would be to redefine the terms "Structurally Deficient" and "Functionally Obsolete" so that, using existing NBIS data items, these categories of deficiency would more accurately represent critical bridge needs. This suggestion would add considerably to the value of the "Recommendations" portion of your report.

Efforts are presently underway in a cooperative FHWA/AASHTO endeavor to improve the NBI system, remove some of its subjectivity, consider levels of service concepts and to enhance the ability of system data to focus more directly on those of the nation's bridges having critical needs. This effort is the result of a recognition of system shortcomings by both federal and state people who are committed on a daily basis to the problems inherent in the nation's bridges. It might serve Congress well if your report would acknowledge this ongoing effort.

Again, thank you for the opportunity to review your draft report and to submit comments that hopefully will be of use in improving the quality and objectivity of the final document. If you desire, Caltrans is available for further discussions or more specific reactions to issues raised or conclusions reached in the draft report.

Sincerely,

Donald L. Watson

DONALD L. WATSON
Interim Director of Transportation

Comments From the California Department of Transportation

STATE OF CALIFORNIA-BUSINESS, TRANSPORTATION AND HOUSING AGENCY GEORGE DEUKMEJIAN, Governor

DEPARTMENT OF TRANSPORTATION
OFFICE OF DIRECTOR
1120 N STREET
SACRAMENTO, CALIFORNIA 95814
(916) 445-5408

March 7, 1988

Mr. Kenneth M. Mead
Associate Director
Resources, Community and Economic
Development Division
United States General Accounting Office
Washington, D. C. 20548

Dear Mr. Mead:

The Department is grateful for the opportunity to review the draft copy of the U. S. General Accounting Office report entitled, "Bridge Condition Assessment, Inaccurate Data May Cause Inequities in Apportionment of Federal Aid Funds," received with your letter of February 17, 1988. We hope that our review and commentary on this draft will help you achieve an accurate and objective final report to the Congressional committees commissioning the study.

It is unfortunate, we believe, that the report, and in particular the Executive Summary and your chosen title, project an overall sense that the National Bridge Inventory (NBI) is grossly inaccurate and that the combined use of state-furnished inventory data and FHWA-applied apportionment factors leads to significant inequities and improprieties in the distribution of HBRRP funding allocations. In reality, of the approximately 90 data items present in the Inventory for each of the nation's nearly 600,000 bridges, only a very few were found by your three state reviews to be in error on a recurring or systematic basis. In the case of your study of California data, some of those focused errors are not accurately evaluated in the draft report. For example, both the Executive Summary and the body of the report suggest that California inappropriately included "Mobilization" costs in its cost-per-square-foot estimates. Identifying mobilization costs is a technique of contract administration that only some states (including CA) employ but it does not inflate the final total cost of a project. Factually, it merely reflects some downward adjustment of unit costs by all bidders in exchange for early contract payments to help the successful contractor get the job underway and is thus an entirely legitimate cost of constructing a bridge. (See NBI Item 84 definition.)

The following are GAO's comments on the Indiana Department of Highways' letter dated March 28, 1988.

GAO Comments

1. We do not believe that bridge management systems (BMS) alone will necessarily reduce inequities in the apportionment process. The inequities we found in the apportionment data base were attributed, in part, to inaccurate, incomplete, and outdated data in states' inventories, and the lack of FHWA oversight of states' inventory practices and their computation of square foot costs. We also found that FHWA's criteria for what constitutes a deficient bridge is too broad to assure that bridges that do not require replacement or rehabilitation are excluded from the apportionment data base

We do believe, however, that BMS, if adopted as proposed by FHWA, will guide states in collecting the type and quality of bridge data needed to estimate their critical bridge needs and identify options for improvement other than replacement or rehabilitation. This type of effort by the states will, no doubt, help FHWA to identify the varying levels of bridge need for reporting and apportionment purposes.

As indicated by the results of our review, consistency in states' data collection is not necessarily a prerequisite to states' abilities to distinguish bridges in need of replacement or rehabilitation from those they do not intend to replace or rehabilitate. In responding to our survey of state transportation agencies, states were able to identify bridges that they do not intend to replace or rehabilitate even though FHWA does not currently require states to maintain this type of information in their inventories.

2. Indiana used an appraisal rating scale that differed from the the American Association of State Highway Transportation Officials' suggested appraisal rating scale (in the NBI coding guide) and its use resulted in an overstatement of Indiana's deficient bridges. Indiana's inspection guidelines, referred to in chapter 2 of this report, are used by the department and state inspectors to lower appraisal ratings for locally owned bridges. While the NBI coding guide encourages states to develop their own criteria for evaluating appraisals for items such as deck geometry, the guide also recommends that states be mindful of relationships among selected bridge data items when coding appraisal ratings. For example, the coding guide states that an appraisal rating for a bridge's structural condition should be based, in part, on the condition ratings given for the deck, superstructure, substructure, and a bridge's

Indiana is currently developing a limited bridge management program utilizing the data currently available in the NBI. Although it will not enable us to determine which bridge can be "fixed" without costly replacement or rehabilitation unless additional data is collected and recorded, we anticipate that it will be a useful tool for prioritizing our bridge rehabilitation/replacement needs more accurately. As your report confirms, the sufficiency rating cannot be of use as a single tool in prioritizing bridge improvement needs.

Some mention should be made regarding the GAO report findings of inaccurate/outdated bridge data. As indicated in the report, FHWA NBI data as of August and December 1985 was used in the study. This data, which was submitted by Indiana to the FHWA in May 1985 included data which may have been dated back as far as 1980 or 1981.

As local agency bridge inspections in Indiana were performed on a four year cycle at the time, and Indiana's NBI data was submitted to the FHWA in May 1985, it may have included inspection data dated 1980 or 1981. Therefore we can understand why GAO's review of our current office data might result in sufficiency ratings and deficiency status which may differ from those previously calculated from the FHWA NBI data used.

At the present, all Indiana bridges are inspected within the two year interval, and unless requested otherwise, updated NBI data is submitted to the FHWA each May.

See comment 2

The report seems unclear where it suggests practices in Indiana that resulted in an overstatement of Indiana's bridge needs relative to other states. Also it is not clear how Indiana's "practices" and "criteria" differ from those used by other states since Indiana "practices" have followed the current "Coding Guide".

Regarding Functionally Obsolete Coding, Indiana had been following the current "Coding Guide" which indicates that each state should develop criteria for Item 68 - Deck Geometry. The "Coding Guide" also indicates that Item 68 should be 3 or less if the clear roadway on the bridge is narrower than the width of the approach roadway travel lanes. The criteria which IDOH had been using were developed with the input and approval of the FHWA. However on April 21, 1987, at the urging of the FHWA's Division Bridge Engineer, our bridge inspectors were notified to begin using the then "New Proposed Coding Guide" guide lines for Item 68 - Deck Geometry. The "New Proposed" coding guide was subsequently not adopted by AASHTO. Indiana has no assurance as to what criteria other states may be using.

Concerning Indiana's "policy" of improving a bridge's rating only if "major work" had been done on a bridge. Any improvement work classified as "minor work" in Indiana would not affect the classification of Structurally Deficient, Functionally Obsolete, or the Sufficiency Rating. And if this "minor work" such as signing, striping, guardrail, traffic control, and etc. were coded as "major work" the bridges would not be eligible for repair or replacement using HBRRP funds although they may require "major work" or replacement within the next ten year period based on the FHWA current policy. We would welcome specific equable guide lines defining areas such as "Major Work", "Minor Work" and etc. which would be used by all the states.

As stated in response to the first three GAO recommendations, bridge needs should be viewed from a total cost perspective. Any time a bridge does not provide safe, full service to the public, the public pays, even though the bridge may not be scheduled for improvement in the immediate future. As a result, it is not valid to limit needs reporting to some arbitrary limit which ignores the total picture of public use and related user costs.

The FHWA's method of estimating bridge needs is a reasonable representation of gross national bridge needs. That is, bridges are classified as deficient according to a criterion which the FHWA sets administratively. It may not be cost-effective to improve every bridge that meets this criterion and, by the same token, it may be cost-effective to improve some bridges that do not meet the criterion. Despite these drawbacks, the present system has many advantages. It is simple, it minimizes the Federal Government's paperwork burden and, for funding allocation purposes, it provides a correct estimate of each State's bridge needs in relation to the other States. All States are treated equally under the system.

As a result of the FHWA's concern for better use of available bridge funds by all bridge owners, the FHWA will have completed a bridge management demonstration project in 45 States by April 1988. This training and demonstration effort covers all aspects of comprehensive bridge management systems and stresses the need for project selection based upon maximum user benefits versus costs.

The Department is about to submit a report to Congress, as required by Section 162 of the 1987 Surface Transportation and Uniform Relocation Assistance Act, on recommendations for administrative and minimum requirements for State bridge management systems along with recommendations to Congress.

The FHWA is strongly promoting the incorporation of life cycle and user costs analysis in the bridge improvement decision making processes at the State level; however, the DOT did not envision performing such detailed analyses at the Federal level.

Analytical models for calculating bridge life cycle and user costs are only now being developed. Preliminary indications from these studies are that the FHWA's bridge needs estimates, if anything, are understated.

The HBRRP is just one source of Federal funds for bridge improvements. In recognition that the Congress directed that priority for use of HBRRP funds be directed towards bridges most in danger of failure, the FHWA is considering a change in eligibility thresholds for HBRRP funds to postpone consideration of many bridges with only geometric deficiencies. This change, if adopted, would not imply that bridges with geometric deficiencies should not be improved. It would merely result in an administrative procedure for HBRRP funds to more strongly emphasize bridges with load capacity or structural safety problems.

GAO Recommendation:

Establish internal controls and a management oversight program including guidance to the States designed to assure the accuracy, completeness, and timeliness of bridge inventory and apportionment cost data.

DOT Comment:

The FHWA has almost completed a 2-year long effort to upgrade and improve the Coding Guide for Structure Inventory and Appraisal of the Nation's Bridges. The improved instructions, clarification of NBI data requirements, added data items and improved editing and review programs which will be used in conjunction with it, should result in improved NBI data.

The fact that Highway Bridge Replacement and Rehabilitation Program (HBRRP) funds are apportioned on the basis of each State's relative bridge needs provides a significant incentive for States to provide the most current NBI data possible.

The FHWA has recently drafted a final rule for changes in the National Bridge Inspection Standards (NBIS) which is under review by the Department's staff. The final rule addresses the need for the States to keep changes in bridge status current in State inventories.

In 1987, the FHWA Office of Program Review conducted a comprehensive review and evaluation of State and FHWA procedures to determine State-by-State unit bridge cost data for the apportionment of HBRRP funds. The results and recommendations of the review were implemented and used in computing FY 1988 apportionments. The instructions and procedures already implemented are more than adequate to address the concerns regarding unit bridge cost data.

One particular data item that the GAO report discussed was average daily traffic (ADT). The GAO draft report emphasized strongly that ADT counts were not being kept current and that bridge needs and eligibility determinations were therefore adversely affected. To be eligible for HBRRP funding, a bridge must be both deficient and have a sufficiency rating of 80 or less. Section 144 of Title 23 of the U.S. Code requires the Secretary to establish priorities for bridge improvements, giving consideration to those bridges most in danger of failure. Therefore, the sufficiency rating formula is structured so that its major emphasis is on the relative safety of bridges. The sufficiency rating formula was, as a result, designed to be comparatively insensitive to variations in ADT.

Because ADT values nearly always grow with time, States or local governments with less than the most current ADT value in the NBI tend to wind up with fewer eligible bridges and smaller needs than

Comments From the Department of Transportation

U.S. Department of Transportation

Assistant Secretary for Administration

400 Seventh St., S.W. Washington, D.C. 20590

MAR 18 1988

Mr. J. Dexter Peach
Assistant Comptroller General
Resources, Community, and Economic
Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Peach:

Enclosed are two copies of the Department of Transportation's comments concerning the U.S. General Accounting Office (GAO) draft report entitled, "Bridge Condition Assessment: Inaccurate Data May Cause Inequities in Apportionment of Federal-Aid Funds," GAO/RCED-88-75, dated February 17, 1988.

Thank you for the opportunity to review this report. If you have any questions concerning our reply, please call Bill Wood on 366-5145.

Sincerely,

Jon H. Seymour

Enclosures

Table II.3: Estimated Number of Bridges With Missing NBI Data

State	Estimated number of bridges with missing data (percent)	Sampling error	95-percent confidence limits Lower	Upper
California	3,420 (15 3%)	1,373 (6 2%)	2,047 (9 2%)	4,793 (21 5%)
Indiana[a]	282 (1 6%)	387 (2.2%)	37 (0 2%)	962 (5 5%)
Massachusetts	1,854 (37.9%)	411 (8 4%)	1,443 (29 5%)	2,265 (46 3%)

[a]The confidence interval for this variable is approximated using a poisson distribution

Table II.4: Estimated Number of Bridges With Outdated Average Daily Traffic (ADT) Counts

State	Estimated number of bridges with outdated ADTs (percent)	Sampling error	95-percent confidence limits Lower	Upper
California	16,207 (72.7%)	1,681 (7 5%)	14,526 (65 1%)	17,888 (80 2%)
Indiana	2,676 (15 2%)	1,190 (6.8%)	1,486 (8 4%)	3,866 (22 0%)
Massachusetts	2,483 (50.7%)	423 (8 6%)	2,060 (42.1%)	2,906 (59 3%)

Table II.5: Estimated Number of Indiana Bridges With Untimely Inspections

State	Estimated number of bridges with untimely inspections (percent)	Sampling error	95-percent confidence limits Lower	Upper
Indiana	5,210 (29 6%)	1,494 (8 5%)	3,716 (21.1%)	6,704 (38 1%)

Table II.6: Estimated Number of Bridges Considered Deficient in Indiana

	Estimated number of bridges considered deficient (percent)	Sampling error	95-percent confidence limits Lower	Upper
Using FHWA's criteria	6,478 (36 8%)	1,575 (8 9%)	4,903 (27 9%)	8,053 (45.7%)
Using Indiana's criteria	7,604 (43.2%)	1,615 (9.2%)	5,989 (34 0%)	9,219 (52 4%)

NBI Items Affecting the Sufficiency Rating Calculation and Bridge Classification

NBI item	Item affects: Sufficiency rating	Item affects: Bridge classification
Road section number	X	
Bypass detour length	X	
Lanes on/under structure	X	
Average daily traffic	X	
Approach roadway width	X	
Traffic safety features	X	
Structure type, main	X	
Bridge roadway width	X	
Minimum vertical clearance (over)	X	
(Condition Ratings)		
Deck	X	X
Superstructure	X	X
Substructure	X	X
Culvert and retaining walls	X	X
(Capacity Rating)		
Inventory Rating	X	
(Appraisal Ratings)		
Structural condition	X	X
Deck geometry	X	X
Underclearances	X	X
Waterway adequacy	X	X
Approach roadway alignment	X	X
Total	**19**	**9**

significant numbers of bridges not needing improvement to obtain more funds than would otherwise be justified.

We cannot conclude that improvements in FHWA oversight alone will make the apportionment process equitable, because we did not examine the apportionment formula itself. However, we do believe that the recommendations we made in chapter 2 will provide greater assurance that the data used in the apportionment are accurate.

Recommendation to the Secretary of Transportation

To further assure the quality of states' bridge data and the equity of the HBRRP apportionment process, we recommend that the Secretary of Transportation direct the Administrator of FHWA to exclude those bridges that are not in need of replacement or rehabilitation from the apportionment data base.

Agency Comments and Our Evaluation

DOT disagreed with our recommendation. It believes that needs should be viewed from a total cost perspective and that the needs picture it presents using its methods to identify bridges and improvements eligible for HBRRP funding underestimate the nation's total bridge needs.

We believe that while DOT is responsible for reporting the total needs picture in its annual report to the Congress, it is equally responsible for assuring that HBRRP funds are used for HBRRP-eligible bridges and HBRRP-eligible improvement activities. The HBRRP legislation directs DOT to consider those bridges most in danger of failure. Unlike the cost-to-improve estimate,[1] which should reflect the total cost to improve all of the nation's deficient bridges, the apportionment data base should not include bridges that do not need to be replaced or rehabilitated. We believe that by including in the apportionment base bridges that do not need replacement or rehabilitation, each state's needs base becomes distorted, which in turn leads to inequities in the distribution of HBRRP funds.

CALTRANS said in its comments that we were inaccurate in reporting that CALTRANS inappropriately included "mobilization" costs in its unit cost estimates forwarded to FHWA in support of the fiscal year 1986 apportionment process. CALTRANS contended that mobilization costs do not inflate the final total cost of a project and that such are legitimate costs of constructing a bridge.

[1]See chapter 2.

- with problems that can be remedied with actions such as the use of traffic control devices or signs, or
- that states do not intend to fix.

Therefore, when FHWA reports to the Congress that $51 billion is needed to improve the 220,000 deficient bridges eligible for HBRRP funds, those figures represent the cost to totally replace or rehabilitate each deficient and eligible bridge regardless of the magnitude of deficiencies.

Just as these bridges are included in FHWA's count of deficient bridges and its cost-to-improve estimate, the square footage associated with these bridges is also included in the states' apportionment data bases (except the exclusions mentioned previously in this chapter). The apportionment is based on total square footage of deficient bridges in each state multiplied by a cost per square foot for replacement or rehabilitation.

The criteria FHWA uses for deficient bridges include bridges that are in marginal condition. These are bridges that the bridge inspector determined had deficiencies, but did not fall into a category requiring immediate replacement or rehabilitation. For example, one of the local bridges in our sample for Indiana was deficient under FHWA's criteria because of cracks in its concrete girders. The inspector determined that the bridge could safely handle the maximum loads normally encountered on a city street and estimated that it would cost only $2,000 to remedy the girder problem. The other components of the bridge were adequate, and the inspector estimated that the bridge would last another 15 years. Using its criteria, FHWA classified this bridge as deficient and needing rehabilitation. Thus, even though it only needed $2,000 in repairs, for apportionment purposes it was considered to need $29,300 in rehabilitation work. This latter figure was based on the square footage area of the bridge and Indiana's $26 per square foot rehabilitation cost for off-system bridges.

FHWA recognizes that both structural and functional deficiencies may be minimized through load-posting and other actions that do not require total rehabilitation or replacement of the bridge. For example, FHWA notes in its annual report that 51,000 of the 108,000 functionally obsolete bridges may be good candidates for traffic control devices rather than structural improvement because they are considered obsolete only because of deficiencies in their deck geometry. Not all deficient bridges

Our examination of states' inventory methods also disclosed two practices in Indiana that resulted in an overstatement of Indiana's bridge needs relative to other states and went undetected by FHWA field offices. First, Indiana developed inspection guidelines for its state inspectors that reduced the appraisal ratings[2] for all locally owned bridges. Second, Indiana updated inspection data to improve a bridge's rating only if major work had been done on a bridge, thereby disregarding any other type of work that may also have improved a bridge's rating. These practices gave the state an inappropriately high number of deficient bridges. Based on our analysis of Indiana's practices, had Indiana used FHWA's guidelines, 37 percent, or about 6,500, of the 17,603 bridges in the state would have been considered deficient. Instead, using Indiana's revised rating system, 43 percent, or 7,600, of the bridges in the state were considered deficient for the 1986 apportionment. (See appendix II for associated sampling errors.) FHWA's division bridge engineer in Indiana was not aware of these problems until we brought them to his attention. This FHWA official agreed that Indiana's practice was not acceptable and that he would follow-up with the appropriate state officials.

FHWA's Review of State Square Foot Costs Is Uneven

For the fiscal year 1986 apportionment, unit costs were to include only the cost of the bridge itself, thereby excluding costs such as mobilization (site preparation). The costs were to be based on all bridges built in the state with federal-aid funds for which construction funds were obligated in fiscal or calendar year 1984. FHWA treated each of the four cost categories differently in arriving at the unit cost. The basis for each is shown in appendix III.

FHWA correspondence to the regional offices instructed them to review replacement or rehabilitation costs submitted by the states. We found that FHWA's Bridge Division had not specified the type and depth of review that it expected from its regional offices. As a result, the level of review varied in the three states we examined which were located in three different FHWA regions.

In Massachusetts, for example, the FHWA division office reviewed the preliminary replacement and rehabilitation costs compiled by the state for the fiscal year 1986 apportionment and recommended adjustments to the figures. FHWA headquarters officials told us that the errors found

[2]A score indicating the inspector's evaluation of certain aspects of the bridge, such as deck geometry and waterway adequacy. The rating is on a scale of 0 to 9, with 0 indicating a need for immediate replacement and 9 indicating a condition superior to the present desirable standards.

states' apportionment data base. Our review indicated that FHWA cannot assure an equitable basis for the apportionment of HBRRP funds because of inaccurate and incomplete state bridge inventories and inappropriate classifications of deficient bridges as noted in chapter 2.

The HBRRP legislation requires that the Secretary of Transportation, in consultation with the states, inventory all federal-aid bridges. FHWA requires each state to maintain an accurate and current inventory of the status and condition of all their bridges. FHWA, however, has not required the states to establish procedures to assure completeness of bridge inventory data and to detect and correct inaccuracies in the data prior to reporting it to FHWA. Many of the problems we found in states' data bases could have been detected and corrected if the states had the procedures in place to assure the quality of their data. Also, once states adopt quality assurance mechanisms, FHWA needs to provide oversight to assure that such mechanisms are operating effectively.

Our review of states' computations of their cost-per-square-foot data submitted for the apportionment indicated that inconsistencies in states' computations of such costs also compromises the equity of the apportionment process. FHWA oversight of states' computations of square foot costs was uneven, therefore contributing to the compromise in apportionment equity.

The scope of our review of the HBRRP apportionment process was limited to states' practices that support the apportionment process and FHWA's oversight of those practices. This review was not designed to evaluate the appropriateness of the apportionment formula itself. Therefore, inequities in the apportionment of funds may be caused by factors associated with the apportionment formula that were not detected by this review.

FHWA Apportionment Oversight Is Inadequate

FHWA does not have a comprehensive approach for monitoring states' inventory and reporting practices that support the apportionment process. Thus, errors and differences in states' practices that could cause serious apportionment inequities went undetected. FHWA's headquarters Bridge Division monitors states' overall bridge activities through a cycle of annual on-site state reviews and by ad hoc reviews of the NBI data. While some problems are disclosed in this manner, FHWA must still rely primarily on its regional and field division offices for more detailed oversight of states' practices affecting apportionment.

DOT also noted that the estimated cost-to-improve deficient and HBRRP-eligible bridges somewhat underestimates total need because some bridge improvements are not eligible for HBRRP funding. We believe that when DOT determines the national cost-to-improve estimate, the average cost to replace or rehabilitate deficient bridges should be applied only to those bridges that are in need of replacement or rehabilitation. The costs associated with all other bridge improvements, for example, posting, striping, or installation of any other traffic control devices, which may not be eligible for HBRRP should be identified and reported separately in the annual report. In the HBRRP annual report as of December 1986, DOT noted that over 50,000 functionally obsolete bridges and an undetermined number of structurally deficient bridges may be good candidates for such actions.

Agency Comments and Our Evaluation

The Department of Transportation (DOT) noted several actions that it is currently undertaking to improve the NBI coding guide and clarify NBI data requirements for states' use in keeping their bridge inventories current. While we agree that actions were needed to address problematic inventory practices at the state level, such changes do not eliminate the need for our recommendation that DOT establish internal controls and a management oversight program to assure the accuracy of bridge inventory data. DOT still needs internal control procedures to assure that states' input into the NBI, under the new procedures, is accurate, timely, and complete.

Regarding the errors we found in the NBI, DOT and CALTRANS commented that we over emphasized their impact on bridge sufficiency ratings. DOT said that states with outdated ADT counts in the NBI tend to have fewer eligible bridges and reduced bridge needs than they would if they kept their ADT counts current, because ADT counts nearly always grow over time. We acknowledge that a change in ADT counts alone may not result in a dramatic change in a sufficiency rating and have reworded our description of this accordingly. However, as discussed in the chapter, a change in the ADT count can, in conjunction with other errors, contribute to inaccurate sufficiency ratings. Such was the case in 5 percent to 15 percent of the bridges sampled in the three states we reviewed.

CALTRANS commented that we did not convincingly demonstrate that errors in the three states' inventories were systemic in nature. CALTRANS noted that of the 90 data items contained in the NBI, we reported that only a few were in error on a recurring basis. While there are 90 data elements in the NBI, only 19 are used to determine the eligibility and deficiency status of a bridge. We focused our examination of states' inventory practices on the accuracy, timeliness, and completeness of these 19 data elements in the NBI. A weighted error rate, taking into account errors found in all 19 data elements, ranged from 5 percent to 15 percent in the three states' bridge inventories. A more systemic problem in states' inventory practices was demonstrated by the range of errors found in the individual data elements, that is, from 2 percent to 38 percent of states' inventories were missing one or more of the 19 data elements; from 15 percent to 73 percent of states' bridge records had outdated traffic counts; and from 14 percent to 30 percent of bridge records reflected untimely inspections.

DOT also disagreed with our recommendation concerning the need to identify varying levels of bridge deficiencies in its annual report. DOT conceded that identifying a bridge as deficient has certain drawbacks in

on our review of the NBI, which provides the basis for the data presented in the annual report, we found that the NBI contains insufficient data to allow FHWA to distinguish between those bridges requiring total replacement or rehabilitation and those bridges needing only remedial improvements.

For example, we queried state highway departments on the status of 20,979 bridges classified in the NBI as deficient. The states responding to our survey indicated that they do not intend to replace or rehabilitate an estimated 4,300 of these bridges because they consider the bridges safe with proper load-posting. In addition, FHWA acknowledges in its annual report that over 50,000 functionally obsolete bridges and an undetermined number of structurally deficient bridges could safely serve existing traffic demands with load-posting or other remedial improvements short of costly replacement or rehabilitation. FHWA, however, cannot identify how many bridges should be so classified based on the existing data in the NBI.

Our analysis of bridge data reporting practices in Indiana, California, and Massachusetts indicated that from 5 percent to 15 percent of the bridge records in those states contained errors in the data that affected the bridges' deficiency and/or eligibility status. We found that the deficiency and eligibility status for bridges were misclassified because states did not update bridge inventory data, perform inspections in a timely manner, or neglected to input data into the NBI. FHWA's ability to determine the eligibility of bridges for HBRRP funding, therefore, is jeopardized by the inaccuracies in states' inventory data.

Some of the errors we found in the states' inventories tend to overstate the actual number of deficient and eligible bridges in those states, while others tend to understate the number of such bridges. We could not quantify the net effect of errors on total counts of deficient and eligible bridges in those states, thus we could not determine what the actual number of such bridges should be.

FHWA has not established the necessary management controls and oversight of its field offices to assure that field staffs examine state controls over their bridge inventory data. As a result, FHWA field offices have not been able to detect and correct systemic weaknesses in states' data collection and reporting methods. Although the edit/update program that FHWA developed for states' use could identify certain errors in state bridge inventories, and, if used by the state, could be an effective method to help assure data quality, neither FHWA nor the states are fully

How FHWA Estimates Cost to Improve

To arrive at an estimate of the cost to improve deficient bridges eligible for HBRRP, FHWA first categorizes all bridges in a state by component of the highway system they are on, (e.g., interstate, primary, secondary, urban, and off-system) and indicates whether or not each bridge is eligible for replacement or rehabilitation. Next, FHWA identifies all bridges in the NBI for which states have estimated the costs of rehabilitation or replacement.

Using the cost to improve estimates reported by the states, FHWA computes the average cost of improving a bridge in each highway component. Next, FHWA multiplies the average cost to improve for each component by the total number of bridges in each component, including the bridges that states provided no cost estimates. This calculation provides the total estimated cost to improve all deficient and eligible bridges on each component of the highway system.

Basis for Cost-To-Improve Estimate Is Questionable

FHWA has estimated that the total cost to replace or rehabilitate approximately 220,000 deficient and eligible bridges is about $51 billion. As discussed earlier, FHWA's count of deficient and eligible bridges includes thousands of bridges that, while they may have deficiencies, can be made safe without replacement or rehabilitation and bridges that states do not intend to replace or rehabilitate.

Our review also indicates that differing states' methods for estimating replacement and rehabilitation costs lessens the reliability of FHWA's overall cost-to-improve estimate. One reason for the inconsistency in states' methods is that FHWA has not provided states adequate guidance and criteria for estimating costs of replacing or rehabilitating deficient bridges. FHWA's "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges" contains some instructions on estimating improvement costs. However, the guide does not instruct states as to the proper basis for estimating replacement and rehabilitation costs. California and Indiana used different methods for estimating improvement costs—one used historic cost data and the other used engineering estimates of the new structure. Massachusetts, on the other hand, does not supply FHWA cost-to-improve data.

California has developed a computer program to automatically generate the type and cost of improvements for all of its deficient bridges. The data are based on: (1) the sufficiency rating category used to establish whether the bridge may be eligible for replacement or rehabilitation, (2) the deck area of the existing bridge, and (3) a unit cost factor, depending

that the state establish a more active internal monitoring system to check its conformance with inventory standards. The FHWA division engineer told us that the department officials have constantly told him that they will correct all of the problems. Our review of Massachusetts' inventory in 1986 and early 1987, however, detected problems that should have been corrected by the state.

FHWA Oversight of State Collection and Reporting Does Not Assure Data Quality

In 1979, FHWA developed a computerized edit/update program to assist states in identifying and correcting errors and/or omissions in their bridge records when updating their inventories. The program is the only mechanism, aside from bridge program management reviews, that FHWA has to assure that states correct their data bases. The computer program generates a listing of omissions, inconsistencies, and suspected errors in a state's bridge records. The program checks, for example, to see if certain items in the bridge record are blank and rejects the record if essential fields, such as structure number, are blank. It also checks to make sure that data, like the roadway width, are not greater than the bridge deck since this item is critical in determining total square footage of deficient and eligible bridges. The edit/update program would not, however, identify the types of errors, such as missing source data, outdated ADTs, and untimely inspections, that we detected in the manual review of bridge records in the three states.

A bridge division official told us that FHWA intended for the states to use the edit/update program to check their data, but the states are not required to do so. FHWA, however, has not provided adequate oversight of states' use of the program to assure that states use the program to correct errors they identify.

A Massachusetts' Department of Public Works official told us that although they did not receive a copy of the FHWA program, FHWA provided Massachusetts an error listing in 1986 which was then forwarded to appropriate public works personnel for review and corrections. The results of the department's review were not available at the time of our review.

The Statistical Section Chief for CALTRANS told us that although they did receive the program from FHWA, they do not use it. The official explained that the software for the edit/update program is not compatible with the state's computer system, and operating the program would generate voluminous pages of data that would not clearly identify the problem structures.

In Indiana, 30 percent of the inspection dates of the sampled bridges were over 2 years old. Our examination of the data disclosed that more current information that changed the sufficiency ratings of the bridges was available but was not submitted to the NBI. While the state and FHWA had taken several measures to increase the timeliness of the inspections, no action was taken to assure timely updates of the NBI.

All bridges in our California sample were inspected within the 2-year interval. California had developed a computerized system for monitoring inspection timeliness. Under this system, each inspection engineer receives regular reports on the timeliness of bridge inspections within their area of responsibility.

FHWA Oversight of Its Field Offices Is Inadequate

FHWA has not provided the oversight of its field offices needed to assure that they effectively examine state controls over bridge inventory data. As a result, FHWA field offices have not been able to detect and correct systemic weaknesses in states' data collection and reporting methods that ultimately result in the types of errors we found in the NBI.

The Federal-aid Highway Program Manual prescribes FHWA policies and procedures for fulfilling its responsibilities for reporting on federally aided bridges. The manual states that FHWA must annually assure that states are complying with the National Bridge Inspection Standards. To accomplish this, FHWA personnel are required to review (1) states' bridge inspection procedures, (2) the frequency of inspections, (3) qualifications of state personnel, (4) inspection reports, and (5) states' bridge inventories. The policy further states that it is the responsibility of the division offices to determine the methods for assuring states' compliance with such requirements. FHWA's program manual also stipulates that each division's proposed maintenance review program shall be approved by its regional office.

FHWA headquarters Bridge Division's correspondence discussing management review criteria for fiscal year 1987 regional and field office reviews of bridge program activities indicated that attention would be placed on inspection frequency, quality assurance of data, and inspection activities, among other bridge program elements. The correspondence indicated that regional offices should develop their own guidelines for conducting reviews of division office programs, with appropriate emphasis placed on the fiscal year 1987 review focus. The headquarters Bridge Division also stated that the regional office guidelines should include provisions for appropriate follow-up action by FHWA

bridge designer, the design standards, the load history, and field inspections. The FHWA Division bridge engineer in California told us that he approved CALTRANS' methods and believed CALTRANS' process to be timely and performed by experienced, licensed engineers.

State officials in Indiana calculated the load-carrying capacity for some state bridges using the load requirement at the time the bridge was built, rather than the current bridge load capacity level. In Massachusetts, we found that officials substituted the state's statutory load limit for the current load-carrying capacity of bridges or left the item blank when documents specifying the bridges' current load-carrying capacity were not available.

Outdated Traffic Counts

FHWA requires that bridge average daily traffic (ADT) counts be updated every 5 years. In the three states we visited, we examined individual bridge records to determine the date of the most recent traffic count. If the most recent ADT was more than 6 years old, we counted the item as an error. We found that ADTs were outdated for 15 to 73 percent of the bridges sampled in the three states visited.

Since ADTs tend to change over time, using outdated ADT information in calculating the sufficiency rating for a bridge could impact the rating thereby affecting the eligibility status of a bridge. We did not, however, determine the effect on eligibility status for the sampled bridges based on the updated ADTs alone, since other errors were generally found in the bridge records that also affected the eligibility of the bridges. Table 2.1 shows the cumulative effects of all errors on deficiency and/or eligibility status for bridges in the three states.

In California, 73 percent of the bridge records contained more recent ADTs than were indicated in the NBI. In Massachusetts, ADTs were outdated for 51 percent of the bridges. In Indiana, ADTs were outdated for 15 percent of the bridges.

When we asked state transportation officials why the ADTs were outdated, their explanations varied. CALTRANS officials told us that they do not routinely update ADTs for two reasons. First, the computer system that was used to automatically provide ADT data has been inoperable since 1976. Second, inspection engineers for bridges under local jurisdiction generally obtain ADTs only when they first inspect a bridge, but do not routinely update it. The FHWA California Division Engineer informed us that he was aware of the state's practice regarding ADT; however, he

updated bridge data. In Massachusetts, an estimated 10.7 percent, or 525, of the 4,896 bridges in the state experienced a change in status once we updated and corrected the bridge records.

In each state, the error ratio was calculated based on the number of bridges in our sample, with a change in status expressed as a percentage of the total number of bridges in our samples. In all three states, we found bridges whose eligibility and/or deficiency status was inappropriately classified. In Massachusetts, for example, the eligibility and/or deficiency status changed for 15 bridges in our statistically projectable sample of 140 bridges, once we corrected all of the bridge data items that affected the status of the bridges. Our recalculations of the status of the 15 bridges using FHWA's bridge eligibility and deficiency criteria showed that

- six of the seven bridges that were classified as ineligible for HBRRP funding should have been considered eligible for rehabilitation funding,
- two bridges classified as eligible for replacement should have been eligible only for rehabilitation,
- two bridges classified as eligible only for rehabilitation should have been eligible for replacement,
- three bridges classified as deficient should have been considered nondeficient, and
- two bridges classified as nondeficient should have been considered deficient.

We discussed the errors we found with appropriate state transportation/highway and FHWA regional and division officials in all three states. In Massachusetts, for example, we discussed the most prevalent errors disclosed by our analysis with a Department of Public Works official and the FHWA Division bridge engineer. The public works official told us more training was necessary to educate district inspectors in the proper methods to code bridge data entries for submission to FHWA. This official also said that resource limitations prevented the necessary review of data before it was forwarded to FHWA. The FHWA bridge engineer acknowledged that achieving accuracy of NBI data was a constant problem for the public works department.

The most prevalent types of errors noted in the three states' bridge inventories were

- missing NBI data,
- outdated traffic counts and untimely inspection data, and

The Branch Chief said that a critical consideration in determining the amount of improvements needed for a bridge is the level of service that a bridge must provide. This type of information would be captured in the proposed bridge management program. States, however, are not required to adopt the program as proposed by FHWA. As of December 1987, FHWA had no indication of how many states would eventually implement the program. According to a Bridge Division official, however, more than 40 states have invited FHWA to present its proposed bridge management system to their transportation officials, who have been receptive to the information FHWA offered.

Our analysis also showed that the lack of information in the NBI leads to an inaccurate count of the number of bridges needing replacement or rehabilitation. FHWA reported that 112,522 bridges were load-posted. We identified 20,979 load-posted bridges in the NBI for which states had not supplied cost-to-improve estimates although such information is required. We asked state highway departments, in our survey of states' use of the NBI, why they had not supplied cost data. The departments said that for about 4,300 of these load-posted bridges, they did not give FHWA cost information because they did not intend to rehabilitate the bridges.[1] The states believed that with load-posting the bridges were adequate to carry the existing traffic loads even though technically the bridges are classified as deficient by FHWA definition because of load limitations.

Adequacy of Controls for Collecting and Reporting Reliable Inventory Data

FHWA relies on the state highway and transportation departments' bridge data submissions in order to maintain the NBI and report to the Congress on the status of the nation's bridges. The enabling legislation for HBRRP provides FHWA the authority to require states' compliance with bridge inventory standards. Although the HBRRP legislation does not specify FHWA oversight responsibilities, FHWA has issued some guidance to its field offices regarding their responsibilities to oversee states' inventory practices. FHWA officials have told us that they do not have the resources, however, to provide constant oversight of states' efforts.

In analyzing data collection and reporting techniques in Massachusetts, California, and Indiana, we found that there is little assurance that deficient and eligible bridges are accurately identified by the states. Further, FHWA guidance and oversight of state bridge inventory activities

[1]See appendix II for the sampling error for states' responses

FHWA's Annual Report Does Not Accurately Identify Bridge Improvement Needs

In authorizing the Highway Bridge Replacement and Rehabilitation Program, the Congress directed the states and the Secretary of Transportation to identify bridges that are significantly important and unsafe because of structural deficiencies, functional obsolescence, or physical deterioration. In the eighth annual HBRRP report to the Congress, the Secretary stated that as of December 31, 1986, over 220,000 of the nation's 575,000 bridges were either structurally deficient or functionally obsolete and eligible for funding under the program. The costs associated with "fixing" all deficient and eligible bridges was estimated to be about $51 billion.

The Secretary also stated that because a bridge is categorized as deficient, that is, either structurally deficient or functionally obsolete, does not imply that it is unsafe, and that with proper load-posting, enforcement, and installation of appropriate traffic control devices, many of the bridges considered deficient can continue to safely serve most traffic. Our analysis of the NBI using FHWA criteria found that the annual report

- does not distinguish bridge deficiences based on levels of improvement needed and their respective costs;
- is based on inaccurate, incomplete, and inconsistent state bridge data which are not adequately verified by FHWA; and
- contains a national cost-to-improve estimate that is inaccurate because it includes nondeficient bridges, bridges that states do not intend to replace or rehabilitate, and bridges that can be fixed without costly replacement or rehabilitation.

In view of the limited federal funding available—approximately $1.6 billion per year—we believe that a fuller range of data, including identification of deficient bridges that are unsafe and pose a threat to public safety and their associated improvement costs, need to be reported in order for the Congress to have a sound basis for making program policy and funding decisions. Although we cannot quantify with precision the number of bridges that pose a threat to public safety, we have identified bridges that should not be included in FHWA's estimates of bridges in need of replacement or rehabilitation.

and 140 of the 4,896 bridges in Massachusetts.[6] When we found that the states' records contained more accurate or current information than what the states had submitted to FHWA for the NBI, we recomputed the sufficiency rating for the bridge using the more accurate or current data. (In all cases, the data we used in our analysis of states' records predated the states' most recent update of the NBI data.)

We did not make a detailed assessment of the controls over the computer systems that FHWA and the states use to process the inventory data. However, we used the results of our statistically valid samples in the three states to judge the efficacy of these activities and to identify problems and their potential effects. We discussed the results of this work with state and FHWA officials.

To determine whether FHWA procedures provide an equitable basis for apportioning HBRRP funds (our second objective), we first reviewed the HBRRP legislation as well as applicable FHWA policies, procedures, and regulations. We then evaluated the effects that errors in the NBI have on FHWA's ability to apportion funds equitably among the states. The scope of our review, however, did not include an evaluation of the apportionment formula itself. Therefore, errors in the NBI that we determined have an effect on the equity of the appportionment process are not representative of any problems in the apportionment formula that may also cause inequities in the apportionment of HBRRP funds.

As part of our review, we examined FHWA's management controls and oversight of its field offices in discharging their responsibilities to ensure the accuracy of states' bridge data. To obtain information on FHWA oversight of states' inventory practices and all states' use of the NBI system, we mailed surveys to FHWA field offices and state highway departments. The surveys were designed using one set of questions for the 9 FHWA regional offices, a second set for the 52 FHWA division offices, and a third set for the 52 state or local highway offices.[7] The state highway and FHWA division surveys were pretested in Illinois, Wisconsin, and Maryland. The FHWA regional office survey was pretested in Maryland. The surveys were mailed out in September 1986. All three surveys had a 100-percent response rate.

[6]Sampling errors for the bridge samples were +/- 3.6 percent for California, +/-6.3 percent for Indiana, and +/-5.1 percent for Massachusetts. All sampling errors noted in this report are calculated at the 95-percent confidence level.

[7]FHWA offices and highway departments in the District of Columbia and Puerto Rico were also included in our survey

FHWA submits to the states a listing of bridges that are eligible for HBRRP funding (i.e., have sufficiency ratings of 80 or less). States may select any bridge on the listing and apply to the appropriate FHWA division office for funding. Bridges with sufficiency ratings below 50 can be either replaced or rehabilitated, and those with sufficiency ratings 50 through 80 generally can only be rehabilitated.

Bridge Replacement and Rehabilitation Funding

Under the Special Bridge Replacement Program enacted in 1970, the Congress made available $835 million through fiscal year 1978. The Surface Transportation Assistance Act of 1978 replaced the Special Bridge Replacement Program with the Highway Bridge Replacement and Rehabilitation Program and authorized a total of $4.2 billion for fiscal years 1979 through 1982. In 1982, HBRRP was continued and a total of $6.9 billion was authorized for fiscal years 1983 through 1986. In 1987, the Surface Transportation and Uniform Relocation Assistance Act authorized the continuation of HBRRP at a total of $8.15 billion for fiscal years 1987 through 1991.

Objectives, Scope, and Methodology

Given the large number of bridges identified as being in need of replacement and rehabilitation and the limited funding available, the Senate Committee on Environment and Public Works; the House Committtee on Public Works and Transportation; and Senator James B. Sasser expressed concern regarding the accuracy of information available on the status of the nation's bridges and the equity of the apportionment process. Accordingly, our specific objectives in this review were to determine whether

- FHWA's annual report on HBRRP provides the Congress an accurate picture of the status and needs of our nation's bridges and
- FHWA has established policies and procedures to assure an equitable basis for apportioning bridge funds.

To accomplish the first objective, we evaluated FHWA's categorization of bridges in its annual report to determine if the annual report accurately reflected bridge conditions as reported by the states in the NBI. In our evaluation, we first selectively tested the accuracy of the computer programming methods used by FHWA to generate its seventh annual report to the Congress, the most current report available at the start of this review in 1986.

reviewing and approving state applications for bridge replacement/rehabilitation funds, monitoring compliance with the National Bridge Inspection Standards and other legal requirements, and providing technical guidance and advice.

The states and/or local governments are responsible for inspecting their bridges in accordance with the National Bridge Inspection Standards established by FHWA and the American Association of State Highway Transportation Officials. In accordance with HBRRP regulations, each state is also responsible for maintaining an accurate and current inventory of the status and condition of all their bridges and submitting specified inventory data (including inspection results) to FHWA for its National Bridge Inventory (NBI).

The Surface Transportation Assistance Act (STAA) provides FHWA the authority to require states' compliance with bridge inventory standards. STAA does not specifically deal with the question of what process FHWA should use if a state refused to comply with the requirements of the National Bridge Inspection Standards. FHWA policies regarding the bridge program specify FHWA responsibilities for overseeing states' inventory practices.

FHWA uses states' bridge inventory data to determine the deficiency status of each bridge as well as its eligibility for HBRRP funding. On the basis of inventory data submitted by the states, FHWA considers each bridge to be either "nondeficient," "structurally deficient," or "functionally obsolete." A bridge is considered nondeficient if inspections show that it can safely carry the load and traffic it was designed to handle. FHWA defines a structurally deficient bridge as one that is

- closed (because of structural inadequacy),
- restricted to light vehicles (load-posted) because it can no longer carry the weight it was designed to handle, or
- in immediate need of rehabilitation to remain open.

In determining the number of bridges falling into this category, for purposes of the annual report, FHWA classifies a bridge as structurally deficient if the states' bridge inventory data show that

- the bridge deck, superstructure, or substructure, or if the bridge is a culvert, the culvert and retaining wall are in marginal or worse condition or

Introduction

In its eighth annual report to the Congress, the Federal Highway Administration (FHWA) estimated that about 42 percent, or over 240,000, of the nation's 575,000 bridges are deficient. FHWA also reported that it would cost approximately $51 billion to improve the 220,000 deficient bridges that are eligible to receive Highway Bridge Replacement and Rehabilitation Program funds. That cost will increase over time as older bridges become structurally deficient due to inclement weather, erosion, metal fatigue, and other factors.

Even more bridges will become functionally obsolete as traffic increases and roadways are widened and improved but bridges are not. The threat to safety, the inconvenience to the motoring public, the free movement of commerce, and the financial burden of deficient bridges have become a national concern. A basic dilemma that confronts the federal, state, and local governments is how to identify, replace, and rehabilitate as many deficient bridges as possible with the limited funds available. In 1987, the Congress authorized $8.15 billion for the Highway Bridge Replacement and Rehabilitation Program for fiscal years 1987 through 1991.

Bridge Safety Legislation

The December 1967 collapse of the Silver Bridge between West Virginia and Ohio killed 46 people and focused the nation's attention on bridge conditions. As a result, the Congress established two major bridge safety programs: (1) the National Bridge Inspection Program, consisting of periodic inspections to identify bridge conditions, maintenance needs, and safety problems and (2) the Special Bridge Replacement Program, providing federal funds to the states to help replace those bridges most in danger of failure.

The Federal-Aid Highway Act of 1968 (Public Law 90-495), established the National Bridge Inspection Program. The act required the Secretary of Transportation, in consultation with state highway departments and other interested and knowledgeable parties, to establish standards for inspecting federal-aid system bridges.[1] The standards were to specify methods for the state highway departments to use in (1) conducting safety inspections, (2) establishing maximum time lapses between inspections, and (3) determining the qualifications of those responsible for carrying out the inspections. The act further required each state to

[1]The nation's roadway network is composed of nearly 4 million miles of state and local roads of which 829,000 miles constitute the federal-aid system and are eligible for federal assistance.

Contents

Executive Summary		2
Chapter 1 Introduction		8
	Bridge Safety Legislation	8
	Program Administration and Responsibilities	9
	Bridge Replacement and Rehabilitation Funding	12
	Objectives, Scope, and Methodology	12
Chapter 2 FHWA's Annual Report Does Not Accurately Identify Bridge Improvement Needs		16
	The NBI Contains Insufficient Data to Allow Determination of Bridges Needing Only Remedial Improvements	17
	Adequacy of Controls for Collecting and Reporting Reliable Inventory Data	18
	The Annual Cost-To-Improve Estimate Is Not a Reliable Indicator of Bridge Needs	27
	Conclusions	29
	Recommendations to the Secretary of Transportation	31
	Agency Comments and Our Evaluation	32
Chapter 3 Actions Needed to Eliminate Apportionment Process Inequities		35
	FHWA Apportionment Oversight Is Inadequate	36
	Redefinition of Apportionment Base	39
	Conclusions	41
	Recommendation to the Secretary of Transportation	42
	Agency Comments and Our Evaluation	42
Appendixes		
	Appendix I: NBI Items Affecting the Sufficiency Rating Calculation and Bridge Classification	44
	Appendix II: Sampling Errors for Selected Variables in States' Bridge Inventories	45
	Appendix III: Process for Calculating Replacement and Rehabilitation Cost Per Square Foot	47
	Appendix IV: Comments From the Department of Transportation	48
	Appendix V: Comments From the Indiana Department of Highways	55
	Appendix VI: Comments From the California Department of Transportation	60

Estimated Cost to Improve Deficient Bridges Is Questionable

FHWA's $51 billion estimate of the cost to replace or rehabilitate deficient bridges is questionable because it includes bridges that (1) are not deficient, (2) states do not intend to replace or rehabilitate, and (3) can be "fixed" without costly replacement or rehabilitation. These bridges would tend to overstate the estimate. However, because GAO could not determine the actual number of deficient and eligible bridges in the nation, it also could not make an accurate estimate of the cost to improve such bridges. GAO also found that the states used inconsistent methods to estimate the costs to improve their deficient bridges. For example, California used bridge contract bids received during 1982. Indiana, on the other hand, used current engineering cost estimates. Massachusetts submitted no cost-to-improve estimates. (See ch. 2.)

Equity of Apportionment Among States Is Questionable

Computation of each state's apportionment requires data on the total square footage associated with a state's deficient bridges that are eligible for bridge program funding and the cost per square foot to replace or rehabilitate those bridges. Inequities in the apportionment are introduced initially because of errors in states' counts of deficient and eligible bridges and because FHWA does not exclude from the apportionment data base bridges that can be corrected without replacement or rehabilitation. Equity of the apportionment is further compromised by inadequacies in states' practices that support the apportionment process.

GAO found that California, for example, included site preparation costs in its cost-per-square-foot estimates, which FHWA does not allow. If all other factors remained constant in California's apportionment data base, this error would cause a $5 million overstatement in the state's fiscal year 1986 apportionment of $58.9 million. (See ch. 3.)

As with inventory data, ineffective FHWA oversight and management controls contributed to the inconsistencies GAO found in states' practices that support the apportionment process. (See ch. 2.)

Recommendations

GAO recommends that the Secretary of Transportation direct FHWA to

- establish internal controls and a management oversight program, including guidance to the states, designed to assure the accuracy, completeness, and timeliness of bridge inventory and apportionment data;
- require states to report the data that would enable FHWA to identify in its annual report varying levels of bridge deficiencies;

Executive Summary

Purpose

In December 1986, the Federal Highway Administration (FHWA) reported to the Congress that, based on its analysis of the national bridge inventory, over 240,000 of the nation's 575,000 bridges were deficient. FHWA also reported that it would cost about $51 billion to replace and rehabilitate those bridges. In response to congressional requests, GAO determined if (1) the information FHWA reports to the Congress provides an accurate picture of the status and needs of our nation's bridges and (2) FHWA has established procedures to assure an equitable basis for apportioning funds to the states.

Background

The Surface Transportation Assistance Act of 1978 created the Highway Bridge Replacement and Rehabilitation Program. In authorizing the program, the Congress directed the states and the Secretary of Transportation to annually inventory all bridges in the nation and to identify those that are unsafe because of structural deficiencies or functional obsolescence.

The act, as amended, specifies that bridge program funds be apportioned to the states based on their relative share of the estimated cost to replace or rehabilitate all deficient bridges nationwide. The act also specified that, when approving the use of program funds, the Secretary give consideration to those bridges most in danger of failure.

The Congress made available a total of $11.25 billion for fiscal years 1979 through 1987 for bridge replacement and rehabilitation. In 1987, the Congress continued the bridge program at a total cost of $8.15 billion for fiscal years 1987 through 1991.

Results in Brief

The national bridge inventory, which is the basis for FHWA's annual bridge program report to the Congress, does not accurately identify bridge funding needs because it

- is based on inaccurate, incomplete, and inconsistently reported state data and
- does not distinguish bridges that require total replacement or rehabilitation from those that can be "fixed" with actions short of replacement or rehabilitation.

FHWA cannot assure an equitable basis for apportionment of bridge program funds to the states because of inaccuracies in the national bridge