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Report to Congressional Committees

July 2017

HIGHWAY BRIDGES

Major Projects Present Challenges for States, but Strategies Exist to Overcome Them

Accessible Version

GAO-17-707

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GAO Highlights

Highlights of GAO-17-707, a report to congressional committees

Why GAO Did This Study

Over 600,000 bridges carry the nation's passenger car, bus and commercial vehicle traffic over waterways, highways, and railways. Large bridges are typically located on heavily used highways and some are in need of repair or replacement, which can be resource intensive. In addition, the nation's surface transportation system is under growing strain and funding it is on GAO's High Risk list.

GAO was asked to review major bridge projects. This report examines (1) condition trends over the past 10 years for the nation's large bridges and (2) challenges states reported facing in constructing or completing major bridge projects in the past 5 years, as well as state and FHWA strategies to address those challenges.

GAO analyzed federal bridge data for the top 1 percent of bridges defined by deck area and surveyed transportation departments in all 50 states, the District of Columbia, and Puerto Rico to identify recent and ongoing major bridge projects. For those states identifying applicable major bridge projects, the survey asked for further information on challenges faced. GAO also conducted interviews with federal and state transportation officials involved with 8 projects in 5 states, selected to include various design and contracting methods, among other criteria.

GAO provided a draft of this report to the U.S. Department of Transportation (DOT) for comment. DOT provided technical comments, which were incorporated as appropriate.

View GAO-17-707. For more information, contact Mark Goldstein at (202) 512-2834 or GoldsteinM@gao.gov.

What GAO Found

The condition of the nation's "large bridges"—defined as those that make up the top 1 percent of bridges in deck area (the surface area that carries vehicles)—has improved since 2007, based on GAO analysis of federal bridge data. From 2007 through 2016, the percentage of deck area on those bridges that the Federal Highway Administration (FHWA) identified as structurally deficient (i.e., one or more components of the bridge is in poor condition) declined from 11.2 to 7.5 percent. However, the condition of large bridges varies by location and age. Some states have substantially higher percentages of deck area that is structurally deficient on large bridges than other states. This could be due to bridge age, climate, or other factors. Because the number of large bridges and amount of total deck area increased dramatically from the 1950s through the 1970s, with bridges generally built with a design-life of 50 years, the condition of large bridges may become more challenging to address as these bridges age. GAO analysis of federal bridge data shows that the amount of deck area on large bridges that is structurally deficient is greatest for bridges built from 1957 through 1976, indicating a need for maintenance, rehabilitation, or replacement.

State departments of transportation reported facing challenges on major bridge projects they constructed or completed in the past 5 years, but identified state and FHWA strategies used to address them. Specifically, 13 of the 52 transportation departments GAO surveyed, including the District of Columbia and Puerto Rico, reported constructing or completing 19 major bridge projects in the past 5 years. GAO defined a "major bridge project" as a project on a large bridge that: (1) receives federal financial assistance, (2) meets or exceeds $500 million in total cost, and (3) focuses primarily on the bridge. See examples of major bridge projects below. State respondents rated four factors—public opposition, availability of funding, right-of-way acquisition, and obtaining environmental permits—as the most challenging. However, for each of these factors, states and FHWA identified strategies they used to address it. For example, to overcome public opposition to tolling on the Ohio River Bridges project, Kentucky officials held numerous public meetings and provided access to the project and the decision-making process through social media. Other states reported benefitting from FHWA's project oversight manager program, which assigns an FHWA manager to a major bridge project to help the state transportation department navigate federal requirements.

Examples of Major Bridge Project Designs in California, Indiana and Kentucky, and Washington

Self-anchored suspension bridge: San Francisco-Oakland Bay Bridge, East Span

Cable-stayed bridge: Louisville-Southern Indiana Ohio River Bridges Project, Downtown Crossing

Floating bridge: State Route 520 Floating Bridge

Sources: Federal Highway Administration (left), GAO (middle), and Washington State Department of Transportation (right). | GAO-17-707

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Abbreviations

DOT	U.S. Department of Transportation
FAST Act	Fixing America's Surface Transportation Act
FHWA	Federal Highway Administration
MAP-21	Moving Ahead for Progress in the 21st Century Act
MPO	metropolitan planning organization
NEPA	National Environmental Policy Act
NHS	National Highway System.
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
TIFIA	Transportation Infrastructure Finance and Innovation Act

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July 26, 2017

The Honorable Bill Shuster
Chairman
The Honorable Peter A. DeFazio
Ranking Member
Committee on Transportation and Infrastructure
House of Representatives

The Honorable Sam Graves
Chairman
The Honorable Eleanor Holmes Norton
Ranking Member
Subcommittee on Highways and Transit
Committee on Transportation and Infrastructure
House of Representatives

Bridges are essential to the nation's transportation system, supporting commerce, economic vitality, and personal mobility. Bridges carry the nation's passenger car, truck, bus, and commercial vehicle traffic over waterways, highways, railways, and other road obstructions.[1] The largest of these bridges, such as the San Francisco-Oakland Bay Bridge in California and the State Route 520 Floating Bridge over Lake Washington in Seattle, are located on heavily used traffic corridors. For example, more than 250,000 vehicles cross the San Francisco-Oakland Bay Bridge each day in one of the nation's most heavily populated geographic regions. Some large bridges may need replacing or rehabilitating if certain components of the bridge, such as the bridge deck, are in poor condition, or if the bridge does not meet current design standards or traffic demands. However, implementing projects to replace these large bridges can be expensive. We have previously reported that the cost to repair and upgrade the nation's surface transportation system to meet current and future demands is estimated in the hundreds of billions of dollars, yet the buying power of motor fuel and other truck-related taxes that provide the major source of federal surface transportation funding is eroding.[2] As a

[1]Bridges in this report refer to publicly owned highway bridges that are greater than 20 feet in length and that are located on public roads.

[2]See GAO, *Highway Trust Fund: DOT Has Opportunities to Improve Tracking and Reporting of Highway Spending*, GAO-15-33 (Washington, D.C.: Oct. 9, 2014) and *Highway Trust Fund: Pilot Program Could Help Determine the Viability of Mileage Fees for Certain Vehicles*, GAO-13-77 (Washington, D.C.: Dec. 13, 2012).

result, funding the nation's surface transportation system continues to be on GAO's High Risk List.[3]

In recent years, there have been a number of changes to how bridge projects are federally funded and managed by states. After over 40 years of having a dedicated federal program to help fund bridge projects, recent surface transportation authorizations consolidated the bridge-funding program and other existing highway formula programs, resulting in bridge projects generally being funded through broader highway funding programs.[4] Recent authorizations have also sought to accelerate project delivery by, for example, establishing tools to make the environmental review process, which typically consists of identifying and assessing the environmental impacts of highway construction projects, more efficient and encouraging innovative financing mechanisms to advance projects more quickly.

In 2016, we found that bridge conditions nationwide had generally improved and that federal funds obligated for bridge projects had remained relatively stable from 2006 to 2015.[5] We also found that while the Federal Highway Administration (FHWA) estimates total funds dedicated to bridge projects and collects data on bridge conditions nationwide, it does not track the linkage between federal funds and changes in bridge conditions. To address this issue, we recommended that FHWA develop measures that demonstrate the linkage between federal funding of bridges and the desired performance outcomes, such as maintained or improved bridge conditions. FHWA agreed with our recommendation and is working to develop and evaluate such measures. Despite overall improvement in bridge conditions, some transportation

[3]GAO, *High-Risk Series: Progress on Many High-Risk Areas, While Substantial Efforts Needed on Others*, GAO-17-317 (Washington, D.C.: Feb. 2017).

[4]In 2012, the Moving Ahead for Progress in the 21st Century Act (MAP-21) consolidated the bridge-funding program into the National Highway Performance Program and the Surface Transportation Program. Pub. L. No. 112-141, §§ 1106, 1108, 126 Stat. 405, 432, 440 (2012). The 2015 Fixing America's Surface Transportation Act (FAST Act) authorized appropriations out of the Highway Trust fund for the National Highway Performance Program, the Surface Transportation Block Grant Program (which replaced the Surface Transportation Program), and the Highway Safety Improvement Program for fiscal years 2016–2020. Pub. L. No. 114-94, §§ 1101, 1109, 129 Stat. 1312, 1322, 1338 (2015).

[5]GAO, Highway Bridges: *Linking Funding to Conditions May Help Demonstrate Impact of Federal Investment*, GAO-16-779 (Washington, D.C.: Sept. 14, 2016). See also GAO, *Transportation Infrastructure: Information on Bridge Conditions*, GAO-16-72R (Washington, D.C.: Oct. 29, 2015).

stakeholders continue to point out the length of time it takes to complete major transportation projects, including those on some of the nation's largest bridges. Moreover, with the high cost of replacing aging bridge infrastructure, some stakeholders questioned whether states would be able to move forward on projects to replace or rehabilitate large bridges.

You asked us to review major bridge projects. This report examines (1) trends over the past 10 years in the condition of the nation's large bridges and (2) any challenges state departments of transportation reported facing in constructing or completing major projects on large bridges in the past 5 years, and how states and FHWA addressed those challenges.

To determine trends in the condition of the nation's largest bridges in the last 10 years, we reviewed and analyzed FHWA's National Bridge Inventory data for calendar years 2007 through 2016. We define large bridges as those with total deck area (the surface area that carries vehicles) in the top 1 percent of bridges in the National Bridge Inventory.[6] Consistent with our recent reports on bridge conditions, we assessed the conditions of bridges in each state by determining the percentage of both total deck area of bridges classified as structurally deficient and number of bridges classified as structurally deficient.[7] A bridge is considered structurally deficient if one or more components, such as the deck that directly carries vehicles, are in poor condition. Measuring total deck area, which accounts for the size of a bridge, can provide a more complete picture of bridge conditions in terms of the magnitude of repair needed across a state than the number of deficient bridges. For example, a state may have a large number of structurally deficient bridges, but if the structurally deficient bridges are small bridges, the total deck area in need of rehabilitation could still be relatively low. In comparison, another state could have few structurally deficient bridges, but if those structurally deficient bridges are large, then the total deck area in need of rehabilitation could be much higher. We assessed the reliability of the data that we used by reviewing the National Bridge Inventory data dictionary and related on-line tools and resources, and by conducting electronic testing of the data. We found the data to be sufficiently reliable for our purposes.

[6]To determine the total deck area, we calculated the deck area in square feet of each large bridge in the National Bridge Inventory by multiplying the "structure length" by the "deck width."

[7]GAO-16-779 and GAO-16-72R.

To determine the challenges state departments of transportation reported facing in constructing or completing major projects on large bridges, we first identified the number and nature of ongoing or completed major bridge projects in the last 5 years by reviewing FHWA major projects data. A "major project" is statutorily defined as a project receiving federal financial assistance that meets or exceeds $500 million in total cost.[8] We defined a "major bridge project" as a "major project" where the focus is constructing or rehabilitating a large bridge (as opposed to a corridor project, which focuses primarily on a highway). To corroborate the list of major bridge projects, we surveyed bridge engineers in all 50 state departments of transportation plus those in the District of Columbia and Puerto Rico and asked them to list their respective major bridge projects that had been completed or were under construction within the last 5 years.[9] We also reviewed publicly available information, such as major bridge projects' websites, to learn more about the projects. For those states with major bridge projects completed or under construction during that time period, we then asked respondents to rate the extent to which listed factors had been challenging, if at all, when implementing their most recent major bridge project.[10] We identified these factors based on our review of literature, including our prior work, and interviews with FHWA officials and representatives from the American Association of State Highway and Transportation Officials and the American Road and Transportation Builders Association. To increase the validity and reliability of our survey, we conducted pretests of the survey with these officials and representatives, and with bridge engineers from two states. We received a 100 percent response rate to our survey. The challenges identified and the perceived significance of those challenges are not generalizable to other major bridge projects.

To further learn about challenges as well as about strategies states and FHWA have used to address these challenges, we conducted site visits to 8 major bridge projects in California, Indiana, Kentucky, New York, and Washington State, where we interviewed federal and state transportation officials and bridge engineers, as well as contractors and consultants on

[8]23 U.S.C. § 106(h).

[9]We refer to survey recipients as "52 state DOTs" throughout the report.

[10]For states with no major bridge project completed in the last 5 years, we asked survey respondents to focus on a major bridge project that was under construction in the last 5 years.

specific major bridge projects.[11] We selected this non-generalizable sample based on several criteria, including (1) total project cost met or exceeded $500 million, or is expected to meet or exceed $500 million; (2) unique project elements, such as design type, contracting method, or funding/financing solutions; and (3) geographic location. In addition, we interviewed FHWA headquarters officials and representatives from the two previously mentioned industry trade groups.

We conducted this performance audit from August 2016 to July 2017 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

FHWA is the agency charged with oversight of the condition of the nation's bridges. As part of its oversight role, FHWA collects information from states, federal agencies, and tribal governments on bridge conditions and maintains this data in the National Bridge Inventory database. State-level DOTs are responsible for ensuring that highway bridges on public roads within their state, unless owned by federal agencies, are inspected. Each state or federal agency must also prepare and maintain an inventory of all the inspected bridges subject to the National Bridge Inspection Standards. Bridges must be inspected at regular intervals (generally every 2 years). FHWA collects data from these inspections, maintains these data in the National Bridge Inventory, and uses them to assess bridge condition.[12]

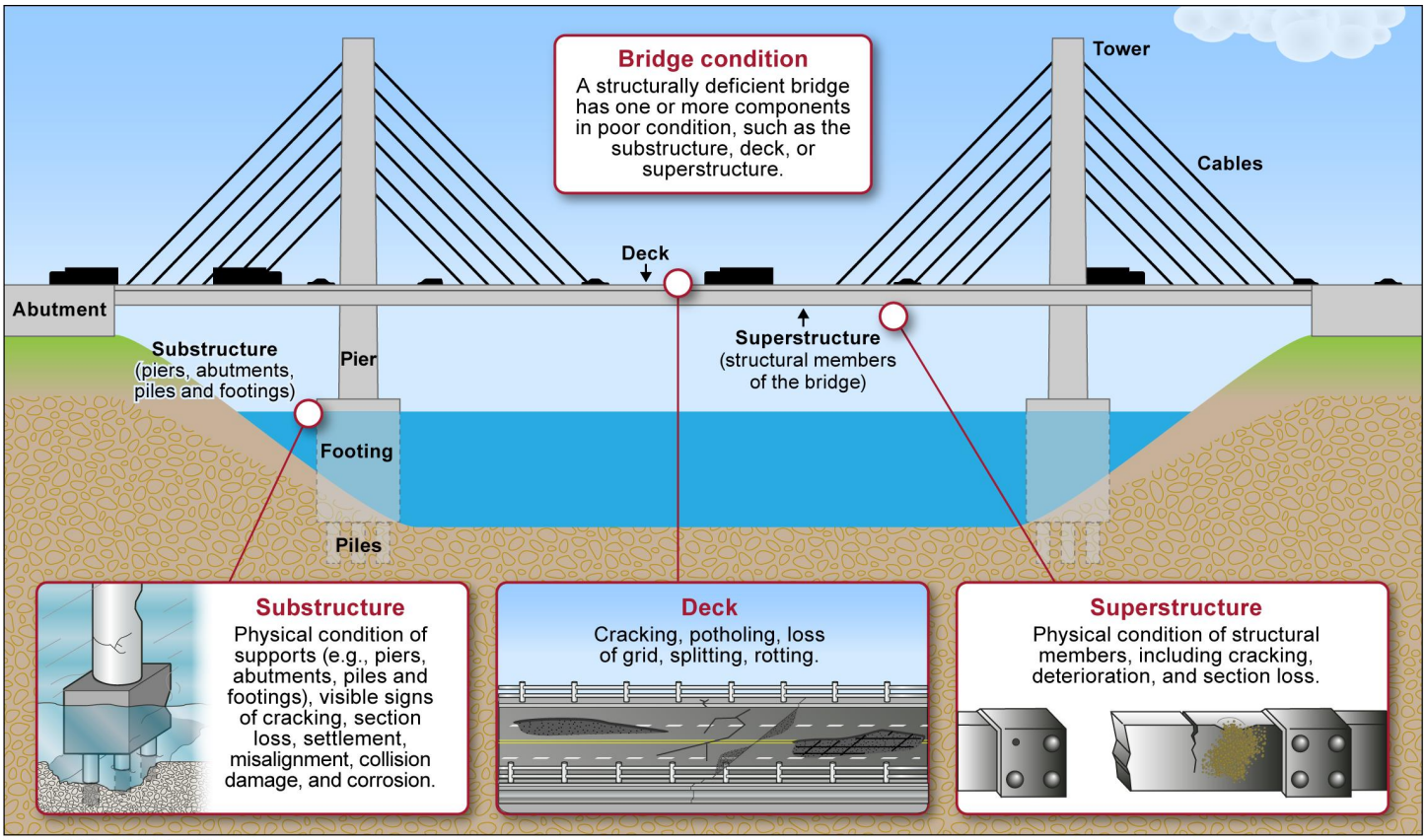
[11]We visited three major bridge projects in California, two in New York, and one each in Indiana, Kentucky, and Washington State.

[12]Bridge condition ratings form the basis for assessing the structural deficiency of a bridge. Condition ratings use a rating system, where 9 indicates excellent, as-new condition, and 0 indicates a failed condition. Codes 7 through 9 indicate good to excellent conditions. Codes 5 and 6 indicate either fair or satisfactory condition of the components. Codes 0 through 4, respectively indicate failed conditions, conditions representing imminent failure of the component, critical conditions, serious or poor conditions.

Under new regulations, bridges that receive low condition ratings on specific bridge components, such as the deck, are classified as structurally deficient (see fig. 1).[13]

[13]In 2012, MAP-21 required DOT to promulgate rules establishing performance measures and standards for the purpose of carrying out the National Highway Performance Program, including measures for the states to assess the condition of bridges on the National Highway System (NHS). Pub. L. No. 112-141, § 1203, 126 Stat 405, 524 (codified as amended at 23 U.S.C. § 150). The National Highway System includes 230,000 miles of highways that are designated important to the nation's economy, defense, and mobility. In January 2017, FHWA promulgated a final rule including the national performance management measures for assessing bridge condition; this rule went into effect on May 20, 2017. Under these new regulations, starting in calendar year 2018, if the deck, superstructure, substructure, or culverts of a bridge is rated 4 or less, the bridge is classified as structurally deficient. 23 C.F.R. § 409.411(b). A bridge classified as structurally deficient is not necessarily unsafe, but it may require the posting of a vehicle weight restriction. Furthermore, if the Secretary determines that for the 3-year period preceding the date of the determination, more than 10 percent of the total deck area of a state's bridges on the NHS is located on structurally deficient bridges, the state must spend an amount equal to 50 percent of its 2009 Highway Bridge Program apportionment on eligible projects on its NHS bridges. Pub. L. No. 112-141, § 1106, 126 Stat. 405, 432 (codified as amended at 23 U.S.C. § 119(f)(2)).

Figure 1: Key Components That May Contribute to a Bridge's Classification as Structurally Deficient



Source: GAO. | GAO-17-707

In 2016, the United States had over 614,000 bridges, comprising more than 4-billion square feet of total deck area. The largest bridges—those in the top 1 percent—accounted for nearly a quarter, or about a billion square feet, of total bridge deck area. The nation's largest bridge, the 24 mile-long Lake Pontchartrain Causeway Bridge in Louisiana, has nearly 4 million square feet of deck area. These large bridges are predominantly located on the National Highway System (NHS), which includes about 230,000 miles of highway that are considered important to the nation's economy, defense, and mobility.[14] Other large bridges may be located on the much larger category known as federal-aid highways, which includes

[14]23 U.S.C. §§ 101(a)(16), 103(b).

the NHS along with other roads.[15] Bridges that are located off federal-aid highways are, by definition, on local or rural roads that often carry lower volumes of traffic. Off federal-aid highway bridges are typically, though not necessarily, located off of the NHS.

FHWA administers the federal-aid highway program that provides about $40 billion each year to states to design, construct, and maintain the nation's roadway and bridge infrastructure. This program is primarily funded by taxes on motor fuels and other truck-related taxes that are deposited into the Highway Trust Fund. Although federal funding is provided to states to improve highway infrastructure, state and local agencies (e.g., state DOTs) own and maintain most of the nation's bridges. They must typically provide a 20 percent match of federal funds and may contribute funds beyond their match amount. State DOTs and local-planning organizations also have discretion in determining how to allocate available federal funds among various projects and are responsible for selecting highway projects in their states, including bridge projects. For projects that meet or exceed $500 million in total estimated cost and include some federal financing, project sponsors, such as the state DOT, local agency, and toll or port authority, must submit to DOT a project management plan and an annual financial plan. The FHWA Office of Infrastructure Major Projects Team oversees these requirements.

Similar to any transportation project, a major bridge project can involve many stakeholders, including federal, state, and local government agencies, nongovernmental organizations, and private citizens. DOT solicits input from the public across the following four primary project phases:

- *Planning*: State DOTs, along with other transportation agencies (e.g., local agencies and toll or port authorities, and metropolitan-planning organizations (MPO)) assess the need for a project in relation to other potential highway projects' needs. The general public, as well as various stakeholder groups—such as nonprofit, community-based, and environmental organizations—may provide input that informs the policies, plans, and overall program direction that a state DOT or MPO follows.

[15]The term "federal-aid highway" means a public highway eligible for federal-funding assistance other than a highway functionally classified as a local road or rural minor collector. 23 U.S.C. § 101(a)(6).

- *Preliminary design and environmental review*: State DOTs identify potential transportation solutions based on 1) needs identified during planning and the potential environmental and social effects of those solutions (e.g., disproportionate impacts on low-income communities); 2) the project's cost; and 3) the construction site's location. State DOTs also analyze the effect, if any, of the proposed project on the environment and potential alternatives and select the preferred alternative. On large projects, the sponsoring agency may hold public hearings, meetings, or workshops to solicit public input.
- *Final design and right-of-way acquisition*: State DOTs finalize design plans, acquire property, and relocate residents and businesses if necessary.
- *Construction*: State DOTs award construction contracts and oversee construction until the project is completed. Construction contracts may include a public information and outreach component, including providing public meetings and online resources to inform the public on construction progress, traffic revisions, and other community effects.

In the preliminary design and environmental review phase, many activities carried out are pursuant to the National Environmental Policy Act of 1969 (NEPA) and other federal and state environmental review and permitting laws. NEPA generally requires federal agencies to evaluate and document the likely environmental effects of actions they propose to carry out or permit—including the development of infrastructure projects, such as roads and bridges. There are also numerous state and local environmental laws—roughly equivalent to NEPA in purpose—with which projects must comply.[16]

Recent federal surface transportation legislation includes provisions to help expedite the delivery of highway projects. For example, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) created a pilot program in which the Secretary of Transportation could allow a state to assume the Secretary's NEPA responsibilities.[17] In 2012, MAP-21 converted this pilot program into a permanent program, and added various other provisions to expedite the

[16]GAO examined state environmental policy acts in GAO, *Highway Projects: Many Federal and State Environmental Review Requirements Are Similar, and Little Duplication of Effort Occurs*, GAO-15-71 (Washington, D.C.: Nov. 18, 2014).

[17]Pub. L. No. 109-59, § 6005, 119 Stat 1144, 1868 (2005) (codified as amended at 23 U.S.C. § 327). According to DOT, California, Florida, and Texas have been delegated NEPA responsibilities.

environmental review process for certain projects.[18] In addition, the FAST Act required DOT to create the National Surface Transportation Innovative Finance Bureau, which must develop and promote best practices for innovative financing and public-private partnerships for transportation projects.[19]

Conditions of Large Bridges Have Improved Overall Since 2007, Although Variation Exists

The Condition of Large Bridges Improved over the Past 10 Years

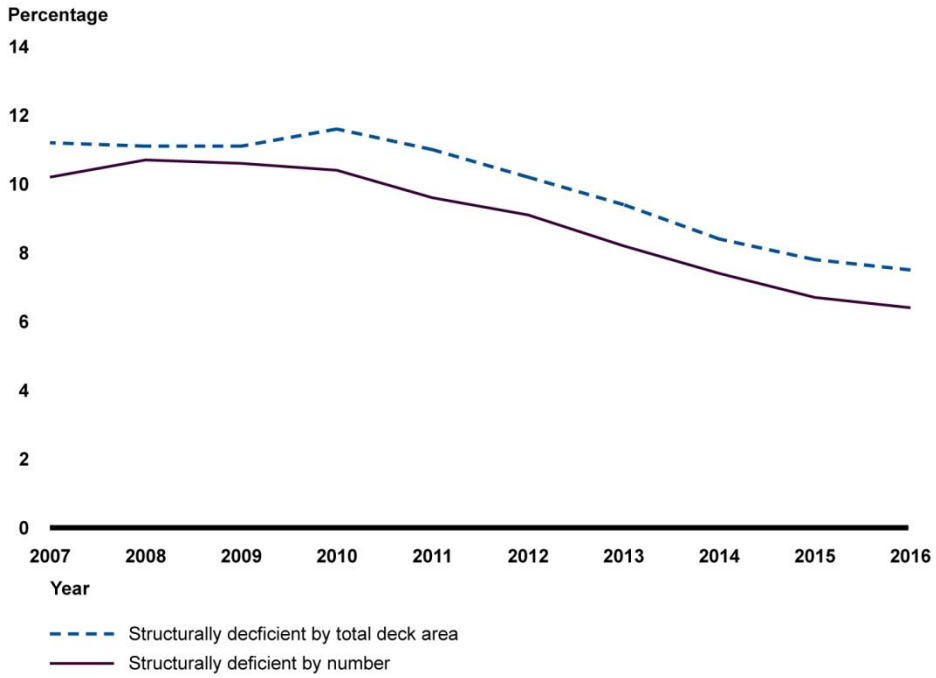
The condition of large bridges improved from 2007 through 2016 based on our analysis of data from the National Bridge Inventory.[20] The percentage of deck area that FHWA identified as structurally deficient on the nation's large bridges decreased from 11.2 percent to 7.5 percent, and the percentage of large bridges that were structurally deficient also declined, from 10.2 percent to 6.4 percent (see fig. 2).

[18]Pub. L. No. 112-141, § 1313, 126 Stat. 405, 546.

[19]Pub. L. No. 114-94, § 9001, 129 Stat. 1312, 1612. (codified as amended at 49 U.S.C. § 116).

[20]As previously noted, we define large bridges as those with total deck area in the top 1 percent of bridges in the National Bridge Inventory. In 2016, this definition results in 6,134 bridges with a combined deck area of approximately 1-billion square feet.

Figure 2: Percentage of Structurally Deficient Large Bridges by Total Deck Area and Number, 2007 through 2016



Source: GAO analysis of Federal Highway Administration data. | GAO-17-707

Notes: A structurally deficient bridge has one or more components in poor condition. We define large bridges as those with total deck area in the top 1 percent of bridges in the National Bridge Inventory.

Similarly, in our prior report we found that the percentage of structurally deficient bridges—both deck area and number—for all the nation's bridges had decreased.[21] However, large bridges are in slightly worse condition. For example, in 2016, 7.5 percent of the deck area of all large bridges was structurally deficient compared to 6.1 percent of the deck area of all bridges.

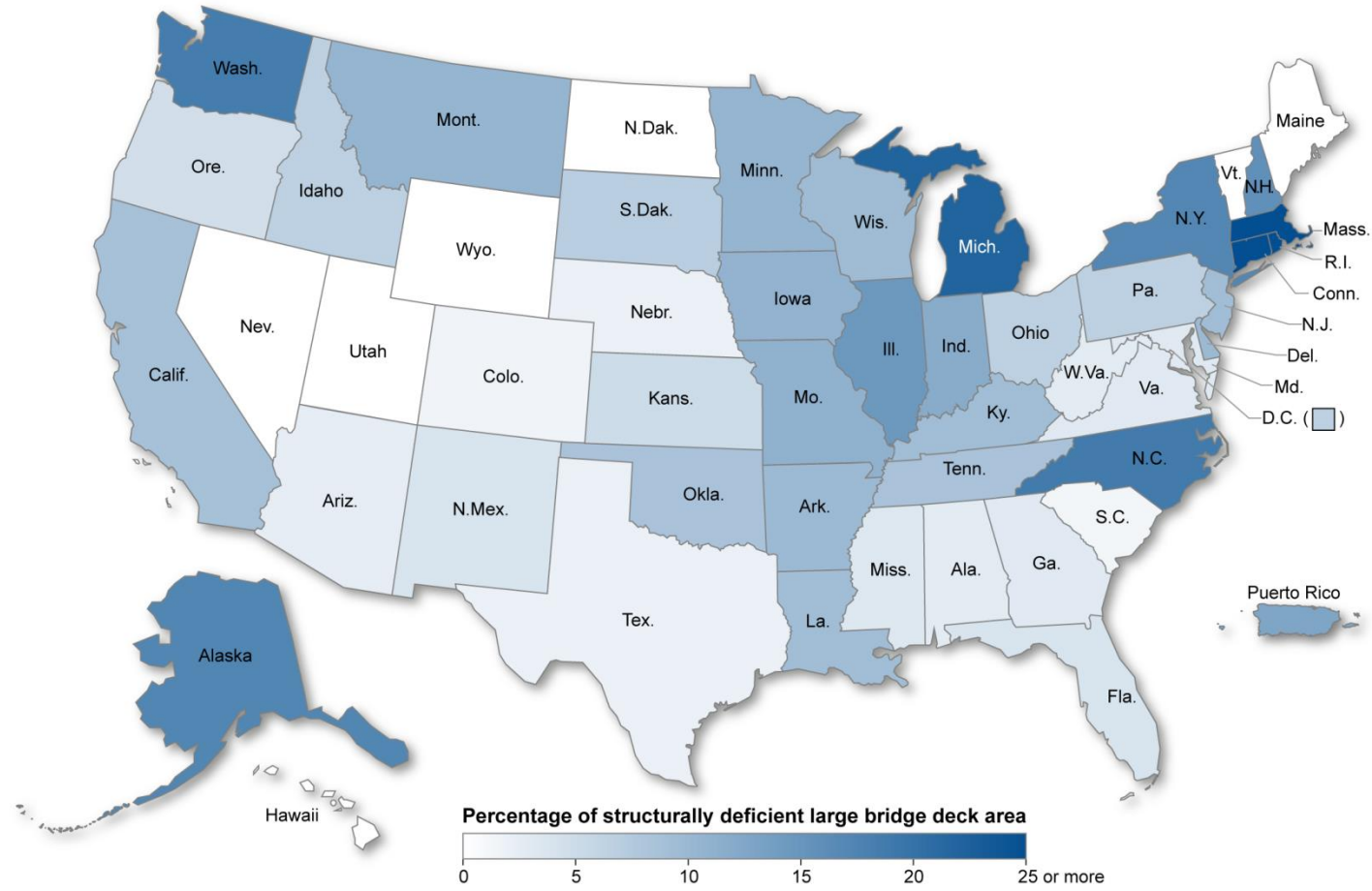
[21]In our 2016 report, we assessed the condition of all bridges between 2006 and 2015. See GAO-16-779.

Despite Overall Improvements, Large Bridge Conditions Vary by Location and Age

Despite overall improvements, among states there is variation in the condition of large bridges. Our review of 2016 National Bridge Inventory data showed that some states have higher percentages of large bridges with deck area that was structurally deficient than other states, as shown in figure 3 below. We found that the percentage of deck area that was structurally deficient on large bridges ranged from 0 to 27 percent among states.[22] There could be a number of explanations for this variation in the condition of states' large bridges, including the age of the bridge inventory, climate, states' funding priorities, and the total number of large bridges in the state. For instance, one structurally deficient large bridge in a state with relatively few large bridges could have a more pronounced effect on the overall percentage of deck area that is structurally deficient in the state than in a state with a number of large bridges. See appendix 1 for additional information regarding state bridge conditions.

[22]There was no structurally deficient deck area on large bridges in Hawaii, Maine, Nevada, North Dakota, Utah, Vermont, and Wyoming; 27 percent of deck area on large bridges in Connecticut and Massachusetts was structurally deficient.

Figure 3: Percentage of Deck Area on Large Bridges That is Structurally Deficient, by State, 2016



Sources: GAO analysis of Federal Highway Administration data and Map Resources. | GAO-17-707

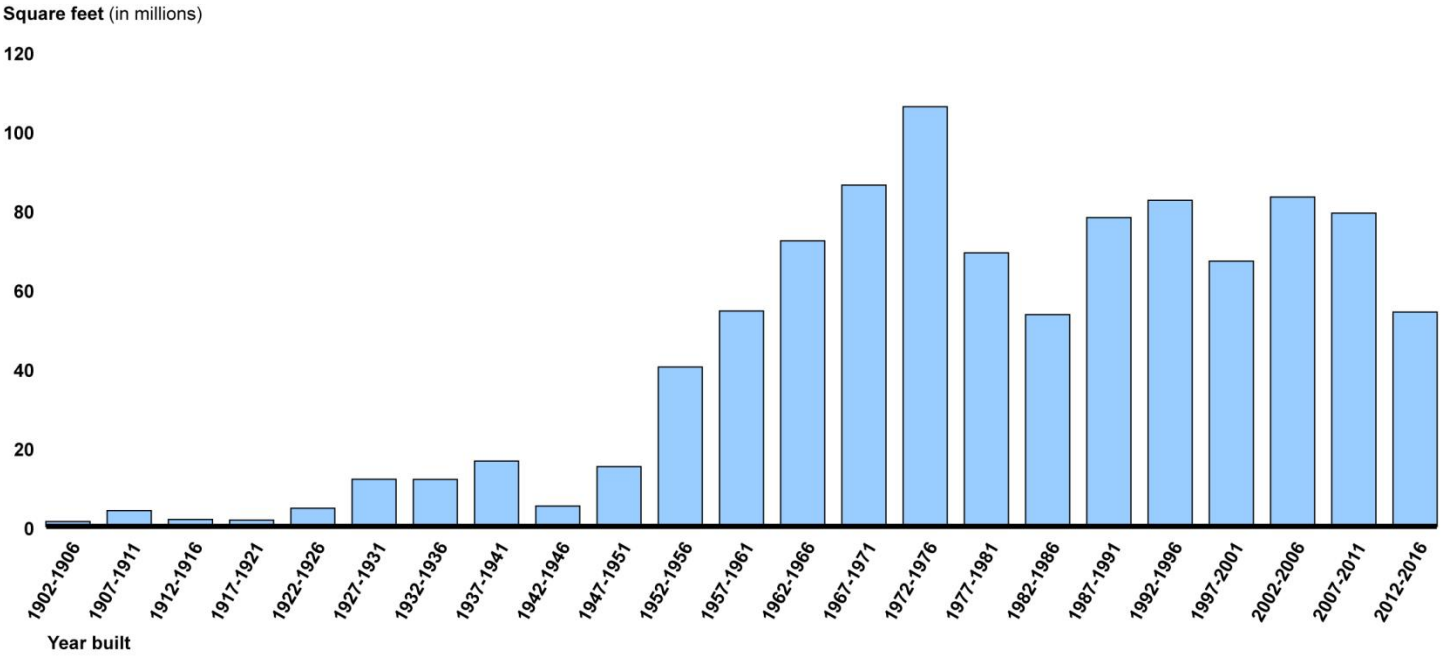
Notes: A structurally deficient bridge has one or more components in poor condition. We define large bridges as those with total deck area in the top 1 percent of bridges in the National Bridge Inventory.

As we previously reported, the amount of deck area and the number of bridges increased dramatically from the 1950s through the 1970s.[23] This holds true for large bridges, as well. Figure 4 below shows that the amount of deck area of large bridges increased beginning in the 1950s and has remained relatively steady since the late 1970s. Our analysis of National Bridge Inventory data indicates that the average age of large bridges nationwide is about 34 years and that the average age of non-

[23]See GAO-16-779.

large bridges is nearly 43 years.[24] According to FHWA, the design life of the majority of existing bridges is 50 years, though bridge life spans are dependent on factors such as construction materials, severity of environment, level of use (i.e., number of crossings per day), vehicle weight, and quality of maintenance.

Figure 4: Total Deck Area of Large Bridges, by Year Built, 1902 through 2016



Source: GAO analysis of Federal Highway Administration data. | GAO-17-707

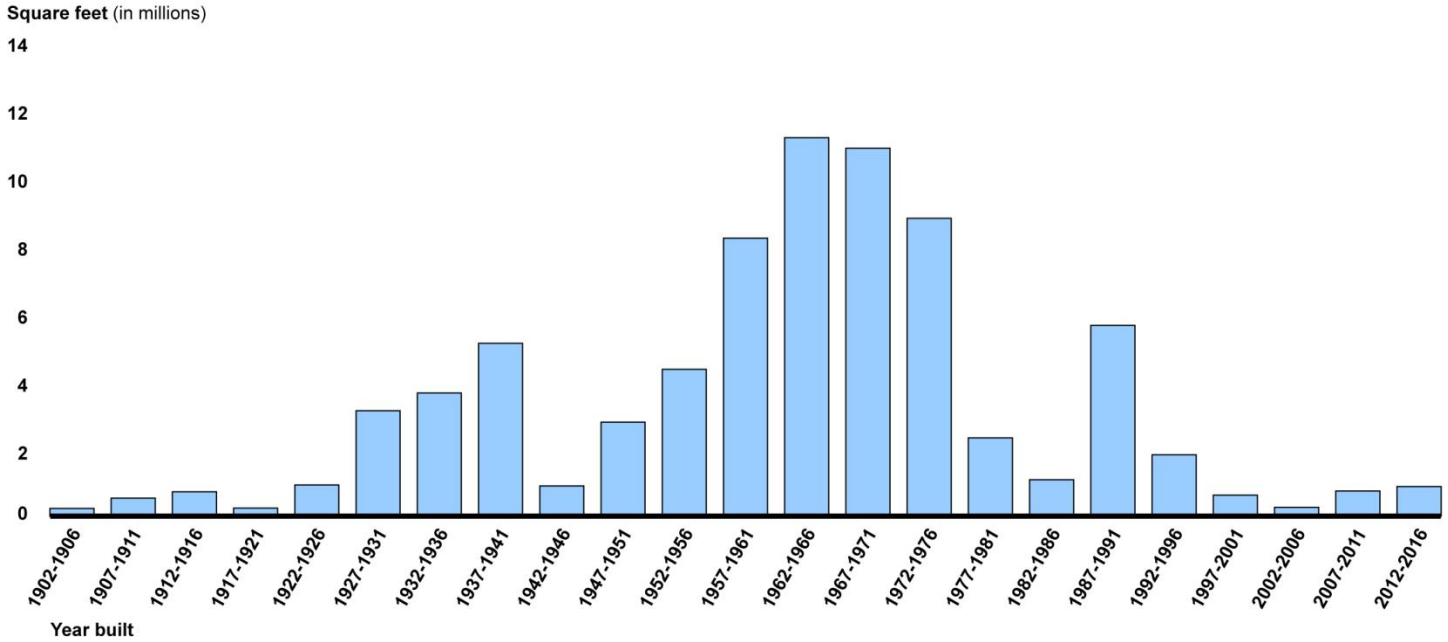
Note: We define large bridges as those with total deck area in the top 1 percent of bridges in the National Bridge Inventory.

We also previously reported that conditions of bridges may become more challenging to address as bridges age.[25] Analysis of National Bridge Inventory data indicates that there is a much higher amount of deck area that is structurally deficient on large bridges built between 1957 and 1976, as shown in figure 5 below. These large bridges would likely be approaching the end of their design life as many are over 50 years old and may be in need of maintenance, rehabilitation, or replacement.

[24]This analysis included 6,134 large bridges (i.e., those with total deck area in the top 1 percent of bridges in the National Bridge Inventory in 2016) compared to 608,244 non-large bridges.

[25]GAO-16-779.

Figure 5: Total Deck Area of Large Bridges That is Structurally Deficient, by Year Built, 1902 through 2016



Source: GAO analysis of Federal Highway Administration data. | GAO-17-707

Notes: A structurally deficient bridge has one or more components in poor condition. We define large bridges as those with total deck area in the top 1 percent of bridges in the National Bridge Inventory.

State DOTs Constructing or Completing Major Bridge Projects in the Past 5 Years Identified Some Challenges, but FHWA and States Identified Strategies to Address Them

Thirteen State DOTs Identified 19 Major Bridge Projects, Most to Increase Traffic Capacity

Of the 52 state and territory DOTs we surveyed, 13 reported having at least one major bridge project reach construction or completion in the past 5 years, for a total of 19 major bridge projects (see table 1).[26]

[26]We defined a "major bridge project" as a project to construct a new bridge or rehabilitate an existing bridge that includes some federal funding, meets or exceeds $500 million in total project costs, and focuses primarily on a large bridge (as opposed to a corridor project that focuses primarily on a highway). We excluded any projects that did not meet these criteria or had not reached at least the construction phase.

Table 1: Major Bridge Projects Completed in the Last 5 Years or under Construction as of April 1, 2017

State	Bridge	Description
California	Gerald Desmond Bridge	Replacement of existing structure with new 6-lane bridge to accommodate commercial truck traffic.
California	San Francisco-Oakland Bay Bridge, East Span[a]	Replacement of East Span to meet current seismic standards.
California	Sixth Street Viaduct	Replacement to address earthquake vulnerabilities identified 20 years after the bridge was constructed in 1932.
Connecticut	Pearl Harbor Memorial Bridge	Construction of a new 10-lane bridge over New Haven Harbor to accommodate additional traffic needs.
Florida	Pensacola Bay Bridge	Replacement of the existing 4-lane bridge with a 6-lane bridge.
Indiana	Louisville-Southern Indiana Ohio River Bridges Project, East End Crossing	Construction of a new bridge over the Ohio River connecting the east end of Louisville, Kentucky, with southern Indiana.
Kentucky	Louisville-Southern Indiana Ohio River Bridges Project, Downtown Crossing	Construction of a new bridge over the Ohio River connecting downtown Louisville, Kentucky, to Jeffersonville, Indiana.
Louisiana	I-10 Bridge over Lake Pontchartrain	Replacement of the existing bridge after it was damaged in Hurricane Katrina.
Minnesota	St. Croix Crossing	Construction of a new bridge across the St. Croix River between Minnesota and Wisconsin.
Missouri	Stan Musial Veterans Memorial Bridge	Construction of a new cable-stayed bridge across the Mississippi River between Illinois and Missouri in St. Louis, Missouri.
New Jersey[b]	Route 7 Witpenn Bridge	Replacement of existing bridge with a new bridge that is taller, wider, and accommodates pedestrian and bike traffic.
New York	Tappan Zee Bridge	Replacement of the bridge over the Hudson River to accommodate additional traffic.
New York	Brooklyn Bridge	Rehabilitation of the 1883 bridge, including repair and painting, to improve safety and reduce congestion.
New York	Kosciuszko Bridge[a]	Replacement of I-278 bridge between Queens, New York and Brooklyn, New York, to address steep grade and inadequate shoulders.
New York	Goethals Bridge	Replacement of the bridge between Elizabeth, New Jersey and Staten Island, New York, to widen lanes, improve sight line, and add shoulders.
New York	Willis Avenue Bridge	Replacement of a bridge originally constructed in 1901 connecting Manhattan and Bronx, New York, to widen lanes and add a pedestrian/bike path.
Ohio	George Voinovich Bridge	Replacement of I-90 bridge in Cleveland, Ohio, to improve safety and reduce traffic congestion.
Texas	Harbor Bridge project	Replacement of existing bridge in Corpus Christi, Texas, to address high accident rate, steep grade, and lack of shoulders.
Washington	State Route 520 Floating Bridge project	Replacement of the bridge over Lake Washington to address structural condition and increased traffic volume.

Source: GAO analysis of state DOT-provided information. | GAO-17-707

Notes: We define major bridge projects as projects that include some federal funding or financing, meet or exceed $500 million in total project costs, and focus on constructing a new large bridge or rehabilitating an existing one. However, one bridge project on this list, the Sixth Street Viaduct in Los Angeles, has a project cost of $482 million. We included it because it is an FHWA-designated special

project. Of the 19 major bridge projects listed in this table, 3—the Stan Musial Veterans Memorial, Willis Avenue, and I-10 over Lake Pontchartrain—were completed as of April 1, 2017. We excluded the I-95 Woodrow Wilson Bridge between Maryland and Virginia from this list as FHWA officials said the bridge replacement project was completed more than 5 years ago, but some interchange contracts on the Virginia side of the bridge were completed less than 5 years ago. Officials from Maryland's DOT, which was the project sponsor, said the project had been completed more than 5 years ago, and therefore they did not complete our survey.

[a]For the states that reported multiple projects completed or underway in the past 5 years, a superscript "[a]" indicates the bridge project for which the state DOT completed the survey.

[b]New Jersey's Witpenn Bridge was federally-funded for design, but not construction.

Most of the 19 major bridge projects that state DOTs identified were designed to increase the capacity of existing bridges or to generally accommodate higher traffic volumes. Many of the original bridges were built 50 or more years ago when traffic volumes and the number of heavy trucks on the road, were lower. For example, officials from the Port Authority of New York and New Jersey, which owns the Goethals Bridge, told us that the original bridge (completed in 1928) was insufficient for the area's current heavy truck traffic, was narrow, and lacked a shoulder for emergency vehicles, regularly creating traffic bottlenecks. Figure 6 depicts some of the major bridge projects included in our review and appendix II provides additional information on the 8 major bridge projects we visited.

Figure 6: Examples of Major Bridge Project Designs in California, Indiana and Kentucky, and Washington

Self-anchored suspension bridge: San Francisco-Oakland Bay Bridge, East Span

Cable-stayed bridge: Louisville- Southern Indiana Ohio River Bridges Project, Downtown Crossing

A self-anchored suspension bridge relies on a single main cable to support the weight of the bridge.

A cable-stayed bridge uses towers from which cables run directly to the bridge deck, to support the bridge deck.

A floating bridge relies on pontoons to support the bridge deck.

Floating bridge: State Route 520 Floating Bridge

Sources: Federal Highway Administration (top), GAO (middle) and Washington State Department of Transportation (bottom). | GAO-17-707

Officials in some states reported that safety concerns also contributed to their decision to replace a bridge. For example, the Sixth Street Viaduct in Los Angeles, which was constructed in 1932, began showing evidence of deterioration and disintegration just 20 years later as a result of a chemical reaction in the concrete. In 2004, seismic vulnerability studies

concluded that the bridge had a high vulnerability for failure in the case of a major earthquake. As a result, the City of Los Angeles is in the process of replacing the bridge and estimates completion in 2020.

State project sponsors used a variety of contracting methods for these projects, with most using design-bid-build (7 projects) or design-build (9 projects). Under design-bid-build, the project sponsor creates a design for the bridge either in-house or with a contractor, and then opens a bidding process to select a contractor to construct the bridge. In contrast, design-build contracts are awarded to a design-build team, which works under a single contract with the bridge owner to lead both the bridge design and construction. New York state DOT officials told us that using design-build for the Kosciuszko Bridge accelerated the delivery time of that project. Additionally, project sponsors from two states (New York and Indiana) used public-private partnerships to design, build, finance, and maintain their respective major bridge projects. Public-private partnerships are contractual agreements between a public agency (e.g., the state DOT) and a private sector entity that often provides or leverages private financing for the project. Finally, the City of Los Angeles utilized a construction manager/general contractor contract for its Sixth Street Viaduct.[27] Similar to the design-build contracting method, construction manager/general contractor allows the builder to be more involved during the design phase. According to FHWA, both the design-build and construction manager/general contractor methods can accelerate project delivery by allowing a construction manager to provide constructability input during design, thereby reducing the risk of design errors and the need for redesigns.[28]

[27]The California Department of Transportation also utilized a construction manager/general contractor contract to remove the foundations of the East Span of the San Francisco-Oakland Bay Bridge project. This contract was relatively small compared to the other contracts utilized for this project.

[28]FHWA also promotes best practices on these contracting methods through its Alternative Contracting Methods Library, and by hosting webinars and training on topics such as public-private partnerships.

All 13 State DOTs Reported Facing Challenges, but They Identified Strategies and FHWA Resources to Help Address Them

All13 state DOTs that reported constructing or completing a major bridge project in the past 5 years also reported facing one or more challenges on that bridge project.[29] When rating how challenging 9 factors were on their most recent major bridge project, four factors were rated most challenging; two factors were rated less challenging; and three factors were rated least challenging (see fig. 7 below).[30] States and FHWA identified strategies used to address these challenges, such as soliciting local community input early in the project timeline and utilizing FHWA's project oversight manager program.

[29]States rated challenges on their most recently completed major bridge project within the last 5 years. For states with no major bridge project completed in the last 5 years, we asked survey respondents to focus on a major bridge project that was under construction in the last 5 years.

[30]For exact survey question wording, see appendix III. Note we asked states to rate how challenging various contracting methods were on their most recent major bridge project, but used this information for internal cross-checking purposes and thus do not report it in figure 7.

Figure 7: How the 13 State DOTs That Reported Implementing Major Bridge Projects in the Last 5 years Rated Potential Project Challenges on Their Most Recent Project

Challenge	Extremely/ Very	Somewhat	Slightly/ Not at all	Not Applicable/ No answer
Public opposition	6	3	3	1
Availability of funding	5	6	2	0
Right-of-way acquisition	4	7	2	0
Obtaining environmental permits	3	6	3	1
FHWA or state coordination of federal resource agencies' input	1	6	6	0
Compliance with FHWA-required documents (e.g., project management plan)	0	7	6	0
Availability of financing	2	1	4	6
Changing state transportation priorities	0	4	7	2
Adhering to federal labor and construction requirements (e.g., Buy America)	0	5	8	0

Factors rated as most challenging

Factors rated as less challenging

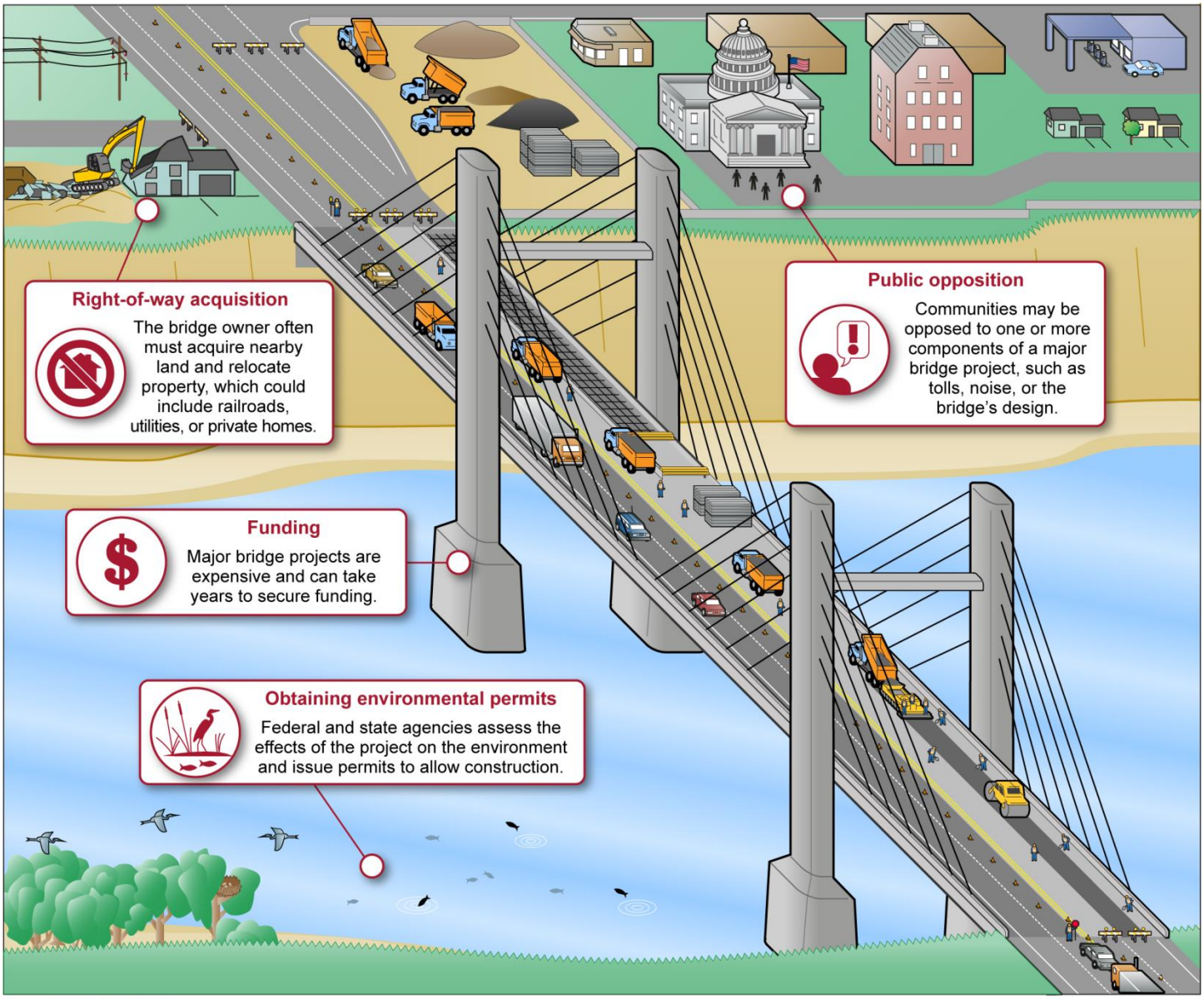
Factors rated as least challenging

Source: GAO analysis of survey data. | GAO-17-707

Notes: We define major bridge projects as projects that include some federal funding or financing, meet or exceed $500 million in total project costs, and focus on constructing a new large bridge or rehabilitating an existing one. For exact survey question wording, see appendix III.

Of the nine factors identified in the survey, four were rated most challenging. Specifically, for each of those four factors, 3 or more of the 13 state respondents identified the factor as extremely or very challenging (see fig. 8 below).

Figure 8: Four Factors Rated Most Challenging by 13 State Survey Respondents on Their Most Recent Major Bridge Project



Source: GAO. | GAO-17-707

Public opposition

Six state DOTs identified public opposition to their most recent major bridge project as extremely or very challenging, while 3 identified it as somewhat challenging. Major bridge projects are expensive, complex, and affect local communities. As such, communities may be opposed to one or more components of a project, such as tolling and noise; bridge design (e.g., communities may want a "signature" or "iconic" bridge); or multi-modal transportation (e.g., some communities advocate for a bike path). For example, Minnesota DOT officials reported that vocal opposition related to the preservation of the historic bridge and the scenic river delayed and elevated costs on the St. Croix River Bridge project, for which planning first started in the 1960s.

Several state DOTs said that strong public opposition could even prevent a project from reaching construction. For example, Kentucky DOT officials told us that public opposition to tolling from some communities has prevented the Brent Spence Bridge, between Cincinnati, Ohio, and Covington, Kentucky, from being constructed.[31] The Columbia River Crossing between Oregon and Washington and the Gowanus viaduct in Brooklyn, New York, have also stalled due to public opposition, according to FHWA officials.[32]

Most of the 5 state DOTs we interviewed said that involving the public early in a major bridge project, through public meetings and listening sessions, can help mitigate opposition to major bridge projects.[33] For example, to overcome public opposition to tolling, the Kentucky DOT and its consultant held numerous public meetings and provided access to the project and decision-making process through a website and social media. Kentucky transportation officials told us that they included communication

[31]Kentucky's DOT is the Kentucky Transportation Cabinet.

[32]The Brent Spence Bridge, Columbia River Crossing, and Gowanus viaduct have not reached construction and thus do not meet our definition of major bridge projects for the purpose of this report.

[33]NEPA requires states to solicit public involvement at various points in the environmental review process. As we have previously reported, state environmental policy acts generally have public involvement requirements similar to NEPA. See GAO, *Highway Projects: Many Federal and State Environmental Review Requirements are Similar, and Little Duplication of Efforts Occurs*, GAO-15-71 (Washington, D.C.: Nov. 18, 2014).Officials from one state DOT we interviewed said they established a Stakeholder Advisory Committee to comply with NEPA requirements.

and outreach requirements in the request for proposal, and once the project progressed to construction, the contractor had to keep the public informed about major upcoming construction activities and advise about proposed traffic changes. These efforts to promote openness and shared information helped to build good will and support for the project, according to those officials. New York DOT officials attributed much of the success of the Kosciuszko Bridge project to their early and consistent involvement of local communities. They noted that while it was a lengthy process to engage the public at each stage of the project, it created buy-in from local stakeholders that ultimately allowed the project to advance.

FHWA officials said that, although state DOTs are largely responsible for responding to public opposition on major bridge projects, FHWA's division office staff in each state can help identify strategies or provide support to help states address public concerns. For example, FHWA officials cited a major highway project in Arizona in which the FHWA division office engineer attended 10 public outreach meetings that the state DOT officials could not attend. In addition, FHWA's 2015 *Red Book: Synchronizing Environmental Reviews for Transportation and Other Infrastructure Projects* (*Red Book*) outlines the points at which federal law requires public input during the environmental review process, and offers tips to obtain and manage such input.[34] For example, it cites a checklist from the North Carolina DOT that identifies projects with certain challenges, such as an "unusually high level of public controversy," and recommends strategies for managing such controversy. FHWA also helps state DOTs assess the risk of challenges such as public opposition and then identify a strategy to mitigate that risk. FHWA's New York Division officials showed us a risk assessment the New York State DOT conducted for construction of the Kosciuszko Bridge, in which they rated public complaints regarding noise and traffic as a potential risk for this project, and identified a mitigation strategy to conduct local outreach to keep the community aware of disruptions and project changes.

[34]FHWA, 2015 *Red Book*: *Synchronizing Environmental Reviews for Transportation and Other Infrastructure Projects*. (Washington, D.C.: September 2015).

Funding

Five of 13 state DOTs reported that the availability of funding to complete a major bridge project was extremely or very challenging on their most recent project, while 6 additional states reported it was somewhat challenging. For example, Washington State DOT officials told us that the high cost of reconstructing the State Route 520 Floating Bridge delayed construction for years until the state could build design consensus and obtain full funding for the bridge project through a mix of federal and state funding and financing.[35] Texas DOT officials reported that the total project cost of almost $1 billion for the U.S. 181 Harbor Bridge made it difficult to identify sufficient funding.

To address this challenge, some state officials we interviewed described piecing together multiple sources of funding and financing, which typically entails borrowing money—either through bonds, loans, or other mechanisms—to ensure major bridge projects could be accomplished. For example, the new Gerald Desmond Bridge in Long Beach, California, is partially financed by a federal Transportation Infrastructure Finance and Innovation Act (TIFIA) loan, which provides federal credit assistance in the form of direct loans, loan guarantees, and standby lines of credit to finance surface transportation projects of national and regional significance.[36] In addition, five of the eight projects we visited are being tolled.

FHWA has a number of tools to help state DOTs address funding challenges, in part by making use of financing. For example, FHWA's Office of Innovative Program Delivery was created to support large transportation projects and houses a center specifically focused on financing support. The Center for Innovative Finance Support provides information related to funding and financing options for state transportation projects and helps states identify the best funding or financing solution. It also has expertise in public private partnerships, which, according to FHWA officials, can bring creativity, efficiency, and

[35]Washington State DOT officials also noted that the floating bridge section was prioritized for replacement as a vital connection for both public safety and regional cross-lake mobility. Funding to replace the old floating bridge was authorized in 2009, construction of the new floating bridge began in 2011, and the new bridge opened to traffic in 2016.

[36]23 U.S.C. §§ 602-609. This loan comprised $325 million of the total estimated project cost of $1.47 billion. The remainder of the project was funded through federal, state, and local programs.

capital to major projects by involving the private sector. DOT's Build America Bureau[37] oversees the TIFIA program mentioned above, which provides federal credit assistance to qualifying projects.[38] All five of the state DOTs we interviewed received TIFIA assistance, which typically exceeded several hundred-million dollars for each project.[39] According to FHWA, financing—through public-private partnerships or credit assistance—helps accelerate implementation of needed projects and infrastructure.

Right-of-way acquisition

Four states reported that completing right-of-way acquisition on their most recent project was extremely or very challenging, while seven rated it as somewhat challenging.[40] Before building a new bridge, the bridge owner often must acquire nearby land and property, especially if the new bridge alignment is different or larger than the existing bridge. Federal and state right-of-way practices and procedures determine how federal, state, and local agencies can legally acquire private land and property while also maintaining the integrity of the environmental review process. However, working with the entities from which it is necessary to acquire this land and relocate property—such as private homes, railroads, and utilities—can be challenging. For example, Ohio DOT officials reported that acquiring property for reconstruction of the George Voinovich Bridge in Cleveland was very challenging, and necessitated the state purchasing a "big piece of very expensive property." Washington State and New York DOT officials reported similar challenges, with Indiana DOT officials reporting that "parcels [of land] had to be purchased from many entities"

[37]The Fast Act required the Secretary of Transportation to establish a National Surface Transportation and Innovative Finance Bureau in the Department with the responsibility, among others, to administer the application process for the TIFIA program. Pub. L. No. 114-94, § 9001,129 Stat. 1312,1612. DOT refers to this Bureau as the Build America Bureau.

[38]In 2015, the FAST Act authorized $1.4 billion in capital over 5 years for the TIFIA program. Pub. L. No. 114-94, § 1101, 129 Stat 1312, 1322.

[39]We have previously reported on TIFIA and public-private partnerships. See: GAO, *Surface Transportation: Financing Program Could Benefit from Increased Performance Focus and Better Communication*, GAO-12-641 (Washington, D.C.: June 21, 2012) and GAO, *Highway Public-Private Partnerships: More Rigorous Up-front Analysis Could Better Secure Potential Benefits and Protect the Public Interest*, GAO-08-44 (Washington, D.C.: Feb. 8, 2008).

[40]We provided the following examples of right-of-way acquisition in our survey—relocating utilities, acquiring property, or working with railroads.

and that “acquisition was long, involved, and expensive.” New York DOT officials reporting spending $130 million on right-of-way acquisition for the Kosciuszko Bridge, stating this expenditure was the “cost of doing business” in a dense, urban environment.

Congress and FHWA have attempted to streamline the environmental review process. Congress has established some legal provisions to streamline portions of the environmental review process for highway projects. Additionally, FHWA, through its Every Day Counts Initiative, assembles state and local transportation agencies and industry stakeholders biennially to share practices that can speed up the delivery of highway projects, and has identified opportunities for improved coordination of right-of-way activities. FHWA launched Every Day Counts in 2009 with the American Association of State Highway and Transportation Officials. Every Day Counts is designed to speed up the delivery of highway projects, encourage use of innovative technologies, and address the challenges presented by limited budgets. During the first biennial round of Every Day Counts (2011–2012), FHWA identified and shared flexibilities established in certain federal, state, and local statutes, such as the flexibility to provide incentive payments to encourage land and property owners to relocate more quickly. According to FHWA officials, the Indiana DOT has revised its state right-of-way policies to include an option of incentive payments under certain circumstances to help manage acquisition of right-of-way. Through this arrangement, the state DOT can gain access to land and property earlier.

Obtaining environmental permits

Three state DOTs reported that obtaining environmental permits for their most recent major bridge project was extremely or very challenging, while six rated it as somewhat challenging.[41] As discussed above, for many projects, the environmental review process includes both the process of evaluating environmental effects of the project, as well as obtaining necessary environmental permits. We have previously found that obtaining environmental permits can affect the construction schedule and increase costs.[42] For example, California DOT officials told us that

[41]For the purposes of this report, the challenge of “obtaining environmental permits” refers to both the process of completing environmental review and obtaining environmental permits.

[42]GAO-16-779.

obtaining permits for demolition of the San Francisco-Oakland Bay Bridge East Span's existing bridge piers was delayed due to concerns that cutting concrete under water could impact fish populations. Similarly, Washington FHWA division officials described special provisions, which could stop construction during certain times of year, to protect salmon populations.

FHWA provides guidance on streamlining environmental reviews, and it includes practical tips for doing so. For example, the *Red Book* highlights that state DOTs can use federal funding to hire personnel at resources agencies, such as the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service, to serve as liaisons dedicated to reviewing environmental paperwork for the state's transportation projects. Two state DOT officials we interviewed said their ability to hire personnel at resource agencies expedited environmental-permitting reviews.

Two other factors—FHWA or state coordination of federal resource agencies' input during the environmental review phase and compliance with FHWA-required documents—were cited by about half of the 13 states as somewhat challenging and by the other half as less challenging or not applicable. Six state DOTs rated FHWA's or the state's coordination of input from federal resource agencies during the environmental review process as somewhat challenging, while one rated it as extremely or very challenging.[43] However, 6 of 13 state DOTs rated it as slightly or not at all challenging. Kentucky DOT officials told us that FHWA is well positioned as the coordinating agency to bring project stakeholders together. Regarding compliance with FHWA-required documents, 7 of the 13 state DOTs rated this as somewhat challenging. A project management plan as well as annual financial plans based on detailed cost estimates are required by law and improve FHWA's oversight of major projects. New York State DOT officials working on the Kosciuszko Bridge said that the project management and financial plan requirements initially sounded onerous, but FHWA provided guidance and the required documents ended up serving as valuable tools to help them manage and oversee the project.

Finally, most state DOTs rated the remaining three challenges identified in our survey as either slightly or not at all challenging, or not applicable.

[43]As discussed above, unless delegated by FHWA to the state, FHWA coordinates the input and permitting from federal resource agencies during the environmental review.

For example, most state DOTs did not rate the availability of financing as very challenging, perhaps in part because it was viewed more as a solution to the more prominent challenge of the availability of funding. Changing state transportation priorities, which could occur when a new governor is elected and has different priorities for a bridge project than a prior administration, was also rated low in the list of challenges, as did adhering to federal labor and construction requirements (outside of environmental review requirements), such as Buy America, which prevents the Secretary of Transportation from providing federal funds to certain transportation infrastructure projects unless they are built with certain American-made products.[44]

Cross-cutting strategies

In addition to the strategies described above, officials from FHWA and some state DOTs identified strategies that can help states address multiple challenges. For example, for some major bridge projects, FHWA assigns a specially designated project oversight manager ("oversight manager") to help the state DOT navigate federal requirements and challenges, including those described above. FHWA currently has funding for 18 oversight managers, each of whom oversees one or more major projects. FHWA officials told us they conduct a risk assessment on all major projects (currently over 100) and assign an oversight manager for the 25 projects perceived to pose the highest risk. State DOTs we interviewed noted working with an oversight manager. For example, Kentucky DOT officials said the oversight manager helped the state navigate federal laws and requirements, and helped coordinate with other federal agencies. New York State DOT officials said the assigned oversight manager for the Kosciuszko Bridge was heavily involved in the project and helped them coordinate with other federal agencies, such as the Historical Preservation Office when four Native American tribes suggested there could be artifacts on the construction site. FHWA's Infrastructure Research and Development program can also help states address multiple potential project challenges. According to FHWA officials, the program contributions include technologies and tools to improve the durability and sustainability of highway infrastructure, accelerate bridge construction, improve the efficiency of bridge condition assessment, and enhance transportation performance management.

[44]23 U.S.C. § 313.

Finally, a majority of state DOTs we interviewed emphasized that a project champion—such as a state governor—is critical to helping complete a major bridge project. An effective champion can help gather the political will and commitment necessary to move a major bridge project forward. For example, Washington State DOT officials said the governor's support of the State Route 520 Floating Bridge helped move the project to construction. In addition, state transportation officials said that the support of the governors of Indiana, Kentucky, and New York was crucial in moving their respective projects forward.

Agency Comments

We provided a draft of this report to DOT for review and comment. DOT provided technical comments that we incorporated as appropriate.

We are sending copies of this report to appropriate congressional committees and the Secretary of Transportation. In addition, the report is available at no charge on GAO's website at http://www.gao.gov.

If you or your staff have questions about this report, please contact me at (202) 512-3824, or goldsteinm@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Major contributors are listed in appendix IV.

Mark Goldstein
Director, Physical Infrastructure Issues

Appendix I: Large Bridge Data by State: Count, Deck Area, and Bridge Conditions, 2016

Table 2 below provides the results of our analysis of National Bridge Inventory data on the number, size, and condition of large bridges across the country and for each state, the District of Columbia, and Puerto Rico in 2016. We define large bridges as those with total deck area (the surface area that carries vehicles) in the top 1 percent of bridges in the National Bridge Inventory. Consistent with our recent reports on bridge conditions, we assessed the conditions of bridges in each state by determining the percentage of both total deck area of bridges and number of bridges classified as structurally deficient.[1]

[1]See GAO-16-779 and GAO-16-72R.

Table 2: Large Bridge Data by State: Count, Deck Area, and Bridge Conditions, 2016

	Count of bridges			Deck area (in square feet)[a]			Condition—structurally deficient	
State	Total count of bridges	Large bridges[b]	All other bridges	Total deck area of all bridges	Total deck area of large bridges	Total deck area of all other	Count of structurally deficient large bridges	Deck area of structurally deficient large bridges
All	**614,387**	6,143	608,244	**4,117,048,511**	**1,001,147,389**	**3,115,901,122**	396	75,298,292
AK	**1,488**	5	1,483	**7,744,612**	**502,075**	**7,242,537**	1	86,316
AL	**16,098**	140	15,958	**105,464,160**	**28,212,264**	**77,251,896**	3	787,541
AR	**12,871**	100	12,771	**71,764,560**	**16,906,960**	**54,857,600**	7	1,636,593
AZ	**8,154**	100	8,054	**61,327,160**	**11,804,813**	**49,522,347**	3	308,040
CA	**25,431**	591	24,840	**319,053,972**	**93,678,199**	**225,375,773**	54	8,218,149
CO	**8,682**	41	8,641	**53,191,755**	**5,053,065**	**48,138,690**	1	69,298
CT	**4,214**	55	4,159	**36,068,432**	**8,864,211**	**27,204,221**	17	2,403,956
DC	**245**	21	224	**6,122,806**	**3,099,522**	**3,023,284**	1	198,420
DE	**877**	16	861	**10,672,769**	**4,516,864**	**6,155,905**	2	438,659
FL	**12,313**	440	11,873	**183,840,248**	**81,381,193**	**102,459,055**	18	3,115,729
GA	**14,835**	127	14,708	**106,585,747**	**16,732,538**	**89,853,209**	4	518,267
HI	**1,132**	33	1,099	**14,233,392**	**7,797,927**	**6,435,465**	0	0
IA	**24,184**	70	24,114	**92,005,112**	**9,240,902**	**82,764,210**	6	988,183
ID	**4,445**	16	4,429	**18,548,354**	**1,982,116**	**16,566,238**	1	130,410
IL	**26,704**	186	26,518	**143,826,302**	**27,722,743**	**116,103,559**	32	3,987,763
IN	**19,245**	57	19,188	**86,989,755**	**7,270,774**	**79,718,981**	4	848,798
KS	**25,013**	59	24,954	**91,804,990**	**8,741,456**	**83,063,534**	3	433,005
KY	**14,265**	79	14,186	**67,377,620**	**10,212,903**	**57,164,717**	5	937,910
LA	**12,915**	385	12,530	**177,545,419**	**107,780,342**	**69,765,077**	32	10,036,713
MA	**5,171**	66	5,105	**43,912,878**	**9,781,046**	**34,131,832**	16	2,604,442
MD	**5,321**	125	5,196	**58,288,731**	**20,592,446**	**37,696,285**	5	642,245
ME	**2,450**	15	2,435	**13,406,507**	**2,281,462**	**11,125,045**	0	0
MI	**11,156**	49	11,107	**69,040,989**	**8,770,182**	**60,270,807**	8	1,919,252
MN	**13,355**	92	13,263	**75,222,329**	**13,793,496**	**61,428,833**	9	1,427,935
MO	**24,468**	137	24,331	**114,500,108**	**20,879,585**	**93,620,523**	14	2,322,946
MS	**17,068**	122	16,946	**102,405,098**	**21,675,689**	**80,729,409**	1	717,934
MT	**5,276**	9	5,267	**21,847,800**	**716,001**	**21,131,799**	1	74,843
NC	**18,099**	82	18,017	**104,135,973**	**16,288,443**	**87,847,530**	8	3,044,495
ND	**4,400**	13	4,387	**14,186,825**	**1,640,476**	**12,546,349**	0	0
NE	**15,334**	43	15,291	**46,152,063**	**5,229,070**	**40,922,993**	1	111,419
NH	**2,486**	8	2,478	**12,261,358**	**1,084,221**	**11,177,137**	2	171,082
NJ	**6,730**	134	6,596	**74,663,833**	**25,896,610**	**48,767,223**	14	2,415,534
NM	**3,973**	17	3,956	**22,602,174**	**2,117,627**	**20,484,547**	1	79,222
NV	**1,933**	25	1,908	**18,655,608**	**3,461,692**	**15,193,916**	0	0

	Count of bridges			Deck area (in square feet)[a]			Condition—structurally deficient	
State	Total count of bridges	Large bridges[b]	All other bridges	Total deck area of all bridges	Total deck area of large bridges	Total deck area of all other	Count of structurally deficient large bridges	Deck area of structurally deficient large bridges
NY	17,462	222	17,240	139,991,880	44,117,445	95,874,435	21	7,507,796
OH	28,284	143	28,141	145,728,928	18,866,029	126,862,899	8	1,234,671
OK	23,053	102	22,951	93,052,309	12,240,429	80,811,880	8	1,034,452
OR	8,118	81	8,037	54,213,790	11,139,062	43,074,728	5	515,308
PA	22,791	219	22,572	135,322,327	29,174,086	106,148,241	14	1,893,379
PR	2,308	59	2,249	23,389,708	8,142,475	15,247,233	9	1,038,213
RI	772	15	757	8,462,987	2,866,847	5,596,140	5	722,346
SC	9,358	120	9,238	73,204,865	20,717,048	52,487,817	3	238,379
SD	5,849	11	5,838	19,250,089	1,257,488	17,992,601	1	89,910
TN	20,123	141	19,982	109,449,841	17,727,731	91,722,110	7	1,487,020
TX	53,488	1,128	52,360	527,389,727	159,442,992	367,946,735	10	3,218,027
UT	3,039	15	3,024	21,397,757	1,825,672	19,572,085	0	0
VA	13,892	161	13,731	106,973,566	30,552,853	76,420,713	7	918,818
VT	2,766	2	2,764	9,378,686	338,700	9,039,986	0	0
WA	8,178	136	8,042	74,494,267	20,734,824	53,759,443	16	3,859,031
WI	14,230	56	14,174	74,204,329	6,514,072	67,690,257	5	609,105
WV	7,217	72	7,145	41,512,189	9,591,517	31,920,672	3	256,737
WY	3,128	2	3,126	14,181,821	189,203	13,992,618	0	0

Source: GAO analysis of FHWA data. | GAO-17-707

[a]To determine the total deck area, we calculated the deck area of each large bridge in the National Bridge Inventory by multiplying the "structure length" by the "deck width." Due to rounding, summing columns will not equal total square feet.

[b]Large bridges are defined as those in the top 1% largest bridges as measured in square feet.

Appendix II: Summaries of Major Bridge Projects that GAO Reviewed

Table 3: Description of the Gerald Desmond Bridge Replacement Project, Long Beach, California

Project overview:

The project will replace the existing Gerald Desmond Bridge with a new cable-stayed bridge at the Port of Long Beach. The new bridge will provide 6-lanes of travel and will connect to existing freeways connecting the port to the surrounding community. The new bridge will provide clearance for larger container ships. Construction of the new bridge is expected to take 7 years (2013–2019) and once completed, it will be the second tallest cable-stayed bridge in the United States.

Expected project benefits:

- 3 lanes in each direction for improved traffic flow.
- Emergency lanes on both sides to reduce traffic delays and safety hazards from accidents and vehicle breakdowns.
- A 205-foot vertical clearance above the channel to improve navigation for the newest generation of the most efficient container ships.
- A reduction in the bridge's steep grades for traffic flow improvements.
- Bicycle / pedestrian path with scenic overlooks.

Source: Gerald Desmond Bridge Replacement Project, Port of Long Beach. | GAO-17-707

Project sponsors:	California Department of Transportation and Port of Long Beach
Project initiation:	2010
Estimated project completion:	2019
Contract method:	Design-build
Total estimated project cost:	$1.47 billion
Funding sources:	Variety of federal, state, and local funding and financing, including $325 million Transportation Infrastructure Finance and Innovation Act (TIFIA) Program loan

Source: GAO analysis of FHWA, Port of Long Beach, and publicly available project information. | GAO-17-707

Notes: For this major bridge project, we calculated the project initiation date as the date of issuance of the "Finding of No Significant Impact," after completing the Environmental Assessment. According to Port of Long Beach officials, planning for the Gerald Desmond Bridge Replacement project began in 2002.

Table 4: Description of the San Francisco-Oakland Bay Bridge, East Span, California

Project overview:

Following the 1989 Loma Prieta earthquake, which damaged sections of the East Span of the San Francisco-Oakland Bay Bridge, the California Department of Transportation determined that the entire bridge required seismic safety improvements. The most cost-effective solution for the 2.2 mile East Span required a complete replacement of the bridge between Oakland and Yerba Buena Island. This involved multiple projects, including a self-anchored suspension structure with a single 525 foot-tall steel tower, and a 1.2 mile Skyway that gradually descends towards the Oakland shoreline.

Expected project benefits:

- 5 lanes in each direction built in parallel, rather than configured as upper and lower decks.
- State-of-the-art seismic innovations capable of withstanding a major earthquake.
- New 2.2-mile bicycle and pedestrian path provides access between Oakland and Yerba Buena Island.

Source: Federal Highway Administration. | GAO-17-707

Project sponsors:	California Department of Transportation, California Transportation Commission, and the Bay Area Toll Authority
Project initiation:	2001
Estimated project completion:	2019
Contract method:	Several methods used, including: • design-bid-build • construction manager/general contractor • performance-based
Total estimated project cost:	$6.6 billion
Funding sources:	Over $300 million in federal funding was included as part of the Skyway contract; however, no federal funds were used for any other East Span contracts. Bulk of funding revenues generated from tolls and state-legislated seismic surcharge revenues.

Source: GAO analysis of FHWA, state DOT, and publicly available project information. | GAO-17-707

Notes: For this major bridge project, we calculated the project initiation date as the date of issuance of the Record of Decision for the Environmental Impact Statement. The California Department of Transportation began to design seismic safety improvements for the East Span of the San Francisco-Oakland Bay Bridge following the 1989 Loma Prieta earthquake.

Table 5: Description of the Sixth Street Viaduct Replacement Project, Los Angeles, California

Project overview:

The Sixth Street Viaduct replacement project consists of removing the existing Sixth Street viaduct over the Los Angeles River and U.S. Highway 101 and replacing it with a new viaduct approximately 3,700 feet in total length. The viaduct was in need of replacement due to a reaction in the concrete and seismic vulnerability. The viaduct is owned by the City of Los Angeles, with the exception of the portion over U.S Highway 101, which is owned and operated by California Department of Transportation. The viaduct is located in a highly urbanized area just east of downtown Los Angeles and has been an important symbol in the local community, and in Hollywood movies, since its construction in 1932.

The City of Los Angeles is using the construction manager/general contractor method to deliver the project. This method of project delivery incorporates construction expertise early in the design process to enhance constructability, manage risks, and accelerate timelines.

Expected project benefits:

- Accommodate all modes of travel on the new viaduct, including, cars, bicyclists, and pedestrians.
- Protected bicycle / pedestrian lanes and ramp to landscaped area beneath new viaduct.
- Design for 1,000-year seismic event and 100-year design life.
- Reduce the piers in the railroads, river, and freeway.
- Arches with planned multi-colored lights.

Source: City of Los Angeles, California. | GAO-17-707

Project sponsor:	City of Los Angeles, Bureau of Engineering
Project initiation:	2011
Estimated project completion:	2020
Contract method:	Construction manager/general contractor
Total estimated project cost:	$482 million
Funding sources:	Variety of federal, state, and local funding and financing.

Source: GAO analysis of FHWA, city of Los Angeles, and publicly available project information. | GAO-17-707

Notes: For this major bridge project, we calculated the project initiation date as the date of issuance of the Record of Decision for the Environmental Impact Statement. According to City of Los Angeles officials, planning for the Sixth Street Viaduct began in 2002. The bridge was rated structurally deficient due to a rare chemical reaction in the structural concrete and seismic vulnerability.

Table 6: Description of the Louisville-Southern Indiana Ohio River Bridges Project—East End Crossing Bridge, Indiana and Kentucky

Project overview:

The Louisville-Southern Indiana Ohio River Bridges project addresses current and future mobility across the Ohio River between Jefferson County, Kentucky, and Clark County, Indiana. The project was undertaken in two major procurements, with Kentucky managing the Downtown Crossing procurement and Indiana managing the East End Crossing procurement.

The East End Crossing comprises several projects, including a new 4-lane Ohio River bridge. The new signature cable-stayed bridge is 2,500 feet long with 300-feet high towers. On the Kentucky side of the river, the project includes 3.5 miles of new roadway, including a twin 2-lane tunnel under a historic property. On the Indiana side, approximately 4 miles of new roadway were constructed to connect State Route 265 to the new bridge. The procurement involved a public-private partnership agreement where the project developer designs, builds, finances, and operates and maintains the bridge for 35 years under an availability payment structure.

Expected project benefits:

- Reduces the amount of travel time to the Louisville metro area from eastern Kentucky and southeastern Indiana.
- Regional economic development, including new commercial and housing growth. The economic impact of the entire project was estimated in 2012 to provide $87 billion in new economic activity over 30 years, including supporting upwards of 15,000 jobs per year.

The pedestrian/bicycle trail provides increased recreational opportunities.

Source: GAO. | GAO-17-707

Project sponsor:	Indiana Finance Authority (IFA), with Indiana DOT serving as the owner representative
Project initiation:	2012
Expected project completion:	2017
Contract method:	Public-private partnership
Total estimated project cost (East End Crossing):	$1.1 billion
Funding sources:	Variety of federal and state funding, and private financing, including $162 million Transportation Infrastructure Finance and Innovation Act (TIFIA) Program loan

Source: GAO analysis of FHWA, state DOT, and publicly available project information. | GAO-17-707

Notes: For this major bridge project, we calculated the project initiation date as the date of the issuance of the Record of Decision for the Environmental Impact Statement. According to Indiana DOT officials, planning for the Louisville-Southern Indiana Ohio River Bridges project began in 1969.

Table 7: Description of the Louisville-Southern Indiana Ohio River Bridges Project—Downtown Crossing Bridge, Kentucky and Indiana

Project overview:

The Louisville-Southern Indiana Ohio River Bridges project addresses current and future mobility across the Ohio River between Jefferson County, Kentucky and Clark County, Indiana. The Downtown Crossing comprises several project components, including a new Ohio River bridge located east of the existing I-65 Kennedy Bridge in Louisville. The new bridge provides six northbound I-65 lanes, and the existing I-65 Kennedy Bridge has been reconstructed to serve southbound only traffic. The project also includes reconstruction of the Kennedy Interchange (convergence of I-64, I-65, and I-71) in downtown Louisville. On the Indiana side of the river, the project involved reconfiguration of about 1 mile of I-65 and new and improved access to the cities of Clarksville and Jeffersonville, Indiana.

Expected project benefits:

- The Downtown Crossing project alleviates traffic congestion by adding a new bridge connecting downtown Louisville with southern Indiana.
- The modernization of the Kennedy Interchange eliminates design deficiencies and safety hazards, such as dangerous weaves, and provides sufficient capacity to meet the rush hour demands. It also improves safety by adding emergency pull-off areas.
- The cable-stayed bridge includes three sets of twin towers, allowing less inhibited views of the Louisville skyline.
- Improved access to the bridge for Jeffersonville and Clarksville, Indiana.

Source: GAO. | GAO-17-707

Project sponsor:	Kentucky Transportation Cabinet
Project initiation:	2012
Estimated project completion:	2017
Contract method:	Design-build
Total estimated project cost (Downtown Crossing):	$1.3 billion
Funding sources:	Federal and state funding, toll revenue bonds and federal financing, including $452 million Transportation Infrastructure Finance and Innovation Act (TIFIA) Program loan

Source: GAO analysis of FHWA, state DOT, and publicly available project information. | GAO-17-707

Notes: For this major bridge project, we calculated the project initiation date as the date of issuance of the Record of Decision for the Environmental Impact Statement. According to Kentucky Transportation Cabinet officials, planning for the Louisville-Southern Indiana Ohio River Bridges project began in 1969.

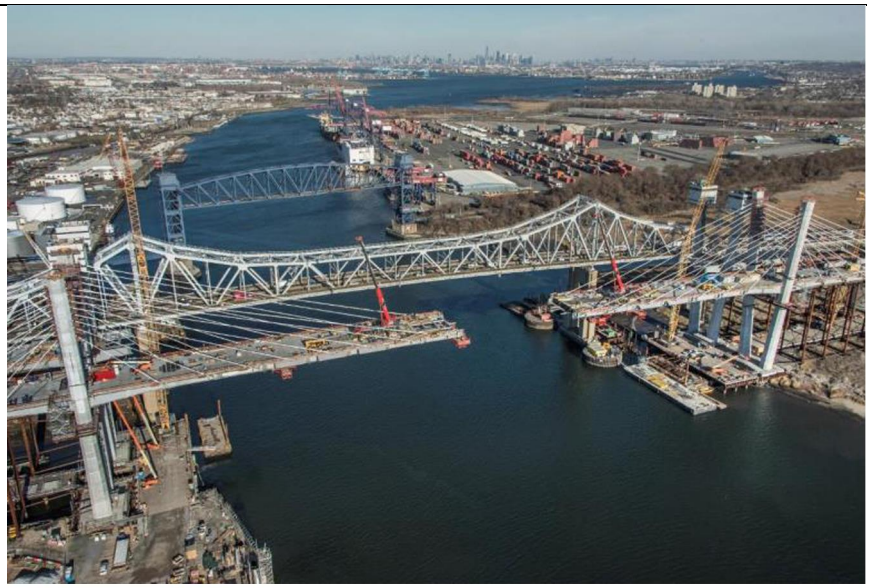
Table 8: Description of the Goethals Bridge Project, Elizabeth, New Jersey, and Staten Island, New York

Project overview:

The project will replace the existing Goethals Bridge between Elizabeth, New Jersey, and Staten Island, New York, with a new cable-stayed signature bridge. The bridge provides a direct connection between I-95 and I-278 and is important for moving cargo between local airports (Newark, LaGuardia, and JFK) and seaports (ports of Newark and Elizabeth). The original bridge, constructed in 1928, was too narrow and lacked shoulders necessary to handle the area's current-day heavy truck traffic. Construction of the new bridge and demolition of the old bridge is expected to take 5 years (2014–2019).

Expected project benefits:

- Added one lane in each direction and widened all lanes for a total of three lanes in each direction to reduce congestion and improve traffic flow.
- Added shoulders on both sides to reduce traffic delays and safety hazards from accidents and vehicle breakdowns.
- Improved sight lines to reduce accidents.
- Bike and pedestrian lane.



Source: Port Authority of New York and New Jersey. | GAO-17-707

Project sponsor:	Port Authority of New York and New Jersey
Project initiation:	2011
Estimated project completion:	2019
Contract method:	Public-private partnership
Estimated total project cost:	$1.5 billion
Funding sources:	Federal, Port Authority, and private financing, including a $474 million Transportation Infrastructure Finance and Innovation Act (TIFIA) Program loan

Source: GAO analysis of FHWA, Port Authority of New York and New Jersey, and publicly available project information. | GAO-17-707

Notes: For this major bridge project, we calculated the project initiation date as the date of issuance of the Record of Decision for the Environmental Impact Statement. According to Port Authority officials, planning for the Goethals Bridge project began in 2002.

Table 9: Description of the Kosciuszko Bridge Project, Queens and Brooklyn, New York

Project overview:

The project will replace the existing Kosciuszko Bridge between Queens, New York, and Brooklyn, New York, with a new cable-stayed signature bridge. The original bridge, constructed in 1939, was structurally deficient and required frequent repairs to keep the bridge in good repair. Construction of the new bridge and demolition of the existing bridge is expected to take 7 years (2014–2020).

Expected project benefits:

- Wider lanes in each direction for improved traffic flow.
- Wider emergency lanes on both sides to reduce traffic delays and safety hazards from accidents and vehicle breakdowns.
- A reduction in the bridge's steep grades for improved sight lines to reduce accidents.

Source: New York State Department of Transportation. | GAO-17-707

Project sponsor:	New York State Department of Transportation
Project initiation:	2009
Estimated project completion:	2020
Contract method:	Design-build and design-bid-build
Total estimated project cost:	$963 million
Funding sources:	Federal and state funding

Source: GAO analysis of FHWA, state DOT, and publicly available project information. | GAO-17-707

Notes: For this major bridge project, we calculated the project initiation date as the date of issuance of the Record of Decision for the Environmental Impact Statement. According to New York State officials, planning for the Kosciuszko Bridge project began in 2002.

Table 10: Description of the State Route 520 Floating Bridge Project, Seattle, Washington

Project overview:

The entire bridge replacement and high-occupancy vehicle program spans approximately 7 miles of the State Route 520 corridor (from I-5 in Seattle to I-405 in Bellevue) and involves replacing 3 main bridges: the Evergreen Point floating bridge, the west approach bridge, and the Portage Bay bridge. The purpose of the project is to improve traffic safety and improve mobility for the region. The new floating bridge required construction of 77 new bridge pontoons and cast-in-place bridge sections. The new floating bridge is elevated from the lake, which allows for better access below the highway, and eliminates the issue of waves splashing over the roadway.

Expected project benefits:

- 3 lanes in each direction for improved traffic flow, including new transit/high-occupancy vehicle lane.
- New 14-foot wide bicycle and pedestrian path with view of Lake Washington.
- New floating bridge is a safer structure that is resistant to windstorms and waves.
- Improved transit reliability and travel times.
- Ability to accommodate light rail if the region chooses to fund it in the future.

Source: Washington State Department of Transportation. | GAO-17-707

Project sponsor:	Washington State Department of Transportation
Project initiation:	2011
Estimated project completion:	2017
Contract method:	Design-build
Total estimated project cost:	$1.52 billion (for floating bridge and pontoons projects)
Funding sources:	Variety of federal, state, and local funding and financing, including $179 million Transportation Infrastructure Finance and Innovation Act (TIFIA) Program loan

Source: GAO analysis of FHWA, state DOT, and publicly available project information. | GAO-17-707

Notes: For this major bridge project, we calculated the project initiation date as the date of issuance of the Record of Decision for the Environmental Impact Statement. According to Washington State DOT, initial planning for the bridge improvements began in 1997. The State Route 520 Floating Bridge is open to traffic and project completion is expected in 2017. Additional corridor construction projects are expected to start in 2018.

Appendix III: Survey on Major Bridge Projects

United States Government Accountability Office

Major Bridge Projects

Introduction:
The goal of this brief questionnaire is to gather information on major bridge projects under construction or completed in the states, D.C., and Puerto Rico and the challenges, if any, experienced in completing such projects.

For the purposes of this questionnaire, we use the following definition:

- *Major bridge project* – a highway construction project of a new bridge or major rehabilitation to an existing bridge that:
  - Costs more than $500 million in total project costs and includes some federal funding or financing.
  - Focuses primarily on a large bridge (deck area greater than 50,000 ft^2).

PLEASE NOTE:

- If you select "extremely challenging," or "very challenging," for any of the items listed in question 5 below, please provide a brief explanation of how that item affected the major bridge project in your state.
- If a major bridge project in your state was conducted jointly with another state, please answer the questions below based on your state's experience with the project.
- Feel free to consult with others in your department if the consultation will help provide more accurate responses.

START HERE

1. **Does your state have any major bridge projects that are under construction or were completed (open to traffic or state has accepted delivery of project) within the last 5 years?**

   YES ☐ ➔ Continue to Q2
   NO ☐ ➔ STOP here and return survey to GAO.

2. **Please list those major bridge projects, noting whether the project is currently under construction or was completed within the last 5 years:**

The next set of questions is about the most recently-completed major bridge project in your state in the last 5 years. If no major bridge project was completed in your state in that timeframe, please focus on a major bridge project that was under construction in the last 5 years.

3. **What is the name of the most recently-completed major bridge project, or if none completed, the bridge project you will be focusing on for the questions below?**

4. **Did the project use any of the following contracting methods?** *Check all that apply*

   - ☐ Design-Bid-Build
   - ☐ Design-Build
   - ☐ Public-Private Partnership
   - ☐ Contracting Manager/General Contractor

2

5. How challenging, if at all, were the following items to this project?

	Extremely challenging	Very challenging	Somewhat challenging	Slightly challenging	Not at all challenging	Not applicable
a. Availability of funding	☐	☐	☐	☐	☐	☐
b. Availability of financing (e.g., TIFIA loan or GARVEE bonds)	☐	☐	☐	☐	☐	☐
c. Public opposition to project or project components (e.g., tolling, multimodal use, aesthetics)	☐	☐	☐	☐	☐	☐
d. Changing state transportation priorities	☐	☐	☐	☐	☐	☐
e. Obtaining environmental permits	☐	☐	☐	☐	☐	☐
f. FHWA or state coordination of federal resource agencies' input (e.g., U.S. Fish and Wildlife Service or National Marine Fisheries Service)	☐	☐	☐	☐	☐	☐
g. Completing right of way acquisition (e.g., relocating utilities, acquiring property, working with railroads)	☐	☐	☐	☐	☐	☐
h. Use of a Design-Bid-Build contracting method	☐	☐	☐	☐	☐	☐
i. Use of a Design-Build contracting method	☐	☐	☐	☐	☐	☐
j. Use of a Public-Private Partnership	☐	☐	☐	☐	☐	☐
k. Use of a Contractor Manager/General Contractor contracting method	☐	☐	☐	☐	☐	☐
l. Compliance with FHWA's major project requirements (e.g., annual financial and project management plan)	☐	☐	☐	☐	☐	☐
m. Adhering to labor and construction provisions governing the use of Federal Aid highway funds (e.g., Disadvantaged Enterprise Program, Buy America Provisions)	☐	☐	☐	☐	☐	☐
n. Other, please specify ▸	☐	☐	☐	☐	☐	☐

3

6. If you selected "extremely challenging" or "very challenging" to any of the items, please explain why it was a challenge. Please include the item letter that corresponds to each response. Note: the box will expand to fit your answers.

Thank you for your time and assistance

4

Appendix IV: GAO Contact and Staff Acknowledgments

GAO Contact:

Mark Goldstein, (202) 512-2834, or GoldsteinM@gao.gov

Staff Acknowledgments:

In addition to the individual named above, Heather MacLeod (Assistant Director), Jon Carver, Lacey Coppage, Sarah Farkas, Delwen Jones, Ying Long, SaraAnn Moessbauer, Josh Ormond, Kelly Rubin, and Sandra Sokol made key contributions to this report.

Appendix V: Accessible Data

Data Tables

Data Table for Figure 2: Percentage of Structurally Deficient Large Bridges by Total Deck Area and Number, 2007 through 2016

Year	Structurally Deficient Large Bridges by Total Deck Area (percentage)	Structurally Deficient Large Bridges by Number (percentage)
2007	11.2	10.2
2008	11.1	10.7
2009	11.1	10.6
2010	11.6	10.4
2011	11	9.6
2012	10.2	9.1
2013	9.4	8.2
2014	8.4	7.4
2015	7.8	6.7
2016	7.5	6.4

Data Table for Figure 4: Total Deck Area of Large Bridges, by Year Built, 1902 through 2016

Years	Deck area (in millions of square feet)
1902-1906	1.2058
1907-1911	3.98307
1912-1916	1.7392
1917-1921	1.58043
1922-1926	4.59804
1927-1931	11.907
1932-1936	11.8682
1937-1941	16.4931
1942-1946	5.12595
1947-1951	15.1231
1952-1956	40.2458
1957-1961	54.4116
1962-1966	72.1521
1967-1971	86.2268

Years	Deck area (in millions of square feet)
1972-1976	106.018
1977-1981	69.1077
1982-1986	53.49
1987-1991	78.003
1992-1996	82.3844
1997-2001	67.0304
2002-2006	83.221
2007-2011	79.1238
2012-2016	54.1542

Data Table for Figure 5: Total Deck Area of Large Bridges That is Structurally Deficient, by Year Built, 1902 through 2016

Years	Deck area (in millions of square feet)
1902-1906	0.227632
1907-1911	0.528244
1912-1916	0.718185
1917-1921	0.236144
1922-1926	0.919204
1927-1931	3.10077
1932-1936	3.62235
1937-1941	5.08427
1942-1946	0.891096
1947-1951	2.76652
1952-1956	4.31846
1957-1961	8.17767
1962-1966	11.1347
1967-1971	10.8263
1972-1976	8.76438
1977-1981	2.30153
1982-1986	1.07216
1987-1991	5.61264
1992-1996	1.80396
1997-2001	0.617021
2002-2006	0.260378
2007-2011	0.742094
2012-2016	0.86919

PDF Survey

Text of Appendix III: Survey on Major Bridge Projects

Major Bridge Projects

Introduction:

The goal of this brief questionnaire is to gather information on major bridge projects under construction or completed in the states, D.C., and Puerto Rico and the challenges, if any, experienced in completing such projects.

For the purposes of this questionnaire, we use the following definition:

- *Major bridge project* – a highway construction project of a new bridge or major rehabilitation to an existing bridge that:
    - Costs more than $500 million in total project costs and includes some federal funding or financing.
    - Focuses primarily on a large bridge (deck area greater than 50,000 ft^2).

PLEASE NOTE:

- If you select “extremely challenging,” or “very challenging,” for any of the items listed in question 5 below, please provide a brief explanation of how that item affected the major bridge project in your state.
- If a major bridge project in your state was conducted jointly with another state, please answer the questions below based on your state’s experience with the project.
- Feel free to consult with others in your department if the consultation will help provide more accurate responses.

START HERE

1. Does your state have any major bridge projects that are under construction or were completed (open to traffic or state has accepted delivery of project) within the last 5 years?

If YES → Continue to Q2

If NO → STOP here and return survey to GAO.

2. Please list those major bridge projects, noting whether the project is currently under construction or was completed within the last 5 years:

The next set of questions is about the most recently-completed major bridge project in your state in the last 5 years. If no major bridge project was completed in your state in that timeframe, please focus on a major bridge project that was under construction in the last 5 years.

3. What is the name of the most recently-completed major bridge project, or if none completed, the bridge project you will be focusing on for the questions below?

4. **Did the project use any of the following contracting methods?** C*heck all that apply*

   - Design-Bid-Build
   - Design-Build
   - Public-Private Partnership
   - Contracting Manager/General Contractor

5. How challenging, if at all, were the following items to this project?

	Extremely challenging	Very challenging	Somewhat challenging	Slightly challenging	Not at all challenging	Not applicable
a. Availability of funding						
b. Availability of financing (e.g., TIFIA loan or GARVEE bonds)						
c. Public opposition to project or project components (e.g., tolling, multimodal use, aesthetics)						
d. Changing state transportation priorities						
e. Obtaining environmental permits						
f. FHWA or state coordination of federal resource agencies' input (e.g., U.S. Fish and Wildlife Service or National Marine Fisheries Service)						
g. Completing right of way acquisition (e.g., relocating utilities, acquiring property, working with railroads)						
h. Use of a Design-Bid-Build contracting method						
i. Use of a Design-Build contracting method						
j. Use of a Public-Private Partnership						
k. Use of a Contractor Manager/General Contractor contracting method						
l. Compliance with FHWA's major project requirements (e.g., annual financial and project management plan)						
m. Adhering to labor and construction provisions governing the use of Federal Aid highway funds (e.g., Disadvantaged Enterprise Program, Buy America Provisions)						
n. Other, please specify ▸						

6. If you selected “extremely challenging” or “very challenging” to any of the items, please explain why it was a challenge. Please include the item letter that corresponds to each response. Note: the box will expand to fit your answers.

Thank you for your time and assistance

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