



Toll Bridge Seismic Retrofit Program

The State Could Save Millions of Dollars Annually by
Implementing Lessons Learned

Report 2018-104

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621 Capitol Mall, Suite 1200 | Sacramento | CA | 95814



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August 28, 2018

2018-104

The Governor of California
President pro Tempore of the Senate
Speaker of the Assembly
State Capitol
Sacramento, California 95814

Dear Governor and Legislative Leaders:

As requested by the Joint Legislative Audit Committee, the California State Auditor presents this audit report concerning the Toll Bridge Seismic Retrofit Program (seismic program) including work to replace a section of the San Francisco–Oakland Bay Bridge construction project. This report concludes that the State could save millions of dollars annually by mandating oversight and risk management lessons learned from the seismic program.

We found that the effective use of oversight and risk management in the \$9 billion seismic program provides a valuable lesson for the State. In 2005, concerned about escalating costs, the Legislature created the Toll Bridge Program Oversight Committee (Oversight Committee) to oversee the seismic program, and required the California Department of Transportation to develop a comprehensive risk management plan. These two factors minimized delays and controlled costs. For example, Oversight Committee decisions resulted in cost avoidance and savings totaling at least \$505 million. Moreover, comprehensive risk management played a critical role in preventing more than \$455 million in potential costs and seven years in probable delays. With more than \$600 billion in transportation infrastructure projects projected to occur over the next several decades in three of the State’s largest metropolitan areas alone, a lack of sufficient oversight and risk management could result in significant delays and cost escalations that taxpayers ultimately would bear. Requiring early oversight committee involvement and risk management plans for major publicly funded transportation projects could mitigate these risks and ensure transparency and accountability throughout California.

Further, we found that the seismic program will end in 2019 roughly on budget at a cost of about \$9 billion; however, maintenance and debt service costs will continue. The seismic program experienced significant cost growth between 1997 and 2005, before additional oversight helped to stabilize the cost. Revenues from tolls on San Francisco Bay Area bridges, as well as debt backed by that revenue, accounts for nearly two-thirds of all funds for the seismic program and will pay for maintenance costs in the future. The Bay Area Toll Authority (Toll Authority) is responsible for administering toll revenues. As of the end of fiscal year 2016–17, the Toll Authority projects that its remaining debt service payments—principal and interest on all of its current bonds—through fiscal year 2055–56 will total \$18.7 billion. The Toll Authority had also projected the possible need for a toll increase in fiscal year 2026–27; however, it will be reevaluating its projections in light of a recent voter-approved measure to increase tolls to fund a variety of transportation projects.

Respectfully submitted,



ELAINE M. HOWLE, CPA
California State Auditor

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Summary

Results in Brief

The Toll Bridge Seismic Retrofit Program (seismic program), and particularly the work completed within the program to replace a section of the San Francisco—Oakland Bay Bridge (Bay Bridge), is one of the most expensive and controversial transportation infrastructure programs in California history. It is also a valuable lesson on how a major project experienced rapid cost escalations before the implementation of robust oversight and risk management brought them under control.

By 2005 the projected costs of the seismic program had soared far beyond the initial estimates of \$2.6 billion to \$8.7 billion. In response to the seismic program's growing price tag, we recommended in a 2004 audit report that the California Department of Transportation (Caltrans) increase its risk management of the program. Following our review, the Legislature imposed certain requirements on Caltrans and the seismic program that included the establishment of an oversight committee, known as the Toll Bridge Program Oversight Committee (Oversight Committee), which is required to provide program management and approve significant change orders. Beginning in 2005, this legislatively mandated oversight of the seismic program successfully minimized potential delays and controlled costs. For example, the Oversight Committee cites its decision to alter the method used to demolish the old east span of the Bay Bridge (east span) as saving \$94 million and cutting the demolition time by four years. In aggregate, our review indicates that Oversight Committee decisions resulted in hundreds of millions of dollars in cost avoidance and savings. The seismic program also benefitted from a 2005 state law requiring Caltrans to implement comprehensive risk management for the program that would inform Oversight Committee decisions. Caltrans documentation indicates that this approach ultimately avoided more than \$455 million in potential costs and seven years of potential delays related to the seismic program.

Large-scale transportation infrastructure projects—federal law defines a *major highway project* as one costing over \$500 million—such as the seismic program have posed challenges for public entities in California, and we identified no state statute that generally requires all state and local sponsors of large transportation infrastructure projects to institute oversight and risk management similar to what it requires in the seismic program. With more than \$600 billion in anticipated infrastructure projects contemplated in the next several decades in just three of the State's largest metropolitan areas, a lack of mandated oversight and risk management could result in project delays and cost escalations. For example, San Francisco's Transbay Terminal experienced cost

Audit Highlights . . .

Our audit regarding the management of seismic program costs highlights the following:

- » *The legislatively mandated oversight of the seismic program successfully minimized potential delays and controlled costs.*
 - *Oversight Committee decisions resulted in hundreds of millions of dollars in cost avoidance and savings.*
 - *The comprehensive risk management implemented for the seismic program ultimately avoided more than \$455 million in potential costs and seven years of potential delays.*
- » *Large-scale transportation infrastructure projects have posed challenges for public entities and state statutes do not generally require all state and local sponsors of such projects to institute oversight and risk management.*
 - *A lack of mandated oversight and risk management could result in project delays and cost escalations.*
- » *Expenses related to the repair or replacement of components accounted for a small portion of the Bay Bridge project's overall cost.*
- » *Although the seismic program will end roughly on budget in 2019, borrowing and maintenance costs are significant and will continue for decades.*

increases of \$1.1 billion before instituting additional oversight through a cost review committee and increased involvement by the San Francisco Department of Public Works to manage construction. Without additional mandated oversight and risk management, future projects will face significant risk of similar cost increases that must be borne by the State and local governments, and ultimately the taxpayers who support them.

Our review also suggests that expenses related to the repair or replacement of components accounted for a small portion of the Bay Bridge project's overall cost. Specifically, we determined that the project has resulted in at least \$86 million worth of work to address defects—using a definition of *defect* based on project management best practices. Our review noted instances in which Caltrans had to pay to repair or replace a component after a contractor had installed it, as well as problems with fabrication that ultimately led to additional costs. For example, Caltrans spent more than \$22 million remediating issues involving broken bolts—widely reported in the media—intended to anchor portions of the east span. However, our identification of costs associated with remediation of defects does not indicate the presence of current safety issues on the bridge, as multiple panels of engineers and construction experts have concluded that critical components of the bridge are safe. Further, although \$86 million represents a significant investment of funds, in the context of the overall \$6.6 billion Bay Bridge project it amounts to only 1.5 percent of the total cost.

Although the seismic program will end roughly on budget in 2019, borrowing and maintenance costs are significant and will continue for decades. Funding for the seismic program includes a mix of state, federal, and, overwhelmingly, regional bond funds backed by tolls paid by drivers crossing the seven state-owned San Francisco Bay Area (Bay Area) toll bridges. As of June 2017, the Bay Area Toll Authority (Toll Authority) held \$9 billion in bond debt for the seismic program and other transportation projects, and will pay approximately \$9 billion in interest over the life of those bonds—as far out as 2056. Routine and long-term maintenance costs on bridges in the Bay Area amounted to more than \$100 million in fiscal year 2016–17, and while the Toll Authority anticipates that those costs will continue to increase over time, it projects it will have sufficient revenue to meet its obligations well into the future.

Selected Recommendations

Legislature

To ensure that large transportation infrastructure projects throughout the State benefit from appropriate oversight, the Legislature should require that all publicly funded major transportation infrastructure construction projects that are estimated to cost \$500 million or more form oversight committees subject to open meeting laws. When practical, each oversight committee should include individuals from at least three major agencies involved in the project, with roles that reflect financial interests as well as project execution and oversight. Further, when possible, each committee should include at least five members to support the ability of its members to conduct day-to-day business without violating open meeting law requirements. The oversight committees should act as the authorities for critical decisions and have sufficient staff to support decision-making.

To ensure that oversight committees and the agencies involved in large transportation infrastructure projects engage in sufficient and appropriate risk management, the Legislature should also require all publicly funded transportation infrastructure projects with a total estimated cost of \$500 million or more to develop and use risk management plans throughout the course of the projects.

Agency Comments

The Metropolitan Transportation Commission agreed with our recommendations and provided its perspective on our recommendations to the Legislature.

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Introduction

Background

In October 1989, the Loma Prieta earthquake caused the collapse of a section of a highway in Oakland and a section of the upper deck of the San Francisco–Oakland Bay Bridge (Bay Bridge). Under state law, the California Department of Transportation (Caltrans) is responsible for maintaining and reconstructing state highways and state toll bridges. Following the earthquake, Caltrans began to use hazard analyses based on individual bridge locations to address the effects of probable seismic events—and for critical structures such as the Bay Bridge—to incorporate projections of the strongest credible earthquake into their retrofit or replacement calculations. In 1996 the State established a retrofit program to meet the latest seismic safety standards. This program, which Caltrans based on likely seismic events, required the retrofit or replacement of California’s state-owned toll and highway bridges.

Caltrans is responsible for the retrofit or replacement of the state-owned toll bridges separately from other bridges in the State, and manages the Toll Bridge Seismic Retrofit Program (seismic program), for this purpose. Figure 1 on the following page shows the locations of the state-owned toll bridges in the San Francisco Bay Area (Bay Area).¹ Following the Northridge earthquake in January 1994, Caltrans began preparing retrofit strategies for each of the toll bridges, except for the east span of the Bay Bridge (east span), which it scheduled for replacement instead. By 2002 Caltrans had finished seismic retrofits for the Benicia–Martinez, Carquinez, and San Mateo–Hayward bridges in the Bay Area, and the San Diego–Coronado and Vincent Thomas bridges in Southern California.² Caltrans finished retrofitting the main portion of the west span of the Bay Bridge in 2004 and the Richmond–San Rafael Bridge in 2005. Figure 2 on page 7 shows the history of the seismic program.

Management of the Seismic Program

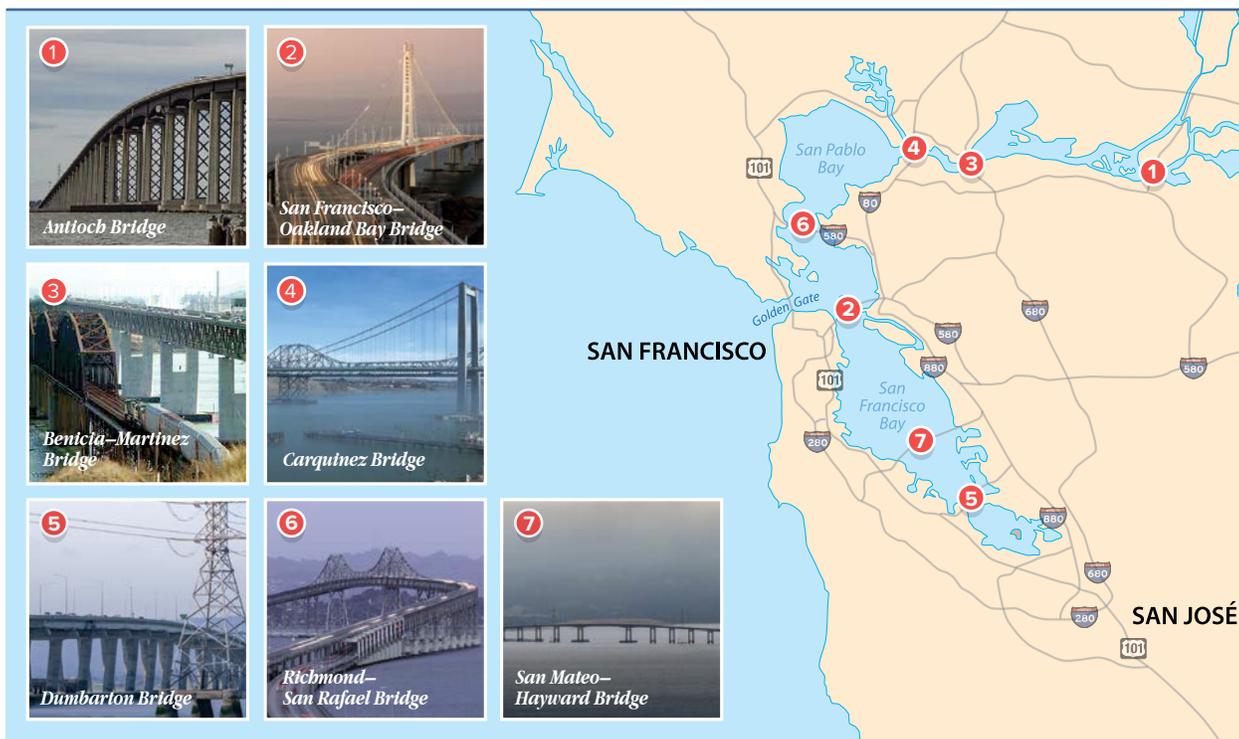
Caltrans has been responsible for implementing the seismic program since 1996. In addition to requiring Caltrans to complete seismic program projects on Bay Area bridges, state law prior to 2005 also required Caltrans to report to the Legislature on

¹ The Golden Gate Bridge is not a state-owned toll bridge, nor is it a part of the seismic program. Rather, it is operated by the Golden Gate Bridge, Highway and Transportation District.

² The eastbound portion of the Carquinez Bridge was retrofit. The westbound replacement of the Carquinez Bridge, which opened in 2003, was part of Regional Measure 1 (1988) and not the seismic program. The Legislature later added the remaining two state-owned toll bridges—the Antioch and Dumbarton bridges—to the seismic program.

program status, issues identified, and actions taken to address those issues. During this period, a number of factors led to cost increases in the seismic program, including the cost of steel, contractor overhead, and support costs. For example, after construction began on the east span in the early 2000s, the price of steel increased substantially, while lengthened construction schedules also contributed to an increased need for contractor overhead and a corresponding increase in Caltrans support costs.

Figure 1
Bay Area Seismic Program Toll Bridges

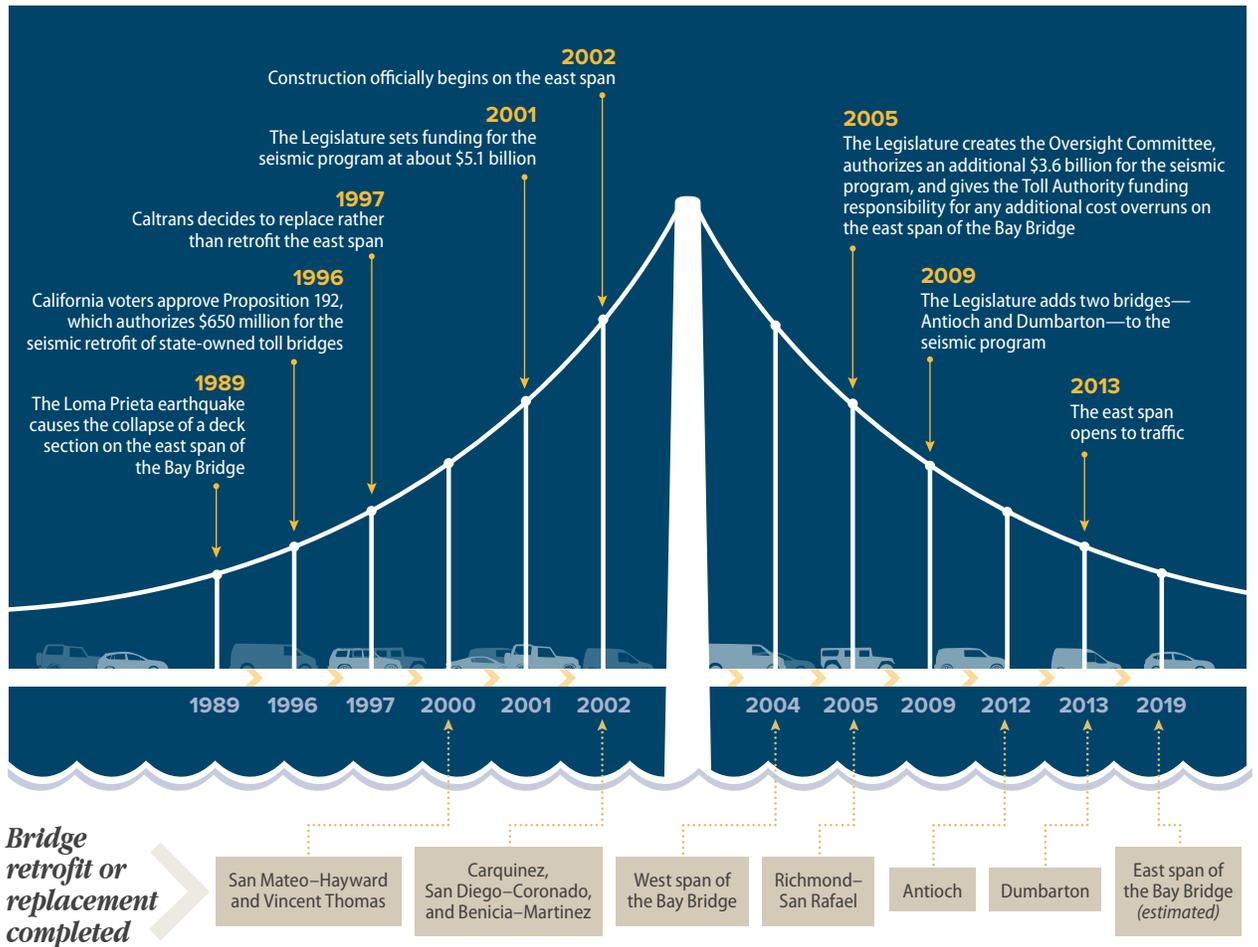


Source: Oversight Committee quarterly report, first quarter 2018.

Note: The Golden Gate Bridge is overseen by the Golden Gate Bridge, Highway and Transportation District, and is not part of the seismic program.

However, as we described in a prior audit report published in December 2004—*Department of Transportation: Various Factors Increased Its Cost Estimates for Toll Bridge Retrofits, and Its Program Management Needs Improving*, report 2004-140—Caltrans failed to provide timely reporting to the Legislature when it experienced cost overruns on the Bay Bridge. Caltrans also underestimated its need for additional funds and failed to perform adequate risk management to quantify the potential for future cost increases.

Figure 2
History of the Seismic Program



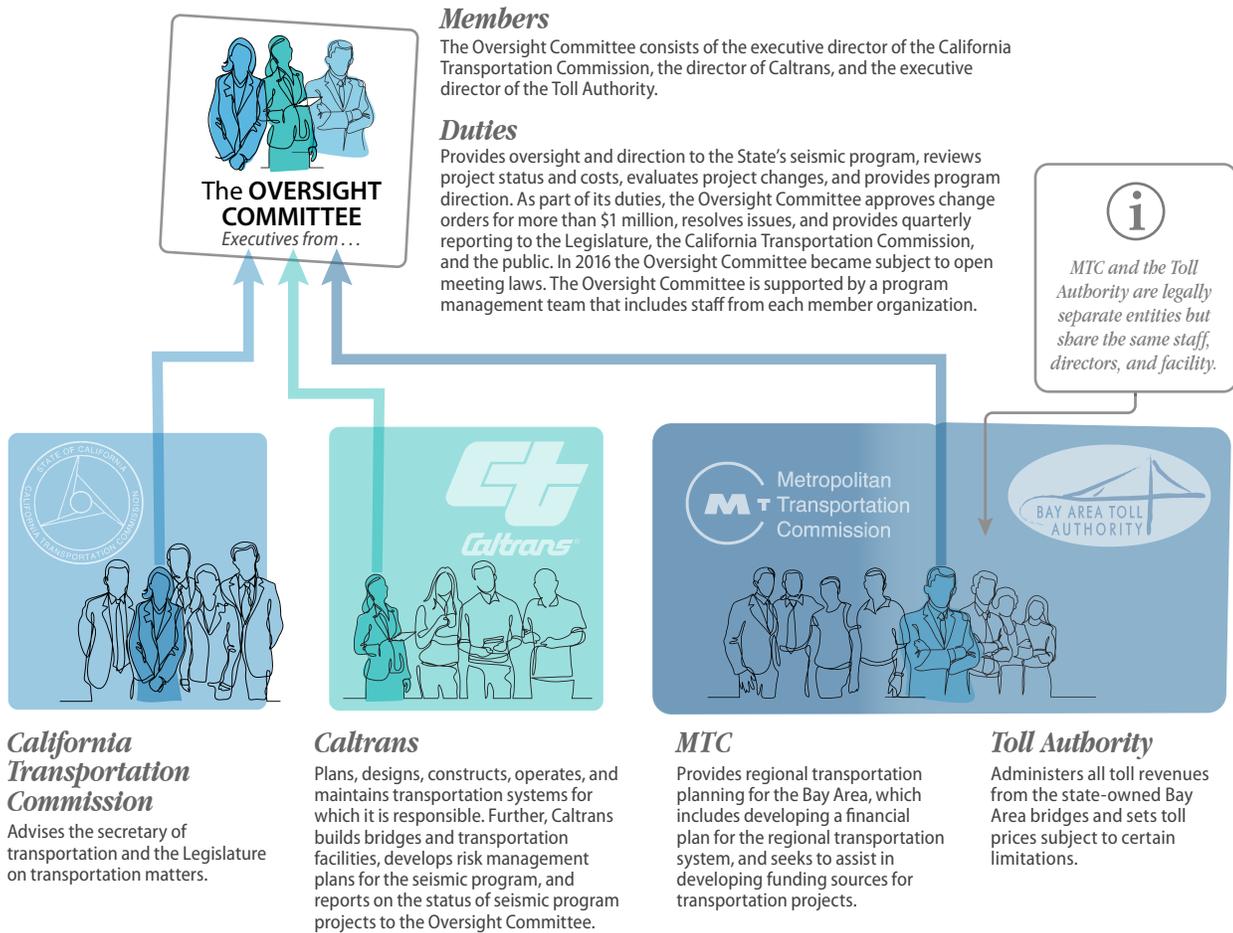
Source: State law and quarterly reports of the Oversight Committee.

In response to these issues, the Legislature provided additional funding in 2005, but also required Caltrans and the Metropolitan Transportation Commission (MTC) to establish the Toll Bridge Program Oversight Committee (Oversight Committee). The Oversight Committee is required to provide oversight and management to the seismic program, while reporting regularly to the Legislature and the California Transportation Commission. As shown in Figure 3 on the following page, the Oversight Committee is composed of three members—the chief executives of Caltrans, MTC, and the California Transportation Commission—who represent agencies with a wide array of responsibilities. State law requires the Oversight Committee to provide program direction, review costs and schedules, and approve significant change orders.

The Oversight Committee has interpreted significant change orders to mean those over \$1 million; Caltrans approves change orders under \$1 million. In addition, the Oversight Committee is to resolve seismic program issues and regularly update cost estimates.

At the same time it provided additional funding, the Legislature also consolidated financial management of the seismic program within the Bay Area Toll Authority (Toll Authority) by placing Bay Area toll revenues within the Toll Authority’s purview. State law allows the Toll Authority to issue bonds backed by toll revenues for a variety of transportation projects including the seismic program.

Figure 3
Oversight Committee Composition



Source: State law and Oversight Committee documents.

To provide the Bay Area with a lifeline structure for use following an earthquake, the Oversight Committee prioritized timely completion of the east span over potential cost savings until the east span opened to traffic in 2013. This decision was in line with state law, which also recognizes the Bay Bridge as a lifeline structure. Caltrans designs lifeline structures to remain functional following a major earthquake in order to facilitate disaster response activities. In the case of the Bay Bridge, Caltrans designed the structure to withstand rare but potentially devastating seismic events expected to occur at the bridge site once in a 1,500-year period.

Bay Area Toll Increases

The Legislature and Bay Area voters have approved a number of toll increases to accommodate the Bay Area's regional transportation needs, including the seismic program. As Figure 4 on the following page shows, in 1988 voters approved Regional Measure 1, which in part financed toll bridge rehabilitation and replacement. This measure established a uniform toll of \$1 on state-owned Bay Area toll bridges; from 1984 through 1988 bridge tolls had averaged about 65 cents. In 1997 the Legislature approved another toll increase to bring Bay Area tolls to \$2 and dedicated the additional toll revenue to the seismic program.

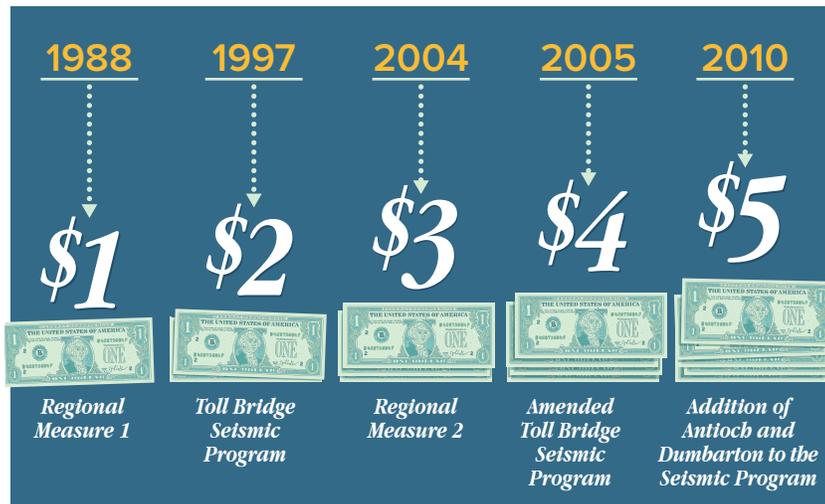
Voters approved Regional Measure 2 in 2004, which raised tolls to \$3 to fund a number of transportation projects including the San Francisco Transbay Terminal. The Legislature again increased tolls in 2005, primarily to support the completion of the east span of the Bay Bridge. In 2009 the Legislature added the Dumbarton and Antioch bridges to the seismic program. In 2010, with the Legislature's authorization and citing the need for an increase in the toll rates to fund seismic program work that included the retrofit of the two additional bridges, the Toll Authority board voted to increase the base toll by an additional \$1. Currently, the base toll on state-owned Bay Area bridges is \$5; however, it can vary depending on the type of vehicle, time of day, and whether the vehicle is part of a carpool.³

The Legislature requested this audit in part to ascertain MTC's and Caltrans' ability to manage future projects because of a measure on the June 2018 ballot, which Bay Area voters subsequently approved. Regional Measure 3 will increase tolls to fund major transportation projects. Specifically, tolls will increase by \$1 in 2019, 2022, and 2025, thereby eventually raising the base toll on Bay Area bridges

³ The \$5 toll does not include the Golden Gate Bridge, which is not part of the seismic program.

to \$8. The measure lists \$4.5 billion in highway and transit capital improvements, including support for the Bay Area Express Lane Network, an expansion in the number of Bay Area Rapid Transit cars, and a ferry enhancement program. Further, MTC’s regional transportation plan, Bay Area 2040, which shares certain projects with Regional Measure 3, anticipates \$303 billion in transportation projects and investments throughout the region by 2040. MTC estimates that more than \$212 billion to support its plan will come from local and regional sources, including Bay Area tolls. However, Regional Measure 3 must first pass additional legal scrutiny due to a lawsuit filed in July shortly after the measure’s passage. The lawsuit alleges that the measure is in fact either a state tax, which would require approval by two-thirds of the Senate and Assembly, or a local special tax that would require approval by two-thirds of voters from the nine Bay Area counties.

Figure 4
Increase in Base Bay Area Toll Prices Over Time



Source: State law and documents from MTC’s website.

Note: The base toll on the seven Bay Area bridges is currently \$5; however, the Toll Authority has established discounted rates for carpools and certain low-emission vehicles, as well as variable rates on the Bay Bridge depending on the time of day. Voters approved an additional \$3 in toll increases in 2018, which will be phased in through 2025.

The Design for Replacing the East Span of the Bay Bridge

In late 1997, Caltrans reported on the cost estimates for several different design alternatives for the east span between Yerba Buena Island and the city of Oakland. According to Caltrans, MTC then became involved in the design selection at the request of

the Governor and Bay Area legislative leaders to ensure that region-wide interests would be appropriately addressed. Caltrans recommended construction of a concrete skyway—a form of elevated freeway—which it estimated would cost \$1.2 billion. However, the Bay Bridge Design Task Force’s Engineering Design and Advisory Panel, which was formed by MTC, drafted guidelines that sought to produce a bridge that would be visually memorable, and in harmony with the existing western span of the Bay Bridge. After significant public input, in June 1998 MTC selected an alternative design known as the self-anchored suspension span (suspension span) rather than the skyway or a different suspension design. The preliminary estimate for the suspension span design was \$141 million greater than Caltrans’ estimate for the skyway.

While cost increases related to the suspension span have proven significant, we cannot quantify the potential for similar increases had the skyway design been implemented. Caltrans predicted that other design alternatives would be less costly, but the true cost of these designs is uncertain because the design phase could not capture all potential costs associated with each of the design options. For example, another seismic program bridge, Richmond–San Rafael, underwent significant cost increases due to complications with its underwater foundation that Caltrans did not anticipate until construction was underway. Further, contract bidding for the seismic program took place during a time of increased market volatility, in which consolidation within the construction industry resulted in fewer competitors to bid on large projects. Any bridge design would have been subject to the same market volatility that influenced cost increases on the east span.

Scope and Methodology

The Joint Legislative Audit Committee (Audit Committee) directed the California State Auditor (State Auditor) to perform an audit related to the management of Bay Area bridge costs by MTC, the Toll Authority, and Caltrans. Table 1 on the following page outlines the Audit Committee’s objectives and our methods for addressing them.

Table 1
Audit Objectives and Methods Used to Address Them

AUDIT OBJECTIVE	METHOD
1 Review and evaluate the laws, rules, and regulations significant to the audit objectives.	Reviewed relevant laws, rules, and regulations related to Caltrans, MTC, the California Transportation Commission, the Oversight Committee, and the seismic program.
2 a. Review records related to the Bay Bridge construction project to determine the source of funding used to pay for cost overruns of the Bay Bridge project and whether there are any existing obligations, including debt, from those overruns.	<ul style="list-style-type: none"> • Reviewed Caltrans' expenditure reports and the Oversight Committee's quarterly reports from 2005 through the first quarter of 2018. • Identified and documented costs associated with the seismic program and work concerning the east span of the Bay Bridge in particular. • Interviewed MTC and Caltrans financial staff and reviewed documentation related to cost savings and funding sources. • Reviewed the Toll Authority's audited financial statements to determine the authority's debt and debt service payments.
b. Review records related to the Bay Bridge construction project to determine whether the Bay Bridge project cost overruns affected capital improvement projects on other Bay Area bridges. If funding was diverted from other projects to pay for the overruns, determine what plans exist to pay for those other projects.	<ul style="list-style-type: none"> • Reviewed MTC documents and the Oversight Committee's quarterly reports, and interviewed key Caltrans staff regarding retrofitting the Antioch and Dumbarton bridges. • Reviewed Caltrans documentation showing estimated completion dates for seismic program bridges and compared them to the respective completion dates. For bridges with completion delays, we reviewed Caltrans documentation to ascertain the cause.
c. Review records related to the Bay Bridge construction project to determine whether there is any continued financial risk as a result of the construction of the Bay Bridge and, if so, what funding source is planned to cover the risk.	<ul style="list-style-type: none"> • Worked with Caltrans staff to confirm outstanding contract costs for the east span. • Reviewed contingency data provided by Caltrans to confirm the amount remaining for future costs on the Bay Bridge. • Reviewed MTC documentation for tracking maintenance costs. • Interviewed Caltrans and MTC staff to obtain their perspective on ongoing risks and costs on the Bay Bridge.
3 Determine the total cost of Bay Bridge defects identified by MTC, the Toll Authority, and Caltrans and the source of funds that have been used or are planned to be used to pay for remediation of those defects. To the extent possible, for each defect, determine the cost associated with remediation.	<ul style="list-style-type: none"> • Interviewed Caltrans staff to gain Caltrans' perspective on defects. • Reviewed reports and correspondence from MTC and Caltrans regarding defects on the Bay Bridge. • Consulted the Project Management Institute's <i>Guide to the Project Management Body of Knowledge</i> for guidance regarding the definition of defect. • Obtained more than 2,000 contract change orders related to permanent work on the east span. • Judgmentally selected and reviewed more than 800 contract change orders based on terms indicating repairs or replacements, as well as information provided in correspondence from MTC and the Oversight Committee's quarterly reports. • Identified instances in the reviewed contract change orders where Caltrans or the Oversight Committee approved and paid for repairing or replacing bridge components. • Calculated the costs of defect remediation and determined applicable funding sources.
4 Determine whether MTC and Caltrans have modified their approaches to prevent and address cost overruns on major infrastructure projects since the construction of the Bay Bridge. As part of this effort, identify any steps that MTC and Caltrans have taken to reduce project defects or budget for defect remediation.	<ul style="list-style-type: none"> • Reviewed Caltrans reports, legislative reports, and prior audits regarding seismic retrofit project management and oversight. • Interviewed Caltrans and MTC staff to get their perspective on how their approach to large infrastructure projects changed due to their experience with the seismic program. • Interviewed staff and reviewed documentation regarding the use of oversight and risk management on Caltrans projects.

AUDIT OBJECTIVE	METHOD
<p>5 Identify any risk-management plans MTC has developed to properly spend and effectively manage any future funding for infrastructure projects.</p>	<ul style="list-style-type: none"> • Interviewed MTC staff and reviewed documentation related to risk management by MTC. • Reviewed the PMBOK Guide and assessed the extent to which MTC incorporated best practices related to risk management. • Interviewed MTC staff concerning plans for risk management in Regional Measure 3.
<p>6 Determine how long it will take to pay off the debt obligations for the seismic program and what will be the total cost of the program.</p>	<ul style="list-style-type: none"> • Reviewed information on the Toll Authority's debt in MTC's audited financial statements. • Interviewed Toll Authority staff regarding seismic program financing and confirmed that the Toll Authority does not track debt service costs specifically for the seismic program. • Reviewed Toll Authority revenue projections and interviewed financial staff to assess the Toll Authority's ability to meet its debt obligations.
<p>7 Review and assess any other issues that are significant to the audit.</p>	<p>To determine ongoing costs associated with maintenance and rehabilitation on the seismic program bridges after the program is complete, we performed the following:</p> <ul style="list-style-type: none"> • Worked with MTC and Caltrans staff to calculate routine and long-term maintenance costs on seismic program bridges. • Interviewed staff at MTC and Caltrans and reviewed documentation to assess the adequacy and sufficiency of maintenance funding. • Obtained and reviewed risk management documents from Caltrans concerning maintenance risks and risk methodology. • Reviewed Caltrans maintenance manuals.

Source: Analysis of the Audit Committee's audit request number 2018-104 and information and documentation identified in the table column titled *Method*.

Assessment of Data Reliability

In performing this audit, we obtained information from Caltrans' and the Toll Authority's accounting systems to ensure the figures presented in the Oversight Committee's quarterly reports were reliable for the purposes of our audit. The U.S. Government Accountability Office, whose standards we are statutorily required to follow, requires us to assess the sufficiency and appropriateness of computer-processed information that we use to support findings, conclusions, and recommendations. The Oversight Committee constructs the quarterly report of costs related to the seismic program using a report on expenditures from Caltrans' accounting system. We performed data-set verification and electronic testing of key data elements in the expenditure reports from 2006 through 2017 and did not identify any issues. To ensure the reports were complete, we compared the reports to the amounts recorded in the Toll Authority's system and found them to be materially identical. To assess the accuracy of the data in the reports, we reviewed quarterly audits of Caltrans' billing statements to the Toll Authority, reviewed records and interviewed Toll Authority and Caltrans' staff and determined the organizations addressed

issues the audits discovered. We determined that Caltrans reports on expenditures are sufficiently reliable for the purposes of this audit. Thus, we have adequate assurance that the Oversight Committee's quarterly reports reasonably represent the costs of the seismic program.

Audit Results

Lessons Learned From the Seismic Program Could Improve the State's Oversight of Future Projects

The Legislature's decision to shift oversight of the seismic program from Caltrans to the Oversight Committee had positive results. The Oversight Committee provided examples of \$866 million in cost avoidance and savings due to its oversight and the use of risk management to inform decisions. Further, the use of risk management resulted in avoiding seven years of potential delays. The seismic program is one of the largest transportation projects in California, and the experience of the Oversight Committee shows that similar oversight of the hundreds of billions of dollars in transportation projects that state and local agencies are either engaged in or anticipating can produce significant benefits.

When the Legislature formed the Oversight Committee in 2005, it also required Caltrans to develop a comprehensive risk management plan for the seismic program. Since then, Caltrans has adopted a policy to make risk management a part of all of its major construction and maintenance projects. Conversely, although MTC has taken a more active role in managing regional transportation projects, it has not yet created a policy to ensure that future projects it directs will benefit from appropriate levels of risk management. While MTC has stated it will create such a policy, there is little to ensure the application of risk management statewide because state legislation does not impose a general requirement on all sponsors of state or locally funded major transportation infrastructure projects to develop risk management plans.

The Oversight Committee's Actions Curtailed the Soaring Costs of the Seismic Program

The Oversight Committee's involvement curbed cost overruns on the seismic program. As we discuss in the Introduction, the Legislature created the Oversight Committee so that it would provide oversight and management to the seismic program. Before the establishment of the Oversight Committee, the seismic program experienced significant cost escalations. However, after the Legislature established the Oversight Committee, the budget for the program remained relatively constant—in fact, the Oversight Committee forecasts that the seismic program will complete its work roughly on budget.

Members of the Oversight Committee provided examples of savings of at least \$505 million resulting from its actions and decisions. State law requires it to resolve project issues, perform

risk assessments and monitor staffing levels among other duties. According to members of the Oversight Committee, it achieved these savings in part by combining project responsibility with approval authority and by incorporating the multiple viewpoints the committee's members represent. Table 2 provides examples of cost avoidance and savings achieved through Oversight Committee action.

Table 2
Examples of Savings and Avoided Costs Achieved by the Oversight Committee

AREA	DESCRIPTION	ESTIMATED SAVINGS AND AVOIDED COSTS
Demolishing the old east span of the Bay Bridge*	The Oversight Committee directed the creation of an alternative demolition strategy, which relied on marine implosions.	<i>\$94 million</i>
Encouraging multiple bids on the suspension span of the Bay Bridge	<ul style="list-style-type: none"> Only one bidder responded to Caltrans' original solicitation for construction of the suspension span. The Oversight Committee offered a \$3 million stipend to up to the three lowest bidders to encourage multiple bidders. Increased competition resulted in a bid below Caltrans' estimated cost. 	<i>\$49 million</i>
Retrofitting the Antioch and Dumbarton bridges	<ul style="list-style-type: none"> The Oversight Committee voted to remove \$353 million saved in the two projects from the seismic program's budget. The Toll Authority made these savings available to other regional projects. 	<i>\$353 million</i>
Reducing staffing levels	The Oversight Committee reduced a proposed Caltrans fiscal year 2016–17 staff support budget from \$32 million to \$23 million after in-depth inquiry into project staffing levels.	<i>\$9 million</i>
TOTAL		<i>\$505 million</i>

Source: MTC, California Transportation Commission, and Oversight Committee records.

* Potential costs avoided related to the demolition of the old east span are also referenced in Table 3 on page 19.

In one example, the Oversight Committee took action to encourage multiple bidders on the suspension span, resulting in savings of nearly \$50 million. The original solicitation for construction of the suspension span in 2004 resulted in a response from one bidder, and the bid was \$666 million higher than Caltrans' initial engineers' estimate. As the State Auditor's Office reported in 2004, Caltrans chose not to disclose program information according to the regular reporting schedule established by law; as a consequence,

Caltrans had placed the Legislature in the awkward position of having to try to devise a funding solution six weeks before the bid on the suspension span was set to expire. When the Legislature did not approve funding by September 2004, the bid expired.

According to an Oversight Committee report, when Caltrans rebid the work on the suspension span in 2005, the Oversight Committee used its authority to approve bid stipends of \$3 million to each of the three lowest responsive bidders. The stipends acted as partial compensation for expenses the contractors incurred in preparing the complex bids for the suspension span and were designed to prevent having only one contractor bid, as had occurred in 2004. According to the Oversight Committee, the increased competition resulted in two bids, one of which was \$49 million below the engineers' revised 2006 estimate. This decrease from the expected cost was especially noteworthy because in 2005 a Caltrans market analysis noted that Caltrans had been experiencing fewer bidders and increasing bid prices for its awarded contracts.

Although the Oversight Committee was successful in managing the seismic program, committee representatives we spoke to suggested improvements for future oversight committees. For example, the Legislature amended state law to require that the Oversight Committee be subject to open meeting laws beginning in 2016. The committee had already opted to institute a modified version of open meetings before the legislative requirement. Although the legislative change resulted in increased transparency for the public according to the executive director of MTC, it also increased the difficulty of conducting day-to-day business. In a three-person committee, two members constitutes a majority; thus, when any two members of the committee discuss, hear, or deliberate on any issue pertaining to the Oversight Committee, it would constitute a meeting of the Oversight Committee. This could lead to committee members inadvertently holding a "meeting" when conducting other business. For example, Caltrans and the California Transportation Commission work closely together and it is reasonable to assume that their directors would need to meet from time to time. The executive director of the California Transportation Commission indicated that the Oversight Committee may benefit from having its own attorney to ensure that legal issues that affect the committee as a whole—such as compliance with open meeting laws—are addressed. She stated that counsel from the members' respective agencies currently represents members of the Oversight Committee; however, there is no attorney assigned to represent the Oversight Committee as a whole.

Although increasing the number of Oversight Committee members and assigning dedicated counsel would likely increase costs, the Oversight Committee's current quarterly report notes the cost

Committee representatives we spoke to suggested improvements for future oversight committees.

of Oversight Committee operations from 2005 to 2018 as being about \$17 million, or slightly more than \$1 million per year. This is a small fraction of the \$9 billion cost of the seismic program and significantly less than the cost savings the Oversight Committee achieved. The cost of the Oversight Committee derives mostly from the labor costs of support staff and consultants at each respective Oversight Committee agency.

Caltrans' Risk Management Plan Played a Critical Role in the Oversight Committee's Ability to Prevent Unnecessary Costs and Delays

Caltrans risk management handbook, published in 2003, notes that risk management is most effective when it is performed early and continues throughout the project. However, in 2004 our office found that Caltrans failed to embody these principles early in the seismic program. The Project Management Institute's *Guide to the Project Management Body of Knowledge*, 6th Edition (PMBOK Guide) recommends that organizations make a conscious decision to manage risk in a controlled and intentional manner in order to prevent deviations from a project plan that could cause a project to fail to achieve its objectives.⁴ In 2004, as the seismic program was experiencing significant cost overruns, we recommended that Caltrans implement a comprehensive risk management plan for the seismic program using its risk management handbook. In 2005, as part of the same legislation that created the Oversight Committee, the Legislature required Caltrans to develop and conduct

comprehensive risk management for the seismic program, including identifying project risks and quantifying such risks in financial terms.

Following this legislation, risk management played a critical role in informing the decisions of the Oversight Committee. Qualitative and quantitative risk analysis informed Oversight Committee decisions that led to avoiding hundreds of millions of dollars in potential costs, and seven years of potential delays, as shown in Table 3. The text box describes qualitative and quantitative risk analysis. In one case, the risk management team performed an analysis in 2008 that identified up to \$305 million in potential costs for schedule delays and fabrication issues related

to the suspension span. As a result, the Oversight Committee approved a \$13.9 million mitigation procedure to improve quality

The Definition of Qualitative and Quantitative Risk Analysis According to the PMBOK Guide

Qualitative: The process of prioritizing individual project risks for further analysis or action by assessing their probability of occurrence and impact as well as other characteristics.

Quantitative: The process of numerically analyzing the combined effect of identified individual project risks and other sources of uncertainty on overall project objectives.

Source: PMBOK Guide.

⁴ Recognized for its development of standards for project management, the Project Management Institute publishes the PMBOK Guide, which provides guidelines for managing individual projects.

control with Caltrans’ fabrication contractors, which Caltrans projected would enable the project to avoid between \$132 million and \$291 million in costs. In another instance, according to the Oversight Committee in 2005, its risk management team conducted an analysis of two contracts to weigh the cost of accelerating one to avoid delay to the other. The team’s analysis accurately predicted that the first contract would finish in time for work to begin on the other without needing to accelerate the first contract; Caltrans estimated that this decision avoided \$12 million in potentially wasted costs.

Table 3
Examples of Costs Avoided Through Risk Management in the Seismic Program

EXAMPLE OF RISK MITIGATION	DESCRIPTION	POTENTIAL COSTS AVOIDED (IN MILLIONS)	POTENTIAL DELAY AVOIDED
Demolishing the old east span*	Risk analysis demonstrated the high costs associated with traditional demolition of certain east span components, leading to the Oversight Committee’s decision.	\$94	4 years
Avoiding underwater construction	<ul style="list-style-type: none"> In 2009 the Oversight Committee estimated the seismic retrofit of the Antioch and Dumbarton bridges would cost \$950 million. The risk management team determined underwater construction would be precarious, prompting the team to devote resources towards developing an alternative strategy. As a result, the potential costs significantly decreased. 	\$200	
Suspension span fabrication	<ul style="list-style-type: none"> The risk management team identified several risks related to the fabrication of suspension span components. The Oversight Committee used this information to approve a process that would ensure quality and timely fabrication in China. 	\$132 to \$291	2 years
Contract acceleration analysis	<ul style="list-style-type: none"> The risk management team performed a risk analysis of two contracts to determine whether funds should be expended to accelerate completion on a contract to support work in another area. The analysis revealed less than a 5 percent chance such acceleration would be necessary. The Oversight Committee elected not to accelerate the contract. 	\$12	
Nesting birds permit†	<ul style="list-style-type: none"> In 2011 the risk management team identified bird nesting as a large delay risk to the old east span’s demolition. This led the project team to obtain special permits, which allowed for the safe relocation of birds. As a result, the contract did not experience any delays due to nesting birds. 	\$17	1 year
TOTALS		\$455 to \$614	7 years

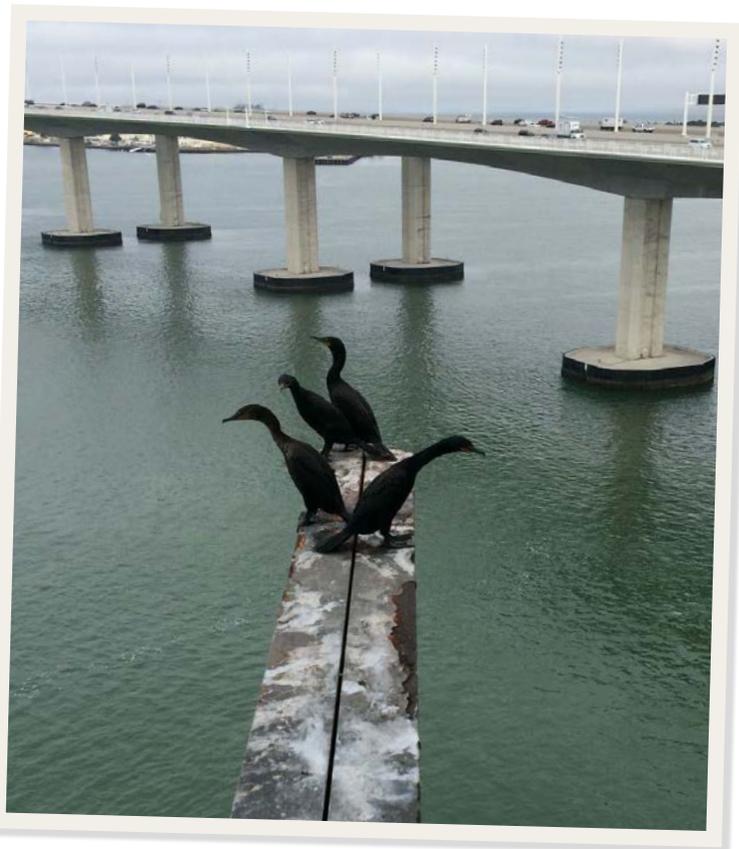
Source: Auditor-generated using Caltrans and MTC project documentation and unaudited savings estimates.

* Potential costs avoided related to the demolition of the old east span are also referenced in Table 2 on page 16.

† Multiple species of protected birds’ nests were relocated as a result of this effort, indicating that the project would have suffered without this mitigation strategy.

Risk management on the seismic program has also resulted in reduced environmental and societal impacts. For example, Caltrans noted that in 2011 its risk management team identified nesting birds as one of the largest delay risks to the demolition of the old east span. According to Caltrans, if certain protected birds lay eggs on site, work needs to stop until any chicks hatching from the eggs leave their nests. Caltrans states that federal law prohibits the removal of certain migratory birds—one species, the double-crested cormorant is pictured in Figure 5—or their nests without a permit. Based on Caltrans' data, each day of delay in the demolition project could cost more than \$44,000, and a nest could cause a delay of up to 12 weeks. Thus, a single nest could potentially have resulted in costs of more than \$2.5 million. These financial and ecological concerns drove Caltrans to develop a strategy for responsibly managing the bird population, which included securing Fish and Wildlife permits, collaborating with International Bird Rescue, and providing alternative nests on the new span before the beginning of nesting season in 2014.

Figure 5
Cormorants Relocated From the Prior East Span During Construction



Source: Johnson Marigot Consulting.

Risk management on the seismic program has also reduced the impact of the project on the public. Caltrans stated that its risk management analysis led it to plan for a four-day bridge closure over Labor Day weekend in 2009, instead of relying on the contractor's estimate of three days. To provide transportation agencies enough time to arrange alternatives, Caltrans needed to announce the bridge closure months in advance. The decision proved correct, as the contractor completed work just under the scheduled four-day allotment. Considering that almost 125,000 cars crossed the Bay Bridge daily in 2009, an unscheduled closure would have led to traffic delays and frustration for thousands of drivers during a long holiday weekend.

State Law Should Require Oversight Committees and Risk Management Plans for All Major Transportation Infrastructure Projects

The Oversight Committee, combined with Caltrans' risk management, contributed to significant cost savings for the seismic program. The Bay Bridge and the Transbay Terminal faced significant cost increases of \$3 billion and \$1.1 billion, respectively, before instituting increased oversight.⁵ In order to respond to its increasing costs, the Transbay Terminal project implemented a cost review committee to provide additional financial oversight and enlisted the help of the San Francisco Department of Public Works to provide construction oversight beginning in 2016.

State statutes do not impose a general requirement for all major transportation infrastructure projects to institute similar measures. The importance of a general requirement is particularly evident given that regional plans in the Bay Area, San Diego, and Los Angeles—three of the largest metropolitan regions in California—forecast transportation infrastructure projects totaling more than \$600 billion over the coming decades. Although not all cost increases are avoidable, without assurance that large-scale projects have sufficient oversight, California and its communities are at greater risk that these projects will have unplanned cost increases—costs ultimately borne by taxpayers.

While Caltrans may use executive steering committees to provide advice and direction on some projects, it does not always do so. According to the chief deputy director of Caltrans' District 4, Caltrans and its partners may choose to use a steering committee on a case-by-case basis for large projects as it deems necessary. The current replacement of the Gerald Desmond Bridge in

Without assurance that large-scale projects have sufficient oversight, California and its communities are at greater risk that these projects will have unplanned cost increases—costs ultimately borne by taxpayers.

⁵ The Transbay Joint Powers Authority originally estimated the Transbay Terminal to cost \$1.2 billion in 2007, but its budget grew to \$2.3 billion in 2016. Located in downtown San Francisco, this terminal will serve as the primary bus and rail terminal for the Bay Area.

Long Beach, for example, has a multiagency steering committee that, according to its charter, provides direction and facilitates actions across partnering agencies. Caltrans has acknowledged the need for additional project oversight: when Caltrans reported to the Legislature in 2014 on lessons learned throughout the seismic program, among its recommendations was the use of multiagency oversight structures on large transportation projects. An investigation completed in July 2014, on behalf of the Senate Transportation Committee, reached a similar conclusion.

Following its use of risk management in the seismic program, Caltrans developed a scalable risk management policy based on the project's size, from \$1 million to over \$100 million, that applies increasing levels of risk management. In 2012 Caltrans issued a directive requiring staff to apply risk management practices to all capital and major maintenance projects. The directive outlines a scalable policy with increasing levels of risk management depending on the size of the project. Without establishing a general requirement for all major state and local transportation infrastructure projects to develop and conduct comprehensive risk management from the outset of a project, the application of risk management relies on either Caltrans involvement in projects or federal oversight.

Not all projects involve Caltrans and even when federal oversight is required there is no assurance that it will be sufficient to prevent cost overruns.

However, not all projects involve Caltrans and even when federal oversight is required there is no assurance that it will be sufficient to prevent cost overruns. For example, because Caltrans estimated that the Bay Bridge project would cost more than \$1 billion, it was subject to enhanced federal oversight.⁶ This oversight included the assignment of a full-time Federal Highway Administration project manager. However, the oversight proved insufficient to prevent cost increases prior to the establishment of the Oversight Committee. In its 2014 report to the Legislature on lessons learned in the seismic program, Caltrans noted that the project did not get the full benefits from risk management that would have accrued had it been implemented earlier than 2005. A statutory requirement applicable to all major publicly funded transportation infrastructure projects would ensure that projects sponsored by Caltrans, and other state and local entities, would benefit from similar requirements from the onset.

⁶ Previously, projects over \$1 billion were required to submit annual financial plans. However, in 2005 Congress revised this to define a major project as a project with an estimated cost of \$500 million or more and required such projects to submit project management and annual financial plans.

MTC Should Develop a Policy to Ensure That Future Projects Will Also Benefit From Risk Management

MTC lacks a formal policy to ensure that future projects it directs will benefit from appropriate levels of risk management, although it is using risk management on the projects it is currently managing. Under state law, MTC's primary role is that of a regional transportation planning agency but in recent years it has taken a more active role by directly managing some projects. MTC currently manages several projects including the Bay Area Express Lanes Program, for which MTC is responsible for implementing 270 miles of express lanes throughout the region that will use MTC's FasTrak toll collection system. To support this effort, MTC has developed a program-specific risk management plan that clearly identifies roles, responsibilities, and expectations. For instance, the program risk manager's responsibilities on MTC's express lanes program include reporting to the program manager, ensuring that project managers maintain project risk registers, and preparing quarterly risk management reports.

However, according to MTC's deputy director, MTC does not have a formal policy ensuring that it will develop similar plans for future projects it directs. Instead, it has historically made risk management decisions for the projects it directs on a case-by-case basis. He also stated that risk management costs could sometimes exceed what MTC believes to be fiscally prudent for a project. However, it is possible to develop a scalable risk management policy, as Caltrans has done, to accommodate projects of varied complexity and cost. For example, Caltrans' policy encourages risk documentation on extremely small projects of under \$1 million but requires increasingly in-depth risk management as costs increase up to and above \$100 million. Without a formal policy, MTC may apply risk management inconsistently—or neglect to apply it altogether—on future projects, which could increase costs and ultimately the financial burden on toll payers. As Caltrans has discovered, ensuring judicious and measured risk management on all projects requires a policy that allows flexibility but ensures the universal application of best practices. According to its executive director, MTC intends to develop a policy for projects it directs, which will improve efficacy and ensure the systematic application of risk management.

MTC's risk management policy should include the asset management plan the Toll Authority is currently creating.⁷ State law requires the Toll Authority to fund maintenance and rehabilitation

Ensuring judicious and measured risk management on all projects requires a policy that allows flexibility but ensures the universal application of best practices.

⁷ As noted in the Introduction, MTC and the Toll Authority are legally separate entities that share the same board, staff, and facilities.

programs on the Bay Area toll bridges after the seismic projects are completed. However, due to the long lifespan of Bay Area bridges, MTC cannot reasonably rely on the expertise of its current staff to ensure it applies appropriate engineering considerations to future maintenance funding decisions. To address this issue, the Toll Authority is assembling a panel of independent engineering consultants to assist it in creating an asset management plan that supplements similar Caltrans efforts. The asset management plan will assist in MTC's current efforts, which prioritize projects based on a scoring system that heavily weighs life and structural safety while considering current bridge conditions. Including the asset management plan as a component of an overall risk management policy will help ensure that MTC appropriately manages critical assets throughout their projected lifespans.

The Remediation of Defective Components on the Bay Bridge Represented a Small Portion of the Project's Total Costs

The Definition of Defect According to the PMBOK Guide

An imperfection or deficiency in a project component where that component does not meet its requirements or specifications and needs to be either repaired or replaced.

Source: PMBOK Guide.

State statutes do not define what constitutes a defect for major transportation infrastructure projects. Similarly, Caltrans and MTC have not created a definition for defects generally, or on the Bay Bridge in particular, and therefore have generally not identified items as defective. For the purposes of this report, we used the PMBOK Guide definition of defect as detailed in the text box.

As indicated in Table 4, we found that Caltrans spent at least \$66.6 million on remediating construction defects and at least another \$19.7 million resolving fabrication problems in the contract change orders that we reviewed. Construction defect costs are those that indicate Caltrans paid to repair or replace a component that had already been installed on the bridge, while fabrication problems involve repairing or replacing a component before installation. Costs associated with Table 4 do not indicate the existence of current defects, but rather detail the cost of work conducted after Caltrans identified an issue and resolved it to the satisfaction of the engineers on the project. As we discuss later, multiple peer reviews and engineer panels have reviewed critical elements of the Bay Bridge and noted that they were safe.

Although Caltrans has developed specifications in its contracts which utilize technical industry standards to define certain defects, this information is specific to each contract and would not provide a general definition for the project as a whole. Because contractors are generally responsible for the cost and effort to

remediate defective work if they fail to meet contract specifications, our review focused on instances in which Caltrans compensated a contractor to repair or replace a component. While Caltrans and MTC may disagree with respect to work we identified as defect remediation, the seismic program nevertheless incurred expenses while repairing or replacing bridge components. In total, our review of a selection of 800 contract change orders—out of about 2,500 total change orders for permanent work—identified \$86 million of defect remediation costs on the Bay Bridge, or 1.5 percent of the project cost. Our review did not include temporary structures or work that was tangential to the bridge itself, such as electrical substations providing power to the bridge.

Table 4
Cost of Remediation in Change Orders We Reviewed
 (In Thousands)

AREA OF THE BRIDGE	CONSTRUCTION DEFECT	FABRICATION PROBLEM	TOTAL
<i>Suspension span</i>	\$56,550	\$17,591	\$74,141
<i>Yerba Buena Island</i>	2,315	620	2,935
<i>Skyway</i>	1,746	755	2,501
<i>Oakland touchdown</i>	6,017	726	6,743
TOTALS	\$66,628	\$19,692	\$86,320

Source: Analysis of selected east span contract change orders.

Note: Of the approximately 2,500 change orders for permanent work on the Bay Bridge, we reviewed a selection of 800.

Caltrans has procedures to identify and address problems experienced during construction, such as work that does not meet specifications. Federal law requires Caltrans to develop a quality assurance program for federal-aid highway construction projects and according to Caltrans, its quality assurance program generally seeks to improve production and avoid defects. When Caltrans personnel identify an issue, they are to document it and communicate with both the resident engineer and the contractor on the project to resolve it. For example, in one instance, Caltrans personnel found that a contractor working on the east span allowed the use of a protective coating technique that was out of compliance with the contract’s specifications. Caltrans staff worked with the contractor to resolve the issue at the contractor’s expense.

Caltrans spent more than \$22 million remediating problems surrounding broken bolts and developing an alternate anchoring method.

Resolution may sometimes result in a contract change order, depending on the nature and severity of the issue. For example, quality assurance personnel detected a problem and issued a report when metal plates failed to meet quality requirements, which prompted Caltrans to work with the contractor to develop a solution that could be implemented without additional cost. However, there were other cases in which Caltrans incurred significant expenses remediating defects. For example, resolving problems surrounding well-publicized broken bolts—originally intended to anchor a segment of the bridge—required developing and implementing an alternative anchoring method. Caltrans' procedures allow it to identify a variety of issues and remediate defects when necessary, but not all defects can be proactively prevented.

Caltrans incurred increased costs remediating fabrication problems and construction defects depending on the complexity of the issue identified. For instance, Caltrans paid more than \$400,000 to make modifications to a fabrication process for certain beams after the original process caused the steel to behave in unanticipated ways. Further, in correspondence with the requestor of this audit, the executive director of the Toll Authority and MTC stated that the well-publicized broken bolts, part of the anchoring system on the eastern side of the suspension span, were unquestionably a construction defect. Experts noted that a confluence of environmental factors and metallurgical conditions caused the bolts to fail, despite meeting industry standards. Caltrans spent more than \$22 million remediating problems surrounding the broken bolts and developing an alternate anchoring method. Another significant expenditure, \$13.9 million, provided for the development of a quality control process improvement after Caltrans personnel identified welding defects during fabrication of support structures. Caltrans also spent more than \$12 million to make repairs, modifications, and adjustments to resolve fit issues between various complicated components.⁸ Examples similar to these account for the vast majority of remediation costs we identified and were paid for using contingency funds.

In spite of increased costs associated with remediating defects, according to multiple peer review panels from as recently as 2014, remediated defects such as those identified in our review do not indicate the presence of safety issues on the bridge. Caltrans designates the Bay Bridge as a lifeline structure, which requires that the bridge be able to provide a high level of post-earthquake transportation service for emergency response and support for the economic

⁸ Fit issues occurred when a component required modification to fit properly with another component.

livelihood of the Bay Area. According to Caltrans, the east span is designed to withstand a once-in-1,500-years seismic event. To ensure that problems have been resolved effectively, and that the Bay Bridge is ready to function in a seismic event, the project has undergone multiple peer reviews, in which internal and external engineering experts have conducted in-depth evaluations and determined that critical components are safe. For example, the Toll Bridge Seismic Safety Peer Review Panel stated that the tower foundation, part of the suspension span, was designed and constructed in a manner that meets or exceeds structural safety standards.

The Seismic Program Will Cost About \$9 Billion, but Debt Service and Ongoing Maintenance Costs Will Continue

The seismic program will end in 2019 at a cost of about \$9 billion, roughly on budget. Although costs associated with debt on bonds backed by toll revenues as well as ongoing maintenance and rehabilitation costs on all of the Bay Area bridges will continue into the future, the Toll Authority forecasts that it will have sufficient revenues to cover those expenses.

The Seismic Program Will Have Cost About \$9 Billion at Completion

The Oversight Committee estimates that the seismic program will end by 2019 having cost just under \$9 billion, not including ongoing maintenance and rehabilitation. As of August 2018, the Oversight Committee estimated that the final cost of the program will be about \$34 million under the program's current budget. Nevertheless, as we discussed previously, the history of the seismic program has been one of escalating costs. Table 5 on the following page shows the evolution of the program's budget by bridge, as well as the anticipated final costs of the program.

The cost estimates of the seismic program increased substantially from 1997 through 2005. In 1997 the Legislature allocated \$2.6 billion in funds from various sources to finance what was at that point projected to be the entirety of the seismic program—five Bay Area toll bridges and two toll bridges in Southern California. A 2001 Caltrans report on the seismic program cited several factors leading to increased cost estimates including rising construction costs and delays in selecting a design for the east span. The Legislature responded in 2001 by allocating additional funds, bringing the new total for the seismic program to \$5.1 billion. By 2005 Caltrans' estimates of the cost of the seismic program had grown well beyond \$5 billion to \$8.7 billion. In that year, the Legislature identified an additional \$3.6 billion of funds to pay for the estimated cost overruns, with \$2.2 billion to come from toll revenues and the remainder from

several state funding sources. The Legislature further indicated that the Toll Authority would be responsible for covering any excess costs associated with the east span of the Bay Bridge through toll revenues.

Table 5
Seismic Program Budgets and Costs by Bridge
(In Millions)

BRIDGE RETROFIT OR REPLACEMENT	1997 COST ESTIMATE	2001 COST ESTIMATE	2005 BUDGET	2009 BUDGET	CURRENT APPROVED BUDGET (AS OF JUNE 2018)	COSTS TO DATE (AS OF JUNE 2018)	PROJECTED COSTS AT CLOSEOUT (2019)
<i>Bay Bridge, east span replacement</i>	\$1,285.0	\$2,600.0	\$5,486.6	\$5,486.6	\$6,509.0	\$6,428.3	\$6,533.0
Bay Bridge, west span	553.0	700.0	736.9	736.9	757.9	757.7	757.9
Benicia–Martinez	101.0	190.0	177.8	177.8	177.8	177.8	177.8
Carquinez*	83.0	125.0	114.1	114.1	114.2	114.2	114.2
Richmond–San Rafael	329.0	665.0	914.0	914.0	811.9	794.8	794.9
San Mateo–Hayward	127.0	190.0	163.5	163.5	163.4	163.4	163.4
Vincent Thomas	45.0	62.0	58.5	58.5	58.5	58.4	58.5
San Diego–Coronado	95.0	105.0	103.5	103.5	103.2	103.2	103.2
Antioch				267.0	71.1	71.1	71.2
Dumbarton				483.0	112.4	111.8	112.2
Contingency [†]		448.0	900.0	900.0	46.7		
Misc program costs			30.0	30.0	26.0	26.0	26.0
Net programmatic risk							5.6
TOTALS	\$2,618.0	\$5,085.0	\$8,684.9	\$9,434.9	\$8,952.1	\$8,806.7	\$8,917.9

Source: State law and Oversight Committee quarterly reports.

Note: The cost estimates in 1997 and 2001 are as expressed in legislation; the budgets and costs from 2005 onward are as noted in the Oversight Committee's quarterly reports.

* The eastbound portion of the Carquinez bridge was retrofit. The westbound replacement of the Carquinez Bridge, which opened in 2003, was part of Regional Measure 1 (1988) and not the seismic program.

† In 2001 the Legislature appropriated \$448 million in additional funds to cover potential cost overruns. Caltrans referred to this amount as a "program contingency." In 2005, based on earlier Caltrans estimates, the Oversight Committee established a program contingency budget of \$900 million. The contingency does not appear in the columns for 2018 and 2019, as contingency funds are incorporated into the costs of the individual bridges when spent.

The budget for the seismic program increased again after 2009 legislation that added two bridges to the program. The seismic program did not initially include the Antioch and Dumbarton bridges because they met seismic standards established in the early 1970s. However, after a series of earthquakes both in California and abroad, in 2008 the Toll Authority and Caltrans determined

that the two bridges needed retrofitting. The Legislature added both bridges to the seismic program and directed the Oversight Committee to pay for the projects through cost savings or with toll revenue from the Toll Authority, authorizing the Toll Authority to increase tolls to complete work on the bridges. Early the following year, the Toll Authority approved adding \$750 million to the seismic program's budget—a figure based on cost projections for retrofitting the Antioch and Dumbarton bridges. Because the Toll Authority was responsible for costs exceeding prior legislative appropriations, the \$750 million would come from toll revenues. This brought the total budget for the seismic program to \$9.4 billion.

Much of the increasing cost of the program was due to rising costs for replacing the east span. In 2005 Caltrans estimated the budget for the east span at \$5.5 billion, an amount roughly equal to the prior legislative appropriation for the entire seismic program. As described in the bill analysis and supported by Caltrans estimates, this increase absorbed most of the \$3.6 billion for overruns appropriated by the Legislature in 2005. Further, the cost of the east span would continue to grow; the Oversight Committee projects that the final cost of the east span will be about \$6.5 billion. The additional \$1 billion was the result of increased costs in three areas: the diversion of traffic from the old bridge to a detour structure at Yerba Buena Island, the suspension span, and Caltrans' support costs. Of these projects, the Yerba Buena Island detour accounted for over \$340 million due to contract changes that combined the detour with other foundation work related to the Yerba Buena Island portion of the Bay Bridge. According to Caltrans, it advanced the foundation work on the Yerba Buena Island contract as a risk mitigation measure to get foundation work completed on schedule. It incurred more than \$260 million in additional costs on the suspension span in an attempt to mitigate delays, resolve complex construction issues, and keep the Bay Bridge opening on schedule.

Caltrans' support costs accounted for an additional \$390 million of the costs of the east span; this amount represents the cost of support personnel involved in developing and delivering the project, including staff such as project managers, engineers, and others. Any delays in the project, as well as contract changes, will increase costs in this area. The Oversight Committee projects that support costs on the east span will amount to about 26 percent of capital costs upon project completion. By comparison, in fiscal year 2015–16 Caltrans reported that the ratio of support to capital costs across all of its projects was much higher at about 38 percent.

Despite the continued growth in the cost of the east span, overall the seismic program will end in 2019 roughly on budget, due to the Oversight Committee and the application of risk management,

In 2005 Caltrans estimated the budget for the east span at \$5.5 billion, an amount roughly equal to the prior legislative appropriation for the entire seismic program.

The inclusion of a contingency fund in the budget has allowed the Oversight Committee to manage cost increases to the east span without going over budget.

as we discussed previously, as well as cost savings in other parts of the program and a \$900 million contingency in the program budget. In fact, the Oversight Committee reduced the overall program budget after achieving cost savings on other bridges. The final cost of retrofitting the Antioch and Dumbarton bridges was about \$180 million, nearly \$570 million less than projected. These reductions were largely the result of Caltrans' assessment that it could reduce project scope and risk by eliminating underwater work on the bridges. Further, Caltrans received significantly lower bids than anticipated for the work on both bridges. As Figure 6 demonstrates, in 2010 and 2013 the Oversight Committee chose to remove funds from the seismic program's budget entirely, reducing the budget from \$9.4 billion to about \$9 billion. State law gives the Toll Authority latitude in the use of toll revenues, and according to the Toll Authority's chief financial officer (CFO), MTC returned some of the Antioch and Dumbarton savings to the Toll Authority's toll account for use on other projects but generally did not direct them to a specific use. However, in 2013, MTC redirected \$130 million of savings from the seismic program to other Bay Area transit agencies for replacing buses and rail cars.

The inclusion of a contingency fund in the budget has allowed the Oversight Committee to manage cost increases to the east span without going over budget. In 2001 Caltrans included a \$448 million contingency in the program budget. By 2004 Caltrans had increased the estimated contingency to \$900 million. According to a 2004 report on the seismic program from the Toll Authority, Caltrans arrived at the \$900 million amount through a quantitative analysis that established a contingency range of between \$500 million and \$900 million. That amount was part of the estimate Caltrans provided to the Legislature in 2005 showing an increase of nearly \$3.6 billion in the seismic program. According to Caltrans' breakdown of contingency expenditures, the bulk of the \$900 million contingency has gone to the east span.

Our review of the Oversight Committee's most recent budget and cost projections indicates that the Oversight Committee anticipates \$112 million in remaining work before project closeout. The vast majority of the remaining expenditures relate to work on the east span. For instance, the largest item, \$76 million, is to dismantle the old east span and to retain and improve piers to allow for public access, collectively the final major phase of project closeout. Further, Caltrans' most recent risk management estimate show a reduced draw on the program's contingency fund, which will result in a surplus of roughly \$34 million at project closeout. Due to the resolution of several issues, including a recent settlement with the firm that built the suspension span, costs have come down slightly and Caltrans staff predict the seismic program will finish slightly under budget.

Figure 6
Effect of Oversight Committee Actions on Seismic Program Budget and Costs
(Billions of Dollars)



Source: State law and Oversight Committee quarterly reports.

Note: The 1997–2013 amounts represent budgeted amounts. In 2013 the Bay Bridge opened to traffic.

* The Antioch and Dumbarton bridges were added to the seismic program.

Based on contemporaneous Caltrans and MTC documents, cost overruns on the east span of the Bay Bridge did not cause significant delays on other bridges in the seismic program. Before the creation of the Oversight Committee, state law required Caltrans to issue annual reports on funds spent on the seismic program. These reports include information on anticipated

Caltrans finished the retrofit of two bridges within a year of its initial estimates, and it finished one within two years.

completion dates for each of the bridges. After examining those reports and comparing them to project completion dates, we determined that of the six bridges in the initial seismic program other than the Bay Bridge, Caltrans completed two on time, and it completed another—the Richmond–San Rafael Bridge—on time after revising its initial estimate. Caltrans finished the retrofit of two bridges within a year of its initial estimates, and it finished one within two years. According to Caltrans, the delays on the Richmond–San Rafael Bridge were the result of complications related to underwater foundation work and environmental restrictions. Further, Caltrans completed work on the main portion of the west span of the Bay Bridge earlier than its initial estimate, although it completed the approach to the west span on time after revising the initial estimate by one year. In fact, Caltrans had completed work on most of the bridges, aside from the east span, by 2005, when the Oversight Committee began managing the seismic program. MTC’s executive director stated that MTC’s increased responsibility after 2005 did not negatively affect other projects that were in progress. Caltrans finished retrofitting the Antioch and Dumbarton bridges, added to the seismic program in 2009, on time and well under budget.

The Toll Authority Forecasts Sufficient Toll Revenues to Meet Maintenance Expenditures Over the Next Decade

In addition to funding toll bridge retrofitting and eventual replacement, the Toll Authority funds bridge maintenance. Bridges are complex structures that require both routine and long-term maintenance throughout their lifespans. State law specifies that Caltrans is responsible for maintaining the Bay Area toll bridges, and once seismic work is complete on each bridge, the Toll Authority will be responsible for funding that maintenance. According to Caltrans’ records, the cost of routine maintenance—which includes activities such as graffiti cleanup, deck repair, and inspections—on the Bay Area toll bridges ranged from about \$8 million to \$13 million annually from fiscal years 2012–13 through fiscal year 2016–17. Costs associated with rehabilitation—which includes all nonroutine activities such as replacement of damaged or worn components, improved toll collection systems, and studies—totaled about \$110 million in fiscal year 2016–17. The Toll Authority already pays for maintenance and rehabilitation costs for most of the Bay Area toll bridges, and when Caltrans completes work on the Bay Bridge, it will begin billing the Toll Authority for maintenance and rehabilitation costs on that bridge as well.

The Toll Authority forecasts that it will collect sufficient revenue to meet the bridges’ maintenance and rehabilitation needs over the next 10 fiscal years, projecting that toll revenues will increase

from \$724 million in fiscal year 2016–17 to \$889 million in fiscal year 2026–27. This revenue would also be sufficient to cover the Toll Authority’s expenses, including payments on bonds. After reviewing the revenue forecasts for the previous 10 fiscal years, we determined that actual revenues have consistently exceeded revenue forecasts by small amounts, suggesting that future forecasts are reasonable. Before the passage of Regional Measure 3 in June 2018, the Toll Authority had projected the need for a \$1 toll increase in fiscal year 2026–27. According to the Toll Authority’s CFO, this was to prepare for the replacement of the region’s oldest toll bridges, several of which are over 50 years old. However, because Regional Measure 3 authorizes a series of toll increases and transportation projects beginning in 2019, the Toll Authority’s most recent projections are outdated. The increased revenue from Regional Measure 3 may make the \$1 increase in fiscal year 2026–27 unnecessary. According to the Toll Authority’s CFO, the Toll Authority will update its revenue projections in the next fiscal year. In fact, it will need to do so when it prepares to issue bonds to fund future projects.

Finally, the Toll Authority maintains a reserve for maintenance and rehabilitation costs to help ensure that it is able to meet future needs. The Toll Authority retains consultants to help it predict future maintenance and rehabilitation needs. Based on the consultants’ work, the Toll Authority created a reserve for maintenance and rehabilitation. That reserve is currently \$120 million and is based on costs of \$60 million per year. Although this is below the maintenance and rehabilitation costs for fiscal year 2016–17, these costs fluctuate from year to year. According to the Toll Authority’s CFO, the authority builds the rehabilitation budget on a “life-to-date” basis—that is, it is less concerned about a single fiscal year’s expenditures, and focuses instead on whether the expenditures do not exceed the authorized budget over the life of the project. Nevertheless, according to its CFO, the Toll Authority is planning to reevaluate all of its reserves sometime next year in order to take into consideration changes due to the passage of Regional Measure 3 in June 2018. Further, an updated consultant’s assessment estimated that annual maintenance and rehabilitation costs would increase to an average of slightly more than \$90 million a year beginning in 2017, although this has not yet resulted in an update to the reserve.

The Toll Authority’s Payments on the Debt It Incurred as a Result of the Seismic Program Will Continue for Decades

Although state law allocated state funds for the seismic program, the total funding was a mix of state, federal, and, overwhelmingly, bond money backed by toll revenues. In fact, of the anticipated

\$9 billion final cost of the seismic program, more than \$6 billion will have come from toll revenues paid by drivers. The appendix on page 37 provides a breakdown of revenue sources for the seismic program.

The Toll Authority's debt service on bonds related to the seismic program will continue for decades. Based on the Toll Authority's power in state law to issue revenue bonds and use the proceeds for financing projects, it has generally issued bonds for both seismic and non-seismic projects. According to the Toll Authority's CFO, due to this pooling of bond funds it cannot separately identify interest payments for the seismic program. However, according to MTC's most recent financial statements, it will pay \$9.3 billion from fiscal years 2017–18 through 2055–56 in interest on various MTC projects. When outstanding principal is included, the Toll Authority's remaining debt service payments through fiscal year 2055–56 will total \$18.7 billion.

The Toll Authority's practice of pooling bond proceeds from both seismic and non-seismic projects is within its authority and benefits the region. Not only does state law give the Toll Authority broad powers to issue bonds and use bond proceeds, its CFO stated that doing so creates several advantages such as reducing risk for investors and creating additional funding to cover debt. He also said that pooling has led to more favorable financing terms that allow the Toll Authority to maximize the amount of funding it receives for the bonds it issues.

Recommendations

Legislature

To ensure that large transportation infrastructure projects throughout the State benefit from appropriate oversight, the Legislature should require that all publicly funded major transportation infrastructure construction projects estimated to cost \$500 million or more, have oversight committees subject to open meeting laws. When practical, each oversight committee should include individuals from at least three major agencies involved in the project, with roles that reflect financial interests as well as project execution and oversight. Further, when possible, each committee should include at least five members to support its ability to conduct day-to-day business without violating open meeting law requirements. The oversight committees should act as the authorities for critical decisions and have sufficient staff to support their decision-making roles.

To ensure that oversight committees perform their duties in a manner commensurate with the demands of large transportation infrastructure projects, the Legislature should require that the oversight committees have duties similar to those of the Oversight Committee, including the following:

- Providing project direction.
- Reviewing project status, costs, schedules, and staffing levels.
- Resolving project issues and evaluating project changes.
- Developing and regularly updating cost estimates, risk assessments, and cash-flow requirements.

To ensure that oversight committees effectively address both the fiscal and project management elements of large transportation infrastructure projects, the Legislature should require consolidated reporting at least annually detailing cost savings, cost overruns, and updates on project completion.

To ensure that oversight committees and the agencies involved in large transportation infrastructure projects engage in sufficient and appropriate risk management, the Legislature should require all publicly funded transportation infrastructure projects with a total estimated cost of \$500 million or more to develop risk management plans that use both qualitative and quantitative risk analyses throughout the course of the projects.

MTC

To ensure that future projects have adequate risk management, MTC should formalize a scalable risk management policy by June 2019 so that the projects it directs benefit from sufficient and ongoing risk management.

We conducted this audit under the authority vested in the California State Auditor by Government Code 8543 et seq. and according to 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 specified in the Scope and Methodology section of the report. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Respectfully submitted,



ELAINE M. HOWLE, CPA
California State Auditor

Date: August 28, 2018

Staff: John Lewis, MPA, Audit Principal
Nicholas B. Phelps, JD
Christina L. Downard
Joseph S. Sheffo, MPA
Ashley Snyder

Legal Counsel: Heather Kendrick, Sr. Staff Counsel

For questions regarding the contents of this report, please contact Margarita Fernández, Chief of Public Affairs, at 916.445.0255.

Appendix

FUNDING SOURCES FOR THE SEISMIC PROGRAM

Upon California voters passing the Seismic Retrofit Bond Act of 1996, the Legislature began appropriating funds for the seismic program from a variety of sources. In 2005 the Legislature required that toll revenues—which account for about two-thirds of total revenues in the seismic program—cover any excess costs associated with the east span of the Bay Bridge. The table lists the sources of these funds.

Table
Seismic Program Funding Sources

Toll Authority Financing	SOURCE LEGISLATION	AMOUNTS APPROPRIATED (IN MILLIONS)
<i>Bay Area Seismic Surcharge</i>	Assembly Bill 1171 (2001)	\$2,282
	Assembly Bill 144 (2005)	2,150
	Assembly Bill 1175 (2009)*	750
<i>Toll revenue consolidation:</i> Funds made available as a result of legislative action consolidating toll revenues under the Toll Authority's management and the refinancing of the Toll Authority's bonds	Assembly Bill 144 (2005)	820
	TOLL AUTHORITY SUBTOTAL	\$6,002
State Financing		
<i>Seismic Retrofit Bond Act</i>	Proposition 192 (1996) Senate Bill 60 (1997)	\$790
State Contributions		
State Highway Account	Senate Bill 60 (1997)	\$745
Transit Capital Improvement Program funded by the Transportation Planning and Development Account in the State Transportation Fund	Senate Bill 60 (1997)	130
Vincent Thomas Toll Bridge Revenue Account	Senate Bill 60 (1997)	15
San Diego–Coronado Toll Bridge Revenue Fund	Senate Bill 60 (1997)	33
Interregional Transportation Improvement Plan/ State Highway Operation Protection Plan	Assembly Bill 1171 (2001)	448
State Highway Account (for the demolition of the east span)	Assembly Bill 144 (2005)	300
State Highway Account	Assembly Bill 144 (2005)	130
Motor Vehicle Account	Assembly Bill 144 (2005)	75
Public Transportation Account	Assembly Bill 144 (2005)	125
	STATE SUBTOTAL	\$2,791
Federal Contributions		
Federal Highway Bridge Replacement and Rehabilitation Program	Assembly Bill 1171 (2001)	\$642
	FEDERAL SUBTOTAL	\$642
	TOTAL	\$9,435

Source: State law and Oversight Committee reports.

* Assembly Bill 1175 appropriated funding for the retrofit of the Antioch and Dumbarton bridges from savings in other parts of the seismic program and authorized the Toll Authority to raise tolls to pay for the retrofit's completion. The Oversight Committee appropriated \$750 million from toll revenues, and the Toll Authority increased tolls by \$1 in 2010.

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August 2018



METROPOLITAN
TRANSPORTATION
COMMISSION



Bay Area Metro Center
375 Beale Street, Suite 800
San Francisco, CA 94105
415.778.6700
www.mtc.ca.gov

Jake Mackenzie, Chair
Sonoma County and Cities

Scott Haggerty, Vice Chair
Alameda County

Alicia C. Aguirre
Cities of San Mateo County

Tom Azumbrado
U.S. Department of Housing
and Urban Development

Jeannie Bruins
Cities of Santa Clara County

Damon Connolly
Marin County and Cities

Dave Cortese
Santa Clara County

James E. Davis
California State
Transportation Agency

Carol Dutra-Vernaci
Cities of Alameda County

Dorene M. Giacopini
U.S. Department of Transportation

Federal D. Glover
Contra Costa County

Anne W. Halsted
San Francisco Bay Conservation
and Development Commission

Nick Josefowitz
San Francisco Mayor's Appointee

Jane Kim
City and County of San Francisco

Sam Liccardo
San Jose Mayor's Appointee

Alfredo Pedroza
Napa County and Cities

Julie Pierce
Association of Bay Area Governments

Libby Schaaf
Oakland Mayor's Appointee

Warren Stocum
San Mateo County

James P. Spering
Solano County and Cities

Amy R. Worth
Cities of Contra Costa County

Steve Heminger
Executive Director

Alix Bockelman
Deputy Executive Director, Policy

Andrew B. Fremier
Deputy Executive Director, Operations

Brad Paul
Deputy Executive Director,
Local Government Services

August 8, 2018

Ms. Elaine Howle, CPA*
California State Auditor
621 Capital Mall, Suite 1200
Sacramento, CA 95814

Re: Draft Report "Seismic Retrofit: The State Could Save Millions of Dollars Annually by Implementing Lessons Learned from the Program"

Dear Ms. Howle:

Thank you for the opportunity to review and comment on your draft report, titled "*Seismic Retrofit: The State Could Save Millions of Dollars Annually by Implementing Lessons Learned from the Program.*" We have three comments on your draft report as follows:

First, since submission of your draft report for our review, the Toll Bridge Program Oversight Committee has issued their 2nd Quarter 2018 TBSRP Progress Report that now forecasts a program cost surplus. The report has been submitted to your staff and we request your consideration to update your draft report to reflect this new information. ①

Second, we accept your recommendations for MTC to adopt a risk management policy for our major projects and programs.

Third, while we accept your recommendation that having oversight committees over major projects would be beneficial to successful project delivery, we would suggest your consideration of additional flexibility over mega projects selected for additional oversight. The MTC Draft 2019 TIP includes 19 projects with cost greater than \$500 million. MTC would not have the capacity to have executive participation in 19 oversight committees. Furthermore, some of those projects are "state of good repair" type projects where oversight committees may not be entirely warranted. Perhaps examination of a risk, higher dollar threshold, and/or focus on certain project types (i.e. capital construction projects) would be appropriate. ②

Lastly, we have identified some additional suggested minor revisions and comments that are attached. If you have any questions or need additional support, please do not hesitate to call or contact me at (415) 778-5240.

Sincerely

Andrew B. Fremier
Deputy Executive Director, Operations
Metropolitan Transportation Commission

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* California State Auditor's comments appear on page 41.

Ms. Elaine Howle, CPA
California State Auditor
August 8, 2018

Attachment A – Suggested Revisions and Comments

- ③④ 1) On Page 5, Figure 3, the description of Bay Area Toll Authority, rather than “Manages all toll revenues . . .”, it should simply state, “administers toll revenues” For a reference, see SH Code Section 30950.2
- ③⑤ 2) On Page 8, first paragraph, for consistency to the use of San Diego-Coronado Bridge, suggest revising “Vincent Thomas Bridge” to “Los Angeles-Vincent Thomas Bridge”.
- ③⑥ 3) On Page 9, first paragraph, suggest clarifying MTC and Toll Authority roles and responsibilities as legally separate entities with separate responsibilities, but with shared same staff, directors, and facility.
- ③⑦ 4) On Page 11, second paragraph, Regional Measure 3 will help complete the Bay Area Express Lanes Network, but does not fully fund the completion of the network.
- ⑧ 5) On Page 24, last paragraph, suggest clarifying that the Toll Authority, not MTC, is implementing an asset management plan with Caltrans over the Toll Bridges. MTC is involved in other asset management plans as required/appropriate, including for transit assets and for local roads throughout the region, which are not relevant to this report.
- ③⑨ 6) On page 35, at end of paragraph, “form” should be “from.

Comments

CALIFORNIA STATE AUDITOR'S COMMENTS ON THE RESPONSE FROM THE METROPOLITAN TRANSPORTATION COMMISSION

To provide clarity and perspective, we are commenting on the response to our audit report from MTC. The numbers below correspond to the numbers we placed in the margin of the response.

We reviewed the 2nd quarter 2018 Progress Report for the Seismic Program and updated our report where appropriate.

①

We appreciate MTC's perspective related to our recommendation that the Legislature set the threshold for oversight committees on large transportation infrastructure projects at \$500 million. However, as we note on page 22, we set the threshold in our recommendation at \$500 million because that is the definition of a *major project* in federal law. When we reviewed the draft 2019 Transportation Improvement Plan, we determined that some of the 19 projects MTC mentions in its response would not be affected by our recommendation because they are not construction projects for transportation infrastructure. Further, our recommendation on page 34 provides flexibility as to which agencies should comprise an oversight committee. We recommend that when practical the committee should include representatives from at least three major agencies involved in the project, but we do not specify which agencies.

②

While preparing our draft report for publication, some page numbers shifted. Therefore, the page numbers MTC cites in its response do not correspond to the page numbers in our final report.

③

We incorporated MTC's suggested revision in Figure 3 on page 8.

④

Streets and Highways Code section 188.5 specifies the name of the Vincent Thomas Bridge.

⑤

Figure 3 on page 8 and our footnote on page 23 makes this distinction clear.

⑥

We clarified that Regional Measure 3 provides support for the Bay Area Express Lanes Network on page 10.

⑦

We clarified that the Toll Authority is implementing the asset management plan on page 24.

⑧

We corrected the typographical error MTC identified on page 34.

⑨