

**Edmund G. Brown Jr.**  
Governor

915 Capitol Mall, Suite 350B  
Sacramento, CA 95814  
916-323-5400  
[www.calsta.ca.gov](http://www.calsta.ca.gov)

**Brian P. Kelly**  
Secretary

May 6, 2015

The Honorable Edmund G. Brown Jr.  
Governor of California  
State Capitol, Suite 1173  
Sacramento, CA 95814

Dear Governor Brown:

I am pleased to submit the California Department of Transportation's "2015 Five-Year Maintenance Plan," prepared in accordance with Streets and Highways Code section 164.6.

Distribution to the California State Legislature has been made pursuant to Government Code section 9795. This report can be found at [www.dot.ca.gov/reports-legislature.htm](http://www.dot.ca.gov/reports-legislature.htm).

Sincerely,



**BRIAN P. KELLY**  
Secretary

Enclosure  
2015 Five-Year Maintenance Plan

*Distribution:*

Diane Boyer-Vine, Legislative Counsel, California State Legislature  
Daniel Alvarez, Secretary of the Senate, California State Senate  
E. Dotson Wilson, Chief Clerk of the Assembly, California State Assembly  
Will Kempton, Executive Director, California Transportation Commission

**DEPARTMENT OF TRANSPORTATION**

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*Serious drought.  
Help save water!*

May 6, 2015

Mr. Will Kempton  
Executive Director  
California Transportation Commission  
1120 "N" Street, Room 2233 (MS 52)  
Sacramento, CA 95814

Dear Mr. Kempton:

I am pleased to submit the California Department of Transportation's "2015 Five-Year Maintenance Plan," prepared in accordance with Streets and Highways Code section 164.6.

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Sincerely,

A handwritten signature in blue ink, appearing to read "Malcolm Dougherty".

MALCOLM DOUGHERTY  
Director

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2015 Five-Year Maintenance Plan

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*Serious drought.  
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May 6, 2015

Mr. E. Dotson Wilson  
Chief Clerk of the Assembly  
State Capitol, Room 3196  
Sacramento, CA 95814

Dear Mr. Wilson:

I am pleased to submit the California Department of Transportation's "2015 Five-Year Maintenance Plan," prepared in accordance with Streets and Highways Code section 164.6.

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May 6, 2015

Ms. Diane Boyer-Vine  
Legislative Counsel  
State Capitol, Room 3021  
Sacramento, CA 95814

Dear Ms. Boyer-Vine:

I am pleased to submit the California Department of Transportation's "2015 Five-Year Maintenance Plan," prepared in accordance with Streets and Highways Code section 164.6.

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May 6, 2015

Mr. Daniel Alvarez  
Secretary of the Senate  
State Capitol, Room 3044  
Sacramento, CA 95814

Dear Mr. Alvarez:

I am pleased to submit the California Department of Transportation's "2015 Five-Year Maintenance Plan," prepared in accordance with Streets and Highways Code section 164.6.

Distribution to the California State Legislature has been made pursuant to Government Code section 9795. This report can be found at <[www.dot.ca.gov/reports-legislature.htm](http://www.dot.ca.gov/reports-legislature.htm)>.

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2015 Five-Year Maintenance Plan

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Will Kempton, Executive Director, California Transportation Commission

**CALIFORNIA DEPARTMENT OF TRANSPORTATION**



**2015 Five-Year Maintenance Plan**

**To Be Finalized with the 2015 Ten-Year State Highway  
Operation and Protection Program Plan, May 2015**



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## **REQUIREMENTS OF STREETS AND HIGHWAYS CODE SECTION 164.6**

Streets and Highways Code section 164.6 requires the California Department of Transportation (Caltrans) to prepare a five-year maintenance plan, updated every two years and submitted each odd-numbered year. The Five-Year Maintenance Plan shall address the State Highways System's maintenance needs for pavement, bridge, and drainage. Section 164.6 also requires Caltrans to attempt to balance resources between the ten-year State Highway Operations and Protection Program (SHOPP) Plan and the Five-Year Maintenance Plan.

Section 164.6 requires the five-year maintenance plan to include the following:

- Only maintenance activities that, if the activities were not performed, could result in increased SHOPP costs in the future.
- Identified backlog and recommended strategies, specific activities, and funding to reduce or prevent backlog during the five years of the maintenance plan.
- Specific goals and quantifiable accomplishments.
- Cost control and efficiency strategies.
- Cost estimates for the five years of the maintenance plan.
- SHOPP cost avoidance from implementation of the maintenance plan.
- A budget model that allows achieving the requirements of this legislation.

The full text of Streets and Highways Code section 164.6 is appended.





## EXECUTIVE SUMMARY

The State of California and its partners have strategically invested in the State Highway System (SHS) for more than a century to develop the core of California's complex, multimodal transportation system. Hundreds of billions of dollars have been applied to construct, maintain, and operate more than 50,000 state highway lane-miles that include more than 13,000 bridges and other structures, providing transportation access to every region of the State. This system is the foundation of California's economy, the world's eighth largest, enabling the efficient movement of people, goods, and services throughout the State. Our remarkable economy and more than 38 million residents are dependent on the continued availability of safe, reliable, well-maintained highways.

In order to keep the SHS functioning well, it is necessary to invest continually in maintaining, instituting safety improvements, modernizing, and as needed, reconstructing highway facilities. Many of the highways and bridges that were built in the mid-20th century are in need of substantial renovation and sometimes even replacement. Newer facilities also require regular maintenance to keep pavement, bridges, and other facilities in good condition as well as responding to damage from natural disasters and vehicle collisions. Applying a "fix-it-first" perspective to the SHS prioritizes available funding to address these basic needs. Most of the costs to respond to these system preservation needs are predictable and can be scheduled based on periodic facility inspections and assessments, while other costs, such as damage caused by accidents, are unexpected and must be dealt with as they occur. An underlying assumption in keeping the SHS in good condition is that there is sufficient funding available to provide the needed preventative maintenance activities. Absent such funding, the SHS will deteriorate at a faster rate and necessitate much more expensive remedies in the future and possibly force the closure of some facilities due to unacceptable conditions.

As highlighted in Governor Brown's proposed 2015-16 State Budget, California currently has many billions of dollars in deferred maintenance and rehabilitation for highway infrastructure due to long-term under-investment in system preservation. If additional revenue were available, Caltrans could target the funding to address the highest-priority goals to achieve outcomes such as:

- Achieve 90 percent "good pavement" by reducing distressed lane miles to 10 percent
- Achieve 95 percent bridge health index
- Achieve 90 percent of culverts in good health

This "2015 Five-Year Maintenance Plan" (2015 Maintenance Plan), as required by statute, addresses the maintenance needs of the SHS for maintenance activities that, if not performed, could result in increased preservation needs requiring SHOPP funding in the future. Caltrans accomplished the bridge goal specified in the 2013 Maintenance Plan but was unable to meet the pavement and drainage assessment goals because of several external factors.



The current baseline funding for the maintenance program is \$433.5 million annually, after adjusting staff expenditures for Bridge Program maintenance crews. At current revenue assumptions, this same expenditure level of \$433.5 million is recommended. If additional revenue were to be available, a combination of SHOPP and maintenance funding augmentations would be recommended to best manage and maintain these transportation assets.

The 2015 Maintenance Plan is coordinated with the "2015 Ten-Year State Highway Operations and Protection Program Plan" and is consistent with the provisions of the federal transportation bill, "Moving Ahead for Progress in the 21st Century Act" or "MAP-21" (Pub. L. 112-141, July 6, 2012; 126 Stat. 405), which requires Caltrans to implement a comprehensive asset management program.

**Pavement Maintenance.** The SHS includes more than 50,000 lane-miles of pavement. The pavement maintenance goal established in the 2013 Maintenance Plan was to repair 2,100 lane-miles annually. Caltrans did not succeed in meeting that goal because of increased average construction costs and a greater percentage of higher-cost maintenance strategies such as thin overlays, in-place recycling, and slab replacements.

**Bridge Maintenance.** The State bridge inventory now includes more than 13,100 bridges. The bridge maintenance annual goal established in the 2013 Maintenance Plan was to reduce the bridge backlog to 10 percent of the inventory at that time, or approximately 1,290 bridges. Caltrans exceeded that goal by an additional 10 percent, reducing the backlog to approximately 1,160 bridges. Through a combination of strategic planning, maintenance field activities, and delivery of bridge preservation contracts, Caltrans has slowed the growth of the backlog of bridge maintenance needs. The Bridge Program recorded a 47 percent reduction in new SHOPP recommendations from historic levels.

As mentioned earlier in the report, the Bridge Program funding level has been revised to reflect updated staff expenditures for maintenance crews, effectively adjusting the baseline funding level associated with the Bridge Program to \$176.5 million annually. The State bridge inventory has increased steadily during the last several years, and Caltrans expects the inventory will continue to increase in the future. The bridge maintenance goal in the 2015 Maintenance Plan is to reduce the backlog to 1,090 bridges, or 8 percent of the inventory, during the next five years.

**Drainage Maintenance.** The SHS includes an estimated 205,000 culverts. The current investment level is \$23 million annually for draining inspection and maintenance. The drainage maintenance annual goal will be to repair 140 culverts through contract work and inspect 12,000 culverts a year.

Based on a two-year average of fiscal years (FY) 2012/13 and 2013/14, Caltrans was able to accomplish both the repair and inspection goals. The inspection rate historically has been different each year because of several external factors, such as right-of-way constraints, environmental issues, and the difficulty of assessing various culvert locations.



Approximately 50 percent of the total State drainage system has been inspected to date, or approximately 101,250 culverts, and about 40 percent require some type of maintenance repair. Approximately 26 percent of the culverts inspected annually require corrective maintenance repair work.

**Level of Service.** The Maintenance Level of Service (LOS) Program was developed to evaluate and report how well the Division of Maintenance is able to maintain the State's highways according to guidelines established in the Maintenance Manual. The Maintenance Program repairs pot holes/spalls, performs crack sealing, tree and brush encroachment, and maintains raised pavement markers on more than 50,000 lane-miles on the SHS. Caltrans has approximately 50,814 linear miles of striping, 3,971 miles of guardrail, 5,160 miles of median barriers, 2,839 attenuators, and 39,425 acres of landscape.

Table 2 reflects the LOS activity and score as of the 2014 survey. An additional annual investment of \$98 million and 926 positions for ten years would be required to reach and maintain Caltrans' LOS goals in the safety areas of pot holes/spalls, crack sealing, striping, raised pavement markers, attenuators, median barrier, guardrail, and tree and brush encroachment on roadways. LOS activities represent cost avoidance to the SHOPP when performed in the maintenance program.



## THE MAINTENANCE PROGRAM

In 2005, the Governor and the Legislature approved Caltrans' inaugural maintenance plan as a means of ensuring the reliability of California's SHS by completing critically needed preventive maintenance work. The 2005 Maintenance Plan included baseline funding of \$148 million beginning in July 2006 for preventive maintenance work associated with pavement, bridges, and drainage systems on the more than 49,500 lane-miles of the SHS. The governing administration and the Legislature subsequently augmented the Maintenance Program by \$138 million, of which \$128 million was redirected from the SHOPP and \$10 million from the approval of a Budget Change Proposal in FY 2006/07. This additional funding brought the level of investment to a total of \$286 million for the 2005 Maintenance Plan.

In the 2007 Maintenance Plan, Caltrans recommended an increase of \$147.1 million. Subsequently, SHOPP funding was redirected in FY 2007/08 to augment the Maintenance Program by a total of \$126.1 million: \$85 million for pavement and \$41.1 million for bridges. This funding was directed specifically to preventive maintenance-type work, consistent with Caltrans' recommendation, bringing the total annual investment of the 2007 Maintenance Plan to \$412.1 million. In the 2009 Maintenance Plan, Caltrans did not recommend an increase in funding from the 2007 Maintenance Plan. However, a total of \$57 million one-time funding resulting from the federal American Recovery and Reinvestment Act of 2009 was authorized from FY 2008/09 through FY 2009/10. The funding level of the 2011 Maintenance Plan and recommended level of the 2013 Maintenance Plan remain at the total annual investment of \$412.1 million. The current funding has been updated to reflect revised staff expenditures for maintenance crews effectively adjusting our baseline Bridge Program funding to \$176.5 million a year. This brings the total funding for the Maintenance Program to \$433.5 million. The 2015 Maintenance Plan recommends the funding level remain consistent.

Currently, the baseline annual funding of \$433.5 million includes \$234 million for pavement maintenance, \$176.5 million for bridge maintenance, and \$23 million for drainage maintenance. By sustaining the current funding level, the pavement maintenance backlog will increase by 120 miles each year and the bridge backlog will decrease by 54 bridges. The drainage system inventory is incomplete and not all the needed rehabilitation work has been identified, but Caltrans estimates an additional 3,120 culverts will need corrective maintenance repair work each year; the current funding level will reduce the rate of drainage maintenance backlog increase but will not eliminate it.

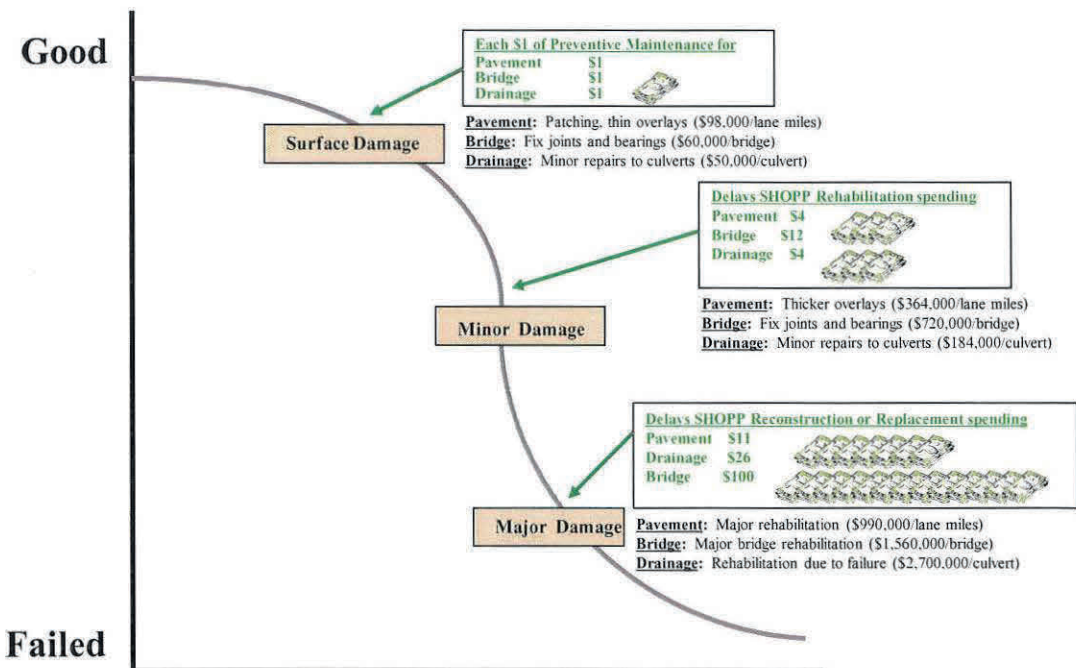
Preventive maintenance is the most cost-effective means of protecting the State's infrastructure investment. In the 2015 Maintenance Plan, Caltrans recommends strategies to prevent deterioration and extend the life of the pavement, bridge, and drainage in fair or good condition. As listed in Table 1, the average cost for a SHOPP roadway rehabilitation project to treat one lane-mile of minor pavement damage in FY 2011/12 was \$364,000, and the average cost of pavement maintenance was \$98,000 a lane-mile, which is slightly higher than reported in the 2013 Maintenance Plan. Pavement maintenance results in a cost-benefit ratio of about 4:1. Similarly, the cost-benefit ratio for bridge maintenance is 12:1 (\$720,000 for minor damage rehabilitation versus \$60,000 for preventive maintenance) and 4:1 for drainage maintenance



(\$184,000 for minor damage rehabilitation versus \$50,000 for preventive maintenance). Table 1 lists these cost-benefit ratios, and the chart following it displays preventive maintenance cost-effectiveness.

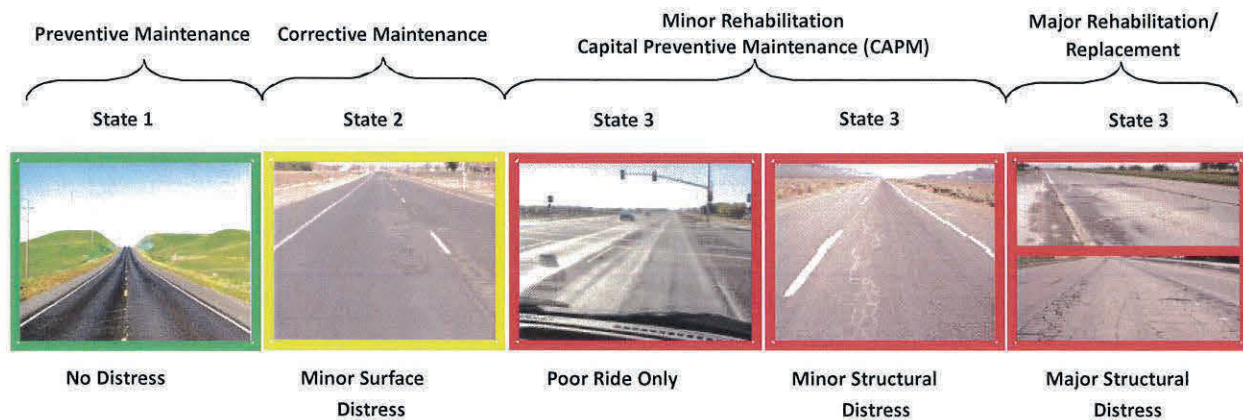
<b>FY2011/12 Capital Construction Costs Only</b>	<b>Cost of Rehabilitation (\$000)</b>	<b>Cost of Preventive Maintenance (\$000)</b>	<b>Unit of Measure</b>	<b>Cost-Benefit Ratio</b>
Pavement	364	98	Lane-mile	4:1
Bridge	720	60	Bridge	12:1
Drainage	184	50	Culvert	4:1

### COST EFFECTIVENESS CHART



## PAVEMENT MAINTENANCE

Based on Caltrans' assessments of SHS pavement conditions, only 59 percent of all state highway lane-miles are in good condition, with 25 percent of lane miles requiring preventive or corrective maintenance treatments, and approximately 16 percent of lane-miles in distressed condition that requires major or minor rehabilitation. Preventive and corrective maintenance treatments are generally less expensive than minor and major rehabilitation. Preventive treatments include seal coats, cold in-place recycling or thin asphalt-concrete (AC) overlays. Corrective maintenance treatments include digouts, cold plane and replace pavement and isolated slab replacements. Minor rehabilitation, such as a thicker AC overlay or concrete panel replacement, is more expensive and requires a longer lead-time to prepare the project for funding. And finally, major rehabilitation requires the removal of existing pavement and possibly the removal of subgrade material to reconstruct the road base. Major rehabilitation also often necessitates the upgrading or replacement of other roadway features, such as culverts, and is far more expensive and takes much longer to develop and construct. These projects may also require expensive environmental and cultural resources mitigation due to impacts.



**State 1:** Good/excellent condition with few potholes or cracks ⇒ Preventive maintenance project

**State 2:** Fair condition with minor cracking or slab cracking ⇒ Corrective maintenance project

**State 3:** Poor condition with significant to extensive cracks or poor ride only ⇒ CAPM, rehabilitation or reconstruction project

In the past, Caltrans personnel conducted manual, visual inspections of the SHS to determine pavement conditions. Due to the lengthy extent of the SHS (50,000 miles), worker safety considerations, and potential traffic disruptions caused by inspection activities, it was not possible to inspect every lane-mile of the highway system. Instead, sample inspections were conducted at regular intervals along the outside lane of highways and then condition estimates were made for the entire highway based on those sample inspections. Recognizing the shortcomings of such an assessment methodology and the recent availability of dramatically improve assessment technologies, Caltrans invested in developing the Automated Pavement Condition Survey (APCS.) APCS utilizes a specially developed vehicle that collects pavement distress data utilizing lasers and photography to assess every lane-mile of the SHS in its entirety and in detail. California is the only state to have such a tool. The refined assessment enables

Caltrans to optimize our ability to select the best pavement preservation strategy at the right time. This has helped to reduce the cost of projected pavement preservation funding needs.



Automatic Road Analyzer Vehicle

Example of Pavement Detail from APCS

The SHS includes more than 50,000 lane-miles of pavement. Caltrans' "2013 State of the Pavement Report" states that 7,820 lane-miles (16 percent) of the SHS are in a distressed condition; 12,364 lane-miles (25 percent) are in fair condition and require pavement maintenance; and 29,534 lane-miles (59 percent) are in excellent condition. The 2015 Maintenance Plan focuses preservation strategies on pavement identified as being in good or fair condition, while the 2015 SHOPP focuses on pavement identified as being in a distressed condition.

The pavement maintenance goal established in the 2013 Maintenance Plan was to repair 2,100 lane-miles annually. Although Caltrans did not succeed in meeting that goal because of increased average construction costs and a greater percentage of higher-cost maintenance strategies such as thin overlays, in-place recycling, and slab replacements, Caltrans projects that 2,100 lane-miles will be treated in FY 2014/15 and annually during the next few years.

At the current baseline funding level of \$234 million, the pavement maintenance backlog will increase approximately 3 percent, from 12,404 to 13,611 lane-miles during a ten-year period. At current revenue assumptions, this same expenditure level of \$234 million is recommended to for Pavement Program expenditures. If additional revenue were to be available, pavement rehabilitation in the SHOPP would be a higher-priority than additional preventative maintenance. If bridge rehabilitation was funded consistent with the 2015 Ten-Year SHOPP goal-constrained plan, no additional funding is recommended for the pavement preventative maintenance program, as growth of future maintenance would be reduced. If pavement rehabilitation in the SHOPP is not fully funded, the bridge maintenance need will continue to grow over time.

To trim pavement costs and overcome the challenges of maintaining the SHS in the future, Caltrans is turning to advanced technologies. One of the latest data collection technologies Caltrans has incorporated is ground-penetrating radar, which provides a snapshot of the layers underneath a pavement surface on the SHS and the corresponding pavement structure inventory data, including the thickness of the pavement layers. Another innovation Caltrans is



using for data collection is the automated pavement condition survey vehicle, which travels at highway speeds and collects pavement distress data at the pavement surface using lasers.

Caltrans also is implementing the state-of-the-art Pavement Management System, known as Pavem, which is anticipated to prioritize pavement projects and optimize limited funding efficiently to improve pavement performance. Pavem will provide the innovative tools and best practices that optimize pavement treatment strategies and improve pavement design, construction, and maintenance. Pavem will target future repairs that do the most good for the least amount of money.

In addition to Pavem, Caltrans is adopting a variety of other investment strategies to maximize limited funds, such as the following:

- Apply life-cycle cost analysis in design. Caltrans has doubled the rehabilitation design life of pavement from 20 to 40 years by using more effective pavement design and life-cycle cost analysis. This design analysis, applied during the planning and development of pavement capital projects, ensures the most cost-effective project is constructed at the lowest cost.
- Explore and maximize the Pavement Program and deliver pavement preservation and rehabilitation projects in a scheduled, timely manner.
- Follow an appropriate 3-year to 20-year cycle of preventive maintenance treatments on the SHS.
- Increase the use of sustainable pavements.
  - Using recycled materials in pavement reduces the impact on virgin materials and the environment while maintaining the same or better pavement performance. Caltrans uses recycled tires in some pavement, reducing the pressure on landfills. According to the "2013 Crumb Rubber Report," approximately 23 percent of all flexible pavement on the SHS was designed with rubberized asphalt.
  - Target \$36 million for cold-in-place recycling.

Together, these types of projects reduce the pressure on aggregate mines and greenhouse gas emissions. According to the April 2013 report "Caltrans Activities to Address Climate Change," it is estimated that more than 61,000 tons of greenhouse gas emissions are reduced annually using these innovative projects.

## **BRIDGE MAINTENANCE**

Caltrans' structural assets include more than 13,100 bridges on the SHS. State-owned bridges are an average of 43 years old. Five hundred fifty seven (557) bridges require major repair or rehabilitation, with an additional 369 bridges considered structurally deficient due to not meeting today's design standards. Caltrans' objective is to manage the bridge inventory





safely and economically to limit operational restrictions and prevent sudden closure or collapse. Major structural rehabilitation caused by lack of preventive maintenance is more costly than preventive maintenance and has the potential to cause significant long-term disruptions to mobility.

Bridge maintenance needs are identified during regularly scheduled bridge inspections mandated by federal regulations. Bridge maintenance needs fall into two general categories: State maintenance forces and Major Maintenance contract work. Bridge needs identified for maintenance bridge crews or Major Maintenance contracts are considered backlogged two years after the recommendation is made by the inspector. Bridge maintenance needs total approximately \$450 million over the five-year plan period of the backlog with 93 percent being contracts and the remaining 7 percent assigned to crews. Bridge crew needs have increased slightly during the past five years on work for smaller repairs that require immediate attention and other minor maintenance work. Bridge maintenance needs that are larger in size or complexity are packaged together into Major Maintenance contracts that are awarded to construction companies to perform.

At the beginning of FY 2013/14, Caltrans reported 1,771 bridges with backlogged Major Maintenance contract needs. Caltrans has developed projects to address the maintenance needs for 687 bridges during FY 2014/15. At the beginning of FY 2015/16, the number of bridges with backlogged Major Maintenance contract needs is projected to be 1,717, or approximately 13 percent of the inventory. Caltrans' goal is to reduce the number of bridges with backlogged Major Maintenance contract needs to approximately 1,090 bridges.

Bridge Program accomplishments and expenditures are tracking very closely with previous five-year plan projections. Through a combination of strategic planning, maintenance field activities, and delivery of bridge preservation contracts, Caltrans has slowed the growth of the backlog of bridge maintenance needs.

The rate of backlog reduction is a function of project delivery on the positive side and the rate of new backlog needs being identified on the negative side. As the inventory continues to age, the rate of newly identified maintenance needs is growing. Since 2005, the average number of bridge maintenance needs being identified annually has increased by 80 percent. Caltrans expects it will take approximately ten years to achieve the desired backlog levels. Caltrans is optimistic that the projected reductions identified in the 2015 Maintenance Plan will be realized in that time.

Caltrans continues to maximize efficiencies and control bridge maintenance costs by using new materials that last longer and are easier to apply, such as epoxy paints, polyester concretes, corrosion-resistant rebar, and design details. In addition, Caltrans is implementing policies to ensure new projects are constructed with cost-effective and easily maintainable elements, continually reviewing activities of other state departments of transportation to ensure the best business practices are employed in California.



The timely preventive maintenance made possible by funding authorized by previous maintenance and SHOPP plans has begun to slow the progression of bridges requiring major rehabilitation in the SHOPP. Since the inception of the maintenance plan, the Bridge Program recorded a 47 percent reduction in new SHOPP rehabilitation recommendations from historic levels. This decrease in SHOPP recommendations is a welcome trend and demonstrates that Caltrans is accomplishing the goals of the previous maintenance plan.

The current baseline funding has been revised to reflect updated staff expenditures for maintenance crews effectively adjusting our baseline Bridge Program funding to \$176.5 million a year. At current revenue assumptions, this same expenditure level of \$176.5 million is recommended to for Bridge Program expenditures. If additional revenue were to be available, bridge rehabilitation in the SHOPP would be a higher-priority than additional preventative maintenance. If bridge rehabilitation was funded consistent with the 2015 Ten-Year SHOPP goal-constrained plan, no additional funding is recommended for the bridge preventive maintenance program, as growth of future maintenance would be reduced. If bridge rehabilitation in the SHOPP is not fully funded, the bridge maintenance need will continue to grow over time.

## **DRAINAGE MAINTENANCE**

Culverts perhaps best exemplify the potentially severe consequences of not caring adequately for components of the transportation system that are out-of-sight but are critically important to the functioning and long-term viability of highways. The SHS includes many tens-of-thousands of culverts that drain rainwater, streams, and rivers away from highways. Culverts require regular maintenance to avoid costly replacement and possible catastrophic failure in the future. If a culvert becomes clogged, decays, or fails due to rust or other factors, and therefore fails to convey water away from the highway, the water may then flood the highway or erode highway foundations or adjacent slopes resulting in washouts of the road and its closure. Repairing such destruction is far more expensive than providing adequate funding to maintain and upgrade culverts.

The SHS includes an estimated 205,000 culverts. These culverts drain the State's highways, serving as conduits for streams, drainage channels, and other waterways to flow under highways. Culvert damage or failure can seriously damage roadways, create the need for extensive repairs, and threaten the mobility and safety of the traveling public. The 2013 Maintenance Plan provided for continuation of a proactive inspection program to identify damaged or failed culverts, and Caltrans has developed management procedures to measure the health of drainage systems, prioritize potential culvert projects based on condition, cost, and traveler delay, and track accomplishments and delivery schedules for maintenance work.

Approximately 50 percent of the total State drainage system has been inspected to date, about 101,250 culverts, and about 40 percent require some type of maintenance repair. Approximately 26 percent of the culverts inspected annually, or 3,120 culverts, require corrective maintenance repair work. At the beginning of FY 2012/13, Caltrans identified an estimated 14,315 culverts with backlogged preventive maintenance needs. During FY 2012/13,



196 culverts were repaired under contract, with an additional 165 culverts repaired in FY 2013/14. A total of 238 culvert repair work was done under the State forces during this time.

Caltrans was able to meet the 2013 Maintenance Plan drainage maintenance and inspection goals. At the current level of investment of \$23 million a year, Caltrans is able to repair 140 culverts through contract work and inspect 12,000 culverts a year. In ten years, 62 percent of the culverts will be in "good" health. A large percentage of culvert inspections and repairs identified through previous maintenance plans have included "easier" access and repairs, and it is anticipated that the remaining culvert inspections and repairs will be more difficult to address and require additional time and planning to complete. Several external factors, such as right-of-way constraints, environmental issues, multiyear mitigation permits, and difficulty in accessing various culvert locations, have played a role in drainage maintenance inspection progress.

At current revenue assumptions, this same expenditure level of \$23 million is recommended to for drainage maintenance expenditures. If additional revenue were to be available, a combination of SHOPP and maintenance funding augmentations would be recommended to best manage and maintain these drainage-related assets.

## LEVEL OF SERVICE

The Maintenance Level of Service (LOS) Program was developed to evaluate and report how well the Division of Maintenance is able to maintain the State's highways according to guidelines established in the Maintenance Manual.

LOS evaluations are conducted once a year and represent a snapshot of the roadway condition at the time the evaluations were conducted. LOS scores presented at the district level are not adjusted for Average Daily Traffic (ADT), terrain, or climate; the reader should consider these characteristics when comparing LOS scores for each district. LOS scores are primarily used as a tool by the Division of Maintenance to assess how well policies established in the Maintenance Manual are implemented statewide.

The Maintenance Program repairs pot holes/spalls, performs crack sealing, tree and brush encroachment, and maintains raised pavement markers on more than 50,000 lanes miles on the SHS. Caltrans has approximately 50,814 linear miles of striping, 3,971 miles of guardrail, 5,160 miles of median barriers, 2,839 attenuators, and 39,425 acres of landscape. Table 2 reflects the LOS element and score as of the 2014 survey. An additional annual investment of \$98 million and 926 positions for ten years would be required to reach and maintain Caltrans' LOS goals in the safety areas of pot holes/spalls, crack sealing, striping, raised pavement markers, attenuators, median barrier, guardrail, and tree and brush encroachment on roadways.

The activities identified in Table 2 represent cost avoidance to the SHOPP when performed in the maintenance program. At current revenue levels, no staff or funding increases are recommended for these activities.



<b>Table 2. LEVEL OF SERVICE</b>						
<b>LOS Activity and Score</b>			<b>Additional Funding Necessary to Attain LOS Goal</b>			
<b>LOS Element</b>	<b>Current LOS</b>	<b>Goal LOS</b>	<b>Positions Required</b>	<b>Personnel Services Funding (\$)</b>	<b>Operating Expense Funding (\$)</b>	<b>Total Dollars (\$)</b>
<b>Safety Items</b>						
Potholes/Spalls/ Crack Sealing	56	90	580	40,570,288	21,516,394	62,086,682
Striping/Raised Pavement Makers	85	95	111	7,730,435	7,657,300	15,387,735
Attenuators/ Median Barrier/ Guardrail	92	95	26	1,832,251	1,038,209	2,870,460
Tree and Brush Encroachment	65	95	132	9,225,109	2,081,912	11,307,021
Bridge Maintenance Crew	26	90	77	5,309,000	924,000	6,233,000
Total	---	---	926	64,667,083	33,217,815	97,884,898



## MAINTENANCE PROGRAM BUDGET MODEL

The Maintenance Program Budget Model was developed to enhance budget management capabilities on an annual basis. The performance-based model uses a combination of historical expenditures, LOS performance measures, and inventory data to project future resource needs with performance-level expectations for the entire SHS. While the budget model does include all resources, the model is used primarily to determine a performance-based budget for field maintenance activities.

Historically, the budget model grouped Caltrans' 12 districts into sets of comparable units, using geographic, population, and traffic volume characteristics. Current versions of the model have shifted the focus from district-level analysis to route-level analysis by grouping all routes based on traffic volumes and geographic locations. Through route-level analysis, the budget model provides detailed comparative analysis for determining relationships between performance and resource needs for each highway inventory unit which creates standardized allocation and efficiency rates for each route.

The budget model is used:

- To measure the direct relation between funding and LOS, and the effects of changes to either.
- To measure an efficiency curve at the route-level for statewide comparisons.
- To measure a standardized allocation process for inventory items at a route-level for life-cycle cost and asset management practices.
- To assist decision-makers in determining the best course of action relative to budgetary and performance issues.
- To predict funding needs based on project delivery actions and decisions.



## ANALYSIS OF ALTERNATIVE LEVELS OF MAINTENANCE INVESTMENT

### LEVEL OF INVESTMENT 1—BASELINE FUNDING

The current annual baseline funding level for pavement, bridge, and drainage maintenance totals \$433.5 million, as listed in Table 3 below. Maintaining this level of funding will increase the annual average backlog of maintenance needs for pavement by 125 lane-miles and decrease the bridge backlog by 54 bridges. The pavement backlog will increase from 12,404 lane-miles (25 percent) to 13,611 lane-miles (27 percent) in ten years, and the bridge backlog will decrease from 1,717 bridges (13 percent) to 1,177 bridges (9 percent) in ten years. Although the overall drainage backlog will increase, the rate of increase is less than projected in the 2013 Maintenance Plan. The backlog for drainage will increase to 45,274 culverts (22 percent of estimated inventory) in ten years.

**Table 3. LEVEL OF INVESTMENT 1—CURRENT BASELINE FUNDING**

Program	Annual PYs	Annual Cost (\$000,000)	Annual Accomplishments	Average Annual Change in Backlog	Future SHOPP Cost Avoidance (\$000,000)
Pavement*	290	234.0	2,100 lane-miles	120 increase	936.0
Bridge†	264	176.5	710 bridges	54 decrease	1,613.0
Drainage‡	188	23.0	140 culverts 12,000 assessments	2,380 increase	92.0
Total	742	433.5	---	---	2,641.0

\*Pavement costs include State forces services and Major Maintenance contracts. Annual costs include \$204 million in Major Maintenance contracts and \$30 million for contract delivery support. The 2005, 2007, 2009, and 2011 Maintenance Plans did not include State maintenance forces for pavement work. The State force work included is limited to spot locations of damage, such as pothole repair and crack sealing.

†Bridge costs include State force repair crews, materials, equipment rental, contract dollars, and support. Bridge structural resources include \$94.1 million in Major Maintenance contracts and \$82.4 million in support of contract delivery, paint, and inspection.

‡Drainage costs include \$16 million for State maintenance forces for assessments, maintenance, repairs, and associated equipment and materials and \$7 million in Major Maintenance contract dollars and support costs.



## LEVEL OF INVESTMENT 2—REDUCE BACKLOG (TEN YEARS)

An increase of \$102.7 million a year beginning in FY 2015/16 will bring the total maintenance annual funding level to \$536.2 million. Table 4 below presents data considering additional investments of \$1.2 billion for pavement rehabilitation and an additional \$450 million for culvert rehabilitation, consistent with the goal-constrained needs plan identified in the 2015 Ten-Year SHOPP Plan. At the end of ten years, the backlog of pavement and bridge maintenance needs would be reduced as listed in the table below, and the known drainage maintenance backlog would be reduced to zero. The pavement backlog will decrease from 12,404 lane-miles (25 percent) to 5,943 lane-miles (12 percent) in ten years, and the bridge backlog will decrease from 1,717 bridges (13 percent) to 1,090 bridges (8 percent) in ten years. An increase of \$101 million in maintenance funding for drainage and an additional 239 positions would decrease the culvert repair backlog from 26 percent of the inventory to 15 percent of the inventory.

<b>Table 4. LEVEL OF INVESTMENT 2—REDUCE BACKLOG (TEN YEARS)</b>					
<b>Program</b>	<b>Annual PYs</b>	<b>Annual Cost (\$000,000)</b>	<b>Annual Accomplishments</b>	<b>Average Annual Change in Backlog</b>	<b>Future SHOPP Cost Avoidance (\$000,000)</b>
Pavement*	290	234.0	5,443 lane-miles	641 decrease	936
Bridge†	268	178.2	719 bridges	63 decrease	1,632
Drainage‡	427	124.0	2,760 culverts 12,000 assessments	2,760 decrease	496
Total	985	536.2	---	---	3,064

\*Pavement costs include State forces services and Major Maintenance contracts. Annual costs include \$204 million in Major Maintenance contracts and \$30 million for contract delivery support. The 2005, 2007, 2009, and 2011 Maintenance Plans did not include State maintenance forces for pavement work. The State force work included is limited to spot locations of damage, such as pothole repair and crack sealing.

†Bridge costs include State force repair crews, materials, equipment rental, contract dollars, and support. Funding includes \$95.3 million in Major Maintenance contracts and \$82.9 million in support of contract delivery, paint, and inspection.

‡Drainage costs include \$16 million for State maintenance forces for assessments, maintenance, repairs, and associated equipment and materials, and \$108 million in Major Maintenance contract dollars and support costs.



### LEVEL OF INVESTMENT 3—ELIMINATE BACKLOG (FIVE YEARS)

With an increase of \$986.4 million a year beginning in FY 2015/16 to bring the total annual maintenance funding level to more than \$1.4 billion, within a five-year period, the goal for pavement and bridge maintenance work would be achieved. Table 5 below presents data considering additional investments of \$1.2 billion for pavement rehabilitation and an additional \$450 million for culvert rehabilitation, consistent with the goal-constrained needs plan identified in the 2015 Ten-Year SHOPP Plan. The pavement backlog will decrease from 12,404 lane-miles (25 percent) to 5,076 lane-miles (10 percent) in five years, and the bridge backlog will decrease from 1,717 bridges (13 percent) to 1,090 bridges (8 percent) in five years. At the projected drainage assessment rate of 12,000 assessments a year, there still would be 44,000 culverts remaining in the inventory to be assessed at the end of the five years, with an estimated 3,120 culverts needing repair work each year. However, the current backlog for drainage repairs will be eliminated in five years.

<b>Program</b>	<b>Annual PYs</b>	<b>Annual Cost (\$000,000)</b>	<b>Annual Accomplishments</b>	<b>Average Annual Change in Backlog</b>	<b>Future SHOPP Cost Avoidance (\$000,000)</b>
Pavement*	1,083	872.0	7,787 lane-miles	1,485 decrease	3,488
Bridge†	300	190.9	782 bridges	125 decrease	1,775
Drainage‡	1,041	357.0	6,820 culverts 12,000 assessments	4,300 decrease	1,428
<b>Total</b>	<b>2,424</b>	<b>1,419.9</b>	<b>---</b>	<b>---</b>	<b>6,691</b>

\*Pavement costs include State forces services and Major Maintenance contracts. Annual costs include \$760 million in Major Maintenance contracts and \$112 million for contract delivery support. The 2005, 2007, 2009, and 2011 Maintenance Plans did not include State maintenance forces for pavement work. The State force work included is limited to spot locations of damage, such as pothole repair and crack sealing.

†Bridge costs include State force repair crews, materials, equipment rental, contract dollars, and support. Funding includes \$103.6 million in Major Maintenance contracts and \$87.3 million in support of contract delivery, paint, and inspection.

‡Drainage costs include \$16 million for State maintenance forces for assessments, maintenance, repairs, and associated equipment and materials and \$341 million in Major Maintenance contract dollars and support costs.





## APPENDIX

### STREETS AND HIGHWAYS CODE SECTION 164.6

164.6.(a) The department shall prepare a 10-year state rehabilitation plan for the rehabilitation and reconstruction, or the combination thereof, by the State Highway Operation and Protection Program, of all state highways and bridges owned by the state. The plan shall identify all rehabilitation needs for the 10-year period beginning on July 1, 1998, and ending on June 30, 2008, and shall include a schedule of improvements to complete all needed rehabilitation during the life of the plan not later than June 30, 2008. The plan shall be updated every two years beginning in 2000. The plan shall include specific milestones and quantifiable accomplishments, such as miles of highways to be repaved and number of bridges to be retrofitted. The plan shall contain strategies to control cost and improve the efficiency of the program, and include a cost estimate for at least the first five years of the program.

(b) The department shall prepare a five-year maintenance plan that addresses the maintenance needs of the state highway system. The plan shall be updated every two years, concurrent with the rehabilitation plan described in subdivision (a). The maintenance plan shall include only maintenance activities that, if the activities were not performed, could result in increased State Highway Operation and Protection Program costs in the future. These activities may include roadway, structural, and drainage maintenance. The maintenance plan shall identify any existing backlog in these maintenance activities and shall recommend a strategy, specific activities, and an associated funding level to reduce or prevent any backlog during the plan's five-year period. The maintenance plan shall include specific goals and quantifiable accomplishments, such as lane-miles of highway to be repaved and the number of bridge decks to be sealed. The maintenance plan shall contain strategies to control cost and improve the efficiency of these maintenance activities, and include a cost estimate for the five years of the plan.

(c) The rehabilitation plan and the maintenance plan shall attempt to balance resources between State Highway Operation and Protection Program activities and maintenance activities in order to achieve identified milestones and goals at the lowest possible long-term total cost. If the maintenance plan recommends increases in maintenance spending, it shall identify projected future State Highway Operation and Protection Program costs that would be avoided by increasing maintenance spending. The department's maintenance division shall develop a budget model that allows it to achieve the requirements of this subdivision.

(d) The rehabilitation plan shall be submitted to the commission for review and comments not later than January 31 of each odd-numbered year, and shall be transmitted to the Governor and the Legislature not later than May 1 of each odd-numbered year. The maintenance plan shall be transmitted to the Governor, the Legislature, and the commission not later than January 31 of each odd-numbered year.

(e) The rehabilitation plan and the maintenance plan shall be the basis for the department's budget request and for the adoption of fund estimates pursuant to Section 163.

*(Amended by Stats. 2004, Ch. 212, Sec. 6. Effective August 11, 2004.)*