

## MEMORANDUM

To: CHAIR AND COMMISSIONERS  
CALIFORNIA TRANSPORTATION COMMISSION

CTC Meeting: October 9, 2019

From: STEVEN KECK, Chief Financial Officer

Reference Number: 4.5, Information Item

Prepared By: Michael Johnson, State Asset Management Engineer

Subject: **TRANSPORTATION ASSET MANAGEMENT PLAN – ANNUAL BENCHMARK PERFORMANCE UPDATE**

### **SUMMARY:**

The California Department of Transportation (Department) will present to the California Transportation Commission (Commission) its 2018-19 Performance Benchmark Report (Report) for the four core asset classes, established by the Commission, at the October 2019 meeting.

### **BACKGROUND:**

The California Transportation Asset Management Plan (TAMP) and Senate Bill 1 (SB 1) established performance targets for the SHOPP primary asset classes (pavement, bridges, culverts and traffic management system elements). To measure progress toward meeting the defined performance targets, the Commission adopted an addendum to SHOPP Guidelines in October of 2017. The addendum called on the Department to develop annual benchmarks (future condition projections) to measure progress made for each of the four primary asset classes.

The benchmark projections were established using the following general steps:

1. Begin with the most recent inventory and condition information available
2. Reduce the condition by the expected annual deterioration
3. Improve the condition with annual project level accomplishments
4. Incorporate inventory growth

These four steps are repeated for each of the 10 years in the analysis horizon 2017-18 through 2026-27. If the annual project accomplishments exceed the annual deterioration, then the condition of the asset improves by the net difference.

*“Provide a safe, sustainable, integrated and efficient transportation system to enhance California’s economy and livability”*

The benchmark projection analysis includes uncertainty factors associated with assumptions made relative to the size of the inventory, condition, deterioration rates and expected project accomplishments. These factors were incorporated into the analysis using a Monte Carlo simulation that develops a range of potential outcomes given these uncertainties. These potential outcomes are represented graphically using a shaded range on each side of projection line shown in the lower trend line set of three charts for each asset. The Department will update the benchmark projections every two years to reflect the annual project accomplishments and future uncertainties, and will adjust the work plan where necessary to meet the SB 1 performance outcomes.

Senate Bill 1 included two additional performance metrics related to pavement and bridges; Level of Service (LOS) for pavement and a number of bridges fixed. These two are calculated using a different methodology given the nature of the measure. The methodology used for determining the bridge fixes was defined in a separate Book Item. The criteria used for the pavement (LOS) will be presented at a future Commission meeting.

Attachment



# 2018/19 Performance Benchmark Report

OCTOBER 2019

California Department of Transportation





# Introduction

This report presents Caltrans' efforts to date in reducing deferred maintenance through an assessment of current and projected performance accomplishments through 2027. In compliance with Federal and State requirements, Caltrans has prepared an assessment of progress against annual benchmarks associated with the four primary asset classes (pavement, bridge, transportation management systems, and drainage) for the 10-year period spanning 2018-2027.

The 2018 California Transportation Asset Management Plan (TAMP) and Senate Bill 1 (SB1) established 10-year performance targets for the State Highway Operation and Protection Program (SHOPP) primary asset classes. To measure progress toward meeting the defined performance targets, the California Transportation Commission (Commission) adopted an addendum to SHOPP Guidelines in October of 2017. The addendum called on Caltrans to develop annual benchmarks (future condition projections) to measure progress made for each of the four primary asset classes towards achieving the 10-year targets.

Benchmarks were initially adopted by the Commission in March 2018. This report presents updated projections relative to the Commission adopted benchmarks. The updated progress reflects Commission actions through August 2019, updated condition information where available, SHOPP Project Book accomplishments and updated Maintenance projections.

SB1 included two additional performance objectives related to pavement and bridges – Level of Service (LOS) for pavement cracking and spalling, and number of bridges fixed. These two metrics will be achieved through the same project accomplishments and maintenance strategies included in the benchmark analysis for the core assets. The department is committed to reporting progress made toward these specific lagging performance measures when the information becomes available so that the Commission can evaluate progress.

# 2018/19 Performance Summary

The projections presented in this report show that the condition of the four primary asset classes will generally improve over the next ten years. Caltrans is on track to meet or exceed SB1 condition-based targets by 2027 for pavement, bridges, and culverts, as presented in Table 1. Condition of traffic management systems (TMS) are expected to close in on SB1 targets, well within the uncertainties and limitations of the analysis. The current Pavement Level of Service (LOS) reports do not yet reflect increased SB1 resources. Caltrans will continue to monitor progress towards achieving LOS as well as TMS targets.

**Table 1 – Progress Towards 2027 SB1 Targets**












Asset Class	2027 SB1 Target	Status of Progress
<b>Pavement</b>	98% Good or Fair Condition;	 On Track
	90% level of service (LOS) achieved for maintenance of potholes, spalls, and cracks	 Monitor
<b>Bridges</b>	Fix an additional 500 bridges	 On Track
<b>Culverts</b>	90% Good or Fair Condition	 On Track
<b>TMS</b>	90% Good Condition	 Monitor

Table 2 presents the status of progress towards achieving 2027 targets set forth in the TAMP. Caltrans is on track to meet or exceed TAMP targets by 2027 for pavement and culverts. While the proportion of good condition bridges is projected to rise, corrective actions need to be initiated to assure that the fair and poor targets are achieved. Caltrans will continue to monitor progress towards achieving TMS targets.

**Table 2 – Progress Towards 2027 TAMP Targets**

Asset Class		Good	Fair	Poor	Status of Progress	
Pavement	Class 1	60%	39%	1%		On Track
	Class 2	55%	43%	2%		On Track
	Class 3	45%	53%	2%		On Track
Bridges and Tunnels		83.5%	15%	1.5%		Action Required
Drainage (Culverts)		80%	10%	10%		On Track
TMS		90%	N/A	10%		Monitor

# Pavement Class I

## Overview

Pavement Class I is comprised of route segments classified as interstate, other principal arterials, and urban freeways and expressways. It includes Freight Network Tier I and II, and the Strategic Highway Network (STRAHNET) routes. Examples of Class I routes include Sacramento 80, Ventura 101, San Diego 8, Los Angeles 210, and Alameda 580. There are 27,151 lane miles of pavement on Class I roadways, representing over half of the 50,259 lane miles of pavement on the State Highway System (SHS).

## Changes in Asset Condition

Pavement condition changes over time because of construction activities, traffic loading, and environmental factors, such as aging and changes in temperature and moisture. Table 3 summarizes the condition of the Pavement Class I asset inventory for the most recent condition assessment (2018 APCS) as well as the prior condition assessment (2016 APCS). Condition is presented in percentages of good, fair, and poor, by lane miles corresponding to the condition at the end of calendar year.



### Timing of the Condition Assessment

Reported annual pavement conditions are based on a phased data collection effort through the Automated Pavement Condition Survey (APCS) over an 11-month period, between January and November of the reporting year. Projects under construction may not be reflected in the condition assessment.

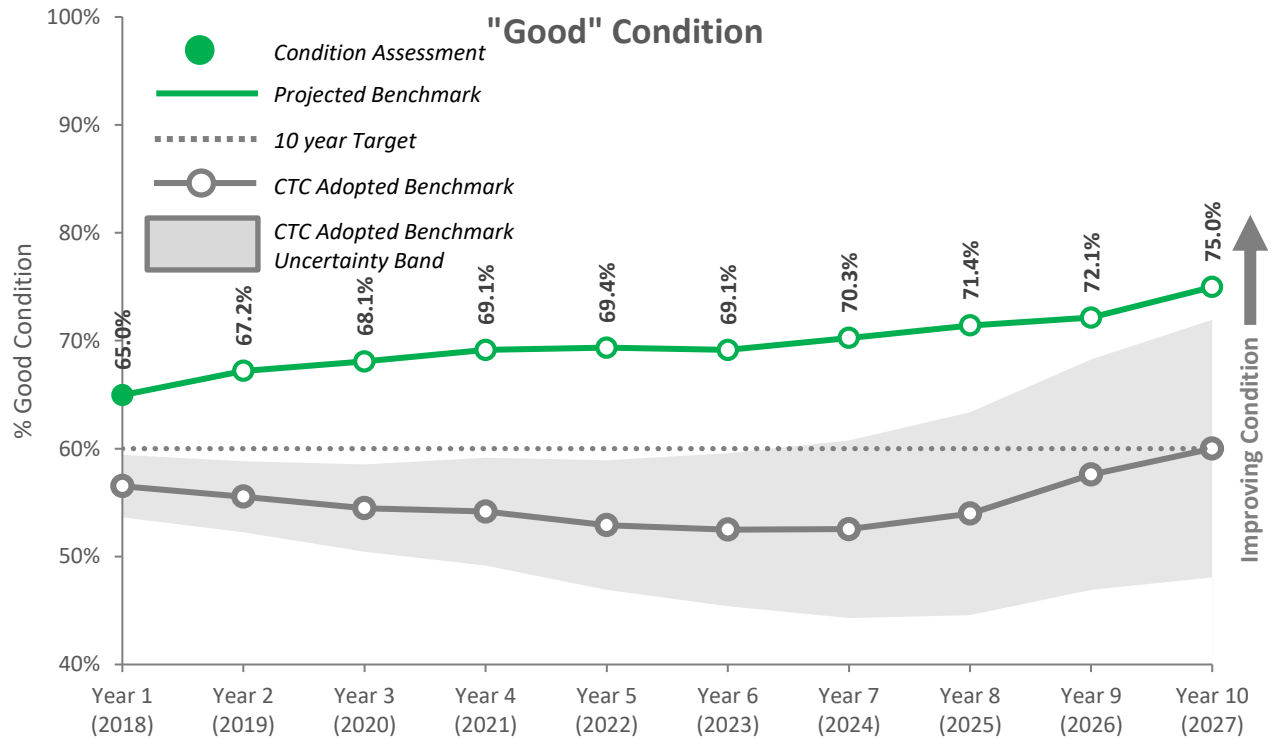
**Table 3 – Pavement Class I Condition Summary**

Condition	2027 Target	2016 Year End	2018 Year End	Change in Condition
Good	60.0%	45.1%	65.0%	+19.9% ↑
Fair	39.0%	50.5%	33.8%	-16.7% ↓
Poor	1.0%	4.4%	1.3%	-3.1% ↓

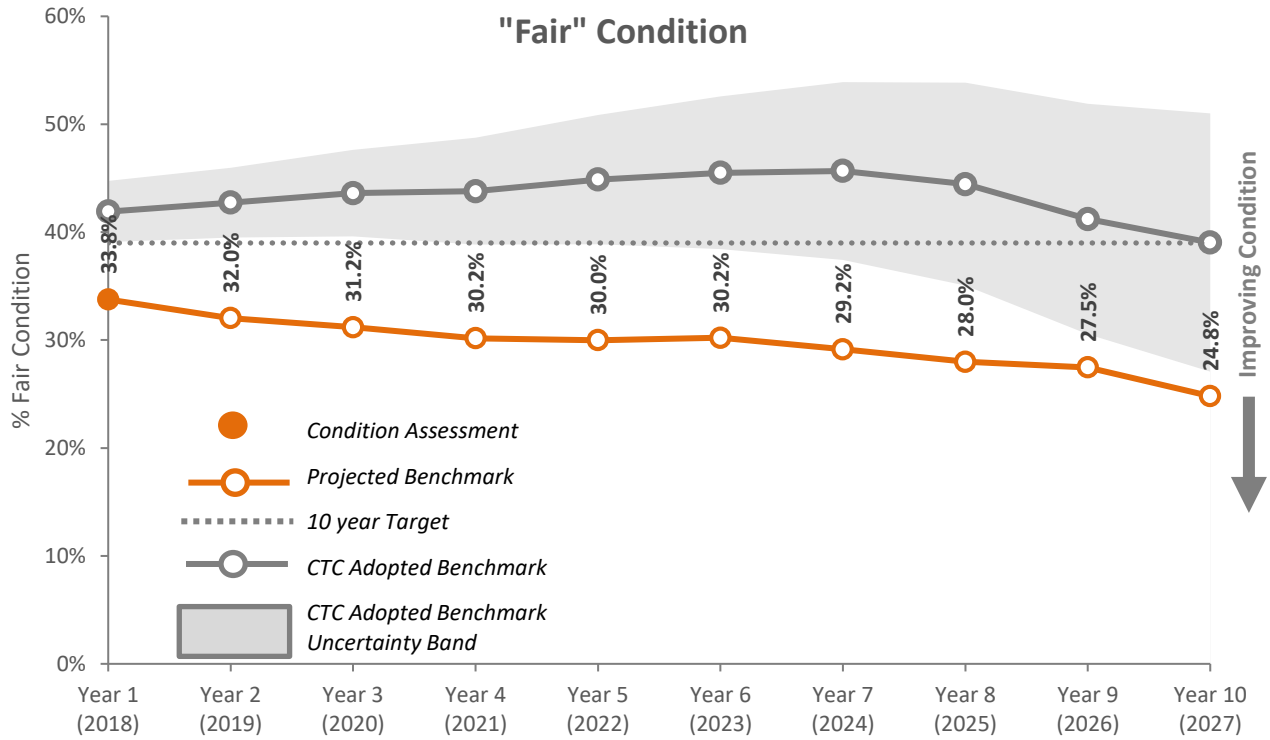


# Projected and Assessed Conditions

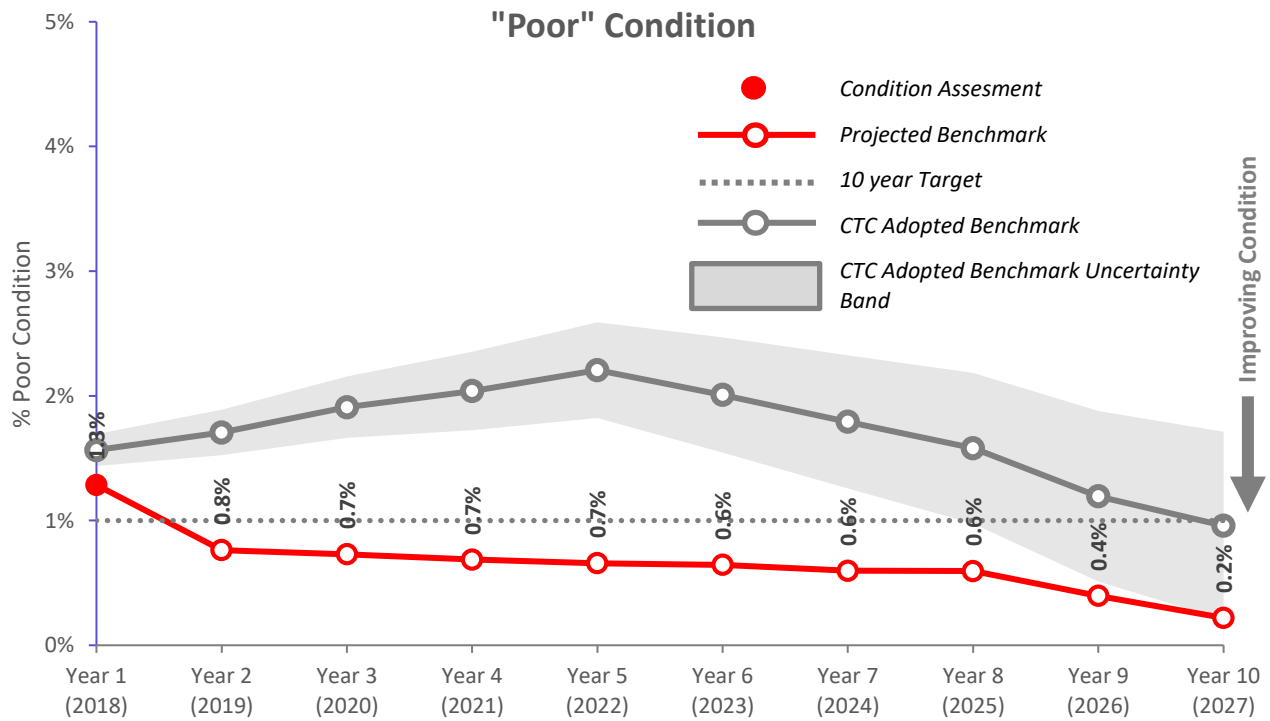
Pavement Class I benchmarks are presented in Figure 1 through Figure 3. These charts show projected year-end good, fair, and poor condition as percentages of total lane miles from 2018 through 2027. The assessed condition for 2018 is presented in the charts with a solid fill symbol.



**Figure 1 - Pavement Class I, Good**



**Figure 2 - Pavement Class I, Fair**



**Figure 3 - Pavement Class I, Poor**

## **Benchmark Observations**

The projected and assessed conditions for Pavement Class I are significantly better than the benchmark projections adopted by the Commission in March 2018. The 2018 APCS showed that pavement conditions substantially improved since the prior condition assessment in 2016. An increase in pavement projects supported by SB-1 funding was a contributing factor to condition improvements.

# Pavement Class II

## Overview

Pavement Class II is comprised of route segments classified as non-interstate National Highway System and Interregional Road System (IRRS). It includes Freight Network Tier III. Examples of Class II routes include Mendocino 20, Napa 29, Monterey 1, Riverside 74, and Orange 73. There are 16,396 lane miles of pavement on Class II roadways, representing approximately one-third of the 50,259 lane miles of pavement on the State Highway System (SHS).

## Changes in Asset Condition

Pavement condition changes over time because of construction activities, traffic loading, and environmental factors, such as aging and changes in temperature and moisture. Table 4 summarizes the condition of the Pavement Class II asset inventory for the most recent condition assessment (2018 APCS) as well as the prior condition assessment (2016 APCS). Condition is presented in percentages of good, fair, and poor, by lane miles corresponding to the condition at the end of calendar year.



### Timing of the Condition Assessment

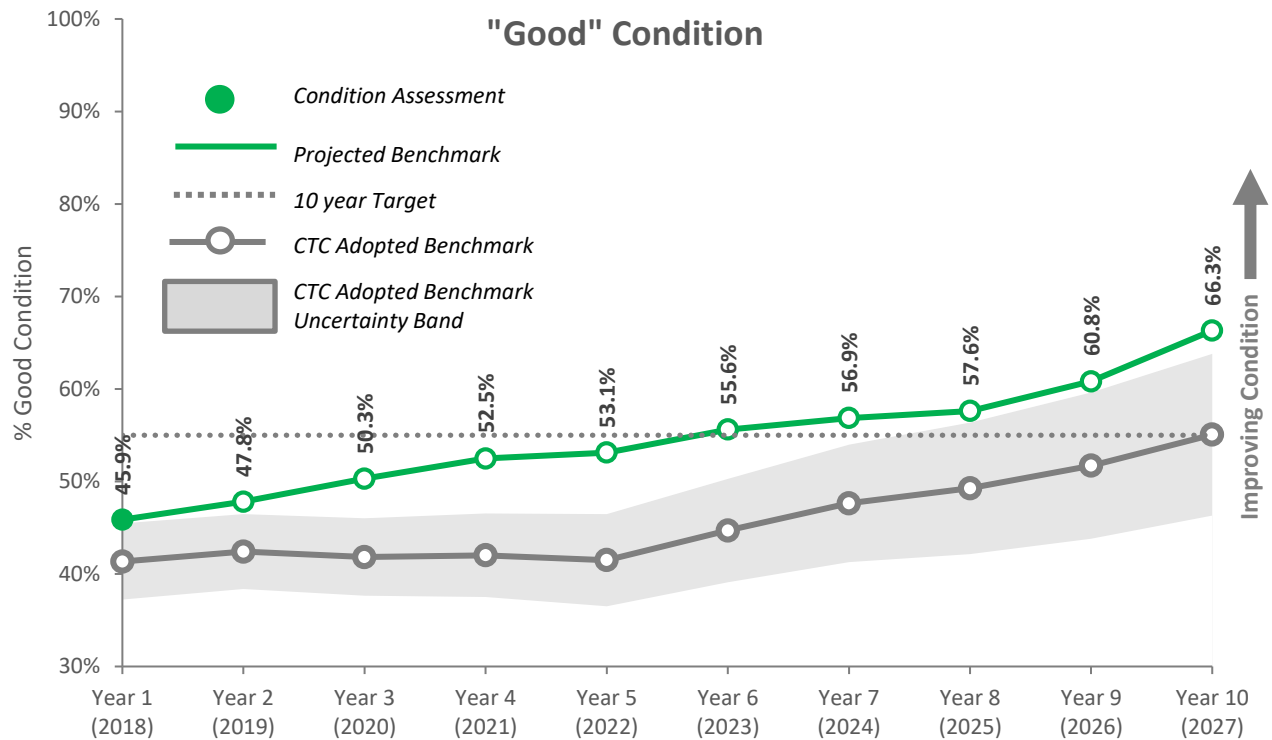
Reported annual pavement conditions are based on a phased data collection effort through the Automated Pavement Condition Survey (APCS) over an 11-month period, between January and November of the reporting year. Projects under construction may not be reflected in the condition assessment.

**Table 4 - Pavement Class II Condition Summary**

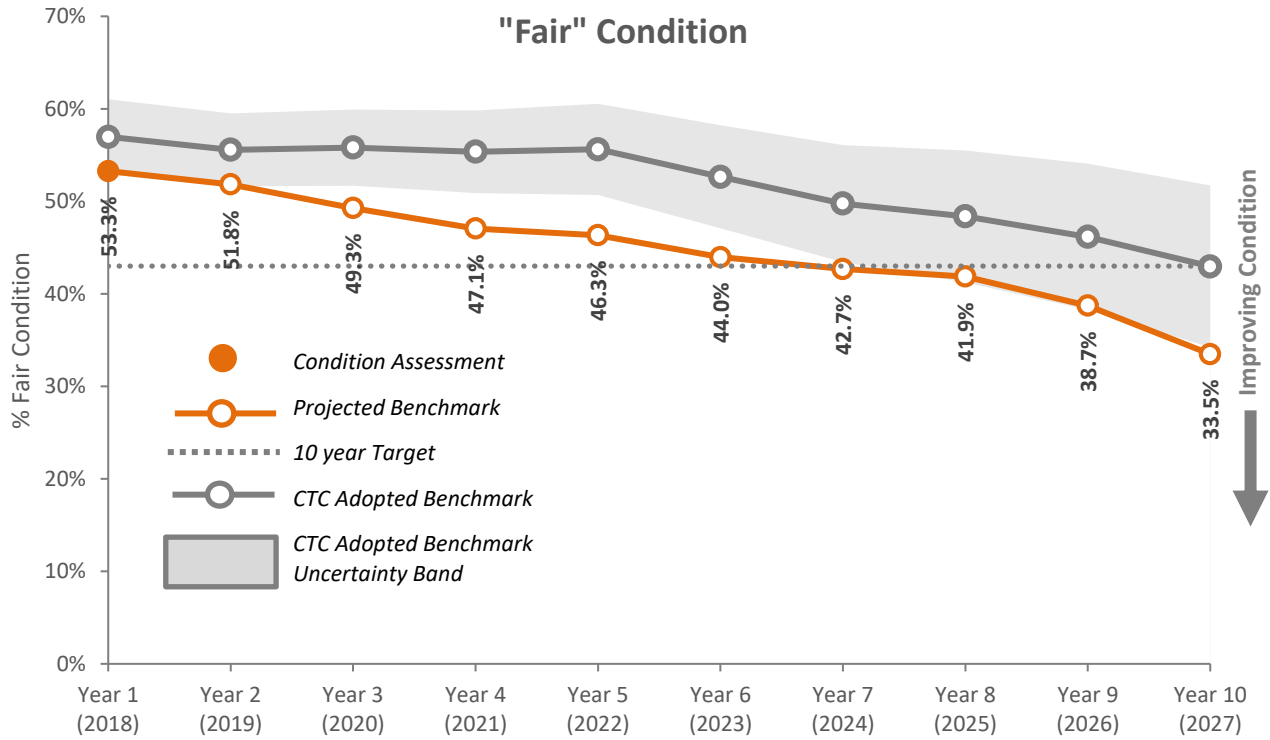
Condition	2027 Target	2016 Year End	2018 Year End	Change in Condition
Good	55.0%	35.6%	45.9%	+10.3% ↑
Fair	43.0%	57.6%	53.3%	-4.3% ↓
Poor	2.0%	6.8%	0.9%	-5.9% ↓

## Projected and Assessed Conditions

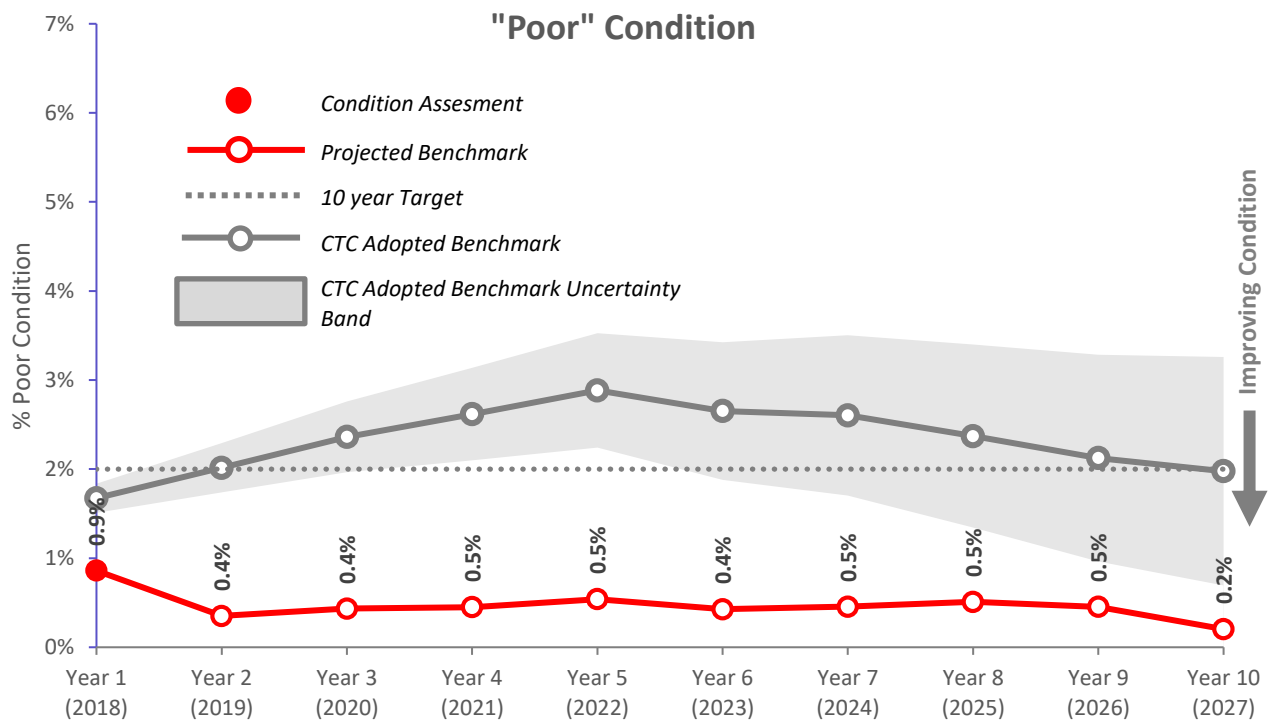
Pavement Class II benchmarks are presented in Figure 4 through Figure 6. These charts show projected year-end good, fair, and poor condition as percentages of total lane miles from 2018 through 2027. The assessed condition for 2018 is presented in the charts with a solid fill symbol.



**Figure 4 - Pavement Class II, Good**



**Figure 5 - Pavement Class II, Fair**



**Figure 6 - Pavement Class II, Poor**

## **Benchmark Observations**

The projected and assessed conditions for Pavement Class II are significantly better than the benchmark projections adopted by the Commission in March 2018. The 2018 APCS showed that pavement conditions substantially improved since the prior condition assessment in 2016. An increase in pavement projects supported by SB-1 funding was a contributing factor to condition improvements.

# Pavement Class III

## Overview

Pavement Class III is comprised of all other routes not included in Classes I and II. Examples of Class III routes: are Trinity 3, Humboldt 36, San Luis Obispo 58, and Mono 167. There are 6,712 lanes miles of pavement on Class III roadways, representing approximately 13% of the 50,259 lane miles of pavement on the State Highway System (SHS).

## Changes in Asset Condition

Pavement condition changes over time because of construction activities, traffic loading, and environmental factors, such as aging and changes in temperature and moisture. Table 5 summarizes the condition of the Pavement Class III asset inventory for the most recent condition assessment (2018 APCS) as well as the prior condition assessment (2016 APCS). Condition is presented in percentages of good, fair, and poor, by lane miles corresponding to the condition at the end of calendar year.



### Timing of the Condition Assessment

Reported annual pavement conditions are based on a phased data collection effort through the Automated Pavement Condition Survey (APCS) over an 11-month period, between January and November of the reporting year. Projects under construction may not be reflected in the condition assessment.

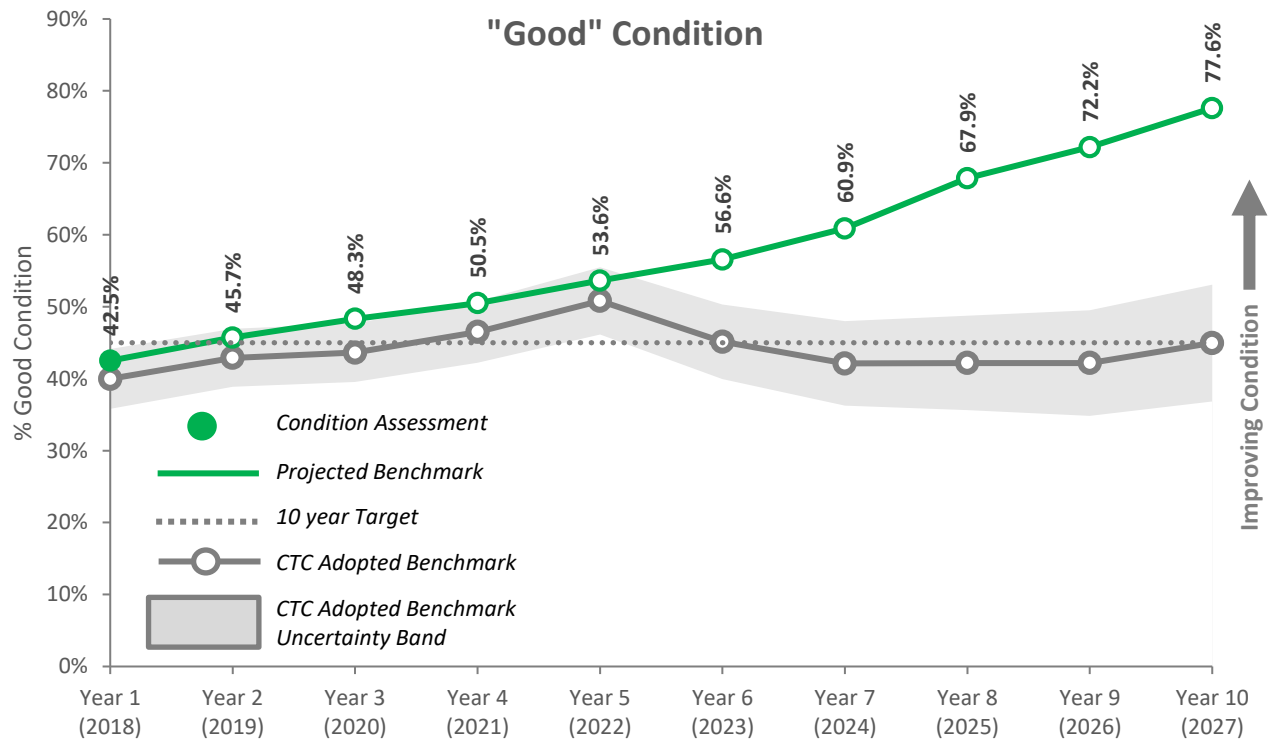
**Table 5 - Pavement Class III Condition Summary**

Condition	2027 Target	2016 Year End	2018 Year End	Change in Condition
Good	45.0%	37.6%	42.5%	+4.9% ↑
Fair	53.0%	54.3%	56.5%	+2.2% ↑
Poor	2.0%	8.1%	1.0%	-7.1% ↓

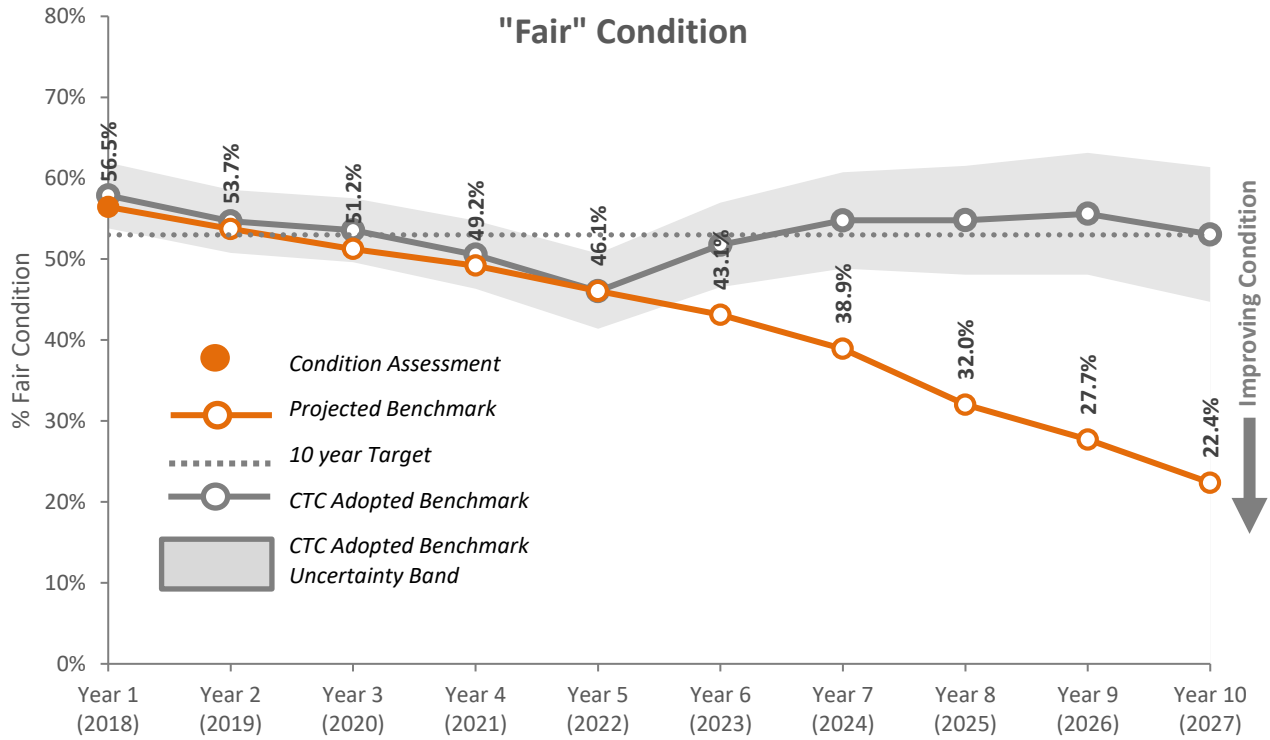


## Projected and Assessed Conditions

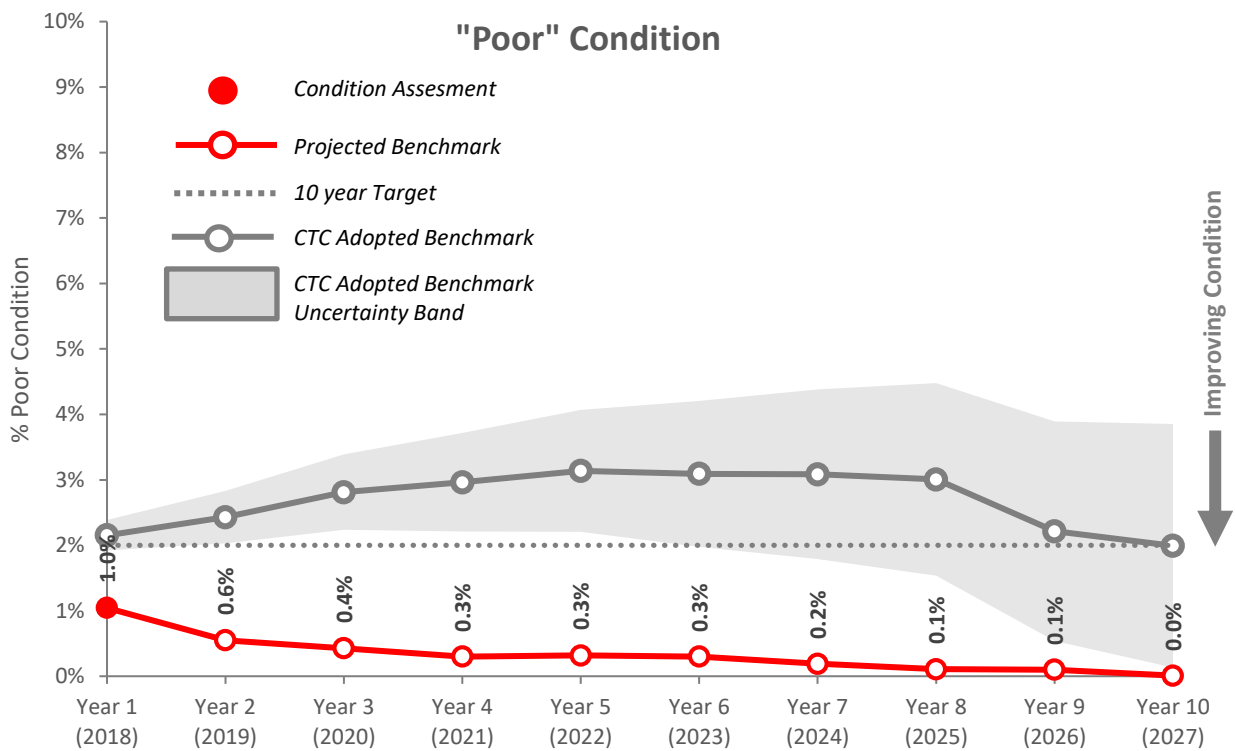
Pavement Class III benchmarks are presented in Figure 7 through Figure 9. These charts show projected year-end good, fair, and poor condition as percentages of total lane miles from 2018 through 2027. The assessed condition for 2018 is presented in the charts with a solid fill symbol.



**Figure 7 - Pavement Class III, Good**



**Figure 8 - Pavement Class III, Fair**



**Figure 9 - Pavement Class III, Poor**

## **Benchmark Observations**

The 2018 APCS showed that pavement conditions overall improved since the prior condition assessment in 2016. There is a marked increase in good and a corresponding reduction in poor pavement conditions, although fair pavement condition increased slightly. The projected conditions for Pavement Class III are significantly better than the benchmark projections adopted by the Commission in March 2018. An increase in pavement projects supported by SB-1 funding was a contributing factor to condition improvements.

# Bridge and Tunnel Health

## Overview

Caltrans is responsible for the maintenance of 13,189 State Highway System (SHS) bridges totaling over 246 million square feet of bridge deck area. These bridges are an average of 47 years old and at the point that typically results in increased maintenance needs. Caltrans also maintains 57 tunnels totaling over 5 million square feet of liner area.

## Changes in Asset Condition

Under requirements established through the federal Moving Ahead for Progress in the 21st Century (MAP-21) Act, the performance measure for bridge health is based on the total deck area, while tunnel health is based on the total structure's liner area. Both structure types are rated as good, fair, or poor condition.



### Timing of the Condition Assessment

The reported annual bridge and tunnel health conditions are based on data collected over a multi-year inspection cycle. Most bridges are inspected every 2-years, with some bridges inspected every 4-years.

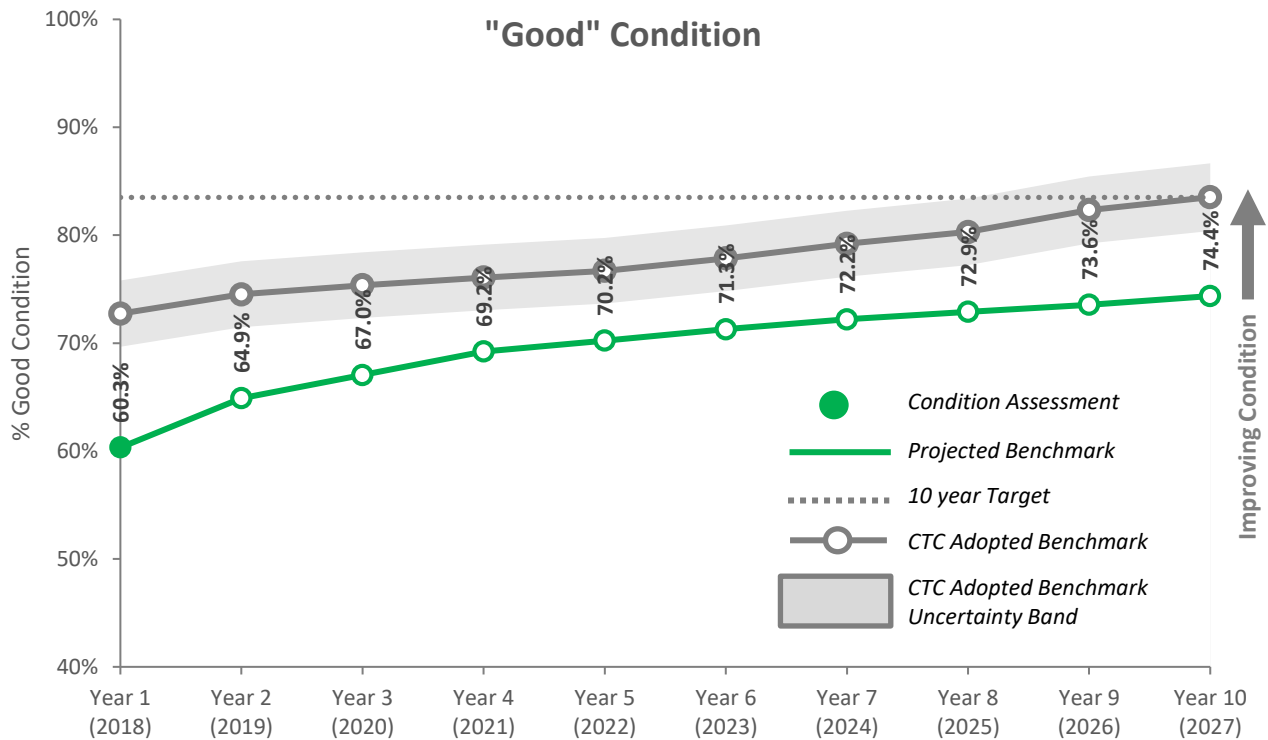
Table 6 summarizes the condition of the bridge and tunnel asset inventory for the most recent condition assessment. Condition is presented in percentages of good, fair, and poor, relative to total deck or liner area. The condition presented in these benchmarks is based on the data set submitted for the National Bridge Inventory (NBI) in March of 2019.

**Table 6 – Bridge and Tunnel Health Condition Summary**

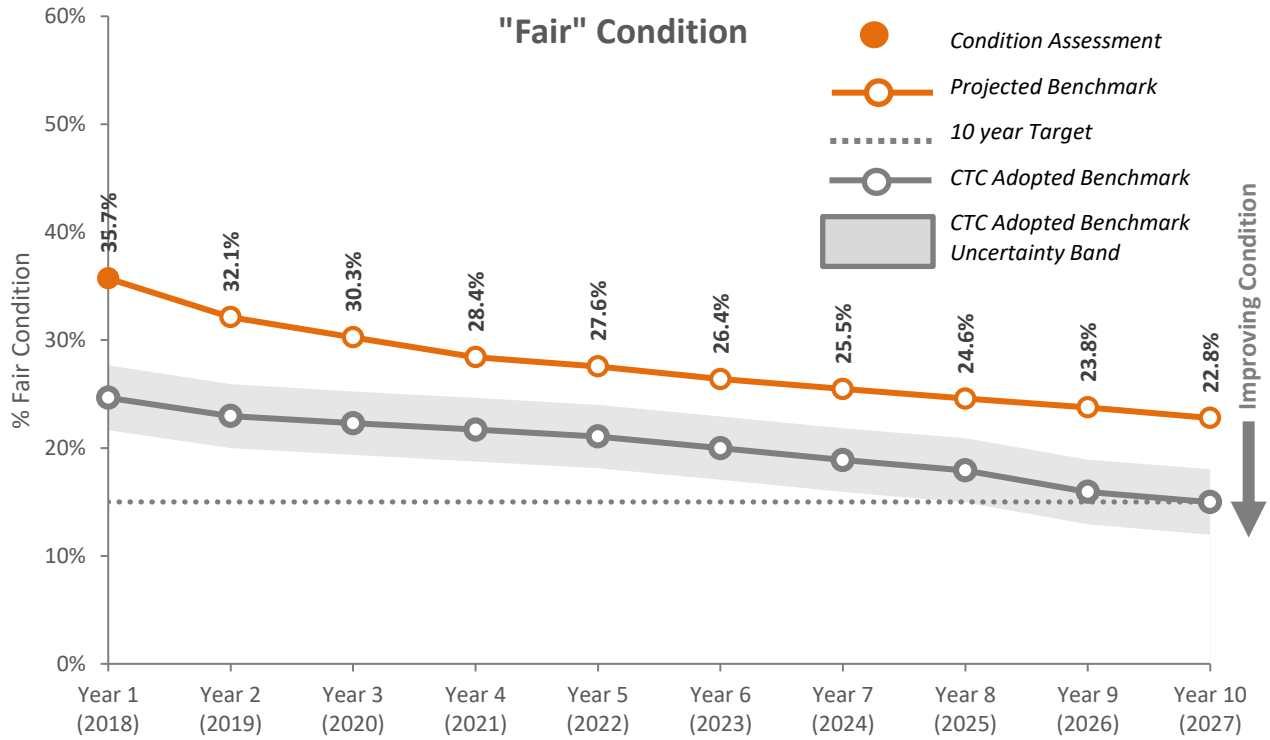
Condition	2027 Target	2017 Year End	2018 Year End	Change in Condition
Good	83.5%	65.9%	60.3%	-5.6% ↓
Fair	15.0%	30.8%	35.7%	+4.9% ↑
Poor	1.5%	3.3%	4.0%	+0.7% ↑

## Projected and Assessed Conditions

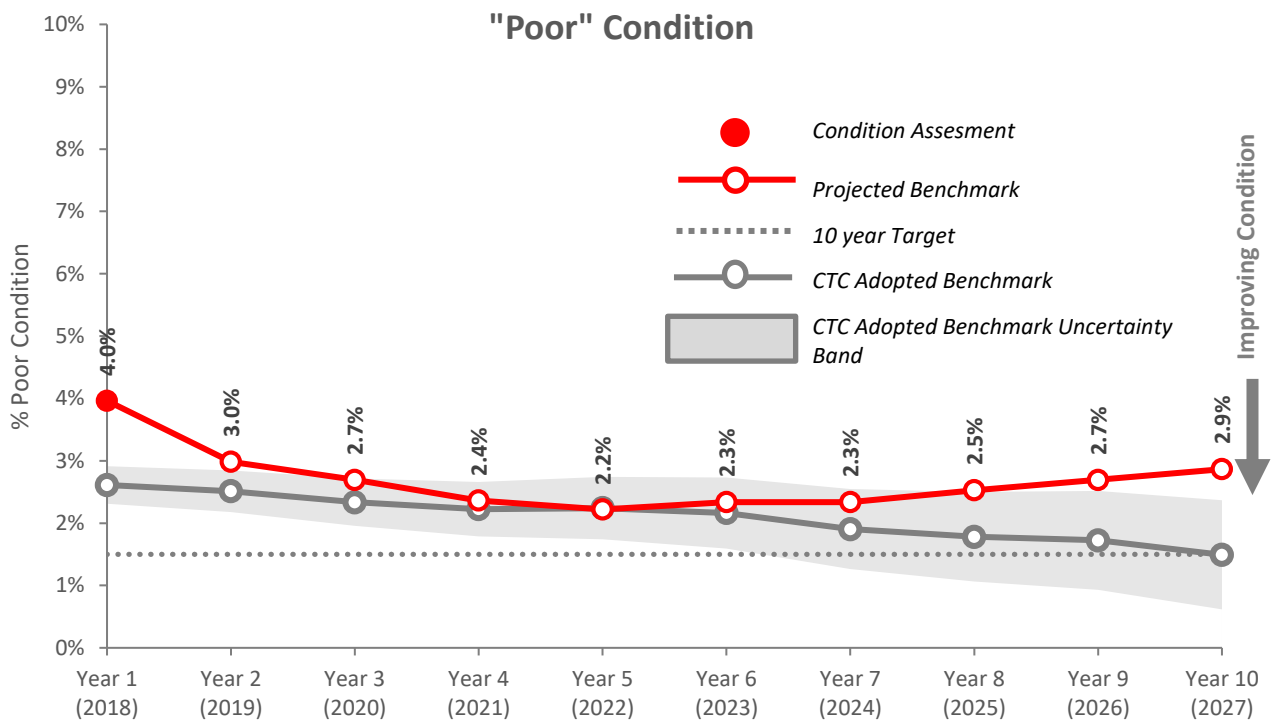
Bridge and Tunnel Health benchmarks are presented in Figure 10 through Figure 12. These charts show projected year-end good, fair, and poor condition as percentages of total deck and liner area from 2018 through 2027. The assessed condition for 2018 is presented in the charts with a solid fill symbol.



**Figure 10 – Bridge and Tunnel Health, Good**



**Figure 11 - Bridge and Tunnel Health, Fair**



**Figure 12 – Bridge and Tunnel Health, Poor**

## **Benchmark Observations**

Between 2017 and 2018, the condition of bridges and tunnels have not improved as projected. The percentages of good and fair have worsened, on the order of 5% to 6%, while the percentage of poor has increased slightly by just under 1%. While the percentages of good, fair, and poor bridges are projected to steadily improve over the next ten years, future target conditions are not likely to be met without corrective action. The increased funding from SB1 will have a significant impact on future bridge and tunnel conditions. However, due to time frames for bridge project delivery, an average of 9 plus years from initiation to construction completion, the condition improvements will likely be realized after 2027.

# Drainage

## Overview

Caltrans provides for the replacement or in-place rehabilitation of culverts and other highway drainage system elements that have lost serviceability because of age, wear, or degradation. Currently, the SHS includes 212,181 culverts, totaling an estimated 20.98 million linear feet, that drain rainwater, drainage channels, streams, and rivers away from highways in a controlled manner.

## Changes in Asset Condition

The health condition assessment of drainage assets is based on a visual inspection of five attributes: waterway adequacy, joints, materials, shape, and culvert alignment. Each attribute is scored, and culvert condition is calculated using a weighted average of attribute scores. Table 7 summarizes the condition of the drainage asset inventory for the most recent condition assessment (December 2018 as reported in 2019 SHSMP) as well as the prior condition assessment (January 2018 as reported in March 2018 Benchmarks). Condition is presented in percentages of good, fair, and poor, by linear feet of drainage systems, corresponding to the condition at the end of calendar year.



### Timing of the Condition Assessment

The reported annual drainage asset conditions are determined based on the initial inspection and the expected improvement to the condition state upon completion of the restoration work. This assessment is updated monthly.

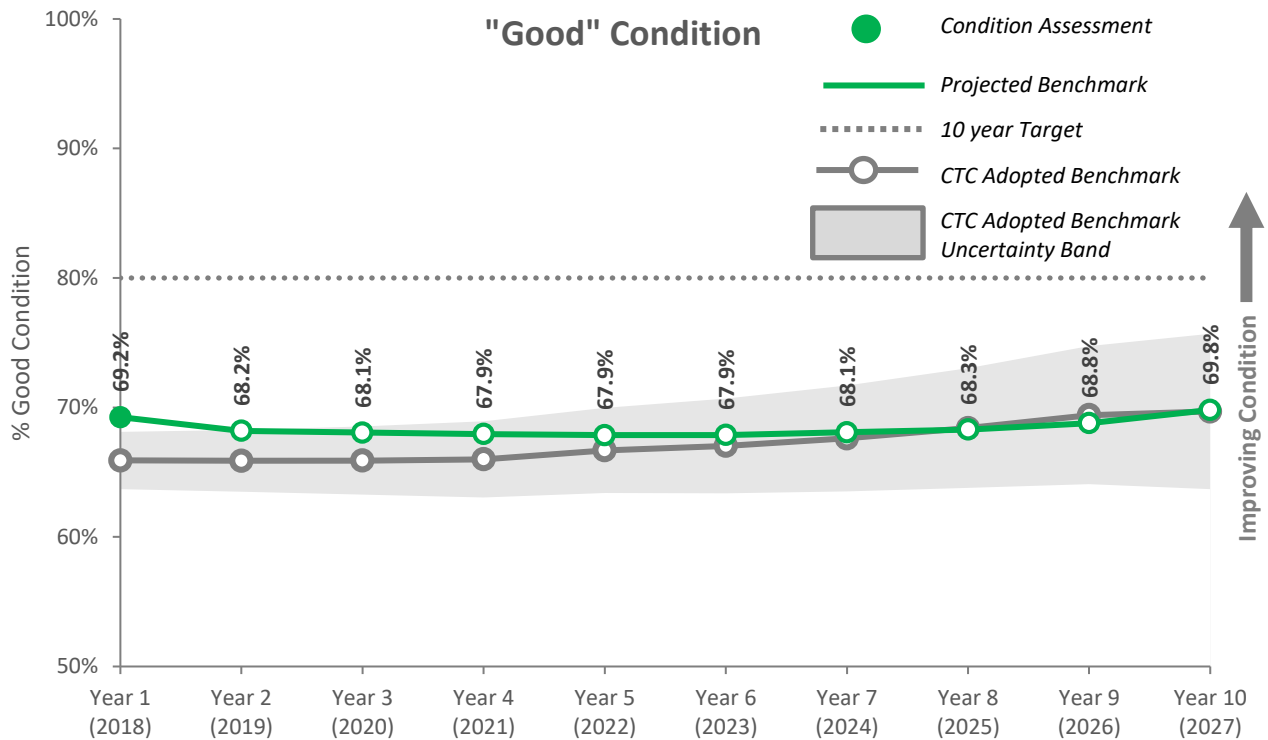
**Table 7 - Drainage Condition Summary**

Condition	2027 Target	2017 Year End	2018 Year End	Change in Condition
Good	80.0%	66.1%	69.2%	+3.1% ↑
Fair	10.0%	23.3%	21.0%	-2.3% ↓
Poor	10.0%	10.6%	9.8%	-0.8% ↓

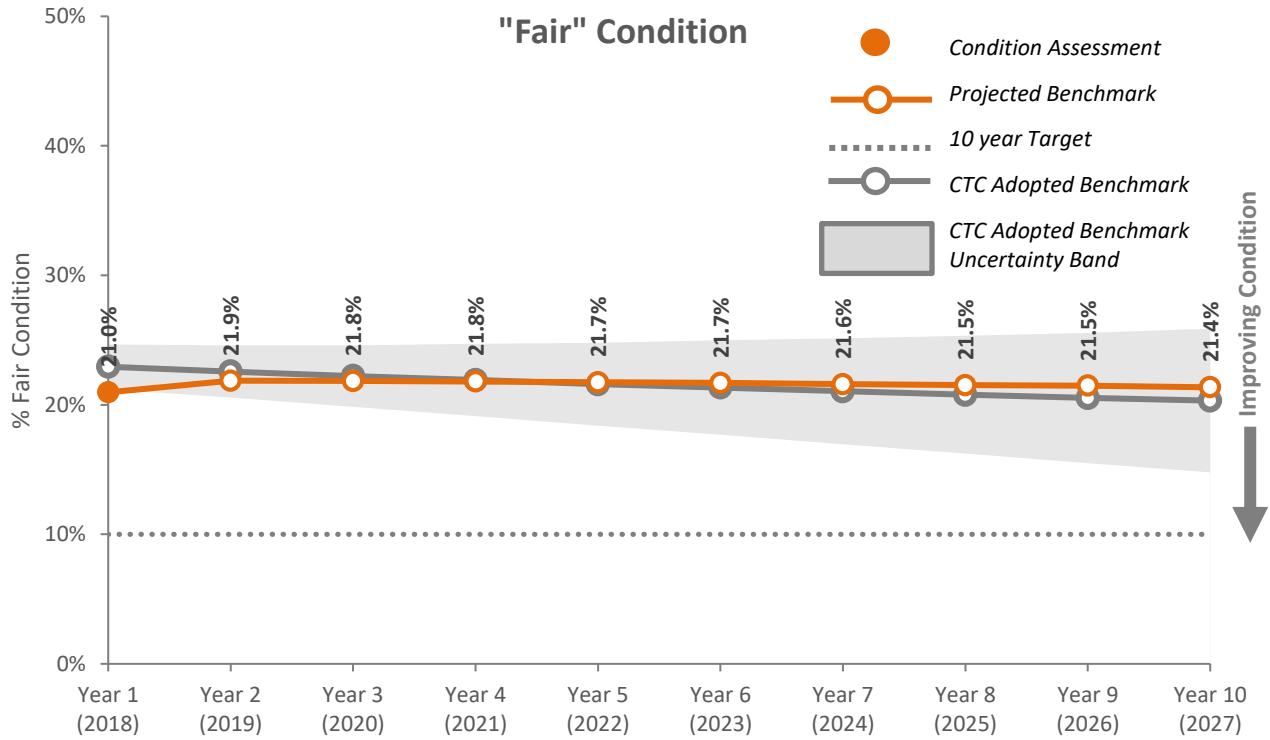


## Projected and Assessed Conditions

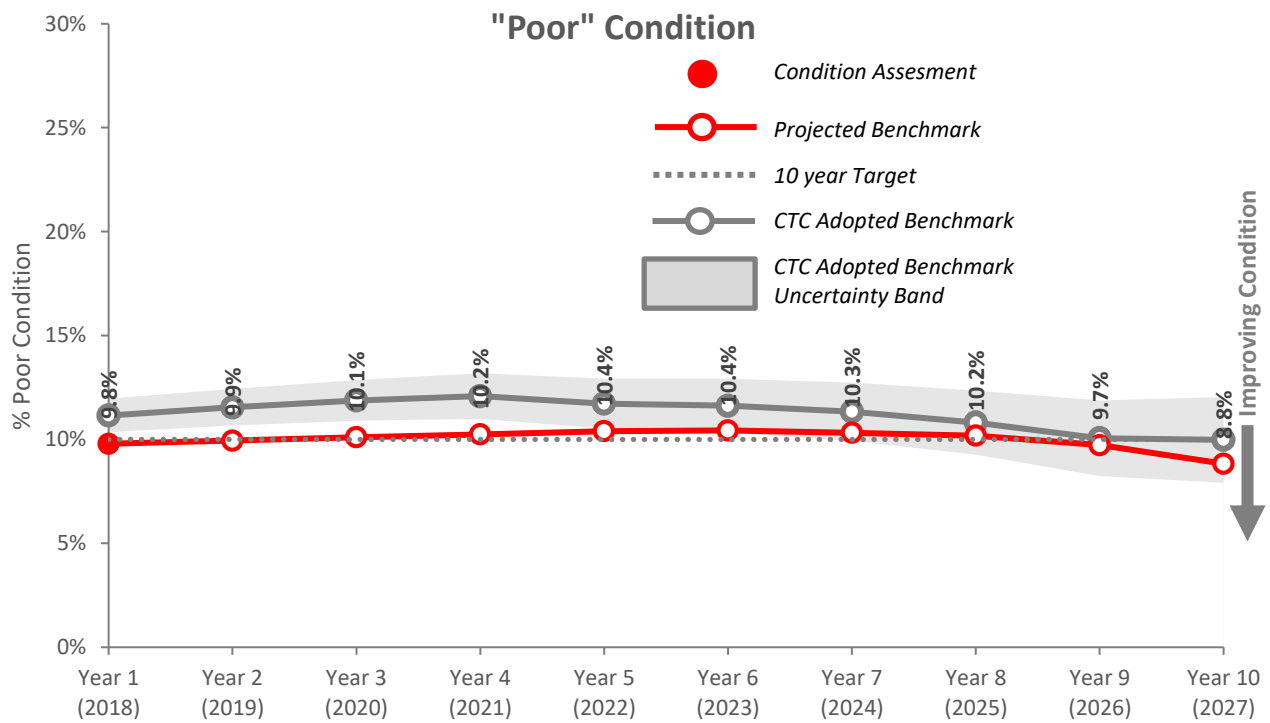
Drainage benchmarks are presented in Figure 13 through Figure 15. These charts show projected year-end good, fair, and poor condition as percentages of total linear feet from 2018 through 2027. The assessed condition for 2018 is presented in the charts with a solid fill symbol.



**Figure 13 – Drainage, Good**



**Figure 14 - Drainage, Fair**



**Figure 15 - Drainage, Poor**

## **Benchmark Observations**

The projected and assessed conditions for drainage have generally improved, with the exception of fair condition drainage which is not projected to change significantly over the 10-year period. This is mainly because Caltrans has been focusing our initial efforts on fixing poor culverts to achieve the SB1 goal. It is expected that Caltrans will continue to use additional maintenance forces to clean out clogged culverts and make repairs as a strategy to improve culverts in both fair and poor condition. SHOPP and Maintenance Program efforts will continue to address identified needs.

# Transportation Management Systems

## Overview

A Transportation Management System (TMS) is comprised of electrical/electronic TMS units that work together to reduce highway user delay, provide traveler information, and collect information on traffic behavior. There are over 19,500 TMS units on the SHS, comprised of closed-circuit televisions, changeable message signs, traffic monitoring detection stations, highway advisory radios, freeway ramp meters, roadway weather information systems, traffic signals, traffic census stations, and extinguishable message signs.

## Changes in Asset Condition

TMS units are categorized as being in either good or poor condition. The condition of a TMS unit is based on the unit being within its expected life cycle and its functional availability. Table 8 summarizes the condition of the Transportation Management Systems asset inventory for the most recent condition assessment as well as the prior condition assessment. Condition is presented in percentages of good, and poor, by TMS units, corresponding to the conditions reported in the 2017 and 2019 State Highway System Management Plans.



### Timing of the Condition Assessment

The reported annual TMS asset conditions are determined based on the age of the TMS asset and an assessment of how the TMS asset is functioning. This assessment is currently being updated quarterly.

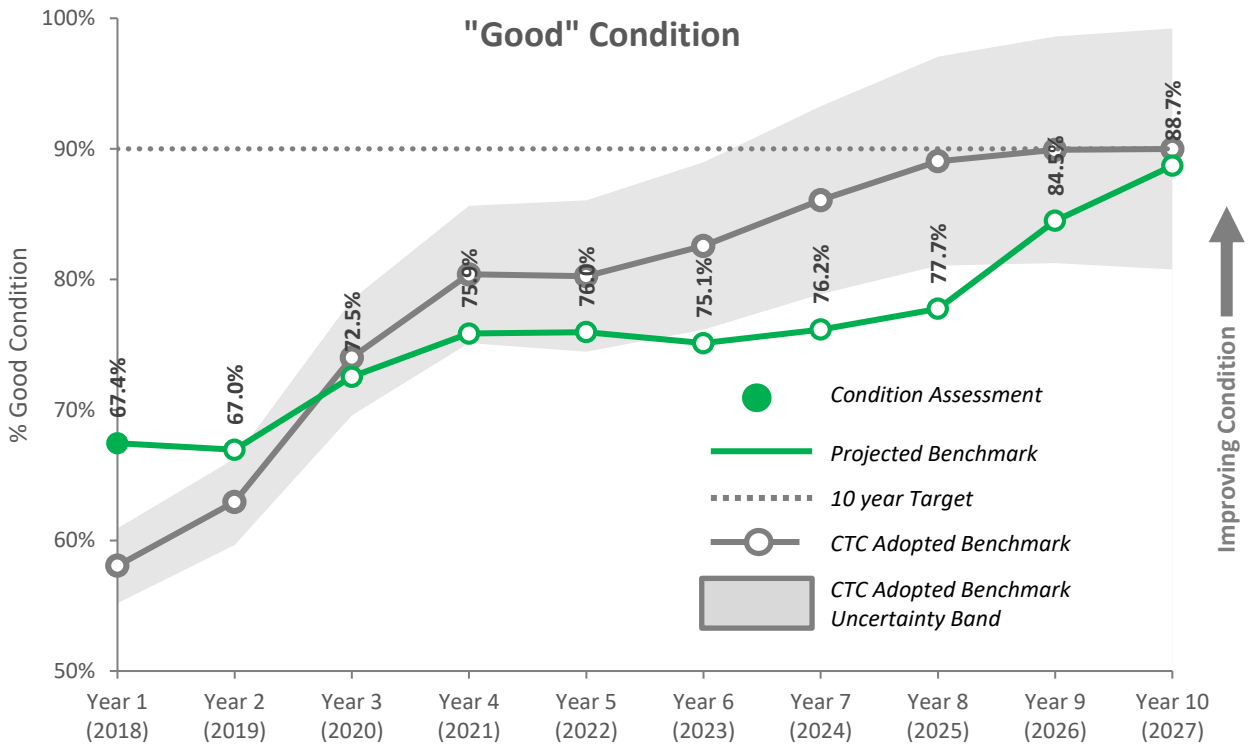
**Table 8 - Transportation Management Systems Condition Summary**

Condition	2027 Target	2016 Year End	2018 Year End	Change in Condition
Good	90.0%	58.8%	67.4%	+8.6% ↑
Poor	10.0%	41.2%	32.6%	-8.6% ↓

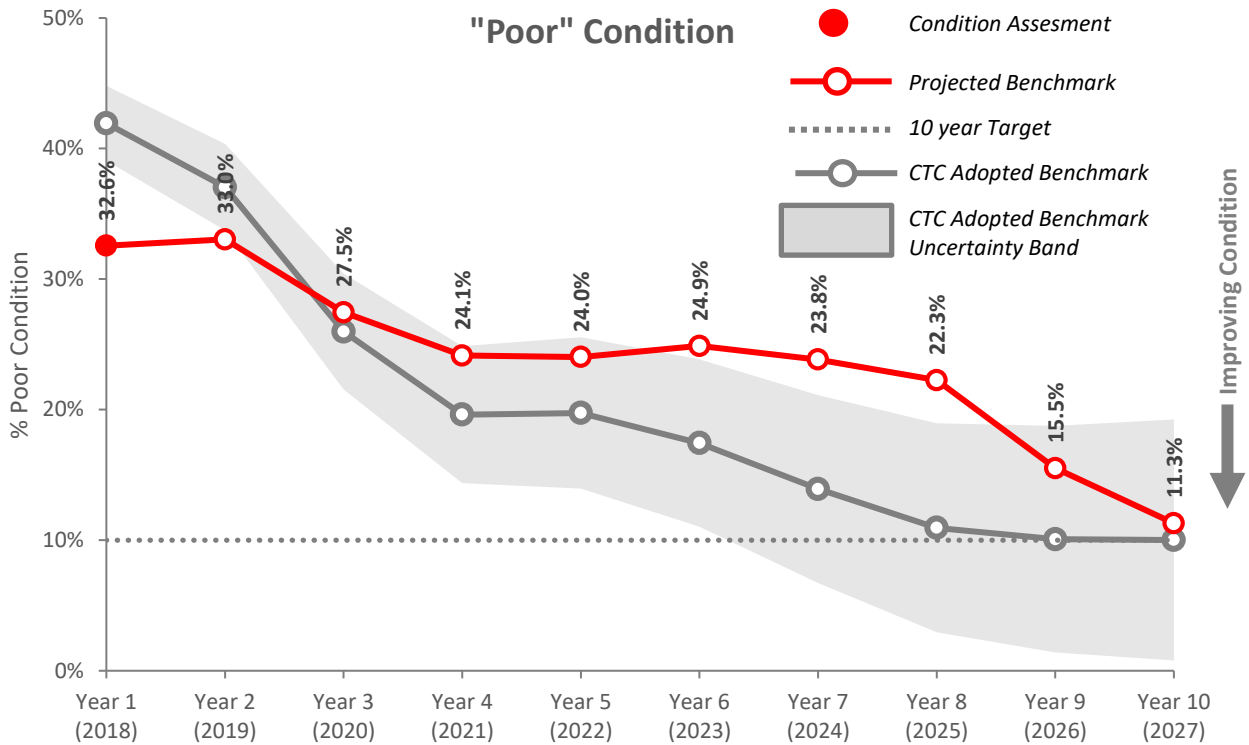
## Projected and Assessed Conditions

Transportation Management Systems benchmarks are presented in Figure 16 and Figure 17. These charts show projected year-end good and poor condition as

percentages of total TMS units from 2018 through 2027. The assessed condition for 2018 is presented in the charts with a solid fill symbol.



**Figure 16 – Transportation Management Systems, Good**



**Figure 17 - Transportation Management Systems, Poor**

## Benchmark Observations

Since the March 2018 benchmarks, a significant review process has been undertaken to verify TMS inventory and condition and to validate the condition changes resulting from anticipated work on projects in the latter years of the 10-year period. In a number of instances, the TMS projects reviewed over-projected accomplishments and resulting condition. While this differs from the March 2018 benchmarks, these revised projections reflect a more accurate state of TMS condition over 10 years.

# Fix an Additional 500 Bridges

## Overview

SB1 includes a performance requirement to fix not less than an additional 500 bridges over a 10-year period ending in 2027. Projects that improve the condition of the bridge from a lesser condition to a better condition, mitigate seismic or scour vulnerabilities, address operational limitations, or replace bridge rail not meeting current federal crash test standards are counted towards this goal. Prior to the passage of SB1, Caltrans was fixing an average of 126 bridges per year. For the purpose of counting towards the additional 500 bridges which should be fixed, Caltrans is reporting bridges fixed in excess of the baseline of 126 bridges. To satisfy the provisions of SB1, Caltrans need to fix at least 1760 bridges between 2018 and 2027.

## Current and Projected Number of Bridges Fixed

The number of bridges fixed in the current and last fiscal years is determined from an analysis of bridge project records and an estimate of when the work was effectively complete, referred to as the Expected Construction Work Complete (ECWC) date.

Table 9 presents the number of bridges fixed in FY 2017/18 and 2018/19.

## Expected Construction Work Complete (ECWC)

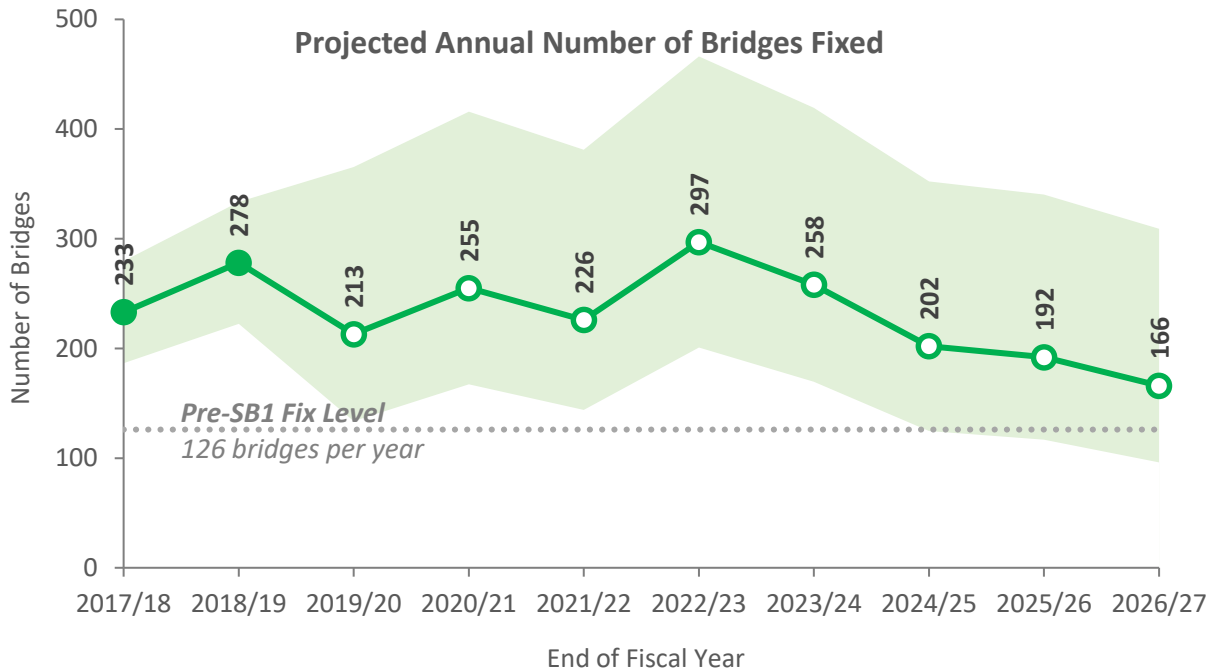
The point in time when performance credit is taken is defined by the Expected Construction Work Complete (ECWC) date. This is the date when construction work is effectively complete, the project limits are open to traffic, and benefits are realized by the travelling public. The ECWC is estimated to be 2/3rds the time between the contract award date and the Construction Contract Acceptance (CCA) date.

**Table 9 – Fix an Additional 500 Bridges**

Fix Bridges	FY 2017/18	FY 2018/19
Baseline	126	126
Additional	107*	152
<b>Total</b>	<b>233</b>	<b>278</b>

\*Adjusted to previous reporting to reflect ECWC dates

A 10-year projection of bridges fixed is presented in Figure 18. The chart shows the total number of bridges anticipated to be fixed each year over the 10-year period through FY 2026/27. Bridges fixed through the SHOPP are based on projects defined in the SHOPP Ten Year Project Book. For bridges fixed through the Highway Maintenance (HM) Program, the first two years are based on projects in a currently approved HM workplan. For HM projects in the remaining 8 years, the minimum of the first two years is used to estimate the number of bridges fixed in subsequent years.



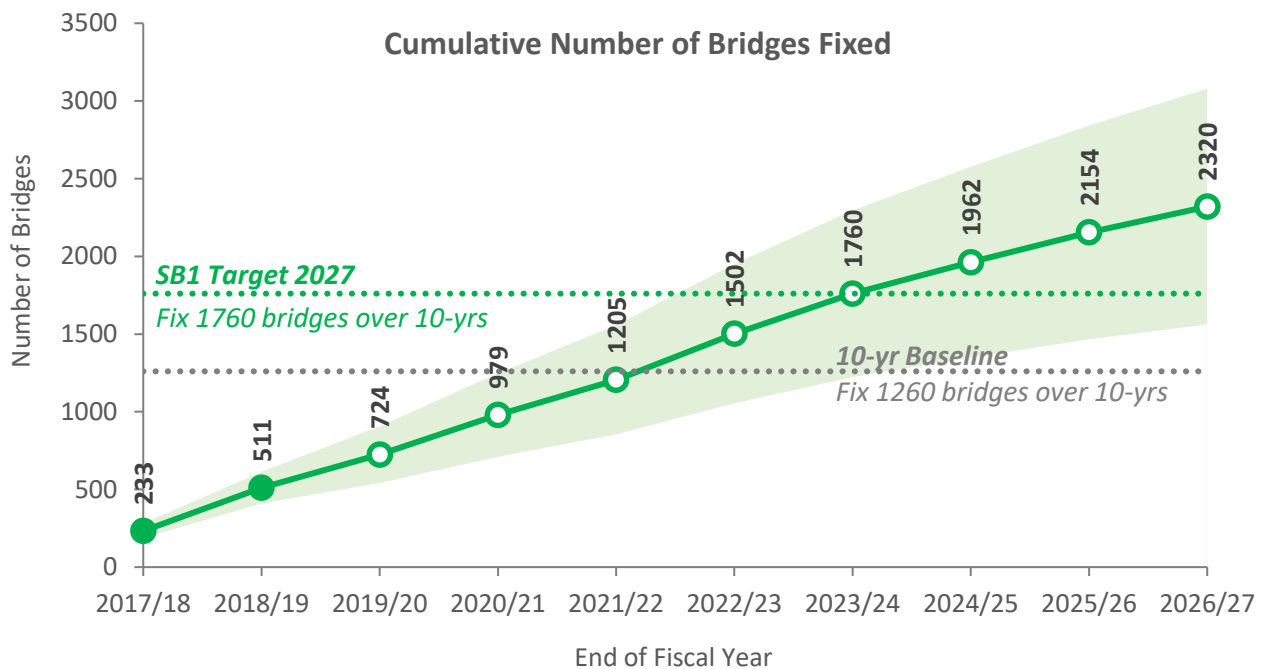
**Figure 18 – Projected Number of Bridges Fixed Each Year**

The assessed conditions for fiscal years 2017/18 and 2018/19 are presented in the chart with a solid fill symbol.



The shaded area in the chart represents an upper and lower boundary, quantifying two primary uncertainties from assumptions used in the analysis. First, delays in delivery of bridge projects are common but difficult to predict and could account for a shift of up to 20% of the projected fixed bridges in any given year. Second, programming levels for Highway Maintenance (HM) work and fluctuations in annual HM funding can be a significant source of additional uncertainty.

Caltrans is expected to fix an additional 500 bridges beyond the established baseline of 1260 bridges over the 10-year period (126 bridges/year on average), for a total of 1760 bridges. Figure 19 presents the cumulative total number of bridges fixed, including the uncertainty band to account for project delays and HM programming. Based on the projection and modeling assumptions, it is possible that the SB1 target could be achieved earlier than 2027.



**Figure 19 – Projected Cumulative Total Number of Bridges Fixed Above the Baseline**

# Level of Service (LOS)

## Overview

Caltrans has been conducting Level of Service assessments for many years to assess the degree of pavement maintenance being carried out. The pavement LOS is driven by a sampling of highway segments in California and is intended for internal management of maintenance crews. During the development of this benchmark report, the technical criteria that has been utilized for many years by Caltrans was discussed with Commission staff. Both Commission Staff and Caltrans agreed that this legacy methodology was not appropriate for Senate Bill 1 reporting. Caltrans has agreed to develop an alternative technical criteria and bring that to the Commission for approval at a future meeting.



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