California Transportation Asset Management Plan

Fiscal Years 2021/22-2031/32

Caltrans

Updated July 2022

Prepared by
California Department of Transportation

Executive Summary

California Transportation Asset Management Plan

Caltrans and its transportation partner agencies are responsible for supporting safe and efficient travel on California's transportation network. Maintenance and preservation of transportation infrastructure are critical aspects of this responsibility. Pavements, bridges, and other infrastructure assets require ongoing investment to sustain a state of good repair. As we maintain our existing assets, a dramatic shift is taking shape in California to low or zero emission transportation modes to minimize climate impacts and to better serve people of all means.

This document presents a coordinated plan by Caltrans and its partner agencies to maintain California's highway infrastructure assets today and into the future.

STATE OF CALIFORNIA · CALIFORNIA TRANSPORTATION COMMISSION

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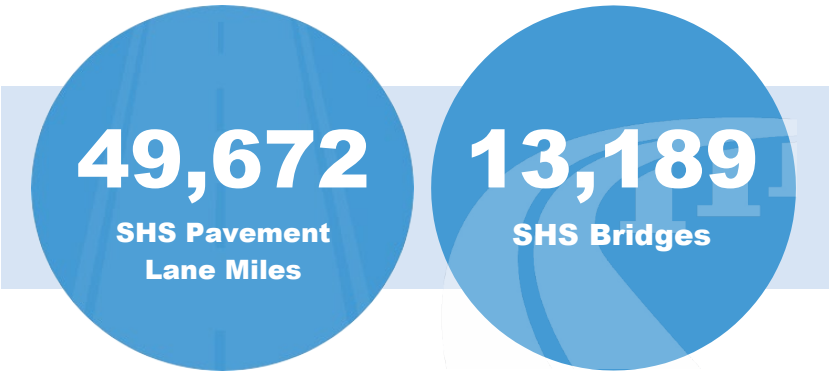
California's Transportation Assets

California's multimodal transportation system consists of a wide variety of physical assets. The most significant assets on the system, in terms of their cost and extent, are pavements and bridges. However, many other interconnected systems are needed to support mobility and improve safety, as depicted in the illustration below.

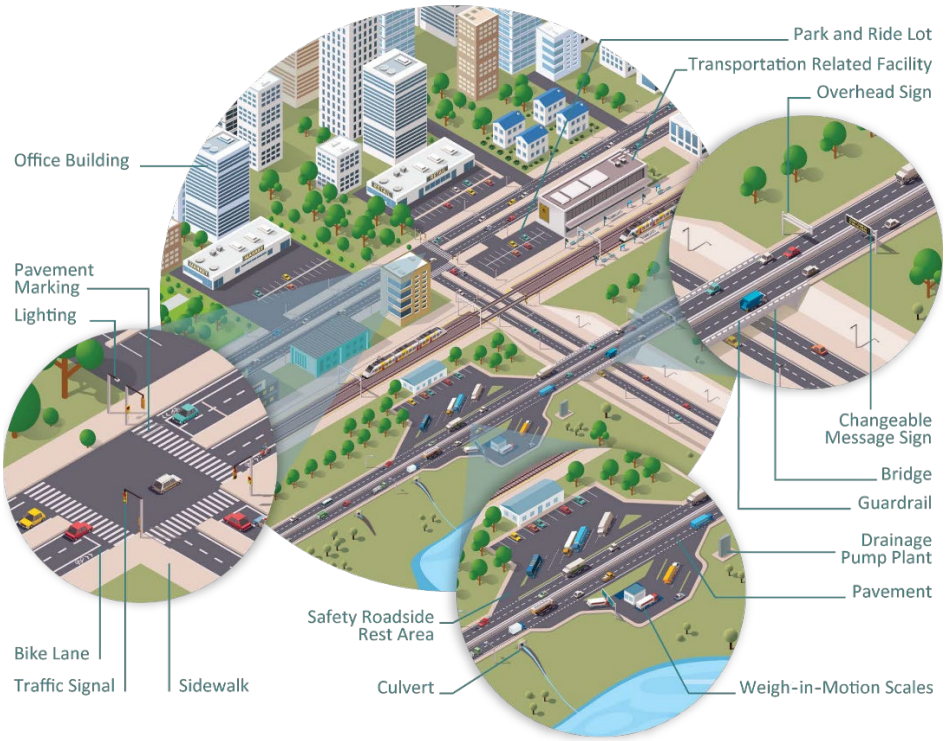
California's State Highway System

The California State Highway System (SHS) includes all assets within the boundaries of the highway system including 49,672 lane miles of pavements, 13,189 bridges, 212,759 culverts and drainage facilities, and 20,481 Transportation Management System (TMS) assets. Caltrans is the state agency responsible for planning, developing, maintaining, and operating the legislatively designated SHS.



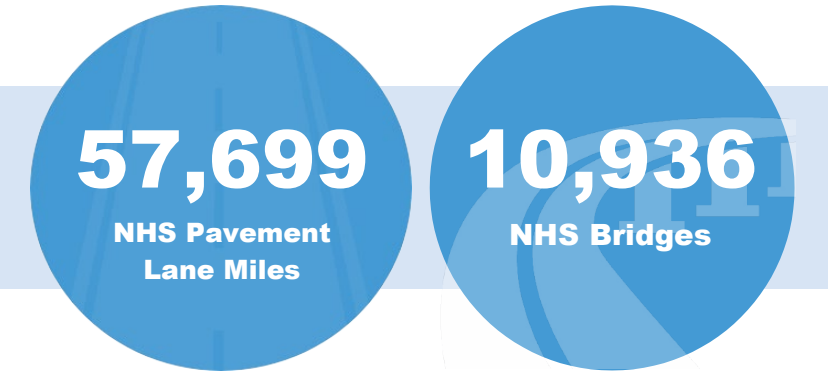
California's Multimodal Transportation System

The highway assets described in the California TAMP are an integral part of California's multimodal transportation system.



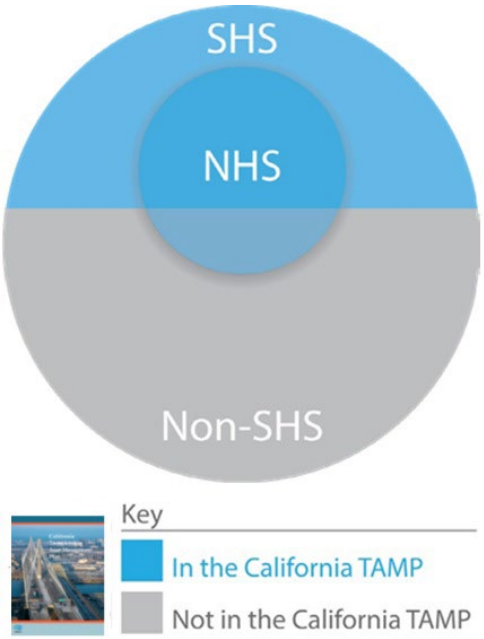
The National Highway System

The National Highway System (NHS) in California is owned by Caltrans as well as local, tribal governments, federal, and other state agencies. The system consists of 57,699 lane miles of pavements and 10,936 bridges totaling 243,347,047 square feet of bridge deck area.



A Coordinated Approach

California's transportation system includes assets owned by the state, cities and counties, toll authorities, tribal governments, and state and federal agencies. These assets intersect across federal, state and local ownership, meaning that a statewide view of the system is critical to maintaining and improving asset condition and meeting national and state performance goals. In particular, a significant number of NHS bridges and pavements are under local control in California. Caltrans and its partners can maximize limited resources by understanding the inventory and condition of the California transportation system.



California TAMP Scope

The scope of the California Transportation Asset Management Plan (TAMP) is primarily determined by federal and state requirements.

The California Transportation Commission (Commission) adopted TAMP guidelines in 2017, following the requirement of Senate Bill 486. These guidelines require that the California TAMP include pavement, bridge, drainage, TMS, as well as a list of supplementary assets on the SHS.

The Federal Highway Administration (FHWA) requires that California's TAMP include a summary listing of NHS pavements and bridges, including a description of the condition of these assets.

Managing California's Transportation Assets

Transportation asset management (TAM) is defined by United States Code (23 U.S. Code § 101) as "a strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on both engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the assets at minimum practicable cost."

Caltrans and its transportation partners have long recognized the importance of asset management, using asset performance targets to drive investment decisions as part of performance management and asset management best practice. State law requires the development of a state highway system needs assessment that uses performance targets to estimate current needs. Performance measures and targets are used to track progress and guide state and local agencies towards short, medium, and long-term objectives.

Strong asset management practices help to ensure Caltrans and its partners continue to make the best use of resources by carefully balancing multiple competing needs for infrastructure preservation and improvement.

In addition to the condition of physical assets, Caltrans and our partners are increasing focus on low or zero emission transportation options to reduce emissions and improve transportation access to people of all means. As the modal options expand in California, the breadth of the asset management plan will need to expand to reflect the new system components.

Federal & State Requirements

FHWA requires that a state's TAMP include pavements and bridges on the NHS. The Commission requires inclusion of pavements, bridges, drainage, and TMS, in addition to nine supplementary SHS asset classes. The Commission's approval authority of the TAMP is in accordance with Government Code section 14526.5.

System	Asset Class				
	Pavement	Bridges	Drainage	TMS	Supplementary Assets
NHS Federal Requirements	✓	✓			
SHS State Requirements	✓	✓	✓	✓	✓

Roles & Responsibilities

Four key stakeholders (Caltrans, MPOs/RTPAs, Commission, and FHWA) play a coordinated role and share a common vision in assuring that strategies for achieving performance targets in the TAMP are sound.

FHWA

- Establish national performance measures based on 7 national performance goals.
- Review and certify the TAMP.
- Monitor progress of the State towards achieving 2 and 4- year performance targets.

Caltrans

- Prepare a robust TAMP to guide transportation investments through the SHOPP to achieve performance targets.
- Ensure the TAMP is consistent with applicable state and federal requirements.
- Establish 10-year performance targets to support long-range investment strategies.
- Develop 2 and 4-year performance targets.
- Plan, design, and oversee construction of projects.

Commission

- Approve SHS assets for inclusion in the TAMP.
- Adopt targets and performance measures.
- Review and approve the TAMP.
- Report progress to the state legislature on Caltrans' progress towards meeting SHS performance targets.
- Review and adopt the SHOPP, consistent with the TAMP.

MPOs/RTPAs/Local Agencies

- Establish 4-year performance targets or adopt the state DOT's performance targets.
- Develop long-range transportation plans reflective of TAMP goals.
- Plan, design, and oversee construction of local projects.

Asset Condition at a Glance

California's transportation asset information is summarized in two ways: for the entire Caltrans-maintained SHS (portions of which are on the NHS), and for the entire NHS (which includes a portion of the state system and a portion of the local system managed by regions, cities, counties as well as tribal governments). This approach is used to provide a complete picture of SHS assets to meet state mandates, as well as to meet federal requirements for all NHS pavements and bridges in the TAMP.

Inventory and Conditions for NHS and SHS Assets in California

Whether based on age, condition, level of service, or simply frequency of repair, a performance measure is critical to actively managing the preservation of an asset. In the California TAMP, asset performance refers to asset condition and performance measures to report on the percentage of the asset classes in good, fair, and poor condition.

NHS	Asset Inventory	Good	Fair	Poor	
Pavement	57,699 Lane Miles	29.8%	62.2%	7.9%	
Bridges	243,347,047 Square Feet	48.5%	46.1%	5.4%	
SHS	**Asset Inventory**	**Good**	**Fair**	**Poor**	
		Primary Asset Classes			
Pavement	49,672 Lane Miles	57.0%	42.0%	1.0%	
Bridges	251,703,052 Square Feet	54.1%	42.4%	3.5%	
Drainage	21,449,336 Linear Feet	72.9%	17.5%	9.6%	
TMS	20,481 Each	79.0%	n/a	21.0%	
		Supplementary Asset Classes			
Drainage Pump Plants	288 Each	15.3%	34.4%	50.3%	
Lighting	97,745 Each	37.9%	15.3%	46.7%	
Office Buildings	2,669,524 Square Feet	43.6%	28.9%	27.6%	
Overhead Sign Structures	16,433 Each	57.3%	35.5%	7.1%	
Safety Roadside Rest Areas	86 Locations	36.0%	36.0%	27.9%	
Complete Streets	7,623,345 Linear Feet	70.6%	22.5%	6.9%	
Transportation -Related Facilities	4,382,000 Square Feet	22.8%	17.6%	59.6%	
Weigh in Motion Scales	140 Stations	44.3%	17.9%	37.9%	

Risks to the System

Managing transportation assets entails managing risk. California must balance a wide variety of transportation related risks on an ongoing basis. This includes day-to-day concerns such as risks that assets will deteriorate faster than expected or projects will cost more than budgeted, to the potentially catastrophic risks of asset failure caused by factors such as natural disasters. Climate change also presents a looming risk that will exacerbate all weather-related damage. Caltrans and its partners are undertaking several activities to better characterize and help reduce or potentially avoid risk to the transportation system such as vulnerability assessments to identify potential stressors.

California's Investment Strategies

Asset management best practices emphasize the use of performance management for transportation programs, shifting the decision-making framework towards data-driven, proactive, goal-oriented investment choices. Asset management investment strategies are the policies for resource allocation that will deliver the best asset performance given available funds and the goals and objectives of state and local agencies. Strategies documented in the California TAMP represent an investment philosophy of prioritizing preservation activities, adopting complete streets, implementing clean and sustainable practices, seeking progress towards broad goal areas, and focusing on selected asset classes. The investment strategies of the 2022 TAMP focus on the following:

- Preventive maintenance through Stewardship activities, also known as a "fix it first" approach.
- Embrace the principles outlined in the *Climate Action Plan for Transportation Infrastructure* (CAPTI) in all our investment decision making
- Embrace equitable transportation solutions to serve citizens of all means
- Selected asset classes: pavement, bridge,drainage, and TMS. These were designated as focus areas by the Commission, as they represent a significant portion of the SHS.
- Leverage investments to support the full range of Caltrans goals: Safety First; Strengthen Stewardship and Drive Efficiency; Enhance and Connect the Multimodal Transportation Network; Advance Equity and Livability in all Communities; Lead Climate Action; and Cultivate Excellence.

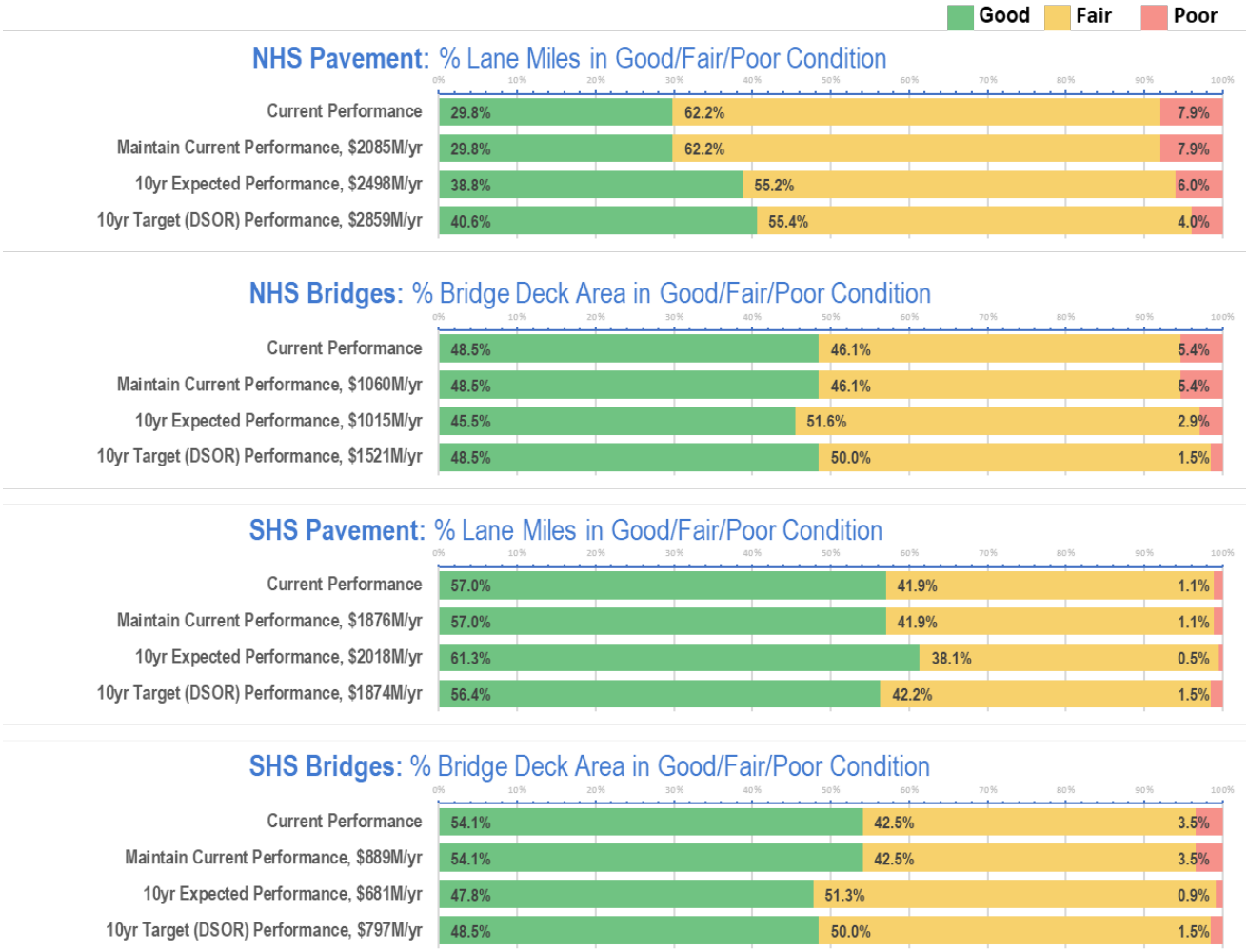
Making an Impact

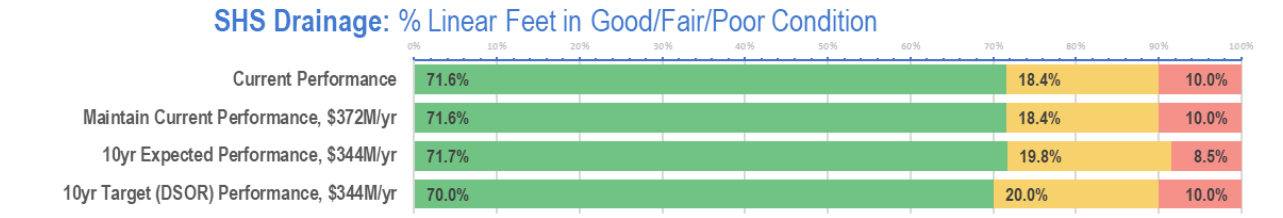
California's NHS and SHS will require substantial investment to achieve established Desired State of Repair 10-Year Targets. However, California is currently on track to achieve these targets for all of its' primary assets on the SHS while narrowing the gap for NHS pavements and bridges under current funding expectations. The additional federal funding included in the *Infrastructure Investment and Jobs Act* (IIJA) has brought additional transportation investment to California. These resources will further the "Fix it First" management of existing assets including supplementary assets at the same time we expand modal choice and focus on the equity of our decisions and projects. The CAPTI has provided a

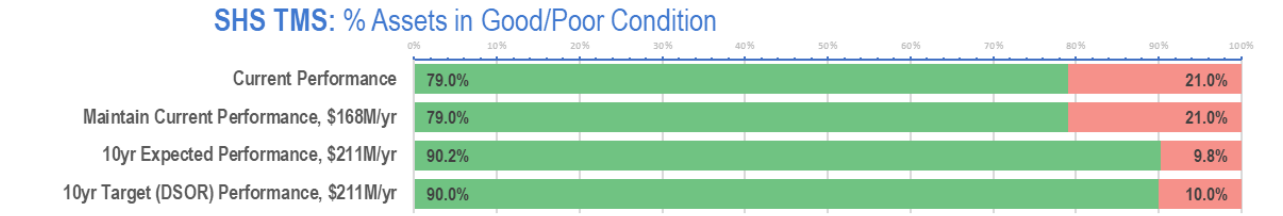
framework for change in how we deliver transportation options to the people of California providing specific recommendations for state programs and providing climate guidance for local agencies. The development of the TAMP will help California to direct major investment in its existing transportation system components serving all non-rail modes.

NHS and SHS Projected Asset Conditions

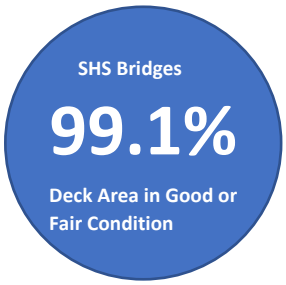
Performance scenarios for Current Performance, Maintain Current Performance, 10-Year Expected Performance, and 10-Year Target Desired State of Repair (DSOR) Performance are summarized for NHS and SHS asset classes. Note, the 10-Year Target includes additional maintenance funding required to sustain the target level of performance over the long term.







Expected 10-Year Accomplishments



About the California TAMP

The California TAMP describes the vision for how good asset management will help to deliver broad transportation goals and fundamental objectives supported by information on current asset conditions, the desired conditions in the future, and the likely conditions given future funding scenarios.

The TAMP is also a key requirement of federal regulation and California law. Federal regulation (23 CFR 515) requires an asset management plan be updated every 4 years from the date of initial TAMP certification for pavements and bridges on the NHS, including those owned by Caltrans and other federal, state and local agencies.

California law (Senate Bill 486) requires Caltrans to develop an asset management plan for the SHS. This document is intended to meet both sets of requirements.

The TAMP was produced through the collaborative effort of numerous stakeholders, starting with listening sessions and then structured around a regular series of workshops, and a robust feedback loop with our transportation partner entities. The TAMP is a living document. It will be regularly reviewed and updated, using performance outcomes and drawing from the 10-year project plan coming from the State Highway System Management Plan.

Improving Asset Management Practice

Good transportation asset management (TAM) is a continuously improving set of practices. California has been improving TAM programs and data, making progress towards aligning them with state goals and targets. Several opportunities for future improvements were identified and documented while developing the California TAMP:

- Strengthening local, regional, state, and federal coordination
- Improving transportation infrastructure management through better information, more transparent sharing of information, and collaboration
- Addressing the need for better data and software tools
- Achieving better reporting of transportation expenditure information
- Enhancing asset modeling capabilities

Progress in these areas, along with subsequent improvements to TAM processes are documented in this TAMP.

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1. Introduction

California's state highway and local roadway network serves as the transportation backbone that supports a $3.1 trillion economy, greater than any other state, and places California as having the world's fifth largest economy. This transportation infrastructure connects communities serving approximately 40 million residents and over 35 million registered vehicles, providing vital links that move goods through some of the busiest ports in the United States.

The demands on the transportation system lead to ongoing deterioration of our roadways and bridges that must be repaired, rehabilitated, or replaced to preserve the integrity and reliability of the transportation system. Transportation managers must continually evaluate system safety, performance, condition, and vulnerabilities in the context of available funding to make good transportation investment decisions. Although varied in their approach, most California jurisdictions have been managing pavement assets for a long time. For bridges, the use of formal management systems by local agencies are much less common than for pavement.

The ongoing costs associated with preserving the condition and performance of existing transportation assets are significant. Billions of dollars are spent each year by state and local government agencies to hold deterioration at bay, so the transportation system can continue to support its users reliably, safely, and with minimal disruption. Similar to maintaining a home or an automobile, doing the right preventative maintenance at the right time can significantly extend the service life and avoid costlier repairs in the long run. The need to efficiently manage transportation system investments has led to a recognition of the benefits of managing assets using a data-driven systematic approach generally

referred to as Transportation Asset Management (TAM).

To maximize the benefit of available federal transportation funding, the United States Congress established regulations that require each state to develop an initial Transportation Asset Management Plan (TAMP) by April 30, 2018, for all roadways on the National Highway System (NHS) and a state-approved TAMP meeting all requirements by June 30, 2019. The TAMP is to be updated at least every 4 years from date of the State's certified TAMP, with the 2022 California TAMP being the first updated plan.

The NHS is a collection of significant routes that includes all interstate highways and many non-interstate routes managed by the California Department of Transportation (Caltrans) and over 360 cities and counties making the California TAMP more unique than any other State in the US. Federal regulations require state departments of transportation (DOT) coordinate with regional transportation agencies in the development of the TAMP, addressing both state and local pavement and bridge assets using national performance metrics. The NHS in California includes portions of the State Highway System (SHS) and the local road network.

California Government Code (pursuant to Senate Bill 486, Statutes of 2014)[1] requires the development of a TAMP to guide the investments made on the SHS. Maintenance, rehabilitation, and operation of the entire SHS are the responsibility of Caltrans. Though the scope of the transportation system addressed by federal and state regulations differs, both exist to improve transportation investment decision making through the implementation of sound asset management principles to achieve state goals and objectives. The TAMP serves as an integral component of a suite of statewide plans covering all aspects of the broader transportation system as shown in Figure 1-1 from the long-range California Transportation Plan 2050.

[1] Senator DeSaulnier, Senate Bill 486, Statutes of 2014, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB486

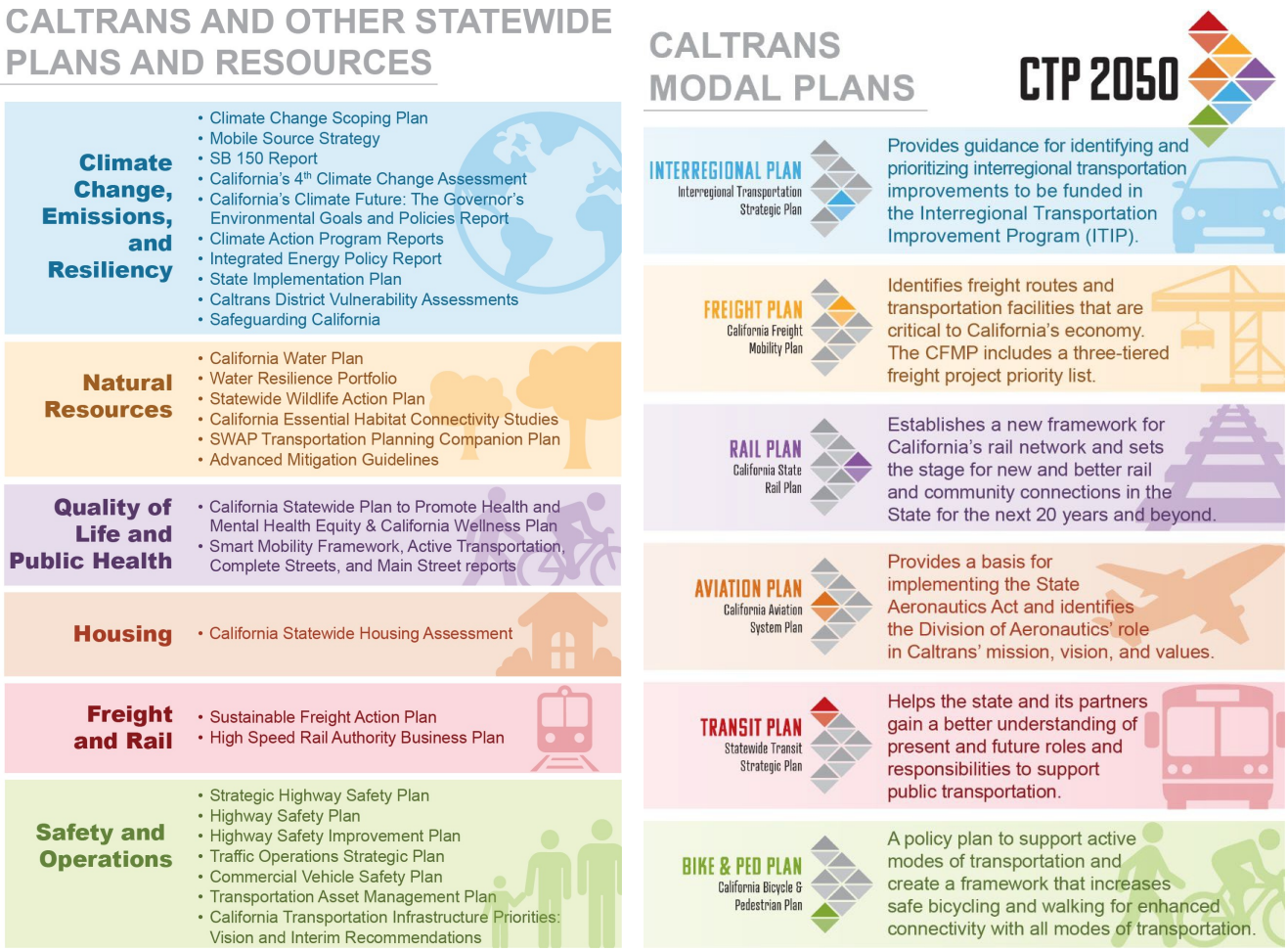


Figure 1-1. TAMP and other related California Transportation Plans

1.1. What is in the TAMP?

The TAMP documents current system conditions, establishes condition targets, quantifies the gaps in condition, evaluates risks that could impact the system condition or reliability, documents life cycle planning strategies, defines available transportation funding, evaluates funding scenarios relative to established targets, and identifies areas of potential improvement in the management of transportation assets.

10-year performance targets for both state and local NHS stakeholders were established in the TAMP through a collaborative process. The resulting shared vision for maintaining the transportation system is expected to bring more opportunities for improved coordination in transportation planning and investment.

Transportation Asset Management

"A strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on both engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the assets at minimum practicable cost."

(23 U.S.C. 101(a)(2). MAP-21 § 1103)

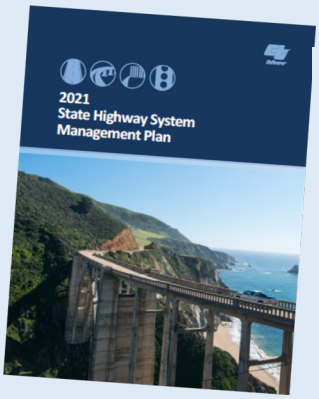
The financial plan for California changed dramatically with the passage of the *Road Repair and Accountability Act of 2017*, Senate Bill 1 (SB 1)[2] and with passage of local transportation funding measures. This funding has provided Caltrans and its local partners with critically needed resources and increased funding for system repair and rehabilitation to help support an asset management approach. The additional funding included in the federal *Infrastructure Investment and Jobs Act* (IIJA)[3] will be put to use furthering California's "Fix it First" management of existing assets at the same time we expand modal choice in transportation and focus on the equity of our decisions and projects.

The TAMP aligns with strategic investment strategies by taking a network view of assets and evaluating investment decision trade-offs over a 10-year period. The systematic framework put forth in the TAMP provides a solid basis for decision making that is both transparent and defensible.

1.2. Making Progress

Significant progress has already been made towards the development and implementation of asset management in California. New processes and changes to business practices have been put in place to bring greater transparency to the decision-making process. Federal and local agencies have been actively engaged to strengthen partnerships which will facilitate the transition towards improved asset management practices.

The *2021 State Highway System Management Plan* (SHSMP)[4] is the current asset management plan for the SHS published by Caltrans, which implements a performance management framework for state owned assets. The SHSMP integrates maintenance and rehabilitation activities performed on the SHS through a performance-based approach that aligns with Caltrans' strategic goals from the *Caltrans Strategic Plan 2020-2024*[5]. The SHSMP defines the inventory and condition of assets, establishes condition targets, determines the magnitude of condition gaps, develops cost estimates to close the gaps and defines a constrained investment plan for the entire State Highway Operation and Protection Plan (SHOPP).



The ***State Highway System Management Plan*** implements a performance management framework for the SHS.

A new Sea Level Rise Adaptation objective was introduced in the 2021 SHSMP that provides a high level, rough order of magnitude cost estimate for adapting roadways and bridges on the SHS to the projected

[2] Senator Beall, "Road Repair and Accountability Act of 2017", SB 1 , 2017, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB1

[3] US Congress 2021-2022, Federal Infrastructure Investment and Jobs Act, https://www.congress.gov/bill/117th-congress/house-bill/3684/text

[4] Caltrans, "2021 State Highway System Management Plan", 2021, http://www.dot.ca.gov/assetmgmt/documents/SHSMP.pdf

[5] Caltrans, "Caltrans Strategic Plan 2020-2024", 2020, https://dot.ca.gov/-/media/dot-media/programs/risk-strategic-management/documents/sp-2020-16p-web-a11y.pdf

impacts of climate change and rising seas. This adaptation estimate begins the conversations regarding the transportation priorities and adaptation costs. This analysis supports the statutes, policies and executive orders related to climate change as detailed in Appendix D. Additional climate stressors are being considered for the 2023 SHSMP.

Integrated into the SHSMP, is also an equity-based, programmatic-level approach to identify needs unique to each of the twelve Caltrans' districts. As an example, regional investments in bridges are larger where higher concentrations of poor condition bridges are identified, independent of historic regional bridge funding levels. At the project level, Caltrans' district staff collaborate with partner agencies and communities to make project level decisions that consider the needs and modes of all transportation system users. The combination of the SHSMP's statewide strategies with the district project-level considerations helps advance the department's goal to eliminate barriers leading to more equitable transportation for all Californians.

It is important to note that the SHSMP addresses the majority of the asset management requirements for a TAMP, but goes beyond the TAMP requirements to implement a performance-driven approach for the entire SHOPP, and includes contributions being provided by the highway maintenance program. All project planning is based on SHSMP performance objectives. This ensures that projects that begin the planning process will collectively accomplish enough work to achieve the condition goals established in the TAMP.

Caltrans collected the data needed to develop the TAMP for the locally-owned NHS by working with our regional and local transportation partners. A number of asset management listening sessions and workshops were held over a 9-month period hosted by Caltrans where a substantial focus was on bringing local asset management practices into the TAMP. Caltrans also provided mapping on the location and condition of the NHS by region and summarized investments by the five federal work types (initial construction, maintenance, preservation, rehabilitation, and reconstruction) helping to inform the TAMP investment strategies. This involved providing regional transportation agencies a performance target analysis tool (PTAT) to evaluate NHS pavement and bridge conditions and targets inclusive of risk. This provides the clearest picture for both risk mitigation funding and remaining budget available to improve the conditions of physical transportation system assets. A list of all workshops held and the transportation partner entities represented are available in Appendix A.

Feedback and information gathered from these workshops provided a foundation for the draft TAMP. Once the final draft was prepared, it too was sent out for review. The TAMP comment period began December 2021 and continued into February 2022. Caltrans announced the availability of the draft TAMP and requested public input through a dedicated online survey tool, accessible through the Caltrans Asset Management website[6]. Caltrans' Division of Local Assistance sent an announcement to all statewide partners, and Caltrans' Asset Management staff reached out to prior workshop attendees to submit feedback online.

[6] Caltrans Asset Management website, http://www.dot.ca.gov/assetmgmt/

1.3. Aligning Asset Management Objectives into Policies and Operations

In March 2018, Caltrans established a Director's Policy (DP-35) on transportation asset management shown in Appendix D. This policy set the responsibilities for asset management for all levels of the organization. A Statewide Asset Management Steering Committee was also formed to provide leadership and policy decision making for all major funding programs that impact condition and performance of the SHS inclusive of the state-owned NHS. Members of the Steering Committee include the Caltrans Deputy Directors for Project Delivery, Maintenance and Operations, Planning and Modal Programs, Finance, District Directors, and are supported by the State Asset Management Engineer. The alignment of the committee to the funding programs is shown in Figure 1-2.

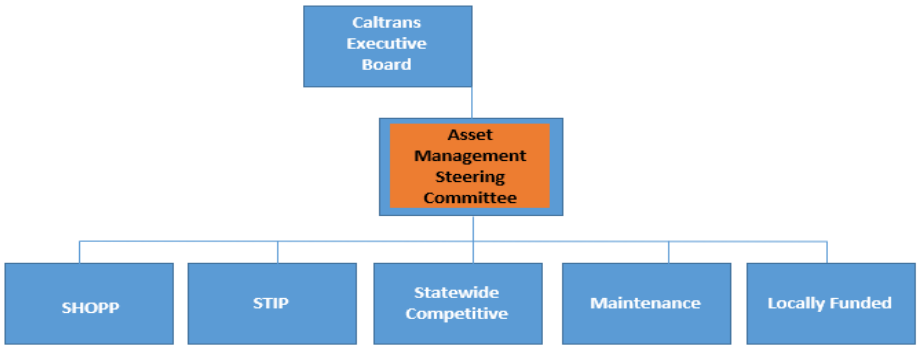


Figure 1-2. Asset Management Steering Committee Organization Structure

Caltrans' asset management framework can be described by a cycle of dependent business processes institutionalizing asset management throughout the organization as shown in Figure 1-3. Every 4 years the TAMP is updated to reflect the most current SHSMP which operationalizes the TAMP. For the SHS inclusive of the state-owned NHS, the SHSMP documents the performance gap analysis and investment planning process, which are used to develop district level performance plans.

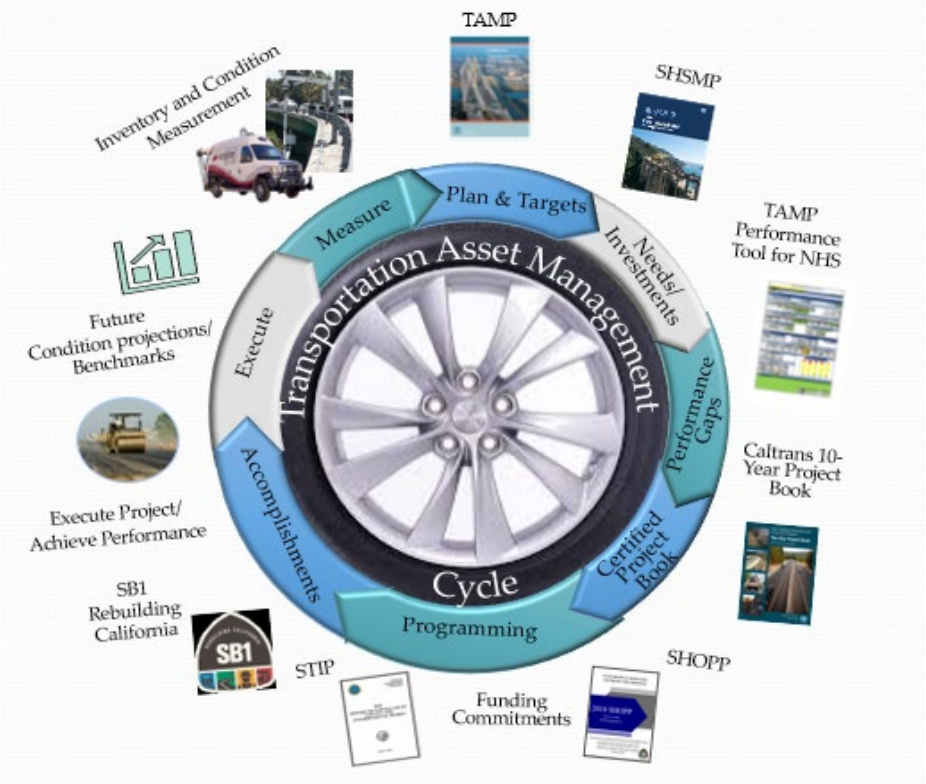


Figure 1-3. Transportation Asset Management Cycle

These performance plans define the performance targets and budget for each of 12 Caltrans' districts and are used to develop 10 years-worth of planned and programmed projects that meet established performance targets within financial constraints. Every quarter, these project portfolios are published in a 10-year SHOPP project book available to the public. For locally-owned assets, Caltrans developed the PTAT used to predict pavement and bridge conditions for the 2022 TAMP. This improved process provides a more realistic approach for the development of short term and long-term performance targets.

Once projects are prioritized by asset owners and committed for funding, state projects are programmed in the SHOPP if included in the previously described 10-Year project book. For local agencies, projects are programmed by the Metropolitan Planning Organizations (MPO) as established by existing programming rules. Routine annual preventive maintenance projects are not programmed in the SHOPP, but significant funding is spent on maintaining transportation assets by both the state and local agencies. Due to the large number of jurisdictions that own NHS pavement and bridges in California, Caltrans and MPOs have committed to furthering asset management through Memorandums of Understanding (MOU) that improve upon the coordination of federal performance management including NHS pavement and bridge data collection, target development, transportation programming, and the reporting of progress towards performance goals and outcomes.

Reporting TAMP Progress

An annual progress report submitted to FHWA on implementing the TAMP documents how the investment strategies are being used to make progress towards achievement of its targets for asset condition and performance of the NHS and supports progress towards national goals. This progress report documents prior year spending on NHS pavement and bridges by the five federal work types defined in federal regulations. It includes challenges faced in implementing asset management, but also discusses the major asset management initiatives undertaken in the prior year providing a snapshot of the progress being made in California on achieving asset performance.

Annual benchmarks are developed for state-owned assets and included as part of the asset management cycle to compare 10-year projections of asset conditions developed from project portfolios to actual measured performance, providing opportunities for adjustments and assuring that long-term targets are achieved. Asset condition is measured and reassessed according to program guidance which establishes the basis for beginning the asset management cycle again creating a performance driven continuous evolution of transportation system improvement.

1.4. Transportation Asset Management Plans are Living Documents

TAMPs are intended to evolve over time as changes in condition, budgets, risks, constraints, and strategic priorities are identified. Throughout the development of this California TAMP, opportunities for potential improvement were identified. As these improvements are realized, the TAMP will be updated to reflect better information or improved processes. Code of Federal Regulation (CFR) (23 CFR 515.13(c))[7] requires that the TAMP and its development processes be updated at least every four years to incorporate improvements and re-evaluate conditions, targets, and performance. This provision in federal regulation ensures that close collaboration between state and regional planning agencies continues.

The California TAMP presents a coordinated plan by Caltrans and its partner agencies to maintain California's highway infrastructure assets today and into the future. This TAMP meets the requirements of both federal and state regulations for TAM and provides a solid foundation to build upon and improve the management of transportation in California into the future.

[7] Electronic code of Federal Regulation (23 CFR 515.13), https://www.ecfr.gov/current/title-23/chapter-I/subchapter-F/part-515/section-515.13

2. Asset Inventory and Conditions

California's transportation system contains a wide variety of asset classes, including pavements, bridges, drainage, transportation management system (TMS), signs, bicycle/pedestrian infrastructure, signals, and others. California's TAMP addresses NHS pavement and bridge assets, and SHS pavement, bridges, drainage, TMS, and supplementary assets. This chapter presents summary information on asset inventory and conditions for these assets.

2.1. Overview

Asset inventory and condition data are the foundation for managing transportation assets. They are essential for communicating the extent of California's transportation infrastructure assets and their current condition state and are the building blocks for other asset management processes. Accurate inventory and condition data are needed for supporting asset management processes, such as life cycle planning, projecting funding needs, prioritizing projects, and monitoring asset performance.

California's transportation system includes assets owned by cities and counties, toll authorities, tribal governments, and state and federal agencies. These assets intersect across federal, state and local ownership, meaning that a statewide view of the system is critical to maintaining and improving asset condition and meeting national and state performance goals. In particular, a significant number of NHS pavements and bridges are under local control in California. Caltrans and its partners can maximize limited resources by understanding the inventory and condition of the California transportation system.

2.2. California's Transportation System

California's multi-modal transportation system consists of a wide variety of physical assets, as depicted in Figure 2-1. The most significant assets on the system, in terms of their cost and extent, are pavements and bridges. However, many other supporting systems are needed to support mobility and improve safety. In many cases, replacement or rehabilitation of roads and bridges includes replacement or upgrades to other supplementary assets depicted in Figure 2-1. For instance, the cost of reconstructing or replacing a bridge includes the cost of guardrail, and pavement projects often include upgrades to associated traffic and safety assets. Where applicable, costs associated with these supplementary assets are included in the costs of maintaining pavements and bridges.

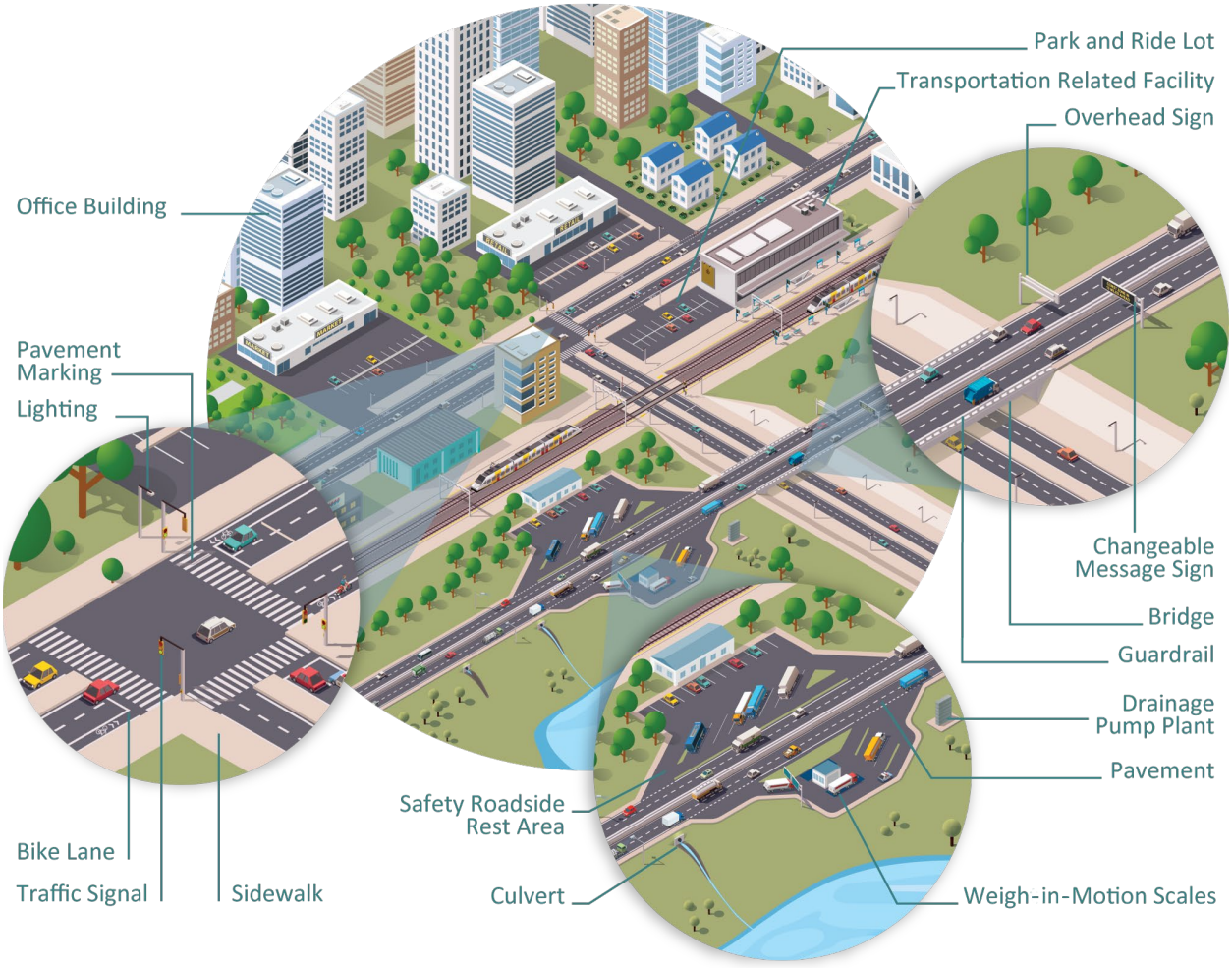


Figure 2-1. Typical Highway Assets

The TAMP addresses assets on two overlapping highway systems: SHS and NHS. The SHS is the highway system managed by Caltrans. The SHS includes all assets within the boundaries of the highway system and is largely managed through Caltrans maintenance and SHOPP[8]. The NHS includes portions of the SHS, as well as roads and bridges managed by a variety of other owners, including California cities and counties, toll authorities, tribal governments, and federal agencies. Roads on the NHS are defined by FHWA to be important to the nation's economy, defense, and mobility, and may include:

- Interstates
- Principal arterials
- The Strategic Highway Network (STRAHNET), another federally defined network
- Major strategic highway connectors
- Intermodal connectors

FHWA requirements dictate that the TAMP includes all NHS pavements and bridges. State TAMP Guidelines from the Commission require that the California TAMP include selected asset classes on the SHS. As stated earlier in this chapter, the Commission approved four primary asset classes and nine supplementary asset classes for inclusion in the TAMP. The four primary asset classes (pavement, bridges, drainage/culverts, and TMS) on the SHS are subject to the same analysis as the NHS pavements and bridges. The supplementary asset classes on the SHS shown in Figure 2-2 below are included in the TAMP to a limited degree. The overlapping federal and state requirements for this plan are depicted in Figure 2-2.

	Asset Classes				
System	Pavement	Bridge	Drainage	TMS	Supplementary Assets
NHS Federal Requirements	✔	✔			
SHS State Requirements	✔	✔	✔	✔	✔

Figure 2-2. Federal and State TAMP Requirements

Throughout the TAMP document, asset information is summarized in two ways:

(1) the entire Caltrans-maintained SHS, portions of which are on the NHS; and

(2) the entire NHS, which includes a portion of the state system and a portion of the local system managed by regions, cities, counties as well as tribal governments.

This approach is overlapping and used to provide a complete picture of SHS assets to meet state mandates, as well as to meet federal requirements for all NHS pavements and bridges in the TAMP.

In addition, all performance data for NHS pavements and bridges presented in the tables throughout the

[8] Caltrans, SHOPP Program, https://dot.ca.gov/programs/financial-programming/state-highway-operation-protection-program-shopp-minor-program-shopp

TAMP (i.e., good, fair, and poor condition) are based on Federal Regulation (23 CFR 490)[9].

National Highway System

The NHS in California is owned by Caltrans as well as local, tribal governments, federal, and other state agencies. The system consists of 57,699 lane miles of pavement and 10,936 bridges totaling 243,347,047 square feet of bridge deck area. The pavement inventory reflects the total surveyed lane-miles and does not include collection gaps from road closures, detours, and construction zones. A map of the NHS is shown in Figure 2-4.

State Highway System

The California SHS includes all assets within the boundaries of the highway system including 49,672 lane miles of pavement, 13,189 bridges, 212,759 culverts and drainage facilities, and 20,481 TMS assets. Caltrans is the state agency responsible for planning, developing, maintaining and operating the legislatively designated SHS.

These inventories are based on the best information available as of March 2021 and includes information from the 2021 SHSMP.

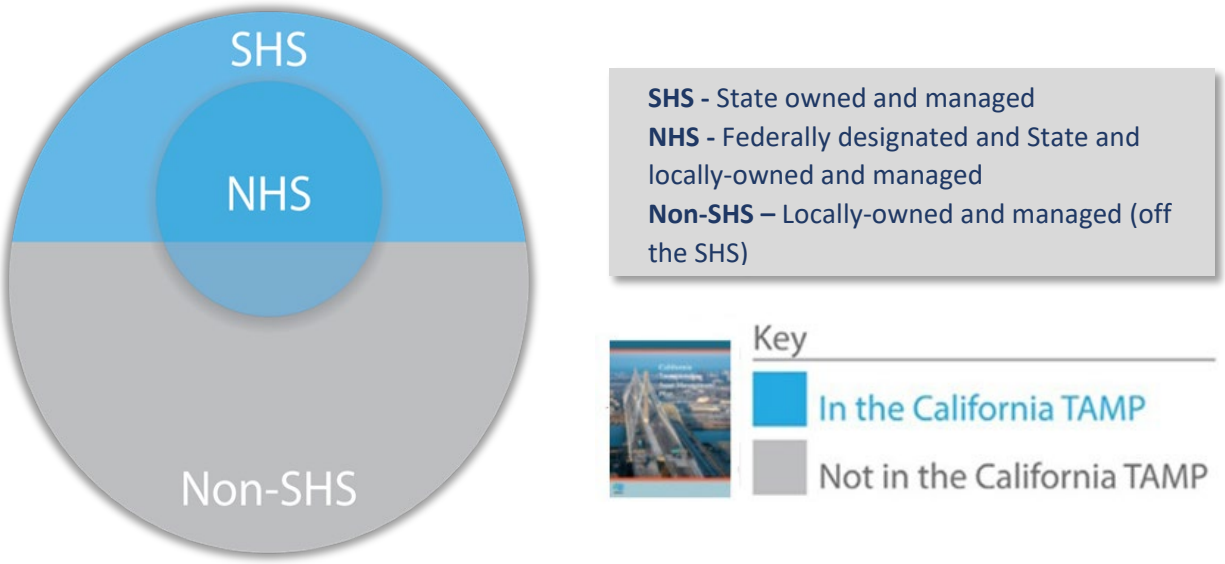


Figure 2-3. Assets Included in the California TAMP

[9] Electronic code of Federal regulation (23 CFR 490), https://www.ecfr.gov/current/title-23/chapter-I/subchapter-E/part-490

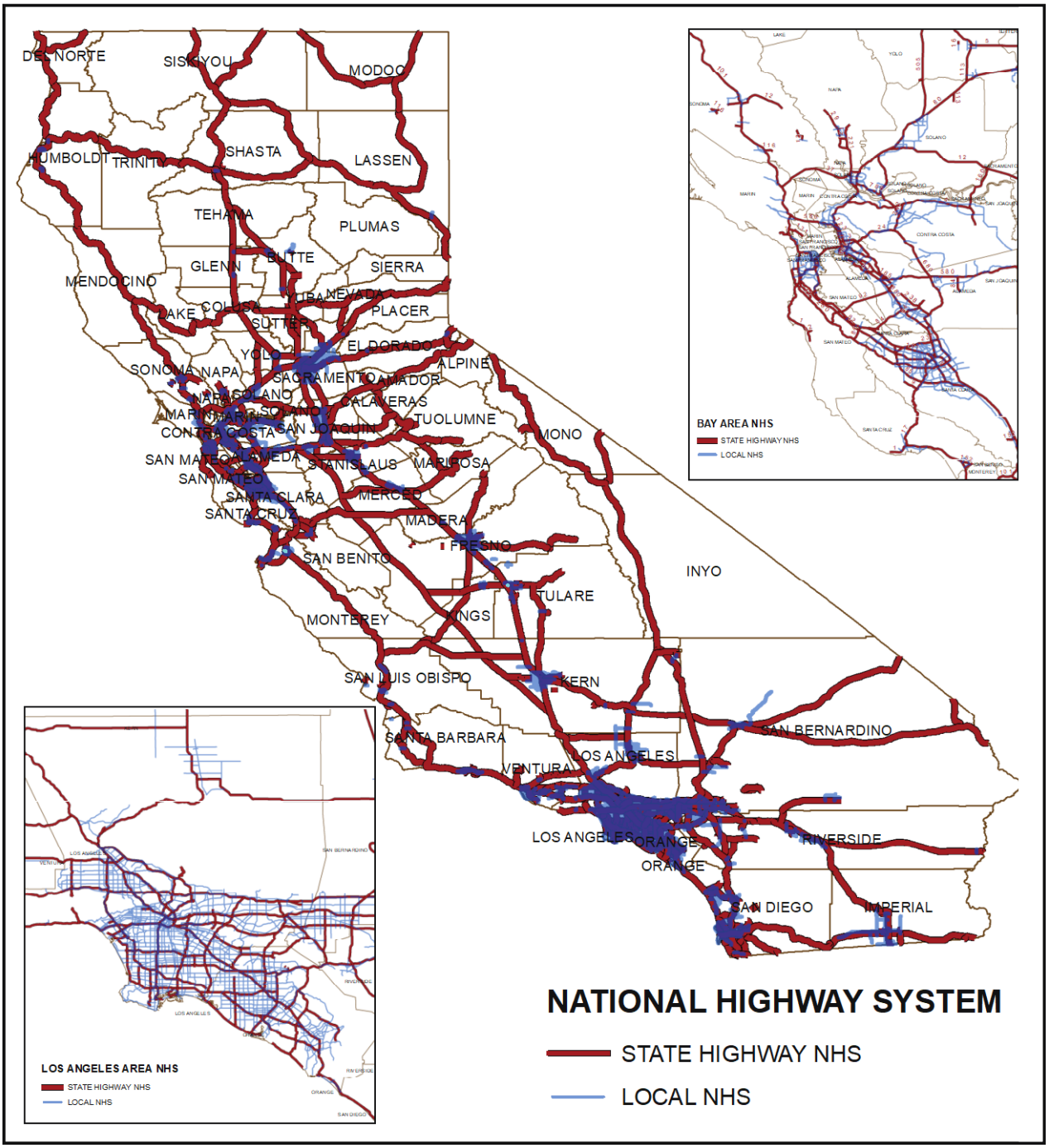


Figure 2-4. California NHS Map

2.3. Inventory and Condition

Monitoring and measuring transportation asset condition helps California's transportation agencies assess the performance of the transportation system, predict future needs, allocate funding, and schedule projects. Asset condition is also an important public-facing measure in which users of the transportation network notice and experience every day. Users can be very responsive to changes in asset condition.

FHWA developed national-level condition performance measures for NHS pavements and bridges outlined in the Pavement and Bridge Performance Management Final Rule (23 CFR 490). Caltrans recommended and the Commission adopted the national performance measures for SHS pavements and bridges. Caltrans recommended and Commission also established state performance measures for other assets on the SHS such as drainage, TMS, and supplementary assets. Federal and State performance measures are explained in greater detail for each asset in this chapter.

Condition data collection cycles vary depending on the asset. Pavement condition data on the SHS and NHS are collected annually, and bridges are inspected and their condition measured every two years. Caltrans inspects roughly 26,000 drainage assets and performs roughly 80,000 preventive maintenance checks on TMS assets annually.

Caltrans updates performance models based on the latest inventory and condition of assets every year as part of the SHSMP development.

2.4. Pavements

Pavements are designed to support anticipated traffic loads and provide a safe and comfortable driving surface. Keeping pavements in good condition lengthens their useable life, enhances safety, helps reduce road users' operating costs, and reduces vehicle emissions.

Pavement Data

Caltrans collects pavement inventory and condition data for all NHS and SHS pavements through an annual Automated Pavement Condition Survey (APCS)[10]. The APCS uses high definition images and lasers to measure pavement condition for every 0.1 mile for NHS and SHS pavements. Caltrans adopted this data collection methodology in 2015. Caltrans reports NHS pavement data to FHWA through the Highway Performance Monitoring System

Caltrans collects pavement inventory and condition data annually for all NHS and SHS pavements through APCS.

For the 2022 TAMP, NHS pavement data is reflective of the 2019 HPMS.

[10] Caltrans, Automated Pavement Condition Survey website, https://dot.ca.gov/programs/maintenance/pavement/pavement-management

(HPMS)[11], a national database maintained by FHWA with data on the nation's highways and their conditions. Additional discussion of data collection is included in Chapter 4. Life Cycle Planning.

Pavement Performance Measures

Caltrans recommended and the Commission adopted FHWA's four pavement condition performance measures:

- Percentage of pavements on the Interstate System in Good condition
- Percentage of pavements on the Interstate System in Poor condition
- Percentage of pavements on the NHS (excluding the Interstate System) in Good condition
- Percentage of pavements on the NHS (excluding the Interstate System) in Poor condition

Caltrans uses these performance measures for NHS pavements. These performance measures are calculated based on data reported in HPMS. The four measures are calculated using quantitative data on the following metrics:

- **Pavement roughness,** an indicator of discomfort experienced by road users traveling over pavements, is measured using the International Roughness Index (IRI).
- **Rutting** is quantified for asphalt pavements by measuring the maximum depth of undulation transversely along the wheel path. Rutting is commonly caused by a combination of slow-moving traffic and heavy vehicles or insufficient underlying support.
- **Cracking** is measured in terms of the percentage of cracked pavement surface. Cracks can be caused or accelerated by excessive loading, poor drainage, moisture or temperature changes, material issues, and construction flaws.
- **Faulting** is quantified for concrete pavements as the height difference across transverse joints or cracks. Faulting occurs when there is heavy vehicle loading, slab curling, erodible base material, and water present that cause independent slab movement.

A graphic depiction of the four pavement condition metrics is shown in Figure 2-5.

[11] FHWA, Office of Highway and Policy Information, HPMS website, https://www.fhwa.dot.gov/policyinformation/hpms.cfm

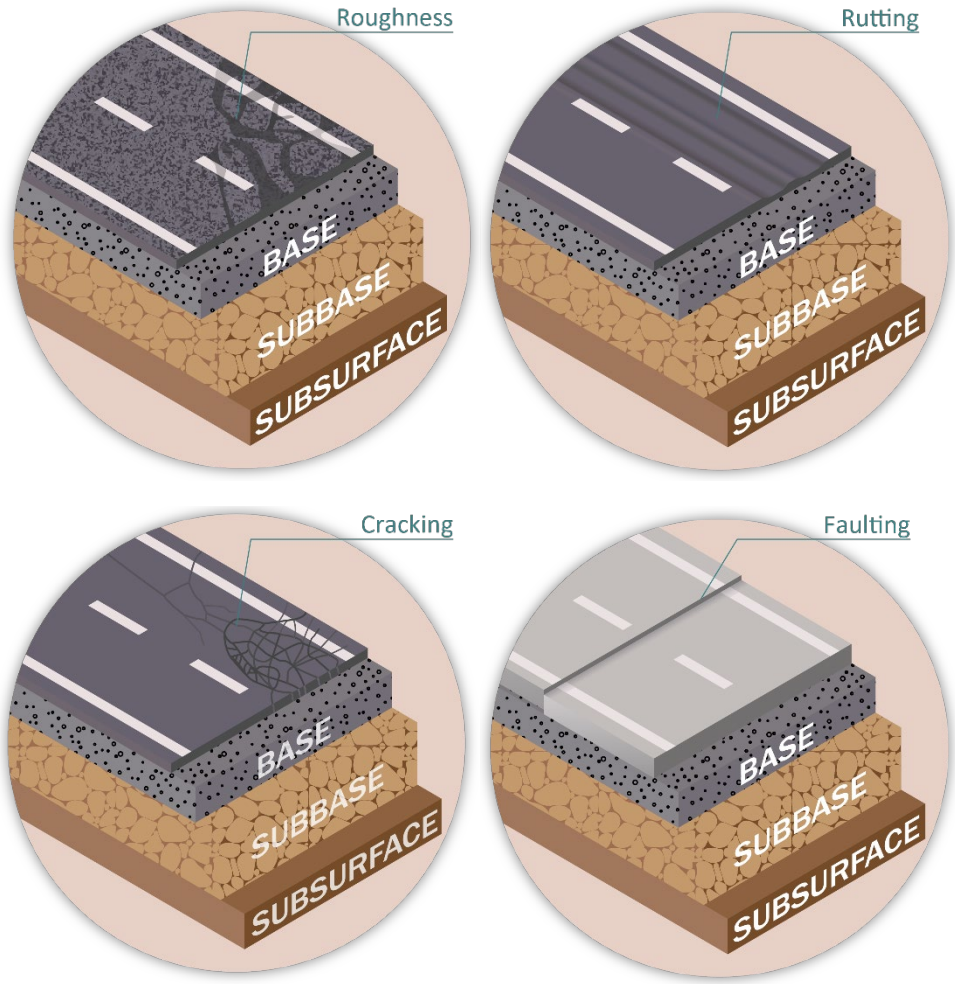


Figure 2-5. Pavement Condition: Four Metrics

MAP-21 established pavement performance metrics which have been in use in California since 2017 for reporting pavement conditions.

For each of the above metrics, thresholds for good, fair, and poor condition have been established by the federal transportation act, *Moving Ahead for Progress in the 21st Century Act* (Map-21). See Appendix D for further information on federal asset management regulations. The pavement condition metrics are used to calculate FHWA performance measures for pavement condition. Conditions are assessed using these criteria for each 0.1-mile-long pavement section. An individual section is rated as being in good overall condition if all of the metrics are rated as good, and poor when two or more are rated as poor. All other combinations are rated as fair. Lane miles in good, fair, and poor condition are tabulated for all sections to determine the overall percentage of pavement in good, fair and poor condition. For the NHS, overall pavement condition is based on outer lane distresses only. For SHS, all lanes are used to calculate pavement condition. Caltrans also uses additional metrics beyond

the federal requirements to assess pavement condition. Pavement thresholds are summarized in Table 2-1 for the NHS.

In addition, Caltrans also recommends and Commission sets targets for fair condition for assets on the SHS, as required by Commission TAMP Guidelines, using condition thresholds set by FHWA.

The majority of local jurisdictions in California utilize an alternative performance measure called the Pavement Condition Index (PCI) to measure pavement condition. PCI is a numerical index between zero and 100 used to indicate the general condition of a pavement section but excludes the pavement roughness required in the FHWA performance metric. Because FHWA metrics for NHS pavements do not include PCI as a performance measure, local agencies expressed concern that this may be causing inaccurate reflection of condition on the locally-owned system. Their concern is that PCI is more effective in monitoring conditions on local streets and roads because of slower speed and other physical features that impact condition measurement. Chapter 9. TAMS Process Improvements has listed this item for further action.

Table 2-1. NHS Pavement Condition Thresholds

Condition Thresholds			
Metric	**Good**	**Fair**	**Poor**
IRI (inches/mile)	**<95**	**95-170**	**>170**
Cracking (%)			
- Asphalt	<5	5-20	>20
- Jointed Plain Concrete	<5	5-15	>15
- Continuously Reinforced Concrete	<5	5-10	>10
Rutting (inches) *	**<0.20**	**0.20-0.40**	**>0.40**
Faulting (inches) **	**<0.10**	**0.10-0.15**	**>0.15**

Note: This table reflects final pavement condition thresholds for NHS pavements only.

*: Only applicable to Asphalt Pavement
**: Only applicable to Jointed Plain Concrete Pavement

NHS Pavement Inventory and Conditions

Pavement inventory is organized by system. The NHS is broken down into Interstate and Non-Interstate NHS pavements. Interstate pavements are part of the Interstate Highway System, a highway network which is part of the NHS. All other pavement subsystems on the NHS are represented as “Non-Interstate NHS.”

SHS pavements are owned by Caltrans. “Non-SHS” or “locally-owned” refers to pavements owned by other agencies, including cities, counties, tribal governments, federal agencies, and other state agencies.

Figure 2-3 shows the ownership and network of the assets included in the California TAMP.

Table 2-2 summarizes California's NHS pavement inventory and conditions by lane miles, organized by owner and system from the 2019 HPMS. A centerline mile is a measure of the total length (in miles) of pavement, as measured along the roadway centerline. A lane mile is the federal and state required unit of measure for performance and is a measure of the total length of traveled pavement surface for each lane. Lane miles is the centerline length (in miles) multiplied by the number of lanes. Lane miles is a more complete metric of pavement surface because it reflects the area of the pavement and is used for calculating performance measures and targets.

California pavement condition is presented in Table 2-2 in terms of the percent of pavements in good, fair, and poor condition, weighted by lane miles.

Table 2-2. Inventory and Conditions of NHS Pavements in California, by Lane Miles

Pavements on the NHS (2019 HPMS)					
	Lane Miles	Good	Fair	Poor	
State-owned NHS	**36,896**	**45.0%**	**52.8%**	**2.3%**	
Interstate	14,419	47.9%	50.2%	1.9%	
Non-Interstate NHS	22,477	43.1%	54.4%	2.5%	
Locally-owned NHS					
Non-Interstate NHS	20,803	3.0%	79.0%	17.9%	
All NHS	**57,699**	**29.8%**	**62.2%**	**7.9%**	
Interstate	14,419	47.9%	50.2%	1.9%	
Non-Interstate NHS	43,281	23.8%	66.2%	9.9%	

Table 2-3 presents inventory and condition of locally-owned NHS pavements. The table is organized by geographical jurisdiction, grouping pavement by Metropolitan Planning Organization (MPO)/Regional Transportation Planning Agency (RTPA) and then by the city or county owner within the region. A large portion of the locally-owned NHS pavements is in the areas covered by the Southern California Association of Governments (SCAG) or Metropolitan Transportation Commission (MTC) region.

Table 2-3. Inventory and Conditions of Local NHS Pavements, Listed by Geographical Jurisdiction

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
Butte CAG			100.8	4.2%	77.7%	18.2%
	Butte		100.8	4.2%	77.7%	18.2%
		Chico	48.3	0.0%	76.3%	23.7%
		Gridley	3.7	0.0%	69.0%	31.0%
		Paradise Town	42.4	9.5%	78.3%	12.3%
		County*	6.3	3.2%	89.1%	7.8%
Fresno COG			522.2	8.0%	75.4%	16.6%
	Fresno		522.2	8.0%	75.4%	16.6%
		Clovis	80.8	4.5%	87.6%	7.9%
		Fresno	339.6	7.8%	70.1%	22.0%
		Kingsburg	5.8	0.0%	89.1%	10.9%
		Selma	18.9	1.1%	82.2%	16.8%
		Parlier	3.0	0.0%	86.6%	13.4%
		County*	74.1	15.5%	82.6%	1.9%
Local Glenn CTC			5.6	6.2%	80.6%	13.2%
	Glenn		5.6	6.2%	80.6%	13.2%
		Orland	1.1	0.0%	52.6%	47.4%
		Willows	4.4	8.0%	87.4%	4.6%
		County*	0.1	0.0%	100.0%	0.0%
Humboldt CAOG			36.1	3.0%	86.2%	10.7%
	Humboldt		36.1	3.0%	86.2%	10.7%
		Arcata	3.6	0.0%	84.4%	15.6%
		Eureka	20.2	1.5%	86.3%	12.3%
		Fortuna	7.7	10.4%	84.0%	5.6%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
		County*	4.7	0.0%	90.9%	9.1%
Kern COG			706.4	8.5%	81.6%	10.0%
	Kern		706.4	8.5%	81.6%	10.0%
		Bakersfield	429.6	4.4%	81.0%	14.6%
		California	34.5	30.4%	68.4%	1.2%
		Delano	0.7	22.5%	77.5%	0.0%
		Shafter	38.0	8.9%	86.9%	4.1%
		Ridgecrest	8.0	5.0%	91.9%	3.1%
		County*	195.6	13.6%	83.6%	2.8%
Kings CAG			35.1	5.0%	95.0%	0.0%
	Kings		35.1	5.0%	95.0%	0.0%
		Hanford	28.1	6.2%	93.8%	0.0%
		County*	7.0	0.0%	100.0%	0.0%
Lassen CTC			7.5	0.0%	100.0%	0.0%
	Lassen		7.5	0.0%	100.0%	0.0%
		County*	7.5	0.0%	100.0%	0.0%
Madera CTC			3.8	0.0%	81.1%	18.9%
	Madera		3.8	0.0%	81.1%	18.9%
		Madera	3.8	0.0%	81.1%	18.9%
Merced CAG			86.7	0.0%	72.0%	28.0%
	Merced		86.7	0.0%	72.0%	28.0%
		Atwater	24.6	0.0%	66.9%	33.1%
		Merced	36.7	0.0%	74.6%	25.4%
		County*	25.4	0.0%	73.0%	27.0%
Metropolitan MTC			3121.0	1.7%	85.8%	12.5%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
	Alameda		586.8	1.6%	83.3%	15.1%
		Alameda	26.3	1.5%	74.6%	23.9%
		Albany	7.0	0.0%	74.5%	25.5%
		Berkeley	25.6	0.0%	70.3%	29.7%
		Emeryville	1.1	0.0%	100.0%	0.0%
		Fremont	107.6	0.6%	91.6%	7.8%
		Hayward	42.0	0.0%	96.2%	3.8%
		Livermore	32.2	0.0%	92.8%	7.2%
		Newark	30.0	0.0%	69.6%	30.4%
		Oakland	129.3	0.2%	75.5%	24.4%
		Pleasanton	51.9	0.0%	93.6%	6.4%
		San Leandro	14.4	0.0%	93.0%	7.0%
		Union	41.3	0.0%	83.1%	16.9%
		County*	78.2	10.5%	78.4%	11.1%
	Contra Costa		452.0	2.5%	85.0%	12.6%
		Antioch	38.3	0.0%	97.7%	2.3%
		Clayton	6.9	0.0%	100.0%	0.0%
		Concord	73.6	0.0%	67.1%	32.9%
		Danville Town	9.4	0.0%	96.3%	3.7%
		El Cerrito	2.8	0.0%	82.0%	18.0%
		Hercules	3.2	12.3%	84.3%	3.5%
		Lafayette	19.4	0.0%	87.7%	12.3%
		Martinez	10.6	0.0%	83.0%	17.0%
		Orinda	10.9	2.5%	81.2%	16.3%
		Pittsburg	27.0	0.0%	87.2%	12.8%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
		Pleasant Hill	10.0	0.0%	85.5%	14.5%
		Richmond	54.4	0.0%	88.2%	11.8%
		San Pablo	14.7	0.0%	86.5%	13.5%
		Walnut Creek	4.2	0.0%	81.1%	18.9%
		San Ramon	21.2	0.0%	96.4%	3.6%
		Brentwood	13.2	0.0%	92.5%	7.5%
		Oakley	11.0	4.7%	89.9%	5.5%
		Pinole	4.5	0.0%	93.6%	6.4%
		County*	116.9	8.5%	84.6%	6.9%
	Marin		69.8	1.4%	76.7%	21.9%
		Fairfax Town	5.1	3.9%	68.9%	27.2%
		Novato	13.0	0.0%	75.2%	24.8%
		San Anselmo Town	11.4	0.0%	94.0%	6.0%
		San Rafael	8.2	0.0%	95.0%	5.0%
		Sausalito	6.9	0.0%	43.3%	56.7%
		Ross Town	2.0	0.0%	100.0%	0.0%
		Larkspur	5.4	0.0%	96.1%	3.9%
		County*	17.9	4.5%	65.1%	30.4%
	Napa		33.7	1.2%	69.0%	29.9%
		Napa	33.6	1.2%	68.8%	30.0%
		County*	0.2	0.0%	100.0%	0.0%
	San Francisco		326.5	0.7%	89.2%	10.1%
		San Francisco	326.5	0.7%	89.2%	10.1%
	San Mateo		53.8	0.0%	84.8%	15.2%
		Brisbane	12.3	0.0%	88.9%	11.1%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
		Daly	14.9	0.0%	87.6%	12.4%
		Millbrae	0.9	0.0%	100.0%	0.0%
		Redwood	5.3	0.0%	71.6%	28.4%
		South San Francisco	4.7	0.0%	95.7%	4.3%
		East Palo Alto	0.9	0.0%	25.3%	74.7%
		Menlo Park	6.0	0.0%	100.0%	0.0%
		Belmont	0.5	0.0%	100.0%	0.0%
		County*	8.2	0.0%	68.7%	31.3%
	Santa Clara		1243.9	2.1%	88.2%	9.7%
		Campbell	41.8	0.0%	68.9%	31.1%
		Cupertino	13.5	0.0%	100.0%	0.0%
		Gilroy	16.3	0.0%	75.4%	24.6%
		Los Altos	9.9	0.0%	96.0%	4.0%
		Los Altos Hills Town	0.8	0.0%	99.5%	0.5%
		Los Gatos Town	16.3	0.0%	97.6%	2.4%
		Milpitas	37.7	0.0%	83.6%	16.4%
		Morgan Hill	19.8	20.2%	79.8%	0.0%
		Palo Alto	37.0	0.0%	92.6%	7.4%
		San Jose	690.0	2.2%	89.6%	8.2%
		Santa Clara	200.1	1.3%	87.5%	11.2%
		Saratoga	22.5	0.0%	83.2%	16.8%
		Sunnyvale	87.4	2.3%	89.0%	8.7%
		Mountain View	16.6	0.0%	85.5%	14.5%
		County*	34.3	5.8%	90.0%	4.2%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
	Solano		286.4	1.5%	81.5%	17.0%
		Benicia	32.2	0.7%	76.0%	23.4%
		Fairfield	64.7	4.3%	82.9%	12.8%
		Suisun	10.0	0.0%	96.0%	4.0%
		Vacaville	75.1	1.2%	79.8%	19.0%
		Vallejo	95.4	0.0%	81.1%	18.9%
		County*	9.1	3.1%	93.7%	3.3%
	Sonoma		68.0	0.0%	87.9%	12.1%
		Petaluma	7.6	0.0%	85.8%	14.2%
		Santa Rosa	41.6	0.0%	89.4%	10.6%
		Sebastopol	3.1	0.0%	40.0%	60.0%
		Sonoma	1.4	0.0%	100.0%	0.0%
		Rohnert Park	10.0	0.0%	94.0%	6.0%
		County*	4.2	0.0%	93.2%	6.8%
Monterey AMBAG			268.6	7.5%	78.6%	13.9%
	Monterey		186.3	9.0%	77.2%	13.8%
		Del Rey Oaks	0.4	0.0%	50.0%	50.0%
		Marina	28.7	19.8%	62.1%	18.1%
		Monterey	21.3	0.0%	76.7%	23.3%
		Pacific Grove	4.8	0.0%	58.3%	41.7%
		Salinas	79.6	1.5%	83.8%	14.7%
		Seaside	26.0	24.3%	71.0%	4.6%
		County*	25.4	13.8%	84.7%	1.6%
	San Benito		16.0	16.2%	83.8%	0.0%
		Hollister	12.7	15.7%	84.3%	0.0%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
		County*	3.3	18.2%	81.8%	0.0%
	Santa Cruz		66.3	1.2%	81.2%	17.6%
		Capitola	11.2	0.0%	80.3%	19.7%
		Santa Cruz	15.7	1.3%	79.6%	19.1%
		Watsonville	24.2	1.7%	79.7%	18.6%
		Scotts Valley	2.2	0.0%	100.0%	0.0%
		County*	12.9	1.6%	83.3%	15.2%
Sacramento COG			1398.1	2.3%	75.9%	21.8%
	El Dorado		1.7	0.0%	100.0%	0.0%
		Placerville	1.7	0.0%	100.0%	0.0%
	Placer		163.6	6.2%	91.3%	2.6%
		Auburn	0.7	0.0%	71.2%	28.8%
		Roseville	128.9	1.6%	96.2%	2.2%
		Rocklin	13.0	9.2%	84.0%	6.8%
		Loomis Town	3.8	0.0%	95.8%	4.2%
		County*	17.1	39.8%	59.5%	0.7%
	Sacramento		1136.0	1.8%	72.9%	25.3%
		Citrus Heights	79.2	1.4%	68.1%	30.5%
		Elk Grove	90.7	2.1%	84.8%	13.2%
		Folsom	40.0	12.1%	86.1%	1.8%
		Rancho Cordova	74.8	1.4%	76.9%	21.7%
		Sacramento	360.7	1.2%	78.7%	20.1%
		County*	490.6	1.5%	65.5%	32.9%
	Yolo		96.8	1.5%	84.4%	14.1%
		Davis	15.7	0.6%	89.8%	9.6%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
		West Sacramento	50.4	0.0%	80.3%	19.7%
		Woodland	24.5	3.9%	88.7%	7.4%
		County*	6.3	7.0%	86.8%	6.2%
San Diego SANDAG			1225.1	1.0%	84.3%	14.7%
	San Diego		1225.1	1.0%	84.3%	14.7%
		Carlsbad	123.8	0.6%	93.1%	6.3%
		Del Mar	2.8	0.0%	82.2%	17.8%
		El Cajon	27.0	0.0%	94.1%	5.9%
		Encinitas	30.3	0.0%	89.9%	10.1%
		Escondido	99.4	0.0%	79.6%	20.4%
		La Mesa	32.1	0.0%	91.7%	8.3%
		Lemon Grove	11.5	0.0%	77.1%	22.9%
		National City	7.4	0.0%	94.6%	5.4%
		Oceanside	94.6	1.4%	76.1%	22.5%
		Poway	32.8	4.9%	83.7%	11.4%
		San Diego	597.9	0.9%	83.0%	16.1%
		San Marcos	52.2	3.6%	90.9%	5.5%
		Santee	27.3	0.0%	82.4%	17.6%
		Solana Beach	3.9	0.0%	82.3%	17.7%
		Vista	32.1	0.0%	88.6%	11.4%
		Unknown	0.2	0.0%	100.0%	0.0%
		County*	49.9	2.8%	80.8%	16.4%
San Joaquin COG			564.4	4.7%	86.4%	8.9%
	San Joaquin		564.4	4.7%	86.4%	8.9%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
		Lathrop	25.9	12.4%	71.4%	16.2%
		Lodi	25.8	0.0%	95.4%	4.6%
		Manteca	56.0	6.3%	78.5%	15.2%
		Stockton	274.7	1.1%	89.6%	9.3%
		Tracy	94.8	8.6%	84.2%	7.2%
		County*	87.1	9.9%	85.9%	4.3%
San Luis Obispo COG			47.2	6.8%	86.1%	7.1%
	San Luis Obispo		47.2	6.8%	86.1%	7.1%
		Arroyo Grande	4.7	8.6%	87.2%	4.3%
		San Luis Obispo	21.6	8.6%	91.4%	0.0%
		Atascadero	19.9	3.6%	80.5%	15.9%
		County*	1.0	21.7%	78.3%	0.0%
Santa Barbara CAG			147.8	3.3%	88.7%	8.0%
	Santa Barbara		147.8	3.3%	88.7%	8.0%
		Goleta	37.3	4.3%	82.1%	13.6%
		Lompoc	7.0	4.3%	95.7%	0.0%
		Santa Barbara	54.7	0.0%	93.3%	6.7%
		Santa Maria	6.3	0.0%	81.1%	18.9%
		Guadalupe	2.0	0.0%	89.8%	10.2%
		County*	40.6	7.4%	88.5%	4.1%
Shasta RTA			10.4	0.0%	81.7%	18.3%
	Shasta		10.4	0.0%	81.7%	18.3%
		Redding	10.4	0.0%	81.7%	18.3%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
Southern California SCAG			12170.4	2.7%	76.7%	20.6%
	Imperial		288.4	11.7%	62.1%	26.1%
		Brawley	8.4	0.0%	10.3%	89.7%
		Calexico	30.8	6.5%	54.9%	38.6%
		El Centro	20.5	0.0%	73.5%	26.5%
		Holtville	1.7	0.0%	85.0%	15.0%
		Imperial	5.5	89.4%	10.6%	0.0%
		County*	221.4	12.2%	65.2%	22.7%
	Los Angeles		6450.7	0.9%	71.5%	27.6%
		Alhambra	56.9	0.0%	76.6%	23.4%
		Arcadia	41.4	1.4%	67.9%	30.6%
		Artesia	4.2	0.0%	90.5%	9.5%
		Azusa	28.1	0.0%	61.0%	39.0%
		Baldwin Park	13.8	0.0%	87.4%	12.6%
		Bell	18.1	4.4%	73.9%	21.7%
		Bell Gardens	21.4	0.0%	55.0%	45.0%
		Beverly Hills	40.1	1.0%	87.5%	11.5%
		Burbank	59.2	0.8%	77.8%	21.4%
		Carson	97.1	0.8%	73.4%	25.8%
		Cerritos	10.5	0.0%	87.6%	12.4%
		Claremont	29.8	0.0%	93.5%	6.5%
		Commerce	73.2	0.0%	81.5%	18.5%
		Compton	78.0	1.3%	78.6%	20.1%
		Covina	25.1	0.0%	73.3%	26.7%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
		Culver	81.5	0.0%	77.4%	22.6%
		Diamond Bar	5.7	7.0%	72.6%	20.4%
		Downey	52.6	0.0%	73.1%	26.9%
		Duarte	9.2	0.0%	88.7%	11.3%
		El Monte	38.6	0.0%	62.1%	37.9%
		El Segundo	15.1	5.3%	73.1%	21.6%
		Gardena	48.3	0.0%	85.6%	14.4%
		Glendale	97.3	0.0%	66.7%	33.3%
		Glendora	20.4	0.0%	42.2%	57.8%
		Hawaiian Gardens	7.1	5.6%	82.8%	11.6%
		Hawthorne	56.4	2.3%	91.3%	6.4%
		Hermosa Beach	1.6	0.0%	75.2%	24.8%
		Huntington Park	24.5	0.0%	30.8%	69.2%
		Industry	56.3	0.0%	69.2%	30.8%
		Inglewood	79.0	1.2%	62.4%	36.3%
		Irwindale	28.8	0.0%	92.8%	7.2%
		La Canada Flintridge	6.1	0.0%	67.3%	32.7%
		La Habra Heights	6.1	6.5%	84.4%	9.0%
		La Mirada	35.6	1.7%	89.4%	8.9%
		La Puente	21.8	2.0%	51.4%	46.5%
		La Verne	20.0	0.0%	45.8%	54.2%
		Lakewood	35.6	10.1%	78.4%	11.4%
		Lancaster	112.7	3.8%	70.9%	25.3%
		Lawndale	22.4	5.4%	60.1%	34.5%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
		Long Beach	234.9	2.2%	74.6%	23.3%
		Los Angeles	2785.1	0.0%	70.4%	29.5%
		Lynwood	54.6	0.6%	58.5%	40.9%
		Malibu	2.7	0.0%	100.0%	0.0%
		Manhattan Beach	19.5	0.0%	80.2%	19.8%
		Maywood	9.7	0.0%	83.6%	16.4%
		Monrovia	17.8	2.3%	67.7%	30.0%
		Montebello	61.6	0.0%	74.8%	25.2%
		Monterey Park	31.0	0.0%	72.8%	27.2%
		Norwalk	61.6	1.3%	85.0%	13.7%
		Palmdale	61.2	15.3%	61.3%	23.4%
		Palos Verdes Estates	10.0	0.0%	99.4%	0.6%
		Paramount	36.3	0.0%	87.5%	12.5%
		Pasadena	67.5	0.0%	67.2%	32.8%
		Pico Rivera	58.3	0.0%	70.3%	29.7%
		Pomona	95.7	1.3%	59.7%	39.0%
		Rancho Palos Verdes	45.8	10.6%	82.7%	6.7%
		Redondo Beach	14.6	0.0%	79.9%	20.1%
		Rosemead	13.4	0.0%	92.3%	7.7%
		San Dimas	24.3	3.3%	60.7%	36.0%
		San Fernando	13.3	0.0%	67.8%	32.2%
		San Gabriel	26.1	3.3%	50.3%	46.4%
		San Marino	23.3	0.0%	88.2%	11.8%
		Santa Clarita	97.3	2.9%	91.5%	5.6%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
		Santa Monica	43.7	0.0%	69.2%	30.8%
		Sierra Madre	3.4	0.0%	100.0%	0.0%
		South El Monte	3.1	0.0%	100.0%	0.0%
		South Gate	38.2	0.5%	53.9%	45.5%
		South Pasadena	14.0	0.0%	60.5%	39.5%
		Temple	9.3	0.0%	79.5%	20.5%
		Torrance	88.6	0.4%	75.4%	24.1%
		Vernon	49.9	0.0%	56.6%	43.4%
		Walnut	27.3	1.5%	97.1%	1.5%
		West Covina	37.1	0.0%	88.8%	11.2%
		West Hollywood	34.7	0.0%	71.6%	28.4%
		Whittier	44.4	0.0%	60.7%	39.3%
		Santa Fe Springs	59.9	2.0%	66.7%	31.3%
		Calabasas	3.1	0.0%	88.5%	11.5%
		Bellflower	17.8	0.0%	67.5%	32.5%
		Cudahy	4.2	0.0%	99.0%	1.0%
		Signal Hill	8.8	0.0%	97.4%	2.6%
		Rolling Hills Estates	20.8	0.0%	90.0%	10.0%
		Lomita	10.2	0.0%	100.0%	0.0%
		Westlake Village	0.3	0.0%	0.0%	100.0%
		County*	586.9	1.5%	67.1%	31.3%
	Orange		3059.0	3.9%	85.9%	10.2%
		Aliso Viejo	25.3	6.7%	85.8%	7.5%
		Anaheim	359.1	1.0%	86.7%	12.3%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
		Brea	24.5	2.0%	88.3%	9.6%
		Buena Park	78.0	1.9%	85.3%	12.7%
		Costa Mesa	89.4	0.0%	83.5%	16.5%
		Cypress	52.5	2.7%	96.6%	0.8%
		Dana Point	30.0	12.0%	86.7%	1.3%
		Fountain Valley	86.2	8.6%	85.8%	5.6%
		Fullerton	124.3	0.6%	70.0%	29.4%
		Garden Grove	156.1	0.3%	87.0%	12.7%
		Huntington Beach	160.2	1.0%	87.5%	11.5%
		Irvine	277.5	3.8%	90.7%	5.5%
		La Habra	20.6	0.0%	94.6%	5.4%
		La Palma	13.0	12.3%	87.6%	0.1%
		Laguna Beach	3.7	2.9%	97.1%	0.0%
		Laguna Hills	53.5	1.3%	73.7%	25.0%
		Laguna Niguel	78.8	4.6%	87.0%	8.4%
		Laguna Woods	25.0	2.4%	97.6%	0.0%
		Lake Forest	87.8	3.0%	86.1%	10.9%
		Los Alamitos	26.7	0.0%	90.4%	9.6%
		Mission Viejo	149.0	11.8%	80.6%	7.6%
		Newport Beach	65.9	15.8%	80.1%	4.1%
		Orange	159.6	2.6%	90.0%	7.5%
		Placentia	44.9	1.9%	76.0%	22.1%
		San Clemente	23.6	0.8%	91.8%	7.4%
		San Juan Capistrano	1.2	0.0%	79.4%	20.6%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
		Santa Ana	337.5	1.2%	85.8%	13.0%
		Seal Beach	35.4	9.3%	83.5%	7.2%
		Stanton	17.2	2.3%	87.1%	10.6%
		Tustin	144.3	4.5%	92.1%	3.4%
		Villa Park	4.0	0.0%	96.7%	3.3%
		Westminster	91.2	0.7%	88.6%	10.7%
		Yorba Linda	36.4	3.3%	92.2%	4.5%
		Rancho Santa Margarita	42.3	15.6%	74.8%	9.6%
		County*	134.2	16.5%	80.8%	2.7%
	Riverside		678.4	5.3%	79.7%	15.0%
		Beaumont	0.7	0.0%	39.4%	60.6%
		Blythe	4.5	0.0%	82.3%	17.7%
		Canyon Lake	10.9	0.0%	96.3%	3.7%
		Cathedral	49.2	0.8%	87.1%	12.1%
		Coachella	22.0	18.8%	78.4%	2.8%
		Corona	83.4	0.5%	88.4%	11.1%
		Eastvale	4.2	0.0%	90.5%	9.5%
		Indian Wells	9.2	0.0%	100.0%	0.0%
		Indio	40.3	2.0%	85.9%	12.1%
		Jurupa Valley	71.6	10.6%	78.1%	11.2%
		La Quinta	10.3	41.0%	48.8%	10.2%
		Lake Elsinore	11.7	37.5%	62.5%	0.0%
		Moreno Valley	30.3	0.0%	92.1%	7.9%
		Norco	0.7	0.0%	100.0%	0.0%
		Palm Desert	42.2	7.1%	85.3%	7.6%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
		Palm Springs	45.3	6.2%	85.6%	8.2%
		Perris	28.7	1.4%	73.2%	25.4%
		Rancho Mirage	29.8	8.0%	87.3%	4.7%
		Riverside	113.0	0.0%	62.8%	37.2%
		San Jacinto	13.3	0.0%	68.0%	32.0%
		Temecula	35.5	11.8%	83.7%	4.5%
		Menifee	3.1	0.0%	75.0%	25.0%
		County*	18.7	7.3%	76.4%	16.4%
	San Bernardino		1155.6	4.9%	79.0%	16.1%
		Adelanto	7.3	0.0%	26.8%	73.2%
		Barstow	33.8	0.0%	79.4%	20.6%
		Chino	62.3	0.0%	81.0%	19.0%
		Chino Hills	81.8	3.4%	88.5%	8.0%
		Colton	21.6	11.1%	77.8%	11.0%
		Fontana	75.4	1.6%	88.7%	9.8%
		Hesperia	30.7	23.4%	60.3%	16.2%
		Highland	19.1	6.3%	64.0%	29.7%
		Loma Linda	11.6	0.0%	80.3%	19.7%
		Montclair	39.5	1.0%	74.1%	24.9%
		Ontario	193.8	3.7%	85.5%	10.8%
		Rancho Cucamonga	136.3	2.5%	77.3%	20.3%
		Redlands	35.0	14.0%	79.6%	6.4%
		Rialto	80.7	13.6%	63.1%	23.3%
		San Bernardino	45.0	0.0%	40.1%	59.9%

Locally Owned Pavements on the NHS						
Jurisdiction			Lane Miles	Good	Fair	Poor
MPO / RTPA	County	City				
		Twentynine Palms	24.1	1.7%	96.1%	2.3%
		Upland	54.7	4.4%	74.6%	21.0%
		Victorville	28.4	4.2%	91.5%	4.2%
		Yucaipa	27.5	0.0%	92.0%	8.0%
		Grand Terrace	4.1	0.0%	80.6%	19.4%
		Apple Valley Town	21.2	15.1%	84.9%	0.0%
		County*	121.6	6.6%	85.3%	8.1%
	Ventura		538.3	5.0%	86.0%	9.0%
		Camarillo	35.6	3.4%	92.0%	4.6%
		Moorpark	14.1	2.8%	97.2%	0.0%
		Oxnard	158.6	6.6%	88.1%	5.3%
		Port Hueneme	18.5	0.0%	89.9%	10.1%
		Santa Paula	7.3	0.0%	45.0%	55.0%
		Simi Valley	38.6	2.5%	86.8%	10.7%
		Thousand Oaks	148.9	0.5%	90.0%	9.5%
		Ventura	57.6	2.8%	73.6%	23.6%
		County*	59.1	19.3%	79.3%	1.4%
Stanislaus COG			219.7	13.9%	73.0%	13.1%
	Stanislaus		219.7	13.9%	73.0%	13.1%
		Modesto	110.2	15.1%	73.9%	11.0%
		Oakdale	4.6	0.0%	91.3%	8.7%
		Turlock	55.1	4.4%	76.4%	19.2%
		Ceres	23.4	14.3%	82.3%	3.4%
		County*	26.5	30.4%	50.6%	19.0%

Locally Owned Pavements on the NHS							
Jurisdiction			Lane Miles	Good	Fair	Poor	
MPO / RTPA	County	City					
Tahoe MPO			8.0	0.0%	95.0%	5.0%	
	El Dorado		8.0	0.0%	95.0%	5.0%	
		South Lake Tahoe	2.6	0.0%	84.4%	15.6%	
		County*	5.5	0.0%	100.0%	0.0%	
Tulare CAG			118.3	5.5%	79.5%	15.0%	
	Tulare		118.3	5.5%	79.5%	15.0%	
		Dinuba	18.6	10.8%	67.7%	21.5%	
		Porterville	10.2	0.0%	95.8%	4.2%	
		Tulare	25.3	2.4%	65.6%	32.0%	
		Visalia	52.2	3.7%	87.5%	8.9%	
		County*	12.1	16.2%	78.3%	5.5%	
Total							
All Locally-Owned NHS			20,803.0	3.0%	79.0%	17.9%	

*County-owned Assets

2.5. Bridges

Bridges provide road network connectivity, spanning water bodies and other natural features, rail lines, and other roadways. New bridges are designed to last at least 75 years, and in practice, many bridges remain in service for much longer. However, bridges require periodic maintenance to replace individual components (such as decks) that have a shorter life than the bridge as a whole. If preservation work on a bridge is deferred, the deterioration may accelerate to the point where more costly repairs are needed. In extreme cases, deteriorated conditions may require restricting the loads the bridge can carry or closing the bridge until needed repairs are complete–which can mean costly detours for road users. Thus, maintaining bridges in good condition pays off–resulting in the lowest long-term costs both to transportation agencies and road users. Bridges in good condition allow access to essential services and have a positive impact on the economy.

Bridge Data

Bridge asset data are reported by Caltrans annually to FHWA to support National Bridge Inventory (NBI)[12], an FHWA database that includes data on all bridges 20 feet or longer. Any culvert with a width that spans 20 feet, or more is also classified as a bridge and recorded on the NBI. Bridges and culverts with a span shorter than 20 feet are excluded.

Caltrans also records an inventory of bridges in the SHSMP. This inventory has minor differences from NBI data. Notably, SHSMP inventory includes shorter bridges and pedestrian bridges that don't meet NBI requirements. The California TAMP uses NBI data as the source of NHS bridge inventory and condition and uses SHSMP data as the source of SHS bridge inventory and condition.

Bridge asset data are reported by Caltrans annually to FHWA to support NBI, an FHWA database that includes all data on bridges 20 feet or longer and all culverts 20 feet or wider on public roads.

[12] FHWA, National Bridge Inventory (NBI) website, https://www.fhwa.dot.gov/bridge/nbi.cfm

Bridge Performance Measures

FHWA has established and the Commission adopted two measures of bridge condition:

- Percentage of NHS bridges classified as in good condition (weighted by deck area)
- Percentage of NHS bridges classified as in poor condition (weighted by deck area)

FHWA requires that states use these measures in their TAMP to describe condition, set targets, and analyze performance gaps of NHS bridges. All other bridges are considered fair.

Caltrans and local agencies follow FHWA NBI standards for inspecting all California bridges. Caltrans staff perform inspections for all Caltrans bridges and many of California's locally-owned bridges. Inspectors record overall ratings for a bridge's deck, superstructure, and substructure on a scale from zero (worst condition) to nine (best condition) respectively. Structures classified as culverts are included in the inventory if they span more than 20 feet. For these structures, a single culvert rating is recorded using the same zero to nine scale.

Figure 2-6. NBI Ratings for Bridge Condition

Bridge condition ratings are used to classify the bridge as being in good, fair or poor condition. The lowest of the three ratings for deck, superstructure, and substructure determines the overall rating of the bridge. If this value is seven or greater, the bridge is classified as being in good condition. If it is five or six, the bridge is classified as being in fair condition, and if it is four or less, the bridge is classified as being in poor condition. A graphical depiction of the three bridge components is shown in Figure 2-7.

Caltrans also performs element-level inspections that provide additional detail on what portions of a bridge are deteriorated. Element-level information can be used to derive the NBI deck, superstructure, and substructure ratings.

In addition to the federal performance measures above, Caltrans also measures fair condition for assets on the SHS using the condition thresholds set by FHWA. The California TAMP includes fair condition targets to focus on the preservation of bridges in addition to the rehabilitation and replacement of poor bridges.

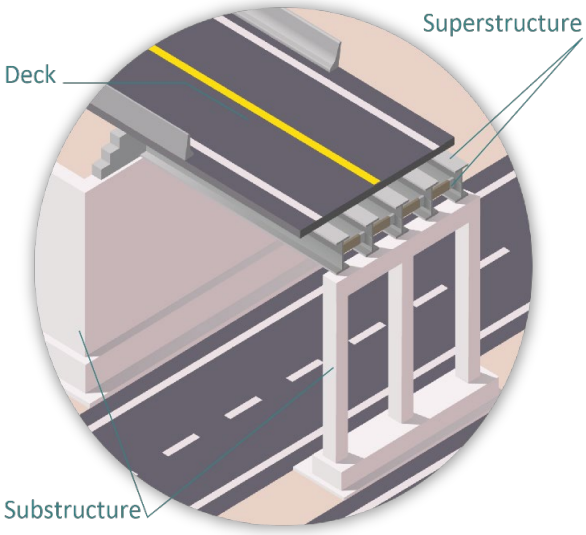


Figure 2-7. Bridge Components

NHS Bridge Inventory and Conditions

Table 2-4 summarizes California's NBI bridge inventory by bridge count and by deck area, organized by owner and system. Furthermore, including deck area in addition to bridge count helps account for differences in bridge size, and is consistent with FHWA TAMP requirements. NBI excludes all non-vehicle bridges (pedestrian/railroad crossings, etc.) and bridges less than 20 feet in length that are still Caltrans' maintenance responsibility.

Table 2-4 also summarizes the condition of California's NBI bridge inventory in terms of the percent of bridges in good, fair, and poor condition, weighted by deck area. On the NHS, 48.5 percent of bridge deck area is in good condition, 46.1 percent is in fair condition, and 5.4 percent is in poor condition.

Table 2-4. Inventory and Conditions of NBI Bridges on the NHS, Weighted by Deck Area

NBI Bridges on the NHS						
System	Count	Deck Area (ft^2)	Good	Fair	Poor	
State-owned						
NHS	9,263	218,564,095	49.9%	45.7%	4.4%	
Locally-owned						
NHS	1,673	24,782,952	35.8%	50.5%	13.7%	
Total						
NHS	10,936	243,347,047	48.5%	46.1%	5.4%	

Table 2-5 shows a breakdown of locally-owned NHS bridges. The table organizes the assets by geographical jurisdiction, grouping the bridges by MPO/RTPA and then by city and county owner within the region. A large portion of the bridges listed in the table is in areas under the jurisdiction of SCAG or MTC.

Table 2-5. Inventory and Conditions of Non-SHS NHS Bridges, Listed by Geographical Jurisdiction

Locally Owned Bridges on the NHS							
Jurisdiction				Deck Area (ft^2)	Good	Fair	Poor
MPO / RTPA	County	City	Count				
Butte CAG			7	40,763	30.4%	69.6%	0.0%
	Butte		7	40,763	30.4%	69.6%	0.0%
		Chico	7	40,763	30.4%	69.6%	0.0%
Fresno COG			31	351,398	52.3%	46.1%	1.6%
	Fresno		31	351,398	52.3%	46.1%	1.6%
		County*	4	109,975	34.0%	66.0%	0.0%
		Clovis	1	4,144	0.0%	100.0%	0.0%
		Fresno	26	237,279	61.7%	35.9%	2.4%
Humboldt CAOG			2	5,113	0.0%	100.0%	0.0%
	Humboldt		2	5,113	0.0%	100.0%	0.0%
		Fortuna	2	5,113	0.0%	100.0%	0.0%
Kern COG			71	915,888	47.3%	45.5%	7.2%
	Kern		71	915,888	47.3%	45.5%	7.2%
		County*	17	175,839	26.2%	73.8%	0.0%
		Bakersfield	50	674,318	48.4%	41.9%	9.7%
		Ridgecrest	1	2,067	100.0%	0.0%	0.0%
		Shafter	2	7,987	46.1%	53.9%	0.0%
		Other	1	55,677	100.0%	0.0%	0.0%
Merced CAG			10	52,959	77.4%	22.6%	0.0%
	Merced		10	52,959	77.4%	22.6%	0.0%
		County*	3	13,940	53.4%	46.6%	0.0%
		Atwater	1	4,564	0.0%	100.0%	0.0%
		Merced	6	34,455	97.4%	2.6%	0.0%
Metropolitan MTC			291	4,904,302	26.6%	53.5%	19.8%

Locally Owned Bridges on the NHS							
Jurisdiction				Deck Area (ft^2)	Good	Fair	Poor
MPO / RTPA	County	City	Count				
	Alameda		49	994,452	19.2%	68.5%	12.3%
		County*	6	76,844	68.0%	32.0%	0.0%
		Albany	1	29,902	0.0%	100.0%	0.0%
		Dublin	1	12,152	100.0%	0.0%	0.0%
		Fremont	6	135,195	16.5%	58.6%	24.9%
		Hayward	5	74,637	71.5%	28.5%	0.0%
		Livermore	1	8,460	0.0%	100.0%	0.0%
		Newark	1	10,775	0.0%	100.0%	0.0%
		Oakland	12	527,202	1.6%	81.5%	16.9%
		Pleasanton	8	86,229	36.1%	63.9%	0.0%
		San Leandro	1	3,132	100.0%	0.0%	0.0%
		Union City	7	29,924	26.7%	73.3%	0.0%
	Contra Costa		63	678,609	25.7%	31.2%	43.1%
		County*	19	113,967	52.0%	37.8%	10.3%
		Antioch	2	4,263	100.0%	0.0%	0.0%
		Brentwood	1	3,638	0.0%	100.0%	0.0%
		Concord	14	151,115	39.3%	41.1%	19.6%
		Lafayette	2	15,005	0.0%	62.1%	37.9%
		Martinez	3	7,815	66.5%	33.5%	0.0%
		Oakley	1	1,970	0.0%	0.0%	100.0%
		Pinole	2	28,040	7.0%	0.0%	93.0%
		Pittsburg	5	30,353	7.6%	22.1%	70.3%
		Pleasant Hill	3	16,544	52.7%	47.3%	0.0%
		Richmond	6	269,517	7.3%	19.8%	72.9%
		San Pablo	2	15,511	11.2%	88.8%	0.0%

Locally Owned Bridges on the NHS							
Jurisdiction				Deck Area (ft^2)	Good	Fair	Poor
MPO / RTPA	County	City	Count				
		San Ramon	1	6,652	100.0%	0.0%	0.0%
		Walnut Creek	2	14,219	36.9%	63.1%	0.0%
	Marin		1	4,101	100.0%	0.0%	0.0%
		Novato	1	4,101	100.0%	0.0%	0.0%
	Napa		8	138,823	31.1%	56.0%	12.9%
		County*	1	5,640	0.0%	100.0%	0.0%
		Napa	7	133,183	32.4%	54.1%	13.4%
	San Francisco		14	519,838	25.6%	74.4%	0.0%
		San Francisco	12	247,580	34.4%	65.6%	0.0%
		Other	2	272,258	17.6%	82.4%	0.0%
	San Mateo		30	868,345	13.7%	45.8%	40.5%
		County*	21	765,829	10.3%	43.8%	45.9%
		Brisbane	1	1,755	100.0%	0.0%	0.0%
		Foster City	3	47,447	65.9%	34.1%	0.0%
		Redwood City	2	5,511	0.0%	100.0%	0.0%
		San Carlos	1	2,842	0.0%	100.0%	0.0%
		San Mateo	1	37,781	0.0%	100.0%	0.0%
		South San Francisco	1	7,180	100.0%	0.0%	0.0%
	Santa Clara		105	1,539,926	38.0%	49.8%	12.2%
		County*	4	23,475	48.6%	51.4%	0.0%
		Campbell	5	66,457	59.7%	21.4%	19.0%
		Cupertino	4	13,508	42.6%	22.1%	35.3%
		Gilroy	2	26,232	100.0%	0.0%	0.0%
		Los Altos	2	13,530	27.1%	72.9%	0.0%

Locally Owned Bridges on the NHS							
Jurisdiction				Deck Area (ft^2)	Good	Fair	Poor
MPO / RTPA	County	City	Count				
		Los Gatos	1	9,472	0.0%	100.0%	0.0%
		Menlo Park	1	13,735	0.0%	100.0%	0.0%
		Milpitas	4	42,420	94.4%	5.6%	0.0%
		Mountain View	2	5,210	0.0%	100.0%	0.0%
		Palo Alto	3	14,371	55.0%	45.0%	0.0%
		San Jose	57	922,324	37.6%	43.8%	18.5%
		Santa Clara	13	191,878	28.6%	71.4%	0.0%
		Saratoga	2	10,646	100.0%	0.0%	0.0%
		Sunnyvale	5	186,668	19.9%	80.1%	0.0%
	Solano		13	104,656	41.6%	58.4%	0.0%
		Benicia	2	20,968	0.0%	100.0%	0.0%
		Fairfield	6	60,342	57.1%	42.9%	0.0%
		Rio Vista	1	2,992	100.0%	0.0%	0.0%
		Vacaville	3	13,347	45.4%	54.6%	0.0%
		Vallejo	1	7,007	0.0%	100.0%	0.0%
	Sonoma		8	55,552	23.4%	76.6%	0.0%
		Cloverdale	1	2,691	0.0%	100.0%	0.0%
		Healdsburg	2	9,924	16.5%	83.5%	0.0%
		Petaluma	2	22,959	0.0%	100.0%	0.0%
		Santa Rosa	3	19,978	56.8%	43.2%	0.0%
Monterey AMBAG			13	231,280	13.4%	63.2%	23.4%
	Monterey		9	188,321	3.8%	67.4%	28.7%
		County*	1	34,929	0.0%	100.0%	0.0%
		Salinas	6	63,324	11.4%	3.1%	85.5%
		Seaside	1	3,068	0.0%	100.0%	0.0%

Locally Owned Bridges on the NHS							
Jurisdiction				Deck Area (ft^2)	Good	Fair	Poor
MPO / RTPA	County	City	Count				
		Other	1	87,000	0.0%	100.0%	0.0%
	San Benito		1	23,681	100.0%	0.0%	0.0%
		County*	1	23,681	100.0%	0.0%	0.0%
	Santa Cruz		3	19,278	0.0%	100.0%	0.0%
		County*	2	12,077	0.0%	100.0%	0.0%
		Santa Cruz	1	7,201	0.0%	100.0%	0.0%
Sacramento COG			99	1,347,950	39.7%	53.0%	7.3%
	Placer		14	202,188	28.9%	71.1%	0.0%
		County*	1	3,358	100.0%	0.0%	0.0%
		Lincoln	1	10,796	100.0%	0.0%	0.0%
		Rocklin	1	2,174	0.0%	100.0%	0.0%
		Roseville	11	185,860	23.8%	76.2%	0.0%
	Sacramento		79	1,071,953	42.6%	52.7%	4.8%
		County*	29	417,962	63.3%	28.9%	7.8%
		Citrus Heights	10	30,580	89.3%	10.7%	0.0%
		Elk Grove	7	65,122	35.6%	64.4%	0.0%
		Folsom	3	101,751	21.6%	78.4%	0.0%
		Rancho Cordova	1	10,301	0.0%	100.0%	0.0%
		Sacramento	28	379,565	13.8%	81.3%	4.8%
		Other	1	66,672	100.0%	0.0%	0.0%
	Yolo		6	73,809	27.2%	8.9%	63.9%
		Davis	1	13,799	100.0%	0.0%	0.0%
		West Sacramento	5	60,010	10.4%	11.0%	78.6%
San Diego SANDAG			71	1,384,978	24.6%	57.6%	17.7%

Locally Owned Bridges on the NHS							
Jurisdiction				Deck Area (ft^2)	Good	Fair	Poor
MPO / RTPA	County	City	Count				
	San Diego		71	1,384,978	24.6%	57.6%	17.7%
		County*	1	2,368	100.0%	0.0%	0.0%
		Carlsbad	8	102,537	22.4%	77.6%	0.0%
		Del Mar	1	11,065	0.0%	100.0%	0.0%
		El Cajon	1	6,824	100.0%	0.0%	0.0%
		Encinitas	2	22,583	38.4%	0.0%	61.6%
		Escondido	4	14,983	100.0%	0.0%	0.0%
		La Mesa	1	16,899	0.0%	0.0%	100.0%
		National City	1	10,409	0.0%	100.0%	0.0%
		Oceanside	2	7,427	100.0%	0.0%	0.0%
		Poway	1	12,045	100.0%	0.0%	0.0%
		San Diego	41	1,046,808	18.1%	61.4%	20.5%
		San Marcos	3	34,079	100.0%	0.0%	0.0%
		Santee	1	19,806	0.0%	100.0%	0.0%
		Solana Beach	1	5,985	0.0%	100.0%	0.0%
		Vista	2	28,912	0.0%	100.0%	0.0%
		Other	1	42,248	100.0%	0.0%	0.0%
San Joaquin COG			40	618,709	48.5%	37.3%	14.2%
	San Joaquin		40	618,709	48.5%	37.3%	14.2%
		County*	9	196,668	73.8%	17.5%	8.7%
		Lathrop	2	43,529	54.7%	45.3%	0.0%
		Stockton	29	378,512	34.7%	46.6%	18.7%
San Luis Obispo COG			5	33,498	0.0%	100.0%	0.0%
	San Luis Obispo		5	33,498	0.0%	100.0%	0.0%
		County*	1	11,819	0.0%	100.0%	0.0%

Locally Owned Bridges on the NHS							
Jurisdiction				Deck Area (ft^2)	Good	Fair	Poor
MPO / RTPA	County	City	Count				
		Atascadero	1	3,283	0.0%	100.0%	0.0%
		San Luis Obispo	3	18,396	0.0%	100.0%	0.0%
Santa Barbara CAG			28	168,791	37.6%	47.6%	14.7%
	Santa Barbara		28	168,791	37.6%	47.6%	14.7%
		County*	5	37,932	55.7%	44.3%	0.0%
		Goleta	9	55,918	32.1%	67.9%	0.0%
		Lompoc	2	22,230	4.4%	0.0%	95.6%
		Santa Barbara	11	51,710	43.4%	49.5%	7.0%
		Other	1	1,001	100.0%	0.0%	0.0%
Shasta RTA			3	133,860	2.6%	97.4%	0.0%
	Shasta		3	133,860	2.6%	97.4%	0.0%
		County*	2	11,367	30.6%	69.4%	0.0%
		Redding	1	122,493	0.0%	100.0%	0.0%
Southern California SCAG			990	14,372,103	38.6%	49.2%	12.2%
	Imperial		28	82,347	9.1%	63.6%	27.3%
		County*	23	62,046	12.1%	56.3%	31.6%
		Calexico	5	20,301	0.0%	85.6%	14.4%
	Los Angeles		579	8,906,340	33.2%	56.3%	10.5%
		County*	48	579,901	29.2%	54.0%	16.8%
		Alhambra	3	14,467	0.0%	0.0%	100.0%
		Arcadia	9	34,433	62.3%	37.7%	0.0%
		Azusa	3	16,489	16.5%	52.5%	31.1%
		Baldwin Park	2	39,127	79.8%	0.0%	20.2%
		Bell	1	27,523	0.0%	100.0%	0.0%

Locally Owned Bridges on the NHS							
Jurisdiction				Deck Area (ft^2)	Good	Fair	Poor
MPO / RTPA	County	City	Count				
		Bell Gardens	1	20,408	0.0%	100.0%	0.0%
		Bellflower	2	45,359	0.0%	100.0%	0.0%
		Buena Park	3	23,681	33.0%	67.0%	0.0%
		Burbank	5	77,598	31.6%	68.4%	0.0%
		Calabasas	1	5,184	100.0%	0.0%	0.0%
		Carson	11	328,575	1.3%	87.8%	10.9%
		Cerritos	1	9,741	0.0%	100.0%	0.0%
		Claremont	1	2,745	100.0%	0.0%	0.0%
		Compton	13	238,337	9.5%	19.1%	71.4%
		Covina	4	20,010	15.0%	28.5%	56.6%
		Culver City	5	57,295	6.9%	93.1%	0.0%
		Diamond Bar	1	21,173	0.0%	100.0%	0.0%
		Downey	4	95,364	19.0%	81.0%	0.0%
		El Monte	3	40,161	0.0%	71.8%	28.2%
		El Segundo	1	1,733	0.0%	100.0%	0.0%
		Gardena	4	25,748	22.2%	45.7%	32.1%
		Glendale	10	119,501	48.7%	51.3%	0.0%
		Glendora	5	31,118	42.4%	57.6%	0.0%
		Hawaiian Gardens	1	2,471	0.0%	100.0%	0.0%
		Hawthorne	2	24,918	100.0%	0.0%	0.0%
		Huntington Park	1	7,955	100.0%	0.0%	0.0%
		Industry	10	225,901	0.0%	80.9%	19.1%
		Irwindale	7	87,522	21.8%	71.3%	6.9%
		La Cañada Flintridge	2	23,652	100.0%	0.0%	0.0%

Locally Owned Bridges on the NHS							
Jurisdiction				Deck Area (ft^2)	Good	Fair	Poor
MPO / RTPA	County	City	Count				
		La Habra Heights	1	3,239	100.0%	0.0%	0.0%
		La Mirada	6	39,257	64.3%	35.7%	0.0%
		La Palma	1	27,523	0.0%	100.0%	0.0%
		La Puente	1	3,746	0.0%	0.0%	100.0%
		La Verne	5	20,624	84.7%	15.3%	0.0%
		Lakewood	5	28,061	42.3%	57.7%	0.0%
		Lancaster	4	36,993	88.5%	11.5%	0.0%
		Long Beach	41	1,318,159	12.4%	74.4%	13.2%
		Los Angeles	254	3,391,612	53.9%	44.1%	2.0%
		Lynwood	2	15,564	0.0%	100.0%	0.0%
		Maywood	1	28,718	0.0%	0.0%	100.0%
		Monrovia	4	14,983	55.6%	44.4%	0.0%
		Montebello	4	118,282	0.0%	74.9%	25.1%
		Norwalk	4	12,905	100.0%	0.0%	0.0%
		Palmdale	3	10,197	76.2%	23.8%	0.0%
		Paramount	3	82,000	0.0%	100.0%	0.0%
		Pasadena	9	121,977	62.8%	37.2%	0.0%
		Pico Rivera	7	212,063	0.0%	43.8%	56.2%
		Pomona	7	45,940	33.6%	66.4%	0.0%
		Rosemead	2	12,121	0.0%	100.0%	0.0%
		San Dimas	3	13,282	16.5%	83.5%	0.0%
		San Gabriel	4	19,992	79.9%	20.1%	0.0%
		San Marino	1	7,632	0.0%	100.0%	0.0%
		Santa Clarita	17	385,026	26.8%	68.7%	4.5%
		Santa Fe Springs	4	49,099	38.5%	37.5%	24.1%

Locally Owned Bridges on the NHS							
Jurisdiction				Deck Area (ft^2)	Good	Fair	Poor
MPO / RTPA	County	City	Count				
		South Gate	3	119,468	45.0%	55.0%	0.0%
		Temple City	2	12,712	37.8%	62.2%	0.0%
		Torrance	6	48,158	65.1%	34.9%	0.0%
		Vernon	4	158,197	0.0%	55.0%	45.0%
		West Covina	3	17,729	71.5%	28.5%	0.0%
		Other	4	282,991	13.8%	86.2%	0.0%
	Orange		193	2,917,974	58.5%	32.5%	9.0%
		County*	15	475,873	70.7%	29.3%	0.0%
		Aliso Viejo	1	21,205	100.0%	0.0%	0.0%
		Anaheim	20	367,654	60.7%	13.0%	26.3%
		Brea	3	14,068	53.8%	0.0%	46.2%
		Buena Park	4	26,317	74.1%	25.9%	0.0%
		Costa Mesa	4	18,794	79.4%	20.6%	0.0%
		Cypress	5	31,183	100.0%	0.0%	0.0%
		Dana Point	2	6,060	0.0%	100.0%	0.0%
		Fountain Valley	1	3,240	100.0%	0.0%	0.0%
		Fullerton	7	56,595	95.8%	4.2%	0.0%
		Garden Grove	2	7,158	100.0%	0.0%	0.0%
		Huntington Beach	13	100,007	82.1%	17.9%	0.0%
		Irvine	25	448,454	88.8%	11.2%	0.0%
		La Habra	1	8,105	100.0%	0.0%	0.0%
		La Palma	1	3,154	100.0%	0.0%	0.0%
		Laguna Hills	5	62,743	94.4%	5.6%	0.0%
		Laguna Niguel	3	47,297	28.7%	0.0%	71.3%

Locally Owned Bridges on the NHS							
Jurisdiction				Deck Area (ft^2)	Good	Fair	Poor
MPO / RTPA	County	City	Count				
		Lake Forest	11	94,948	18.5%	81.5%	0.0%
		Los Alamitos	1	25,564	0.0%	0.0%	100.0%
		Mission Viejo	7	45,111	24.6%	35.2%	40.2%
		Newport Beach	4	93,011	4.2%	95.8%	0.0%
		Orange	9	250,573	62.6%	15.3%	22.2%
		Placentia	4	36,220	100.0%	0.0%	0.0%
		Rancho Santa Margarita	3	189,607	0.0%	100.0%	0.0%
		San Clemente	3	12,282	16.8%	83.2%	0.0%
		Santa Ana	14	145,885	49.0%	33.4%	17.7%
		Seal Beach	6	18,771	45.0%	55.0%	0.0%
		Stanton	1	4,230	100.0%	0.0%	0.0%
		Tustin	9	187,314	50.8%	49.2%	0.0%
		Westminster	6	27,480	66.2%	33.8%	0.0%
		Yorba Linda	3	89,071	0.0%	100.0%	0.0%
	Riverside		78	1,024,713	60.1%	31.8%	8.0%
		County*	7	89,578	10.3%	89.7%	0.0%
		Banning	3	12,680	70.2%	29.8%	0.0%
		Canyon Lake	1	4,413	100.0%	0.0%	0.0%
		Cathedral City	3	57,663	100.0%	0.0%	0.0%
		Coachella	1	18,234	100.0%	0.0%	0.0%
		Corona	2	15,586	100.0%	0.0%	0.0%
		Hemet	11	29,837	63.2%	36.8%	0.0%
		Indian Wells	1	40,483	100.0%	0.0%	0.0%
		Indio	6	134,732	12.1%	81.1%	6.8%

Locally Owned Bridges on the NHS							
Jurisdiction				Deck Area (ft^2)	Good	Fair	Poor
MPO / RTPA	County	City	Count				
		Jurupa Valley	8	36,048	29.8%	70.2%	0.0%
		La Quinta	3	77,845	81.3%	18.7%	0.0%
		Moreno Valley	4	35,618	100.0%	0.0%	0.0%
		Murrieta	5	24,984	36.5%	63.5%	0.0%
		Palm Desert	4	58,017	100.0%	0.0%	0.0%
		Palm Springs	3	78,630	6.9%	0.0%	93.1%
		Perris	2	15,467	62.1%	37.9%	0.0%
		Rancho Mirage	2	15,511	100.0%	0.0%	0.0%
		Riverside	5	171,587	76.7%	23.3%	0.0%
		San Jacinto	5	63,184	100.0%	0.0%	0.0%
		Temecula	1	20,225	0.0%	100.0%	0.0%
		Other	1	24,391	100.0%	0.0%	0.0%
	San Bernardino		76	906,970	15.3%	55.7%	29.0%
		County*	6	54,994	14.7%	29.0%	56.3%
		Barstow	1	1,711	0.0%	100.0%	0.0%
		Chino	2	4,952	46.3%	53.7%	0.0%
		Chino Hills	3	80,277	0.0%	100.0%	0.0%
		Colton	6	132,406	0.0%	19.5%	80.5%
		Fontana	4	43,712	54.0%	46.0%	0.0%
		Hesperia	3	100,406	0.0%	100.0%	0.0%
		Highland	6	93,797	2.3%	97.7%	0.0%
		Loma Linda	2	43,390	0.0%	51.1%	48.9%
		Montclair	2	11,119	66.4%	33.6%	0.0%
		Ontario	13	81,602	31.1%	59.5%	9.4%

Locally Owned Bridges on the NHS							
Jurisdiction				Deck Area (ft^2)	Good	Fair	Poor
MPO / RTPA	County	City	Count				
		Rancho Cucamonga	6	21,764	80.7%	19.3%	0.0%
		Redlands	6	70,117	9.0%	91.0%	0.0%
		Rialto	1	36,791	0.0%	0.0%	100.0%
		San Bernardino	4	82,376	29.7%	10.6%	59.7%
		Twentynine Palms	2	8,429	46.2%	53.8%	0.0%
		Upland	5	11,281	50.4%	49.6%	0.0%
		Victorville	3	22,518	53.3%	0.0%	46.7%
		Yucaipa	1	5,328	0.0%	100.0%	0.0%
	Ventura		36	533,759	23.1%	41.1%	35.8%
		County*	6	190,424	32.1%	62.4%	5.5%
		Camarillo	2	42,001	0.0%	48.7%	51.3%
		Moorpark	1	29,525	0.0%	0.0%	100.0%
		Oxnard	9	87,306	32.2%	67.8%	0.0%
		Port Hueneme	2	8,977	100.0%	0.0%	0.0%
		Simi Valley	8	71,084	12.6%	23.4%	64.0%
		Thousand Oaks	2	12,648	100.0%	0.0%	0.0%
		Ventura	6	91,794	3.9%	4.6%	91.4%
Stanislaus COG			9	188,671	36.7%	18.0%	45.3%
	Stanislaus		9	188,671	36.7%	18.0%	45.3%
		County*	1	44,154	100.0%	0.0%	0.0%
		Ceres	1	57,781	0.0%	0.0%	100.0%
		Modesto	5	82,247	25.1%	41.3%	33.6%
		Patterson	1	2,110	100.0%	0.0%	0.0%
		Other	1	2,379	100.0%	0.0%	0.0%

Locally Owned Bridges on the NHS							
Jurisdiction				Deck Area (ft^2)	Good	Fair	Poor
MPO / RTPA	County	City	Count				
Tulare CAG			3	32,689	0.0%	100.0%	0.0%
	Tulare		3	32,689	0.0%	100.0%	0.0%
		County*	1	28,158	0.0%	100.0%	0.0%
		Tulare	1	2,260	0.0%	100.0%	0.0%
		Visalia	1	2,271	0.0%	100.0%	0.0%
Total							
All Locally-Owned NHS			1673	24,782,952	35.8%	50.5%	13.7%

*County-owned assets

2.6. State Highway System Assets

Pavement Inventory and Conditions

Caltrans defines three classes of pavement on the SHS based on usage and other considerations. Caltrans reports pavement condition and targets based on this classification. Table 2-6 presents an inventory of SHS pavements by class, using data from the 2021 SHSMP. The pavement inventory reflects the total surveyed lane-miles and does not include collection gaps from road closures, detours, and construction zones.

Class I includes Interstates, other principal arterials, and urban freeways and expressways, and represents 54 percent of the network. Class II includes rural freeways and expressways, and minor arterials and represents 32 percent of the SHS network. Class III is comprised of major and minor collector routes and represents 14 percent of the network. The NHS includes all Class I roads, and a portion of the Class II roads.

Table 2-6 also presents the conditions of SHS pavements, as reported in the 2021 SHSMP.

Table 2-6. Inventory and Condition of SHS Pavements

Pavements on the SHS	Lane Miles	Good	Fair	Poor	
Pavement Class					
Total	**49,672**	**57.0%**	**42.0%**	**1.0%**	
Class I	26,895	66.2%	32.6%	1.2%	
Class II	16,056	46.8%	52.4%	0.9%	
Class III	6,721	44.7%	54.4%	1.0%	

Bridge Inventory and Conditions

Table 2-7 presents an inventory of bridges on the SHS, as reported in the 2021 SHSMP. Bridge data in the SHSMP vary slightly from the NBI because they include all bridges managed by Caltrans whether they are in NBI or not.

Table 2-7 also presents the conditions of SHS bridges, as reported in the 2021 SHSMP.

Table 2-7. Inventory and Conditions of SHS Bridges

Bridges on the SHS (State)						
	Count	Deck Area (ft^2)	Good	Fair	Poor	
Total	**13,246**	**251,703,052**	**54.1%**	**42.4%**	**3.5%**	

Bridges, like all transportation assets, are constantly deteriorating, which is reflected in decreasing condition ratings. Other threats to bridge operation include seismic activity and scour. These risks and others are discussed in Chapter 5. Managing Risk and Building Resilience of the TAMP.

2.7. Drainage

Drainage, including culverts and other highway drainage system elements, is one of the four primary SHS asset classes selected by the Commission for inclusion in the California TAMP. As such, drainage assets are subject to the same data requirements and analysis as NHS assets and other primary SHS assets in the TAMP.

Drainage assets channel rainwater, streams, rivers, and other waterways away from roads via culverts that direct water flow under the road. These assets prevent water from flooding roadways and interrupting the transportation system and damaging public and private property.

Drainage Performance Measures

Caltrans' Maintenance Program is responsible for the inspection of drainage on the SHS. Drainage assets are visually inspected during and after each major storm. Inspectors assess drainage asset condition as good, fair, or poor. This asset class is not required under federal regulation and has no defined national performance metric. Caltrans developed three performance measures for drainage assets which the Commission has adopted:

- Percentage of drainage assets in good condition, weighted by linear feet
- Percentage of drainage assets in fair condition, weighted by linear feet
- Percentage of drainage assets in poor condition, weighted by linear feet

Drainage Inventory and Conditions

Caltrans is currently building the inventory of drainage assets that run under or drain the SHS. The typical drainage asset is a 12- to 60-inch diameter (or width) plastic polymer, steel/aluminum, or concrete pipe or box culvert. Any culvert with a width that spans 20 feet or longer is classified as a bridge and recorded on the NBI.

As reported in the 2021 SHSMP, 166,477 culverts totaling over 16.8 million linear feet have been inventoried and fully inspected. The network of culverts is expected to grow to a total of 212,759 and over 20 million linear feet by the completion of the inventory in 2023.

Performing a drainage asset inspection involves taking inventory of drainage assets and doing a condition assessment of those assets. The condition assessment is based on a visual inspection of five attributes:

1. Waterway adequacy
2. Joints
3. Material
4. Shape
5. Alignment

Each attribute is scored on a five-point scale from zero to four, where zero is new condition, one is good condition, two is fair condition, three is poor condition, and four is attribute failure. Asset condition is calculated using a weighted average of the attribute scores.

Table 2-8 shows the current condition of Caltrans known drainage assets as reported in the 2021 SHSMP. The drainage inventory and conditions used to calculate 10-year needs are based on the projected additional inventory using estimated culvert lengths with conditions assumed to be in the same proportion as observed within each district.

Table 2-8. SHS Drainage Asset Inventory and Conditions

Drainage Assets on the SHS (State)					
	Linear Feet	Good	Fair	Poor	
Drainage Restoration					
Total	**21,449,336**	**72.9%**	**17.5%**	**9.6%**	
Known Condition	16,885,159	71.6%	18.4%	10.0%	
Projected Additional Inventory	4,564,177	77.6%	14.1%	8.3%	

Notes:

- Quantity and conditions cited under "Known Condition" include:
  - Culverts that have been inspected and condition assigned based on procedures defined through the Culvert Inspection Program.
  - Culverts that have been replaced/rehabilitated and condition designated as good based on Estimated Construction Work Complete (ECWC) at time of inventory reporting.
- Quantity and conditions cited under "Projected Additional Inventory" include:
  - Culverts that have been cleaned and are pending re-inspection.
  - Culverts that have not yet been inspected.
- Quantity and conditions cited under "Total of Known and Projected Inventory" are used to support 10-year needs and investment requirements. The condition breakdown is estimated using district-specific historic distributions of Good, Fair and Poor known condition culverts applied to the projected additional inventory.

2.8. Transportation Management Systems

Transportation Management Systems (TMS) are one of the four primary asset classes selected by the Commission for inclusion in the California TAMP. As such, TMS are subject to the same data requirements and analysis as NHS assets and other primary SHS assets in the TAMP.

TMS are a broad class of technology assets on the highway system dedicated to improving operational efficiency and user interactions. FHWA defines TMS as complex, integrated amalgamations of hardware, technologies, and processes for performing an array of functions, including data acquisition, command and control, computing, and communications. Disruptions or failures in the performance of these functions can impact traffic safety, reduce system capacity, and ultimately lead the traveling public to lose faith in the transportation network. System failures also have the potential to cause measurable economic loss and increase congestion, fuel consumption, pollutants, and traffic crashes. In addition, the problem is further complicated by the fact that today's systems, subsystems, and components often are highly interdependent, meaning that a single malfunction can critically impact the ability of overall systems to perform their intended functions.

TMS assets help reduce traveler delay, enhance safety, improve communication, and collect data on traffic behavior. These assets are an integral part of the SHS, performing critical functions that keep people, vehicles and goods moving. TMS assets also support Integrated Corridor Management (ICM) and help to move freight around the state efficiently. The TAMP includes information on TMS assets on the SHS.

TMS Performance Measures

To monitor TMS conditions, each asset is classified as in good or poor condition. The condition is based on the asset being within its expected life cycle and its functional availability. TMS is functionally available if it doesn’t have chronic downtime issues.

TMS Inventory and Conditions

TMS are also collectively referred to nationally as Intelligent Transportation Systems (ITS). According to the 2021 SHSMP, there are over 20,000 TMS assets on the SHS. For purposes of asset management, performance targets focus on the nine core types below:

- Traffic signals (Signals)
- Freeway ramp meters (Ramps)
- Changeable message signs (CMS)
- Extinguishable message signs (EMS)
- Closed circuit televisions (CCTV)
- Traffic monitoring detection stations (Detection)
- Traffic census stations (Census)
- Roadway weather information systems (RWIS)
- Highway advisory radios (HAR)

As newer technologies become available and are deployed to support connected and autonomous vehicles in the TMS infrastructure, the number and types of TMS are expected to continue to grow.

Table 2-9 shows the current condition of Caltrans' TMS assets as reported in the 2021 SHSMP.

Table 2-9. Caltrans TMS Inventory and Conditions

TMS on the SHS (State)	Assets	Good	Fair	Poor	
Total	**20,481**	**79.0%**	n/a	**21.0%**	

2.9. Supplementary Assets

Commission TAMP Guidelines require the inclusion of supplementary asset classes in the California TAMP. The TAMP Guidelines require inventory, condition, performance targets, and gaps for these assets. Inventory and condition are presented in this section. Table 2-10 summarizes asset inventory and conditions for the supplementary asset classes based on data from the 2021 SHSMP.

Table 2-10. Inventory and Conditions for State Supplementary Asset Classes

Supplementary Assets On the SHS (State)	Inventory	Good	Fair	Poor	
Drainage Pump Plants	288 Each Location	15.3%	34.4%	50.3%	
Lighting	97,745 Each Asset	37.9%	15.3%	46.7%	
Office Buildings	2,669,524 Square Feet	43.6%	28.9%	27.6%	
Overhead Sign Structures	16,433 Each Asset	57.3%	35.5%	7.1%	
Safety Roadside Rest Areas	86 Each Location	36.0%	36.0%	27.9%	
Complete Streets	7,623,345 Linear Feet	70.6%	22.5%	6.9%	
Transportation-Related Facilities	4,382,000 Square Feet	22.8%	17.6%	59.6%	
Weigh in Motion Scales	140 Each Station	44.3%	17.9%	37.9%	

2.10. Asset Valuation

FHWA requires state DOTs to include an estimate of asset value for NHS pavements and bridges in the TAMP. The following tables summarize NHS pavement and bridge asset values, as well as asset values for the four primary asset classes on the SHS, as required by Commission-adopted TAMP Guidelines. California uses a replacement value methodology for asset valuation: asset inventory multiplied by unit replacement cost equals asset replacement value. Asset valuation is updated every year as part of the SHSMP process. However, Caltrans relies on other performance measures for making investment decisions.

Table 2-11 shows a breakdown of pavement asset value on the NHS. Unit replacement costs by SHS pavement class from the 2021 SHSMP are used to estimate asset value for NHS pavements on the SHS. Interstate pavements are entirely Class I SHS. Non-Interstate NHS includes the remainder of Class I SHS, as well as a portion of Class II SHS. The updated estimate for asset value of NHS pavements in California is $ 69.8 billion which is significantly more than the initial TAMP primarily due to unit cost increases from the 2021 SHSMP.

National Highway System

Table 2-11. NHS Pavement Asset Valuation

Pavements on the NHS			
System	Lane Miles	Unit Replacement Cost ($/Lane Mile)	Replacement Value
State-owned NHS			
Total State (combined)	**36,896**		**$45,238,728,004**
Interstate	14,419	$1,298,000	$18,715.859,956
Non-Interstate	22,477	$1,180,000	$26,522,868,048
Locally-owned NHS			
Non-Interstate	**20,803**	**$1,180,000**	**$24,547,547,448**
Total (State and Locally-owned)			
All NHS	**57,699**		**$69,786,275,452**
Interstate	14,419	$1,298,000	$18,715,859,956
Non-Interstate NHS	43,281	$1,180,000	$51,070,415,496

Table 2-12 shows a breakdown of bridge asset value on the NHS, using unit replacement costs from the 2021 SHSMP.

Table 2-12. NHS Bridge Asset Valuation

Bridges on the NHS			
System	Deck Area (ft^2)	Unit Replacement Cost ($/ft^2$)	Replacement Value
NHS	**243,347,047**	**$750**	**$182,462,965,580**
State-owned Bridges	218,564,095	$750	$163,880,570,710
Locally-owned Bridges	24,782,952	$750	$18,582,394,870

State Highway System

Table 2-13 shows asset valuations from the 2021 SHSMP for the four primary asset classes on the SHS. Asset value has significantly increased over the initial TAMP primarily due to unit cost differences that were updated through a more detailed analysis undertaken as part of the latest SHSMP effort.

Table 2-13. SHS Asset Valuation

SHS			
	Inventory (unit)	Unit Replacement Cost	Replacement Value
All SHS			**$328,183,752,144**
Pavement Class I	26,895 Lane Miles	$1,298,000	$34,909,706,188
Pavement Class II	16,056 Lane Miles	$1,180,000	$18,946,085,749
Pavement Class III	6,712 Lane Miles	$1,180,000	$7,920,162,403
Pavement Subtotal	49,663 Lane Miles		$61,775,954,340
Bridge	251,703,052 Deck Area (ft^2)	$750	$188,728,344,476
Drainage	21,677,024 Linear Feet	$3,466	$75,131,218,685
TMS	23,895 Assets	$106,643	$2,548,234,643

3. Asset Performance Targets

Asset management best practices emphasize the use of performance management for transportation programs, shifting the decision-making framework towards data-driven, proactive, goal-oriented investment choices. FHWA defines transportation performance management as "a strategic approach that uses system information to make investment and policy decisions to achieve national performance goals."

3.1. Overview

The cornerstone of FHWA's highway program transformation was the transition to a performance and outcome-based program with states now required to measure condition and set performance targets for their transportation assets. These targets should be aligned with state goals and objectives, as well as national goals. The targets help states make investment decisions that achieve individual targets while making progress toward national goals.

There are seven national goals defined in federal regulations: safety, infrastructure condition, congestion reduction, system reliability, freight movement and economic vitality, environmental sustainability, and reduced project delivery delays. These national goals[13] are broken into three performance management areas that are part of the overall Transportation Performance Management[14] program. Performance Management 2 (PM 2) covers the condition of NHS pavement and bridges which

[13] US House of Representatives, United States Code 23 USC 150: National goals and performance management measures, http://uscode.house.gov/view.xhtml?req=(title:23%20section:150%20edition:prelim)

[14] FHWA, Transportation Performance Management website, https://www.fhwa.dot.gov/tpm/

is the primary focus of the TAMP. Performance Management 1 and 3 (PM 1 and PM 3) are areas that focus on the other national goals for California. The process of establishing PM 1, PM 2, and PM 3 performance targets and related reporting is available online[15].

3.2. Performance Measures and Targets

Whether based on age, condition, LOS, or simply the frequency of repair, a performance measure is critical to actively managing the preservation of any asset. By understanding the impact of investment of that performance measure, policy makers are able to establish funding priorities and set targets they can reasonably expect to achieve. In this TAMP, asset performance references measured asset condition. California uses performance measures to report condition for the four primary asset classes, supplementary asset classes as well as other major performance targets in this TAMP. Condition information is presented in Chapter 2. Asset Inventory and Conditions, Table 2-1 through Table 2-10.

Asset performance targets specify conditions California seeks to achieve and sustain over a 10-year period to support agency goals and objectives and meet federal requirements. California's targets reflect both state and local priorities and are used to guide strategic planning decisions with the 10-year DSOR targets aligning with the 10-year scope of the TAMP.

As part of a separate performance management rule, states set shorter term performance targets at the 2- and 4-year period of the TAMP. These targets are included in this plan and reported separately to FHWA. In addition, states are required to maintain minimum condition levels for NHS pavements and bridges such that the percentage of bridge deck area classified as poor does not exceed 10 percent of the overall deck area in a state, and that no more than five percent of pavement lanes miles on the interstate system are in poor condition. California currently meets these minimum requirements for both NHS pavements and bridges.

2-and 4-year asset performance targets are set to evaluate progress made towards 10-year TAMP performance targets

Targets presented in this chapter serve as fixed benchmarks against which present and future performance can be evaluated. Consideration of how individual assets operate in concert together over time given climate change mitigation and adaptation targets will be explored in the future, and is described in more detail in Section 5.7, Climate Change and Chapter 7, Investment Strategies.

[15] Caltrans, Federal Liaison website, https://dot.ca.gov/programs/federal-liaison

3.3. NHS Pavement and Bridge Performance Targets

The target setting process for NHS pavement and bridges began in California with a target setting workshop held in 2017 for the development of the first TAMP that established 10-year expected condition performance targets. For this initial target setting process, state and regional transportation agencies used an approach that considered their available resources for the NHS and the extent of the NHS each agency owned. Caltrans presented a few different options for establishing targets, but most local transportation agencies own less than two percent of NHS pavements and less than half a percent of NHS bridge deck area, so MPOs and RTPAs unanimously elected to adopt a statewide weighted-average NHS performance target for pavement and bridges. In May of 2018, Caltrans established 2- and 4-year performance targets as required by federal performance management rules and received documentation from all MPOs that they would support the statewide targets as well as agreed to plan and program projects so they contribute toward established goals. As recently as October 2020, Caltrans reported separately to FHWA on progress made towards performance targets for the mid-performance reporting period.

Caltrans and MPOs have subsequently revisited the performance targets set 4 years ago as part of the 2022 TAMP development process. Caltrans held a virtual workshop in July 2021 that focused on investment strategies and performance targets. A new performance target analysis tool (PTAT) developed for the TAMP was presented at the workshop. The PTAT was customized for each MPO that included their starting inventory and condition of NHS pavement and bridges and investments in the 5 federal work types (i.e. initial construction, maintenance, preservation, rehabilitation, and reconstruction) estimated by Caltrans as part of a financial planning workshop.

Additional parameters needed for predicting end of period asset condition were set as defaults in the PTAT, but agencies could override them if they had better information including investments, deterioration rates, the cost of repair, and the likelihood and/or reasonableness of improvements. The inventory and condition of NHS pavement and bridges was the only parameter built into the tool that could not be changed. A subsequent training session was held in August of 2021 for the MPOs that demonstrated the tool and gave step by step instructions for use. This tool enabled them to evaluate predicted pavement and bridge conditions for their own region utilizing a consistent and data-driven approach. Final results from the MPOs were combined with Caltrans results from the tool to determine overall statewide NHS pavement and bridge targets using a quantity weighted average approach established in 2018. This resulted in more realistic performance targets for the 2022 TAMP. Figure 3-1 provides an example of PTAT results with expected performance given a specified funding level. More discussion on how the PTAT was used for purposes of this TAMP will be presented in subsequent chapters including Life Cycle Planning, Managing Risk and Building Resilience, Financial Planning, Investment Strategies, and Performance Scenarios and Gaps.

Invested: 10Y End		Invested: 4Y End		10Y TAMP Target	
Lane Miles	%	Lane Miles	%	Lane Miles	%
32.5	12.7%	14.1	5.5%	33.3	13.0%
200.0	78.1%	218.8	85.7%	203.4	79.4%
23.7	9.3%	22.3	8.7%	19.5	7.6%

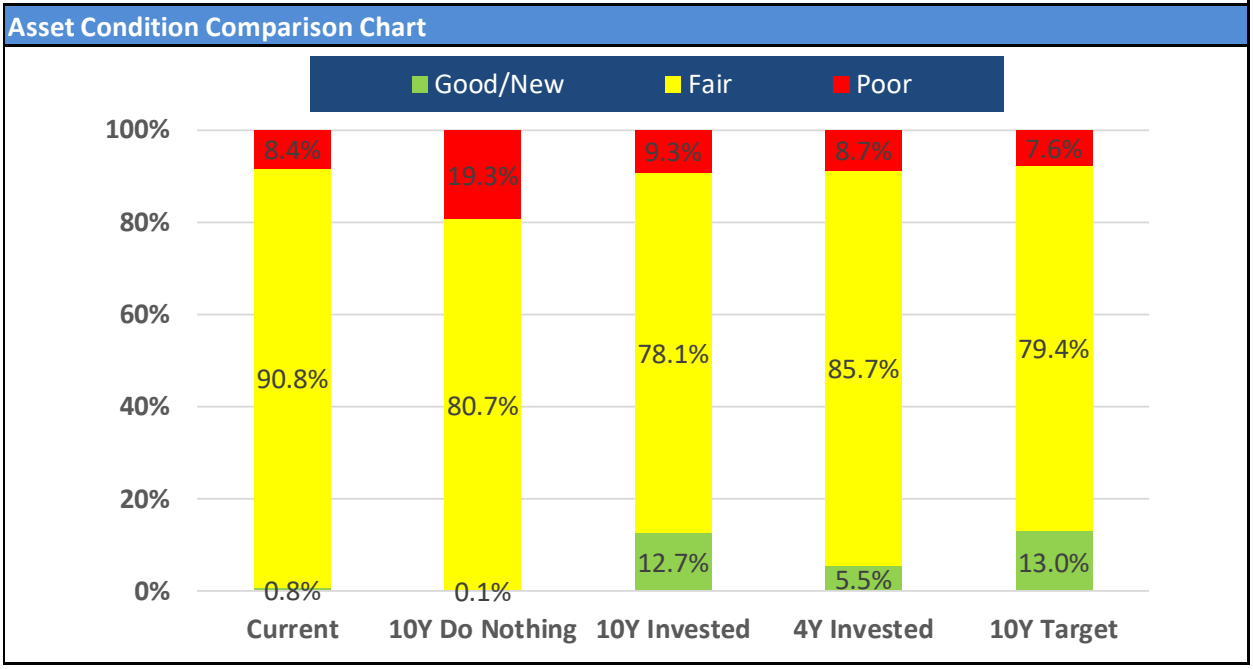


Figure 3-1. Example PTAT Results Showing Expected Performance Given a Specified Funding Level

In May 2022, Caltrans held one last webinar for the TAMP to present an opportunity for MPOs to review their PTATs again considering the additional funding from IIJA. Most of the agencies responded that there was not enough information on investments to make any changes to their performance outcomes and chose to keep their PTAT results the same. The few agencies that did make changes, added investment in pavement assets only. This resulted in no change to performance targets for the local non-Interstate NHS. Caltrans also reviewed investments from IIJA that would benefit the NHS and determined that any additional investments would be for bridges. With this additional funding, the State performance targets would remain the same but a reduction in the performance gap is expected and further detail is included in Chapter 8. Performance Scenarios and Gaps.

Caltrans and MPOs also have Planning and Programming MOU's[16] that documents additional requirements of performance management that supports implementation of the TAMP and achieving NHS performance targets. These MOUs describe roles and responsibilities for performance-based planning and programming and include:

- Coordination on target setting
- Data collection
- Data analysis
- Reporting on progress toward target achievement
- Integration of performance goals, objectives, measures and targets in the State's and MPO's planning and programming process

These MOUs are currently being updated for California and will help strengthen the commitment in the areas of asset management including reporting on NHS performance. On-going communication has continued with MPOs through various Caltrans offices but primarily are carried out through Caltrans Regional Planning, Federal Liaison, Transportation Financial Programming, Traffic Safety and Headquarters Asset Management. However, more asset management communication, collaboration and training has been identified as a top TAMP improvement to advance asset management at the local level.

Table 3-1 presents the statewide asset performance targets for NHS pavements and bridges. NHS pavements are broken down into Interstate and Non-Interstate NHS. Pavement targets on the NHS are different than targets on the SHS due to the scope of the system included and calculation methods for pavement condition. For the NHS, overall pavement condition is based on outer lane distresses only. For SHS, all lanes are used to calculate complete pavement condition. Targets are also broken out by ownership. Non-Interstate NHS pavements are owned by state and non-state entities and use a quantity weighted average performance target, as described above.

[16] SBCAG Memorandum of Understanding, April 19, 2018, http://meetings.sbcag.org/Meetings/SBCAG/2018/April%2019/Item%204B-%20MOU%20Amendment%20Staff%20Report.pdf

Table 3-1. NHS Asset Performance Targets

10 Year Desired State of Repair				
Asset (unit of measure)	Good	Fair	Poor	
Interstate Pavement (lane miles)	**60.0%**	**39.0%**	**1.0%**	
Non-Interstate NHS Pavement (lane miles)	**34.1%**	**60.9%**	**5.0%**	
State-Owned	57.6%	40.9%	1.5%	
Locally-Owned	7.0%	84.0%	9.0%	
NHS Bridge (square feet)	**48.5%**	**50.0%**	**1.5%**	
State-Owned	48.5%	50.0%	1.5%	
Locally-Owned	48.5%	50.0%	1.5%	

2- and 4-Year NHS Performance Targets

The PTAT was used to establish 2 and 4-Year NHS performance targets. State-owned NHS performance analysis was combined with 4-year MPO/RTPA expected conditions for NHS pavement and bridges to set 4-Year targets. These combined targets were calculated using a quantity weighted approach that utilized Caltrans and regional agency condition expectations in statewide aggregate targets. The 2-Year targets used these statewide aggregated targets to determine conditions for the end of the 2-Year period as presented in Table 3-2.

Table 3-2. Statewide Expected Targets

Statewide Expected Targets				
Pavement and Bridge Performance Measures	2-Year NHS Targets (1/1/2022 - 12/31/2023)		4-Year NHS Targets (1/1/2022 - 12/31/2025)	
	Good	Poor	Good	Poor
Pavements on the NHS				
Interstate	**47.2%**	**1.9%**	**49.2%**	**1.7%**
Non-Interstate	**21.7%**	**10.5%**	**28.2%**	**9.0%**
Bridges on the NHS	**49.1%**	**5.9%**	**47.3%**	**4.4%**

3.4. SHS Asset Performance Targets

The DSOR performance targets included in the 2021 SHSMP shown in Table 3-3 represent the primary assets on the SHS developed by Caltrans and adopted by the Commission. SHS asset performance targets are established for a 10-year period.

Table 3-3. SHS Asset Performance 10-Year Targets

10 Year Desired State of Repair				
Asset (unit of measure)	Good	Fair	Poor	
Pavement Class I (lane miles)	**60.0%**	**39.0%**	**1.0%**	
Pavement Class II (lane miles)	**55.0%**	**43.0%**	**2.0%**	
Pavement Class III (lane miles)	**45.0%**	**53.0%**	**2.0%**	
Bridges (square feet)	**48.5%**	**50.0%**	**1.5%**	
Drainage (linear feet)	**70.0%**	**20.0%**	**10.0%**	
TMS (each asset)	**90.0%**	n/a	**10.0%**	

Table 3-4 shows 10-Year DSOR performance targets for the supplementary assets on the SHS.

Table 3-4. Supplementary SHS Asset Performance 10-Year Targets

10 Year Desired State of Repair				
Asset (unit of measure)	Good	Fair	Poor	
Drainage Pump Plants (each location)	50.0%	40.0%	10.0%	
Highway Lighting (each asset)	45.0%	30.0%	25.0%	
Office Buildings (square feet)	50.0%	40.0%	10.0%	
Overhead Sign Structures (each asset)	40.0%	45.0%	15.0%	
Safety Roadside Rest Areas (each location)	30.0%	54.0%	25.0%	
Complete Streets (linear feet)	69.0%	29.0%	2.0%	
Transportation Related Facilities (square feet)	40.0%	40.0%	20.0%	
Weigh in Motion Scales (each station)	40.0%	50.0%	10.0%	

3.5. Additional Performance Targets on the SHS

California Streets and Highway Code (SHC) and the Commission-adopted TAMP Guidelines also include two additional targets that are not required under federal regulations. These additional targets include:

- **A requirement to maintain a minimum level of service (LOS) for pavement potholes, spalls and cracking.** The Department has an existing program to measure the maintenance LOS of highways. The technical criteria for LOS are based on practical thresholds that take into account the pavement condition, effectiveness of treatments, traffic impact and employees/contractor safety.
- **A requirement to "fix an additional 500 bridges" over the 10-year period 2017-2027.** This performance metric most closely aligns with the bridge condition measure adopted by the Commission prior to the passage of SB 1. In June 2021, Caltrans reported that the 500-bridge threshold had been surpassed.

Maintain a Minimum LOS for Pavement Potholes, Spalls and Cracking

LOS scores shown in Table 3-5 are expected to improve over time through the completion of maintenance crew work, major maintenance projects, and SHOPP projects.

Table 3-5. Level of Service Summary

Level of Service Scores and Target Levels Established by SB 1 in 2017	
Existing Score (100 max)	SB-1 Target Score
94	90

Fix an Additional 500 Bridges over the 10-Year Period 2017-2027

Prior to the passage of SB 1, Caltrans was fixing an average of 114 bridges per year becoming the baseline for counting towards the additional 500 bridges to be fixed as presented in Table 3-6.

Table 3-6. Fix Additional Bridge Metrics

Fix 500 Additional Bridges in 10 Years Established by SB 1 in 2017		
Metric	10-Yr Baseline	10-Yr Target
Bridges Fixed	1,140	1,640

Projects that improve the condition of the bridge from a lesser condition to a better condition, mitigating seismic or scour vulnerabilities, or address operational limitations are counted towards the target.

3.6. Transportation Performance Management

The Transportation Performance Management (TPM) federal regulations (23 CFR 490) defines national performance measures that address:

- PM 1: Transportation Safety
- PM 2: Infrastructure Condition
- PM 3: Freight Reliability, Congestion and Air Quality

Targets for these performance measures are required to be developed by each State DOT and MPO in the United States. The targets are reported to the FHWA and monitored for progress at the mid-point of the four-year TAMP period and at the end of the four years.

The TAMP focuses on developing analysis and investment strategies that strive to make progress toward achieving the TPM targets. PM2 directly ties to the pavement and bridge conditions reported in the TAMP. Safety, Congestion and Air Quality are also considered in the TAMP analysis and investment strategies as these performance areas are often competing for available funds and can therefore affect the selected investment strategies for pavement and bridges.

The establishment of the TPM performance targets, the analysis and investment decision making in the TAMP, and performance based planning and programming all work together to define, resource, and execute a performance driven transportation plan with focus on areas of national interest.

The following highlights some of the ways that asset management and TPM are working together in California.

PM 1: Transportation Safety

Caltrans Asset Management and Safety Programs have been collaborating to bring performance management concepts to safety project decision making. Using highway system characteristics and machine learning techniques, Caltrans has been able to identify segments of the transportation system that account for disproportionate numbers of fatal and serious injury crashes. Caltrans extended the system analysis to include highway segments without crash history that have a disproportionate potential for future accidents. Asset Management is then able to evaluate the degree that planned safety projects are addressing the high potential segments. Caltrans recently developed project level tools that can evaluate expected project level safety benefits based on the same system characteristics and treatment effectiveness using crash modification factors. Asset Management provides safety performance targets for each of the districts consistent with PM 1 and budgets that incentivize each district to maximize performance gains for each project to stretch what they can accomplish overall with their available fiscal targets. This collaboration places a focus on performance outcomes by maximizing the safety benefit that can be achieved by selecting the most cost beneficial locations to work. These steps along with many other safety program initiatives focused on wrong way drivers, pedestrian safety and the adoption of a safe systems approach are expected to help make progress toward the PM 1 targets.

PM 2: Infrastructure Condition

The TAMP include significant analysis of the NHS pavement and bridge assets. In California, hundreds of agencies own a piece of the NHS making coordination across these agencies one of the biggest TAMP challenges. For the 2022 TAMP development, Caltrans hosted a series of virtual workshops that walked our partner agencies though the major components of the TAMP.

Caltrans developed GIS information and maps for local partner agencies to clearly display the NHS inventory and conditions on a map. For many of our local partner agencies, the NHS represents a very small portion of the entire local transportation system they are responsible for managing. Caltrans also provided financial information collected by the California State Controller to help define the historical expenditure level for the NHS and then further segregated the expenditures into the five federal work types. The PTAT was also developed to help our local partners evaluate expected condition outcomes given their inventory, condition, deterioration, unit cost, and budget. The PTAT allowed local partner agencies to evaluate the reasonableness of their established TAMP targets for PM 2. To further the PM 2 connection, Caltrans established MOUs with each MPO that clearly defines the roles and responsibilities of each agency related to the collection inventory and condition data, and the use of this information in the planning and programming of work. Caltrans has realized the need to move the evaluation of performance earlier in the process to better allow our local partners to evaluate expected future conditions at the time that project plans are being developed and prior to commencement of planning.

Another initiative led by Caltrans, was the introduction of a new program for the SHS that focuses investment on bridges that are in good overall condition but have poor deck condition ratings. Bridges meeting this criteria account for a majority of all bridge deck area classified in poor condition. This new program, implemented in 2021, is expected to improve the condition of millions of square feet of bridges in California. Through all of these steps, Caltrans and our partners believe that we will make progress toward our pavement and bridge condition targets.

PM 3: Freight Reliability, Congestion, and Air Quality

PM 3 focuses on regional measures to reduce congestion, improve travel time reliability and reduce transportation related emissions. Many MPOs in California have regional congestion and freight plans that draw upon elaborate traffic models. Our partners are embracing strategies such as price managed express lanes, bus on shoulder usage, high occupancy toll lanes and other operational strategies to improve travel time reliability and reduce congestion. Some of the MPOs in California manage extensive rail service that offers modal choice, lessen congestion on highways and reduce transportation related emissions.

Caltrans has published the California Freight Mobility Plan (CFMP) since our initial TAMP was developed. The 2020 CFMP provides a blueprint for freight mobility at the local, regional, and statewide levels in California. The CFMP is a comprehensive freight plan that includes strategies to reduce emissions and improve air quality. The activities being carried out by Caltrans and our partners are expected to make progress toward the targets established for PM 3.

California uses asset performance targets to drive investment decisions as part of performance management and asset management best practice. California law requires the development of an SHS needs assessment that uses performance targets approved by the Commission to estimate current needs. Performance measures and targets are used to track progress and guide state and local agencies towards short, medium, and long-term goals.

PM 1 and PM 3 Targets

The performance management rules for safety and congestion have targets established for the transportation system in California. The SHSMP also has defined objectives for safety and delay reduction. The operational objectives and constrained investment are fully defined within the SHSMP for the SHS and therefore included in our constrained investment plan for improving NHS pavement and bridge conditions. Table 3-7 includes PM 1 targets as of 2022 and Table 3-8 includes reliability and congestion targets.

Table 3-7. Safety Targets

Performance Management Targets for Safety for 2022			
Performance Metric	**Baseline 5-Year Average 2016-2020**	**Target 5-Year Rolling Average 2018-2022**	**Percent Change**
Number of Fatalities (traffic fatalities – all public roads)	3,788	3,491.80	-3.61%
Fatality Rate (traffic fatalities per 100 million VMT – all public roads)	1.0658	1.042	-2.00%
Number of Serious Injuries (serious injuries – all public roads)	15,166	16704.2	1.66%
Rate of Serious Injuries (serious injuries per 100M VMT – all public roads)	4.3978	4.879	1.66%
Number of Non-motorized Fatalities and Serious Injuries (Non-motorized fatalities and serious injuries – all public roads)	4,369	4,684.40	-3.61% for Fatalities and +1.66% Serious Injuries

Notes: Data obtained from the 2021 HSIP Annual Report; Percent Change: (-) indicates a projected decrease and (+) indicates a projected increase

Table 3-8. Reliability and Congestion Targets

Performance Management Targets for Congestion	
Performance Metric	**4-Year Target 2018-2021**
Percent of the Person-Miles Traveled on the Interstate that are Reliable	65.60%
Percent of the Person-Miles Traveled on the Non-Interstate NHS that are Reliable	74.00%
Truck Travel Time Reliability (TTTR) Index	1.67
Annual Hours of Peak Hour (AHPH) Excessive Delay per Capita (Los Angeles-Long Beach-Anaheim)	51.20%
AHPH Excessive Delay per Capita (Riverside-San Bernardino)	16.10%
AHPH Excessive Delay per Capita (Sacramento)	14.70%
AHPH Excessive Delay per Capita (San Diego)	18.00%
AHPH Excessive Delay per Capita (San Francisco-Oakland)	30.00%
AHPH Excessive Delay per Capita (San Jose)	26.40%
Percent of Non-Single Occupancy Vehicle (Non-SOV) Travel (Los Angeles-Long Beach-Anaheim)	26.60%
Percent of Non-SOV Travel (Riverside-San Bernardino)	23.70%
Percent of Non-SOV Travel (Sacramento)	23.80%
Percent of Non-SOV Travel (San Diego)	25.20%
Percent of Non-SOV Travel (San Francisco-Oakland)	46.30%
Percent of Non-SOV Travel (San Jose)	26.50%
Total Emission Reductions: PM2.5	922.34
Total Emission Reductions: NOx	1,788.43
Total Emission Reductions: VOC	970.87
Total Emission Reductions: PM10	
Total Emission Reductions: CO	7,000.54

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4. Life Cycle Planning

One of the core principles of asset management is making investment decisions that consider the full life cycle and associated costs of an asset or system of assets. Transportation asset management involves developing life cycle plans for pavements, bridges, and other core assets included in the TAMP.

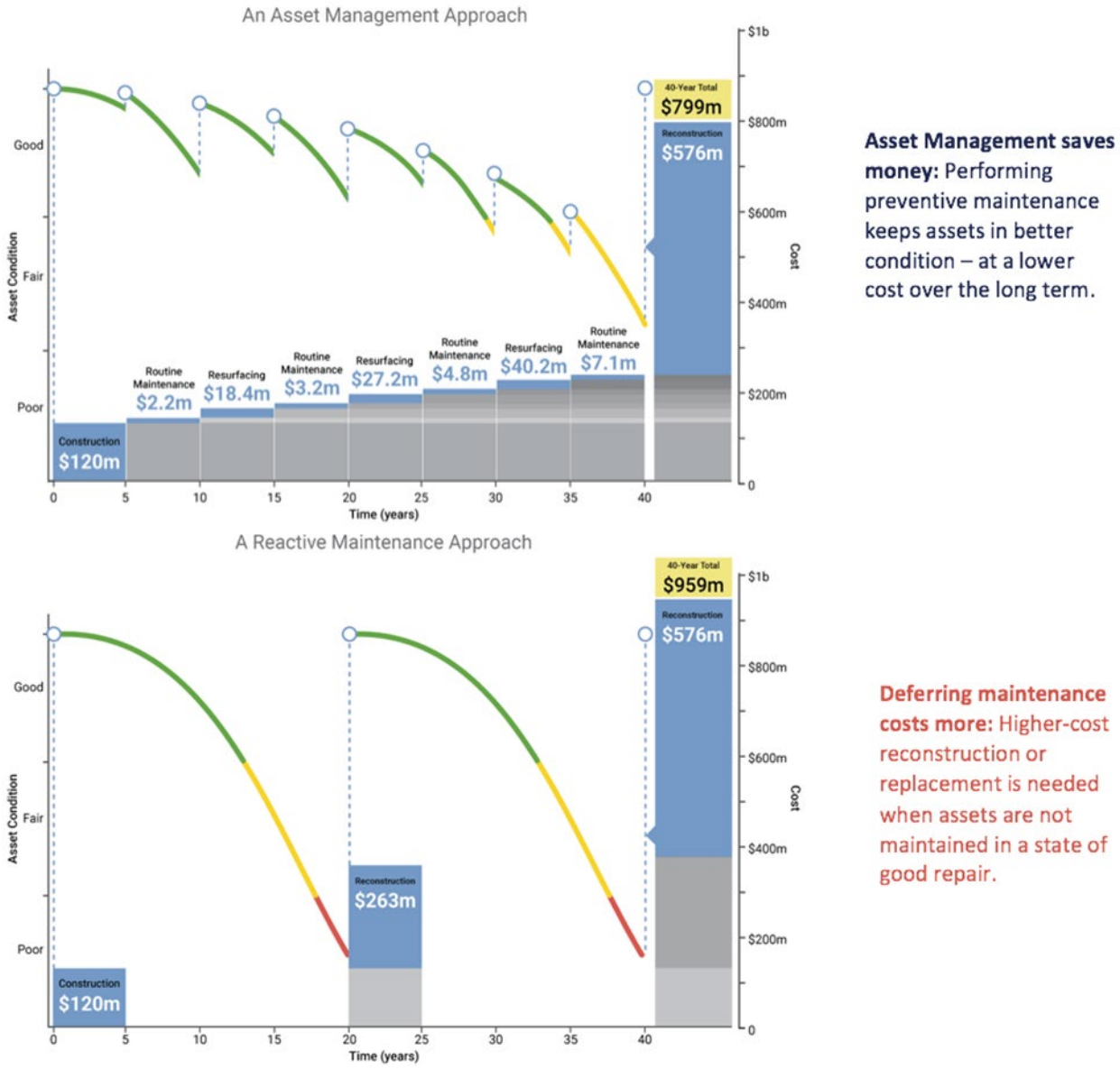
4.1. Overview

This chapter describes California's life cycle planning (LCP) for its pavement, bridge, drainage, and TMS assets. A life cycle plan is a strategy for managing an asset over its life to achieve a target level of performance while minimizing life cycle costs.

LCP focuses on general network-level asset management strategies, that is, the best sequence of maintenance and rehabilitation treatments for a given asset type. Life cycle cost analysis (LCCA) complements LCP. LCCA is a technique for comparing cost alternatives over the life cycle of a project, allowing agencies to minimize life cycle cost. FHWA defines life cycle cost as "the cost of managing an asset class or asset sub-group for its whole life, from initial construction to its replacements."[17] LCCA

[17] Federal Register, Asset Management Plan Definitions. 23 CFR § 515.5. October 24, 2016, https://www.ecfr.gov/current/title-23/chapter-I/subchapter-F/part-515

can be utilized for project level decisions to select the design option that minimizes the initial and discounted future agency, user, and other relevant costs over an analysis time period. The basic principle underlying both LCP and LCCA is fundamental to asset management: timely investments in an asset can result in improved condition and lower long-term cost. This principle is illustrated by Figure 4-1 below.



Source: Rhode Island DOT, Investing in Rhode Island's Future: A 10-Year Plan to Strengthen Our State's Transportation Systems. 2014. Based on an analysis published by TXDOT. Texas DOT, Typical Life Cycle Costs of a Highway, 2014. https://www.ri.gov/press/view/26105

Figure 4-1. Benefits of Preventive Maintenance

LCP is based on a good understanding of the costs, and the effectiveness and longevity of different types of treatments. It involves use of predictive models to understand how assets will deteriorate following different types of treatments. Ideally, these models are developed based on several years of data on treatments applied and resulting measured condition. In practice, they are typically based on a combination of historical data and expert judgment.

Caltrans uses a Physical Asset Model based on the principle of deterioration. Deterioration is the physical degradation of an asset because of a combination of factors, including material durability, operational demands, and physical environment. A set of deterioration rates (good-to-fair and fair-to-poor) are determined for each asset type to account for expected future conditions. The deterioration rates are expressed as an annual percentage rate and are used to quantify the proportion of the asset inventory that will degrade from good-to-fair and fair-to-poor condition states. The analysis has both a system preservation (good-to-good; fair-to-good) and rehabilitation/ replacement (fair-to-good; poor-to-good) goal to ensure a balanced management approach. Figure 4-2 illustrates the cycle of physical asset deterioration and improvements.

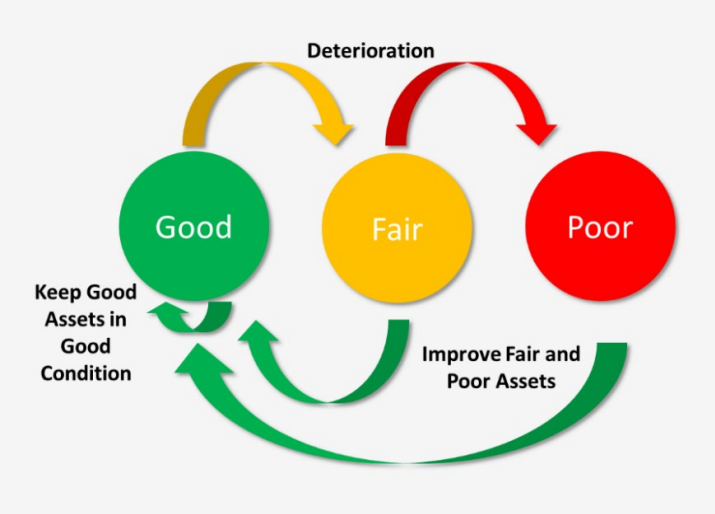


Figure 4-2. Deterioration and Improvement Cycle for Physical Assets

LCP Process Requirements:

- Identification of deterioration models
- Potential work types (i.e., initial construction, maintenance, preservation, rehabilitation and reconstruction), including treatment options and unit costs
- A strategy for minimizing life cycle costs and achieving performance targets
- Asset performance targets

Caltrans has a process for conducting LCP at the network level. This process began during development of the 2017 SHSMP and has matured over the last 5 years with pavement having the highest level of maturity through the use of a pavement management system that has the capability of conducting a network level analysis. All other assets including bridges, use an excel based tool to conduct an LCP analysis for the TAMP.

Information on current and future environmental conditions including extreme weather events, climate change and seismic activity are factors in an LCP analysis. Mitigation of identified vulnerabilities

effectively competes for available funding with condition improvement and other transportation objectives. Caltrans has dedicated funding for vulnerability mitigation at the program level and considers asset life cycle in project level planning. Enhancements made since the first TAMP includes the seismic retrofit, bridge scour, permanent restoration and protective betterment program funding in the investment scenarios through addressing system vulnerabilities in the PTAT. In addition, LCP continues to be impacted by funding priorities driven by legislative mandates that require a "fix it first" approach with emphasis on resilient and equitable transportation solutions. This means that for LCP, resiliency is considered during project development when condition-based rehabilitation, reconstruction, or replacement work is triggered. Additional resiliency efforts by Caltrans and our local partners are described in Chapter 5, Managing Risks and Building Resilience.

For the local NHS, Caltrans relied upon the 2020 Local Streets and Roads Needs Assessment Report[18], feedback from MPOs during development of the 2022 TAMP and spending data from city and county governments on pavement and bridges to understand current LCP practices at the local level.

Management systems are used in analyzing pavement and bridges for purposes of developing and implementing the TAMP. This Chapter will describe the LCP state of the practice for pavement and bridge modelling and use of current systems in place.

4.2. Key Life Cycle Planning Strategies

State Strategies

Caltrans strives to preserve the condition of the SHS and state-owned NHS in the most economical means possible through carefully planned preservation strategies (i.e., preventive maintenance, corrective maintenance, and minor rehabilitation) and to rehabilitate, replace, or retire the assets when it becomes necessary. Caltrans manages the condition of the SHS and state-owned NHS through a combination of three types of work categories and projects: Field Maintenance Crews, Major Maintenance projects, and SHOPP projects. Each plays a key role in the overall management and preservation of the transportation system.

The combination of these three strategies allows Caltrans to preserve the highway infrastructure at defined condition levels and in the most cost-effective manner. Caltrans Field Maintenance Crews carry out work to address minor needs before they grow into major and more expensive repairs. Highway Maintenance (HM) contracts in the Maintenance Program are initiated to carry out work at the right time to extend the useful life of assets at the lowest possible long-term cost and to delay future rehabilitation or replacement activities. And finally, SHOPP capital projects are used to invest in major asset rehabilitation or replacement projects when the end of an asset's useful life has been reached. This tiered approach maximizes transportation preservation investments across a spectrum of conditions and treatments.

In addition to SHOPP and the Maintenance Program, there are other funding programs that address

[18] California Statewide Local Streets and Roads Needs Assessment, 2020, https://www.savecaliforniastreets.org/wp-content/uploads/2021/08/Statewide-2020-Local-Streets-and-Roads-Needs-Assessment-Final-8-4-21.pdf

additional SHS and state-owned NHS needs to address increased active transportation, freight movement, broader economic and population growth and evolving land use patterns. These funding programs, such as the State Transportation Improvement Program (STIP)[19], state transportation bond programs, local transportation tax measures, and other funding programs support these transportation needs. In addition, these programs all invest in the NHS, and they sometimes address NHS preservation needs at the same time. The changes in inventory and/or condition resulting from this additional work is identified as initial construction in Table 4-1 below and are accounted for through regular data collection methods. This inventory is then used in an updated needs assessment and gap analysis during each cycle of the SHSMP supporting continuous progress towards 10-year performance targets.

Table 4-1 presents Caltrans LCP funding programs related to FHWA work types and their primary condition focus to address SHS needs.

Table 4-1. FHWA Work Types, LCP Funding Programs and Condition Focus to Address the SHS Needs

Maintenance, Preservation, and Rehabilitation Strategies						
FHWA Work Types	Initial Construction	Maintenance	Preservation	Rehabilitation	Reconstruction	Asset Condition Focus
Field Maintenance Crews		●	●			Good/Fair
Highway Maintenance			●			Good/Fair
SHOPP	●		●	●	●	New/ Fair/Poor
STIP	●				●	New/Poor
Local	●				●	New/Poor

Local Strategies

In California, 21 MPO/RTPAs rely on over 360 cities and counties to effectively manage their pavement and bridge assets on the NHS. LCP is a relatively new term for many of these local transportation agencies. More recognized for minimizing costs of transportation projects is the use of LCCA. Those that have implemented asset management typically have pavement management systems (PMS) in

[19] Caltrans State Transportation Improvement Program website, https://dot.ca.gov/programs/local-assistance/fed-and-state-programs/state-transportation-improvement-program

place to predict the best time to address pavement needs and minimize costs for their entire system of roads. However, other agencies without management systems must rely on engineering judgement and historical practices to manage their pavements. According to the Local Streets and Roads Needs Assessment Report, the main PMS software used in California at the local level is either the StreetSaver or Paver System. Bridge Management Systems, although not widely implemented at the local level, are being used by agencies with more mature asset management practices.

Because of this variability, LCP strategies for the locally-owned NHS are based on the work types associated with maintaining and improving pavement and bridges shown in Table 4-2 derived from expenditure data reported to the California State Controller's Office (SCO) by all city and county owners of NHS pavement and bridges and the feedback received by the MPO/RTPAs during the development of the TAMP. Refer to Chapter 6. Financial Planning for additional information.

Table 4-2. Work Types, Funding Programs and Strategies to Address the Local System Needs

Maintenance, Preservation, and Rehabilitation Strategies					
FHWA Work Types	Initial Construction	Maintenance	Preservation/ Rehabilitation	Reconstruction	Asset Condition Focus
Local Maintenance Crews		●	●		Good/Fair
Maintenance Contracts		●	●		Good/Fair
Local	●	●	●	●	New/Fair/ Poor
STIP	●			●	New/Poor

Current California LCP practices for pavements, bridges, drainage, and TMS are detailed in the following sections. For each asset class, there are well-established processes starting with inspection and condition assessment, assignment of appropriate treatments, modeling of future asset condition based on realistic funding assumptions, and life cycle strategies for managing assets.

4.3. Life Cycle Planning for Pavements

Data Collection

Caltrans began collecting automated pavement condition data annually for every available mainline mile on the SHS using an automated pavement condition assessment in 2011. When NHS automated condition reporting was expanded to include many local roadways, Caltrans extended our APCS evaluation to include the outer lane in the primary direction of all locally-owned NHS pavement.

Data collected through APCS includes pavement type, profiles, distresses, and images.

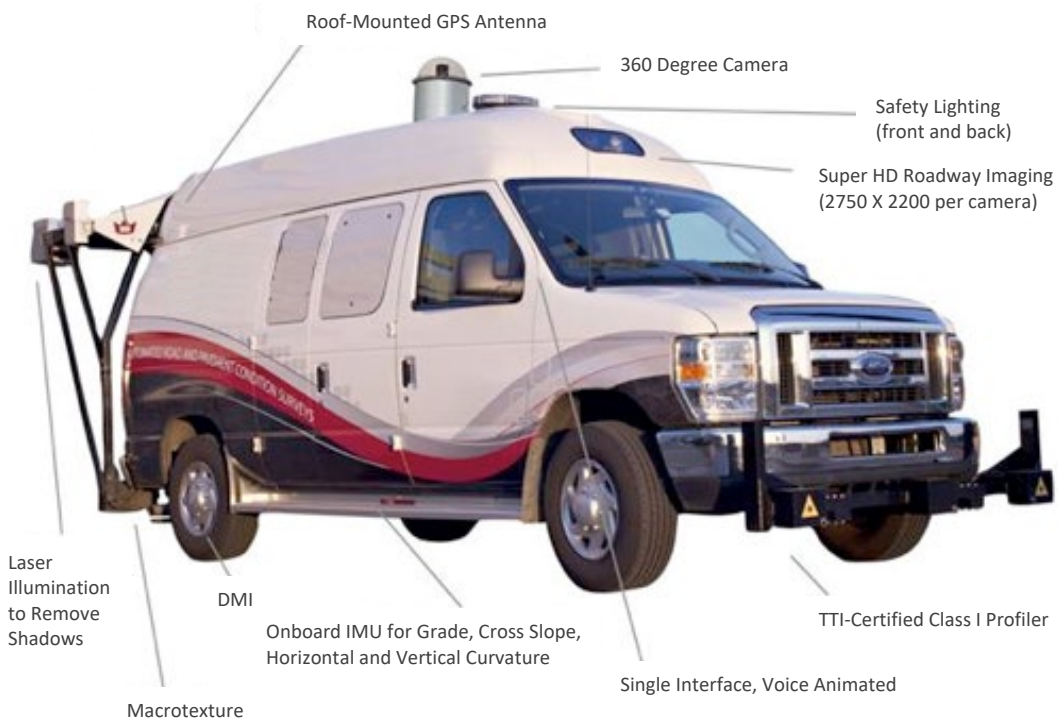


Figure 4-3. Automated Road and Pavement Condition Survey Van

Modeling Approach

Data collected through APCS takes into account a number of variables which impact pavement condition evaluation. Data from APCS are used in Caltrans' Pavement Management System (PaveM). PaveM is a software tool at Caltrans used to model pavement deterioration and prioritize pavement treatment priorities at a network-level. With the implementation of the PaveM system in 2015, Caltrans can analyze and predict SHS needs at a network level based on distress conditions, and evaluate funding scenarios. PaveM supports decision-making based on project optimization that analyzes benefit/cost considerations considering pavement condition, pavement type, climate, traffic, and project history to identify potential treatments that achieve the desired SHSMP performance targets.

Treatments

The approach to predicting pavement condition includes treatments types, impacts on condition, and costs. The network-level approach to the management of pavements begins with preservation after initial construction of new pavement, followed by timely repeated maintenance and minor rehabilitation treatments until the pavement requires major rehabilitation or reconstruction. Unit costs for the treatments are based on historical project data and are updated as needed. Unit costs include materials, labor, traffic handling, and other required costs to construct pavement including mobilization, contingency, state furnished materials and supplemental work.

Table 4-3 shows the unit costs per lane mile for network-level treatments based on strategy:

Table 4-3. Unit Cost for Pavement Treatments

Cost Per Lane Mile for all Treatment Types			
Federal Work Type	**Caltrans Work Type**	**Treatment**	**Unit Cost**
Preservation	Preventive Maintenance	Seal Coat - Preventive	$95,000
		HMA Thin Overlay (≤ 0.20') - Preventive	$225,000
		Slab Replacement - Preventive	$77,000
		Grinding - Preventive	$150,000
Preservation	Corrective Maintenance	Seal Coat - Corrective	$95,000
		Cold In-Place Recycling - Class 3	$360,000
		HMA Thin Overlay (≤ 0.20') - Corrective	$225,000
		Slab Replacement - Corrective	$77,000
		Grinding - Corrective	$150,000
Rehabilitation	Minor Rehabilitation (CAPM)	Cold In-Place Recycling – Class 1	$360,000
		HMA Medium Overlay (≥ 0.15' and ≤ 0.25')	$420,000
		Grind PCC for Smoothness	$150,000
		Grind/Replace slabs	$330 ,000
Reconstruction	Major Rehabilitation	Full Depth Reclamation	$1,000,000
		HMA Thick Overlay (> 0.25')	$1,000,000
		Crack Seat and Overlay	$1,125,000
		PCC Lane Replacement	$2,000,000
		PCC overlay	$2,000,000

Because of the wide range of costs for the various concrete and asphalt treatments, the 2021 SHSMP treatment cost assumptions for SHS pavements are expressed in terms of the unit cost of improving condition from fair to good, from poor to good, and adding new pavement. Table 4-4 presents the unit costs from the 2021 SHSMP. These values vary by SHSMP cycle based on the analysis of recommended treatments considering pavement conditions and available funding.

Table 4-4. 2021 SHSMP Average Costs for SHS Pavements

Costs Per Lane Mile			
	Fix Fair to Good	Fix Poor to Good	Add New
Class I	$814,335	$1,400,894	$1,323,600
	$292,050	$734,621	$714,000
Class III	$124,848	$480,000	$480,000

Targets

LCP is intended to help state DOTs cost-effectively achieve asset performance targets considering the pavement's life cycle. California's pavement performance targets and the target-setting process are discussed in detail in Chapter 3. Asset Performance Targets.

Strategy

FHWA's guidance on using LCP to support asset management defines an LCP strategy as "a collection of treatments that represent the entire life of an asset class or sub-group." Given that definition, the treatment schedules shown in Table 4-5 represents typical service lifes for pavement strategies. More broadly, the objective in California is to treat pavements when they are in good or fair condition to prevent them from deteriorating to poor condition. Assets in poor and fair condition with extensive cracking are targeted for more aggressive rehabilitation treatments.

Table 4-5. Pavement Service Life

Anticipated Pavement Strategy Service Life*		
Strategy	Asphalt**	Concrete**
Highway Maintenance (Preventive and Corrective)	4 to 10 years	4 to 10 years
Minor Rehabilitation (CAPM)	5 to 20 years**	5 to 20 years**
Major Rehabilitation	20 to 40 years**	40 to 50 years**

*Service life can vary depending on location, climate, traffic, subgrade type, etc. **Based on Caltrans Highway Design Manual Chapter 600 and DIB 79 & 81[20]

[20] Caltrans, Highway Design Manual, Revised 2020, https://dot.ca.gov/programs/design/manual-highway-design-manual-hdm

Table 4-6 represents a theoretical treatment schedule and costs for a 20 year design life asphalt pavement. Caltrans currently uses a real discount rate of four percent in carrying out the net present value (PV) calculations for each asset.

Table 4-6. Typical Life Cycle Plan for Asphalt Pavement (20-year design life)

Costs Per Lane Mile				
Activity/Treatment	**Work Type**	**Year***	**Current Cost**	**Discounted Cost****
New Construction	Initial Construction	0	$1,323,600	$1,323,600
Seal Coat	Preventive Maintenance	5	$95,000	$78,083
HMA Thin Overlay (≤ 0.20')	Corrective Maintenance	8	$220,000	$160,752
HMA Medium Overlay (≥ 0.15' and ≤ 0.25')	Minor Rehabilitation (CAPM)	15	$420,000	$233,211
HMA Thick Overlay (> 0.25')	Major Rehabilitation	30	$1,000,000	$308,319
Net Present Value				**$2,103,965**

*Based on service life ranges from Table 4-5; ** escalation is factored into the discounted cost of each treatment or activity

The results from PaveM provide District Maintenance Engineers the recommended pavement needs for potential project development. Engineering analysis, judgment, and cost analysis are used to validate the needs and the preferred alternative that is advertised for construction. The statewide 10-year LCP for pavement by the 5 federal work types is based on PaveM recommendations and district priorities for preserving, rehabilitating, and reconstructing pavements to achieve legislatively mandated performance targets. Initial construction adds new inventory to the system but is not a primary consideration in LCP strategies. Maintenance work is critical to overall system health and helps sustain the state of good repair as described earlier.

LCP Strategy Scenarios

To illustrate Caltrans LCP approach for pavement at the network level, three different scenarios are presented for Interstate and state-owned non-Interstate NHS pavements resulting in the following "Good" and "Poor" condition state at the end of 10 years. The LCP analysis utilizes PaveM for each scenario to determine the end result of the performance desired for the scenario. PaveM influences both funding distribution and project selection differently for each of the scenarios. APCS data is loaded into PaveM and based on predicted pavement condition and a series of decision trees, PaveM triggers project segments to optimally maintain the pavement on an annual basis. These triggered segments are

further vetted based on the location's treatment history to confirm or modify the recommended strategy. This scenario uses the existing SHOPP projects for the first five years of the 10 year plan and the existing Highway Maintenance projects for the first two years of the plan. For the remaining years, the Highway Maintenance funding was set to a pre-determined annual amount and the total SHOPP funding was calculated by PaveM using a trial and error method that intends to determine the best combination of CAPM and rehabilitation funds to meet the good, fair and poor goals established for MAP-21 for each class of roadway. Although PaveM analysis extends beyond 10 years, the results are displayed for the TAMP 10 year period.

Scenario 1: More System Preservation

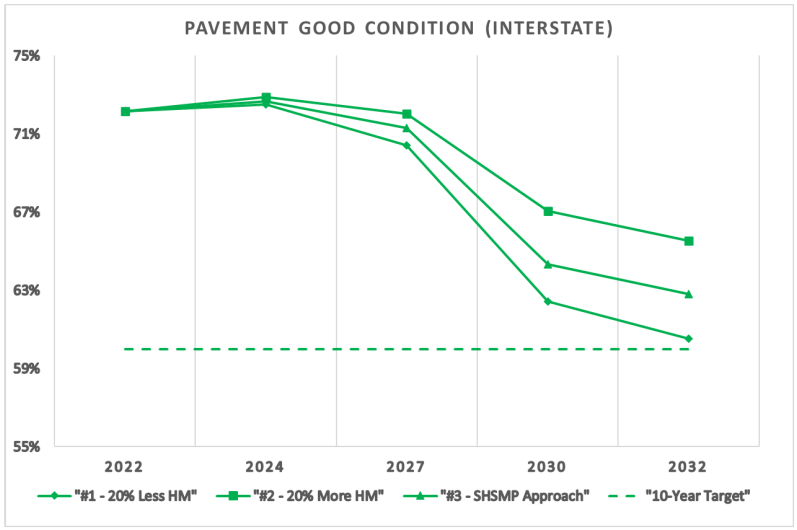
This scenario increases investment in preservation activities by 20%. The Interstate and state-owned non-Interstate NHS conditions predicted for all lanes are shown in Figure 4-4 and Figure 4-5. Total estimated investment $ 6.6 Billion (Interstate); $ 10.3 Billion (non-Interstate NHS)

Scenario 2: Reduced System Preservation

This scenario decreases investment in preservation activities by 20%. The Interstate and state-owned non-Interstate NHS conditions predicted for all lanes are shown in Figure 4-4 and Figure 4-5. Total estimated investment: $ 6.2 Billion (Interstate); $ 9.7 Billion (non-Interstate NHS).

Scenario 3: SHSMP Approach (Implemented Strategy)

This scenario was implemented in the 2021 SHSMP as Caltrans preferred scenario to meet performance targets established by the Commission and as basis for the parameters used in the 2022 TAMP PTAT. Total estimated investment: $ 6.4 Billion (Interstate); $ 10.0 Billion (non-Interstate NHS).



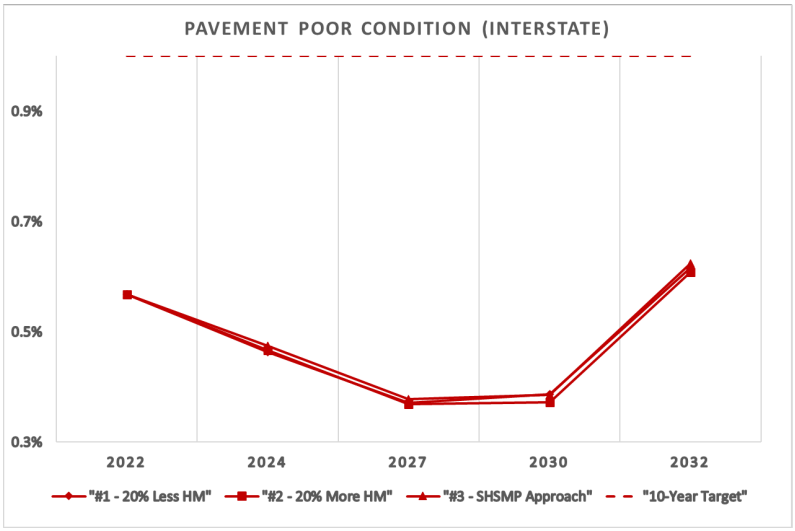
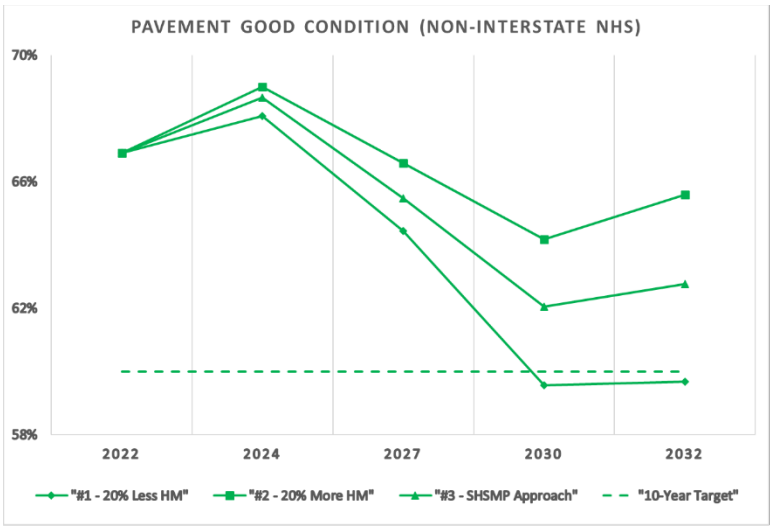


Figure 4-4. Interstate LCP Scenarios

Different investment levels in preservation work used in each of the LCP scenarios demonstrate the impact on results. Through multiple iterations of PaveM analysis evaluated by pavement engineers at

Caltrans, the scenario implemented in the 2021 SHSMP produced the optimum set of pavement treatments including preservation, rehabilitation and reconstruction work to meet established performance targets using available funding. Caltrans SHSMP process is further described in Chapter 8. Performance Scenarios and Gaps.

Other strategies for improving the life cycle of pavements in California include applying LCCA in planning and design, following appropriate three to 20 year cycle of preventive maintenance, changing minimum standards for rehabilitation from 10 years to a 20 or 40-year design life, and using recycled materials in pavement. Caltrans also has a strong leadership structure for the management of pavements and partnerships with the pavement industry and FHWA through the Pavement Materials and Partnering Committee.



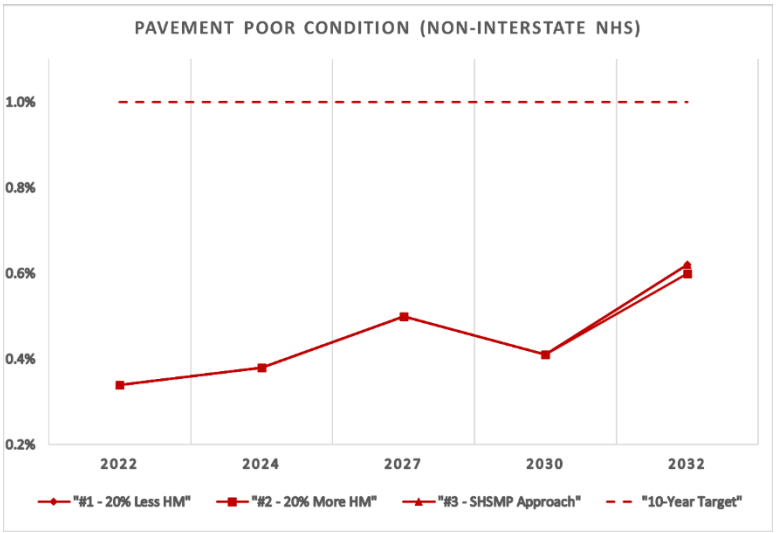


Figure 4-5. Non-Interstate NHS Pavement LCP Scenarios

Since Caltrans does not use PaveM for the local NHS, the PTAT was used to predict pavement condition for the TAMP. Although most cities and counties have pavement management systems, they are not measuring condition by federal performance metrics, and instead use the Pavement Condition Index (PCI) or Pavement Servicability Rating (PSR) to manage pavement conditions for all of their local roads.

Agencies that have pavement management systems are using results to plan pavement work to maintain and improve their pavements at the optimum time. However, not all local agencies have this capability and instead must rely on engineering judgement and historical practice for managing pavements at the lowest practical cost as explained earlier. Sustainable pavement practices are cited in the Local Streets and Roads Needs Assessment as being an improved practice by many local agencies that supports LCP as they are expected to perform better and last longer. With increased emphasis on climate goals, it is expected that both state and local transportation agencies will focus their dollars on more environmentally friendly solutions.

4.4. Life Cycle Planning for Bridges

Data Collection

All bridges in the State of California (both state and locally-owned) are inspected by licensed professional engineers in accordance with mandated federal guidelines by Caltrans or local agency inspectors. Routine inspections are typically performed biennially and specialty inspections (such as hydraulics, fracture critical or underwater) every 2-5 years.

All data collected during the inspection process are documented and maintained in the SMART (Structure Maintenance Automated Report Transmittal) bridge management system and formal inspection reports are produced annually for FHWA.

The result of every bridge inspection (whether routine or specialty) is also documented in a formal Bridge Inspection Report that is signed and sealed (with an engineer stamp) and archived on the state managed Bridge Inspection Report Information System (BIRIS) for historical purposes.

Modeling Approach

The current network level life cycle model for the structural integrity of bridges is included in the Bridge Health model in Appendix B of the SHSMP. The model incorporates planned work generated by work recommendations and estimates additional bridge needs based on the identification of defects during the inspection process. This model is based on percentage of total deck area of the SHS bridge inventory in good, fair or poor condition. Modeling assumptions include a 5.0 percent annual deterioration rate from good to fair which assumes that annually about five percent of the deck area of the total SHS bridge inventory would be added to the minor rehabilitation needs. The model also includes a 0.70 percent annual deterioration rate from fair to poor which assumes that annually less than one percent of the deck area of the total SHS bridge inventory would be added to the major rehabilitation or replacement needs.

Treatments

Typical bridge treatments and unit costs for a concrete bridge are shown below in Table 4-7.

Table 4-7. Typical Concrete Bridge Treatment Costs

Activity/Treatment Costs		
Activity/Treatment	**Unit**	**Unit Cost**
Methacrylate Deck	Square Feet	$4
Replace Joints	Linear Feet	$200
Polyester Concrete Overlay	Square Feet	$25
Deck on Deck	Square Feet	$125
Rail Replacement	Linear Feet	$250
Replace Bridge	Square Feet	$635

Because of the wide range of costs for the various bridge preservation and rehabilitation treatments, the 2021 SHSMP treatment cost assumptions for SHS bridges included a calculated average treatment cost for condition improvement from fair to good, from poor to good, and adding new bridge deck area. Table 4-8 presents the unit costs from the SHSMP.

Table 4-8. Unit Costs for SHS Bridges

Costs Per Square Foot			
	Fix Fair to Good	**Fix Poor to Good**	**Add New**
SHS Bridge	$420	$536	$536

Through research, Caltrans continually improves bridge maintenance activites. As a result of a study on deck cracking, it was determined that the majority of deck cracks were caused by early stage deck cracking during the first hours of concrete curing. Based on these results, a new bridge deck concrete specification was instituted. All new bridge decks will be built using a fiber reinforced concrete specification which allows the fibers in the concrete to take the intitial stresses caused by the shrinkage and curing of the concrete. Through research, this was shown to prevent the early stage cracking which will reduce the cost of maintenance for bridge decks and will lengthen their service life.

Targets

LCP is intended to help state DOTs achieve asset performance targets. California's bridge performance targets and the target-setting process are discussed in detail in Chapter 3. Asset Performance Targets.

Strategy

Work recommendations from the inspection process drive bridge maintenance and rehabilitation projects. Work recommendations developed to address condition defects are documented for all structures (both state and locally-owned). Information regarding condition defects for locally-owned bridges are provided to local agencies in monthly reports. SHS bridge work recommendations are typically either categorized as preventive maintenance (addressed through either maintenance field staff or the Caltrans HM Program) or major rehabilitation (addressed through SHOPP). Caltrans' objective is to manage the bridge inventory safely and economically to limit operational restrictions and prevent sudden closure or collapse. Major rehabilitation, often caused by lack of preventive maintenance, is more costly than preventive maintenance and has the potential to cause significant long-term disruptions.

Systematically, Caltrans has instituted a life cycle planning procedure through our bridge management software, SMART. Policies have been put in place that restrict the creation of work recommendations to the most efficient treatments possible.

Data check flags are also incorporated in the bridge management system. When an error or anomaly is encountered in the bridge data, a warning will appear informing the inspector to verify certain pieces of data. For example, if a bridge is identified as being in poor or fair condition but no work has been identified to fix the bridge, a warning will appear informing the inspector to create a work recommendation to address the defects.

An example of Caltrans' condition and systematic-based LCP strategies are shown below for a typical concrete bridge with an average daily traffic (ADT) volume of 12,000 (five percent trucks) in a non-aggressive environmental zone. In this example, the bridge has a deck area of 12,000 square feet, rail length of 620 linear feet and joint length of 80 linear feet. Table 4-9 includes the treatment schedule and costs for a condition-based strategy.

Table 4-9. Condition-Based LCP Strategy for an Example Concrete Bridge

Costs Per Square Foot				
Activity/Treatment	**Work Type**	**Year**	**Current Cost**	**Discounted Cost****
New Construction	Initial Construction	0	$7,620,000	$7,620,000
Methacrylate Deck Replace Joints	Preventive Maintenance	15	$64,000	$35,537
Polyester Concrete Overlay and Repl Joints	Minor Rehabilitation	30	$316,000	$97,429
Replace Bridge	Reconstruction /Replacement	75	$7,620,000	$402,211
Net Present Value				$8,155,177

** escalation is factored into the discounted cost of each treatment or activity

The bridge program would like to transition the condition based modeling approach to a systematic LCP

strategy which would routinely apply preservation strategies to a structure prior to the identification of defects to maintain the structures in good condition consistently (as shown in Table 4-10). Treatment schedules and costs, shown in Table 4-10 are for a systematic-based strategy.

Table 4-10. Alternative Systematic-Based LCP Strategy for a Concrete Bridge

Costs Per Square Foot				
Activity/Treatment	**Work Type**	**Year**	**Current Cost**	**Discounted Cost****
New Construction	Initial Construction	0	$7,620,000	$7,620,000
Methacrylate Deck Replace Joints	Preventive Maintenance	10	$64,000	$43,236
Polyester Concrete Overlay Replace Joints	Minor Rehabilitation	20	$316,000	$144,218
Deck on Deck Rail Replacement	Major Rehabilitation	40	$1,655,000	$344,718
Methacrylate Deck on Deck Replace Joints	Preventive Maintenance	50	$64,000	$9,006
Polyester Concrete Overlay Replace Joints	Minor Rehabilitation	70	$316,000	$20,293
Replace Bridge	Reconstruction /Replacement	90	$7,620,000	$223,334
Net Present Value				**$8,404,805**

** escalation is factored into the discounted cost of each treatment or activity

Typical LCP Strategy for Bridge Decks

The current strategy in California is to perform bridge work according to the work recommendations generated by inspections. These work recommendations typically identify two types of work: preventive maintenance (preservation) or rehabilitation (non-preservation). Preventive maintenance work extends bridge service life by addressing minor defects before they worsen to more extensive damage. Preventive maintenance bridge work includes joint repairs, spall repair, minor paint needs, as well as some deck repairs. As described in the 2021 SHSMP, bridges exhibiting more serious deterioration or damage, which include bridges in poor condition and a portion of the bridges in fair condition, are addressed with more extensive rehabilitation or replacement activities funded through SHOPP. Figure 4-6 below shows the bridge deck treatments planned in a 10-year period identified by work recommendations.

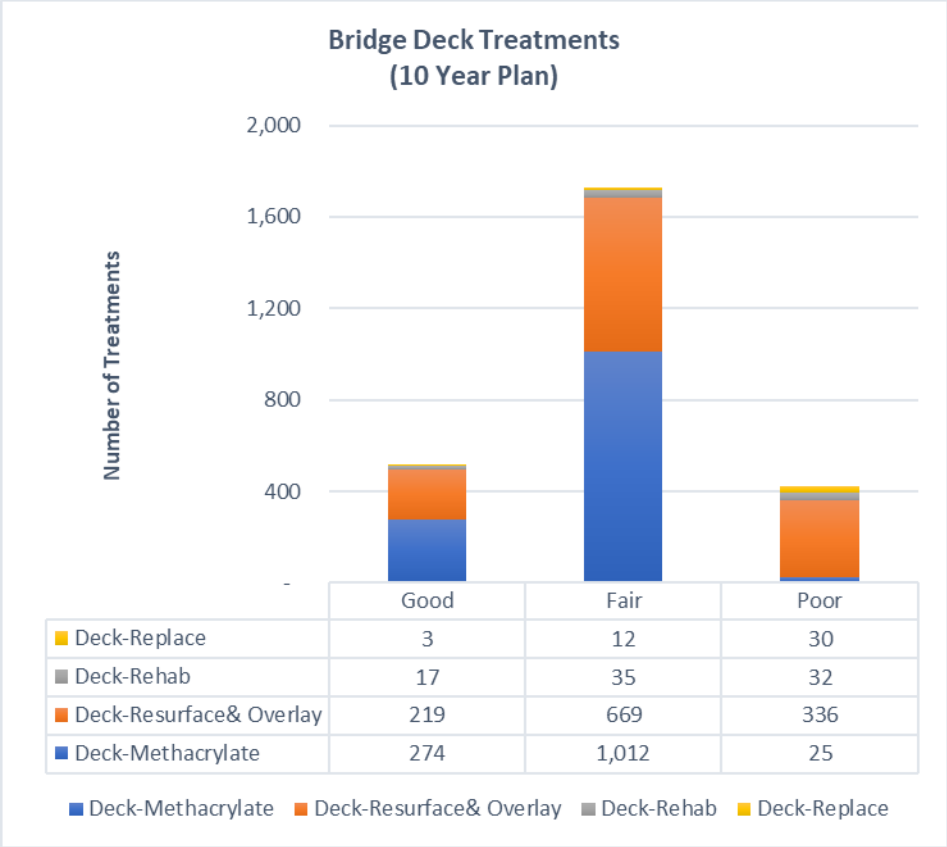


Figure 4-6. Bridge Deck Treatments (10 Year Plan)

LCP Strategy Scenarios

To illustrate LCP approach for bridges at the network level that result in the following "Good" and "Poor" condition state at the end of 10 years, three different scenarios are presented for state-owned bridges which represents 90% of the total NHS. An excel-based tool developed by Caltrans was used for the LCP scenarios with results from the tool displayed below and shown in Figure 4-7.

Scenario 1: No Bridge Preservation

This scenario assumes that all work to improve condition of bridges is through the SHOPP with no investment in bridge maintenance or preservation activities. The LCP analysis includes deterioration rates and statewide average unit costs from the 2021 SHSMP and the amount of work predicted to be accomplished annually for the life span of the asset. Total estimated investment: $ 5.7 Billion.

Scenario 2: Historical Approach

This scenario was based on historical strategies to improve bridge condition including historical deterioration rates, and statewide average unit costs based on a mix of preservation, rehabilitation and replacement work to fix fair and poor bridges, and the amount of work predicted to be accomplished annually for the life span of the asset. Total estimated investment: $ 6.5 Billion.

Scenario 3: SHSMP Approach (Implemented Strategy)

The scenario includes additional bridge deck preservation work for two years of the 10-year plan, deterioration rates from the 2021 SHSMP, and statewide average unit costs that are a mix of preservation, rehabilitation, and replacement work to fix fair and poor bridges including additional bridge decks, and the amount of work predicted to be accomplished annually for the life span of the asset. This scenario was implemented in the 2021 SHSMP as Caltrans preferred scenario to meet performance targets established by the Commission and a basis for the parameters used in the 2022 TAMP PTAT. Total estimated investment: $ 6.8 Billion.

Figure 4-7. Bridge LCP Scenarios

LCP scenarios for bridges demonstrate how highway maintenance funding for preservation effects bridge condition. By not investing in bridge preservation, bridge conditions are predicted to get worse over time. Applying additional funding to preserve bridge decks as demonstrated through Scenario #3 and implemented through the 2021 SHSMP brings over 4.8 billion square feet of bridges from poor to good condition helping to achieve SB1 and TAMP performance targets.

For local bridges, agencies mainly rely on about $300 million/year in funding that is administered by Caltrans. Based on this limited funding, a focus has been on reconstruction. Caltrans develops local policies and procedures for this program by working with a local bridge advisory committee made up of city and county organizations, FHWA, and the Commission that provides a forum to confer with cities and counties on local bridge funding and programming matters. In the 2020 California Local Bridge Needs Assessment Report[21], less than 40 bridge repairs are completed each year based primarily on this funding, but 250 bridges need to be repaired or replaced annually due to poor condition.

[21] Quincy Engineering, California Local Bridge Needs Assessment Report, 2020, https://www.savecaliforniastreets.org/wp-content/uploads/2021/09/California-Local-Bridge-Needs-Assessment-Report-2020-Final-090121.pdf

Other strategies for improving the life cycle of bridge assets include using new materials that last longer and are easier to apply, implementing policies to ensure that new projects are built with cost-effective and easily maintained elements, and using accelerated bridge construction techniques.

Best management practices include centralized statewide management of all bridge assets, on-going training for state and local inspectors, bridge strategy meetings that provide a uniform approach to recommended maintenance strategies and scour and seismic vulnerability screening to ensure that bridges with the most critical needs are addressed.

4.5. Life Cycle Planning for Drainage Culverts

Data Collection

Starting in 2005, Caltrans initiated a process to assess the health of all of the State's drainage culvert assets through a systematic district level inspection program. Each drainage culvert asset is inventoried and given a unique culvert system number, as its condition is evaluated. These assessments are then added to a growing database in the office for identification and prioritization of maintenance and rehabilitation. Drainage culvert assets are assessed as good, fair or poor condition. The current Culvert Inspection Program (CIP) plan reflects the completion of the inventory of drainage culvert assets on the SHS by 2023.

Modeling Approach

The 2021 SHSMP includes a network level LCP model for drainage culvert assets. The model includes deterioration rates, treatments, and unit costs for drainage culvert assets on the SHS.

Treatments

Typical treatments and unit costs are shown below in Table 4-11 for drainage culvert assets based on recent historical costs. This treatment schedule is for a drainage culvert rehabilitation project.

Table 4-11. Typical Activity/Treatments and Unit Costs for Drainage Culvert Systems

Typical Activity/Treatment Costs for Culverts	
Activity/Treatment	**Cost per Culvert**
Maintenance	$400
Invert Paving/Plating	$124,000
Culvert Restoration/Liner	$63,000
Jack and Bore New Pipe	$180,000
Culvert Inspection	$300
Culvert Cleaning	$1,000

The 2021 SHSMP presents treatment cost assumptions for drainage systems on the SHS. Instead of unit costs for individual treatments, the SHSMP calculates unit costs for improving condition from fair to good, from poor to good, and adding new drainage systems. Table 4-12 presents the unit costs from the SHSMP.

Table 4-12. Unit Costs for Drainage Systems

Costs Per Linear Foot			
	Fix Fair to Good	Fix Poor to Good	Add New
Culverts	$558	$2,000	$2,000

Targets

LCP is intended to help state DOTs achieve asset performance targets. California's drainage performance targets and the target-setting process are discussed in detail in Chapter 3. Asset Performance Targets.

Strategy

Caltrans' culvert inspection program identifies drainage systems in need of immediate attention so they can be restored to perform their function and provide the expected level of service. Once identified for restoration, project engineers at the project level determine a final treatment based on the Caltrans Highway Design Manual and other design guides containing multiple possible restoration strategies. The final treatment decision is selected in cooperation and consultation with the public, private organizations, and state and federal agencies. This ensures the selected drainage restoration method is safe, cost efficient, environmentally friendly, and resilient.

Cost alone may not be the final word on ultimate treatment selection. Other factors such as environmentally sensitive areas, fish passage, legal, right of way, or safety impacts may determine the final treatment selection and cost.

Three LCP strategies for drainage systems are presented in Table 4-13, Table 4-14, and Table 4-15 below. The first treatment/activity schedule is for drainage system rehabilitation. The second lists the treatments/activities and costs for drainage system replacement and the third lists the treatments/activities and costs for failed road and drainage system replacement.

Table 4-13. Typical LCP Strategies for Culvert Rehabilitation

Culvert Life Cycle Treatment Schedule			
Activity/Treatment	Schedule (in years)	Current Cost*	Discounted Cost**
New Culvert Installation	0	$20,000	$20,000
Maintenance	5	$400	$329
Culvert Inspection	7	$300	$228
Culvert Cleaning	7	$1,000	$760
Maintenance	10	$400	$270
Culvert Inspection	14	$300	$173
Culvert Cleaning	14	$1,000	$577
Maintenance	15	$400	$222
Maintenance	20	$400	$183
Culvert Inspection	21	$300	$132
Culvert Cleaning	21	$1,000	$439
Maintenance	25	$400	$150
Culvert Inspection	28	$300	$100
Culvert Cleaning	28	$1,000	$333
Rehabilitation (Invert Paving/Plating)	30	$124,000	$38,232
Maintenance	35	$400	$101
Culvert Inspection	35	$300	$76
Culvert Cleaning	35	$1,000	$253
Maintenance	40	$400	$83
Culvert Inspection	42	$300	$58
Culvert Cleaning	42	$1,000	$193
Maintenance	45	$400	$68
Culvert Inspection	49	$300	$44
Culvert Cleaning	49	$1,000	$146
Preservation (Culvert Restoration/Liner)	50	$63,000	$8,865
Net Present Value			$72,016

Table 4-14. Typical LCP Strategies for Culvert Replacement

Culvert Life Cycle Treatment Schedule			
Activity/Treatment	Schedule (in years)	ırrent Cost*	Discounted Cost**
New Culvert Installation	0	$20,000	$20,000
Maintenance	5	$400	$329
Culvert Inspection	7	$300	$228
Culvert Cleaning	7	$1,000	$760
Maintenance	10	$400	$270
Culvert Inspection	14	$300	$173
Culvert Cleaning	14	$1,000	$577
Maintenance	15	$400	$222
Maintenance	20	$400	$183
Culvert Inspection	21	$300	$132
Culvert Cleaning	21	$1,000	$439
Maintenance	25	$400	$150
Culvert Inspection	28	$300	$100
Culvert Cleaning	28	$1,000	$333
Rehabilitation (Invert Paving/Plating)	30	$124,000	$38,232
Maintenance	35	$400	$101
Culvert Inspection	35	$300	$76
Culvert Cleaning	35	$1,000	$253
Maintenance	40	$400	$83
Culvert Inspection	42	$300	$58
Culvert Cleaning	42	$1,000	$193
Maintenance	45	$400	$68
Culvert Inspection	49	$300	$44
Culvert Cleaning	49	$1,000	$146
Reconstruction (Jack & Bore New Pipe)	50	$180,000	$25,328
Net Present Value			$88,479

Table 4-15. Typical LCP Strategies for Culvert Failed Road and Replacement

Culvert Life Cycle Treatment Schedule			
Activity/Treatment	Schedule (in years)	Current Cost*	Discounted Cost**
New Culvert Installation	0	$20,000	$20,000
Maintenance	5	$400	$329
Culvert Inspection	7	$300	$228
Culvert Cleaning	7	$1,000	$760
Maintenance	10	$400	$270
Culvert Inspection	14	$300	$173
Culvert Cleaning	14	$1,000	$577
Maintenance	15	$400	$222
Maintenance	20	$400	$183
Culvert Inspection	21	$300	$132
Culvert Cleaning	21	$1,000	$439
Maintenance	25	$400	$150
Culvert Inspection	28	$300	$100
Culvert Cleaning	28	$1,000	$333
Rehabilitation (Invert Paving/Plating)	30	$124,000	$38,232
Maintenance	35	$400	$101
Culvert Inspection	35	$300	$76
Culvert Cleaning	35	$1,000	$253
Maintenance	40	$400	$83
Culvert Inspection	42	$300	$58
Culvert Cleaning	42	$1,000	$193
Maintenance	45	$400	$68
Culvert Inspection	49	$300	$44
Culvert Cleaning	49	$1,000	$146
Maintenance	50	$400	$56
Maintenance	55	$400	$46
Culvert Inspection	56	$300	$33
Culvert Cleaning	56	$1,000	$111
Reconstruction (Replace Road and Culvert)	60	$1,000,000	$95,060
Net Present Value			**$158,458**

*Notes for Tables 4-13, 4-14 and 4-15: Costs come from historical projects and are based on average of costs from actual construction and maintenance costs including the cost of material, traffic handling, and other required costs to construct or repair drainage systems by Each including 60% support cost. Maintenance represents work performance by field maintenance crews. ** escalation is factored into the discounted cost of each treatment or activity

Beyond maintaining a drainage system there may be a need for restoration after its estimated 50-year service life. Typically over the life of a drainage system there are two major cost points, initial installation cost and repair or restoration cost. Once identified as fair or poor, each district then determines the restoration or replacement strategy.

To return any drainage system to a good state of health, many variables influence the restoration cost; they include length, diameter, water diversions, traffic control, repair/restore strategy, fish passage, environmental or right of way permits, access, slope, and the expected bed load, among others.

One of the main reasons for drainage system replacement is deterioration (typically because of corrosion, abrasion, erosion, piping, storm damage or poor initial installation). If a drainage system fails, an expedited process such as a Department Director's Order (DO) may be initiated to address the problem. If the drainage system has not yet failed, but is in poor condition, Caltrans Maintenance Program will initiate a project for repair, rehabilitation, or replacement.

LCP Strategy Scenarios

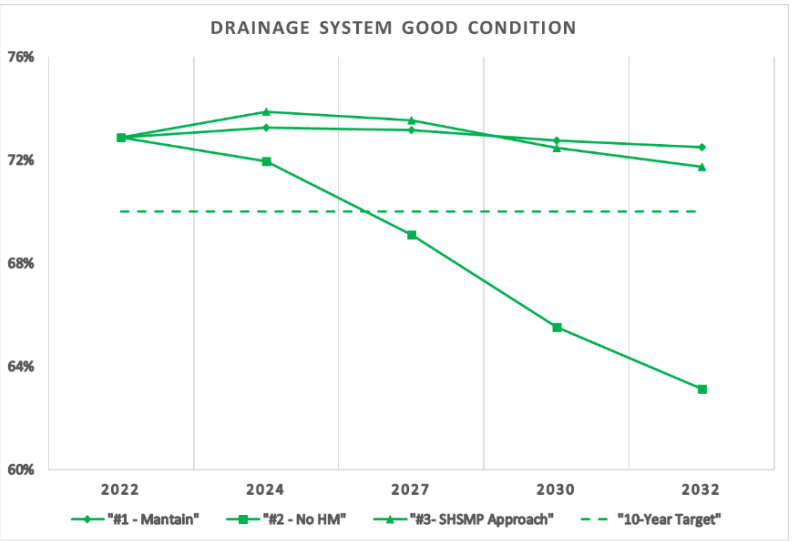
To illustrate LCP approach for Drainage Culverts at the network level, three different scenarios are presented that result in the following "Good" and "Poor" condition state at the end of 10 years. An excel based tool developed by Caltrans was used for the LCP scenarios with results from the tool displayed below and shown in Figure 4-8.

Scenario 1: Maintain Condition

This scenario focuses on maintaining the current condition of drainage culverts. The LCP analysis includes deterioration rates from the 2021 SHSMP, statewide average unit costs based on fixing fair and poor drainage culverts, and the amount of work predicted to be accomplished annually for the life span of the asset. Total estimated investment: $ 3.7 Billion.

Scenario 2: No Drainage Preservation

This scenario assumes no maintenance work with all drainage work included in the SHOPP that focuses on major rehabilitation and replacement of drainage culverts. The LCP analysis includes deterioration rates from the 2021 SHSMP, statewide average unit costs based on a mix of treatments to rehab and replace drainage culverts, and the amount of work predicted to be accomplished annually for the life span of the asset. Total estimated investment: $ 3.0 Billion.



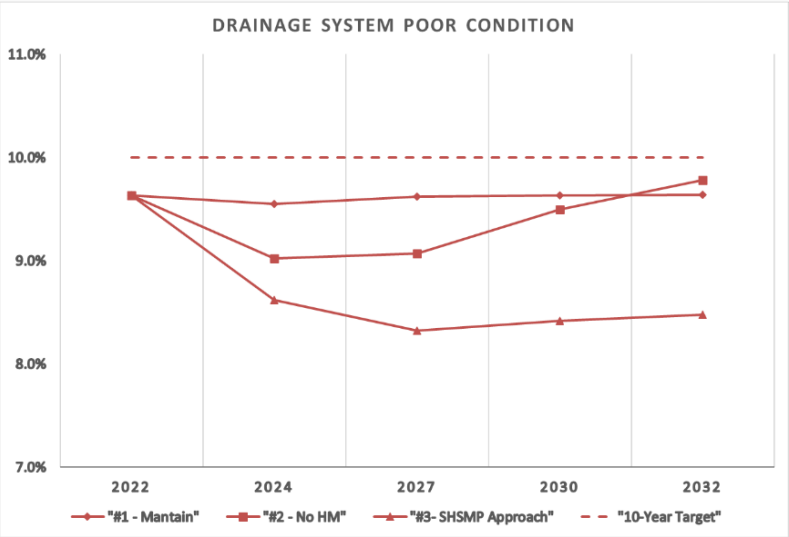


Figure 4-8. Drainage LCP Scenarios

Scenario 3: SHSMP Approach (Implemented Strategy)

This scenario was implemented in the 2021 SHSMP as Caltrans preferred scenario to meet performance targets established by the Commission. The LCP analysis includes deterioration rates from the 2021 SHSMP, statewide average unit costs based on a mix of preservation, rehabilitation and replacement work to fix fair and poor culverts, and the amount of work predicted to be done annually for the life span of the asset. Total estimated investment: $ 3.4 Billion

LCP scenarios for drainage culverts are also demonstrating how highway maintenance funding for preservation effects culvert condition. Without funding for drainage preservation, good culverts are predicted to get worse over the TAMP 10-year period. Utilizing Caltrans cost-effective approach by carrying out the work through Caltrans maintenance crews, contracts, and SHOPP, drainage culverts are predicted to meet SB 1 and TAMP performance targets while minimizing costs.

Other strategies for improving the life cycle of drainage systems include using remote controlled cameras to complete drainage system inspections, trenchless drainage system replacement techniques, and lining replacement techniques.

4.6. Life Cycle Planning for Transportation Management System

Data Collection

Caltrans currently uses a TMS Inventory Database to track all statewide TMS assets. This database is populated by district personnel, who provide information on each system, such as system type, location, and installation date. Fact sheets on each TMS element that are updated every few years inform designers on unit cost, enumeration, as well as give information on expected service life. This service life, along with the installation dates, can be used to provide an assessment or prediction of replacement needs.

Modeling Approach

The 2021 SHSMP includes a network level LCP model for TMS assets. The model includes deterioration rates, treatments, and unit costs for TMS assets on the SHS. Figure 4-9 displays an estimate of TMS needs over the next ten years.

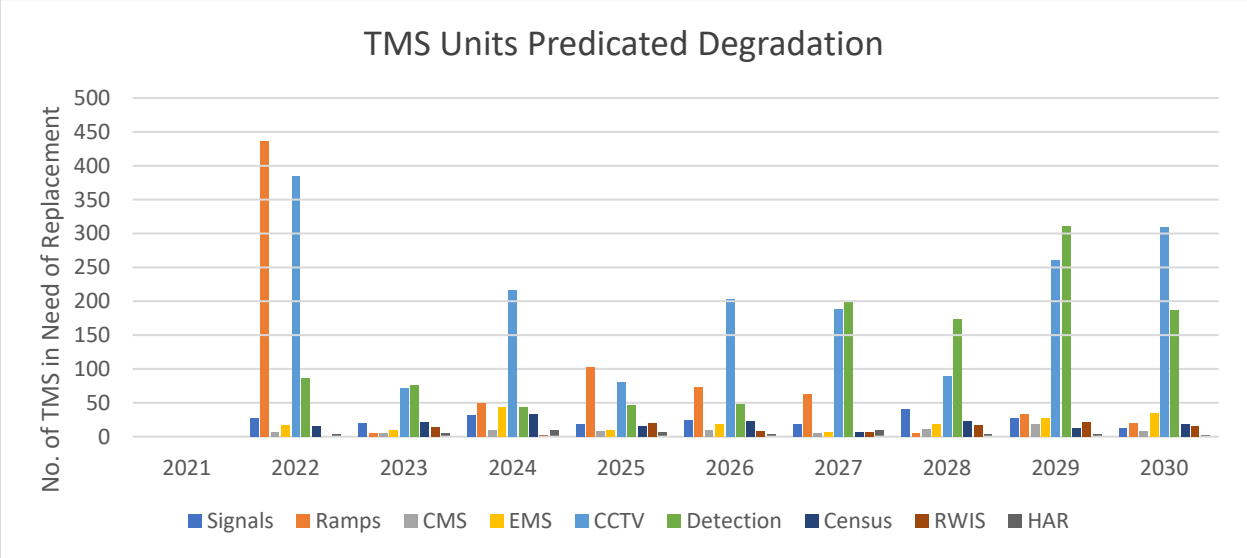


Figure 4-9. Estimate of TMS Elements in Need of Replacement over the next 10 Years

Treatments

The 2021 SHSMP presents treatment cost assumptions for TMS assets on the SHS. Instead of unit costs for individual treatments, the SHSMP calculates average unit costs for improving condition from poor to good and adding new assets. Table 4-16 presents the unit costs from the SHSMP.

Table 4-16. Unit Costs for TMS Assets

Costs Per Element		
	Fix Poor to Good	Add New
TMS Elements	$139,383	$759,981

Targets

LCP is intended to help state DOTs achieve asset performance targets. California's TMS performance targets and the target-setting process are discussed in detail in Chapter 3. Asset Performance Targets.

Strategy

TMS elements represent a significant investment need for Caltrans as a large portion of the current inventory is past its expected service life and will require replacement. Complicating the issue is the fact that if any one of these components fail, it would need to be replaced quickly to bring the system back to an operational state. TMS require replacement for a variety of reasons: some require more maintenance than is reasonable, some become technically obsolete, and others become a network security risk.

Caltrans is developing strategies to better manage the health of the TMS network by performing more extensive system health assessments, as well as greater collaboration with maintenance staff. The TMS database, which stores records of all district systems, is constantly being improved, and records are being audited and checked for clarity and completeness. As part of the 2021 SHSMP, a Transportation Management Systems Asset Management Guide was developed to improve upon asset management practices. This guide provides a consistent approach for managing TMS. It defines the life cycle, condition criteria and network level unit cost of each TMS unit. The life cycle of TMS has been divided into two distinct life cycles: technology components and structure components with technology as a primary focus for the 2021 SHSMP.

Table 4-17 indicates the life cycle years and unit costs for technology and structure components of TMS.

Table 4-17. Life Cycle Years and Unit Costs for TMS Technology and Structure TMS Assets

TMS Life Cycle				
TMS Unit	Technology Life Cycle Years	Technology Unit Cost	Structure Life Cycle Years	Structure Unit Cost
Traffic signals	25	$148,996	50	$367,966
Freeway ramp meters	25	$73,560	50	$234,823
Changeable message signs	20	$151,454	50	$416,901
Extinguishable message signs	20	$64,864	50	$52,542
Closed circuit televisions	10	$57,300	50	$57,825
Traffic monitoring detection stations	20	$61,730	50	$90,921
Traffic census stations	20	$62,250	50	$90,921
Roadway weather information systems	10	$102,427	50	$66,624
Highway advisory radios	15	$97,451	50	$92,364

The latest guidance also provides for extending the technology life cycle if certain criteria are met and a process for recertification as shown in Figure 4-10.

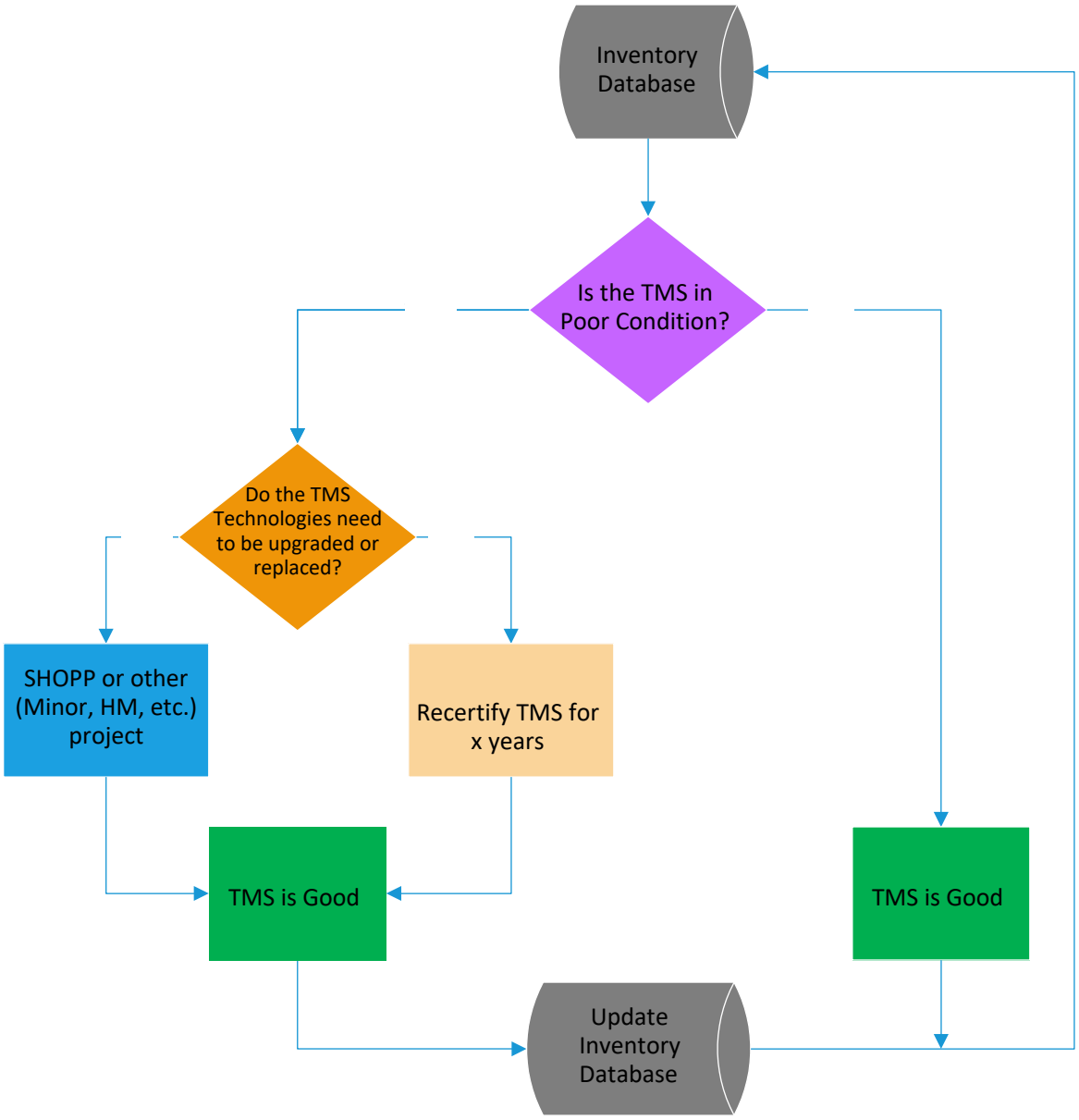


Figure 4-10. TMS Recertification Process

As described in the 2021 SHSMP, Caltrans Maintenance Program is responsible for maintaining TMS assets. TMS elements on the SHS require over 80,000 preventive maintenance checks and repairs annually to maintain a goal LOS of 100 for Traffic Signals and 90 for all other TMS units. A combination of state and contract service addresses the maintenance needs. Assets which are at end of life, obsolete, or otherwise non-functional because of chronic operational issues are addressed through systemic repairs, replacements, or upgrades.

LCP Strategy Scenarios

To illustrate LCP approach for TMS at the network level, three different scenarios are presented that result in the following "Good" and "Poor" condition state at the end of 10 years. An excel based tool developed by Caltrans was used for the LCP scenarios with results from the tool displayed below and shown in Figure 4-11.

Scenario 1: Maintain Condition

This scenario focuses on maintaining the current condition of TMS. The LCP analysis includes deterioration rates from the 2021 SHSMP, statewide average unit costs based on the 9 core TMS, and the amount of work predicted to be accomplished annually for the life span of the asset. Total estimated investment: $ 765 Million.

Scenario 2: Historical Approach

This scenario was based on prior analysis used in the 2017 and 2019 SHSMP that had higher deterioration rates and different criteria for classifying poor to good condition improvement. The LCP analysis also includes statewide average unit costs based on full replacement of the 9 core TMS and the amount of work predicted to be accomplished annually for the life span of the asset. Total estimated investment: $ 2.4 Billion.

Figure 4-11. TMS LCP Scenarios

Scenario 3: SHSMP Approach (Implemented Strategy)

This scenario was based on re-evaluation of the TMS inventory, condition criteria for determining poor TMS, and improved TMS asset management guidance and practice. The LCP analysis includes deterioration rates from the 2021 SHSMP, updated statewide average unit costs based on the 9 core TMS, and the amount of TMS predicted to be fixed annually for the life span of the asset. This scenario was implemented in the 2021 SHSMP as Caltrans preferred scenario to meet performance targets established by the Commission. Total estimated investment: $ 2.1 Billion.

LCP scenarios for TMS demonstrate that improvements made to LCP data such as the life span of the assets, rates of deterioration, cost of improvements, and changes to asset management policy, helped to improve prediction for TMS conditions at lower cost.

4.7. Summary

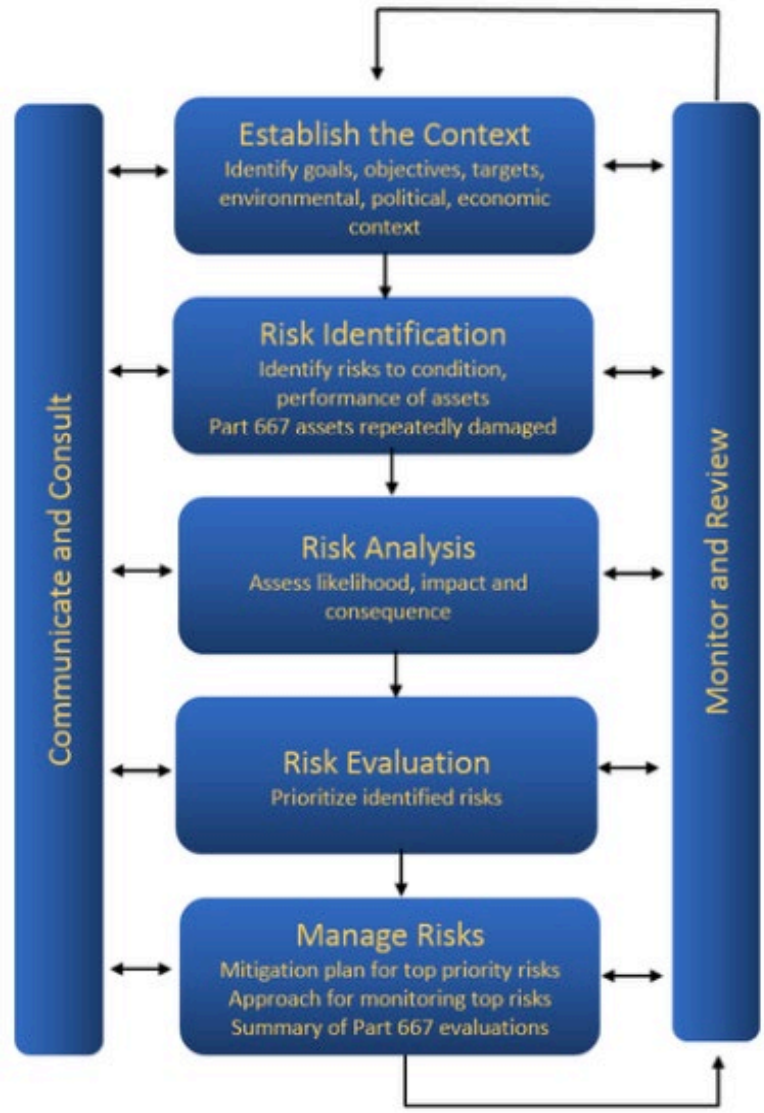
LCP Scenario #3 is Caltrans preferred strategy to meet performance targets of the TAMP for state-owned assets including NHS pavement and bridges. This approach is used for the SHSMP and TAMP investment planning process as further explained in Chapter 8. Performance Scenarios and Gaps. Instead of being able to conduct a separate LCP analysis for the locally-owned NHS, the PTAT was used. MPOs in coordination with some of the cities and counties, used the PTAT to evaluate the work predicted to be accomplished in preservation, rehabilitation and reconstruction to improve condition from fair to good or poor to good over the TAMP 10-year period. This network level analysis allowed key LCP enablers to be changed by MPOs including rates of deterioration, cost of improvements and the amount of expected investment to fix fair or poor condition assets while considering the cost of risk mitigation providing a network level approach that supports TAMP development.

5. Managing Risks and Building Resilience

Managing transportation assets entails managing risk. In the context of asset management, FHWA defines risk as "the positive or negative effects of uncertainty or variability upon agency objectives."

5.1. Overview

California must balance a wide variety of transportation related risks on an ongoing basis. FHWA defines risk management as "the processes and framework for managing potential risks, including identifying, analyzing, evaluating, and addressing the risks to assets and system performance." This includes various day-to-day concerns such as risks that assets will deteriorate faster than expected or projects will cost more than budgeted, to the potentially catastrophic risks of asset failure caused by factors such as natural disasters. Climate change also presents a looming risk that will exacerbate all weather-related risks. Building resiliency into the transportation system helps protect assets against these greater risks by limiting disruptions and eliminating significant downtimes and closures. Figure 5-1 depicts the risk management process and products as defined by FHWA's Asset Management Final Rule in 23 CFR Part 515.



Source: Federal Highway Administration

Figure 5-1. Risk Management Process and Products

Every transportation system faces a range of general types of risks, such as those listed below, as well as risks specific to the individual assets or regional system. California is no exception and faces a number of risks due to the size of the transportation system, the varying geography and climate of the state, and the potential for extreme weather. For the purpose of the TAMP, Caltrans has defined seven basic categories of risks that may impact the TAMP, presented in Figure 5-2. These categories are explained in greater detail in the discussion of risk identification.

Considering risk is important in developing a TAMP for the simple reason that transportation agencies often must spend significant resources responding to and/or mitigating risks. Consequently, every dollar spent reacting to or mitigating risk is a dollar that is not available for other transportation purposes. Furthermore, reacting to risks can be more expensive than proactively mitigating them. For example, a modest investment in seismic safety may eliminate the need to pay for a bridge replacement if left unprotected. Risk management strengthens asset management by explicitly recognizing that any objective faces uncertainty. Being proactive rather than reactive in managing risk, and avoiding "management by crisis," helps the State to best utilize available resources to minimize and respond to risk, as well as to further build public trust. Unmitigated risks can also threaten the safety of the transportation system users and could likely result in longer unplanned closures of routes that can negatively impact the ability to provide basic services and access for communities.

California Transportation System Risks

California faces common risks to its transportation components regardless of who owns the asset or route. These risks, both internal and external, are listed below.

Common Transportation System Risks in California

- Consistency, reliability of state, federal revenue over the decade of the plan
- Construction inflation, which can increase costs and reduce buying power
- Reliable project delivery
- Natural events such as floods, fires, earthquakes and similar climate events
- Changing priorities
- Availability and quality of data, models, information

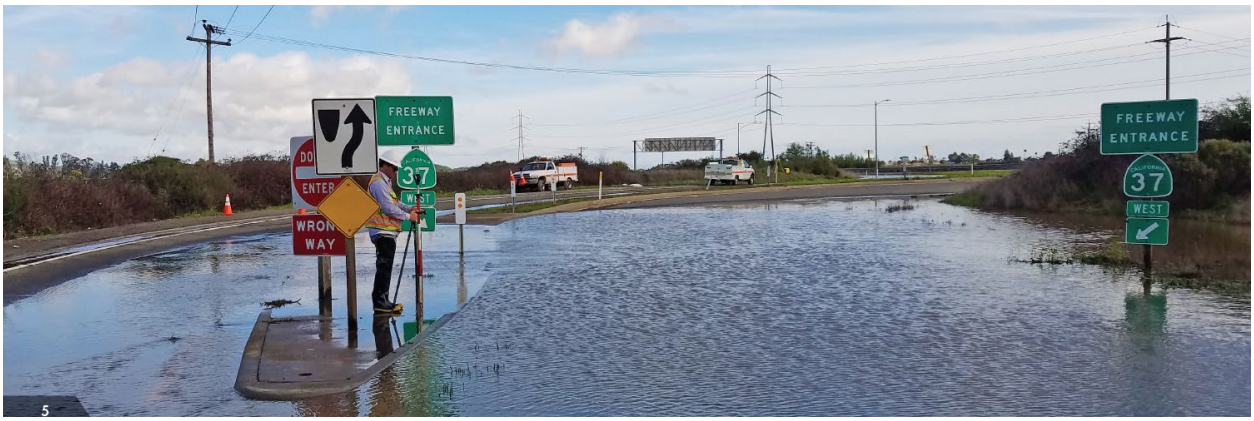
The passage of SB 1 and new federal funding provided by the IIJA provides significantly more funding for transportation in California. Available funding is invested to improve asset condition, mitigate risks and improve operations. The influx of funding itself may increase risks that are associated with project delivery and construction industry pressure for labor and equipment.

Natural events such as floods, fire, and earthquakes are unpredictable and continue to have the potential to cause extensive damage, endangering California residents, crippling transportation systems, and in some cases severing vital links in the State's network of highway and rail lines. On January 17, 1994, the Los Angeles area experienced the 6.7-magnitude Northridge earthquake. This tragic event resulted in 57 deaths and over 8,000 injuries. As a result of the earthquake, a number of buildings either collapsed or caught on fire, and there was extensive damage to highways, bridges and other infrastructure. This included the collapse of a portion of Interstate 5.

Climate change is both a risk itself and an accelerating factor for other TAM risks. Climate change increases uncertainty and variability, making it more difficult to manage opportunities and threats. The uncertainty of changing climate and rising seas poses numerous risks to the transportation network, including increased flooding and unpredictable and powerful weather systems. Furthermore, these negative effects could have a cascading effect, which includes but not limited to, increasing erosion rates, exacerbating bridge scour, intensifying and enlarging geo-hazards, expanding areas vulnerable to flooding, and causing considerable relocation and reconstruction costs.

Figure 5-3. SHS Big Sur, Highway 1 Rat Creek landslide (Source: Caltrans)

Geo-hazards continue to be an ongoing concern in California, mainly because of the topography and precipitation in certain parts of the state which can be exacerbated by wildfires. Roads and bridges cutting across slopes are at constant risk for rock falls and landslides, especially when soaked by rain. On January 28, 2021, a landslide near Big Sur buried Highway 1 after a major storm. A contributing factor to the slide was a massive burn scar that resulted from an earlier wildfire at the edge of Rat Creek which caused rock and debris to clog culverts causing more mud and debris to spill down onto the roadway, as shown in Figure 5-3. As a result, it covered a section of the highway that left Big Sur isolated creating significant economic impacts requiring a detour around the landslide. In only 86 days, Highway 1 was re-opened allowing traffic to go back onto the highway.



Sea level rise represents a long-term threat to coastal and tidally influenced riverine areas as well as the State's economy. The effects of thermal expansion of ocean water combined with glacial and ice sheet melting is leading to higher sea levels around the world. California has an extensive coastline as well as inland connected waterways, with state highway facilities providing much of the access to these areas. Sea level rise will exacerbate the flooding that could occur in these areas during regular tidal or storm events. For Caltrans, this means that many of its roads, bridges and supporting facilities could face risk of inundation or damage in the future.

Other risks to California's transportation system include a lack of asset management maturity, changing agency or political priorities, and availability and quality of data and models that have the potential of negatively impacting decision making, either through underdeveloped processes, misaligned priorities, or lack of supporting data. To proactively address and mitigate these risks, California state and local agencies have participated in a number of risk management workshops. For the 2022 TAMP, virtual workshops on risk management were held over several days to review the risks from the initial TAMP, identify new risks, assess, prioritize, and determine necessary strategies to address these risks. Those requiring mitigation and monitoring were then discussed in small groups for further development.

5.2. Risk Identification

Transportation related risks have been organized into seven categories. These categories were defined based on the approach presented in the final report of *NCHRP Project 08-93, Managing Risk Across the Enterprise: A Guidebook for State Departments of Transportation*[22]. Table 5-1 details these risk categories, including a description of each category with example risks, and elements of risk management practices that could mitigate related risks which were reviewed and updated as part of the 2022 TAMP development process.

[22] The National Academies of Sciences Engineering and Medicine, NCHRP Project 08-93, "Managing Risk Across the Enterprise: A Guidebook for State Departments of Transportation", June 2016, http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3635

Table 5-1. Caltrans Transportation Asset Management Risk Categories

Risk Cat.	Category Description	Elements of Risk Management and Resiliency
Asset Performance	Risks associated with asset failure (whether acute and complete or incremental). Areas of failure can include: • Structural • Capacity or utilization • Reliability or performance • Obsolescence • Maintenance or operation	• Regular, documented inspection programs • Documented allocation of funding for repair and maintenance • Documentation of competing resource demands • Determined intervention levels • Prioritization actions and documented reasoning
Highway Safety	Risks to highway safety related to the asset management program: • Highway crash rates, factors and countermeasures • Safety performance of assets, maintenance and rehabilitation treatment options • Safety in project selection, coordination and delivery	• Safety-focused asset management programs (e.g., pavement friction program) • Network screening for safety hotspots for consideration within asset maintenance, rehabilitation and upgrade programs • Consideration of safety benefits/costs in asset management decision making (e.g., safety cost of repeated lane closures for maintenance) • Safety-related product evaluation (e.g., National Cooperative Highway Research Program (NCHRP)-350/Manual for Assessing Safety Hardware (MASH) product evaluation/approval program
External Threats	External threats include both human-induced and naturally occurring threats, such as: • Climatic or seismic events (e.g., extreme weather, flooding, earthquakes, slope failures and rock falls, lightning strikes) • Climate change • Terrorism or collisions • Paradigm-shift to other transportation modes and use of newer technologies	• Incorporate potential impacts of climate change into long term planning through vulnerability assessments and adaptation plans (sea level rise, extreme weather events.) • Identify and inventory external risks to existing infrastructure (e.g., seismic evaluations, security assessments, bridge scour programs) • Infrastructure inspection, replacement or retrofit programs to mitigate risks (e.g., slope stabilization, alarms to deter copper theft, operational changes to reduce wind loading) • Implement operational and emergency response programs to minimize impacts of asset failures because of external threats (e.g., staff training and planning, staging resources for response) • Programs to review and evaluate construction standards and new technologies to ensure reasonable incorporation of resiliency to external threats
Finances	Risks to the long-term financial stability of the asset management programs, including: • Unmet needs in long-term budgets • Funding stability • Exposure to financial losses	• Programs to forecast changes in revenue and costs (e.g., impacts of fuel-efficient vehicles, flat tax structure, etc. on gas tax revenue) • Programs to maximize available fund sources for asset management (e.g., federalization of program) • Exploration of innovative financing opportunities for asset management programs (such as public-private partnerships, tolling, Energy Savings Contracts, etc.) • Exploration of innovative technologies to reduce maintenance and operational costs (e.g., LED lighting)

Risk Cat.	Category Description	Elements of Risk Management and Resiliency
Information and Decisions	Risks related to the asset management program include: • Lack of critical asset information • Quality of data, modeling or forecasting tools for decision making • Security of information systems	• Enterprise data management programs and strategies • Robust information technology solutions emphasizing risk prevention, preparedness and recovery • Programs to address model risks (e.g., premature failure of pavements from underestimation of truck loading) • Including risk prioritization within Transportation Asset Management System (TAMS)
Business Operations	Risks due to internal business functions associated with asset management programs, such as: • Employee safety and health • Inventory control • Purchasing and contracting	• "Safety first" culture within programs–routine safety meetings, documented safety and standard operating procedures, workforce training, etc. • Robust systems and tools for work force, equipment, inventory, and contract management to reduce risks of theft, misuse, unnecessary storage or inaccurate estimates of program costs
Project and Program Management	Project and program management is a very mature area in U.S. transportation sector	Many programs and products exist here–extensive discussion of these risks and related programs, policy and procedure are likely not necessary

As described in FHWA's guidance for integrating risk management into a TAMP, there are multiple levels of risk for an agency: Enterprise, Program, Project, and Activity. The final report of NCHRP Project 08-93 defines these four levels of risk as shown in Figure 5-4. The risk categories shown above in Table 5-1 cut across these risk levels. The risks presented in California's risk register are focused on program level risks.

In the next section, the TAMP risk management process is described. A virtual workshop was held to refine the initial TAMP risk register, prioritize risks listed in the register, perform a qualitative risk assessment, and based on this assessment, identify potential mitigation strategies, actions and monitoring strategies.

Figure 5-4. Levels of Risk

5.3. Risk Assessment

Caltrans developed a TAM risk register by performing an assessment of the risks identified through initial TAMP efforts coupled with newly identified risks. A risk register is a simple spreadsheet or matrix that summarizes an organization's risks, how they are analyzed, managed, mitigated and monitored. Risk registers can be customized for any organization. The risk register also can include a summary of how the risks will be managed, and by whom. The California TAMP risk register uses a simple table format to capture risks, illustrate their estimated likelihood and impact, and record risk mitigation strategies, actions and monitoring strategies.

Risks are identified by category and developed into risk statements in the risk register. These statements consist of two elements: a description of the risk event and a summary of its potential impact. For example:

Risk Event (if) *If I don't pay my natural gas bill*

Potential Impact (then) *Then the power company may turn off my gas and my home will be too cold to live in*

In updating the risk assessment for the 2022 TAMP, workshop participants, including Caltrans staff and representatives of local agencies, used the risk matrix shown in Figure 5-5 to classify risks in terms of their likelihood and consequence, as well as to score each risk. The matrix includes six categories for likelihood (listed in the left column of the figure) and five categories for consequence (listed in the bottom row). The score of a risk is specified as "Low," "Medium-Low," "Medium," Medium-High," and "High," based on the combination of likelihood and consequence.

Alternatively, the same basic approach can be applied to assessing opportunities, but the focus of the workshop was to identify threats (risks with negative consequences) as these are the risks that should be mitigated.

Likelihood of Occurrence						
	< 1 yr	*Med-Low*	*Medium*	*Med High*	*High*	*High*
	1-2 Yrs	*Med-Low*	*Medium*	*Med High*	*High*	*High*
	2-5 Yrs	*Low*	*Med-Low*	*Medium*	*Med High*	*High*
	5-10 Yrs	*Low*	*Med-Low*	*Medium*	*Med High*	*High*
	10-25 Yrs	*Low*	*Low*	*Med-Low*	*Medium*	*Med High*
	> 25 Yrs	*Low*	*Low*	*Med-Low*	*Medium*	*Med High*
		No Impact or Cost	*Short Term Lane Loss or Cost*	*Short Term Loss of Route or Medium Cost Impact*	*Long Term Loss of Route or High Cost*	*Loss of Critical Route or Very High Cost*
				Consequence		

Figure 5-5. 2022 TAMP Risk Matrix

5.4. Risk Priorities, Potential Mitigation and Monitoring

A mitigation process called the 5 T's was used to evaluate each risk and determine the appropriate treatment or strategy to mitigate the risk. Figure 5-6 describes these options:

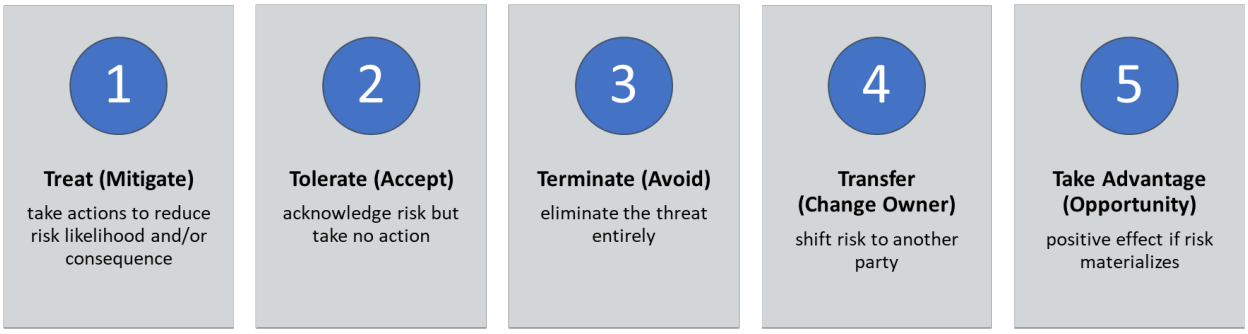


Figure 5-6. Risk Mitigation Process (the 5 T's)

Representatives of state and local agencies evaluated potential risk mitigation options and developed potential actions and monitoring approaches. A combination of both stakeholder feedback and expert judgment was used to select risk owners, the resources needed to implement the actions and an approach for monitoring. For most mitigation actions, additional resources in the form of people, dollars, policies, training, or expertise were identified. A common theme for monitoring included tracking of progress over time, holding regular status meetings, and on-going communication by risk owners. The highest priority risks and results of the workshop are presented in Table 5-2 and are currently being evaluated by Caltrans for further action including the need for additional resources.

Table 5-2. Highest Priority Risks, Potential Mitigation Actions, Risk Owners, and Monitoring Approach

Category	Risk Statement	Strategy	Potential Mitigation Actions	Risk Owner	Monitoring Approach
Highway Safety	If crash reporting is not modernized, we may not accelerate some aspects of safety improvements.	Treat	Streamline and Improve the timeliness of reporting including access to California Highway Patrol (CHP) data system. Innovate the Statewide Integrated Traffic Records Systems (SWITRS). Find areas of improvement to better evaluate Traffic Safety Investigations Roll-out updated Transportation System Network Reporting (TSNR) System allowing local agencies to map and query safety data.	Owner-Operator/ CHP Caltrans	Track progress through State Highway Safety Plan Statewide Committee which includes CHP TSNR is scheduled to be completed in 2024
External Threat	If we don't plan for extreme weather events (rainfall, sea level rise, fire, heat, etc.), then our transportation system components (bridges, roadways, etc.) could be damaged, pose safety risks and cost more.	Treat	Make infrastructure more resilient to withstand extreme weather events	Owner-Operator Owner-Operator	Periodic re-evaluations of the system for vulnerabilities Monitor mitigated locations over time. Prioritize locations with high risk
Finances	If money is spent on the four core assets (bridges, pavements, drainage systems, ITS) most in need, there may not be enough funding for maintaining new inventory or for other critical assets.	Treat/ Terminate	Shift funding as needed Explore additional funding sources	Funding Agency/ Owner-Operator/ Inventory Managers	Monitor asset conditions and funding share of all assets/investments Use Asset Management results to illustrate funding gaps
Asset Performance	If we make projects more complex (by the addition of multiple assets, etc.), project delivery may be delayed.	Treat	Additional guidance criteria and decision support tools needed to ensure projects are designed to meet the goals and targets	Caltrans/ Owner-Operator	Finalize District Active Transportation Plans and guidance for meeting performance targets expected by 2022-2023

Category	Risk Statement	Strategy	Potential Mitigation Actions	Risk Owner	Monitoring Approach
			established through planning and project development teams. Evaluate current practices for Long Lead project schedules Design flexibility is needed including design exceptions Plan for Complete Streets at project inception to avoid cost surprises		
Asset Performance	If we do not coordinate the needs of each asset class or project work, we may not be as efficient as possible (e.g., may be removing new pavements to place new culvert or working on TMS by replacing both technology and structure when only one component is needed.	Treat	Use existing tools, project teams and project control staff to treat and coordinate Use new databases and business intelligence to track assets. Find innovative ways to update existing asset inventory. Increased stakeholder coordination Promote open data	Owner-Operator Owner-Operator	Early Project Manager coordination with project teams to ensure right assets are included in project scopes (right treatment at the right time) Use database with GIS to inform early project decision making and avoid conflicts
Information and Decisions	If we do not have reliable asset performance models (including reliable deterioration rates and reasonable goals), investment decisions will not be optimal.	Treat	Need to ensure data is accurate by establishing rules, policies, and procedures for data management and including the reporting of failure incidents & repair history.	Owner-Operator MPO/RTPA Caltrans	Use project analysis tool when selecting projects, and to monitor progress Work on collaborative basis with MPOs on data sharing and tool development track asset performance and establish better deterioration rates for each cycle of SHSMP and TAMP

Category	Risk Statement	Strategy	Potential Mitigation Actions	Risk Owner	Monitoring Approach
				Owner-Operator	Keep upper management informed of latest financial and performance data to help inform decision making with transportation stakeholders
Finances	If the available funding does not cover our needs, then we still will have some deferred maintenance and operation's needs.	Tolerate/ Transfer to some extent		Funding Agency/ MPO/RTPA Owner-Operator	Manage the budget, and hold regular meetings Program multi-objective projects to reduce fixed costs (mobilization, etc.) Find additional funding opportunities Better communication and transparency with partners
Finances	If new funding for local bridges is not secured, then necessary maintenance of bridges will be delayed and bridges in good repair could slide into fair and/or poor condition.	Treat	Implement IIJA funding for state and local bridges Change maintenance strategies to include more preventive/corrective and life cycle cost considerations (limiting high cost projects) Use innovative construction/delivery methods, bundle multiple bridges for economy of scale	Owner-Operator/ Funding Agency	Monitor backlog such as proposed versus funded projects and track progress Update program policies and guidelines
Business & Operations	If infrastructure is exposed or vulnerable to IT Security/Ransomware/ Hacking issues, then asset or data systems can be out of function for an extended time.	Treat	Need to run periodic diagnostics and daily IT security checks if they are not in place currently. Enhanced password to protect the database. IT training and more	IT Manager Inventory Owner MPO/RTPA	Run daily and periodic diagnostics Train users as they are first line of defense Add training and specialized IT staff as

Category	Risk Statement	Strategy	Potential Mitigation Actions	Risk Owner	Monitoring Approach
			personnel specialized in security needed		justified. Consider training more frequently for all users.
Finances	If we don't program projects and report expenditures by NHS designation and by the federal work types, then investment in pavement and bridges on the NHS will not be accurately identified	Treat	Need to have a change in accounting system to include a field for NHS whether that is through State Controller Office or Caltrans Accounting System Asset Management System (AM Tool / TAMS) at Caltrans needs to be updated for designating NHS	Owner-Operator/ State Controller Office MPO/RTPA	Track expenditures on a regular basis through project development phases including regional planning and programming processes Designate work types in programming documents

5.5. Summary of Transportation Assets Repeatedly Damaged by Emergency Events

As part of a separate rule issued by FHWA, state DOTs must perform periodic evaluation of facilities repeatedly requiring repair and reconstruction due to emergency events. According to FHWA, state DOTs "shall conduct statewide evaluations to determine if there are reasonable alternatives to roads, highways, and bridges that have required repair and reconstruction activities on two or more occasions due to emergency events." Evaluation is defined as "an analysis that includes identification and consideration of any alternative that will mitigate, or partially or fully resolve, the root cause of the recurring damage, the costs of achieving the solution, and the likely duration of the solution." Reasonable alternatives are defined as "options that could partially or fully achieve the following":

1. Reduce the need for federal funds to be expended on emergency repair and reconstruction
2. Better protect public safety and health and the human and natural environment; and
3. Meet transportation needs as described in the relevant and applicable federal, state, local, and tribal plans and programs."

According to federal regulations 23 CFR part 667[23], this evaluation must consider the risk of recurring damage and cost of future repairs under current and future environmental conditions and how the evaluation can best inform the TAMP and STIP. Caltrans' SHOPP funds major damage, permanent restoration, and protective betterment work as part of the SHSMP asset management process.

[23] Electronic Code of Federal Regulations, 23 CFR 667, https://www.ecfr.gov/current/title-23/chapter-I/subchapter-G/part-667

Department policy changes also includes removal of wood posts in fire prone areas for guard railing and signs; bridges are being raised for sea level rise when replaced, and culverts are sized for 100-year storms when applicable. Caltrans is collecting more information on locations repeatedly damaged including reasonable detour route locations and associated declared emergencies. Evaluations will be updated every four years as required by federal regulations.

Beyond the part 667 regulation, Caltrans also has legal authority by state contract law 10122[24] to utilize expedited procedures for the advertising, bidding, and awarding of construction contracts due to an emergency or urgent situation through a DO. This allows Caltrans to respond quickly and repair or reconstruct the facility that has been damaged. It may also be used to forestall an imminent threat or catastrophic damage. Federal funding reimbursement is requested under the Emergency Relief federal funding program and every effort is made to maximize federal participation, but a DO may move forward without it if it is deemed an immediate safety risk or in the public's best interest.

Caltrans reviewed federal Emergency Relief funded projects between 2006-2020 for locations of repeat damage on the NHS caused by landslides, rockfall, flooding, and erosion that have occurred due to more than one declared emergency for both Caltrans and local agencies.

[24] California Legislative Information Website, California State Contract Law 10122, https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=PCC&sectionNum=10122

Figure 5-7 shows the summary of these locations in a map including multiple high load bridge hits between 2006-2020. Location details are shown in Appendix B.

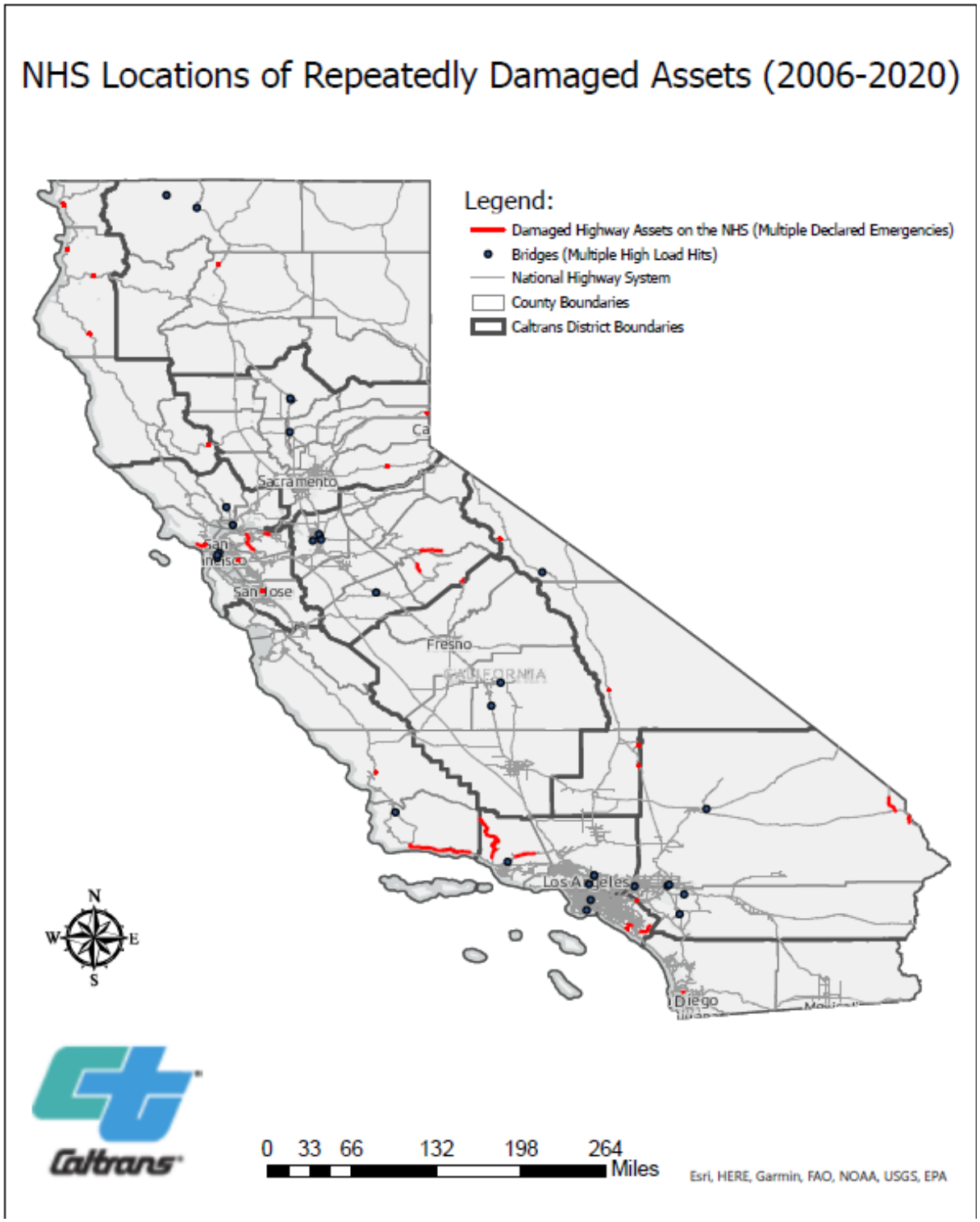


Figure 5-7. Repeated Damage Locations

5.6. Risk Management Approach

Caltrans and local agencies are actively engaged in improving their approaches to risk management. As identified in the risk assessment, if we don't plan for extreme weather events (rainfall, sea level rise, fire, heat, etc.), then our transportation system components (bridges, roadways, etc.) could be damaged, pose safety risks and cost more. The approach for managing these risks is to conduct vulnerability assessments, identify high priority locations and develop effective project solutions and associated costs. Once costs are determined, funding is pursued to mitigate the risk. The following sections include current Caltrans risk management functions, the major programs and processes used to mitigate these risks, and how risk mitigation was included in the investment strategies for the 2022 TAMP.

Caltrans Risk Management

Independent of developing the California TAMP, Caltrans practices risk management in many of its offices. These offices focus on specific categories of risk such as IT risk, emergency risk, safety risk and asset management risks.

Major Risk Management Programs at Caltrans

- **Enterprise Risk Management**–Office of Risk and Strategic Management
- **Project Risk Management**–Project Delivery
- **Information Technology Security**–Information Technology
- **Emergency Risk Management**–Maintenance and Operations
- **Safety Risk Management**–Office of Health and Safety
- **Transportation Asset Risk Management** –Headquarters Asset Management

Caltrans established the Office of Enterprise Risk Management in 2013 to perform biennial enterprise risk assessments and to consult with internal clients. As part of that work, Caltrans develops an Enterprise Risk Profile every two years using the *Committee of Sponsoring Organization of the Treadway Commission (COSO) risk framework*[25]. Caltrans identifies the risks by district or program and evaluates the likelihood, impact, and velocity of each risk. Caltrans most recently updated the Enterprise Risk Profile in 2021 for the biennially required *State Leadership Accountability Act Report*[26]. Caltrans also has management approaches for project delivery risks, information technology security risks, emergency risks, and safety risks. Caltrans' risk management approach is codified in handbooks, guidance, and tools. The Office of Enterprise Risk Management evaluates TAM risks as well as other Caltrans risk areas. Asset Management's primary function related to risk management is through development of the SHSMP and TAMP efforts.

[25] Committee of Sponsoring Organizations of the Treadway Commission (COSO), https://www.coso.org/Pages/default.aspx

[26] Caltrans Leadership Accountability Report, 2021, https://risk.onramp.dot.ca.gov/downloads/risk/files/SLAAReport%202021.pdf

5.7. Risk Mitigation and Resilience Plan

Federal regulations require that the TAMP include a risk mitigation plan for addressing top priority risks and an approach for monitoring those risks. Risk mitigation is a vital piece of any risk management approach. State and local agencies in California already have a number of TAM-related risk mitigation and resilience programs in place as part of a comprehensive risk mitigation plan. For state-owned assets, monitoring of established risk mitigation programs are integrated into standard practice through quarterly review of project portfolios established for risk programs.

Addressing Top Priority Risks

Caltrans and local agencies have developed strong internal risk management cultures, processes, and programs in response to the risks associated with California's vast transportation network.

The following risk related policies and programs beyond enterprise risks are presented below many of which detail the work already integrated into TAM practice.

TAM Risk Mitigation Policies and Programs

- Project Risk Management
- Seismic Safety Retrofit Program
- Climate Change Policies and Actions
- Mitigation of Sea Level Rise
- Local Bridge Program
- Highway Safety Improvement Program
- Roadway Protective Betterments Program

Project Risk Management

Caltrans provides guidance to project managers and teams on risk management methodologies, techniques, and tools; identifies data requirements for risk management; and explains the role of risk management in the overall project management process which is documented in the Project Risk Management Handbook[27]. Project teams can use these resources to identify, assess, prioritize, and monitor project risks.

[27] Caltrans, "Project Risk Management Handbook: A Scalable Approach", 2012, https://dot.ca.gov/-/media/dot-media/programs/project-delivery/documents/f0006930-pd-09-project-risk-management-signed-2012-06-01-a11y.pdf

Seismic Safety Retrofit Program

The Seismic Safety Retrofit Program[28], created in the wake of widespread bridge failure during the 1989 Loma Prieta earthquake, identifies and retrofits existing state highway bridges to achieve compliance with current seismic safety standards. As of August 2021, the Program had completed the retrofit of 2,148 state highway bridges with identified seismic vulnerabilities at a cost of more than $12.2 billion. Figure 5-8 depicts typical improvements made as part of seismic retrofitting of freeway structures.

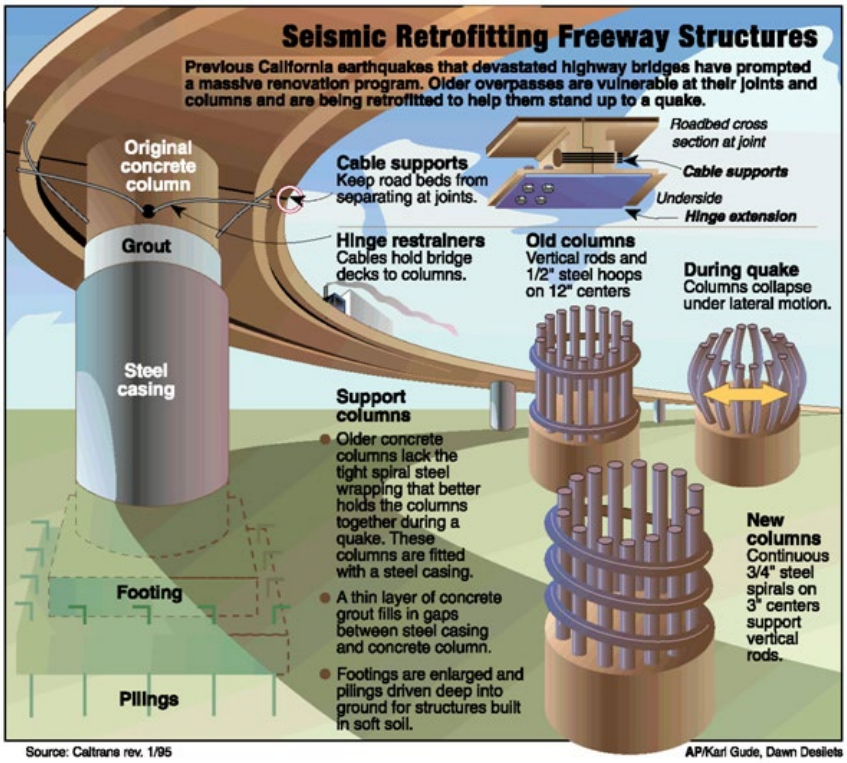


Figure 5-8. Seismic Retrofitting Freeway Structures Infographic

Local Bridge Seismic Safety Retrofit Program

The Local Bridge Seismic Safety Retrofit Program[29] was established to provide funding assistance for public bridges owned by local agencies to achieve compliance with current seismic safety standards. As of August, 2021[30], seismic retrofit work has been completed on 322 of the 374 bridges with identified seismic vulnerabilities.

Climate Change Policies and Actions

Caltrans' 2020-2024 Strategic Plan includes these climate change initiatives:

- provide climate leadership related to the transportation sector in California,
- create and maintain sustainable practices to reduce greenhouse gas emissions from transportation operations and projects,
- implement adaptation measures to increase the resilience of the SHS to climate impacts and address vulnerabilities

These efforts are expected to produce significant benefits, including lowering of greenhouse gas and pollutant emissions, lengthening the service life of transportation assets, reducing costs and need for weather-related maintenance, improving safety for all users of the system, and improving ecosystem

[28] Caltrans, Seismic Safety Retrofit Program, https://dot.ca.gov/programs/engineering-services

[29] Caltrans, Local Bridge Seismic Safety Retrofit Program, https://dot.ca.gov/programs/local-assistance

[30] California Transportation Commission, Local Seismic Safety Retrofit Account, https://catc.ca.gov/programs/proposition-1b-highway-safety-traffic-reduction-air-quality-and-port-security-bond-act-2006/prop1b-local-bridge-seismic-retrofit-account

resiliency and health.

More specifically, Caltrans' focus is on the following strategic actions:

- Prioritize investment and decisions that provide the greatest GHG emission reductions and maximize system resiliency.
- Develop and start implementing a Caltrans Climate Action Plan.
- Accelerate sustainable freight sector transformation.
- Establish a robust Climate Action program of education, training, and outreach.
- Establish a vehicle-miles traveled (VMT) monitoring and reduction program.
- Partner and collaborate to lead climate action.
- Engage with communities most vulnerable to climate change impacts to inform development and implementation of Climate Action activities.
- Implement the CalSTA *Climate Action Plan for Transportation Infrastructure (CAPTI)*

Climate Change Adaptation Measures

Given the ongoing and expected increased impacts of climate change to the SHS, Caltrans is working proactively on integrating climate change adaptation into its practices. In 2019, Caltrans completed vulnerability assessments[31] in all 12 districts to identify any SHS segment vulnerable to sea level rise including tidally influenced riverine areas, storm surge, coastal erosion, changes in precipitation, increasing temperatures, and wildfire. The analyses and recommendations from the assessments provided the basis for the new Sea Level Rise Adaptation performance objective, introduced in the 2021 SHSMP. Since the release of the 2021 SHSMP, Adaptation Priority Reports[32] were completed for all 12 districts. These reports include a prioritized list of potentially exposed assets that considered timing of the climate impacts, severity and extensiveness, the condition of the asset, number of system users affected and the level of redundancy in the area.

Caltrans is also evaluating new practices to address climate change. For example, Caltrans has a design policy that requires consideration of sea level rise and tidal flow for bridge projects where appropriate. Caltrans also has guidance which requires considering, where applicable, a range of sea-level rise scenarios for the years 2050 and 2100 during the planning and project development phases of construction projects. For projects where landslides or related ground failures resulting from coastal erosion are a factor, Caltrans considers the potential long-term impacts on these climate change-based hazards when evaluating design and/or alignment alternatives. With the increase in wildfire occurrences throughout the state in recent years, Caltrans is now evaluating the use of alternative construction materials in fire prone areas.

In addition to Caltrans, regional transportation agencies are also focusing on climate adaptation. A number of agencies to highlight include SCAG that has developed a Regional Climate Adaptation Framework[33] to assist local and regional jurisdictions in managing the negative impacts of climate change. The Framework provides an overview of how the Southern California region can work together

[31] Caltrans, 2019 Climate Change Vulnerability Assessments, https://dot.ca.gov/programs/transportation-planning/2019-climate-change-vulnerability-assessments

[32] Caltrans, 2020 Adaptation Priorities Reports, https://dot.ca.gov/programs/transportation-planning/2020-adapation-priorities-reports

[33] SCAG, Regional Climate Adaptation Framework, https://scag.ca.gov/climate-change-regional-adaptation-framework

to plan and prepare for the impacts of sea level rise, extreme heat, increasingly frequent and damaging wildfires, and other climate-related issues. The Framework consists of a compendium of tools, resources, and best practices to help local planning staff efficiently advance their adaptation planning using the best resources available. In the San Francisco Bay Area, Adapting to Rising Tides (ART) Program[34]also provides staff support, guidance, tools and information to build capacity for planning and implementing adaptation responses.

Improving Roadside Fire Resilience Strategies

Caltrans is moving to inventory, prioritize and implement defensible space maintenance projects and maintenance cycles on nearly 120,000 acres of naturally occurring roadside to improve fire resiliency adjacent to the highway system.

Caltrans is working to improve fire resiliency in coordination with CalFire and local fire agencies by:

- Removing vegetation and Increasing defensible space adjacent to highways.
- Creating a central hub for strategic climate adaptation planning, implementation and tracking of Roadside Resilience performance goals, projects and maintenance activities.
- Developing focused internal workforce planning and consistent accountability to external partners, overseeing regional fire prevention and protection of life, property, infrastructure and environmental resources.
- Focus on prioritizing projects that strengthen resilience of state highway system assets within designated emergency evacuation transportation routes.
- Selecting more fire-resistant materials in areas prone to fires

For roadside resilience, the condition of the asset is determined by expert judgement in natural resource, forestry and grassland management, along with fire protection and prevention planning.

An initial baseline inventory of roadside resilience is expected to be completed by 2022 for all 350,000 acres of the state highway right of way, using existing geospatial vegetation-type datasets, and peer-reviewed for quality assurance/quality control. Consequently, this is expected to lead to a new performance objective in the next SHSMP.

Sea Level Rise

Sea level risk mitigation cost estimates were developed for the 2021 SHSMP by considering the mix of potential engineering solutions based on an initial planning assessment of feasible strategies for the locations identified in the vulnerability studies for the San Francisco Bay Area. These adaptation costs are dependent on a number of variables that result in a range of possible costs that increase over time. Vulnerability Assessments and Adaptation Priority Reports have helped to identify areas of focus, but additional project and corridor level planning is required to better quantify solutions and costs. Future cost estimates are expected to consider a broader range of strategies, including nature-based solutions, and have greater project level specificity. Additional investment is being considered outside the current SHOPP for this work.

[34] San Francisco Conservation and Development Commission, Adapting to Rising Tides website, https://www.adaptingtorisingtides.org/

Local Bridge Program

Historically, about $300 million of federal funds has been made available through Caltrans to local agencies annually for bridge work including replacement, rehabilitation, painting, scour countermeasure, bridge approach barrier and railing replacement, low water crossing replacement, ferry service replacement, and preventative maintenance activities. IIJA funds will provide additional funding for local bridges for the first 5 years of the 2022 TAMP 10-year plan. Bridges are eligible for this funding when requested by local agency owners for various work activities based on bridge condition criteria and overall funding availability. Project funding determinations are also subject to a designated prioritization hierarchy.

Highway Safety Improvement Program

Highway Safety Improvement Program (HSIP) is a federal aid program which provides funds for making safety improvements to public roads. HSIP guidelines dictate that states give special consideration to projects on high risk rural roads. The HSIP program incentivizes local agencies to identify and mitigate their greatest safety risks.

Roadway Protective Betterments Program

Protective Betterments is a program in the SHOPP that funds projects to proactively avert emergencies through the identification of existing vulnerabilities along highways and to reduce risks to existing assets. The program primarily improves the overall condition of the SHS by correcting reoccurring deficiencies and support locations with repeated asset damage to mitigate the loss of impairment of life, health, property, or essential public services.

In addition to these major programs listed, Caltrans recently completed research to develop a statewide normalized risk scale for use in our asset management program. This research developed a methodology to monetize all risks so that locations can be prioritized across threat types. Costs associated with mitigation of high priority threats are then balanced against competing needs in a trade-off analysis in investment scenario evaluations. This risk scale methodology is part of the current development of the Caltrans Transportation Asset Management System (TAMS) expected to be complete by 2023. For additional information on TAMS, refer to Chapter 9 of this plan.

Implementing a Risk-Based Approach to Investment Strategies

For the 2022 TAMP, Caltrans and MPOs integrated risk mitigation in their investment strategy decisions defined in a process that Caltrans presented as part of the Investment Strategy Workshop held in July 2021. This workshop introduced the PTAT that agencies could use to evaluate projected 10-year conditions of pavement and bridges. The PTAT requires annual investments by the 5 federal work types with an option for defining the portion of available asset management funding being directed to risk mitigation as shown in Figure 5-9. Each agency provided their basis for investments and were asked to describe risk mitigation work expected to be done over the 10-year plan period. This approach provided a funding breakdown between risk and condition investments and provides the clearest picture of both risk mitigation funding and remaining budget available to improve the conditions of physical transportation system assets. This updated approach to the TAMP allows for regional differences in risk mitigation investments aggregated at a statewide level to inform TAMP condition analysis and targets.

Estimated Investment (Expected Annual Funding)							
Use Default or Override Parameters?	Override						
Annual Funding	**Initial Const.**	**Maint.**	**Preser/Rehab**	**Reconstruction**	**Total**	% Spending on Fair to Good	39.0%
Default	$ -	$ -	$ -	$ -	$ -	% Spending on Poor to Good	44.0%
Override	$ 13,000,000	$ 73,000,000	$ 280,000,000	$ 338,000,000	$ 704,000,000	% Spending on Adding New	1.8%
		% on Risk Mitigation	0%	10%		% Spending on Risk Mitigation	4.8%
		Dollars Applied to Fair to Good	98%	0%		Spending on Maint. Investment	10.4%
		Dollars Applied to Poor to Good	2%	100%			

Figure 5-9. Performance Target Analysis Tool Investment and Risk Mitigation Input Section

Risk mitigation investments on the state-owned NHS for pavement and bridges comes primarily from SHOPP programs as a combination of rehabilitation, reconstruction, and replacement type work. Risk mitigation for the local NHS was not a contributing factor in local investment strategies as communicated to Caltrans and reflected in their PTATs. For state-owned bridges, seismic retrofitting and scour investments were included in the performance analysis. In some cases, these construction activities, or treatments lead to improved asset condition from fair to good or poor to good condition. For pavement, risk mitigation includes work associated with the SHOPP major damage and protective betterments programs which are also reflected in the investment strategies and performance outcomes for the state-owned assets. Sea Level Rise and other risk mitigation investments were not expected for this TAMP 10-year period as discussed earlier in the chapter.

As described in FHWA's guidance on incorporating risk management into asset management plans, risk monitoring and communication is an ongoing, continuous process. California is committed to transparency throughout the TAMP development process and has made efforts to include stakeholders at every step of the process, including at the risk management workshops where risks were identified, prioritized, and evaluated for mitigation and monitoring actions. California's risk mitigation plan to address top priority risks over the TAMP 10-year plan period includes the work associated with on-going programs defined above and establishing new programs and funding to address climate change. This includes more resilient alternative solutions, improving asset models and methodologies through each cycle of the SHSMP and TAMP development process, incorporating risk into TAMS, and reporting and tracking of risk related items associated with Caltrans Strategic Plan. Each of these efforts include on-going monitoring through executive Caltrans leadership, the Asset Management Steering Committee, and current asset management processes in addition to those identified through the Risk Management Workshop.

6. Financial Plan

The TAM financial plan underpins and enables the implementation of asset management practices. This chapter details the revenues and financial projections for asset management activities in California.

6.1. Overview

California's transportation funding is derived from a variety of sources. The majority of funding for the SHS is through state and federal transportation funding collected through fuel taxes. At the state level, revenues are directed towards a set of transportation-related state accounts for California. Major accounts related to asset management are the State Highway Account (SHA) and the Road Maintenance and Rehabilitation Account (RMRA). These accounts are used to fund maintenance, operations, and capital projects, including asset management-related activities. The two programs most closely related to asset management are HM and SHOPP. The HM program and SHOPP fund maintenance, preservation, rehabilitation, and replacement projects; all are intended to maintain or improve asset condition. SHOPP and HM funds are used for the SHS, and by extension, the portions of the NHS on the SHS. In addition to HM and SHOPP, the STIP primarily funds initial construction or new development on the NHS including new rail and active transportation projects.

For the portion of NHS owned by local agencies, revenues are derived from a variety of sources, including federal and state sources, as well as additional local funding sources, such as local sales taxes, development impact fees, property taxes, and traffic impact fees. Funding sources used by local agencies are further detailed in the *2020 California Statewide Local Streets and Roads Needs Assessment*. Note: local agencies must fund all of the roads and bridges on the local system, not just the portion on the NHS. One challenge in developing a financial plan that meets FHWA's requirements is to determine the portion of transportation funds projected to be used on the NHS.

In 2017, California adopted new legislation increasing funds for asset management. SB 1, *The Road Repair and Accountability Act of 2017*[35], includes a number of provisions that, over time, will provide increased revenues for roads and bridges. SB 1 is projected to increase average annual funding for local pavements and bridges by approximately $1.5 billion. The new federal IIJA funding signed into law on November 15, 2021 impacts the first 5 years of the TAMP 10-year period. California received additional funding of approximately $1.5 billion per year for 5 years for transportation improvements including funding for pavement and bridge condition improvement. It is expected to increase funding for bridges by $575 million per year. Pavement work is also eligible under IIJA but does not have a specific budget line item in federal law. This additional funding has been included in the financial plan below and reflected in the performance gap analysis.

Financial Plan Process Requirements

- Estimate cost of expected future work to implement the investment strategies of the asset management plan, by fiscal year and work type
- Estimate funding levels to address the costs of future work types, by fiscal year
- Identify anticipated funding sources
- Asset valuation estimate for NHS pavements and bridges assets and the needed annual investment to maintain asset value (Note: asset valuation is included in Chapter 2. Asset Inventory and Condition.)

The following subsections present the TAMP financial plan, summarizing funding sources and uses, and detailing the projected funding available for asset management uses over the next 10 years. The financial plan is an estimate of projected revenue, detailing the resources available for helping meet the condition targets presented previously. Note that the financial plan is focused on funds available for selected asset types on the SHS and NHS. Other documents provide a more comprehensive description on topics such as sources of transportation funding, how California projects future revenues, and what constraints exist on use of funds for different purposes. *Transportation Funding in California (2020)*[36], an annual report by Caltrans, provides detail on transportation revenue sources. 2022 STIP Fund Estimate[37] details projected funding and programming capacity for different programs and asset types.

[35] Caltrans Website, Road Repair and Accountability Act, California Senate Bill 1, 2017, https://dot.ca.gov/programs/sb1

[36] Caltrans, "Transportation Funding in California", 2020, https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/transportation-economics/transportation-funding-booklet/2020-final-transportation-funding-a11y.pdf

[37] Caltrans, 2022 STIP Fund Estimate, https://dot.ca.gov/-/media/dot-media/programs/local-assistance/documents/hbp/2022/2022-stipfundestimateassumptions-a11y.pdf

6.2. Funding Sources

State

Caltrans receives transportation funding from both federal and state sources. For the SHOPP and the STIP, the Federal Highway Trust Fund (HTF) and the State Highway Account (SHA) are the main funding sources.

Federal funding for transportation is provided through the HTF, which is funded by the federal gas tax supplemented with additional revenues from SHA or other funds. For a detailed explanation of federal funding support, refer to *Funding Federal-Aid Highways*[38], a 2017 publication of FHWA.

Congress is responsible for authorizing federal funding. Federal transportation funds are typically authorized in advance to allow states to support capital planning. Once authorized, funds are apportioned or allocated to states or programs. Apportioned funds must then be obligated, or committed, to specific projects in a state before the HTF outlays cash to pay eligible recipients. Federal transportation acts outline the uses and distribution of these resources.

The SHA is the largest transportation account and retains the bulk of resources available for the SHS. It includes revenue sources such as fuel taxes, transfers, rental and sale of excess property, and outdoor advertising licenses, permit fees, and fines. RMRA created by SB 1 funds work on deferred maintenance for pavements, bridges, TMS, and drainage systems, primarily through increased fuel taxes.

Maintenance funding for state-owned assets comes primarily from the SHA and consists of both major maintenance and field maintenance. Major maintenance is achieved through highway maintenance contracts whereas field maintenance is done through state forces.

The TAMP requires a 10-year funding plan based on the best available revenue at the time of TAMP development. This estimated funding utilizes similar assumptions used for the STIP FE in determining expected annual capacity for the SHOPP and STIP. SHOPP and Maintenance funding projected for 10-years is detailed below in Figure 6-1 with additional detail in Table 6-1.

[38] FHWA, "Funding Federal-Aid Highways", January 2017, https://www.fhwa.dot.gov/policy/olsp/fundingfederalaid/

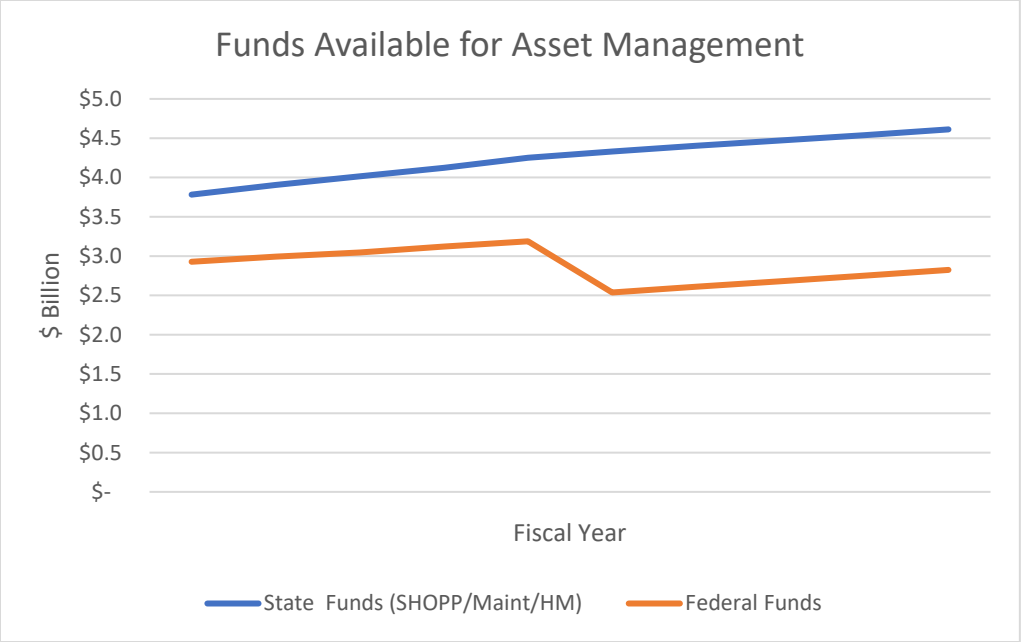


Figure 6-1. State Transportation Funding Available for Asset Management

Table 6-1. Summary of Federal and State Funds Available for Asset Management

Value by FY ($M)											
	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	10 Year Total
STATE FUNDS											
Total Gasoline and Diesel Excise Tax	$8,427	$8,726	$8,903	$9,061	$9,283	$9,355	$9,388	$9,380	$9,332	$9,243	$91,099
Net State Funds (SHA & RMRA)	4,696	4,879	5,027	5,169	5,340	5,459	5,571	5,679	5,789	5,905	$53,514
Bridge & Culvert	400	400	400	400	400	400	400	400	400	400	$4,000
Non-SHOPP Commitments	(1,314)	(1,375)	(1,412)	(1,445)	(1,488)	(1,528)	(1,567)	(1,608)	(1,650)	(1,693)	$(15,080)
TOTAL STATE FUNDS	**$ 3,782**	**$3,904**	**$4,015**	**$4,124**	**$4,252**	**$4,331**	**$4,404**	**$4,471**	**$4,539**	**$4,612**	**$42,434**
FEDERAL FUNDS											
State's Portion (OA & AR)	$2,326	$2,387	$2,451	$2,516	$2,583	$2,651	$2,722	$2,795	$2,869	$2,946	$26,245
State's Portion (IIJA)	$708	$708	$708	$708	$708	-	-	-	-	-	$3,540
Non-SHOPP Commitments	(105)	(103)	(113)	(102)	(103)	(114)	(112)	(115)	(118)	(121)	(1,105)
TOTAL FEDERAL FUNDS	**$ 2,929**	**$2,992**	**$3,046**	**$3,122**	**$3,188**	**$2,537**	**$2,610**	**$2,680**	**$2,751**	**$2,825**	**$28,680**
TOTAL FUNDS AVAILABLE	$ 6,711	$6,896	$7,061	$7,246	$7,440	$6,868	$7,014	$7,151	$7,290	$7,437	$71,114

Abbreviations: OA: Obligation Authority, AR: August Redistribution

Source: 2022 STIP FE supplemented with IIJA funding

STIP funding is summarized in Table 6-2 below and represents the total value of projects that can be funded each year including construction, right of way, and support. Support consists of preliminary engineering, planning, design, and construction engineering.

Table 6-2. Summary of STIP Program Capacity

Value by FY ($M)											
	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	10 Year Total
State + Federal											
2022 STIP Program Capacity	$711	$777	$310	$310	$335	$360	$360	$360	$360	$360	$4,243
2020 STIP Program	$723	$753	$269	$261	-	-	-	-	-	-	$2,006
2022 STIP Program Capacity	-$12	$24	$41	$49	$335	$360	$360	$360	$360	$360	$2,237

Notes: STIP Funding beyond the adopted STIP FE is estimated.

Source: 2022 STIP FE

Local

The *2020 California Statewide Local Streets and Roads Needs Assessment* discusses sources of funding for local roads and bridges. This report lists the following local funding sources including federal and state sources:

Federal Funding Sources:

- Regional Transportation Program (RSTP)
- Surface Transportation Program (STP)
- Congestion Mitigation and Air Quality Improvement Program (CMAQ)
- Community Development Block Grant (CDBG)
- Highway Safety Improvement Program (HSIP)
- Federal Emergency Management Agency (FEMA)
- Forest Reserve
- Transportation Enhancement Activities (TEA)

State Funding Sources:

- Gas taxes (Highway User Tax Account or HUTA)
- Transportation Development Act (TDA)
- State Transportation Improvement Program (STIP)
- Active Transportation Program (ATP) which now includes the Bicycle Transportation Account (BTA) and Safe Routes to Schools (SR2S)
- Vehicle License Fees (VLF)
- Transportation Improvement Fee
- Local Transportation Fund (LTF)
- Traffic Congestion Relief Fund (TCRP)

- Cal-Recycle grants

Local Funding Sources:

- Local sales taxes
- Traffic and development impact fees
- Transportation mitigation fees
- General funds
- Various assessment districts–-lighting, maintenance, flood control, special assessments, community facility districts
- Traffic safety/circulation fees
- Utilities e.g., stormwater, water, wastewater enterprise funds
- Parking and various permit fees
- Flood control districts
- Enterprise funds (solid waste and water)
- Investment earnings
- Parcel/property taxes
- Indian reservation roads
- Indian gaming funds
- Vehicle registration fees
- Vehicle code fines
- Underground impact fees
- Transient Occupancy Taxes (TOT)
- CIP Reserves/Capital Funds

A primary source of local government financial data for the TAMP comes from the SCO open data website "by the numbers"[39] that includes revenues and expenditures reported by 57 counties, 482 cities and other transportation related agencies as required by law. For purposes of the TAMP, SCO financial records come from a combination of City "Streets" and County "Roads" data files to obtain all transportation related costs. In addition to the downloadable raw data files made available, the site offers additional information by fiscal year for revenues and expenditures of each city or county jurisdiction and charts financial trends as shown in Figure 6-2 for City Streets and in Figure 6-3 for County Roads in fiscal year 2020.

[39] State Controller's Office, By the Numbers Open Data website, https://bythenumbers.sco.ca.gov/

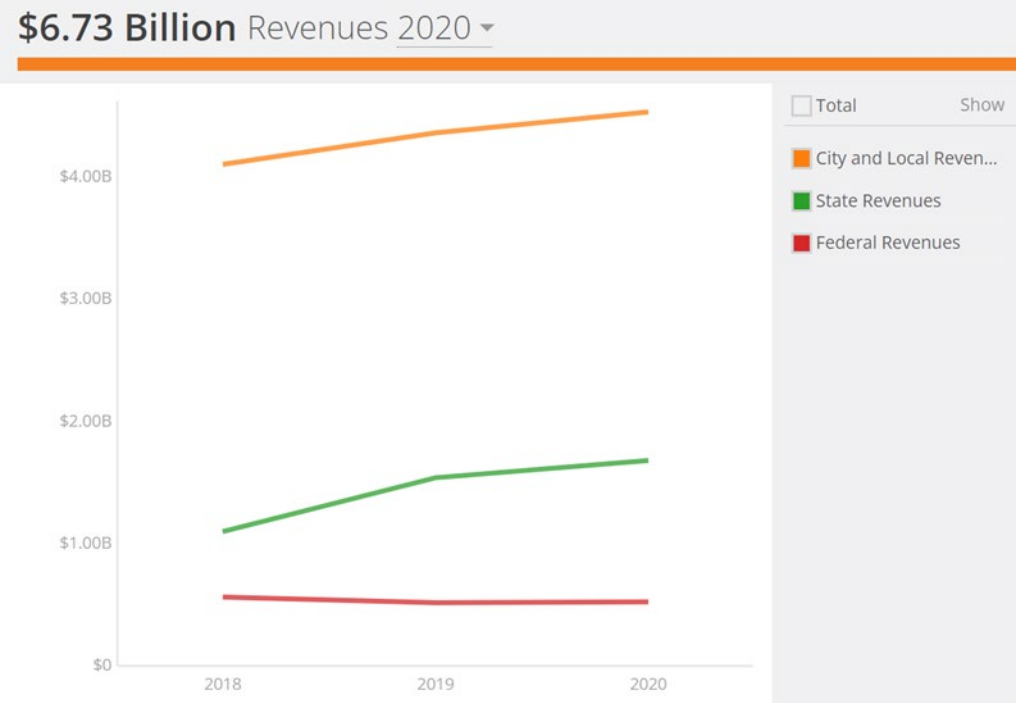


Figure 6-2. SCO Financial Trends for City Streets

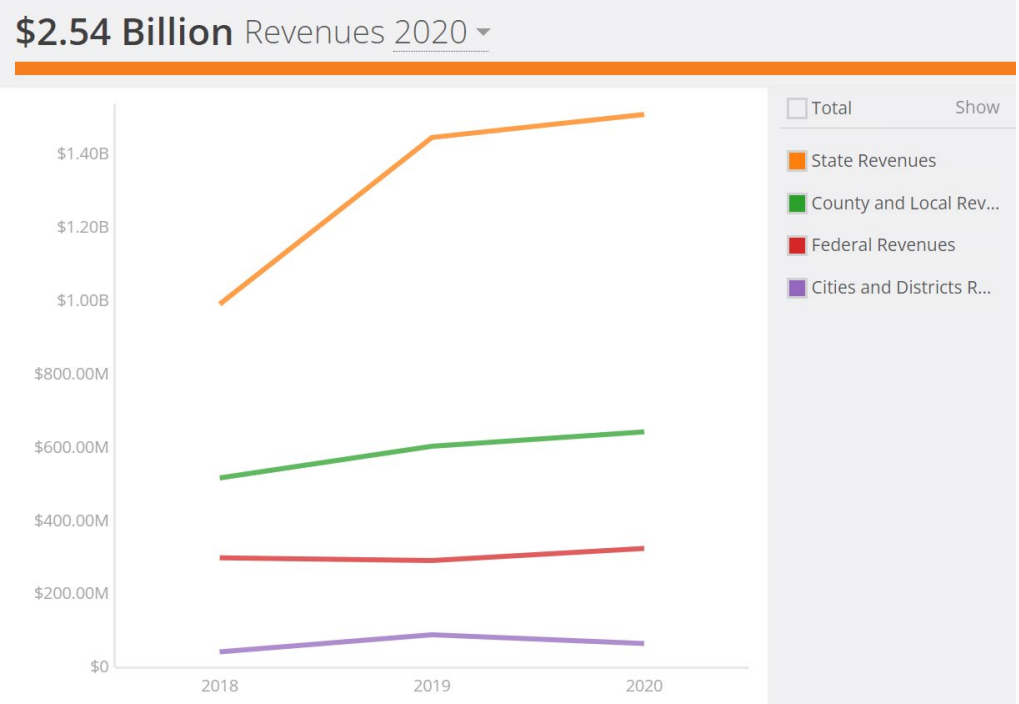


Figure 6-3. SCO Financial Trends for County Roads

6.3. Funding Uses

State

Table 6-3 shows Caltrans' planned spending commitments in upcoming years for Highway Maintenance and Non-Highway Maintenance work, organized by funding source. Highway Maintenance funds maintenance contracts for maintaining and preserving transportation assets. Non-Highway work involves various work operations performed by maintenance employees. Additional detail is available in *Caltrans Maintenance Manual*[40].

Table 6-3. Summary of Caltrans Planned Commitments for Highway and Non-Highway Maintenance Work

Value by FY ($M)											
ITEMIZED COMMITMENTS	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	10 Year Total
State Funds											
Highway/Major Maintenance	$(539)	$(554)	$(569)	$(585)	$(601)	$(617)	$(633)	$(651)	$(668)	$(686)	$(6,103)
Non-Highway/ General Maintenance	$(1,222)	$(1,255)	$(1,289)	$(1,324)	$(1,360)	$(1,396)	$(1,434)	$(1,473)	$(1,513)	$(1,554)	$(13,820)
Planning Initiation Documents	$(45)	$(46)	$(48)	$(49)	$(50)	$(52)	$(53)	$(55)	$(56)	$(58)	$(512)
Federal Funds											
Non-Highway/ General Maintenance	$(28)	$(29)	$(29)	$(30)	$(31)	$(32)	$(33)	$(33)	$(34)	$(35)	$(314)
TOTAL ITEMIZED COMMITMENTS	$(1,835)	$(1,884)	$(1,935)	$(1,988)	$(2,042)	$(2,097)	$(2,153)	$(2,212)	$(2,271)	$(2,333)	$(20,750)

Source: 2022 STIP FE

Table 6-4 presents a summary of estimated SHOPP spending for the SHS inclusive of the NHS based on the 2022 STIP Fund Estimate projected for 10-years.

Table 6-4. Summary of Expected SHOPP Spending

Value by FY ($M)											
SUMMARY OF FUNDS AVAILABLE	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	10 Year Total
Total Funds Available	$6,711	$6,896	$7,061	$7,246	$7,440	$6,868	$7,014	$7,151	$7,290	$7,437	$71,114
Total Itemized Commitments	$(1,835)	$(1,88)	$(1,935)	$(1,988)	$(2,042)	$(2,097)	$(2,153)	$(2,212)	$(2,271)	$(2,333)	$(20,750)
Projected SHOPP Funding	$4,876	$5,012	$5,126	$5,258	$5,398	$4,771	$4,861	$4,939	$5,019	$5,104	$50,364

Source: 2022 STIP FE supplemented with IIJA funding

[40] Caltrans Maintenance Manual, https://dot.ca.gov/programs/maintenance/maintenance-manual

Local

Cities and counties are estimated to spend approximately $290 million per year on all local bridges based on a set aside of federal funds. With the passage of the IIJA, an increase of $253 million per year for 5 years will be available for bridge condition improvement. $2.43 billion annually was estimated for all local pavements inclusive of the NHS as shown in Figure 6-4.

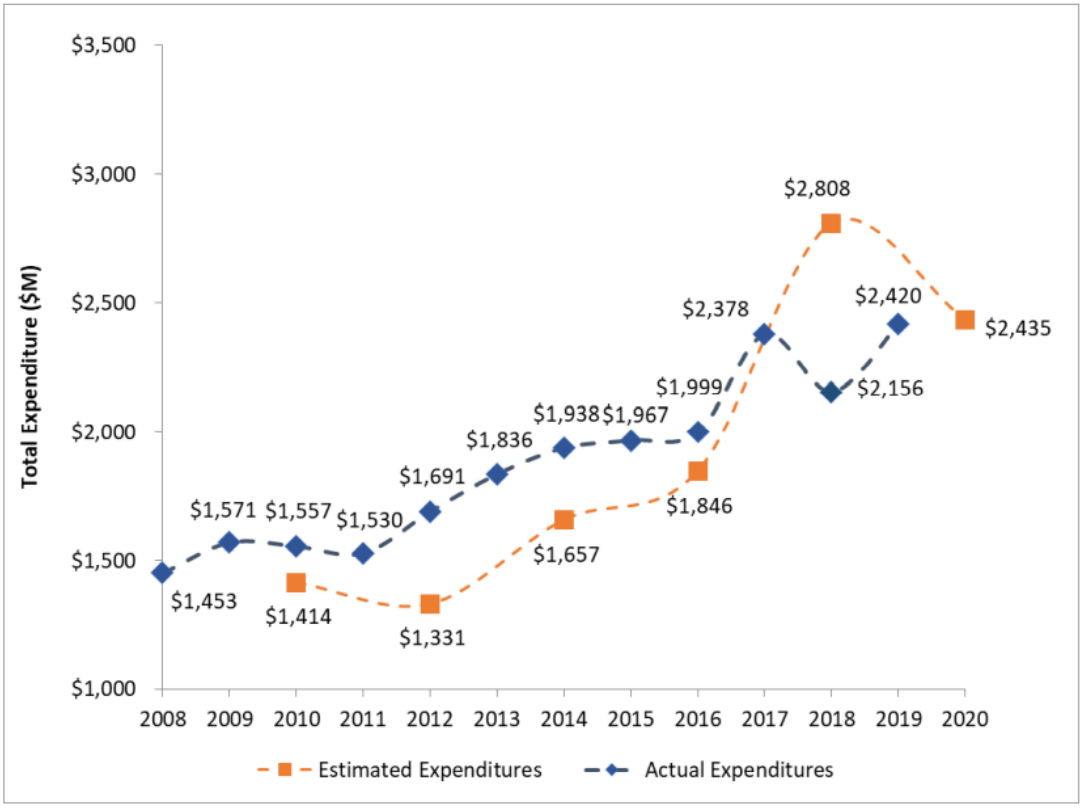


Figure 6-4. 2020 Statewide Local Streets and Roads Needs Assessment Report of Differences between Predicted and Actual Expenditures for Pavements

6.4. Funding Available for Asset Management

Spending on NHS assets in California is not tracked as a separate item, so instead an estimate was derived primarily from financial data obtained from the SCO open data portal for financial expenditures and the 2021 SHSMP. For the locally-owned NHS, the funding estimate is based on the SCO financial data reported annually by local cities and counties for all transportation related expenditures categorized into the five federal work types (initial construction, maintenance, preservation, rehabilitation and reconstruction) and then prorated based on the percentage of pavements and bridges located on the NHS, or in some cases provided directly to Caltrans by the regional agencies. Caltrans estimated funding available on the state-owned NHS by prorating investments from the SHSMP based on the percentage of NHS to total inventory owned and then broken out by the 5 work types through review of pavement and bridge projects included in the June 2021 10-year SHOPP project book and then

adjusted for additional IIJA funding.

For Caltrans, 100 percent of Class I pavements and 63 percent of Class II pavements are located on the NHS. Multiplying these percentages by the funding for the respective pavement classes yields an estimate of spending on NHS pavements located on the SHS. This NHS estimate is broken down into Interstate and Non-Interstate estimates based on the assumptions that 100 percent of Interstate is Pavement Class I, the remainder of Pavement Class I is Non-Interstate NHS, and the remainder of Non-Interstate NHS is Pavement Class II. For bridges, 87 percent of SHS bridge deck area is on the NHS. Projected spending for SHS assets was multiplied by the percent of SHS assets located on the NHS to estimate future spending for NHS assets on the SHS.

For local agencies, approximately five percent of local pavements and 32 percent of local bridges are on the NHS. Projected spending for local NHS assets was based on aggregating investments at the region level prorated by percentage of NHS assets to total local inventory.

Table 6-5, Table 6-6, and Table 6-7 summarize estimated NHS asset management funding uses. These tables present three funding scenarios: the maintain condition funding scenario; the expected performance funding scenario which represents condition of assets expected to be achieved based on available funding, and the achieving targets scenario represents funding required to achieve the 10-year DSOR.

Table 6-5. Summary of Estimated NHS Asset Management Funding Uses, by Owner (Maintain Condition)

Maintain Condition ($ M)						
	Initial Construction	Maintenance	Preservation/ Rehabilitation	Reconstruction	10-Year Total	Average Annual Funding
State-owned						
Interstate	$700	$520	$4,020	$2,150	$7,390	$739
Non-Interstate	$1,090	$820	$6,280	$1.810	$10,000	$1,000
Locally-owned						
Non-Interstate	$889	$540	$500	$1,530	$3,458	$346
Total NHS	**$2,679**	**$1,880**	**$10,800**	**$5,490**	**$20,848**	**$2,085**
Bridges						
State-owned						
NHS	$130	$730	$4,860	$820	$6,540	$654
Locally-owned						
NHS	$1,317	$25	$2,133	$589	$4,064	$406
Total NHS	**$1,447**	**$755**	**$6,993**	**$1,409**	**$10,604**	**$1,060**

Table 6-6. Summary of Estimated NHS Asset Management Funding Uses, by Owner (Expected Performance)

Expected Performance ($ M)						
	Initial Construction	Maintenance	Preservation/ Rehabilitation	Reconstruction	10-Year Total	Average Annual Funding
State-owned						
Interstate	$700	$520	$4,340	$2,390	$7,950	$795
Non-Interstate	$1,090	$820	$7,660	$2,080	$11,650	$1,165
Locally-owned						
Non-Interstate	$888	$539	$951	$3,006	$5,384	$538
Total NHS	**$2,678**	**$1,879**	**$12,951**	**$7,476**	**$24,984**	**$2,498**
Bridges						
State-owned						
NHS	$260	$720	$4,820	$2,170	$7,970	$797
Locally-owned						
NHS	$1,317	$25	$57	$782	$2,181	$218
Total NHS	**$1,577**	**$745**	**$4,877**	**$2,952**	**$10,151**	**$1,015**

Table 6-7. Summary of Estimated NHS Asset Management Funding Uses, by Owner (DSOR)

Desired State of Repair ($ M)						
	Initial Construction	Maintenance	Preservation/ Rehabilitation	Reconstruction	10-Year Total	Average Annual Funding
State-owned						
Interstate	$700	$520	$6,858	$1,228	$9,350	$935
Non-Interstate	$1,090	$820	$9,183	$1,388	$13,171	$1,317
Locally-owned						
Non-Interstate	$889	$539	$1,140	$3,500	$6,068	$607
Total NHS	**$2,679**	**$1,879**	**$17,181**	**$6,116**	**$28,589**	**$2,859**
Bridges						
State-owned						
NHS	$260	$720	$3,573	$2,293	$8,232	$823
Locally-owned						
NHS	$1,317	$248	$2,229	$3,410	$6,981	$698
Total NHS	**$1,577**	**$968**	**$5,802**	**$5,703**	**$15,213**	**$1,521**

Caltrans' two major funding programs for asset management activities are the HM Program and SHOPP. HM projects are preventive or corrective work intended to extend the life of physical assets. SHOPP projects are capital construction projects to rehabilitate or repair assets in fair or poor condition. Both the HM Program and SHOPP provide funds for improving or preserving the condition of pavements, bridges, drainage systems, and TMS assets. Caltrans strategically determines the amount of funding or split of SHOPP and HM funding needed to preserve or improve the condition from the initial construction of the asset to the preservation, rehabilitation and reconstruction work required. Maintenance funds, including state field crews, are used to maintain condition until the next recommended construction work activity.

Table 6-8 shows SHOPP and HM funding for the four primary asset classes on the SHS included in this TAMP: pavements, bridges, drainage systems, and TMS. These funding totals were taken from the 2021 SHSMP. The table presents three funding scenarios: the maintain condition funding scenario; the expected performance funding scenario which represents condition of SHS assets expected to be achieved based on available funding, and the achieving targets scenario represents funding required to achieve the 10-year DSOR.

Table 6-8. Summary of SHS Asset Management Funding Uses, by Program

	Maintain Condition		Expected Performance		Desired State of Repair	
	10-Year Total ($M)	Average Annual Funding ($M)	10-Year Total ($M)	Average Annual Funding ($M)	10-Year Total ($M)	Average Annual Funding ($M)
SHOPP + HM						
All SHS Pavements	**$18,753**	**$1,876**	**$20,175**	**$2,018**	**$18,743**	**$1,874**
Pavement Class I	$12,797	$1,280	$11,662	$1,166	$11,246	$1,125
Pavement Class II	$4,886	$489	$7,228	$723	$6,434	$643
Pavement Class III	$1,070	$107	$1,285	$129	$1,063	$106
Bridges	$8,894	$889	$6,809	$681	$7,969	$797
Drainage	$3,719	$372	$3,440	$344	$2,619	$262
TMS	$1,675	$168	$2,108	$211	$2,099	$210
Total	**$33,041**	**$3,305**	**$32,532**	**$3,253**	**$31,430**	**$3,143**

Source: 2021 SHSMP for Expected Performance and Desired State of Repair

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7. Investment Strategies

Asset management investment strategies are the policies for resource allocation that will deliver the best asset performance given available funds and the goals and objectives of state and local agencies. Generating an asset management investment strategy involves assessing various funding scenarios designed to achieve and sustain a desired state of repair and deliver the program efficiently.

7.1. Overview

The investment strategies presented in this chapter build a foundation for TAM financial decisions by connecting the TAMP to ongoing funding and programming processes, examining TAM-eligible revenue sources, and allocating those resources amongst the major assets. California's investment strategies are shaped by earlier chapters of the TAMP, including Chapter 3. Asset Performance Targets, Chapter 4. Life Cycle Planning, Chapter 5. Managing Risks and Building Resilience, and Chapter 6. Financial Plan. The investment strategies support progress towards achieving national and state goals and closing any performance gaps. The strategies incorporate asset modeling, treatments, and impacts, as well as risks and financial constraints.

The TAMP will help to ensure short and long-term resource allocation decisions are based on data and analysis, including consideration of engineering, life cycle cost, and risk analysis with investment strategies being developed to best manage the physical assets with the available current and future funding. Many factors influence the magnitude of investments that are made towards maintaining and

improving the NHS. In some cases, investment decisions are governed by law or the outcome of court settlements. In other cases, investments are dictated by terms of permits or policy-driven requirements for expenditures on specific transportation related activities.

7.2. Investment Strategies

Investment strategies are "a set of strategies that results from evaluating various levels of funding to achieve State DOT targets for asset condition and system performance effectiveness at a minimum practicable cost while managing risks."

Investment Strategies Process Requirements

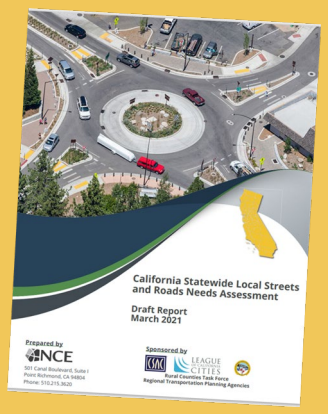
The process must describe how investment strategies are influenced, at a minimum, by:

- Performance gap analysis
- Life cycle planning
- Risk management analysis
- Anticipated available funding and estimated cost of future work

Underlying the investment strategies are the performance targets and projections, life cycle planning, risk management analysis, and anticipated funding and cost of future work. The performance gap analysis, enabled by life cycle planning, helps define the investment needs of the system. Life-cycle plans use the estimated cost of future work to establish network level strategies for managing assets. Available funding is a constraint for performance modeling, allowing California to better predict future scenarios. Risk management tempers the analysis, adjusting potential outcomes based on opportunities and threats. These asset management processes are required in the TAMP and contribute to the investment strategies presented. But the strategies are what make the technical details meaningful at a network level and help communicate California's message of preserving asset condition and making progress towards state and national goals.

Investment strategies for the 2022 TAMP come from a combination of strategies defined in the 2021 SHSMP and by each MPO in California that have NHS pavement and bridges within their jurisdiction. The strategies are defined primarily by state legislation, transportation policies and priorities established by each NHS owner. For Caltrans, the SHSMP investment strategies align with the strategic goals outlined in the latest Caltrans Strategic Plan and focuses on a 'fix it first" commitment to achieve established performance targets, while also increasing investment in bicycle and pedestrian infrastructure helping to achieve climate goals and equitable transportation system access.

For the locally-owned NHS, investment strategies were heavily influenced by each MPO's Regional Transportation Plan (RTP) and their cities and counties capital improvement plans. A "fix it first" approach along with bicycle and pedestrian improvements also remain strong at the local level. Depending on whether a regional agency is considered urban or rural or if they are a self-help agency[2] has a major influence on investment strategies and the funding available for investing on the NHS. For some MPOs, spending on the NHS is limited due to resource constraints and a small percentage of NHS assets in the region. For other MPOs, investments are focused on addressing regional and state climate change goals such as in the CAPTI, *California Air Resource Board (CARB) 2022 Climate Change Scoping Plan* and *Sustainable Communities Strategies*. Under new CAPTI policies, climate action is expected to be a significant factor on investments into the future. Additional detail on these policies are found in Appendix D. The CAPTI Action Plan details short- and medium-term strategies, programs impacted, and the agencies involved in implementation. According to the *2020 Statewide Local Streets and Roads Needs Assessment*, there is also significant focus on climate change and building sustainable communities. Over the last 10 years, there has been a significant increase in both sustainable pavement practices and complete streets policies; both of which were factored into state and local funding scenarios.



*According to the **2020 Statewide Local Streets and Roads Needs Assessment,** a significant focus is on climate change and building sustainable communities, which cannot function without a well-maintained local street and road system*

Equity in Transportation Investments

A greater emphasis and commitment to equitable transportation is advancing in both state and regional transportation agencies including Caltrans work to develop an Equity Index. The Equity Index is envisioned to be used in state planning and project development processes.

A goal in Caltrans Strategic Plan is to advance equity and livability in all communities. Equity is achieved when everyone has access to what they need to thrive, no matter their race, socio-economic status, identity, where they live, or how they travel. Caltrans implements these core principles of equity in the SHSMP in its approach to asset management investments on the SHS, ensuring that maintenance, preservation, rehabilitation, and reconstruction efforts are directed on highway infrastructure and in the communities where the needs are the greatest.

This includes an equity-based, programmatic-level approach to identify needs unique to each of the twelve Caltrans districts and focuses investments to bring each district to the same condition state and performance level. The districts then develop projects and work with impacted communities through a

public engagement process including more work to engage disadvantaged communities helping eliminate barriers to transportation.

Equitable transportation at the local level has been identified in regional transportation plans and include strategies such as providing equitable access to transportation planning processes, engaging the public early, and using a variety of methods to include those of diverse incomes and ethnic backgrounds.

7.3. Alternative Strategies

The following alternative strategies in this chapter are high-level investment policies for California's transportation agencies. These broad strategies are not mutually exclusive but represent an investment philosophy of prioritizing preservation activities, adopting complete streets[41], implementing clean and sustainable practices, seeking progress towards broad goal areas, and focusing on selected asset classes. Based on the *2020 Statewide Local Streets and Roads Needs Assessment Report*, feedback received from our partner agencies, and Caltrans latest SHSMP, these initial TAMP investment strategies are still relevant for the 2022 TAMP but have increased emphasis on climate change and equity influencing how investments are being spent.

The following strategies informed the performance scenarios of the TAMP to predict performance outcomes and are expected to be relied upon in determining alternative approaches to closing performance gaps. Besides these strategies, Caltrans has other requirements that must be met to achieve optimal performance across multiple objectives as described in the next Chapter. Performance Scenarios and Gaps and as detailed in the 2021 SHSMP.

Fix It First

The "Fix it First" investment strategy is a focus on addressing the needs of the existing assets before system expansion is considered. Replacement, rehabilitation, and preventive maintenance is intended to improve or preserve the condition of existing assets, rather than to expand system capacity. The benefit of this strategy is that it maintains asset condition at low cost over the life cycle of assets. Caltrans uses the SHOPP, a major capital program dedicated to rehabilitation and operation of the SHS, along with our Maintenance Program to execute majority of the "Fix it First" strategy.

The SHOPP's 10-year investment plan is laid out in the SHSMP and follows a "fix it first" approach that prioritizes maintenance, rehabilitation, and safety improvements on the SHS. Stewardship activities performed through SHOPP include maintaining, rehabilitating, or replacing pavements, bridges, drainage systems, TMS assets, along with all other physical assets comprising or supporting the SHS.

Caltrans puts significantly more money in SHOPP ($4.3 billion committed in FY 2022) than in STIP ($711 million committed in FY 2022), signaling the statewide focus on preservation. As noted in the 2021 SHSMP, $37.0 billion of projected SHOPP funding is dedicated to Stewardship, representing 80 percent of all SHOPP funding over a 10-year period. The remaining $9.4 billion over a 10-year period will address other goal areas and will contribute to managing California's transportation assets.

[41] Caltrans, Complete Streets Program, http://www.dot.ca.gov/transplanning/ocp/complete-streets.html

The SHSMP also includes a maintenance investment plan that focuses on preventive maintenance activities. Selecting and applying maintenance treatments can help preserve asset condition and extend asset life at low cost. Spending more on preventive maintenance for assets in good and fair condition can yield cost savings by avoiding or delaying the need for expensive rehabilitation or replacement of those assets.

SB 1 created RMRA for investing in infrastructure rehabilitation, signaling additional emphasis on a "fix it first" approach with half of the RMRA funds directed towards local streets and roads as detailed in Chapter 6. Financial Plan. "Fix it first" is also considered a primary strategy for many of the local NHS owners. SCAG, having the largest inventory of local NHS pavement and bridges indicated "fix it first" is their highest priority investment strategy for their region. This investment strategy supports the federal work types: maintenance, preservation, rehabilitation, and reconstruction activities.

Complete Streets Policies

Another investment strategy for both state and local transportation agencies is to adopt and implement Complete Streets policies. Promoting bicycle, pedestrian and transit modes improves transportation access and reduces transportation related emissions. As described in *the 2020 Statewide Local Streets and Roads Needs Assessment Report*, many local agencies have adopted Complete Streets policies as shown in Table 7-1, requiring that roadways be designed for all users. This ensures that local investments will make progress towards broader transportation goals.

Table 7-1. Reported Agencies with Complete Streets Policies

Element	No. of Agencies
Bicycle facilities	276
Pedestrian facilities	276
Curb ramps	262
Signs	246
Green Infrastructure	94
Traffic calming e.g., reducing lane widths	233
Medians	212
Lighting	209
Transit elements	167
Roundabouts	145

For Caltrans, complete streets are legislated into several state policies, including SB 1 which requires projects under this program to incorporate bicycle and pedestrian facilities to the "extent beneficial, cost-effective and practicable". Executive Order N-19-19 and Executive Order N-79-20 both direct the Department to fund bicycle, pedestrian, and transit projects as part of the State's larger goals around climate change. Additional detail on these Executive Orders is found in Appendix D. A new Complete Streets Director's policy (DP-37) was established in December 2021 that requires all transportation projects funded or overseen by Caltrans to provide comfortable, convenient, and connected complete

streets facilities.[42]

Current efforts related to Complete Streets include the establishment of twelve District Caltrans Active Transportation (CAT) Plans[43] that will identify walking and biking needs on the SHS to inform current and future iterations of Complete Streets performance targets expected to be complete in 2022.

For Caltrans, investing in Complete Streets expanded in the 2021 SHSMP. For the first time, Caltrans included specific funding for improving existing bicycle and pedestrian infrastructure and building new facilities.

The benefit of this strategy is that California can make progress towards multiple goal areas with each project investment including improved transportation access, reduced vehicle emissions and better asset condition.

Climate Action

This investment strategy aligns transportation infrastructure investments to the state's climate, health and social equity goals while still committing to a "fix it first" approach to transportation. CAPTI provides the framework and structure to monitor and evaluate progress towards the goals. This comprehensive framework targets investments in clean, safe, and equitable transportation options for all Californians and identifies over two dozen initial key actions necessary for implementation.

Climate goals include reducing vehicle emissions with strategies identified in CAPTI to help achieve a significant reduction in vehicle miles traveled (VMT). Climate action strategies include expanding zero emission charging/fueling infrastructure and zero or lower emission modes of transportation.

Implementing clean and sustainable transportation options also includes improving the materials and construction methods of transportation assets. For pavement, both Caltrans and local agencies continue to improve upon sustainable pavement practices focusing on pavement technologies that increase pavement life, reduce environmental impacts, and yield cost savings.

Leverage Investments

A Caltrans investment strategy is to leverage investments to support the full range of Caltrans and national goals. The SHSMP reorganized key activities into categories that align with the goal areas established in Caltrans' Strategic Plan and support national goals. Projects funded through SHOPP are not solely intended to improve or preserve asset condition. One of the benefits of this strategy is that California can make progress towards multiple goal areas with each investment. This multi-objective project strategy address needs that are located within the project limits at one time. This approach results in lower project development costs, economies of scale and less disruption to the traveling public.

As explained in the SHSMP, SHOPP investment size by goal area is determined based on current and projected inventory, current condition, programmed work, expected deterioration rates, mandated funding levels, risks of inaction, historic investment levels, and the varying importance of preservation

[42] Caltrans, Director's Policy DP-37 December 7, 2021, https://dot.ca.gov/programs/sustainability

[43] Caltrans, Active Transportation (CAT) Plans, https://www.catplan.org/

and rehabilitation needs.

Caltrans calculates performance targets for each objective in each goal area. The SHOPP investment plan allocates available funding to these objectives. Caltrans districts then develop multi-year project portfolios intended to achieve the stated performance targets for each goal area and objective. These project portfolios make up the project pool through which SHOPP programming is executed. Alignment with the goal areas means that SHOPP funding advances Safety, Equity-Livability, Climate and other goal areas, in addition to Stewardship while also aligning with national goals.

Focus on Selected Asset Classes

Another Caltrans investment strategy is to focus on selected asset classes. As mentioned previously, the Commission designated pavements, bridges, drainage systems, and TMS as focus areas. The Commission selected these four asset classes as focus areas because they represent a significant portion of SHS maintenance and rehabilitation investments in California. The benefit of this strategy is to focus on some of the most important assets on the highway system in California. The drawback of this approach is that other assets on the SHS may need additional funding to meet performance targets.

The SHSMP has a projection of 10-year needs for a variety of assets beyond the four focus classes. To the extent that funds are limited, priority has been given to meeting the needs of the four primary asset classes before funding supplementary assets.

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8. Performance Scenarios and Gaps

California's asset management focus involves managing transportation assets throughout their life cycle. This requires looking to the future and projecting asset performance. California's state and local transportation agencies use expected funding to predict future conditions, compare against targets, define funding gaps, and inform resource allocation decisions.

8.1. Overview

This chapter presents scenarios for core transportation system asset (pavement, bridges, drainage systems, and TMS) performance over a 10-year period. A primary objective of the federal requirements is to develop a TAMP and adopt asset management processes to improve or preserve the condition of transportation assets. Progress towards this objective is measured against national, state, and local targets.

Projecting future conditions allows transportation officials to see whether or not asset performance will meet established condition targets, including the 10-year DSOR. To perform these analysis, the exisitng inventory, conditions, deterioration rates, available funding and treatment effectiveness is required for the 10-year time frame of the TAMP. Funding levels can be varied to show the differences in resulting performance depending on the expenditure amount. Projecting conditions is also informed by Chapter 4. Life Cycle Planning and Chapter 5. Managing Risk and Building Resilience.

Based on the revenue projections described in the Financial Plan chapter of this TAMP, three scenarios were defined:

- Maintain existing asset conditions scenario
- Expected performance scenario
- A condition targeting scenario that achieves the desired state of repair targets.

8.2. Performance Gap Analysis

State DOTs are required to establish a process for conducting a gap analysis, evaluating any gaps between current and target condition, and suggesting strategies to close the gap. FHWA defines a performance gap as "the gaps between the current asset condition and State DOT targets for asset condition, and the gaps in system performance effectiveness that are best addressed by improving the physical assets."

Performance Gap Analysis Process Requirements

- State DOT targets for asset condition of NHS pavements and bridges, using FHWA's performance measures
- NHS condition and performance gaps
- Alternative strategies to close or address the gaps

As part of the gap analysis, states must compare current asset performance to established target performance levels, but they may also compare projected asset performance to target performance to calculate an expected gap. The gap analysis is presented following the discussion of performance projections in this chapter.

The California SHC requires the development of an SHS Needs Assessment, that defines program areas and costs associated with achieving condition and performance targets. The majority of the SHS needs are determined through a gap analysis. For the NHS, a needs assessment for both state and locally-owned pavement and bridges utilized the same process.

The Needs Assessment approach is comprised of a series of five key steps, as described in Figure 8-1. This process begins by establishing an inventory of assets, determining current and future projected conditions, calculating gaps relative to performance targets, and concluding with the calculation of the total cost in closing the gap. While this approach is readily applied to performance objectives associated with physical assets and their state of repair, the same approach is applied to the other performance objectives that focus on needs beyond the condition of physical assets.

Figure 8-1. Steps to Carry Out the Needs Assessment

California's gap analysis includes two gap calculations: *current gap* and *projected gap*.

- **Current gap** is the gap between current condition and the 10-year Desired State of Repair (DSOR).
- **Projected gap** is the gap between the expected future condition projection and the 10-year target DSOR.

Both current and projected gaps are shown in terms of the change in performance required to meet DSOR. For measures of good condition, a gap indicates the need to increase good conditions by the specified amount. For measures of poor or fair conditions a gap indicates the need to reduce poor conditions or fair conditions by the specified amount.

Figure 8-2 shows the gap analysis for both current and projected poor and fair gaps at the end of the 10-year period.

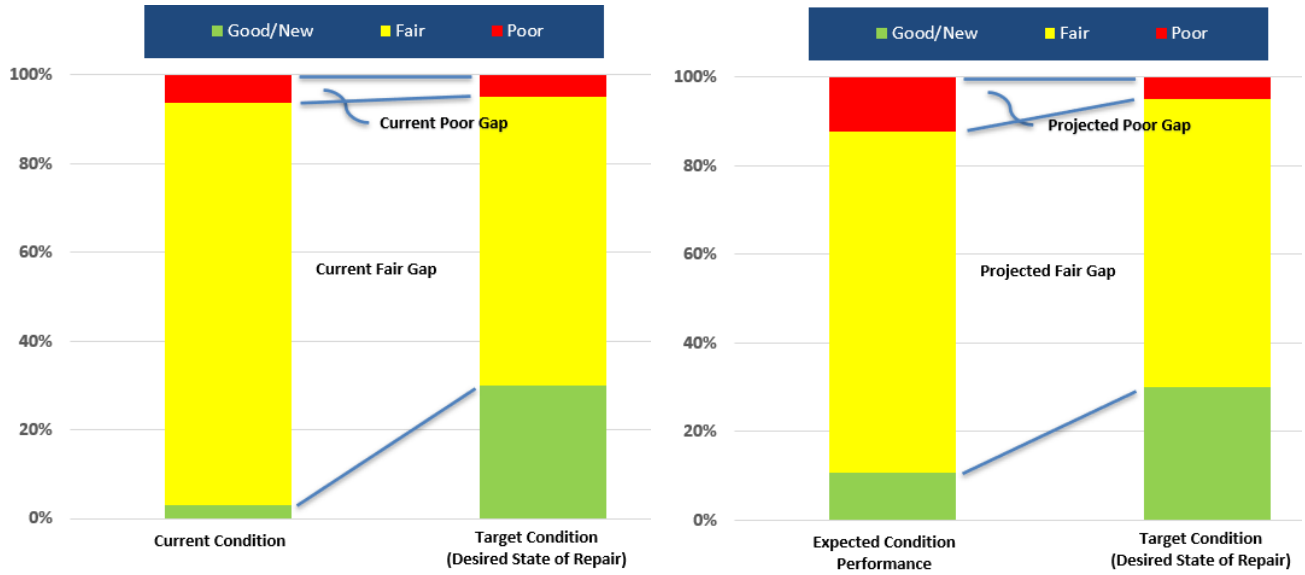


Figure 8-2. Current and Projected Gap Analysis Charts

The excel based PTAT was utilized for the gap analysis as shown in Appendix B. It enabled both the state and regional transportation agencies to conduct the analysis based on their specific investment strategies outlined in Chapter 7 and to factor in the cost of risk mitigation.

8.3. Performance Scenario: Maintain Condition

This scenario is based on the funding required in preservation, rehabilitation and reconstruction work to maintain current condition over a 10-year period for NHS pavement and bridges. This scenario also assumes that additional maintenance funding would be required to sustain the state of repair further for both state and local agencies, but is not explicitly included as part of the calculations. Funding for new construction is also included in the performance framework which adds to the good condition over the 10-year period.

The PTAT was utilized to predict future conditions for both state and locally-owned NHS assets. This scenario was based on a statewide performance model that included deterioration rates and unit costs used in the 2021 SHSMP with investments adjusted in fair or poor assets to maintain end of period conditions. Investment in risk mitigation programs is consistent across all scenarios and explained further in the Expected Performance Scenario.

8.4. Performance Scenario: Expected Condition

For this scenario, MPOs submitted their expected performance for condition of NHS pavement and bridges to Caltrans based on their 2022 TAMP PTAT results with most MPOs re-evaluating performance based on the addition of IIJA funding. Because cities and counties are responsible for managing their respective portions of the NHS, expected performance is the aggregate of all of these local agencies within an MPO. Each MPO is able to then reflect investment strategies based on their individual inventories, condition, funding and risk management approach. Funding for new construction is also included in the performance framework which adds to the good condition over the 10-year period. As indicated in Chapter 3, most MPOs had no change to their PTATs due to IIJA funding, and the few that did update their investments in pavement, it did not change the statewide aggregate performance targets.

Most of the MPOs indicated that their strategies for investing on the NHS are supported by regional transportation plans; but in some cases, there was acknowledgement that there are no requirements for spending state or federal funding on the NHS which was a factor in their resulting performance targets. Planned investments in mitigating risk on the locally-owned NHS was not included in the PTATs received from the MPOs which implies that the entire investments provided in the five work types are applied to condition improvement.

The 2022 TAMP PTAT was also used for the state-owned NHS analysis of expected performance. Weighted averages for investments were utilized based on the portion of NHS to the total SHS, to develop performance projections and estimate funding levels that included re-evaluation due to IIJA funding. Investments were split into federal work types by review of the projects included in the 10-year project book available at the time of TAMP development. Investments in risk were factored into the

performance analysis for state-owned NHS assets including funding for permanent restoration, protective betterments and work associated with seismic retrofitting and scour mitigation of bridges. The remaining investments after subtracting the cost of the NHS portion for risk mitigation was the available investments for condition improvement of pavement and bridges.

The expected funding performance scenario for both state and locally-owned NHS assets is based on average annual revenues maintained over a 10-year period that factors in risk mitigation. This funding scenario is described in Section 6.4. Available Asset Management Funding Section of Chapter 6. Financial Plan.

Results from Caltrans and reporting MPOs were aggregated together using NHS lane mile weighting to develop a performance scenario that truly reflects the variety of circumstances and strategies across the state of California.

8.5. Performance Scenario: Desired State of Repair

The performance scenario for DSOR is based on annual funding in preservation, rehabilitation, and reconstruction work required to meet performance targets over a 10-year period. This scenario includes the additional maintenance funding required to sustain the state of repair further for both state and local agencies, but is not explicitly included as part of the calculations for improving condition. Funding for new construction is also included in the performance framework which adds to the good condition over the 10-year period.

A statewide analysis was used similar to the Performance Scenario: Maintain Condition for developing performance projections and estimating funding levels. This analysis assumes that local agencies will apply additional funds necessary to meet the desired condition state.

NHS Assets

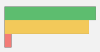
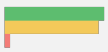
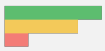
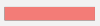
Table 8-1 presents the gap analysis for NHS pavements and bridges. There is a current gap presented for each asset and performance measure combination. A gap is projected for Interstate pavements, because of the difference in the calculation methods for pavement condition. As indicated in Chapter 3. Asset Performance Targets, NHS pavement condition is based on outer lane distresses only whereas for the SHS, all lanes are used to calculate complete pavement condition. However, using the all lanes criteria, Caltrans is expected to meet DSOR targets for the Interstate. Non-Interstate NHS pavements are owned by both state and local agencies. Though the state-owned portion is expected to meet DSOR, the combined subsystem is not unless an additional portion of the local SB 1, IIJA, or other funding sources is applied to the local NHS.

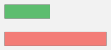
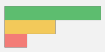
The 2022 TAMP PTAT suggests local agencies would need to spend $69 million more per year to meet the DSOR for pavement based on the difference in spending on poor to good and fair to good work. 56% of planned investments on the local NHS pavements are expected to be spent on poor to good improvements or reconstruction type work, whereas to meet the DSOR, more would need to be spent in reconstruction activities. For improvement in fair pavements, the PTAT expected performance results indicate that 18% would be spent compared to 2% to achieve the DSOR. The assumption on how much of the work is improving condition is a primary factor in the results. For the state-owned non-Interstate

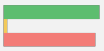
NHS, Caltrans would need to spend an additional $152 million annually per the PTAT results to achieve DSOR, based on a difference in calculation for pavement condition as explained earlier.

To close the performance gap for NHS bridges, the bridge analysis calculates a significant increase in funding of $480 million per year over the expected scenario, resulting in $698 million in annual funding for local NHS bridges to meet the DSOR. Funding for these gaps could be closed by shifting funding to the NHS or by augmenting with funding from local sources.

Table 8-1. Performance Gaps for NHS Assets

NHS Assets	Annual Funding ($M)	Good	Fair	Poor	
Interstate Pavements (lane miles)					
Maintain Current Performance	$739	47.9%	50.2%	1.9%	
10-Year Expected Performance	$795	51.2%	47.3%	1.5%	
10-Year DSOR Performance	$935	60.0%	39.0%	1.0%	
Current Gap		12.1%	11.2%	0.9%	
10-Year Projected Gap		8.8%	8.3%	0.5%	
Non-Interstate NHS Pavements (lane miles)					
Maintain Current Performance	$1,346	23.8%	66.2%	9.9%	
10-Year Expected Performance	$1,703	34.7%	57.8%	7.5%	
10-Year DSOR Performance	$1,924	34.1%	60.9%	5.0%	
Current Gap		8.6%	6.5%	2.1%	
10-Year Projected Gap		0.0%	0.0%	2.4%	
State-owned Non-Interstate NHS Pavements (lane miles)					
Maintain Current Performance	$1,000	43.1%	54.4%	2.5%	
10-Year Expected Performance	$1,165	50.3%	47.9%	1.8%	
10-Year DSOR Performance	$1,317	57.6%	40.9%	1.5%	
Current Gap		14.5%	13.5%	1.0%	

NHS Assets	Annual Funding ($M)	Good	Fair	Poor	
10-Year Projected Gap		7.3%	7.0%	0.3%	
Locally-owned Non-Interstate NHS Pavements (lane miles)					
Maintain Current Performance	$346	3.0%	79.0%	18.0%	
10-Year Expected Performance	$538	17.7%	68.6%	13.8%	
10-Year DSOR Performance	$607	7.0%	84.0%	9.0%	
Current Gap		4.0%	0.0%	9.0%	
10-Year Projected Gap		0.0%	0.0%	4.8%	
NHS Bridges (deck area)					
Maintain Current Performance	$1,060	48.5%	46.1%	5.4%	
10-Year Expected Performance	$1,015	45.5%	51.6%	2.9%	
10-Year DSOR Performance	$1,521	48.5%	50.0%	1.5%	
Current Gap		0.0%	0.0%	3.9%	
10-Year Projected Gap		3.0%	1.6%	1.4%	
State-owned NHS Bridges (deck area)					
Maintain Current Performance	$654	49.9%	45.7%	4.4%	
10-Year Expected Performance	$797	47.8%	50.4%	1.7%	
10-Year DSOR Performance	$823	48.5%	50.0%	1.5%	
Current Gap		0.0%	0.0%	2.9%	
10-Year Projected Gap		0.7%	0.4%	0.2%	
Locally-owned NHS Bridges (deck area)					
Maintain Current Performance	$406	35.8%	50.5%	13.7%	

NHS Assets	Annual Funding ($M)	Good	Fair	Poor	
10-Year Expected Performance	$218	26.3%	60.9%	12.8%	
10-Year DSOR Performance	$698	48.5%	50.0%	1.5%	
Current Gap		12.7%	0.5%	12.2%	
10-Year Projected Gap		22.2%	10.9%	11.3%	

SHS Assets

For state-owned assets, a gap analysis is completed as part of the SHSMP needs assessment. Funding levels for all performance objectives except for emergency response, safety and court ordered requirements which are funded off the top are established through trade-off analysis, which considers investment strategies defined in the TAMP, Caltrans strategic goals, statutory and funding constraints, and transportation priorities. The resulting investment allocation across SHS objectives, inclusive of state-owned NHS pavements and bridges, represents an optimal balance, while assuring key performance targets are met.

With investment levels established for each performance objective, a comprehensive investment plan is developed that sets performance targets and funding constraints for each Caltrans' district. This process is explained further in the 2021 SHSMP and as shown in Figure 8-3.

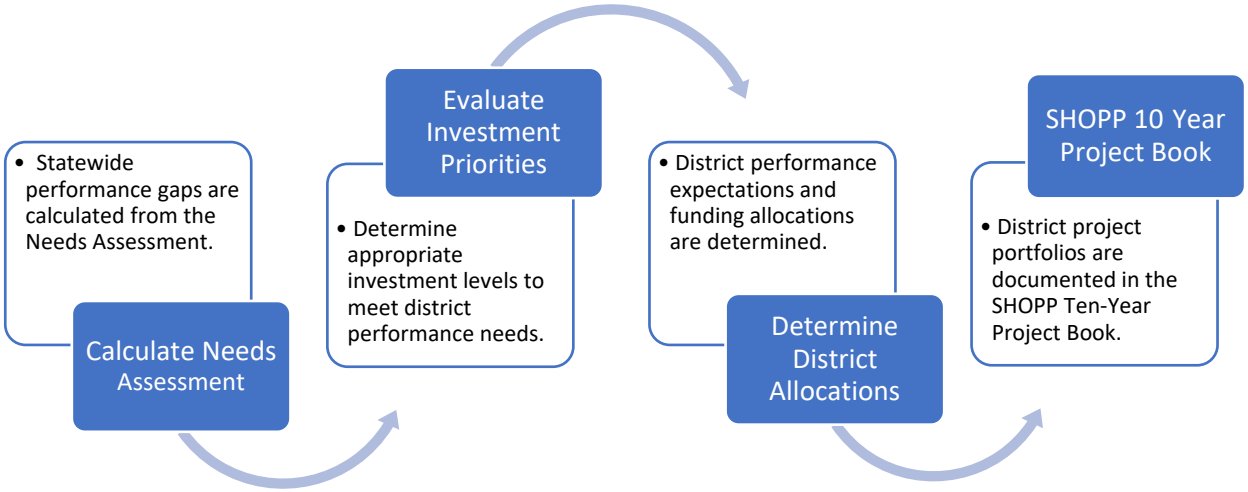


Figure 8-3. Development of the Investment Plan

Funding levels and performance accomplishments from the SHSMP are used to develop expected performance projections for SHS assets which is demonstrated in Chapter 4. Life Cycle Planning.

The needs assessment and investment plan of the SHSMP is the basis for the DSOR and Expected Performance scenarios. Expected pavement performance is based on PaveM analysis which resulted in better conditions than the DSOR primarily because meeting performance goals precisely is not realistic in most cases. The DSOR investment for pavement is therefore demonstrated by a manual calculation to meet performance goals exactly. For all other assets, the needs assessment is estimated at a district level which typically results in higher investment to bring some districts up to a minimum performance threshold.

For the Maintain Performance scenario, an approach was used that considered the paveM analysis for pavements to determine investment levels. An analysis similar to the SHSMP was used for the other core assets which includes bridges, TMS and drainage assets over the 10 year period.

Table 8-2 presents the gap analysis of SHS assets. There is a current gap for each asset and performance measure. The costs include both SHOPP and maintenance investments.

Table 8-2. Performance Gaps for SHS Assets

SHS Assets	Annual Funding ($M)	Good	Fair	Poor	
Pavement Class I (lane miles)					
Maintain Current Performance	$1,280	66.2%	32.6%	1.2%	
10-Year Expected Performance	$1,166	62.5%	36.9%	0.6%	
10-Year DSOR Performance	$1,125	60.0%	39.0%	1.0%	
Current Gap		0.0%	0.0%	0.2%	
10-Year Projected Gap		0.0%	0.0%	0.0%	
Pavement Class II (lane miles)					
Maintain Current Performance	$489	46.8%	52.4%	0.9%	
10-Year Expected Performance	$723	63.0%	36.5%	0.5%	
10-Year DSOR Performance	$643	55.0%	43.0%	2.0%	
Current Gap		8.2%	9.4%	0.0%	
10-Year Projected Gap		0.0%	0.0%	0.0%	

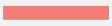
SHS Assets	Annual Funding ($M)	Good	Fair	Poor	
Pavement Class III (lane miles)					
Maintain Current Performance	$107	44.7%	54.4%	1.0%	
10-Year Expected Performance	$129	52.7%	47.0%	0.3%	
10-Year DSOR Performance	$106	45.0%	53.0%	2.0%	
Current Gap		0.3%	1.4%	0.0%	
10-Year Projected Gap		0.0%	0.0%	0.0%	
SHS Bridges (deck area)					
Maintain Current Performance	$889	54.1%	42.5%	3.5%	
10-Year Expected Performance	$681	47.8%	51.3%	0.9%	
10-Year DSOR Performance	$797	48.5%	50.0%	1.5%	
Current Gap		0.0%	0.0%	2.0%	
10-Year Projected Gap		0.7%	1.3%	0.0%	
SHS Drainage (linear feet)					
Maintain Current Performance	$372	71.6%	18.4%	10.0%	
10-Year Expected Performance	$344	71.7%	19.8%	8.5%	
10-Year DSOR Performance	$262	70.0%	20.0%	10.0%	
Current Gap		0.0%	0.0%	0.0%	
10-Year Projected Gap		0.0%	0.0%	0.0%	
SHS TMS (assets)					
Maintain Current Performance	$168	79.0%	n/a	21.0%	
10-Year Expected Performance	$211	90.2%	n/a	9.8%	
10-Year DSOR Performance	$210	90.0%	n/a	10.0%	

SHS Assets	Annual Funding ($M)	Good	Fair	Poor
Current Gap		11.0%	n/a	11.0%
10-Year Projected Gap		0.0%	n/a	0.0%

The gap analysis in Table 8-3 represents Supplementary Assets on the SHS. There is a current gap for each asset and performance measure.

Table 8-3. Performance Gaps for Supplementary Assets on the SHS

Supplementary Assets on the SHS	Good	Fair	Poor
Drainage Pump Plants (locations)			
Current Condition	15.3%	34.4%	50.3%
10-Year DSOR	50.0%	40.0%	10.0%
Current Gap	34.7%	0.0%	40.3%
Highway Lighting (assets)			
Current Condition	37.9%	15.3%	46.7%
10-Year DSOR	45.0%	30.0%	25.0%
Current Gap	7.1%	0.0%	21.7%
Office Buildings (square feet)			
Current Condition	43.6%	28.9%	27.6%
10-Year DSOR	50.0%	40.0%	10.0%
Current Gap	6.4%	0.0%	17.6%

Supplementary Assets on the SHS	Good	Fair	Poor	
Overhead Sign Structures (each)				
Current Condition	57.3%	35.5%	7.1%	
10-Year DSOR	40.0%	45.0%	15.0%	
Current Gap	0.0%	0.0%	0.0%	
Safety Roadside Rest Areas (locations)				
Current Condition	36.0%	36.0%	27.9%	
10-Year DSOR	30.0%	45.0%	25.0%	
Current Gap	0.0%	0.0%	2.9%	
Complete Streets (linear feet)				
Current Condition	70.6%	22.5%	6.9%	
10-Year DSOR	69.0%	29.0%	2.0%	
Current Gap	0.0%	0.0%	4.9%	
Transportation-Related Facilities (square feet)				
Current Condition	22.8%	17.6%	59.6%	
10-Year DSOR	40.0%	40.0%	20.0%	
Current Gap	17.2%	0.0%	39.6%	
Weigh in Motion Scales (stations)				
Current Condition	44.3%	17.9%	37.9%	
10-Year DSOR	40.0%	50.0%	10.0%	
Current Gap	0.0%	0.0%	27.9%	

8.6. Closing the Performance Gap

California's NHS and SHS will require substantial investment to achieve established DSOR 10-Year targets. A number of different strategies defined previously will need to be pursued by local, regional, and state partners in order to assure that the performance gaps identified in the TAMP are addressed.

NHS Assets

The gap analysis for NHS assets identifed the following key observations:

- Caltrans expects to achieve DSOR for Interstate pavements although a gap is identified for the NHS based on performance of outer lane pavement distresses only.
- Caltrans expects to achieve DSOR for state-owned non-Interstate NHS although a gap is identified for the NHS based on performance of outer lane pavement distresses only. The combined state and locally-owned non-Interstate NHS pavements are not expected to meet DSOR unless funding is redirected to the NHS from non-NHS investments or additional funding becomes available for the local NHS.
- There is a projected gap for NHS bridges. Caltrans and local agencies need to direct additional funding to NHS bridges to close the identified gaps even with the additional IIJA funding.

Closing Performance Gaps on the NHS

A shift in prioritization of investments towards NHS assets by local agencies would help to advance achieving performance goals. IIJA and SB 1 funds coupled with local measure funds bring additional financial resources to bear that will assist in closing these gaps.

Caltrans has already initiated a program within the SHOPP to specifically target bridges in poor condition as stated in Chapter 4. Life Cycle Planning. The new program is expected to improve the conditions of millions of square feet of bridges over the next 4 years.

Annual Review

In addition to the strategies to close performance gaps, Caltrans also tracks progress towards the 10-year targets established in the TAMP. Annually, Caltrans reports progress made towards implementing their TAMP to FHWA. The documented progress relies on current information to demonstrate how investment strategies in the TAMP are being used to make progress towards NHS performance targets and goals. The report includes prior year estimates for expenditures by the 5 federal work types on the NHS and compares these actual investments to the planned TAMP investments to evaluate progress.

FHWA also assesses progress towards achieving performance targets over a 4-year baseline performance period as part of Performance Management rule 23 CFR 490. The FHWA will assess progress towards achieving performance targets over the 4-year baseline performance period (defined as the "Baseline Performance Period"), measuring against biennial reports submitted by Caltrans. If FHWA finds that significant progress towards state targets has not been achieved in two consecutive two-year reporting periods, the state must include a plan for improving performance in its next progress report. Significant progress is defined as current performance exceeding baseline performance or equaling or exceeding the performance target.

SHS Assets

To monitor progress in achieving performance targets on the SHS, Caltrans Asset Management established a process for reviewing project portfolios on a quarterly basis and established benchmarks (future condition projections) to assess the progress towards longer-term targets reported to the Commission annually.

Quarterly Review and District Certifications

On a quarterly basis, project portfolios are reviewed in each district to ensure that the performance included in the projects meet DSOR targets within financial constraints. A Fact Sheet is prepared and reviewed for these requirements shown in Figure 8-4 and then certified once requirements are met. Caltrans will then publish the ten years of statewide projects in a virtual SHOPP Ten-Year Project Book.

Page 1 Attachment B

Fact Sheet: 5-Year Portfolio Assessment

FY 2021/22 Quarter 1

District
Statewide

Fact Sheet Report Date
October 20, 2021

Project Portfolio Summary

Total 5-Year Project Portfolio Cost	Total Number of Project in Last 5-Years	Average Portfolio Support-to-Capital Ratio	Are All Financial Requirements Satisfied?	Are All Performance Requirements Satisfied?
$17,516M	728	28%	No	No

Note: Project costs and counts exclude reservation projects

Total 5-Year Project Costs

The total cost of the District's project portfolio must not exceed the SHOPP 5-Year Target Investment from the District Performance Plan. (TAM 19-04)

Fiscal Years	5-Year Target Funding ($K)	# of Projects	Project Cost ($K)	Balance ($K)	Percent of 5-Year Target Funding	Within 5-Year Target Funding?
2026/27 to 2030/31	$18,299,776	728	$17,515,915	$783,861	95.7%	Yes

Annual Total Project Costs

The total cost of the District's project portfolio in any one year of the last 5-years must fall within 20% +/-5% (i.e., greater than 15% and less than 25%) of the District's total SHOPP 5-Year Target Investment from the District Performance Plan. The two years of the District's project portfolio corresponding to the PID Workplan (years 6 & 7) must be less than 40% of the District's SHOPP 5-Year Target Investment. (TAM 19-04)

Fiscal Year	5-Year Target Funding ($K)	Annual Target Funding ($K)	# of Projects	Project Cost ($K)	Balance ($K)	Percent of 5-Year Target Funding	Within 20% (+/-5%) Annual Target Funding?
LL PA&ED	$18,299,776		16	$54,039		0.3%	
2026/27	$18,299,776	$3,659,955	156	$3,610,759	$49,196	19.7%	Yes
2027/28	$18,299,776	$3,659,955	114	$2,718,103	$941,852	14.9%	No
2028/29	$18,299,776	$3,659,955	170	$3,431,264	$228,691	18.8%	Yes
2029/30	$18,299,776	$3,659,955	159	$3,929,340	($269,385)	21.5%	Yes
2030/31	$18,299,776	$3,659,955	129	$3,772,409	($112,454)	20.6%	Yes

Percent of 5-Year Target Funding for Years 6 & 7	Less Than 40% Annual Target Funding for Years 6 &7?
34.9%	Yes

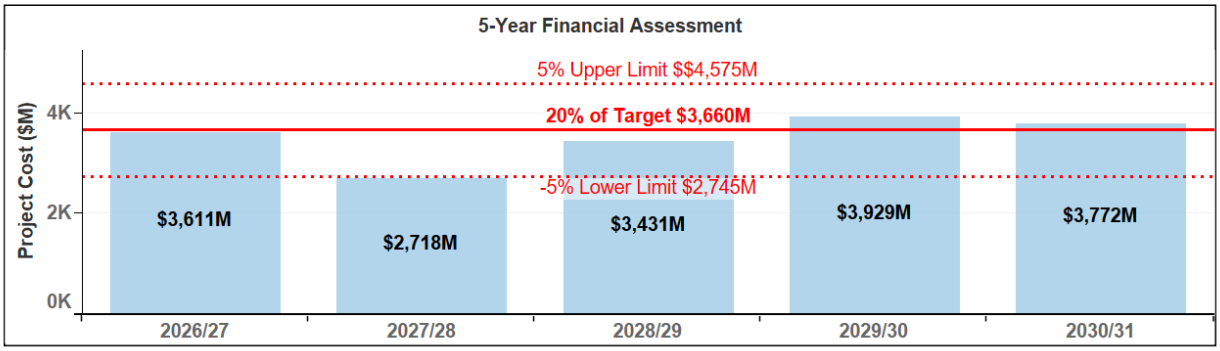


Figure 8-4. Quarterly Project Book Certification Fact Sheet

In addition to the quarterly reviews, a series of dashboards were developed to help monitor project data including asset inventory data and analysis outcomes. The reports, charts, and graphs are used to support development of the SHSMP, TAMP and the Project Book. It enables timely review and evaluation of projects and assists in monitoring progress being made towards performance targets.

A series of dashboards that are updated daily help to evaluate a Districts' portfolio of projects. One unique dashboard developed to summarize the distribution of pavement treatments by district is shown in Figure 8-5 below:

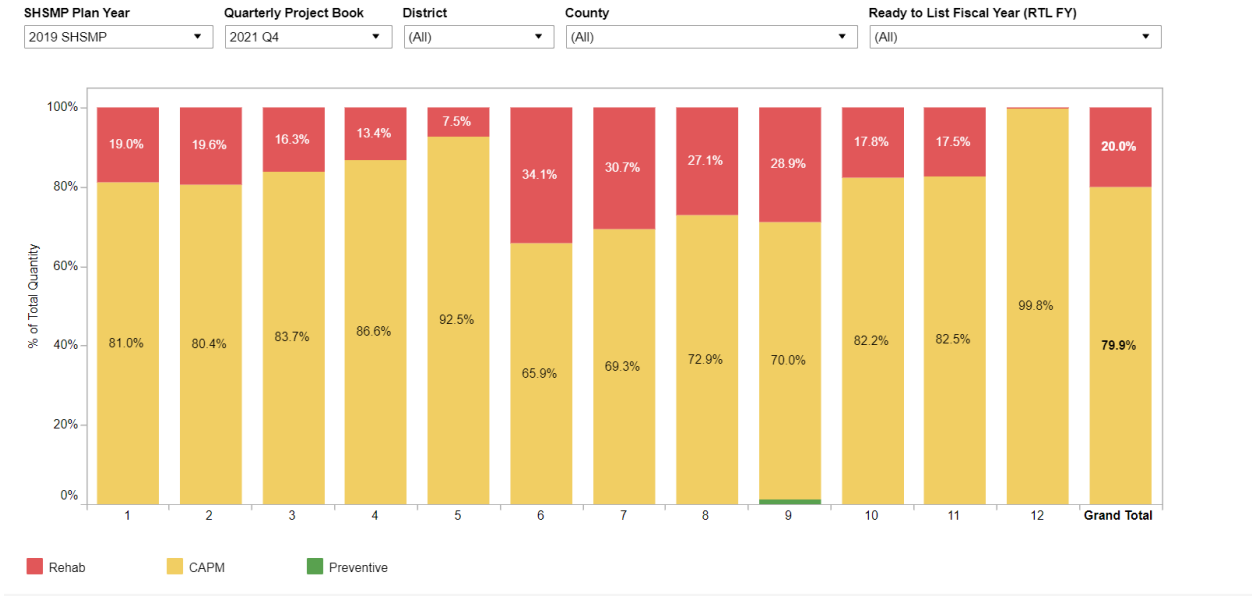


Figure 8-5. Project Book Pavement Treatments by District

Annual Benchmarks

Caltrans' annual benchmarks[44] are developed using a calculation framework that relies on the initial baseline inventory and condition data, deterioration models, and project-level accomplishments for all work completed within a 10-year performance period. A four-step calculation is carried out for each year's performance to determine anticipated asset conditions, as summarized in Figure 8-6.

The benchmarks account for the projected condition of the assets at the completion of the project when the improvements are realized. This is at the end of construction activity and the opening of the highway facility to the traveling public. This approach to condition accounting differs from a project portfolio planning framework, where fiscal balancing requirements necessitate the use of contract execution dates. The benchmark analysis relies on several project-level variables and assumptions that

[44] Caltrans, Performance Benchmark Report, June 2021, https://dot.ca.gov/-/media/dot-media/programs/asset-management/documents/2021_performance_benchmarks_report_ctc_06-01-2021_final_a11y.pdf

in aggregate contribute to uncertainties in future performance projections. The combined uncertainties generally become larger in the later years of the analysis period as deterioration projections and project-level uncertainties grow which are reflected in the analysis using a Monte Carlo simulation and uncertainty bands. As an example, Figure 8-7 presents Pavement Class 1 Benchmarks reported to the Commission in June 2021.

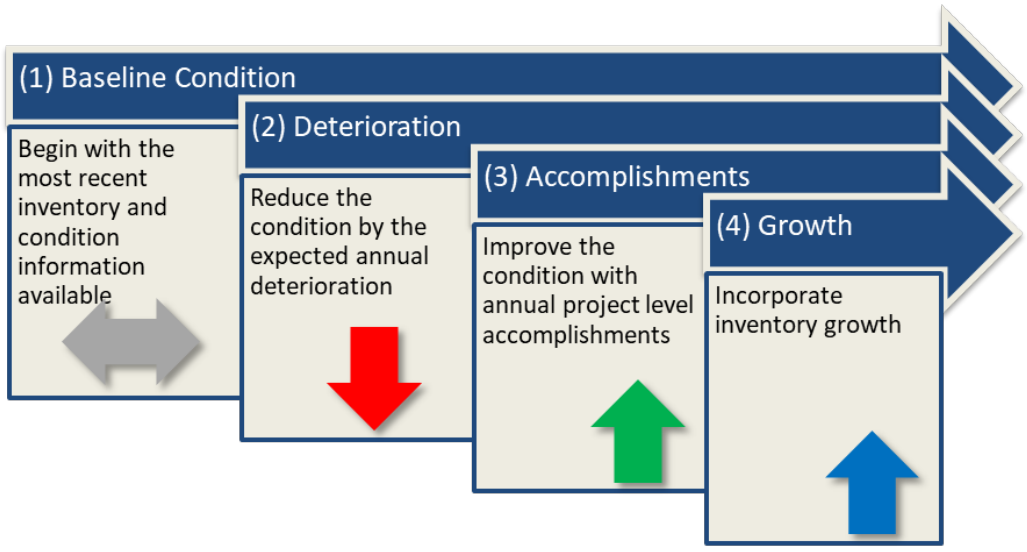


Figure 8-6. Steps in Calculating Benchmark Projections

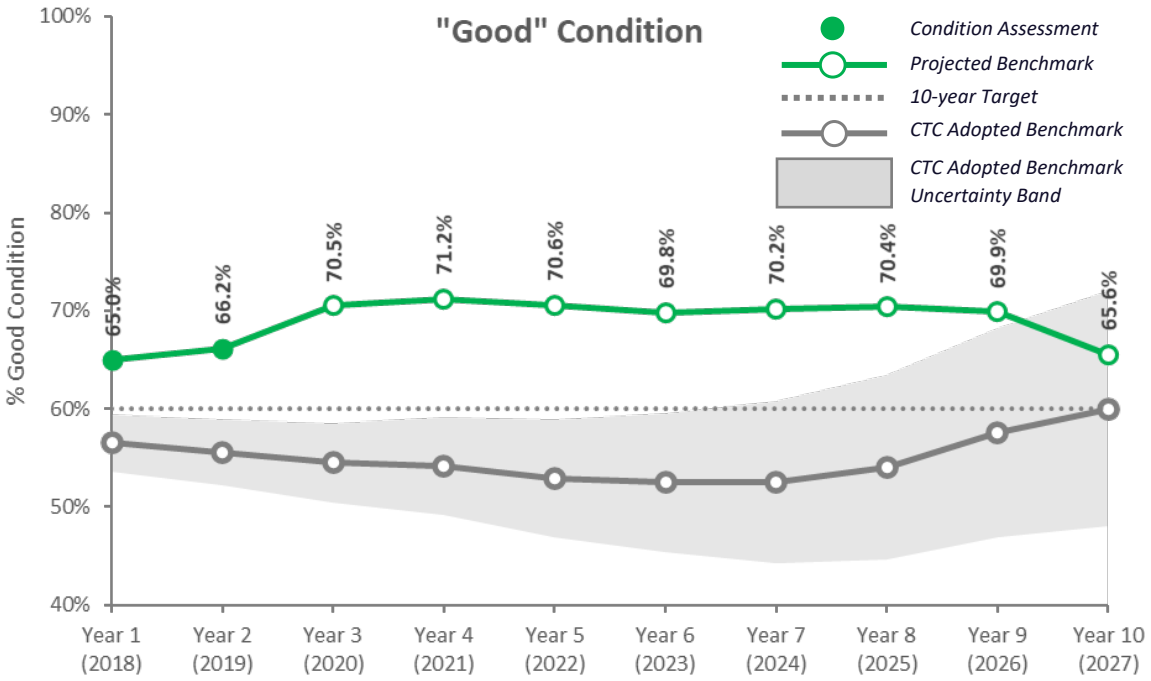


Figure 8-7. Pavement Class 1 Benchmarks, Good Condition

Closing Performance Gaps on the SHS

Caltrans anticipates closing all performance gaps for the four primary SHS asset classes. Performance gaps are expected to persist or widen, however, for the supplementary asset classes, as there is insufficient funding in the current financial plan over the 10-year period ahead. With the addition of IIJA funding, Caltrans will evaluate performance gaps remaining including supplementary assets and address highest priority needs to improve asset conditions.

9. TAM Process Improvements

This chapter supplements the discussion of the current state of asset management practice in California with a set of planned future asset management-related improvements. Transportation asset management is a process of continual improvement. The TAMP will evolve and be updated alongside California's asset management-related business processes and activities.

9.1. Overview

Good transportation asset management is a continuously improving set of practices. California has been improving TAM programs and data, making progress towards aligning them with state goals and targets. This chapter details how California will implement TAM performance improvements in the TAMP and focus on specific initiatives to achieve better TAM performance. The improvements listed in this chapter were taken from TAMP listening sessions and workshops in collaboration with federal, state, regional and local stakeholders to benefit agencies throughout California. For the 2022 TAMP, each of the previously identified improvements were reviewed and an updated status is provided for each.

9.2. TAM Process Improvements

California TAMP stakeholders identified the following priority TAM process improvements to support the defined objectives of the TAMP. They represent the initiative areas that will be undertaken to make progress on asset management performance resulting in a better transportation system for California and to meet federal and state requirements.

Data and Tools

Data-driven decision making is well understood and an important component of many of the business processes that exist for TAM in California. Developing the TAMP identified areas of weakness and many opportunities to strengthen investment decisions in the future. Significant progress has been made on data improvements and tool availability to support TAM since the initial TAMP as provided below:

- During the development of the initial TAMP, awareness of the location and condition of the locally-owned NHS was identified as an area for improvement. For the 2022 TAMP, Caltrans prepared GIS shapefiles, Google map import files and PDF maps to clearly define the NHS inventory and condition at the county level.
- Reporting challenges associated with the financial reporting requirements of the TAMP were identified as an area for improvement in the initial TAMP. For the 2022 TAMP, Caltrans worked with the California State Controller to develop financial data sets to help support local agencies in determining past NHS expenditures for each of the five work types required by federal regulations. No transportation agency, including Caltrans, is currently accounting for expenditures on the NHS by the five work types directly. During workshops with all NHS owners, methodologies were developed to segregate expenditures into the five work types for the NHS from data currently being reported to the State Controller by each agency.
- Condition targets were set shortly after the initial TAMP was developed. Caltrans developed a method to determine the California TAMP targets based on input from all MPOs. This inclusive target setting approach resulted in all NHS owners adopting the TAMP targets. The lack of any analysis tool to aid in setting each agencies target was identified. For the 2022 TAMP development, Caltrans developed a performance target analysis tool to provide a consistent approach to assess reasonable TAMP targets. The tool was customized and sent to each MPO that had NHS pavement and/or bridges in their region for their use in development of performance targets. Caltrans also used the tool for statewide performance analysis. Completed funding, target and performance tool results were submitted to Caltrans by the MPOs for use in developing the statewide TAMP condition targets and performance scenarios shown in Appendix B.
- At the mid-plan performance report in 2020, Caltrans realized the need to move the performance evaluation upstream in the process to provide a performance analysis before planning is undertaken. Caltrans carries this out through our SHSMP and plans to develop a project evaluation tool for our partners to use prior to the submittal of their Regional Transportation Plans. This new tool is expected to be developed in the coming year to provide a resource for assessing expected performance outcomes before planning begins.

Local, Regional, and State Coordination

The need to better coordinate local, regional, and state decision-making about assets is still an important area that needs further improvement. As mentioned in the Data and Tools section, a process was established in the 2022 TAMP to develop performance targets on the local NHS in a consistent way through the development of a performance simulation tool. However, more work is underway to coordinate local needs with state investment decision-making. Making progress in some of the areas listed below can be achieved through development of stakeholder working groups committed to advancing these asset management initiatives:

- Define communication and coordination process and protocol
- Determine roles and governance
- Coordinate data improvement initiatives
- Ability to see a holistic view of assets throughout the state
- Sharing of project plans
- MAP-21/FAST Act performance measurement coordination (PCI vs IRI)
- Coordination on a common permitting process
- Coordinate development of improved LCP practices
- Provide a forum for ongoing asset management discussion and sharing among transportation agencies in California

Asset Modeling

Investment decision-making is based on an understanding of asset behavior given funding availability and choices of actions to improve asset condition and meet other transportation objectives. Making the right choices at the right time is an important tenet of TAM. California's transportation agencies have been at the forefront of developing asset models to make good life cycle management decision during the resource allocation process. Stakeholders identified the need to continue to improve the understanding of pavement and bridge assets and the need to better understand other asset classes as they are included in the TAMP. With each cycle of the SHSMP, improvements are made in deterioration modelling including pavement and bridges. Network level analysis including life cycle planning has improved since the last TAMP as discussed in Chapter 4, but more work is needed to improved bridge and pavement management systems to meet federal regulations.

Deterioration modelling of local NHS pavement and bridges can be further improved through more data analysis. During development of the 2022 TAMP, research was done to develop deterioration curves for local NHS pavement, but the HPMS data proved too limited to draw any meaningful conclusions. Instead, Class 3 pavements on the SHS was the basis of deterioration rates for the local NHS and was recommended to the MPOs for predicting end of period conditions but could be adjusted in the performance tool if better deterioration models were available.

TAM Support for Broader Transportation Objectives

California's transportation goals and fundamental objectives address support for improvements in areas such as safety, mobility, economic development, social equity, climate change, and environmental mitigation. Understanding where and how transportation assets can better support these areas is important during the planning, programming, and implementation process. Some of these opportunities include how asset condition influences safety, supports active transportation, provides transportation access to disadvantaged communities, and allows for goods movement. A better understanding of these relationships is needed for integration into the investment decision-making process. For the 2022 TAMP, the following areas have been identified for future progress; performance measures should be developed to help understand these relationships and that there was a need to prioritize the relationships where TAM will have the greater impact.

Safety - Caltrans Asset Management and Safety programs have been collaborating on a performance driven network and project evaluation methodology. By applying the principles of performance management in a safety context, Caltrans is optimistic we can reduce the number of fatal and serious injuries in California. Caltrans recently completed work to better align safety investments with available safety data, continues to research multi-objective decision-making, and is working towards an equity index as discussed in Chapter 7 to incorporate an equity perspective in a performance framework and as indicated below.

Equity – Equity conversations are commonplace in asset management circles. Asset management often informs transportation investment decision-making. How equity should be included in these decisions is the subject of much research. Moving forward, it does seem clear that asset management will need to adapt to consider performance metrics and outcomes that are more comprehensive than condition alone. This is an area that Caltrans and our partners are continuing to work towards solutions.

Climate Change – Climate change is a profound challenge that will require asset management to adapt to new priorities and new measures of success in future TAMPs. Climate induced sea level rise, extreme weather patterns, drought and wildfires are requiring transportation agencies to extend available resources into entirely new investment areas. System resiliency, proactive risk reduction and emission avoidance strategies are changing the nature of providing transportation. Emission levels, zero emission vehicles, and multi-modalities are just some of the measures being applied to programs and projects alike.

It is clear that transportation success is still about the ability to move people from origin to destination; however, how people are being moved, the impact on the environment and accessibility of the transportation system are all emerging to push asset management beyond simply measuring the condition of assets.

Risk Mitigation

Much has been done across the state through various risk mitigation programs to safeguard California for a more resilient transportation system as discussed in Chapter5. Managing Risks and Building Resilience. Integrating risk management decisions with assets has also been an ongoing practice with project delivery. However, the integration of risk into asset management is even more critical to achieve a resilient system of assets.

For the 2022 TAMP, significant improvements for integrating risk was made by including risk mitigation costs into the performance analysis providing performance outcomes for pavement and bridges that are more realistic and by including a TAMP investment strategy specific to climate action.

Corridor View of TAM Investment Decision-Making

Many California travelers move via existing high-volume corridors. Investment decision-making related to assets can be enhanced using corridor planning and management. Corridor views will support the NHS focus of the federal requirements including climate change goals and support collaborative decision-making across local, regional, and state agencies. Moving forward with this priority we will first look at existing corridor planning and management processes and explore how these can be enhanced with the addition of asset needs. Other activities will look at identification of other corridors based on travel volume and asset needs.

With the current development of TAMS expected to be complete by 2023, additional tools for corridor investment decision-making will be available.

TAM Communications

The stakeholders involved in the TAMP development process recognized the value and importance of better communicating TAM needs and accomplishments.

In stakeholder discussions for the 2022 TAMP, improved TAM communications was identified as being a high priority with more communication needed on a regular basis that includes the sharing of information and data, success stories, and best practices that could be used on a statewide basis.

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Glossary

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
AMBAG	Association of Monterey Bay Area Governments
APCS	Automated Pavement Condition Survey
BCAG	Butte County Association of Governments
BIRIS	Bridge Inspection Report Information System
CAG	County Association of Governments
COG	Council of Governments
CTC	County Transportation Commission
CalSTA	California State Transportation Agency
Caltrans	California State Department of Transportation
CAPM	Capital Preventative Maintenance
CAPTI	Climate Action Plan for Transportation Infrastructure
CCTV	Closed Circuit Television
Census	Traffic Census Station
CHP	California Highway Patrol
CIP	Culvert Inspection Program
CMS	Changeable Message Sign
CFR	Code of Federal Regulation
Commission	California Transportation Commission
Detection	Traffic Monitoring Detection Station
DOT	Department of Transportation
DPP	District Performance Plans
DSOR	Desired State of Repair
EMS	Extinguishable Message Sign
EO	Executive Order
FAST Act	Fixing America's Surface Transportation Act

FCOG	Fresno Council of Governments
FHWA	Federal Highway Administration
FO	Functionally Obsolete
Glenn CTC	Local Glenn County Transportation Commission
GHG	Greenhouse Gas
GIS	Geographic Information System
HAR	Highway Advisory Radio
Humboldt	Humboldt County Association of Governments
HM	Highway Maintenance Program
HPMS	Highway Performance Monitoring System
HSIP	Highway Safety Improvement Plan
HSRA	California High Speed Rail Authority
HTF	Highway Trust Fund
ICM	Integrated Corridor Management
IIJA	Infrastructure Investment and Jobs Act
IRI	International Roughness Index
ISO	International Standards Organization
ITS	Intelligent Transportation Systems
KCAG	Kings County Association of Governments
KCOG	Kern Council of Governments
LCCA	Life Cycle Cost Analysis
LCP	Life Cycle Planning
Lassen CTC	Lassen County Transportation Commission
LM	Lane Mile
LOS	Level of Service
M&O	Maintenance and Operations
M&R	Maintenance and Rehabilitation
MCTC	Madera County Transportation Commission
MAP-21	Moving Ahead for Progress in the 21st Century
MASH	Manual for Assessing Safety Hardware
MCAG	Merced County Association of Governments
MODA	Multi-Objective Decision Analysis
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
MTC	Metropolitan Transportation Commission
NBI	National Bridge Inventory
NCHRP	National Cooperative Highway Research Program
NHS	National Highway System
PaveM	Pavement Management System
PCI	Pavement Condition Index
PID	Project Initiation Document
PV	Present Value
RMRA	Road Maintenance and Rehabilitation Account
RTPA	Rural Transportation Planning Authority
RWIS	Roadway Weather Information System
SACOG	Sacramento Area Council of Governments
SANDAG	San Diego Association of Governments
SB 1	Senate Bill 1
SB 486	Senate Bill 486
SBCAG	Santa Barbara County Association of Governments
SCAG	Southern California Association of Governments
SHA	State Highway Account
SHC	California Streets and Highway Code
SHOPP	State Highway Operation and Protection Program
SHS	State Highway System

SHSMP	State Highway System Management Plan
SJCOG	San Joaquin Council of Governments
SLOCOG	San Luis Obispo Council of Governments
SM&I	Structure Maintenance and Investigation
SMART	Structure Maintenance Automated Report Transmittal
SRRA	Safety Roadside Rest Area
SRTA	Shasta Regional Transportation Agency
StanCOG	Stanislaus Council of Governments
STIP	State Transportation Improvement Program
STRAHNET	Strategic Highway Network
TAM	Transportation Asset Management
TAMAC	Transportation Asset Management Advisory Committee
TAMP	Transportation Asset Management Plan
TAMS	Transportation Asset Management System
TCAG	Tulare County Association of Governments
TMC	Transportation Management Center
TMPO	Tahoe Metropolitan Planning Organization
TMS	Transportation Management System
TOT	Transient Occupancy Taxes
VMT	Vehicle Miles Traveled

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Index of Federal Regulations

Code of Federal Regulations	Description	Chapter (s)	Section (s)	1st Page (s)
515.7	A State shall develop a risk-based asset management plan that describes how the NHS will be managed to achieve system performance effectiveness and State DOT targets for asset condition, while managing the risks, in a financially responsible manner, at a minimum practicable cost over the life cycle of its assets. The State DOT shall develop and use, at a minimum the following processes to prepare its asset management plan:			
515.7(a)	A State DOT shall establish a process for conducting performance gap analysis to identify deficiencies hindering progress toward improving or preserving the NHS and achieving and sustaining the desired state of good repair. At a minimum, the State DOT's process shall address the following in the gap analysis:	8		151
515.7(a)(1)	The State DOT targets for asset condition of NHS pavements and bridges as established by the State DOT under 23 U.S.C. 150(d) once promulgated.	8	8.2-8.5.	152-155
515.7(a)(2)	The gaps, if any, in the performance-of the NHS that affect NHS pavements and bridges regardless of their physical condition; and	8	8.5.	155
515.7(a)(3)	Alternative strategies to close or address the identified gaps.	8	8.6	163
515.7(b)	A State DOT shall establish a process for conducting life-cycle planning for an asset class or asset sub-group at the network level (network to be defined by the State DOT). As a State DOT develops its life-cycle planning process, the State DOT should include future changes in demand; information on current and future environmental conditions including extreme weather events, climate change, and seismic activity; and other factors that could impact whole of life costs of assets. The State DOT may propose excluding one or more asset sub-groups from its life-cycle planning if the State DOT can demonstrate to FHWA the exclusion of the asset sub-group would have no material adverse effect on the development of sound investment strategies due to the limited number of assets in the asset sub-group, the low level of cost associated with managing the assets in that asset sub-group, or other justifiable reasons. A life-cycle planning process shall, at a minimum, include the following:	4		75
515.7(b)(1)	The State DOT targets for asset condition for each asset class or asset sub-group;	4	4.3-4.6	81-101

Code of Federal Regulations	Description	Chapter (s)	Section (s)	1st Page (s)
515.7(b)(2)	Identification of deterioration models for each asset class or asset sub-group, provided that identification of deterioration models for assets other than NHS pavements and bridges is optional;	4	4.3-4.6	81-101
515.7(b)(3)	Potential work types across the whole life of each asset class or asset sub-group with their relative unit cost; and	4	4.3-4.6	81-101
515.7(b)(4)	A strategy for managing each asset class or asset sub-group by minimizing its life-cycle costs, while achieving the State DOT targets for asset condition for NHS pavements and bridges under 23 U.S.C. 150(d).	4	4.3-4.6	81-101
515.7(c)	A State DOT shall establish a process for developing a risk management plan. This process shall, at a minimum, produce the following information:	5		107
515.7(c)(1)	Identification of risks that can affect condition of NHS pavements and bridges and the performance of the NHS, including risks associated with current and future environmental conditions, such as extreme weather events, climate change, seismic activity, and risks related to recurring damage and costs as identified through the evaluation of facilities repeated damaged by emergency events carried out under part 667 of this title. Examples of other risk categories include financial risks such as budget uncertainty; operational risks such as asset failure; and strategic risks such as environmental compliance.	5	5.2	111
515.7(c)(2)	An assessment of the identified risks in terms of the likelihood of their occurrence and their impact and consequence if they do occur;	5	5.3	114
515.7(c)(3)	An evaluation and prioritization of the identified risks	5	5.4	115
515.7(c)(4)	A mitigation plan for addressing the top priority risks;	5	5.6-5.7	122-123
515.7(c)(5)	An approach for monitoring the top priority risks; and	5	5.7	123
515.7(c)(6)	A summary of the evaluations of facilities repeatedly damaged by emergency events carried out under part 667 of this title that discusses, at a minimum, the results relating to the State's NHS pavements and bridges	5	5.5	119
515.7(d)	A State DOT shall establish a process for the development of a financial plan that identifies annual costs over a minimum period of 10 years. The financial plan process shall, at a minimum, produce:	6		129
515.7(d)(1)	The estimated cost of expected future work to implement investment strategies contained in the asset management plan, by State fiscal year and work type;	6	6.4	137
515.7(d)(2)	The estimated funding levels that are expected to be reasonably available, by fiscal year, to address the costs of future work types. State DOTs may estimate the amount of available future funding using historical values where the future funding amount is uncertain;	6	6.2-6.3	131-136
515.7(d)(3)	Identification of anticipated funding sources; and	6	6.2	131
515.7(d)(4)	An estimate of the value of the agency's NHS pavement and bridge assets and the needed investment on an annual basis to maintain the value of these assets.	2	2.1	9
515.7 (e)	A State DOT shall establish a process for developing investment strategies meeting the requirements in § 515.9(f). This process must result in a description of how the investment strategies are influenced, at a minimum, by the following:	7		143
515.7(e)(1)	Performance gap analysis required under paragraph (a) of this section;	8	8.2-8.5	152-155
515.7(e)(2)	Life-cycle planning for asset classes or asset sub-groups resulting from the process required under paragraph (b) of this section;	8	8.2-8.5	152-155
515.7(e)(3)	Risk management analysis resulting from the process required under paragraph (c) of this section; and	8	8.2-8.5	152-155
515.7(e)(4)	Anticipated available funding and estimated cost of expected future work types associated with various candidate strategies based on the financial plan required by paragraph (d) of this section.	8	8.2-8.5	152-155

Code of Federal Regulations	Description	Chapter (s)	Section (s)	1st Page (s)
515.7(f)	The processes established by State DOTs shall include a provision for the State DOT to obtain necessary data from other NHS owners in a collaborative and coordinated effort.	6, 7, 8, 9, Appendix B		129, 143, 151, 169, 193
515.7(g)	States DOTs shall use the best available data to develop their asset management plans. Pursuant to 23 U.S.C. 150(c)(3)(A)(i), each State DOT shall use bridge and pavement management systems meeting the requirements of § 515.17 to analyze the condition of NHS pavements and bridges for the purpose of developing and implementing the asset management plan required under this part. The use of these or other management systems for other assets that the State DOT elects to include in the asset management plan is optional (e.g., Sign Management Systems, etc.).	4, 9	4.1, 4.3, 9.2	75, 81, 170
515.9	Asset management plan requirements			
515.9(a)	A State DOT shall develop and implement an asset management plan to improve or preserve the condition of the assets and improve the performance of the NHS in accordance with the requirements of this part. Asset management plans must describe how the State DOT will carry out asset management as defined in § 515.5.	1	1.3-1.4	6-8
515.9(b)	An asset management plan shall include, at a minimum, a summary listing of NHS pavement and bridge assets, regardless of ownership	2	2.4-2.5	14-37
515.9(c)	In addition to the assets specified in paragraph (b) of this section, State DOTs are encouraged, but not required, to include all other NHS infrastructure assets within the right-of-way corridor and assets on other public roads. Examples of other NHS infrastructure assets include tunnels, ancillary structures, and signs. Examples of other public roads include non-NHS Federal-aid highways. If a State DOT decides to include other NHS assets in its asset management plan, or to include assets on other public roads, the State DOT, at a minimum, shall evaluate and manage those assets consistent with paragraph (l) of this section.			
515.9(d)	The minimum content for an asset management plan under this part includes a discussion of each element in this paragraph (d).			
515.9(d)(1)	Asset management objectives. The objectives should align with the State DOT's mission. The objectives must be consistent with the purpose of asset management, which is to achieve and sustain the desired state of good repair over the life cycle of the assets at a minimum practicable cost.	1, 3, 7	1.3, 3.2, 7.1	6, 62, 143
515.9(d)(2)	Asset management measures and State DOT targets for asset condition, including those established pursuant to 23 U.S.C. 150, for NHS pavements and bridges. The plan must include measures and associated targets the State DOT can use in assessing the condition of the assets and performance of the highway system as it relates to those assets. The measures and targets must be consistent with the State DOT's asset management objectives. The State DOT must include the measures established under 23 U.S.C. 150(c)(3)(A)(ii)(I)-(III), once promulgated in 23 CFR part 490, for the condition of NHS pavements and bridges. The State DOT also must include the targets the State DOT has established for the measures required by 23 U.S.C. 150(c)(3)(A)(ii)(I)-(III), once promulgated, and report on such targets in accordance with 23 CFR part 490. The State DOT may include measures and targets for NHS pavements and bridges that the State DOT established through pre-existing management efforts or develops through new efforts if the State DOT wishes to use such additional measures and targets to supplement information derived from the pavement and bridge measures and targets required under 23 U.S.C. 150.	2, 3	2.4, 3.2, 3.3	14, 19, 63
515.9(d)(3)	A summary description of the condition of NHS pavements and bridges, regardless of ownership. The summary must include a description of the condition of those assets based on the performance measures established under 23 U.S.C. 150(c)(3)(A)(ii) for condition, once promulgated. The	2	2.4-2.5	14-19

Code of Federal Regulations	Description	Chapter (s)	Section (s)	1st Page (s)
	description of condition should be informed by evaluations required under part 667 of this title of facilities repeated damaged by emergency events.			
515.9(d)(4)	Performance gap identification	8		151
515.9(d)(5)	Life-cycle planning.	4		75
515.9(d)(6)	Risk management analysis, including the results for NHS pavements and bridges, of the periodic evaluations under part 667 of this title of facilities repeated damaged by emergency event.	5		107
515.9(d)(7)	Financial plan	6		129
515.9(d)(8)	Investment strategies	7		143
515.9(e)	An asset management plan shall cover, at a minimum, a 10-year period.	3, 4, 6, 8		61, 75, 129,151
515.9(f)	An asset management plan shall discuss how the plan's investment strategies collectively would make or support progress toward:			
515.9(f)(1)	Achieving and sustaining a desired state of good repair over the life cycle of the assets	7, 8		143, 151
515.9(f)(2)	Improving or preserving the condition of the assets and the performance of the NHS relating to physical assets,	4, 8		75, 151
515.9(f)(3)	Achieving the State DOT targets for asset condition and performance of the NHS in accordance with 23 U.S.C. 150(d), and	8	8.2-8.6	152-163
515.9(f)(4)	Achieving the national goals identified in 23 U.S.C. 150(b).	3	3.6	70
515.9(g)	A State DOT must include in its plan a description of how the analyses required by State processes developed in accordance with § 515.7 (such as analyses pertaining to life cycle planning, risk management, and performance gaps) support the State DOT's asset management plan investment strategies.	7	7.2	144
515.9(h)	A State DOT shall integrate its asset management plan into its transportation planning processes that lead to the STIP, to support its efforts to achieve the goals in paragraphs (f)(1) through (4) of this section.	3	3.2	62
515.9(i)	A State DOT is required to make its asset management plan available to the public, and is encouraged to do so in a format that is easily accessible.	1	1.2	4
515.9(j)	Inclusion of performance measures and State DOT targets for NHS pavements and bridges established pursuant to 23 U.S.C. 150 in the asset management plan does not relieve the State DOT of any performance management requirements, including 23 U.S.C. 150(e) reporting, established in other parts of this title.	3, 8	3.1, 3.3, 8.6	61, 63, 163
515.9(k)	The head of the State DOT shall approve the asset management plan.			
515.9(l)	If the State DOT elects to include other NHS infrastructure assets or other public roads assets in its asset management plan, the State at a minimum shall address the following, using a level of effort consistent with the State DOT's needs and resources:			
515.9(l)(1)	Summary listing of assets, including a description of asset condition;	2	2.6-2.9	54-58
515.9(l)(2)	Asset management measures and State DOT targets for asset condition	3	3.4-3.5	67-68
515.9(l)(3)	Performance gap analysis;	8	8.6	163
515.9(l)(4)	Life-cycle planning	4	4.5-4.6	94-101
515.9(l)(5)	Risk analysis, including summaries of evaluations carried out under part 667 of this title for the assets, if available, and consideration of those evaluations	5		107
515.9(l)(6)	Financial plan;	6		129
515.9(l)(7)	Investment strategies.	7		143
515.9(m)	The asset management plan of a State may include consideration of critical infrastructure from among those facilities in the State that are eligible under 23 U.S.C. 119(c).			

Appendix A. Workshops

To be successful, California's Transportation Asset Management Plan must combine the best ideas, needs, and practices of the state's many transportation professionals, as well as transportation users, and transportation interest group members. Without the participation of the transportation community, no plan could reflect the needs and goals of the people most affected by changes in transportation planning and funding. As the plan records statewide asset inventory and condition, the identification of gaps and target setting requires the input of local transportation managers in every area. Local contributions to asset condition and performance goals will build the complete state picture mandated by the federal government.

Workshops

Appendix A discusses the workshops used to collect TAMP information from our partners statewide.

To make sure information was obtained from as broad a perspective as possible, a number of virtual workshops were held from April to September 2021. Project stakeholders from around the state were invited and encouraged to participate. Workshops focused on collecting input on financial planning, risk management, performance analysis, investment strategies and performance targets. Input from the workshops was instrumental in establishing performance goals for NHS pavement and bridges acknowledging that each MPO in California may have their own investment strategies and risk mitigation priorities that contribute to an overall asset management plan for California.

Following are the dates and goals of each workshop, along with a list of many of the known agencies and stakeholders represented at each. Further details on these workshops can be found at the following link:
https://dot.ca.gov/programs/asset-management/virtual-workshop-series-for-the-2022-tamp-update

Kick-off Webinar

April 12, 2021

A kick-off webinar was held with stakeholders to focus on the connection between asset management, performance management, and the transportation planning and programming processes. An expert panel featuring both national and regional FHWA experts presented the relationship between these three federal asset management rules followed by an opportunity for stakeholders to ask questions of the panelists.

Kick-Off Webinar Attendees

Caltrans
Federal Highway Administration
California Transportation Commission
California State Controller Office
Alameda County Public Works
American Association of Retired Persons
Association of Monterey Bay Area Governments
Butte County Association of Governments
California Bicycle Coalition
California Walks
City of Berkeley
City of Campbell
City of Carlsbad
City of Fresno
City of Fullerton
City of Gilroy
City of Glendale
City of Irvine
City of Laguna Niguel
City of Modesto
City of Orange
City of Oxnard
City of Palmdale
City of Rancho Cucamonga
City of Rancho Santa Margarita
City of Salinas
City of San Diego
City of San Jose
City of San Luis Obispo
City of Santa Clara
County of Riverside
County of San Benito
County of San Joaquin
County of Sonoma
Department of Public Works, Los Angeles County
El Dorado County Transportation Commission
Fresno Council of Governments
Humboldt County Association of Governments
Kern Council of Governments
Kings County Association of Governments
Local Glenn County Transportation Commission
Los Angeles County Metropolitan Transportation Authority
Madera County Transportation Commission
Merced County Association of Governments
Metropolitan Transportation Commission
Nevada County Transportation Commission
Orange County Public Works Riverside County
Orange County Transportation Authority
Regional Government Services Authority
Riverside County Transportation Commission
Sacramento Area Council of Governments
Safe Routes Partnership
San Bernardino County Transportation Authority
San Diego Association of Governments
San Francisco County Transportation Authority
San Joaquin Council of Governments
San Luis Obispo Council of Governments
Santa Barbara County Association of Governments
Shasta Regional Transportation Agency
Sonoma County Transportation Authority

Kick-Off Webinar Attendees

City of Santa Clarita
City of Thousand Oaks
City of Tustin
City of Vallejo
City of Watsonville
Colusa County Transportation Commission
County of Glenn
County of Kern
County of Kings
County of Los Angeles
County of Marin
County of Monterey
Southern California Association of Governments
Stanislaus Council of Government
Strategic Growth Council, California
Tahoe Metropolitan Planning Organization
Tahoe Regional Planning Agency
Transportation Agency for Monterey County
Tulare County Association of Governments
Tuolumne County Transportation Council
University of California, Berkeley
Valley Transportation Authority
Ventura Transportation Authority

Fundamentals Workshop

April 22, 2021

This workshop discussed the federal and state requirements of the TAMP, results of a number of listening sessions held with local transportation agencies to help inform future workshops, Caltrans sharing of local NHS inventory and condition mapping, and preparation for upcoming workshops. Kern County also shared their progress on asset management including their mapping and process for maintaining and improving their local roads and bridges.

Fundamentals Workshop Attendees

Caltrans
Federal Highway Administration
California Transportation Commission
California State Controller Office
Association of Monterey Bay Area Governments
Butte County Association of Governments
City of Anaheim
City of Bakersfield
City of Carlsbad
City of Carson
City of Chula Vista
City of Colton
City of Escondido
City of Fresno
City of Fullerton
City of Irvine
City of Oxnard
City of Pomona
City of Rancho Cucamonga
City of Rancho Palos Verdes
City of Rancho Santa Margarita
City of Riverside
City of San Diego
City of San Jose
City of Santa Clara
City of Santa Clarita
City of Thousand Oaks
City of Tustin
City of Vallejo
City of Vista
City of West Hollywood
County of Fresno
County of Kern
County of Kings
County of Marin
County of Mono
County of Monterey
County of Riverside
County of San Benito
County of San Mateo
Department of Public Works, Los Angeles County
El Dorado County Transportation Commission
Fresno Council of Governments
Humboldt County Association of Governments
Kern Council of Governments
Kings County Association of Governments
Los Angeles County Metropolitan Transportation Authority
Madera County Transportation Commission
Mendocino Council of Governments
Merced County Association of Governments
Metropolitan Transportation Commission
Nevada County Transportation Commission
North County Transit District
Orange County Public Works
Orange County Transportation Authority
Riverside County Transportation
Sacramento Area Council of Governments
San Benito County Council of Governments
San Diego Association of Governments
San Joaquin Council of Governments
San Louis Obispo Council of Governments
Santa Barbara County Association of Governments
Santa Clara Valley Transportation Authority
Shasta Regional Transportation Agency
Southern California Association of Governments
Stanislaus Council of Governments
Strategic Growth Council, California
Tahoe Regional Planning Agency
Tulare County Association of Governments
Ventura County Transportation Commission

Financial Planning Workshop

May 24, 2021

This workshop discussed options for determining a 10-year financial plan for the NHS through a review of available information obtained through State Controller's Office financial data system. Caltrans presented assumptions on estimating investment on the local NHS by the 5 federal work types using expenditure data from State Controller's Office and options for projecting a 10-year financial plan.

Financial Planning Workshop Attendees

Caltrans
Federal Highway Administration
California Transportation Commission
California State Controller Office
Association of Monterey Bay Area Governments
Butte County Association of Governments
City of Carlsbad
City of Carson
City of Chino
City of Chula Vista
City of Colton
City of Escondido
City of Fresno
City of Fullerton
City of Glendale
City of Rancho Cucamonga
City of San Diego
City of San Jose
City of Santa Clara
City of Santa Clarita
City of Santa Margarita
City of Thousand Oaks
City of Tustin
City of Vallejo
City of Watsonville
City of West Hollywood
County of Fresno
County of Inyo
County of Kern
County of Kings
County of Merced
County of Mono
County of Monterey
County of Riverside
County of San Benito
County of San Joaquin
County of Sonoma
Department of Public Works, Los Angeles County
Fresno Council of Governments
Kern Council of Governments
Kings County Association of Governments
Los Angeles County Metropolitan Transportation Authority
Madera County Transportation Commission
Merced County Association of Governments
Metropolitan Transportation Commission
North County Transit District
Orange County Public Works
Orange County Transportation Authority
Sacramento Area Council of Governments
Safe Routes Partnership
San Diego Association of Governments
San Joaquin Council of Governments
San Luis Obispo Council of Governments
Santa Cruz County Regional Transportation Commission
Shasta Regional Transportation Agency
Southern California Association of Governments
Stanislaus Council of Government
Strategic Growth Council
Tulare County Association of Governments

Risk Management Workshop

June 23 and 30, 2021

This workshop held on two separate days focused on updating the initial risk register and risk mitigation strategies for California. As part of the workshop, attendees analyzed the initial TAMP risk register and identified potential risk mitigation strategies and actions. The workshop resulted in an improved understanding of California's TAM risks and a revised risk register with prioritized risks, strategies, and actions. It also presented how risks are included in investment strategies for the 2022 TAMP.

Risk Management Workshop Attendees

Caltrans
Federal Highway Administration
California Transportation Commission
California State Controller Office
Association of Monterey Bay Area Governments
City of Carlsbad
City of Chino
City of Chula Vista
City of Colton
City of Concord
City of Fresno
City of Fullerton
City of Irvine
City of Moreno Valley
City of Rancho Cucamonga
City of San Jose
City of Santa Clara
City of Santa Clarita
City of Vallejo
City of West Hollywood
County of Fresno
County of Kern
County of Kings
County of San Joaquin
Department of Public Works, Los Angeles County
Humboldt County Association of Governments
Kern Council of Governments
Kings County Association of Governments
Los Angeles County Metropolitan Transportation Authority
Madera County Transportation Commission
Merced County Association of Governments
Orange County Public Works
Orange County Transportation Authority
Sacramento Area Council of Governments
San Bernardino County Transportation Authority
San Diego Association of Governments
San Joaquin Council of Governments
Santa Barbara County Association of Governments
Shasta Regional Transportation Agency
Southern California Association of Governments
Stanislaus Council of Governments

Investment Strategies & Targets Workshop

July 20, 2021

This workshop included a presentation from transportation asset management consultant, Applied Pavement Technology (APTech) on TAMP Investment Strategies. Caltrans then explained a different approach to the TAMP including a new performance tool to evaluate projected NHS pavement and bridge conditions at the end of the TAMP 10-Year period customized for each regional agency. Current performance targets can then be reviewed to determine if any adjustments should be made for the 2022 TAMP.

Investment Strategies & Targets Workshop Attendees

Caltrans
Federal Highway Administration
California Transportation Commission
California State Controller Office
Applied Pavement Technologies
Association of Monterey Bay Area Governments
Butte County Association of Governments
City of Carlsbad
City of Chula Vista
City of Colton
City of Fullerton
City of Los Gatos
City of Rancho Santa Margarita
City of San Jose
County of Glenn
County of Inyo
County of Kern
County of Kings
County of Tulare
Local Glenn County Transportation Commission
Fresno Council of Governments
Humboldt County Association of Governments
Kern Council of Governments
Kings County Association of Governments
Los Angeles County Metropolitan Transportation Authority
Madera County Transportation Commission
Merced County Association of Governments
Metropolitan Transportation Commission
Orange County Public Works
Orange County Transportation Authority
Sacramento Area Council of Governments
Safe Routes Partnership
San Bernardino County Transportation Authority
San Diego Association of Governments
San Joaquin Council of Governments
San Louis Obispo Council of Governments
Santa Barbara County Association of Governments
Shasta Regional Transportation Agency
Southern California Association of Governments
Stanislaus Council of Governments
Tulare County Association of Governments

TAMP Status and PM 2 Webinar

May 26, 2022

This webinar was held to discuss impact of IIJA funding to TAMP performance targets and to clarify the connection between the TAMP targets and PM 2 reporting. Caltrans requested that MPOs re-evaluate performance targets using the PTATs that they had previously provided to determine whether a change was needed to their investments in NHS pavement and bridges and resulting conditions. If no additional investment in preservation, rehabilitation or reconstruction was expected, then they would be asked to send an email response letting Caltrans know so that we could then finalize statewide NHS performance targets and update the TAMP accordingly.

TAMP Status and PM 2 Attendees

Caltrans	County of Riverside
California Transportation Commission	County of Santa Barbara
Safe Routes Partnership	Kern Council of Governments
Association of Monterey Bay Area Governments	Madera County Transportation Commission
Butte County Association of Governments	Merced County Association of Governments
City of Carlsbad	Kings County Association of Governments
City of Chula Vista	Los Angeles Metropolitan Transportation Authority
City of Carson	Orange County Transportation Authority
City of Garden Grove	Sacramento Area Council of Governments
City of Glendale	San Bernardino County Transportation Authority
City of Modesto	San Diego Association of Governments
City of San Jose	San Joaquin Council of Governments
City of Palmdale	San Louis Obispo Council of Governments
City of Vallejo	Santa Barbara County Association of Governments
City of Ventura	Shasta Regional Transportation Agency
County of El Dorado	Southern California Association of Governments
County of Kern	Stanislaus Council of Governments
County of Orange	Tulare County Association of Governments
Strategic Growth Council, California	City of West Hollywood

Appendix B. TAMP Data

Each Chapter of the TAMP contains the data and information needed to support the required components of the plan. Summary level data is documented within the plan to meet state and federal requirements. Further detail is provided in the appendix focusing on local level data and other key elements of the plan.

Additional Detail for Data Tables & Figures

Appendix B provides the additional detail to support the financial and performance tables and figures of the TAMP.

Chapter 3: Asset Performance Targets

Table A. Example Performance Target Analysis Tool

2022 California TAMP Asset Performance Simulation Tool

Revision 01 07-30-2021 — *Developed by Caltrans HQ TAM Office*

A. Legend

Cells for data entry

B. Analysis Parameters

General

Agency	AMBAG	Asset	Pavement	Annual Escalation Rate	3.20%
Years of Analysis	10	Current Inventory	254.5 Lane Miles	Escalation Period (Years)	5

Estimated Investment (Expected Annual Funding)

Use Default or Override Parameters? Default

Annual Funding by Work Type	Initial Const.	Maint.	Preser/Rehab	Reconstruction	Total
Default	$ 233,714	$ 742,756	$ 1,235,298	$ 2,537,903	$ 4,749,670
Override	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 1,000,000	$ 4,000,000
% on Risk Mitigation			0%	0%	-
$ on Risk Mitigation			$ -	$ -	$ -

% Spending on Fair to Good	13.0%
% Spending on Poor to Good	66.4%
% Spending on Adding New	4.9%
% Spending on Risk Mitigation	0.0%
% Spending on Maint. Investment	15.6%

Average Unit Costs

Use Default or Override Parameters? Default

Treatment	Default - Current			Override - Current			Unit Cost Used - Escalated			Improvement Adjustment
	Capital ($/LM)	Support Ratio	Total ($/LM)	Capital ($/LM)	Support Ratio	Total ($/LM)	Capital ($/LM)	Support Ratio	Total ($/LM)	
Fix Fair to Good	$ 681,257	0.24	$ 844,759	$ 681,257	0.24	$ 844,759	$ 797,461	0.24	$ 1,157,523	100%
Fix Poor to Good	$ 856,990	0.24	$ 1,062,668	$ 856,990	0.24	$ 1,062,668	$ 1,003,169	0.24	$ 1,243,930	100%
Add New	$ 1,000,000	0.24	$ 1,240,000	$ 1,000,000	0.24	$ 1,240,000	$ 1,170,573	0.24	$ 1,451,510	-

Annual Deterioration Rate

Use Default or Override Parameters? Default

Condition Change	Default	Override
Good to Fair (%/Year)	9.3%	9.3%
Fair to Poor (%/Year)	1.2%	1.2%

TAMP Targets

Use Default or Override Parameters? Default

Condition	Default	Override
Good	13.0%	7.0%
Fair	79.4%	84.0%
Poor	7.6%	9.0%

C. Analysis Results

Annual Deterioration if do nothing

Condition Change	Lane Miles	% Curent Total
Good to Fair	0.2	0.1%
Fair to Poor	2.8	1.1%

Annual Improvements from Investment

Improvement	Lane Miles	% Current Total
Fix Fair to Good	0.5	0.2%
Fix Poor to Good	2.5	1.0%
Add New Inventory	0.2	0.1%

Projected Inventory

256.2 Lane Miles

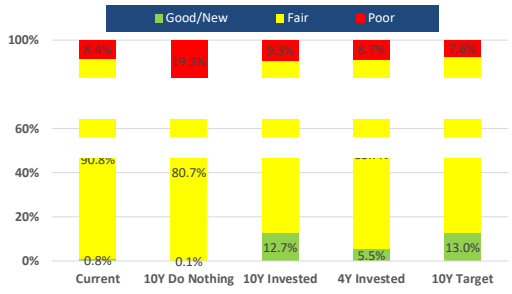
Asset Condition

Condition	Current		Do Nothing: 10Y End		Invested: 10Y End		Invested: 4Y End		10Y TAMP Target	
	Lane Miles	%	Lane Miles	%	Lane Miles	%	Lane Miles	%	Lane Miles	%
Good/New	2.0	0.8%	0.1	0.1%	32.5	**12.7%**	14.1	**5.5%**	33.3	13.0%
Fair	231.2	90.8%	205.3	80.7%	200.0	**78.1%**	218.8	**85.7%**	203.4	79.4%
Poor	21.3	8.4%	49.1	19.3%	23.7	**9.3%**	22.3	**8.7%**	19.5	7.6%

10Y Performance Gap Analysis

Condition	Gap (10Y Invested - Target)	
	Lane Miles	%
Good/New	(0.8)	-0.3%
Fair	(3.4)	-1.3%
Poor	4.3	

Asset Condition Comparison Chart



10Y Needs Assessment

Treatment	Invested	Cost Gap	Total
Fix Fair to Good	$ 6,176,489	$ -	$ 6,176,489
Fix Poor to Good	$ 31,555,515	$ 5,296,493	$ 36,852,008
Add New	$ 2,337,141	$ -	$ 2,337,141
Risk Mitigation	$ -	$ -	$ -
Maintenance	$ 7,427,558	$ -	$ 7,427,558
Total	$ 47,496,703	**$ 5,296,493**	$ 52,793,196

D. Notes

1. The annual funding is based on xxx

Prepared by		Date	
Signature			
Reviewed by		Date	
Signature			

Table B. 4-Year Performance Targets by Jurisdiction

			2022 TAMP 4-Year Target					
MPO/RTPA	NHS System	NHS Asset	Good	Good (%)	Fair	Fair (%)	Poor	Poor (%)
State	Interstate	Pavement	7,188.4	49.2%	7,162.8	49.0%	252.1	1.7%
State	Non-Interstate	Pavement	10,482.9	46.0%	11,803.7	51.8%	506.1	2.2%
State	NHS (combined)	Bridge	107,311,413.3	49.1%	104,081,745.7	47.6%	7,289,333.4	3.3%
AMBAG	Non-Interstate	Pavement	19.8	7.3%	206.5	76.3%	44.4	16.4%
AMBAG	NHS	Bridge	28,165.0	12.2%	148,723.9	64.3%	54,391.0	23.5%
BCAG	Non-Interstate	Pavement	3.8	3.8%	75.9	75.3%	21.2	21.0%
BCAG	NHS	Bridge	9,911.2	24.3%	30,057.3	73.7%	794.5	1.9%
FCOG	Non-Interstate	Pavement	41.3	7.9%	387.4	74.0%	95.1	18.2%
FCOG	NHS	Bridge	152,206.2	43.3%	194,068.2	55.2%	5,123.6	1.5%
Glenn	Non-Interstate	Pavement	0.3	4.9%	4.4	78.7%	0.9	16.4%
Glenn	NHS	Bridge						
Humboldt	Non-Interstate	Pavement	1.4	3.8%	30.0	82.9%	4.8	13.3%
Humboldt	NHS	Bridge	-	0.0%	4,969.8	97.2%	143.2	2.8%
KCAG	Non-Interstate	Pavement	2.3	6.5%	32.0	91.3%	0.8	2.2%
KCAG	NHS	Bridge						
KCOG	Non-Interstate	Pavement	78.6	10.7%	573.1	78.1%	82.5	11.2%
KCOG	NHS	Bridge	374,572.3	40.3%	483,814.0	52.1%	69,983.8	7.5%
Lassen	Non-Interstate	Pavement	0.1	1.9%	7.2	94.0%	0.3	4.1%
Lassen	NHS	Bridge						
MCAG	Non-Interstate	Pavement	2.6	3.0%	59.0	68.1%	25.0	28.9%
MCAG	NHS	Bridge	32,800.0	61.9%	19,824.1	37.4%	334.9	0.6%
MCTC	Non-Interstate	Pavement	0.0	0.3%	2.9	77.2%	0.8	22.5%
MCTC	NHS	Bridge						
MTC	Non-Interstate	Pavement	317.4	10.1%	2532.5	80.4%	299.6	9.5%
MTC	NHS	Bridge	1,073,252.4	21.8%	2,811,363.9	57.2%	1,029,606.3	21.0%
SACOG	Non-Interstate	Pavement	66.8	4.8%	1,018.2	72.6%	317.7	22.6%
SACOG	NHS	Bridge	466,514.1	34.4%	795,550.8	58.6%	95,134.1	7.0%
SANDAG	Non-Interstate	Pavement	99.1	8.0%	984.4	79.5%	154.7	12.5%
SANDAG	NHS	Bridge	424,185.7	29.1%	838,425.0	57.5%	194,358.7	13.3%
SBCAG	Non-Interstate	Pavement	14.3	9.7%	122.2	82.4%	11.8	7.9%
SBCAG	NHS	Bridge	68,486.2	40.6%	85,373.2	50.6%	14,931.6	8.8%
SCAG	Non-Interstate	Pavement	1,147.1	9.3%	8,924.8	72.4%	2,249.8	18.3%
SCAG	NHS	Bridge	5,146,527.4	34.6%	7,944,445.8	53.4%	1,779,451.5	12.0%
SJCOG	Non-Interstate	Pavement	42.7	7.5%	471.9	82.8%	55.1	9.7%
SJCOG	NHS	Bridge	252,273.6	40.8%	284,172.8	45.9%	82,262.5	13.3%
SLOCOG	Non-Interstate	Pavement	4.2	8.9%	39.5	83.5%	3.6	7.6%
SLOCOG	NHS	Bridge	677.8	2.0%	32,560.1	97.2%	260.2	0.8%
SRTA	Non-Interstate	Pavement	0.1	1.1%	8.0	77.6%	2.2	21.3%
SRTA	NHS	Bridge	3,418.6	2.6%	127,427.7	95.2%	3,013.7	2.3%
STANCOG	Non-Interstate	Pavement	25.4	11.5%	163.2	74.1%	31.6	14.3%
STANCOG	NHS	Bridge	79,796.2	42.3%	46,902.1	24.9%	61,972.7	32.8%
TCAG	Non-Interstate	Pavement	9.0	7.6%	91.2	76.9%	18.4	15.5%
TCAG	NHS	Bridge	1,446.3	4.4%	31,242.7	95.6%	-	0.0%
TMPO	Non-Interstate	Pavement	0.0	0.2%	7.2	90.3%	0.8	9.4%
TMPO	NHS	Bridge						

Note: Pavement Condition measured by lane miles; Bridge Condition measured by Square Foot of Bridge Deck

Table C. 10-Year Performance Targets by Jurisdiction

			2022 TAMP 10-Year Target (Expected)					
MPO/RTPA	NHS System	NHS Asset	Good	Good (%)	Fair	Fair (%)	Poor	Poor (%)
State	Interstate	Pavement	7,620.1	51.2%	7,041.5	47.3%	218.2	1.5%
State	Non-Interstate	Pavement	11,710.0	50.3%	11,137.1	47.9%	419.0	1.8%
State	NHS (combined)	Bridge	104,679,631.0	47.8%	110,387,090.4	50.4%	3,793,367.0	1.7%
AMBAG	Non-Interstate	Pavement	19.3	7.0%	199.5	72.9%	55.0	20.1%
AMBAG	NHS	Bridge	24,058.1	10.4%	152,425.9	65.9%	54,796.1	23.7%
BCAG	Non-Interstate	Pavement	3.1	3.1%	72.4	71.7%	25.5	25.2%
BCAG	NHS	Bridge	6,194.5	15.2%	32,582.3	79.9%	1,986.2	4.9%
FCOG	Non-Interstate	Pavement	40.3	7.7%	378.2	71.9%	107.6	20.5%
FCOG	NHS	Bridge	104,694.0	29.8%	242,435.9	69.0%	4,268.1	1.2%
Glenn	Non-Interstate	Pavement	0.2	2.8%	4.3	75.9%	1.2	21.2%
Glenn	NHS	Bridge						
Humboldt	Non-Interstate	Pavement	1.8	4.9%	28.2	78.0%	6.2	17.1%
Humboldt	NHS	Bridge	-	0.0%	4,755.1	93.0%	357.9	7.0%
KCAG	Non-Interstate	Pavement	3.1	8.8%	30.1	85.7%	1.9	5.5%
KCAG	NHS	Bridge						
KCOG	Non-Interstate	Pavement	109.2	14.1%	565.0	72.8%	101.7	13.1%
KCOG	NHS	Bridge	282,742.8	29.9%	587,658.4	62.0%	76,692.0	8.1%
Lassen	Non-Interstate	Pavement	0.4	4.7%	6.6	85.0%	0.8	10.3%
Lassen	NHS	Bridge						
MCAG	Non-Interstate	Pavement	6.5	7.5%	54.0	62.3%	26.2	30.2%
MCAG	NHS	Bridge	20,500.0	38.7%	31,621.9	59.7%	837.1	1.6%
MCTC	Non-Interstate	Pavement	0.0	0.8%	2.7	71.3%	1.0	27.9%
MCTC	NHS	Bridge						
MTC	Non-Interstate	Pavement	720.9	22.6%	2309.6	72.3%	161.8	5.1%
MTC	NHS	Bridge	722,953.7	14.7%	3,091,384.8	62.7%	1,114,765.0	22.6%
SACOG	Non-Interstate	Pavement	119.2	8.5%	953.2	67.6%	337.1	23.9%
SACOG	NHS	Bridge	362,127.5	26.4%	918,357.3	67.0%	90,587.6	6.6%
SANDAG	Non-Interstate	Pavement	232.5	18.5%	910.4	72.4%	114.8	9.1%
SANDAG	NHS	Bridge	561,168.4	35.9%	898,517.8	57.4%	105,270.4	6.7%
SBCAG	Non-Interstate	Pavement	28.6	19.2%	108.8	72.9%	11.7	7.9%
SBCAG	NHS	Bridge	75,902.6	45.0%	92,888.4	55.0%	-	0.0%
SCAG	Non-Interstate	Pavement	2,407.8	19.2%	8,281.6	66.0%	1,859.1	14.8%
SCAG	NHS	Bridge	4,463,167.3	28.6%	9,343,031.7	59.8%	1,811,708.2	11.6%
SJCOG	Non-Interstate	Pavement	67.9	11.7%	447.1	77.4%	62.7	10.9%
SJCOG	NHS	Bridge	180,345.1	29.1%	364,556.1	58.9%	73,807.8	11.9%
SLOCOG	Non-Interstate	Pavement	5.7	12.0%	37.7	79.7%	3.9	8.3%
SLOCOG	NHS	Bridge	1,694.4	5.1%	31,153.1	93.0%	650.5	1.9%
SRTA	Non-Interstate	Pavement	0.3	2.8%	7.4	71.5%	2.7	25.7%
SRTA	NHS	Bridge	3,331.0	2.5%	122,994.7	91.9%	7,534.3	5.6%
STANCOG	Non-Interstate	Pavement	17.7	8.0%	167.5	75.9%	35.6	16.1%
STANCOG	NHS	Bridge	95,606.5	50.7%	66,250.8	35.1%	26,813.7	14.2%
TCAG	Non-Interstate	Pavement	12.7	10.7%	87.0	73.0%	19.4	16.3%
TCAG	NHS	Bridge	3,615.8	11.1%	29,073.2	88.9%	-	0.0%
TMPO	Non-Interstate	Pavement	0.0	0.6%	6.7	83.3%	1.3	16.1%
TMPO	NHS	Bridge						

Note: Pavement Condition measured by lane miles; Bridge Condition measured by Square Foot of Bridge Deck

Chapter 5: Summary of Transportation Assets Repeatedly Damaged by Emergency Events

Table D. Bridges Subject to Multiple High Load Hits

District	County	Structure	Route
2 Redding	Siskiyou	KLAMATH RIVER	96
	Siskiyou	WALTERS ROAD BRIDGE	5
3 Sacramento	Butte	GRAND AVE OC	70
	Butte	GARDEN DRIVE OC	70
	Yuba	MARYSVILLE UP	70
4 San Francisco	Napa	LINCOLN AVENUE OC	29
	San Francisco	SAN FRANCISO-OAKLAND BAY BRIDGE	80
	San Francisco	SILVER AVE OC	101
	San Francisco	BAYSHORE VIADUCT	101
	Solano	SPRINGS ROAD OC	80
5 San Luis Obispo	Santa Barbara	CLARK AVENUE OC	101
6 Fresno	Tulare	AVENUE 152 OC	99
	Tulare	COUNTY ROAD 164 OC	198
7 Los Angeles	Los Angeles	SCHUYLER HEIM LIFT BRIDGE	47
	Los Angeles	E91-N710 CONNECTOR OC	91
	Los Angeles	ROUTE 210-710/E210 SEPARATION	210
	Los Angeles	210-134/E210 SEPARATION	210
	Los Angeles	STATE STREET OC	10
	Ventura	EDWARDS RANCH ROAD OC	126
8 San Bernardino	Riverside	THEODORE STREET OC	60
	Riverside	MCCALL BLVD OC	215
	San Bernardino	GHOST TOWN ROAD UC	15
	San Bernardino	MONTE VISTA AVENUE OC	60
	San Bernardino	BARTON ROAD OC	215
	San Bernardino	WASHINGTON AVENUE OC	215

District	County	Structure	Route
9 Bishop		SOUTH LANDING ROAD OC	395
10 Stockton	Merced	APPLEGATE ROAD OC	99
	San Joaquin	SAN JOAQUIN RIVER (GARWOODS)	4
	San Joaquin	ROUTE 26/99 SEPARATION	26
	San Joaquin	FARMINGTON ROAD OC	99
	San Joaquin	WILSON WAY OC	99

Source: Caltrans

Table E. Repeatedly Damaged Assets on the NHS

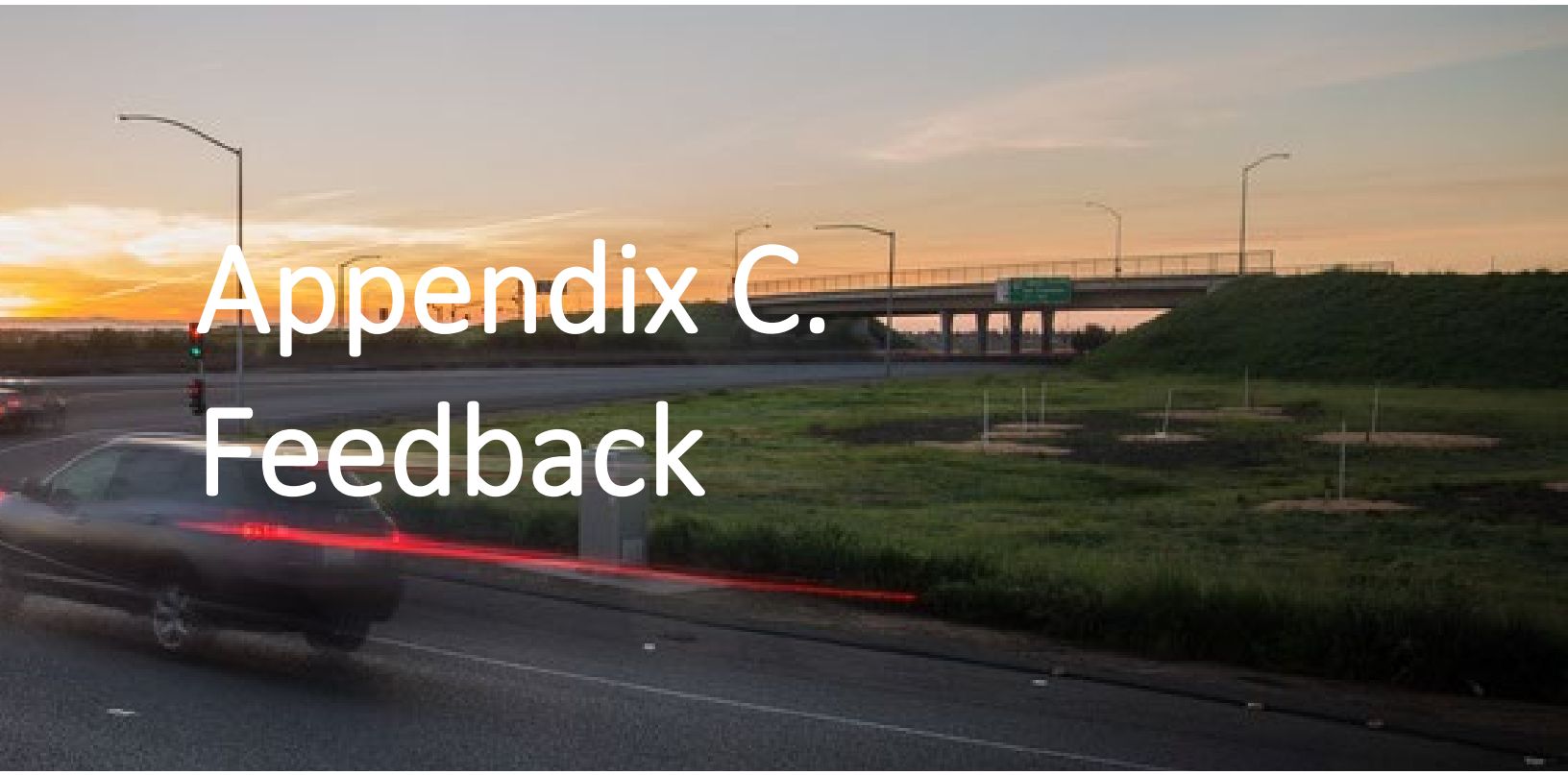
District	County	Route	Emergency Event Type
1 Eureka	Del Norte	101	Storms
	Humboldt	101, 299	Storms
	Lake	20	Storms
2 Redding	Shasta/Trinity	5	Storms
3 Marysville	El Dorado	50	Storms
4 San Francisco	Nevada	80	Storms
	Alameda	880	Storms
	Contra Costa	680	Storms
	Marin	1	Storms
	Santa Clara	101	Storms
	San Francisco	80	Storms
5 San Luis Obispo	Santa Barbara	101	Storms
	San Luis Obispo	101	Storms
6 Fresno	Kern	178, 395	Storms
	Mariposa	41	Storms
7 Los Angeles	Ventura	33, 126	Fire, Storms
8 San Bernardino	San Bernardino	95	Storms
9 Bishop	Inyo	395	Storms
	Mono	120	Storms
10 Stockton	Tuolumne	120	Fire, Storms
	San Joaquin	99	Storms
	Mariposa	49	Storms
11 San Diego	San Diego	52	Storms
12 Santa Ana	Orange	73, 74, 91, 133	Fire, Storms

Source: Caltrans

Chapter 6: Financial Plan

Table F. Available Funding for Asset Management by Jurisdiction

MPO/RTPA	NHS System	NHS Asset	Initial Construction	Maintenance	Preservation/ Rehabilitation	Reconstruction	Total
State	Interstate	Pavement	$ 70,000,000	$ 52,000,000	$ 434,000,000	$ 239,000,000	$ 795,000,000
State	Non-Interstate	Pavement	$ 109,000,000	$ 82,000,000	$ 766,000,000	$ 208,000,000	$ 1,165,000,000
State	NHS (combined)	Bridge	$ 26,000,000	$ 72,000,000	$ 482,000,000	$ 217,000,000	$ 797,000,000
AMBAG	Non-Interstate	Pavement	$ 800,000	$ 1,600,000	$ 1,200,000	$ 400,000	$ 4,000,000
AMBAG	NHS	Bridge	$ -	$ 600,000	$ -	$ 900,000	$ 1,500,000
BCAG	Non-Interstate	Pavement	$ 35,894	$ 80,147	$ 82,311	$ 210,158	$ 408,511
BCAG	NHS	Bridge	$ -	$ -	$ -	$ -	$ -
FCOG	Non-Interstate	Pavement	$ 590,237	$ 733,643	$ 1,628,017	$ 2,497,527	$ 5,449,424
FCOG	NHS	Bridge	$ -	$ -	$ -	$ 1,120,265	$ 1,120,265
Glenn	Non-Interstate	Pavement	$ 6,663	$ 6,215	$ 524	$ 8,041	$ 21,443
Glenn	NHS	Bridge	$ -	$ -	$ -	$ -	$ -
Humboldt	Non-Interstate	Pavement	$ 10,671	$ 50,254	$ 38,586	$ 138,998	$ 238,510
Humboldt	NHS	Bridge	$ -	$ -	$ -	$ -	$ -
KCAG	Non-Interstate	Pavement	$ -	$ 54,057	$ 179,565	$ 128,758	$ 362,380
KCAG	NHS	Bridge	$ -	$ -	$ -	$ -	$ -
KCOG	Non-Interstate	Pavement	$ 12,750,000	$ 3,557,920	$ 1,409,200	$ 7,237,600	$ 24,954,720
KCOG	NHS	Bridge	$ 2,700,000	$ 1,300,000	$ 1,200,000	$ 2,000,000	$ 7,200,000
Lassen	Non-Interstate	Pavement	$ 30,765	$ 3,819	$ 1,028	$ 9,681	$ 45,293
Lassen	NHS	Bridge					
MCAG	Non-Interstate	Pavement	$ -	$ 40,000	$ 175,000	$ 500,000	$ 715,000
MCAG	NHS	Bridge	$ -	$ 92,009	$ -	$ -	$ 92,009
MCTC	Non-Interstate	Pavement	$ -	$ -	$ -	$ 6,351	$ 6,351
MCTC	NHS	Bridge	$ -	$ -	$ -	$ -	$ -
MTC	Non-Interstate	Pavement	$ 10,274,611	$ 9,384,509	$ 22,256,000	$ 56,592,328	$ 98,507,448
MTC	NHS	Bridge	$ 2,178,558	$ 138,228	$ 407,319	$ 3,497,520	$ 6,221,624
SACOG	Non-Interstate	Pavement	$ 1,785,788	$ 3,913,556	$ 2,609,480	$ 11,370,961	$ 19,679,785
SACOG	NHS	Bridge	$ 2,031,067		$ 2,127,484	$ 3,992,604	$ 8,151,155
SANDAG	Non-Interstate	Pavement	$ 4,100,534	$ 6,000,588	$ 3,079,088	$ 18,357,612	$ 31,537,822
SANDAG	NHS	Bridge	$ 15,355,020		$ 1,582,854	$ 15,966,309	$ 32,904,183
SBCAG	Non-Interstate	Pavement	$ 169,457	$ 465,511	$ 2,281,542	$ 596,329	$ 3,512,839
SBCAG	NHS	Bridge	$ -	$ -	$ -	$ 3,876,512	$ 3,876,512
SCAG	Non-Interstate	Pavement	$ 55,784,115	$ 26,424,699	$ 57,287,688	$ 194,178,646	$ 333,675,149
SCAG	NHS	Bridge	$ 109,431,178	$ 352,770	$ 418,533	$ 38,243,578	$ 148,446,059
SJCOG	Non-Interstate	Pavement	$ 2,200,923	$ 1,035,542	$ 1,777,487	$ 5,607,388	$ 10,621,340
SJCOG	NHS	Bridge	$ -	$ -	$ -	$ 2,655,577	$ 2,655,577
SLOCOG	Non-Interstate	Pavement	$ 24,099	$ 66,799	$ 200,068	$ 381,645	$ 672,610
SLOCOG	NHS	Bridge	$ -	$ -	$ -	$ 148,836	$ 148,836
SRTA	Non-Interstate	Pavement	$ -	$ -	$ 12,162	$ 36,706	$ 48,868
SRTA	NHS	Bridge	$ -	$ -	$ -	$ 139,886	$ 139,886
STANCOG	Non-Interstate	Pavement	$ 171,748	$ 311,021	$ 509,255	$ 1,462,081	$ 2,454,106
STANCOG	NHS	Bridge	$ -	$ -	$ -	$ 5,356,340	$ 5,356,340
TCAG	Non-Interstate	Pavement	$ 113,164	$ 113,217	$ 363,995	$ 892,143	$ 1,482,519
TCAG	NHS	Bridge	$ -	$ -	$ -	$ 317,609	$ 317,609
TMPO	Non-Interstate	Pavement	$ -	$ 17,550	$ 5,670	$ -	$ 23,220
TMPO	NHS	Bridge	$ -	$ -	$ -	$ -	$ -



Appendix C. Feedback

Once the final Draft California Transportation Asset Management Plan (TAMP) was prepared, it was sent out for review. The public comment period began January 2022 and continued into February 2022. Caltrans announced the availability of the draft TAMP and requested public input through a dedicated online survey tool, accessible through the Caltrans Asset Management website. Caltrans' Local Assistance Program sent an announcement to all statewide partners, and Caltrans' Asset Management reached out to prior workshop attendees to submit feedback online.

Input from Partners and Stakeholders

The following is a summary of comments and the organizations who responded. We thank all of you who contributed to ensuring this plan is as inclusive and accurate as possible. We look forward to continuing to work together on this iterative process.

Reviewer	Chapter	Comments	Resolution
Fresno COG	2	Table 3-7 refers to PM1 2022 safety targets and not the 2019.	Corrected the paragraph prior to Table 3-7 to indicate safety targets are for 2022 not 2019
Orange County Transportation Authority	Appendix A	Thank you for the opportunity to comment on the Draft 2022 TAMP. A quick question/comment on Workshop Attendees listing in Appendix A and Partners and Stakeholders listing in Acknowledgements: OCTA staff, including myself, attended most workshops. If possible, could the workshop attendees be checked to verify that OCTA was not accidentally excluded?	Thank you for pointing out that our list of attendees needed to be updated. We have corrected each workshop for attendees of the virtual workshops.
Delta Stewardship Council	5	We appreciate that the draft TAMP highlights the risks that sea level rise and flooding pose to transportation infrastructure in California. However, the current draft describes this as a concern for coastal areas (section 5.1, p. 111). While coastal areas may be the most directly affected by increased erosion, the Delta and inland connected waterways are also subject to sea level rise and changes in flood exposure. We request that this be acknowledged in the final TAMP. (See Attached Letter)	Section 5.1 and 5.7 have been revised to reflect impacts of sea level rise to inland connected waterways. Caltrans cost analysis in the 2021 SHSMP included any state highway or bridge impacted by sea level rise.
Delta Stewardship Council	7	I appreciate the section of the draft that discusses equity in transportation and efforts to develop an equity index and include equity in future asset management. We also encourage Caltrans to consider environmental justice throughout every aspect of the TAMP. (See Attached Letter)	Caltrans has had an Environmental Justice policy in place since 2001. The Equity Index is consistent with this policy. The Equity Index is expected to be a two tiered approach that will be implemented at both a programmatic level and at the project level.
City of Chula Vista	2	Pavement by County (Section 2.4) on 44/234 “National” should be “National City” Risk section on 145/234 (p. 127) go to paragraph 1 and line 3; need to define “SD” - Structurally Deficient (SD)	Corrected “National” to “National City” “Structurally Deficient” was replaced with “Poor” to align with the Federal Infrastructure Investment and Jobs Act.

Reviewer	Chapter	Comments	Resolution
City of Carlsbad	2	Suggestion on Page 30 to include "state owned" in paragraph relating to State Highway System to match the "block" bubble of state owned and managed	State-owned and managed is stated this way in the TAMP: “Caltrans is the state agency responsible for planning, developing, maintaining and operating the legislatively designated SHS” which is a more detailed explanation.
City of Carlsbad	2	Figure 2-4, page 31, is misleading with regarding to NHS vs. SHS. Is it SHS or NON-NHS? San Diego could be included in a smaller detail	Figure 2-4 is a map of the NHS in California and shows the two largest local NHS regions of the State which is Bay Area and Los Angeles regions. Instead of depicting each region’s inventory and condition by map, it was done in table format as it provides more detail for each region/city/county. For mapping of the NHS by region, refer to: https://dot.ca.gov/programs/asset-management/california-transportation-asset-management-plan/national-highway-system-performance-and-financial-data
City of Carlsbad	2	We didn't see the source for evaluating the pavement condition, and for the bridges, only as NBI on page 57. Could this information be added, if not already somewhere else within the document?	The source for evaluating pavement condition is detailed in Chapter 2 Section 2.4 Pavements and more specifically in Pavement Performance Metrics. It is also found in Table 2-1 Pavement Condition Thresholds.
California Coastal Commission	Appendix D	Coastal Commission appreciates the opportunity to comment on the Draft 2022 TAMP. We offer the following comments to help further advance the shared priorities of Caltrans and the Coastal Commission in the TAMP. Overall, we believe the document would benefit from fuller articulation of climate adaptation policy guidance and statutory requirements (See Attached Letter)	Additional guidance and executive orders regarding climate change have been included in Appendix D as well as added narrative on climate change in Chapter 1-Making Progress.
California Coastal Commission	9	Coastal Commission appreciates the opportunity to comment on the Draft 2022 TAMP. We offer the following comments to help further advance the shared priorities of Caltrans and the Coastal Commission in the TAMP. Overall, we believe the document would benefit from increased discussion of how assets operate in concert on a corridor scale, making it critical for them to be	A Corridor View of TAM Investment Decisions in Chapter 9 was updated to include climate change goals.

Reviewer	Chapter	Comments	Resolution
		addressed within a corridor perspective (See Attached Letter)	
California Coastal Commission	5	Coastal Commission appreciates the opportunity to comment on the Draft 2022 TAMP. We offer the following comments to help further advance the shared priorities of Caltrans and the Coastal Commission in the TAMP. Overall, we believe the document would benefit from additional context regarding the benefits and shortcomings of Caltrans' current climate change Vulnerability Assessments and Adaptation Priorities Reports. (See Attached Letter)	Additional narrative was added to Chapter 5, Section 5.7 on Sea Level Rise indicating that the Vulnerability Assessments and Adaptation Priority Reports have helped to identify areas of focus, but additional project and corridor level planning is required to better quantify solutions and costs.
California Construction and Industrial Materials Association	4	Our concern is that the draft TAMP does not support initiatives and priorities of the Pavement and Materials Partnering Committee and use of pilot projects to advance sustainable and recycled pavements. (See Attached Letter)	Sustainable pavements and use of recycled materials are consistent with Climate Action goals and Investment Strategies of the TAMP. An update was needed in Chapter 4, Section 4.3 Life Cycle Planning of Pavements to reference the Pavement and Materials Partnering Committee instead of the Rock Products Committee as the importance of this committee to improvement of pavement in California. Caltrans will continue to work with industry on developing appropriate sustainable pavement pilot projects.
CTC	Executive Summary	On page IV, under Federal and State Requirements, it says, "The Commission's approval authority in the TAMP is limited to assets on the SHS." According to Government Code section 14526.5, the Commission approves the entire Transportation Asset Management Plan. Please update the language to align with the statute	Revised page IV to state that the Commission approves the TAMP according to Government Code section 14526.5.
CTC	Executive Summary	On page V, Executive Summary, under Roles and Responsibilities for MPOs/RTPAs/Local Agencies, it says "Develop long-range transportation plans reflective of TAMP goals." What is the status of the development of these long-range plans? Where can they be found?	Regional Transportation Plan Guidelines are currently being updated to include the most current information regarding asset management to better align the planning, programming, and asset management processes. Caltrans has Memorandums of Understandings with each MPO that lays out requirements for performance

Reviewer	Chapter	Comments	Resolution
			management and the goals outlined in the TAMP as stated in Chapter 3.
CTC	Executive Summary	On page V, Executive Summary, the "Asset Inventory" for Complete Streets shows a value of 7,623,345 linear feet. Please clarify what complete streets assets are included in this total and how they can all be quantified with a unit of "linear feet."	The inventory and condition of Complete Streets was based on a planning level analysis that included existing sidewalks, bikeways, and crosswalks measured by linear feet used as a basis for the 2021 SHSMP performance targets. The 2023 SHSMP will be updated to reflect District level Complete Street Action Plans developed through a public engagement process.
CTC	Executive Summary	On page VII, Executive Summary, under "Making an Impact", it states the State Highway System (SHS) is on track to meet the Desired State of Repair 10-year targets. However, under the current funding expectations it says, it is "narrowing the gap" for the National Highway System pavement and bridges targets. What strategies are being considered for non-State Agencies to try to meet the 10-year National Highway System (NHS) Targets? Does the new federal funding included in the *Infrastructure Investment and Jobs Act* provide enough funding ensure the National Highway System is on a trajectory to meet the 10-year Targets?	As stated in Chapter 8, Performance Scenarios and Gaps, there is currently no requirement for prioritizing investments on the local NHS. Local jurisdictions are the owner and operators of their entire transportation system and make decisions on funding based on their unique needs. In some cases, the local NHS is very small compared to an agencies entire roadway system. In review of IIJA funding, a few MPOs included more investment for NHS pavements. However, it wasn't enough to meet performance targets. No MPO increased funding for NHS bridges mainly because of timing and that they didn't have enough information to determine funding expected to be spent on the NHS.
CTC	Executive Summary	On page VIII, Executive Summary, under NHS and SHS Projected Asset Conditions, please provide additional detail (or a link provided) documenting the basis of the yearly investment for each performance scenario? For example, although the yearly investment for State Highway System Pavement is the same for both the 10-year Expected Performance and the 10-year Desired State of Repair Performance scenarios,the resulting Good/Fair/Poor	Revised Executive Summary and Chapter 8 for NHS and SHS Investments as appropriate. For the SHS, the 10-year expected performance is based on results of the SHSMP investment plan with specified funding levels assumed for SHOPP, Highway Maintenance, and Maintenance crews which exceeds the DSOR targets in most cases. For the NHS, an annual average investment/year for 10 years is used in the performance gap analysis. The investment on the state-owned NHS is based on a percentage of the 2021 SHSMP investments in SHOPP and Maintenance using the inventory of the NHS to the total SHS as the percentage.

Reviewer	Chapter	Comments	Resolution
		conditions are different. Please document the nuances of this analysis in a manner that is understandable to the public.	
CTC	1	On page 4, under Section 1.2 Making Progress, it states, "A new Sea Level Rise Adaptation objective was introduced in the 2021 State Highway System Management Plan that provides a high level, rough order of magnitude cost estimate for adapting roadways and bridges on the State Highway System to the projected impacts of climate change and rising seas." Are similar climate change adaptation cost analysis being conducted for all roadways and bridges on the National Highway System?	Caltrans did not evaluate the locally-owned NHS for Sea Level Rise costs. There are localities that have studied Sea level Rise and there are further resources available as provided in Chapter 5.
CTC	1	On page 5, the Transportation Asset Management Plan discusses the Performance Target Analysis Tool the California Department of Transportation (Caltrans) provided to regional transportation agencies to evaluate National Highway System pavement bridgeconditions and targets. Will this be proposed as a requirement for inclusion in the Regional Transportation Plans for the purposes of reporting progress for the entire National Highway System?	A new Performance Tool is currently under development that will be similar to the Performance Target Analysis Tool to help evaluate project level performance. Implementation will require a change in the Regional Transportation Plan Guidelines to require the submittal of the Tool demonstrating that the proposed project portfolio will make progress toward established targets.
CTC	2	On page 14, under Pavement Data, it says "For the 2022 TAMP, NHS pavement data isreflective of the 2019 HPMS (Highway Performance Monitoring System)." Now that Caltrans has received the pavement condition data through the annual Automated Pavement Condition Survey for 2020 and 2021, can the pavement data be updated to be more current?	Caltrans used the best available data for pavement inventory and condition to develop the 2022 TAMP due to the federal deadline to FHWA of March 15, 2022. After the deadlines for submittal of the TAMP, pavement condition data for 2020 and 2021 became available. Incorporation of the newer pavement data would require rework of a number of TAMP chapters as well as rework on the part of all MPOs in California.
CTC	2	On Page 18, Table 2-2 Inventory and Conditions of NHS Pavements in California, by Lane Miles, the percentage of Poor condition	Caltrans and FHWA have been discussing how to improve a number of Transportation Performance Management metrics including pavement and bridge conditions.

Reviewer	Chapter	Comments	Resolution
		pavement for the Locally-owned National Highway System – Non-Interstate is high, and the percentage of Good-condition pavement is low. What strategies are being considered to reduce the amount of Poor condition pavement and increase the amount of Good-condition pavement for the Locally Owned National Highway System?	Caltrans has also been in discussions with the CTC staff on strategies that could be put in place to assist local agencies better understand their expected performance outcomes form proposed project portfolios before planning begins. For the 2022 TAMP, local strategies were derived from the 2020 Local Streets and Roads Needs Assessment and also from discussions between Caltrans and local jurisdictions during TAMP development. Most local agencies have Pavement Management Systems and utilize them to manage their pavements. The focus of this TAMP was to provide more data to the locals on the location and condition of NHS pavement based on federal performance metrics. This was done through Workshop #2 on Fundamentals where Caltrans provided GIS compatible data files, providing pavement data tables in Chapter 2, and by providing the Performance Target Analysis Tool that gives MPOs ability to simulate performance outcomes based on condition of their assets.
CTC	2	On pages 19-36, Table 2-3, Inventory and Conditions of Local NHS Pavements, Listed by Geographical Jurisdiction. Is this table being used to prioritize investments on the Locally Owned Pavements on the National Highway System?	No. This table is provided to bring more awareness on the overall state of pavement by jurisdiction. Local agencies in California determine the locations and extent of their pavement investments.
CTC	2	On pages 40-53, Table 2-5, Inventory and Conditions of Non-SHS NHS Bridges, Listed by Geographical Jurisdiction. Is this table used to prioritize investments on the Locally Owned Bridges on the National Highway System?	No. This table is provided to bring more awareness on the overall state of pavement by jurisdiction. Local agencies in California identify and initiate their own bridge projects. Our hope is that this awareness of conditions will result in more priority being placed on addressing the condition of bridge assets.
CTC	2	On page 56, Table 2-8, SHS Drainage Asset Inventory and Conditions. What is the basis of the conditions of the “Projected Additional Inventory” drainage systems? As Caltrans has continued inspecting drainage systems and adding to the	Projected additional inventory for drainage systems has been based on historical percentages of good/fair/poor. It is validated at the time of inspections.

Reviewer	Chapter	Comments	Resolution
		inventory, have the projected conditions been validated?	
CTC	3	On page 67, Section 3.5, Additional Performance Targets on the SHS. Under the second bullet, it states Caltrans has met the "fix an additional 500 bridges" performance target. Based on the Final Report on the Audit of SB 1 Performance Measures and Targets from the Independent Office of Audits and Investigations, will Caltrans revise the date by which this performance target will be met?	Caltrans worked with the Office of Inspector General extensively and provided copious amounts of data to support our reporting in the Annual Performance Benchmark Report. The number of "fixes" is highly dependent on when along the project development process "credit" is taken. Caltrans had reached agreement with the Commission to use an "Estimated Construction Work Complete" to designate the time when credit would be taken. This is the best estimate of the date when the public will be experiencing the improved asset condition. The Office of Inspector General believes credit for a "fix" should not be taken until the construction contract is closed out. Contact close out often comes years after the public is experiencing the improved conditions and Caltrans does not believe this is appropriate. The Office of Inspector general acknowledges that by either method achieving 500 fixes will happen by 2027.
CTC	3	On page 69, Under PM 1: Transportation Safety it states, "Asset Management provides performance targets for each of our districts consistent with PM 1 and budgets that incentivize projects that work in high reward locations." Please document how Caltrans will "incentivize projects	Revised Chapter 3 under PM1 to further detail the meaning of incentivize: Caltrans asset management framework provides performance expectations for each district with a capped budget. The fiscal constraint incentivizes each district to maximize performance gains for each project to stretch what they can accomplish overall with their available fiscal targets.
CTC	4	On page 81, Table 4-3. Unit Cost for Pavement Treatments. Do these unit costs reflect recent trends for all Transportation Asset Management Plan assets	Pavement Treatment costs are based on the information used for development of the 2021 SHSMP for pavement and are updated every 2 years.
CTC	5	On page 122, Climate Change Policies and Actions. This section describes climate change initiatives listed in Caltrans' 2020-2024 Strategic Plan. Have these initiatives been incorporated into the State Highway System Management Plan and costs considered to determine what strategies may be needed to ensure the ability to meet the	The 2021 SHSMP incorporated some of the items included in the Strategic Management Plan and CAPTI. Caltrans is currently working to incorporate additional items into the 2023 SHSMP.

Reviewer	Chapter	Comments	Resolution
		Transportation Asset Management Plan performance targets?	
CTC	5	On page 123, Climate Change Adaptation Measures. This section describes Caltrans' District vulnerability assessments and regional transportation agency efforts focused on climate adaptation. Have these assessments been incorporated into planning documents and costs considered to determine if additional strategies will be needed to meet the Transportation Asset Management Plan performance targets?	The 2021 SHSMP included cost estimates for addressing Sea Level Rise. The 2023 SHSMP is working to include fire resiliency in the plan. Near term climate adaption projects are already programmed in the SHOPP and are going through formal planning for future programming cycles. Other locations are being evaluated for potential solution s in Planning.
CTC	5	On page 124, under Improving Roadside Fire Resilience Strategies. It mentions the baseline inventory of roadside resilience will be completed by 2022 and is expected to be a new performance objective in the next State Highway System Management Plan. Have unit costs been assigned to this strategy and considered to determine if they will impact the ability to meet the Transportation Asset Management Plan performance targets?	Caltrans is currently evaluating fire resilience as part of the 2023 SHSMP.
CTC	8	On page 161, under Closing the Performance Gap. What strategies are being considered for closing the gaps for bridge and pavement conditions where current investments strategies are not adequate? Will the funding from the Infrastructure Investment and Jobs Act be prioritized to help close these gaps?	In May 2022, all MPOs were given an opportunity to re-evaluate performance based on additional IIJA funding. There were a few agencies that increased pavement investment from IIJA. No local jurisdiction added IIJA funds for NHS bridges. The reason given is that they didn't have enough information on how much would be spent on the NHS. Caltrans is expected to invest more money on NHS bridges and will get much closer to closing the performance gap for the State. Chapter 8 has been updated to reflect IIJA funding. Additionally, in late 2021, Caltrans initiated a Bridge Deck Rehabilitation program. This initiative culminated significant analysis of how best to address the identified gaps. In October and December 2021, the Commission authorized millions of square

Reviewer	Chapter	Comments	Resolution
			feet of bridge area for programming under this new program.
CTC	8	On page 166, under Closing the Performance Gaps on the SHS (State Highways System), the Transportation Asset Management Plan states "With the addition of IIJA funding, Caltrans will evaluate performance gaps remaining including supplementary assets and address highest priority needs to improve asset conditions." With the competing initiatives and strategies how will meeting the Supplementary Asset performance targets be prioritized?	The IIJA funding provides California with an opportunity to catch up on deferred work and to potentially undertake new efforts. Additionally, Caltrans is awaiting the outcome of several budget related bills that may influence how IIJA funding is put to use. Also, the list of work that needs to get done is significantly larger than the IIJA increase. Caltrans will be evaluating these trade-offs where we have discretion in the coming months.

Public Comment Letters

Draft 2022 TAMP comment letters were received from the following entities:

- California Construction and Industrial Materials Association
- California Coastal Commission
- Delta Stewardship Council

These letters are included below:

CALCIMA

California Construction and Industrial Materials Association

February 11, 2022

Michael B. Johnson
State Asset Management Engineer
Caltrans
Sacramento, CA 95814

Re: draft 2022 Transportation Asset Management Plan

Dear Mr. Johnson::

The California Construction and Industrial Materials Association offers these comments on the draft 2022 Transportation Asset Management Plan (TAMP). CalCIMA is the statewide trade association for aggregate, concrete, asphalt, and industrial mineral producers.

While the Transportation Asset Management Plan (TAMP) has provided important benefits and efficiencies, including breaking down rigidity in administration in some areas, it has also come with a price for innovation and sustainability in specification development and materials use.

In particular, the TAMP has invested too much authority in the districts; authority that is limiting statewide efforts to use increased amounts of recycled materials, and particularly in connection with initiatives by the Pavement and Materials Partnering Committee.

As background, Caltrans has authorized the Pavement and Materials Partnering Committee (PMPC) to develop specifications for materials used on pavement and structures. It is a collaborative effort between Caltrans and industry stakeholders, who work cooperatively in teams to research and draft specification changes. It involves multiple levels of review and broad outreach of stakeholders to achieve consensus. Its rigorous processes are authorized through a charter and operates through agreed upon operating procedures. Importantly, it is the primary mechanism to help Caltrans achieve innovation and sustainability in materials.

In early 2019, the PMPC began work on developing specifications to allow for increased use of reclaimed asphalt pavement (RAP) in hot mix asphalt from 25% to 40%--known as high RAP--and to allow use of up to 3% recycled asphalt shingles (RAS) in hot mix asphalt. Both these have huge sustainability benefits, in conserving and reusing natural sources of aggregates and oil, reducing greenhouse gases, and keeping materials out of the landfills. It is a policy area where Caltrans is singularly capable of leading in recycling and climate reduction.

By early 2020, the PMPC had drafted specifications. To complete the process, pilot projects are needed to verify the specifications work as planned. So, one would think that Caltrans would be eager to try these out, taking the initiative to lead in an innovative use of materials, while leading the charge in sustainability, and get the specifications available for widespread use.

Yet, well into 2021, we learned there was only one pilot project—one for RAS and none for high RAP. It was quickly learned that the districts were not accepting pilot projects due to the TAMP. So, the PMPC scheduled a briefing for the TAMP leadership. We learned they had no knowledge of the PMPC and its initiatives, let alone the need for pilot projects to complete those specifications and the sustainability benefits. As a result, Caltrans' PMPC leaders have had to engage in an extensive education effort to inform the districts about the need for these pilot projects. While this is laudatory and may have results, the change is slow and much time has been lost. Even, at that, it is not 100% clear that the districts will engage in enough pilot projects and quickly enough.

The concern is that previously when the PMPC had identified initiatives and needed pilot projects, headquarters could place pilots in projects rapidly. Now, with the TAMP, it is left entirely to the districts and there is no incentive for them to innovate, and particularly, to take on initiatives Caltrans has prioritized through the PMPC. There is a structural impediment.

The concern seems to be exacerbated in the draft TAMP plan, since it does not mention the PMPC and how it intends to integrate initiatives and priorities of the PMPC.

We offer these observations so that Caltrans can address these structural impediments with the TAMP, including that it allows the districts to stimy state priorities, hinders work and priorities of the PMPC, and is a disincentive to the PMPC's and headquarters priorities for innovation and sustainability.

We would look forward to discussing how the TAMP can be improved to address these concerns.

Sincerely,

Charley Rea

Charles L. Rea
Director, Communications, Safety & Technical Services

cc: Mike Keever

CALIFORNIA COASTAL COMMISSION
455 MARKET STREET, SUITE 300
SAN FRANCISCO CA 94105
PHONE: (415) 904-5202
WEB: WWW.COASTAL.CA.GOV

February 11, 2022

Michael B. Johnson
State Asset Management Engineer
California Department of Transportation
1120 N St.
Sacramento, California 95814

Subject: Draft 2022 Transportation Asset Management Plan

Dear Mr. Johnson:

Coastal Commission staff appreciates the opportunity to comment on the Draft 2022 Transportation Asset Management Plan (TAMP). The mission of the Coastal Commission is to protect and enhance California's coast and ocean for present and future generations. As part of this mission, the Commission has a long history of working together effectively with Caltrans to provide a safe and resilient transportation network to and along California's coastline while also protecting coastal natural resources. Climate change and sea level rise, among other stressors, have made this work increasingly intricate and critical. Given this complexity, we appreciate the function of Caltrans' asset management system to organize California's transportation system into a network of interrelated assets. We also appreciate the role of asset management to provide a prospective, anticipatory look at transportation infrastructure assets and to look at assets more proactively in combination with each other so as to better address issues like sea level rise and climate change. We further recognize the specific role of the TAMP in tracking the condition of those assets, establishing asset performance targets, and prioritizing actions to address performance gaps.

With that frame in mind, we offer the following comments to help further advance the shared priorities of Caltrans and the Coastal Commission in the TAMP, and by extension, in the broader asset management framework, particularly in relation to addressing climate change and sea level rise. Overall, we believe the document would benefit from (1) fuller articulation of climate adaptation policy guidance and statutory requirements; (2) increased discussion of how assets operate in concert on a corridor scale, making it critical for them to be addressed within a corridor perspective; and (3) additional context regarding the benefits and shortcomings of Caltrans' current climate change Vulnerability Assessments and Adaptation Priorities Reports.

1. Climate Adaptation Policy Guidance and Statutory Requirements

The State of California has a robust body of policies, orders, and statutes directing state agencies to consider climate change when planning and funding infrastructure projects. The TAMP should recognize these existing directives at the outset, to make clear that Caltrans has the obligation to meaningfully advance climate change mitigation and

adaptation in its planning and project delivery operations, and to establish that asset management is fundamental to fulfilling those obligations. Specifically, as part of the list of *Caltrans and Other Statewide Plans and Resources* on page 3, we suggest that Caltrans add the following state guidance documents. These materials are directly related to and should inform Caltrans' work on climate change, especially sea level rise adaptation.

- Ocean Protection Council (OPC) *State of California Sea-level Rise Guidance 2018 Update*
- California Coastal Commission 2018 Sea Level Rise Policy Guidance
- California State Transportation Agency *Climate Action Plan for Transportation Infrastructure (CAPTI)* (2021)
- California Coastal Commission *Sea Level Rise Coastal Adaptation Planning Guidance for Critical Infrastructure* (November 2021)

Additionally, we would suggest that the following Executive Orders related to climate change adaptation be added to Appendix D:

- EO S-13-08 (2008): Requires all planning and construction projects by state agencies in areas vulnerable to future sea level rise to consider a range of sea level rise scenarios for the years 2050 and 2100 in order to assess project vulnerability and reduce risks and resiliency to sea level rise.
- EO B-30-15 (2015): Requires the consideration of climate change in all state investment decisions using full life cycle cost, the prioritization of adaptation actions that reduce greenhouse gases (GHG), the consideration of the state's most vulnerable populations, the prioritization of natural infrastructure solutions, and the use of flexible approaches where possible.
- EO N-82-20 (2020): Directs the State to accelerate and expand use of nature-based solutions while mitigating greenhouse gas emissions to adapt and become more resilient to the impacts of climate change through conserving 30 percent of California's land and coastal waters by 2030.

Finally, we would like to draw your attention to SB 1 (Ch. 236, Stats 2021), which added Sections 30421 and 30270 to the Coastal Act. Together, these sections require state agencies to identify, assess, and, to the extent feasible and consistent with their statutory authorities, avoid, minimize, and mitigate the impacts of sea level rise. The new provisions also grant the Coastal Commission policy authority over identification, assessment, and, to the extent feasible, avoidance and mitigation of the adverse effects of sea level rise. It would be beneficial for the TAMP to recognize these new statutory requirements that apply to Caltrans plans and projects.

2. Maintaining a Corridor-wide Perspective

We appreciate that the asset management system is premised on viewing the State Highway System and much of the National Highway System in terms of individual assets that can be tracked and evaluated over time, and that closely managing assets at the individual scale will cumulatively provide for a functioning transportation network. At the same time, it is critical for the TAMP to recognize that climate change effects such as sea level rise will impact the transportation network at the corridor scale, not just at the level of individual assets, and that this necessitates having a corridor-wide perspective when evaluating vulnerability and planning for adaptation.

Incorporating this corridor-wide perspective into the asset management system is a challenging but necessary task. This includes considering how individual assets operate in concert together over the short, medium, and long-term to provide reliable service, and developing quantitative and qualitative metrics to track those relationships. Based on these metrics, Caltrans is urged to develop corridor-level performance targets to ensure that the TAMP is programming funds not just for individual assets but also for the other relevant connecting assets that are necessary for service. It is equally critical that the TAMP be structured to avoid programming investments in assets that will provide little return on investment when the larger corridor is impacted by sea level rise, including any “stranded assets” that will be rendered inaccessible or non-functioning by future projected climate change.

We appreciate that these developments represent a paradigm shift in asset management. For the purposes of the 2022 TAMP, we encourage Caltrans to explicitly recognize the need for these changes, and to incorporate them to the greatest extent feasible. Specifically, on page 170 under “Corridor View of TAM Investment Decision-Making,” we suggest that the TAMP elaborate on the need for alignment of the TAMP with the investment principles in the CAPTI in order to achieve Caltrans’ climate change objectives, both in terms of GHG/VMT reduction and context-sensitive adaptation. Furthermore, Section 4 on Life Cycle Planning should recognize that taking proactive action to avoid or mitigate sea level rise vulnerability will save money compared to repeated maintenance costs and eventual failure of critical transportation assets impacted by climate change. This would be consistent with federal regulatory direction for life-cycle planning to include a process for estimating the cost of managing an asset class, or asset sub-group, over its whole life with consideration for minimizing coast while preserving or improving the condition.

As part of our partnership, Caltrans and the Coastal Commission will continue working to realize this paradigm shift in asset management perspective through our ongoing coordination, collaboration on Caltrans climate change guidance and corridor planning guidance, and through the State Transportation and Environmental Partnership for Permitting Efficiency (STEPPE) Recommendation 2.2 Sub-group.

3. Vulnerability Assessments and Adaptation Priorities Reports

The District VAs and APRs provide a useful, standard beginning place for conceptualizing climate risks and adaptation priorities in a consistent fashion throughout the state. However, the TAMP should recognize that there are a number of important shortcomings with both products that Caltrans will need to resolve through future updates to these and related documents.

A. Extreme Risk Aversion (H++) SLR Scenario

The SLR exposure assessments did not reflect the 2018 OPC State of California Sea-Level Rise Guidance which states that SLR analysis for critical infrastructure projects like transportation should assess the medium-high and extreme (H++) SLR projections for the anticipated life of the project. In many cases, the common convention is that expected service life for transportation assets will be 70-100 years —or the 2100 time-horizon—meaning that the H++ SLR amount would be 10 feet. This is a basic gap in all of the District VAs, except for D1 and the southern portion of Santa Barbara in D5.

To be clear, the H++ scenario is meant to provide an overall sense of risk, and it is not expected that Caltrans needs to plan or design for resilience to that threshold in all adaptation projects or plans. Instead, while it may make sense to address the H++ scenario in a single adaptation project for certain pieces of critical infrastructure, in other cases it may be appropriate to use a phased approach to adaptation and resiliency from a corridor perspective. For example, planners can design multiple phases of adaptation measures, each for an incremental amount of sea level rise, up to and including the H++ scenario. By linking each phase to a particular amount of sea level rise or a particular physical impact of sea level rise, phasing allows adaptation measures, including potential relocation or elevation, to be triggered when they are necessary. This allows the adaptation pathway to be responsive to changes in the observed rate of sea level rise and other changing conditions over time. Good explanations of how to consider H++ is provided in the California Coastal Commission's 2018 *Sea Level Rise Policy Guidance* and in the *Critical Infrastructure at Risk: Sea Level Rise Planning Guidance for California's Coastal Zone*. Going forward, future climate planning and design work for Caltrans assets should consider the H++ scenario that matches their expected service life.

B. Regulatory Considerations

Caltrans projects seeking Coastal Development Permits from the Coastal Commission or local jurisdictions will need to be consistent with Coastal Act and LCP policies, including those related to avoiding hazardous areas and minimizing and mitigating the impacts of sea level rise. If Caltrans uses hardening (i.e., seawalls, revetment) approaches to mitigate SLR vulnerabilities, coastal assets like beaches and wetlands could be caught between rising seas and the transportation infrastructure and drown, a phenomenon known as "coastal squeeze." When seeking to initiate plans or program projects in the coastal zone, Caltrans should consider adaptation strategies beyond

hardening approaches, and seek to avoid and minimize impacts to coastal assets like beaches, wetlands, public accessways, and related coastal resources to the greatest extent feasible. To advance this approach in the TAMP, Caltrans should continue to collaborate with the Coastal Commission and other agencies partners in developing an asset prioritization method that considers the range of coastal resources noted above in proximity to transportation system at risk of coastal squeeze. And these considerations should be integrated into APRs and ongoing companion SLR adaptation planning and programming efforts.

C. Spatial Data

The exposure analysis included in Caltrans' Vulnerability Assessments appears to have been a GIS intersection analysis that identified where the Transportation System Network centerline was overlapped or crossed the SLR scenarios. As a result, areas where projected cliff erosion or flooding may impact the roadway west of the centerline, including shoulders and roadside barriers were not identified as vulnerable in the VAs. Limited attention was also given to cliff and bluff erosion in these analyses as well. In addition, the VAs did not assess other Caltrans assets like rail or other important multimodal and public access infrastructure like parking lots, trails, stairways, etc. Going forward, future vulnerability work should consider the full spatial footprint of the highway system and other Caltrans assets including bridges, culverts, rail, and multimodal /public access infrastructure like parking lots, trails, stairways, etc.

Collectively, while the VAs and APRs provide a useful starting point for integrating asset vulnerability and adaptation into the asset management system, the shortcomings of those documents should be acknowledged in the TAMP. We also strongly recommend that the TAMP and other related planning efforts acknowledge the ongoing need for further technical studies and analysis into SLR vulnerability for transportation infrastructure along with how different adaptation responses may impact coastal resources.

Thank you for your consideration of these comments. We look forward to further opportunities to coordinate with Caltrans in promoting a safe, equitable, and resilient transportation network. If you have any questions or would like to discuss these comments, please do not hesitate to contact me.

Sincerely,

Sean Drake

Sean Drake
Senior Transportation Program Manager
California Coastal Commission

Copy: Tami Grove, Statewide Transportation Program Manager, CCC
Kate Anderson, Coastal Program Manager, Caltrans

Delta Stewardship Council
A CALIFORNIA STATE AGENCY

715 P Street, 15-300
Sacramento, CA 95814

916.445.5511
DELTACOUNCIL.CA.GOV

February 16, 2022

Michael B. Johnson, State Asset Management Engineer
California Department of Transportation
1129 N Street
Sacramento, CA 95814

Sent via email: CT-TAM@dot.ca.gov

RE: DRAFT 2022 California Transportation Asset Management Plan (TAMP)

Dear Michael Johnson:

Thank you for the opportunity to review and comment on the draft 2022 California Transportation Asset Management Plan (TAMP). The Delta Stewardship Council (Council) understands the objectives of the draft TAMP to outline the physical condition of key transportation assets in California and strategically maximize limited resources, incorporate risk, and manage the life cycle of these assets to minimize long-term ownership costs. Council staff submitted input on the draft TAMP on February 11, 2022 via the survey link provided by Caltrans on the TAMP website. This letter constitutes the Council's review of the draft TAMP and provides additional context to comments submitted on the survey.

The 2009 Delta Reform Act charged the Council with furthering the State's coequal goals for the Sacramento-San Joaquin Delta (the Delta) of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem, to be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place. (Wat. Code § 85054). A major part of this includes long-term planning for climate change, including consideration for the future of major infrastructure, including transportation facilities. Additionally, Water Code Sections 85307(c) and 85320(c) outline the Council's role in consulting with Caltrans to address climate change and sea level rise across the Delta, and the need to plan for up to 55 inches of sea level rise and possible changes in precipitation and runoff, respectively. Lastly, Public Resources Code Section 71156 requires all state agencies to take into account

the current and future impacts of climate change when planning, designing, building, operating, and investing in state infrastructure.

The draft TAMP provides a framework for understanding performance gaps, prioritizing actions to address the gaps, and establishing business processes that streamline asset management activities. It develops a shared vision for maintaining the state's transportation system, identifies performance measures for safety, reliability, and overall condition, and outlines an approach to life cycle planning in a changing climate. The draft TAMP discusses strategies for managing risks and building resilience, with recognition of the challenges associated with climate change and sea level rise specifically. It also calls for additional climate change initiatives, leadership, adaptation measures, and community engagement. These measures – as well as Caltrans' 2019 vulnerability assessments and participation in other regional climate adaptation frameworks – are helpful in assessing vulnerabilities to climate change.

Comments on the draft TAMP

We appreciate that the draft TAMP highlights the risks that sea level rise and flooding pose to transportation infrastructure in California. However, the current draft describes this as a concern for coastal areas (section 5.1, p. 111). While coastal areas may be the most directly affected by increased erosion, the Delta and inland connected waterways are also subject to sea level rise and changes in flood exposure. We request that this be acknowledged in the final TAMP. Two Council projects may be of interest in quantifying parts of this exposure and potential solutions: Delta Adapts and the Delta Levees Investment Strategy.

The Council is currently carrying out the first-ever comprehensive climate change vulnerability assessment (VA) and adaptation strategy (AS) for the Delta. Known as Delta Adapts, this work aims to inform Delta Plan implementation, help the State prioritize future actions and investments, provide a toolkit of information for local governments, and serve as a framework for the Council and others to build upon in future work. Delta Adapts relies heavily on collaboration with agency partners and stakeholder engagement in a variety of forums ranging from technical advisory committee (TAC) meetings to community-based organization-led workshops. The first phase of this initiative, a vulnerability assessment, was completed in 2021 and includes a detailed assessment of potential impacts to infrastructure in the Delta, including transportation networks in or that pass through the Delta.

Although the draft TAMP includes a focus on sea level rise, it does not address the projected impacts of sea level and changes in riverine inflows within the Delta. We encourage Caltrans to include discussion of transportation assets in the Delta in the final

TAMP, as well as the expected impacts from climate change on those assets, as the Delta is expected to experience up to 1.9 feet of sea level rise by 2050[1]. The Delta is a major component of and is connected to the larger San Francisco Bay Estuary, and as discussed above, is also subject to sea level rise. Numerous local and regional roads cross the Delta, including State Route (SR) 12, SR 4, and SR 160, and the area is partially bounded by I-680, I-80, and I-5. The vulnerability of these transportation assets to flooding from sea level rise and changes in inflows in the Delta should be acknowledged in the final TAMP. For more information on sea level rise and flood vulnerability in the Delta, please refer to the Delta Adapts Flood Hazard Assessment Technical Memo which outlines the effects of sea level rise and changing Delta inflows on local water levels within the Delta. Data for flood risk exposure developed as part of Delta Adapts was shared with Caltrans staff, as requested, on February 2, 2022.

The final TAMP should also consider the Delta Levees Investment Strategy (DLIS), a multi-agency effort led by the Council to update priorities for state investments in the Delta levee system to reduce the likelihood and consequences of levee failures, and to protect people, property and state interests. DLIS was first developed in 2014, and was recently updated to include new information regarding the heights of levees and Delta island floors into the risk assessment and prioritization calculations. This is relevant to transportation assets as many Delta levees have roads running along their crest (including portions of SR 160) or protect additonal transportation assets within the region.

Lastly, we appreciate the section of the draft that discusses equity in transportation and efforts to develop an equity index and include equity in future asset management. We also encourage Caltrans to consider environmental justice throughout every aspect of the TAMP. The Council anticipates developing an environmental justice issue paper in the coming year that could both help inform implementation of Delta Adapts as well as Caltrans investments in transportation infrastructure in the region. We encourage you to engage with Council staff on this effort.

The draft TAMP provides valuable information and approaches that can help guide the future of transportation in the Delta. We invite Caltrans and partners to engage with the Council as you continue to work on specific actions identified in the draft TAMP. Please contact Morgan Chow at (916) 445-5511 or morgan.chow@deltacouncil.ca.gov with any questions.

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[1] California Ocean Protection Council (OPC). 2018. State of California Sea-Level Rise Guidance. 2018 Update. http://www.opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf

Sincerely,

Jeff Henderson, AICP
Deputy Executive Officer
Delta Stewardship Council

CC: Michael Johnson, State Asset Management Engineer (michael.b.johnson@dot.ca.gov)

Marlon Regisford, Deputy District Director, Planning, Local Assistance, and Environmental, Caltrans District 10 (marlon.regisford@dot.ca.gov)

Alex Fong, Assistant Deputy Director for Planning, Local Assistance, and Sustainability, Caltrans District 3 (Alexander.Fong@dot.ca.gov)

Appendix D. Asset Management Related Policies, Regulations, Guidelines

The Transportation Asset Management Plan incorporates guidance from many sources. Summaries or links to the most influential guiding documents for preparing California's Transportation Asset Management Plan are included in this Appendix. It includes related state policies and plans, federal legislation such as MAP-21, PM2 regulations, state legislation including Senate Bills 1 and 486, related climate change orders, policies and guidance, and the Commission TAMP Guidelines and Actions which directed the state specific aspects of the Plan.


CALTRANS 2020-24
STRATEGIC PLAN
VISION
A brighter future for all through a world-class transportation network
MISSION
Provide a safe and reliable transportation network that serves all people and respects the environment
CORE VALUES
ENGAGEMENT
We inspire and motivate one another through effective communication, collaboration, teamwork, and partnership.
EQUITY
We strive to eliminate disparities while improving outcomes for all.
INNOVATION
We are empowered to seek creative solutions and take informed risks.
INTEGRITY
We promote trust and accountability through our consistent and ethical actions.
PRIDE
As one Caltrans family, we are proud of our work and strive for excellence in public service.
STRATEGIC IMPERATIVES
STRATEGIC IMPERATIVE 1
Improve and expand community partnerships, especially in underserved communities.
STRATEGIC IMPERATIVE 2
To the maximum extent feasible, align financial investments to deliver on State goals and Caltrans' strategic outcomes while maintaining a fix-it-first approach and staying within existing funding frameworks.
STRATEGIC IMPERATIVE 3
Commit to equity-focused actions that make advancements in the areas of People, Programs and Projects, Partnerships, and Planet, as referenced in Caltrans' Equity Statement.
GOALS
Safety first
Cultivate excellence
Enhance and connect the multimodal transportation network
Strengthen stewardship and drive efficiency
Lead climate action
Advance equity and livability in all communities

Caltrans Equity Statement

December 10, 2020

Acknowledgement

The California Department of Transportation (Caltrans) acknowledges that communities of color and under-served communities experienced fewer benefits and a greater share of negative impacts associated with our state's transportation system. Some of these disparitiesreflect a history of transportation decision-making, policy, processes, planning, design, and construction that "quite literally put up barriers, divided communities, and amplified racial inequities, particularly in our Black and Brown neighborhoods."[1]

Caltrans recognizes our leadership role and unique responsibility in State government to eliminate barriers to provide more equitable transportation for all Californians. This understanding is the foundation for intentional decision-making that recognizes past, stopscurrent, and prevents future harms from our actions.

Statement of Commitment

We will achieve equity when everyone has access to what they need to thrive — starting with our most vulnerable — no matter their race, socioeconomic status, identity, where they live, orhow they travel. To create a brighter future for all Californians, Caltrans will implement concrete actions as outlined in our Race & Equity Action Plan, regularly update our Action Plan, and establish clear metrics for accountability in order to achieve the following commitments:

1. People - We will create a workforce at all levels that is representative of the communities we serve by improving our recruitment, hiring, contracting, and leadershipdevelopment policies and practices.
2. Programs & Projects - We will meaningfully engage communities most impacted by structural racism in the creation and implementation of the programs and projects thatimpact their daily lives by creating more transparent, inclusive, and ongoing consultation and collaboration processes. We will achieve our equity commitments through an engagement process where everyone is treated with dignity and justice. We will reform our programs, policies, and procedures based on this engagement to avoid harm to frontline and vulnerable communities. We will prioritize projects that improve access for and provide meaningful benefits to underserved communities.
3. Partnerships - By leveraging our transportation investments, we also commit to increasing pathways to opportunity for minority-owned and disadvantaged businessenterprises, and for individuals who face systemic barriers to employment.
4. Planet - We commit to combatting the climate crisis and its disproportionate

impact onfrontline and vulnerable communities — such as Black and Indigenous peoples, communities of color, the people experiencing homelessness, people with disabilities, and youth. We will change how we plan, design, build, and maintain our transportationinvestments to create a more resilient system that more equitably distributes the benefits and burdens to the current and future generations of Californians.

[1] California State Transportation Agency Secretary David Kim's Statement on Racial Equity, Justice and Inclusion in Transportation

Federal Requirements

Moving Ahead for Progress in the 21st Century Act, Public Law (PL) 112-141

MAP-21 PL 112-141 was signed into law by President Obama on July 6th, 2012. MAP-21 authorizes the federal surface transportation programs for highways, highway safety, and transit and provides funding of over $105 billion for the federal FYs 2013 and 2014. It covers a variety of transportation related issues including financing, state and metropolitan transportation planning, congestion relief, improved safety, expedited project delivery, consolidation of federal programs, goods movement, and transportation related research and studies.

https://www.gpo.gov/fdsys/pkg/PLAW-112publ141/html/PLAW-112publ141.htm

Fixing America's Surface Transportation Act, PL 114-94

On December 4, 2015, the Fixing America's Surface Transportation Act, or "FAST Act" was signed into law. It is the first law enacted in over ten years that provides long-term funding certainty for surface transportation, meaning States and local governments can move forward with critical transportation projects, like new highways and transit lines, with the confidence that they will have a Federal partner over the long term. The FAST Act continues asset management requirements and added critical infrastructure to the considerations a State may include in its asset management plan [23 U.S.C. 119(j)(2)].

https://www.gpo.gov/fdsys/pkg/PLAW-114publ94/html/PLAW-114publ94.htm

Infrastructure Investment and Jobs Act, PL 117-58

On November 15, 2021, the Infrastructure Investment and Jobs Act, or "IIJA" was signed into law. This Bipartisan Infrastructure law provides $550 billion over fiscal years 2022-2026 to improve America's roads, bridges, mass transit, water infrastructure, resilience, and broadband. The IIJA also continues asset management requirements including considerations of extreme weather and resilience as part of the lifecycle cost and risk management analyses within the TAMP (23 U.S.C. 119(e)(4)(D).

https://www.govinfo.gov/content/pkg/BILLS-117hr3684enr/pdf/BILLS-117hr3684enr.pdf

23 Code of Federal Regulations Part 515

The TAMP Final Rule establishes the processes State department of transportations must use to develop a TAMP. Each state is required to develop a risk-based TAMP for the NHS to improve or preserve the condition of the assets and the performance of the system in accordance with MAP-21 § 1106(a), codified as 23 U.S.C. 119 (e) and (t) (https://www.gpo.gov/fdsys/pkg/USCODE-2015-title23/html/USCODE-2015-title23-chap1-sec119.htm)

https://www.ecfr.gov/current/title-23/chapter-I/subchapter-F/part-515

23 Code of Federal Regulations Part 490

The Pavement and Bridge Performance Management Final Rule was established to implement MAP-21 and FAST Act performance management requirements.

https://www.federalregister.gov/documents/2017/01/18/2017-00681/national-performance-management-measures-assessing-performance-of-the-national-highway-system

State Requirements

Senate Bill 486

SB 486, Section 6, Statutes of 2014, requires that Caltrans in consultation with the California Transportation Commission prepare a robust asset management plan to guide the selection of projects in the State Highway Operation and Protection Program.

https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB486

Senate Bill 1 (Chapter 5)

SB 1, Chapter 5, Statutes of 2017, Road Repair and Accountability Act of 2017 that provides the first significant, stable, and on-going increase in state transportation funding in more than two decades. SB 1 provides funding and created new programs.

https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1

Senate Bill 1 (Chapter 236)

SB 1, Chapter 236, Statutes of 2021, Coastal Resources: Sea Level Rise added Section 30421 that requires state and regional agencies to identify, assess, and to the extent feasible, avoid, minimize and mitigate for impacts of sea level rise.

https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220SB1

Climate Adaptation Statutory Requirements and Policy Guidance

The State of California has a number of statutes, executive orders, and policies to address climate change in the planning and funding of infrastructure projects. The following are some of the primary climate change related documents to guide asset management activities including the TAMP and SHSMP:

EO S-13-08 (2008)

Requires all planning and construction projects by state agencies in areas vulnerable to future sea level rise to consider a range of sea level rise scenarios for the years 2050 and 2100 in order to assess project vulnerability and reduce risks and resiliency to sea level rise.

https://www.library.ca.gov/wp-content/uploads/GovernmentPublications/executive-order-proclamation/38-S-13-08.pdf

EO B-30-15 (2015)

Requires the consideration of climate change in all state investment decisions using full life cycle cost, the prioritization of adaptation actions that reduce greenhouse gases (GHG), the consideration of the state's most vulnerable populations, the prioritization of natural infrastructure solutions, and the use of flexible approaches where possible.

https://www.library.ca.gov/wp-content/uploads/GovernmentPublications/executive-order-proclamation/39-B-30-15.pdf

EO N-19-19 (2019)

A number of actions are outlined in this executive order to combat climate change and achieve the objectives of the state's climate goals.

https://www.gov.ca.gov/wp-content/uploads/2019/09/9.20.19-Climate-EO-N-19-19.pdf

EO N-79-20 (2020)

Requires 100% of in-state sales of new passenger cars and light duty trucks will be zero-emission by 2035 and medium and heavy duty vehicles sales must be zero emission by 2045 where feasible.

https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf

EO N-82-20 (2020)

Directs the State to accelerate and expand use of nature-based solutions while mitigating greenhouse gas emissions to adapt and become more resilient to the impacts of climate change through conserving 30 percent of California's land and coastal waters by 2030.

https://www.library.ca.gov/wp-content/uploads/GovernmentPublications/executive-order-proclamation/40-N-82-20.pdf

Ocean Protection Council (OPC) State of California Sea-level Rise Guidance 2018 Update

https://www.opc.ca.gov/updating-californias-sea-level-rise-guidance/

California Coastal Commission 2018 Sea Level Rise Policy Guidance

https://documents.coastal.ca.gov/assets/slr/guidance/2018/0_Full_2018AdoptedSLRGuidanceUpdate.pdf

California State Transportation Agency Climate Action Plan for Transportation Infrastructure (CAPTI) (2021)

https://calsta.ca.gov/subject-areas/climate-action-plan

California Coastal Commission Sea Level Rise Coastal Adaptation Planning Guidance for Critical Infrastructure (November 2021)

https://www.coastal.ca.gov/climate/slr/vulnerability-adaptation/infrastructure/

California Air Resources Board Climate Change Scoping Plan (2021)

https://ww2.arb.ca.gov/our-work/programs/sustainable-communities-program/what-are-sustainable-communities-strategies

California Air Resources Board Sustainable Community Strategies (2021)

https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan

Delta Stewardship Council: Delta Adapts: Creating a Climate Resilient Future (2021)

https://deltacouncil.ca.gov/pdf/delta-plan/2021-06-25-delta-adapts-vulnerability-assessment.pdf

California Transportation Commission Transportation Commission Guidelines (Revised June 29, 2017)

The Commission adopted TAMP Guidelines to implement the provisions of SB 486 and SB 1, and expanded the State Highway System asset classes beyond the federal requirements.

These Guidelines are included below:

CALIFORNIA TRANSPORTATION COMMISSION

Transportation Asset Management Plan Guidelines

(Revised June 29, 2017)

STATE OF CALIFORNIA CALIFORNIA TRANSPORTATION COMMISSION

CALIFORNIA TRANSPORTATION COMMISSION

TRANSPORTATION ASSET MANAGEMENT PLAN GUIDELINES

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STATE OF CALIFORNIA CALIFORNIA TRANSPORTATION COMMISSION

TRANSPORTATION
ASSET MANAGEMENT PLAN GUIDELINES

A. TRANSPORTATION ASSET MANAGEMENT PLAN

Senate Bill 486 (DeSaulnier, 2014) requires that the California Department of Transportation (Caltrans), in consultation with the California Transportation Commission (Commission), prepare a "robust" transportation Asset Management Plan (TAMP) to inform and guide the project selection process for the State Highway Operation and Protection Program (SHOPP). Specifically, the legislative intent in support of an asset management plan is that it serves as a policy document to inform future transportation investment decision making.

Subject to Government Code Section 14526.5, the Commission adopts the SHOPP and may decline to adopt the SHOPP if the Commission determines that the SHOPP is not sufficiently consistent with the TAMP. Government Code Section 14526.4 also establishes the requirements for the development of the TAMP and the Commission's roles and responsibilities. Section 14526.4 sets forth the following:

Caltrans responsibilities include:

- Preparing, in consultation with the Commission, a robust TAMP to guide selection of SHOPP projects required by Section 14526.5.
- Ensuring the TAMP is consistent with any applicable state and federal requirements.
- If necessary, preparing the TAMP in phases, with the first phase to be implemented with the 2016 SHOPP, and the complete TAMP to be prepared no later than the 2020 SHOPP.

Commission responsibilities include:

- Adopting targets and performance measures reflecting state transportation goals and objectives.
- Reviewing and approving the TAMP.

The Commission adopted the TAMP Guidelines on June 28, 2017 at its June Commission meeting.

B. STATE GOALS AND OBJECTIVES & ADOPTION OF PERFORMANCE MEASURES AND TARGETS

Government Code Section 14526.4(c)(1) requires that the Commission, in connection with the TAMP, "adopt targets and performance measures reflecting state transportation goals and objectives." The Commission's adoption of targets and performance measures reflects state transportation goals and objectives as identified in substantive part in State Legislation, Governor Executive Orders, and the California Transportation Plan. The Commission's adoption of targets and performance measures is also informed by Federal laws and regulations. Therefore, the Commission expects that Caltrans will submit target and performance measure recommendations for Commission approval that align with these authoritative laws and policies and provide for the following:

Preserve the Existing Transportation Infrastructure

- Ensure existing assets are adequately maintained

Improve the Safety of the Transportation System

- Support projects that minimize fatalities, injuries and reduce property damage

- Provide for emergency preparedness and response

Support State Environmental Goals

- Conserve natural, agricultural and cultural resources
- Reduce greenhouse gas emissions and other pollutants

Support a Vibrant Economy

- Enhance freight mobility, reliability, and global competitiveness

Foster Livable and Healthy Communities

- Support projects that address public health considerations
- Support multimodal and/or active transportation elements

In addition to establishing an TAMP in compliance with the state's transportation goals and objectives, the Road Repair and Accountability Act of 2017, Senate Bill (SB) 1, provides the first significant, stable, and on-going increase in state transportation funding in more than two decades. In providing this funding, the Legislature has increased the Commission's role in a number of existing programs, and created new programs for the Commission to oversee. Specific to the implementation of the TAMP, the legislative intent of SB 1 includes but is not limited to the following:

- Improving the condition of the state's road system will have a positive impact on the economy as it lowers the transportation costs of doing business, reduces congestion impacts for employees, and protects property values in the state.
- Well-maintained roads benefit all users, not just drivers, roads are used for all modes of transport, whether motor vehicles, transit, bicycles, or pedestrians.
- Well-maintained roads additionally provide significant health benefits and prevent injuries and death due to crashes caused by poorly maintained infrastructure.
- Relative to this account, SB 1 states that "it is the intent of the Legislature that the Department of Transportation and local governments are held accountable for the efficient investment of public funds to maintain the public highways, streets, and roads, and are accountable to the people through performance goals that are tracked and reported."
- SB 1 further states that it is the intent of the Legislature that Caltrans meet the following preliminary performance outcomes for additional state highway investments by the end of 2027, in accordance with applicable state and federal standards:
  - Not less than 98 percent of pavement on the state highway system in good or fair condition.
  - Not less than 90 percent level of service achieved for maintenance of potholes, spalls, and cracks.
  - Not less than 90 percent of culverts in good or fair condition.
  - Not less than 90 percent of the transportation management system units in good condition.
  - Fix not less than an additional 500 bridges.

While State Legislation, Governor Executive Orders, the California Transportation Plan, and Federal laws and regulations serve as natural direction for establishment of state goals and priorities. Given limited transportation funding, the Commission expects that Caltrans will recommend targets and performance measures that reflect federal and state goals and objectives, where applicable, through a policy lens that prioritizes high-traffic routes and corridors and identifies opportunities to maximize state funds with matching funds.

C. TRANSPORTATION ASSET MANAGEMENT PLAN COMPONENTS

While Government Code Section 14526.4 defines an asset management plan to mean a "document assessing the health and condition of the state highway system with which the department is able to determine the most effective way to apply the state's limited resources," it provides no rubric for the development of such a plan. For this, Caltrans and the Commission have relied on the federal requirements established in both the Moving Ahead for Progress in the 21st Century (MAP-21) and the Fixing America's Surface Transportation (FAST) Acts, respectively, to formulate what constitutes the TAMP.

According to federal requirements, each State is required to "develop a risk-based Asset Management Plan for the National Highway System to improve or preserve the condition of the assets and the performance of the system" (23 U.S.C. 119(e) (1), MAP-21 § 1106). Under the federal requirements, States are required to address pavements and bridges in their asset management plans but are "encouraged" to include all infrastructure within the transportation system right-of-way. Therefore, to ensure consistency with the Federal Highway Administration (FHWA) specifications, the Commission expects that the Caltrans submitted TAMP shall, at a minimum, include the following components:

a. A summary listing of the State's assets;

b. A description of the condition of the assets identified in section (a);

c. Objectives and measures for asset management;

d. Performance gap identification;

e. Lifecycle cost and risk management analysis*

(* With respect to life cycle cost planning, the Commission and Caltrans will assess the efficacy of the investment strategies outlined in the TAMP from a network perspective, and not a project-based perspective)

f. A financial plan; and

g. Investment strategies.

While the federal requirements require the components described above to be applied to the pavements and bridge asset classes on the National Highway System (NHS), SB 486 is clear in its requirement that from the State's perspective the TAMP contemplate this analysis for all asset classes within the State Highway System (SHS). It is the expectation of the Commission that, pursuant to SB 486, a compliant TAMP will include the narrative or analysis for components a-d above for each asset class approved by the Commission, unless the Commission approves a different level of detail for such asset class based upon the recommendation of Caltrans and approval by the Commission at a Commission meeting. A compliant TAMP will also include a global or cumulative analysis for all Commission approved asset classes that includes components e-g, unless otherwise modified and approved by the Commission.

D. TRANSPORTATION ASSET MANAGEMENT PLAN SAMPLE OUTLINE

The FHWA Office of Asset Management, Pavements and Construction has included a number of sample outlines for State Departments of Transportation to use as they develop their transportation asset management plans. Subject to State and federal requirements, the Commission expects Caltrans to follow the FHWA framework, in pertinent part, in developing the TAMP and presenting it for Commission approval. The FHWA outline for the State Departments of Transportation to utilize in the development of their respective asset management plans is included below:

	FHWA Outline for State Departments of Transportation Asset Management Plan Framework	
a.	Summary listing of SHS Assets	Summarize the inventory.
b.	Asset Inventory and Conditions	Summarize the inventory and condition of the SHS assets.
c.	Asset Management Objectives and Measures	▪ Define the objectives of the asset management program. ▪ Define levels of service and measures. ▪ Define short term and long term condition targets.
d.	Performance Gap Assessment	▪ Define asset management planning assessment horizons. ▪ Describe traffic growth and demand on the system. ▪ Present an analysis of future funding versus condition scenarios. ▪ Illustrate the performance gap between existing condition levels and future condition levels.
e.	Lifecycle Cost Considerations and Risk Management Analysis	▪ Define "lifecycle costs" and explain why they are important. ▪ Describe the methodology used to address life cycle costs in the TAMP. ▪ Set the context for risk management. ▪ Define key programmatic risks associated with implementation of the TAMP (e.g., cost escalations, budget cuts and environmental delays.) ▪ Define system risks that could adversely affect the SHS (e.g., asset failure and external events such as floods, earthquakes, and hurricanes.) ▪ Provide a map showing the SHS assets most at risk. ▪ Include a risk register that provides the following for each programmatic risk – likelihood of occurrence, consequences of occurrence, and mitigation activities.
f.	Financial Plan	▪ Summarize historic funding levels for asset management. ▪ Define the amount of funds expected to be available for asset management and describe where funds will come from. ▪ Define how funds will be allocated in the short term. ▪ Define how funds will be allocated in the long term, as part of the asset management long term planning horizon. ▪ Determine current value of the assets and describe the implications of various funding levels in terms of asset valuation and financial sustainability.
g.	Investment Strategies	▪ Describe key work strategies resulting from the above analyses. The strategies should include typical unit costs and typical timing. ▪ Identify priorities for asset management improvement.

E. COMMISSION APPROVED TRANSPORTATION ASSET MANAGEMENT PLAN CLASSIFICATIONS

At the March 2015 Commission meeting, Caltrans recommended the approval of four asset classes that comprise the majority of the SHOPP physical asset expenditures for inclusion in the TAMP. A summary listing of 15 additional assets not recommended for inclusion in the TAMP were listed in Caltrans' book item for a total of 19 asset classes. The Commission requested that office buildings be added to the list of asset classes. The Commission approved the primary and supplementary asset classes for inclusion in the

TAMP, consisting of 20 asset classes identified below and expects that these asset classes will be included in the final TAMP.

Furthermore, in the event there are any deletions, additions, or refinements to the list of approved asset classes, Caltrans will seek approval by the Commission prior to incorporating any changes to the final list of both primary and supplementary asset classes. The following primary and supplementary asset classes have been approved by the Commission and subject to inclusion in the TAMP:

Compliant Transportation Asset Management Plan Components*	Asset Inventory (a)	Condition Assessment (b)	Performance Measures and Targets (c)	Performance Gap Identification (d)
Primary Asset Classes **				
Bridges	☑	☑	☑	☑
Culverts	☑	☑	☑	☑
ITS Elements	☑	☑	☑	☑
Pavements	☑	☑	☑	☑
Supplementary Asset Classes				
Drainage Pump Plants	☑	☑	☑	☑
Highway Lighting	☑	☑	☑	☑
Office Buildings	☑	☑	☑	☑
Overhead Signs	☑	☑	☑	☑
Park and Ride Facilities ***	☑	☑	☑	☑
Roadside Rest Facilities	☑	☑	☑	☑
Sidewalks ***	☑	☑	☑	☑
Transportation Related Facilities****	☑	☑	☑	☑
Weigh in Motion Scales	☑	☑	☑	☑

* A compliant TAMP will also include a global or cumulative analysis for all Commission approved asset classes that includes lifecycle cost and risk management analysis, where applicable, a financial plan, and Investment strategies.
** For primary asset classes, Caltrans will perform a life cycle/risk management assessments
*** For this asset class, Caltrans will perform accessibility analysis.
**** Transportation Related Facilities include maintenance stations, traffic management centers, equipment shops and transportation laboratories)

F. SCHEDULE FOR SUBMISSION OF THE TRANSPORTATION ASSET MANAGEMENT PLAN PHASES INCLUDING PERFORMANCE MEASURES AND TARGETS

Attachment A (Commission Actions as of March 2017) includes a summary of items submitted to the Commission by Caltrans and actions taken, if any, by the Commission related to the TAMP. The Commission acknowledges that Caltrans must submit a compliant TAMP that addresses certain components outlined in these TAMP Guidelines for the purpose of compliance with state and federal regulation that includes how California will address asset management principles for the NHS and SHS. On or before the October 2017 Commission meeting, Caltrans shall present an updated TAMP to the Commission for review and approval that includes the following components for all Commission approved asset classes as specified in Section C of the TAMP Guidelines. For the purposes of the October 2017 draft TAMP, components e-g identified in Section C may be presented for Commission review and approval if such components are substantially completed by Caltrans. Caltrans' proposed schedule for the submission of the October 2017 draft TAMP is as follows, and may be modified subject to mutual agreement:

- October/2017: October 2017 draft TAMP published by Caltrans for stakeholder comments.

- January/2018: October 2017 draft TAMP submitted to the Commission for formal comments.
- March/2018: Commission adopted of the October 2017 TAMP.
- April/2018: Submission of October 2017 TAMP to FHWA for compliance with federal requirements.

G. REPORTING/ACCOUNTABILITY

The Commission understands that Caltrans is currently working on various components and phases of the TAMP. The Commission expects that as Caltrans completes various components and phases of the TAMP, that Caltrans will submit the TAMP revisions to the Commission for formal approval. At a minimum, and no less frequently than on a quarterly basis, the Commission expects that Caltrans will provide reporting to the Commission on the development of components or phases of the Commission approved TAMP and on the implementation and achievement of the Commission approved and SB 1 mandated targets and performance measures.

The final update to the TAMP after the 2020 roll-out will be submitted to the Commission no later than January 31, 2021. It is the expectation of the Commission that the final TAMP that is approved by the Commission is updated on odd years similar to the submission of the Ten Year SHOPP Plan. Thereafter, at a minimum, and no less frequently than on a quarterly basis, the Commission expects that Caltrans will provide reporting to the Commission on the achievement of the Commission approved and SB 1 mandated targets and performance measures.

STATE OF CALIFORNIA CALIFORNIA TRANSPORTATION COMMISSION

ATTACHMENT A

COMMISSION ACTIONS AS OF MARCH 2017

As of March 31, 2017, the following actions have been taken by the Commission with respect to the Asset Management Plan:

January 2015

Caltrans Submission: Caltrans informed the Commission of the Federal asset management plan rule-making process and indicated that the first phase of the Asset Management Plan is likely to include four asset classes: Pavement, Bridges, Culverts, and Intelligent Transportation System (ITS) Elements. Caltrans indicated a more detailed Asset Management Plan would be presented at the March 2015 Commission meeting. Commission staff requested a listing of all asset classes and an Asset Management Plan implementation timeline.

Commission Action: This item was noticed and presented as an information item only and, therefore no actions were taken by the Commission.

March 2015

Caltrans Submission: Caltrans presented the following Phase I Asset Management Plan milestones:

March 2015. Identification of the asset classes recommended for inclusion in the Phase I Asset Management Plan (Pavement, Highway Structures (bridges & tunnels), Culverts, and Highway Operations (ITS Elements).

March 2015. Recommendation of performance measures (Good, Fair, Poor) for the Pavement, Bridges and Culvert asset classes and (Operational or Not) for the ITS Elements asset class.

October 2015. Establishment of the baseline conditions and performance targets for the four Phase I asset classes.

At the meeting, Caltrans recommended four state highway system asset classes for inclusion in the TAMP: Pavement, Bridges, Culverts, ITS Elements. Caltrans also presented fifteen supplementary asset classes which would be "excluded" from the TAMP.

Commission Action: The Commission approved the following four asset classes for inclusion in Phase I of the Asset Management Plan: Pavement, Bridges, Culverts, and ITS Elements. The Commission also approved Good, Fair, and Poor performance measures for the Pavement, Bridges, and Culverts asset classes and Operational or Not Operational performance measures for the ITS Elements asset class. After much discussion, the Commission approved the supplementary classes and added office buildings to the list as well. The Commission approved 20 asset classes (primary and supplementary) in total which included Pavement, Bridges, Culverts, ITS Elements. Overhead Signs, Pump Houses, Closed Circuit Television (CCTV) Cameras, Weigh in Motion Scales, Highway Barriers, Bridge Barriers, Roadside Rest Facilities, Park and Ride Facilities, Highway Lighting, Highway Signs, Sidewalks, Traffic Management Centers, Equipment Shops, Labs, and Maintenance Stations, and office buildings.

October 2015

Caltrans Submission: Caltrans requested that the Commission approve the use of existing performance measures and targets for the Pavement and Bridges asset classes until such time as the Federal asset management rule-making process is finalized, in place of the Good, Fair, Poor performance measures adopted by the Commission at the March 2015 meeting. Caltrans requested to use the amount of distressed pavement for the Pavement asset class and the number of distressed bridges for the Bridges asset class. For the four Phase I asset classes, Caltrans presented the baseline conditions and requested that the unconstrained targets be set as follows: Pavement baseline condition 84% good and unconstrained target 90% good, Bridges baseline condition 93% good and unconstrained target 90 % good, Culverts baseline condition 86% good and unconstrained target 90% good, ITS Elements baseline condition 68% good and unconstrained target 90% good. Caltrans further requested that the Commission approve the development of performance targets based on a fiscally constrained budget over a four year time horizon.

Commission Action: The Commission approved the use of the existing performance measures and targets for the Pavement and Bridges asset classes only until such time as the Federal asset management rule-making process is finalized. The Commission approved the following unconstrained targets: Pavement 90% good, Bridges 96% good, Culverts 90% good, and ITS Elements 90% good.

March 2016

Caltrans Submission: To meet the SB 486 requirements for a Phase 1 of the TAMP required to accompany the 2016 SHOPP, Caltrans presented a 2016 Asset Management Performance Report ahead of the Commission adoption of the 2016 SHOPP. Caltrans stated the "report is provided to meet the Phase I requirement of the TAMP" and to address "the expected performance of the four core asset classes; pavement, bridges, culverts and ITS elements resulting from the 2016 SHOPP project portfolio as well as how each of the core assets are represented as they relate to the adoption of the proposed 2016 SHOPP."

Commission Action: The Commission requested that Caltrans return at the May 2016 Commission meeting to request an extension from the Commission for the approval of the TAMP performance measures and targets if the Federal rule-making process was not finalized by then. This item was noticed as information item only and no action was taken by the Commission.

May 2016

Caltrans Submission: Caltrans requested an extension through August 2016 for Commission approval of Asset Management Plan performance measures and targets because the specific technical criteria proposed by the Federal government to determine Good, Fair and Poor performance measures for the Pavement and Bridges asset classes was still in the Federal rule-making process.

Commission Action: The Commission approved the extension request with the stipulation that Caltrans was to return in August 2016 with recommendations for Asset Management Plan performance measures and targets either derived under Federal rules or Caltrans technical expertise.

August 2016

Caltrans Submission: At the May 2016 Commission meeting, Caltrans committed to provide recommended performance targets for the four approved Asset Management Plan asset classes in time for the August meeting. Unfortunately, the technical details for the Pavement and Bridge asset classes' performance measures were still pending final Federal rules. Caltrans developed the requested performance targets based on the draft Federal rules. However, Commission staff requested that Caltrans

include the fiscal impacts of the proposed performance targets and to further explain the basis for the targets. In lieu of a book item, Caltrans submitted a letter requesting postponement of the performance target discussion until the October 2016 meeting to allow time to produce the fiscal impacts of the proposed targets.

Commission Action: Although, this item was noticed on the agenda as an action item, the Commission took no action after reviewing the Caltrans letter requesting a postponement of the performance target discussion.

October 2016

Caltrans Submission: Caltrans presented *fiscally unconstrained* performance targets for the four Phase I Asset Management Plan asset classes: Pavement, Bridges, Culverts and ITS Elements. In addition, Caltrans subdivided the Pavement asset class into three subclasses: Class 1 Pavement (interstate freeways and other principal arterial and urban freeways/expressways), Class 2 Pavement (rural freeways/expressways and minor arterials), and Class 3 Pavement (major and minor collector routes). Caltrans also presented the technical criteria used to determine the Good, Fair and Poor performance measures.

Commission Action: The Commission approved the proposed fiscally unconstrained targets.

January 2017

Caltrans Submission: Caltrans presented an overview of its 2017 State Highway System Management Plan (SHSMP). The SHSMP is a new Caltrans integrated plan that combines the Ten-Year SHOPP Plan and the Five-Year Maintenance Plan and implements a number of key asset management requirements.

Commission Action: This item was noticed as information item only, the actual 2017 SHSMP document was not provided to the Commission for its consideration and no action was taken by the Commission.

March 2017

Caltrans Submission: Caltrans formally submitted the SHSMP dated March 8, 2017 to the Commission at the March 2017 Commission meeting.

Commission Action: The Commission postponed action on the proposed SHSMP because the Commission was not provided adequate time to respond with its comments. Commission directed staff to provide comments to the SHOPP plan portion of the SHSMP at the May 2017 Commission meeting.

California Department of Transportation

Director's Policy

Number:	DP-35
Effective Date:	03/07/2018
Supersedes:	NEW
Responsible Program:	Transportation Asset Management

TITLE Transportation Asset Management

POLICY

The California Department of Transportation (Caltrans) maximizes the effectiveness of transportation investments through the development and implementation of a performance-driven strategic infrastructure asset management plan in conformance with the:

- Code of Federal Regulations (23 CFR 515) Moving Ahead for Progress in the 21st Century (MAP-21) (23 U.S.C. 101(a)(2), MAP-21 § 1103) and Fixing America's Surface Transportation (FAST) Act.
- California Government Code section 14526.

Caltrans manages assets using a systematic asset management framework to achieve defined performance levels for the best possible value by planning, designing, constructing, operating, maintaining and rehabilitating assets considering life cycle cost and performance.

Caltrans promotes accountability of performance metrics, practices, and business operations to determine the most effective way to apply the state's available resources to benefit the condition and performance of the transportation system in California. Caltrans also encourages our partners to promote good asset management practices.

INTENDED RESULTS/DEFINITIONS

Transportation Asset Management (TAM) is a strategic and systematic process of operating, maintaining, upgrading, and expanding physical assets effectively throughout their lifecycle.

Assets as defined in this policy include all physical assets that comprise the State Highway System (SHS), the facilities that support the maintenance and operation of the SHS, and Caltrans office facilities.

This policy is intended to establish accountability as a department-wide policy that ensures coordinated efforts to incorporate TAM into decisions and activities that affect the SHS. This policy ensures a strategic and systematic process of planning, designing, constructing, operating, maintaining, and improving assets to

achieve and sustain desired system performance levels over the life cycle of the asset.

This policy supports the 2015-2020 Caltrans Strategic Management Plan's, Stewardship and Efficiency goal explicitly and all other goals through project accomplishments.

RESPONSIBILITIES

Director:
Establishes and promotes a strategic department-wide TAM Program and associated business operations.

Chief Deputy Director:
- Develops an organizational structure that promotes a systematic performance-driven TAM Program.
- Provides necessary resources to develop, implement, and maintain a TAM Program within Caltrans.

Deputy Director, Maintenance and Operations:
- Provides an organizational structure and resources that support timely maintenance of assets to minimize long term costs.
- Collects and shares transportation asset inventory and condition information to support TAM analysis and decisions.

Deputy Director, Project Delivery:
- Designs and constructs transportation projects using materials, standards, and practices that maximize condition and performance and minimize life cycle costs.
- Promotes project decisions that consider best value and performance goals.

Deputy Director, Planning and Modal Programs:
- Conducts planning efforts consistent with the performance-driven strategic TAM framework.
- Resources project planning efforts in alignment with the department's asset management performance priorities.

Deputy Director, Finance:
- Develops project programming and budgeting to support the TAM Program project prioritization.
- Promotes the performance-driven TAM Program with the California Transportation Commission (CTC).

District Directors:
Promote a performance-driven strategic TAM culture and confirm that district projects, products, and services maximize condition and performance, and minimize life cycle costs consistent with this policy.

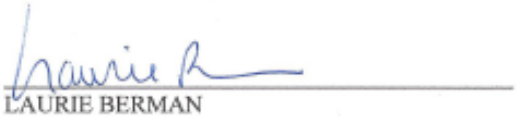
State Asset Management Engineer:
- Develops and maintains the statewide TAM policy.
- Leads the implementation and update of the Transportation Asset Management Plan (TAMP).

Managers and Supervisors
- Confirm that all employees are aware of and adhere to this policy.
- Empower employees to integrate transportation asset management into daily responsibilities.
- Set a positive example by practicing transportation asset management.

All Employees
- Work collaboratively with partners and stakeholders to make informed TAM decisions.
- Seek innovative solutions for TAM.
- Integrate asset management practices into daily activities.

APPLICABILITY

This policy applies to all Caltrans employees.



LAURIE BERMAN
Director

3/7/2018
Date Signed

"Provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability"

Acknowledgements

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Executive Team

Toks Omishakin, Secretary, California State Transportation Agency
Elissa Konove, Undersecretary, California State Transportation Agency
Tony Tavares, Director, Caltrans
Michael Keever, Chief Deputy Director, Caltrans
Michael B. Johnson, State Asset Management Engineer, Caltrans

Caltrans Project Team

Dawn Foster, Supervising Transportation Engineer, TAMP Project Manager
Loren Turner, Supervising Transportation Engineer
Youwei Zhou, Senior Transportation Engineer
Pritpall Bhullar, Senior Transportation Engineer
Zhenyu Zhu, Transportation Engineer
Mara Chaudhari, Transportation Engineer
Manpaul Sandhu, Transportation Engineer
Melissa Thompson, Staff Services Manager III
Mary Alice Morency, Staff Services Manager I
Sithiphone Choi, Staff Services Manager I

Asset Management would like to thank all Districts and Programs for their support and contributions in the development of the California TAMP.

TAMP Workshop Presenters:

Yolanda Alcantar, Kern County Public Works, Fundamentals Workshop
Carol Dirksen, State Controller's Office, Financial Planning Workshop
Lisa Tam, State Controller's Office, Financial Planning Workshop
Brad Allen, APTech, Investment Strategies Workshop

Partners and Stakeholders

We would like to acknowledge the valuable input received from numerous local and regional transportation agencies and attendees of the virtual TAMP development workshops and listening sessions. We would especially like to thank the MPO/RTPAs for their input on local NHS funding and the setting of TAMP performance targets.

Federal Highway Administration
California Transportation Commission
California State Controller's Office
Association of Monterey Bay Area Governments
Butte County Association of Governments
Fresno Council of Governments
Glenn County Transportation Commission
Humboldt County Association of Governments
Kern Council of Governments
Kern County
Kings County Association of Governments
Lassen County Transportation Commission
Los Angeles County Metropolitan Transportation Authority
Madera County Transportation Commission
Merced County Association of Governments
Metropolitan Transportation Commission
Orange County
Orange County Transportation Authority
Riverside County Transportation Commission
Sacramento Council of Governments
San Diego Association of Governments
San Joaquin Council of Governments
San Joaquin County
San Luis Obispo Council of Governments
Santa Barbara County Association of Governments
Santa Cruz County
Marin County
Los Angeles County
City of Sacramento
City of Santa Clarita
Shasta Regional Transportation Agency
Southern California Association of Governments
Stanislaus Council of Governments
Tahoe Metropolitan Planning Organization
Tahoe Regional Transportation Agency
Tulare County Association of Governments

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California Department of Transportation
1120 N Street
Sacramento, CA 95814
www.dot.ca.gov