DRAFT for CTC Review

2021
State Highway System Management Plan

DRAFT for CTC Review

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Prepared by
California Department of Transportation
in accordance with Streets and Highways Code 164.6

Executive Summary

State Highway System Management Plan

The 2021 State Highway System Management Plan (SHSMP) presents a performance driven and integrated management plan for California's State Highway System (SHS). SHS needs, investments, and resulting performance projections for the 10-year period spanning July 2021 – June 2031 are presented in this Plan. The SHSMP is organized to align with the California Department of Transportation (Caltrans) Strategic Plan.

About the SHSMP

The State Highway System Management Plan (SHSMP) integrates the maintenance, rehabilitation and operation of the State Highway System (SHS) into a single management plan that implements state and federal asset management requirements, including those from Senate Bill 1 (SB 1) the Road Repair and Accountability Act of 2017.

The SHSMP operationalizes the California Transportation Asset Management Plan (TAMP) using California Transportation Commission adopted asset classes, performance measures and targets pursuant to California SB 486. The 2021 SHSMP builds on the performance driven framework from prior plans, and further strengthens integration with the TAMP.

The SHSMP is founded on the core principles of asset management, using objective analysis to focus investments on measured condition and performance objectives. The focused asset-based funding approaches of the past were replaced with the introduction of the first SHSMP in 2017 and continues in the current plan, providing greater local flexibility to achieve multiple performance objectives within a single project. This performance management methodology allows Caltrans to integrate multi-modal transportation options into traditional rehabilitation work to provide a cost-effective way to expand mode choice and reduce transportation related emissions.

The 2021 SHSMP refines and expands the asset management framework, introducing new performance objectives to maintain and expand the network of bicycle and pedestrian facilities, incorporate sea level rise impacts, and remove transportation induced fish passage barriers. These new performance objectives expand the maturity of asset management in Caltrans and move the SHSMP toward a comprehensive and equitable transportation plan for all Californians.

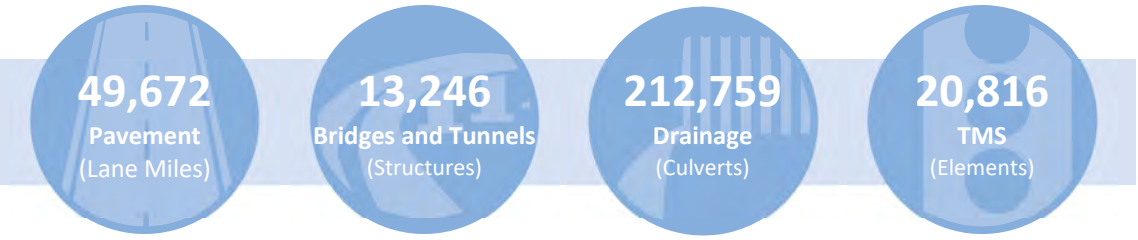
State and Federal Requirements

Under California statutes, Caltrans is the state agency responsible for planning, developing, maintaining and operating the legislatively designated SHS and a variety of supporting infrastructure. The SHSMP satisfies the requirements of the Streets and Highway Code section 164.6 for a 10-Year State Highway Operation and Protection Program (SHOPP) Plan and a 5-Year Maintenance Plan.

Assembly Bill (AB) 515 amended California Government Code Section 164.6 to require Caltrans to prepare a State Highway System Management Plan. The SHSMP is also consistent with the asset management requirements in the federal Fix America's Surface Transportation (FAST) Act and federal Performance Management (PM) regulations.

California's State Highway System

The SHS includes a wide variety of physical assets, including the four primary assets as shown here.



Inventory and Conditions for State Highway System Assets

A breakdown of the baseline SHS Inventory and Condition for assets defined in the TAMP is presented in Table A. These quantities represent the most current and best available information at the time of report preparation.

Table A. SHS Inventory and Baseline Condition for Assets Defined in the TAMP

SHS Inventory and Baseline Condition for Assets Defined in the TAMP					
Performance Objective	Inventory	Good	Fair	Poor	
Primary Asset Classes					
Pavement	49,672 Lane Miles	57.0%	42.0%	1.0%	
Bridges and Tunnels	251,703,052 Square Feet	54.1%	42.5%	3.5%	
Drainage	22,402,404 Linear Feet	74.0%	16.7%	9.3%	
Transportation Management Systems	20,816 Each	71.1%	N/A	28.9%	
Supplementary Asset Classes					
Drainage Pump Plants	288 Each	15.3%	34.4%	50.3%	
Highway Lighting	94,745 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%	
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%	

Note, the pavement inventory reflects the total surveyed lane-miles and does not include collection gaps from road closures, detours, and construction zones.

Performance Management

The SHSMP includes a Needs Assessment to achieve the established performance targets and an Investment Plan to guide SHS and related infrastructure management. The Needs Assessment is an aggregation of numerous analyses that fully defines our existing inventory or deficiency, condition or performance targets, existing pipeline of work, a gap analysis, and cost estimate to close the gaps. Collectively these steps are referred to as Performance Management and are a requirement of the Moving Ahead for Progress in the 21st Century Act (MAP-21) and Fixing America's Surface Transportation Act (FAST Act).

Managing SHS Needs

The 10-year Needs Assessment identifies a $122.9 billion total need to maintain the existing assets on the SHS (Table A). The estimated SHOPP need is greater than prior plans in large part due to the addition of new performance objectives, an increase in rehabilitation and preservation unit costs, maturity in asset management inventories and practices, and improved condition assessment methods and data. Considering these expanding needs, the available funding will address about 45% of the total identified needs.

Investment Plan

The SHSMP presents a fiscally constrained allocation of available funding for the maintenance and rehabilitation of the SHS. The 2021 SHSMP identifies a $6.1 billion annual shortfall that imposes a constraint requiring transportation objectives to be prioritized. The constrained funding is presented in the SHSMP as an Investment Plan. The plan focuses available funding on core system assets following our "fix it first" commitment to achieve the SB1 performance targets, while simultaneously increasing our investment in bicycle and pedestrian transportation modes to help achieve climate goals and provide more equity in transportation system access.

The SHSMP Investment Plan considers factors such as existing conditions, system performance, pipeline of projects, legal mandates, consequences of inaction, environmental stewardship, and funding reservations to arrive at the proposed allocation of funding. These factors are systematically evaluated through a trade-off analysis, balancing multiple competing priorities and acknowledging that no one combination of investments will fully address all the pressing needs for the SHS. A breakdown of the Maintenance and SHOPP Needs and recommended Investment Plans for the 10-year period is shown in Table B.

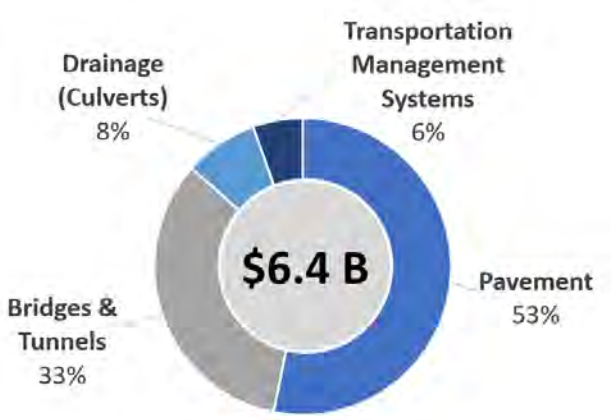
Table B. 10-Year Needs Assessment and Investment Plan

10-Year Needs Assessment and Investment Plan		
Program	**10-Year Needs ($B)**	**10-Year Investment ($B)**
Maintenance Program	$6.4	$6.4
SHOPP (Rehabilitation/Operations)*	$109.9	$49.3
Total	**$116.3**	**$55.7**

**Includes SHOPP Major and Minor needs*

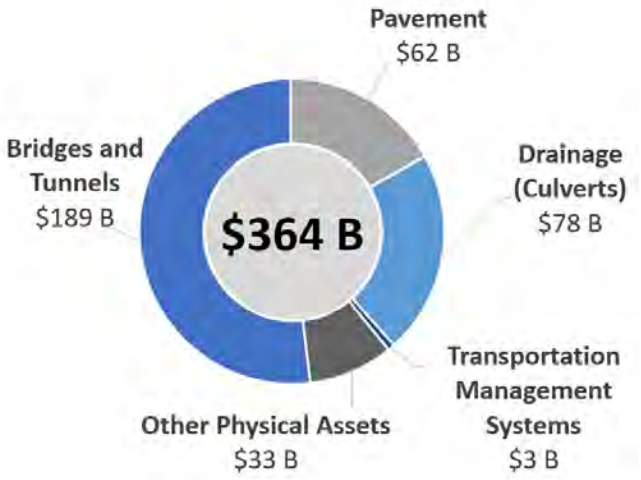
10-Year SHOPP Investment Plan

10-Year Maintenance Investment Plan



Value of Physical Assets on the SHS

Investments in the SHS over time have created a highway network with an estimated replacement cost of $364 billion. A breakdown of the major system component replacement values is shown here, where the replacement value is calculated using the inventory quantity multiplied by the unit replacement cost.



Projected 10-Year Performance Accomplishments

With the available funding and anticipated deterioration over the next ten years, Caltrans expects to be able to complete maintenance and rehabilitation work as shown in the performance outcomes chapter of this Plan. Table C highlights combined expected accomplishments from the Maintenance and SHOPP programs for the four primary asset classes. This table quantifies project-level outputs expected across the spectrum of treatments by condition category. Quantities have been rounded for presentation.

Table C. Estimated 10-Year Performance Accomplishments (2021-2031)

Estimated 10-Year Performance Accomplishments (2021-2031)			
Asset Class	Good Condition (Preventive Maintenance)	Fair Condition (Maintenance and SHOPP)	Poor Condition (Maintenance and SHOPP)
Pavement	13,857 Lane Miles	32,319 Lane Miles	591 Lane Miles
Bridges and Tunnels	127.9 million Square Feet	79.6 million Square Feet	10.6 million Square Feet
Drainage (Culverts)	-	1.8 million Linear Feet	1.0 million Linear Feet
TMS	800,000 Maintenance checks/repairs	-	10,500 Replacements 3,300 New Elements

Due to the general funding shortfall relative to the needs, this plan recommends investment in supplementary asset classes at levels below what is necessary to achieve the Desired State of Repair (DSOR).

Improved asset management strategies and a focus on project delivery will result in visible improvement to the transportation system in California over time. Significant work has been done to implement new programs and expand our asset management breadth that will allow Caltrans to continue making progress toward improving the State Highway System in California.

Projected 10-Year Condition

With the available funding, Caltrans anticipates that the condition of the four primary asset classes will improve over the plan period. Caltrans is on track to meet SB 1 targets by 2027, as shown in Table D. These targets are aligned with targets set forth in the TAMP, as shown in Table E. By meeting TAMP targets, Caltrans will surpass SB 1 targets. Condition targets under both SB 1 and the TAMP will be maintained through 2031.

As presented in Table D, SB 1 includes a performance requirement to fix not less than an additional 500 bridges over a 10-year period ending in 2027. Projects that improve the condition of the bridge to a better condition, mitigate seismic or scour vulnerabilities, or address operational limitations are counted towards this goal. Prior to the passage of SB 1, Caltrans was fixing an average of 114 bridges per year. For the purpose of counting towards the additional 500 bridges which should be fixed, Caltrans is reporting only those in excess of the baseline of 114 bridges.

Table E lists the targets established in the TAMP and provides the projected condition for the four primary asset classes at the end of the Plan period relative to baseline conditions.

Table D. SB 1 Targets for 2027

SB 1 Targets for 2027	
Asset Class	**SB 1 Target**
Pavement	98% Good or Fair Condition; 90% level of service (LOS) achieved for maintenance of potholes, spalls, and cracks
Bridges	Fix an additional 500 bridges
Culverts	90% Good or Fair Condition
TMS	90% Good Condition

Table E. Transportation Asset Management Plan Targets for 2027

Transportation Asset Management Plan (TAMP) Targets for 2027					
Asset Class		**Good**	**Fair**	**Poor**	**Projected 10-Year Condition Relative to Baseline**
Pavement	Class 1	60%	39%	1%	Fair pavement conditions are expected to improve gradually for all pavement classes over the Plan period. In all classes, the amount of poor condition pavement is expected to reach targets and maintain those levels over the Plan period.
	Class 2	55%	43%	2%	
	Class 3	45%	53%	2%	
Bridges and Tunnels		48.5%	50%*	1.5%	The number of poor condition bridges is expected to be reduced over the Plan period. The design and construction of several larger bridge replacement projects will be critical in meeting the target conditions by 2027. Fair condition bridges are also expected to improve over the Plan.
Culverts		70%	20%*	10%	Culvert inspection is expected to be completed over the Plan period. Culvert condition is expected to gradually improve over the Plan period, achieving the poor target by 2027 and maintaining through 2031. At the current investment level, projections are falling short of the fair target.
TMS		90%	N/A	10%	TMS inventory is expected to grow over the Plan period. The condition is expected to improve to achieve performance targets by 2027 by introducing more TMS work earlier in the plan.

*Note: The 50% fair target for Bridges and Tunnels and the 20% fair target for Culverts are pending approval by the California Transportation Commission. Poor targets remain unchanged from the TAMP.

Optimizing Investments in California's Transportation Infrastructure

The 2021 SHSMP carries forward the major paradigm shift initiated with the 2017 SHSMP to a performance driven asset management framework, further strengthening Caltrans' investment decision-making capabilities to optimize the needs of the State Highway System with available funding. These changes collectively improve the management of the State Highway System, focus activities on performance in alignment with the Caltrans 2020-24 Strategic Plan, and provide structure and transparency to improve the management of our assets.

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1 Introduction

The 2021 State Highway System Management Plan (SHSMP) presents a performance-based framework that guides decision-making and priorities for maintenance, preservation, rehabilitation, and reconstruction investments on the State Highway System (SHS).

It continues the same framework initially established in the 2017 SHSMP, which replaced a legacy asset-based funding approach. The SHSMP performance-based approach represents a fundamental change in how Caltrans spends transportation funds for major capital improvements necessary to preserve and protect the SHS.

The SHSMP spans a 10-year period from July 2021 through June 2031 and provides more flexibility in achieving multiple objectives within a single project. This improved framework allows Caltrans to better integrate multimodal transportation options into traditional rehabilitation work to provide a cost-effective way to expand mode choice and reduce transportation-related emissions. It enables Caltrans to make better-informed investment decisions, balance competing priorities, evaluate long-term performance outcomes, promote transparency, and communicate to stakeholders the value of investments in transportation infrastructure.

Furthermore, Caltrans has been actively improving asset management methods, tools, and data that underpins analyses for performance projections and investment decision-making presented in this plan. The department has a major technology development project underway for a new Transportation Asset Management System (TAMS). This enterprise system will integrate data from existing asset inventories, financial systems, and project management systems to enable Caltrans to focus investments to maximize the longevity of infrastructure assets on the SHS, improve safety, and achieve performance targets. Caltrans has two research efforts underway, one to improve methods on assessing multiple risks and vulnerabilities, and another to refine multi-objective decision analysis (MODA) methods for project prioritization and cross-asset investment decision-making. These efforts reflect an overall maturation in Caltrans' asset management.

1.1 Overview

The SHSMP applies a performance management framework to the SHS, integrates maintenance and rehabilitation activities, and aligns investments with the *Caltrans Strategic Plan 2020-2024*[1]. 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 State Highway Operation and Protection Program (SHOPP) and the Maintenance Program.

The SHSMP addresses a majority of the asset management requirements from the *2018 California Transportation Asset Management Plan (TAMP)*[2]. The SHSMP goes beyond the TAMP requirements to implement a performance-driven approach for the SHOPP and the Maintenance Program. All project planning, initiated after July 2017, is based on SHSMP performance objectives. This ensures that projects that begin the planning process will collectively accomplish enough work to achieve the performance targets established by Senate Bill (SB) 1, Road Repair and Accountability Act[3]. The SHSMP addresses key requirements set forth in state and federal statutes.

1.2 Making Progress

Established with the *2017 State Highway System Management Plan*[4], Caltrans made structural changes to how funding is distributed within SHOPP programs. The silo-based funding approach that had been in place for decades was replaced with a performance-driven allocation methodology. This methodology facilitates more comprehensive project solutions by combining numerous assets into a corridor-type project. It provides the opportunity to develop projects that minimize negative impacts to users with economies of scale for traffic control and environmental costs. This revamped structure of the SHOPP has led to earlier collaboration with local partners and opportunities to find mutually beneficial project opportunities to avoid potentially overlapping work, enhance efficiency, and maximize the effectiveness of available funding.

The SHSMP implemented fundamental changes in the way Caltrans manages available funding by focusing on measured condition and performance objectives. Under the provisions of the SHSMP, performance and funding targets are provided to each Caltrans district, empowering them to combine performance accomplishments together in cost-effective projects that are less disruptive and better align with local partners' work. The SHSMP methodology allows Caltrans to better integrate multimodal transportation

[1] Caltrans, "Caltrans 2020-24 Strategic Plan", 2021, https://dot.ca.gov/
[2] Caltrans, "2018 California Transportation Asset Management Plan", https://dot.ca.gov/programs/asset-management
[3] Senator Beall, "Road Repair and Accountability Act of 2017", (Senate Bill 1), 2017, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1
[4] Caltrans, "2019 State Highway System Management Plan", 2019, https://dot.ca.gov/programs/asset-management

options into traditional rehabilitation work to provide a cost-effective way to expand mode choice and reduce transportation-related emissions.

The SHSMP provides unprecedented transparency in the presentation of the current conditions and performance of the system, project stream, deterioration rates, repair costs, and targets used to develop the Needs Assessment in Chapter 2. The 10-year Investment Plan, in Chapter 4, clearly shows where available funds are being invested and the expected condition and performance outcomes of those investments.

Caltrans has integrated SHOPP and Maintenance Program investment decisions for pavement, bridges, culverts, and Transportation Management System (TMS) units to realize efficiencies in the combination of these resources. These four asset classes represent a significant portion of the SHS maintenance and rehabilitation investments in California. The California Transportation Commission (Commission) adopted these four as focus areas, in the ongoing implementation of asset management. The integrated presentation provides a clear understanding of how these funding programs work together to bring a continuum of asset management throughout their life cycle.

1.3 Federal, State, and Departmental Requirements

The SHSMP implements key requirements set forth in State and Federal statutes, organizing activities and performance in a framework aligned with Caltrans' strategic objectives. It applies principles of performance management for each asset class to develop optimum performance need for the asset subject and then further define the expected performance targets. Total needs of individual asset classes as well as that of the highway system reflect contributions of both the SHOPP and Maintenance Program to asset condition and overall system performance.

Federal Requirements

Moving Ahead for Progress in the 21st Century (MAP-21) Act[5] and Fixing America's Surface Transportation Act (FAST Act)[6] outline federal asset management requirements addressed in the SHSMP. MAP-21 requires states to adopt national asset management performance measures to establish nationwide consistency for pavement and bridge condition reporting.

Performance Management

A strategic approach where one uses the baseline inventory and performance of an objective, predicts the future inventory and performance of the objective via performance models, and quantifies performance gaps which need to be addressed to achieve performance targets.

Performance Measure

A quantitative basis to assess progress of an objective towards its performance targets. Caltrans uses a three-state performance measure which is composed of the percentage of the inventory with a good, fair, and poor performance for the objective. As an example, Caltrans uses the percentage of good, fair, and poor lane-miles relative to the pavement inventory as the performance measure for the pavement objectives.

Performance Metric

A quantifiable criterion which is used to determine whether the performance of the objective is good, fair, or poor. As an example, Caltrans uses roughness and cracking for all pavements, rutting for asphalt pavements, and faulting for concrete pavements as the performance metrics.

[5] Rep. Mica, John L., (23 U.S.C. 101(a)(2), MAP-21 § 1103) Moving Ahead for Progress in the 21st Century Act, 2012, https://www.gpo.gov/fdsys/granule/USCODE-2011-title23/USCODE-2011-title23-chap1-sec101

[6] Fixing America's Surface Transportation Act, 2015,https://www.gpo.gov/fdsys/pkg/PLAW-114publ94/pdf/PLAW-114publ94.pdf

These performance measures use a condition scale (good, fair, and poor) to quantify pavement lane miles or bridge deck area condition. The Automated Pavement Condition Survey (APCS) and bridge Element Level Inspection (ELI) data incorporate these condition assessment requirements into Caltrans' practice.

State Requirements

The 2021 SHSMP is an integrated management plan that defines specific quantifiable accomplishments, goals, objectives, costs, and performance measures and targets as required by the California Streets and Highway Code (SHC), Section 164.6[7], for the SHOPP 10-Year Plan and the 5-Year Maintenance Plan. The SHC requires Caltrans to update this plan every two years. These requirements were amended to combine these two plans under Assembly Bill (AB) 515[8].

Under California statutes Caltrans is the state agency responsible for planning, developing, maintaining, and operating the legislatively designated SHS and its variety of supporting infrastructure (highway maintenance stations, safety roadside rest areas, and drainage facilities, among others). Similarly, the SHC assigns various state highway funding and project approval responsibilities to the Commission. Together and in partnership with a wide variety of local, regional, and federal transportation oversight agencies, the private sector, Caltrans, and the Commission, direct highway system preservation activities and projects to support a robust asset management approach as required by SB 486[9].

Departmental Requirements

The SHSMP organizes key activity areas or objectives into categories that generally align with the *Caltrans 2020-24 Strategic Plan*. This structure provides clarity on the specific strategic goals Caltrans is working to accomplish, along with transparency of the level of needs and investments in each of the strategic areas.

[7] California Streets and Highway Code, Section 164.6, 2017, https://leginfo.legislature.ca.gov/faces/billCompareClient.xhtml?bill_id=201720180AB515
[8] Assemblyman Frazier, Assembly Bill 515, 2017, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB515
[9] Senator DeSaulnier, Senate Bill 486, 2014, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB486

1.4 The California State Highway System

Caltrans is the state agency responsible for planning, developing, maintaining, and operating the legislatively designated SHS. The SHS includes a wide variety of physical assets. Highway infrastructure assets, within state highway boundaries, include 49,672 lane miles of assessed pavement; 13,246 bridges and tunnels; 212,759 culverts; and 20,816 TMS assets. The most significant assets on the SHS, in terms of their cost and extent, are pavement and bridges. However, many other assets 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 as depicted in Figure 1-1. 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 cost of maintaining pavement and bridges.

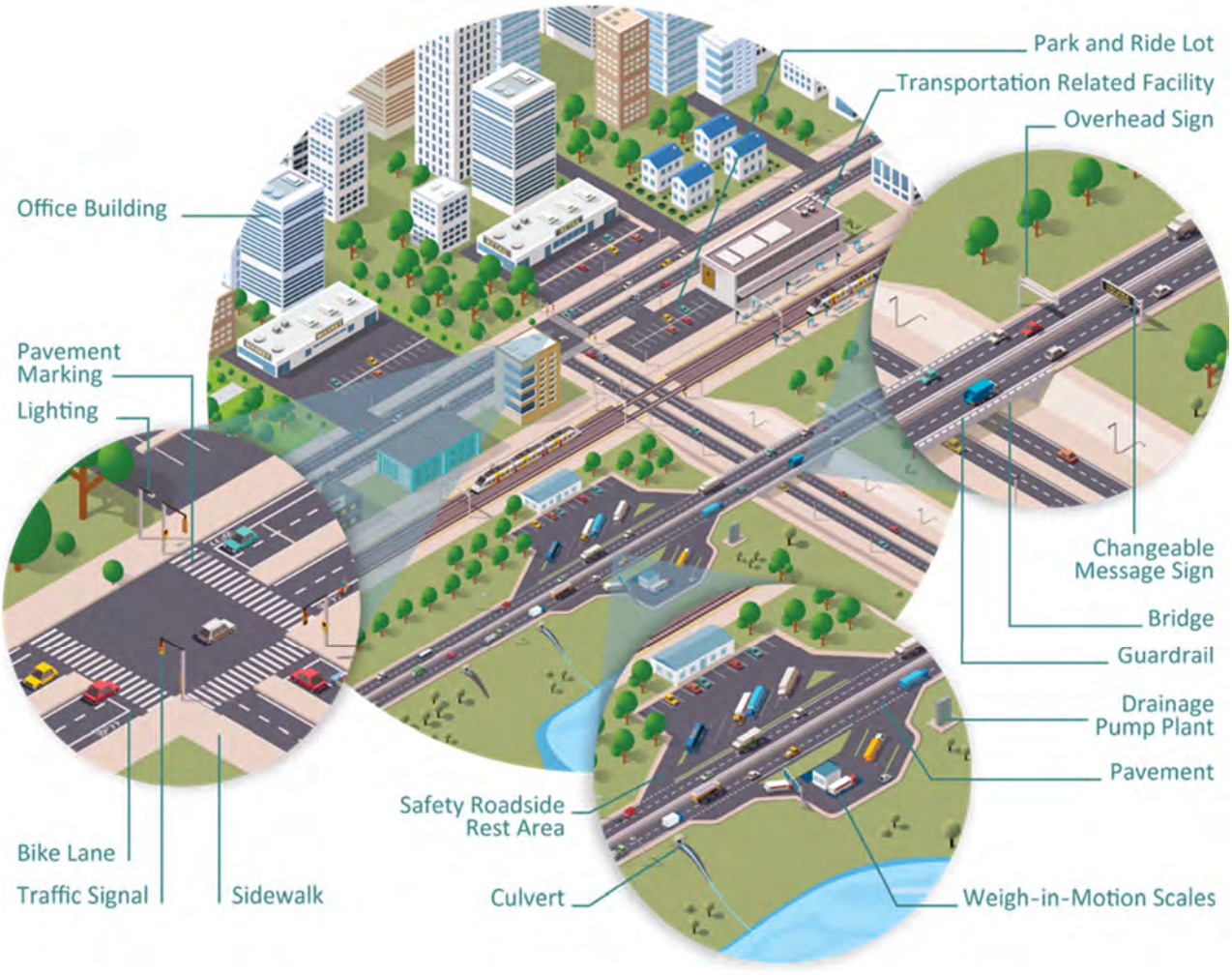

Figure 1-1. Typical Highway Assets

Additional support facilities, such as maintenance stations, equipment shops, and transportation materials laboratories and testing facilities, are also included as SHS assets. Many system components, built in the 1950s, 1960s, and early 1970s, have either reached or are reaching the end of their service life. Asset deterioration is accelerating at a faster rate than in previous decades, because of age and change in traffic demands, often requiring extensive rehabilitation and even full reconstruction. The vast extent of the SHS is illustrated in Figure 1-2.

Figure 1-2. State Highway System

1.5 Strategies for Maintaining the State Highway System

Caltrans strives to preserve the condition of the SHS in the most economical means possible through carefully planned preservation strategies (i.e., preventive maintenance, corrective maintenance, and minor rehabilitation) and rehabilitation or replacement when necessary. Caltrans manages the SHS condition by performing the right treatment at the right time through a combination of three approaches: Field Maintenance Crews, Major Maintenance projects, and SHOPP projects. Each approach plays a key role in the overall management and preservation of the SHS, as shown in Figure 1-3.

Figure 1-3. Approaches to Maintain the State Highway System

Field Maintenance Crews

Caltrans Field Maintenance Crews regularly address the day-to-day demands of the SHS. These field activities are the first line of defense in Caltrans' SHS maintenance, and are reactionary in nature. The Field Maintenance Crews collectively perform many aspects of ongoing maintenance of highways and assets on the SHS. Crews address minor maintenance, repairs, and preservation work. This typically includes pothole repair, crack sealing, cleaning of drains, servicing lighting and signs, structural painting, minor facility repairs, irrigation repairs, and more. Crews also provide rapid response to repair minor accident damage.

Preventive maintenance is applied to assets in good condition and some fair condition assets when appropriate, with the goal of maintaining their condition. For example, a bridge preventive maintenance activity is the painting of steel structures. Field maintenance strategies serve as important tools for extending asset service life in a cost-effective manner.

Major Maintenance Projects

Highway Maintenance (HM) projects help prolong the life of existing infrastructure. These projects include preventive and corrective maintenance strategies that exceed the scope of what Field Maintenance Crews typically manage. Corrective maintenance typically applies to assets in fair condition; however, it can also be applied to some assets in poor condition, with the goal of maintaining serviceability and/or restoration to good condition. Since deterioration (which is the degradation of materials over time) can accelerate the longer the asset is in fair condition, the timely application of corrective maintenance can often prevent the need for more costly treatments in the future. Treatments can vary in levels of effectiveness and time intervals between applications.

Caltrans executes HM projects through individual contracts. HM work, designed to extend the life of physical assets, delays rehabilitation or replacement of assets, and is performed on pavement, bridges, culverts, facilities, TMS, and more. HM projects, which may be preventive or corrective in nature, include thin pavement overlays, deck crack sealing, polyester concrete overlays, bridge joint seals, and culvert repairs. This category of projects repairs but generally does not upgrade or replace facilities.

SHOPP Projects

When field maintenance and more extensive HM project activities are no longer cost-effective or viable, Caltrans considers asset rehabilitation or replacement. Rehabilitation or replacement, which can apply to assets in both fair and poor condition, is typically funded through the SHOPP. SHOPP projects are more complex capital construction projects that typically use private construction contractors obtained through a competitive bidding process. These projects, which may involve complex upgrades, overhaul infrastructure nearing the end of its lifespan. They may involve extensive planning and design, environmental permitting and right-of-way acquisition. Rehabilitation and replacement activities are performed on pavement, bridges, culverts, buildings, overhead signs, lights, roadside elements, Safety Roadside Rest Areas (SRRA), and more. The SHOPP invests available funds to implement safety improvements, rehabilitate or replace physical assets, improve the operation of the highways, improve system resiliency, and mitigate transportation-related environmental impacts. The SHOPP includes 34 Performance Objectives as described in this document. The Commission has direct responsibility to adopt SHOPP projects and to approve all scope, schedule, and costs changes to adopted projects. Furthermore, the Commission sets asset performance targets to ensure SHOPP investments are achieving desired statewide transportation outcomes.

Additional Strategies

In addition to SHOPP and Maintenance Programs, there are other funding programs that address additional SHS needs. Beyond Asset Management's objective of taking care of existing SHS assets, there are SHS needs for upgrading and expanding facilities to accommodate increased freight movement, broader economic growth, population increases, new transportation technologies, and evolving land use patterns. These needs go beyond the scope of SHOPP and Maintenance Programs and are instead addressed through a variety of other funding programs, such as FAST Act, the State Transportation Improvement Program

(STIP), state transportation bond programs, local transportation tax measures, and other funding programs. These programs all invest in the SHS, as well as in local roads, and they sometimes address SHS preservation needs at the same time. As projects are developed and constructed through these other funding programs, it is essential the project development process incorporates life cycle and asset management considerations. Projects should be as efficient and cost-effective as possible to maintain, preserve, and when the time comes, rehabilitate assets on the SHS.

Each of these programs plays key roles and works together in the overall management of the SHS. Using the three-pronged approach to asset preservation, Caltrans can make timely repairs at the right time to extend the useful life of the assets at the lowest possible long-term cost and to delay future rehabilitation and replacement activities.

Benefits of Preventive Maintenance

The combination of these three approaches allows Caltrans to effectively preserve the highway infrastructure 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. HM contracts 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 to ensure maximum operability. And finally, SHOPP capital improvement 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.

Preventive maintenance is the most cost-effective means of protecting the State's infrastructure investment; these activities focus on keeping good condition assets in good condition. Caltrans recommends strategies to slow deterioration and extend pavement, bridge, and drainage life in fair or good condition. Figure 1-4 presents the benefits of preventive maintenance.

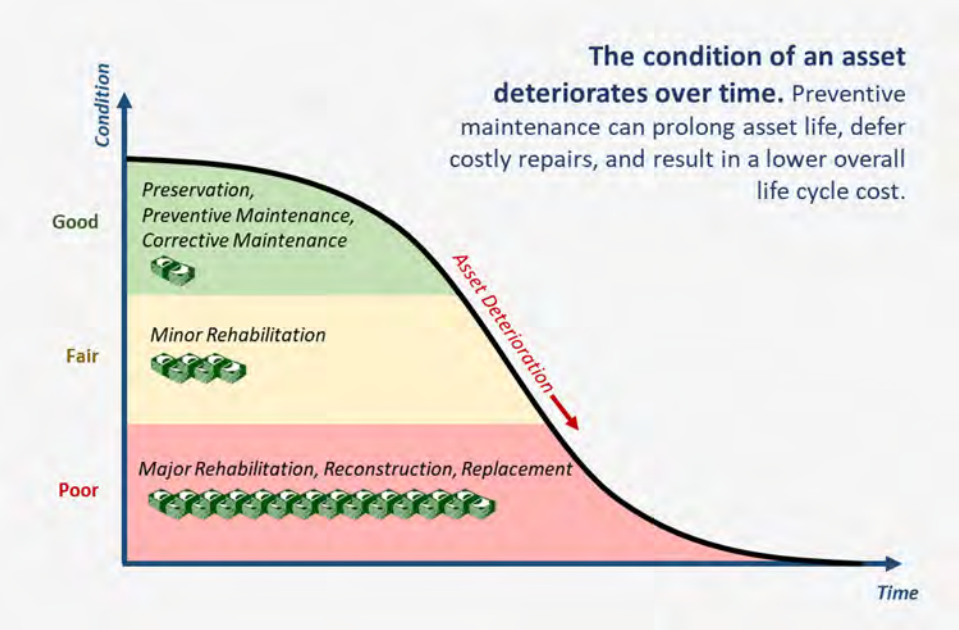

Figure 1-4. Benefits of Preventive Maintenance

1.6 Performance-Based Asset Management Approach

The SHSMP is built from a performance-based asset management approach comprised of several key analysis steps. These steps define the inventory and condition of assets, establish condition targets, determine the magnitude of condition gaps, develop cost estimates to close the gaps, and define a constrained investment plan. This analytical process is organized into the three major steps shown below. The following chapters present each of these steps in greater detail. Additional chapters cover Program Objectives, Life Cycle Planning, and Risk Management.

Performance-Based Asset Management Approach

Needs Assessment

Conduct a performance management analysis to determine the total needs, unconstrained by funding. Estimate the costs necessary to close all condition and performance gaps.

Revenue and Financial Projections

Determine funding and resources available over the 10-year SHSMP period.

Investment Plan and Performance Outcomes

Define how available funding is recommended to be allocated, prioritize where available resources should be focused to keep highways functioning with constrained funding. Estimate the performance metrics anticipated to be achieved, given the defined Investment Plan.

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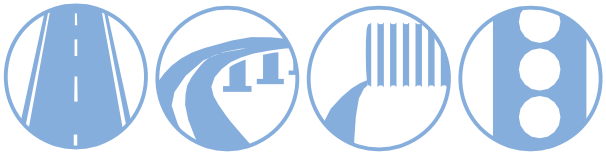

2 Needs Assessment

The California Streets and Highway Code (SHC) requires the development of a State Highway System (SHS) Needs Assessment to define program areas and costs associated with achieving condition and performance targets.

The Needs Assessment provides an overall picture of the SHS total needs and is not constrained by currently available funding. The majority of the SHS needs is determined through a gap analysis completed as part of the performance management implementation.

The Needs Assessment is the first in a series of steps in a performance management analysis framework. In this context, "needs" can be defined as the gap in performance between the current condition (i.e., distribution of good, fair, and poor condition) and a future Desired State of Repair (DSOR) condition. The SHSMP defines needs over a 10-year period, spanning July 2021 through June 2031. These needs are addressed through a combination of SHOPP capital investment projects, Highway Maintenance projects, and work carried out by Caltrans Field Maintenance Crews.

The total needs to be addressed through maintenance and rehabilitation work are determined through a gap analysis. Preventive maintenance needs are also considered in the gap analysis. These are associated with activities that focus on keeping good condition assets in good condition for as long as possible.

2.1 Needs Assessment Approach

The Needs Assessment approach comprises of a series of five key steps, as described in Figure 2-1. 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.

Figure 2-1. Steps to Carry Out the Needs Assessment

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. (Note, the gap analysis for pavement assets is carried out using a more rigorous condition modelling approach in a dedicated pavement management system.)

STEP 1 – Asset Inventory

Establish an asset inventory or deficiency level.

The inventory comprises the count or quantity of individual assets or deficiencies, reported in units of measure appropriate to the asset type. Caltrans quantifies pavement inventory by lane miles, bridges by square feet of deck area, drainage in linear feet, and TMS by each unit.

STEP 2 – Baseline and Projected Condition

Establish the baseline and projected future condition of each objective.

For each asset in the inventory, the condition is determined for the baseline (or current) condition as well as a projected future condition at the end of the 10-year Plan period. The future condition at the end of the 10-year Plan period is typically projected for two scenarios: (1) future condition in the absence of any project, which is also known as a do-nothing or free-fall scenario, and (2) future condition with only pipelined projects. The three condition descriptors used are good, fair, and poor. Criteria for determining asset condition are unique to the type of asset.

STEP 3 – Target Condition

Establish targets to achieve desired state of repair.

Caltrans establishes performance targets that represent the desired condition (good, fair, poor) of the asset inventory at the end of the performance plan period. A combination of federal and state statutes (MAP-21, SB 1), Commission guidelines, and Caltrans practices guide the target setting process. The targets are documented in the TAMP and the SHSMP and approved by the Commission.

STEP 4 – Performance Gaps

Perform a gap analysis between projected and performance targets.

Caltrans performs a gap analysis to quantify the difference between the projected condition with pipelined projects and the target DSOR condition at the end of the 10-year Plan period. Pipelined projects are projects programmed in the current SHOPP or Project Initiation Document (PID) Work Plan, or other work underway resulting in a change in condition from the baseline. The resulting change is assumed to be realized when the contract is advertised.

STEP 5 – Cost to Close Performance Gaps

Estimate the cost to close performance gaps.

From the fair and poor gap quantities, the cost associated with closing these gaps can be calculated using the unit costs associated with poor and fair treatment strategies.

Figure 2-2 summarizes the gap analysis steps and illustrates an example where the projected condition for both poor and fair assets will fall short of targets.

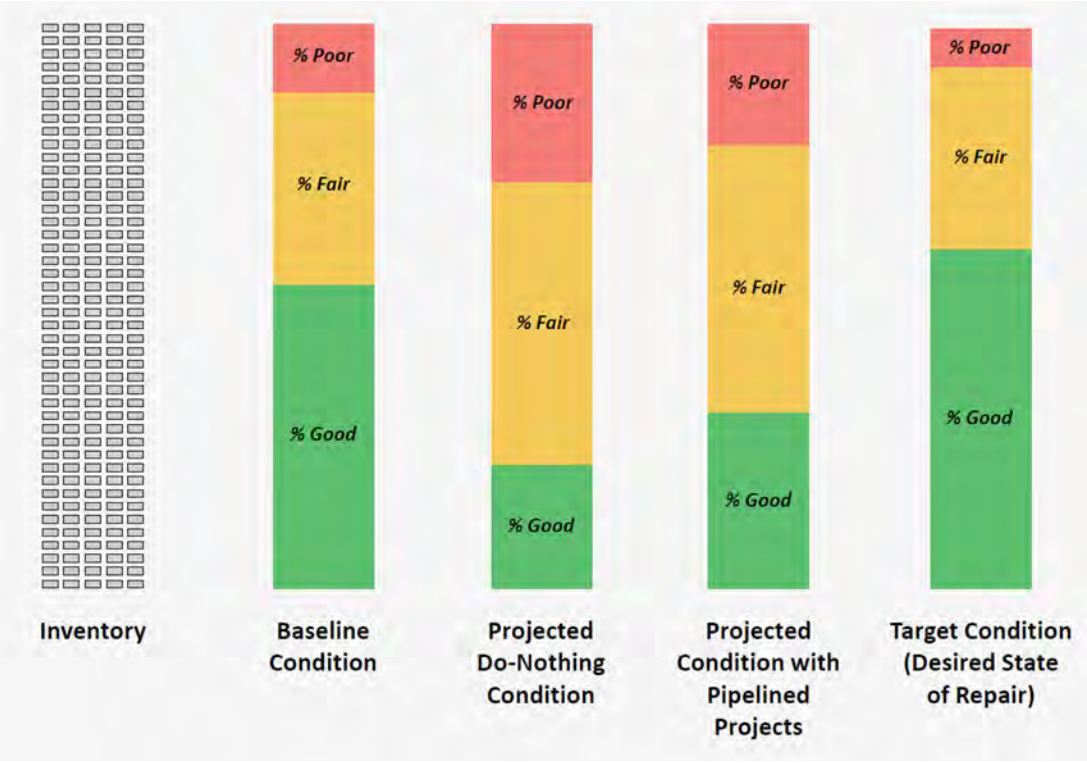

Figure 2-2. Gap Analysis

2.2 Performance Management Framework

Performance objectives are established to quantify and measure the most significant elements of work that Caltrans addresses through SHOPP and maintenance activities. These elements are important because of their relative asset valuation, strategic priority, or statutory or legal mandate. These 34 Performance Objectives address the needs of physical highway infrastructure assets (e.g., pavement, bridges), deficiencies (e.g., safety, storm water mitigation), as well as unplanned needs (e.g., emergency response).

Caltrans builds the Needs Assessment analysis upon a strategic framework of 34 Performance Objectives organized by the primary goals from the *Caltrans 2020-24 Strategic Plan*, as shown in Figure 2-3.

The categorization of performance objectives by strategic goal and performance management model type is presented in Table 2-1. Chapter 5 of this Plan provides detailed discussion of each Performance Objective.

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SAFETY FIRST	STRATEGIES	Leverage proven practices.
		Accelerate advanced technology.
		Lead safety culture change.
		Partner on traffic safety legislation and enforcement.
		Increase collaboration with external organizations to identify and implement best practices, technology, and lessons learned.
		Advance delivery of safety enhancements in, and that are responsive to, the priorities of underserved communities.
CULTIVATE EXCELLENCE	STRATEGIES	Foster a work environment that welcomes everyone and resembles the communities we serve.
		Support career progression through professional and leadership development.
		Inspire a values-based culture through an innovative, performance-driven workforce.
		Clearly communicate and align expectations at all levels.
		Improve internal and external relationships to create beneficial solutions aligned with Statewide Goals and Objectives.
		Improve, update, or adopt new strategies to advance equity in recruitment, hiring, and promotions.
MULTIMODAL NETWORK	STRATEGIES	Use operational strategies and incentives to reduce vehicle miles traveled (VMT) through increased high occupancy modes, active transportation, and other Transportation Demand Management (TDM) methods.
		Improve network operations and invest in networks for walking, cycling, transit, and multimodal trips.
		Better utilize technology and data to create a seamless multimodal travel experience and improve travel demand management.
		Optimize and expand equitable pricing.
STEWARDSHIP AND EFFICIENCY	STRATEGIES	Standardize and modernize our equipment, facilities, technology, and supporting work practices.
		Enhance asset management and decision support tools.
		Develop and implement a methodology to allocate resources to support strategic priorities.
		Promote and implement innovative and creative solutions.
		Enhance diversity, equity, and inclusion for contracting and procurement.
CLIMATE ACTION	STRATEGIES	Develop and start implementing a Caltrans Climate Action Plan that incorporates the CalSTA Climate Action Plan for Transportation Investments.
		Accelerate sustainable freight sector transformation.
		Establish a robust Climate Action program of education, training, and outreach.
		Partner and collaborate to lead on climate action.
		Establish a VMT monitoring and reduction program.
		Engage with communities most vulnerable to climate change impacts to inform development and implementation of Climate Action activities.
EQUITY AND LIVABILITY	STRATEGIES	Avoid, and work to address, transportation-related disparities in underserved communities on all new projects.
		Plan and design transportation facilities to support vibrant livable places, with a focus on addressing the needs and concerns of underserved communities.
		Collaborate with partner agencies to make equity and inclusion central in funding decisions.

Figure 2-3. Caltrans Strategic Goals

Table 2-1. Framework for Categorizing SHS Needs

SHS Needs by Strategic Goal and Model Type			
Performance Objectives	**Physical Asset Model**	**Deficiency Model**	**Reservation Model**
Safety First			
Proactive Safety		✓	
Reactive Safety			✓
Stewardship & Efficiency			
Bridge and Tunnel Health	✓		
Bridge Goods Movement Upgrades	✓		
Bridge Scour Mitigation		✓	
Bridge Seismic Restoration		✓	
Commercial Vehicle Enforcement Facilities	✓		
Drainage Pump Plants	✓		
Drainage Restoration	✓		
Fish Passage		✓	
Lighting Rehabilitation	✓		
Major Damage (Emergency Opening)			✓
Major Damage (Permanent Restoration)			✓
Office Buildings	✓		
Overhead Sign Structures Rehabilitation	✓		
Pavement Class 1	✓		
Pavement Class 2	✓		
Pavement Class 3	✓		
Relinquishments			✓
Roadside Rehabilitation	✓		
Roadway Protective Betterments		✓	
Safety Roadside Rest Area (SRRA) Rehabilitation	✓		
Sign Panel Replacement	✓		
Storm Water Mitigation		✓	
Transportation Management Systems	✓		
Transportation Management System Structures	✓		
Transportation Related Facilities	✓		
Water and Wastewater Treatment at SRRAs	✓		
Weigh-In-Motion Scales	✓		
Climate Action			
Sea Level Rise Adaptation		✓	
Equity & Livability			
ADA Pedestrian Infrastructure		✓	
Complete Streets (Fix Existing)	✓		
Complete Streets (Build New)		✓	
Multimodal Network			
Operational Improvements		✓	

Performance Management Models

The SHSMP defines three performance management models that support the development of future need projections over the 10-year Plan period:

- Physical Asset Model
- Deficiency Model
- Reservation Model

The Physical Asset Model defines the methods and parameters needed to characterize how the condition of a physical asset, such as a bridge, will degrade over time. The Deficiency Model is used to measure progress towards addressing elements or locations identified through statutory, legal, or strategic goal-driven requirements. To anticipate work likely needed because of natural disaster and other unplanned events that impact the SHS, Caltrans uses the Reservation Model. While many of the performance objectives are related to physical highway infrastructure assets and can be characterized using a physical asset model, two additional models are needed to characterize unique circumstances. Further explanation of how these models apply to the Performance Objective is presented in Chapter 5.

Physical Asset Model

The Physical Asset Model is founded on the principle of deterioration. Deterioration is the physical degradation of an asset because of a combination of factors, including age, construction materials, environment, accidental damage, and traffic load. A set of deterioration rates (good-to-fair and fair-to-poor) are determined for each asset type to account for expected future conditions. Deterioration rates, expressed as an annual percentage rate, 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 (fair-to-good) and rehabilitation/replacement (poor-to-good) goal to ensure a balanced management approach. Figure 2-4 illustrates the cycle of physical asset deterioration and improvements.

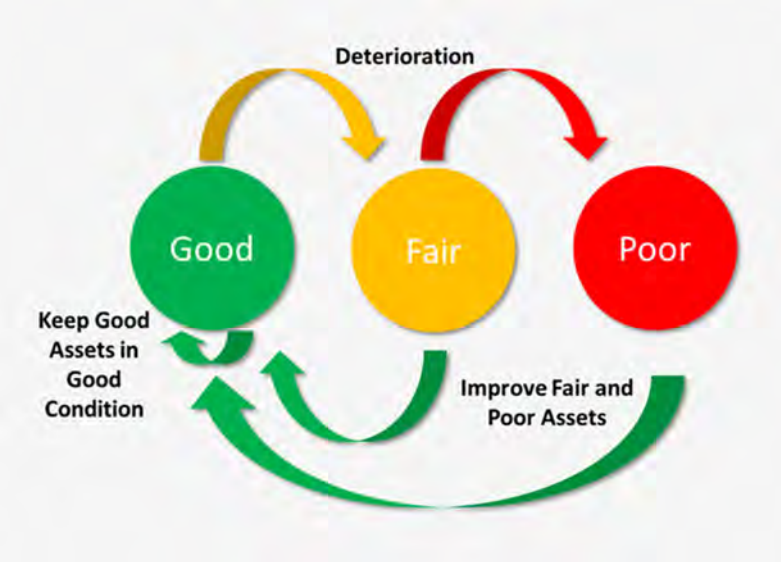

Figure 2-4. Deterioration and Improvement Cycle for Physical Assets

Deficiency Model

The *Deficiency Model* is applied to objectives where work is needed to improve or correct issues on highway infrastructure assets identified through state or federal mandates, legal settlements, updated design codes and engineering practices, or similar motivating factors. Examples include mitigating environmental impacts from storm water, enhancing worker safety through modification of roadside elements, and modifying or adding elements to comply with Americans with Disabilities Act (ADA) requirements. These

needs do not have a condition breakdown like the physical assets; they are either deficient or not. A gap analysis between the current deficiency and the target is conducted similarly to the physical asset model. Cost estimates to address this need are calculated similarly to the asset model. Where a deficiency exists, it is designated as poor, while deficiencies that have been addressed are designated as good. The fair designation is not applicable in the deficiency model.

Reservation Model

The *Reservation Model* is applied to unanticipated or unplanned needs, primarily emergency response activities. Objectives using the reservation model cannot be predicted in terms of the quantity or location of need as location and scope of needs are not known until an event such as a flood or landslide occurs. To effectively manage the SHS, Caltrans establishes a financial reservation to meet these needs when they arise. Reservations do not have an identified inventory, condition, or target. The reservation levels are established based on historical demand in the respective areas.

2.3 Addressing State Highway System Needs

Caltrans uses a combination of three strategies to maintain the SHS: SHOPP, Major Maintenance, and Field Maintenance Crews. These strategies are applied in combination to cover the range of maintenance activities including corrective and preventive maintenance, rehabilitation, and replacement. Table 2-2 summarizes these strategies and their focus, which are described further in this Section.

Table 2-2. Strategies to Address the State Highway System Needs

SHOPP and Maintenance Strategies				
Strategy	**Type of Work**			**Condition Focus**
	Replacement	**Rehabilitation**	**Corrective and Preventive Maintenance**	
SHOPP	●	●		Poor and Fair Condition Assets
Major Maintenance			●	Poor and Fair Condition Assets
Field Maintenance Crews			●	Fair and Good Condition Assets

Work under these three strategies is limited to activities that are consistent with state laws that govern the use of SHOPP or Maintenance funds. Generally, these laws require available funding to be expended on the safety, maintenance, rehabilitation and operation of the existing system. System expansion is not permitted through the SHOPP or Maintenance Programs.

2.4 SHOPP Needs Assessment

SHOPP needs are determined through performance management gap analysis. Assets in poor and fair condition are the primary focus of the SHOPP. The SHOPP uses capital improvement projects for rehabilitation and replacement of highway infrastructure assets. In addition, SHOPP projects address needs identified through deficiency and reservation models. The SHOPP also addresses the needs of the Minor Program and PIDs in project planning phases.

Projects currently programmed in the 2020 SHOPP or in the 2022 Project Initiation Document (PID) Work Plan are referred to as "pipelined" projects. Figure 2-5 shows how the pipelined projects and the remaining performance gap are aligned within the ten years of the Plan. The costs of the pipelined projects in the SHOPP in the first five years of the plan can be determined with reasonably high confidence, as these projects have either been programmed or their costs have undergone reviews through the PID process. By contrast, the costs of the needed projects in the last five years have a greater range of uncertainty. The estimated cost of this work is determined by multiplying the quantity of performance units by the average unit cost associated with poor-to-good or fair-to-good treatments.

Figure 2-5. Pipeline Projects and Remaining Performance Gap

Table 2-3 summarizes the total cost associated with addressing fair and poor gaps through the SHOPP. This cost estimate is based on a combination of the cost of programmed and committed projects in the first 5 years of the 10-year Plan period, plus the projects needed to close performance gaps in the last five years of the 10-year Plan period.

2.5 Maintenance Needs Assessment

The California Streets and Highways Code requires that the Maintenance Needs Assessment include only program activities, "that if not performed, could result in increased SHOPP costs in the future."

Maintenance needs are identified through the performance management gap analysis for fair and poor condition asset classes under pavement, bridge and tunnel health, drainage restoration, and TMS. The needs from the gap analysis are then added to the preventive maintenance needs associated with activities primarily focused on good condition assets.

Table 2-3 summarizes the SHOPP and maintenance needs for the four primary asset classes, and also includes costs associated with inspection forces, Field Maintenance Crews, and Major Maintenance. Chapter 5 includes a more extensive discussion of these assets.

Appendix C presents the 5-year Maintenance Investment Plan and identifies projected future State Highway Operation and Protection Program costs that would be avoided by increasing maintenance spending.

2.6 Summary of SHOPP and Maintenance Needs

A summary of SHOPP and Maintenance needs for the 10-year Plan period are presented the Table 2-3.

Table 2-3. Summary of 10-Year SHOPP and Maintenance Needs

10-Year SHOPP and Maintenance Needs							
Performance Objectives		SHOPP ($M)			Maintenance ($M)		Strategic Goal
		Pipeline	Gap	Total 10-yr	Major Maintenance	Field Maintenance Crews	
Safety		**$3,809**	**$9,082**	**$12,891**			
Proactive Safety		$2,183	$7,482	$9,665			Safety
Reactive Safety		$1,626	$1,600	$3,226			Safety
Primary Assets		**$12,833**	**$16,199**	**$29,033**	**$4,904**	**$1,515**	
Pavement	Class 1	$4,732	$5,279	$10,011	$3,230	$181	Stewardship
	Class 2	$3,034	$3,097	$6,131			Stewardship
	Class 3	$313	$308	$621			Stewardship
Bridge and Tunnel Health		$1,654	$5,435	$7,090	$1,321	$822	Stewardship
Drainage Restoration		$1,766	$1,255	$3,021	$267	$249	Stewardship
Transportation Management Systems		$1,333	$825	$2,158	$85	$263	Stewardship
Supplementary Assets		**$1,565**	**$12,072**	**$13,638**			
Drainage Pump Plants		$117	$121	$238			Stewardship
Lighting Rehabilitation		$150	$1,659	$1,809			Stewardship
Office Buildings		$0	$2,053	$2,053			Stewardship
Overhead Sign Structures Rehabilitation		$164	$1,373	$1,537			Stewardship
ADA Pedestrian Infrastructure		$474	$825	$1,298			Equity-Livability
Safety Roadside Rest Area (SRRA) Rehabilitation		$107	$1,100	$1,207			Stewardship
Transportation Related Facilities		$460	$4,659	$5,119			Stewardship
Weigh-In-Motion Scales		$92	$284	$376			Stewardship
System Resiliency Objectives		**$1,688**	**$17,520**	**$19,208**			
Bridge Scour Mitigation		$550	$504	$1,054			Stewardship
Bridge Seismic Restoration		$353	$1,190	$1,543			Stewardship

10-Year SHOPP and Maintenance Needs						
Performance Objectives	SHOPP ($M)			Maintenance ($M)		Strategic Goal
	Pipeline	Gap	Total 10-yr	Major Maintenance	Field Maintenance Crews	
Major Damage (Emergency Opening)	-	$2,388	$2,388			Stewardship
Major Damage (Permanent Restoration)	$705	$700	$1,405			Stewardship
Roadway Protective Betterments	$79	$1,618	$1,697			Stewardship
Sea Level Rise Adaptation	-	$11,120	$11,120			Climate
Other Assets and Objectives	**$3,181**	**$29,441**	**$32,622**			
Bridge Goods Movement Upgrades	$574	$7,869	$8,443			Stewardship
Commercial Vehicle Enforcement Facilities	$53	$810	$864			Stewardship
Complete Streets (Fix Existing)	$50	$341	$391			Equity-Livability
Complete Streets (Build New)	$428	$11,505	$11,932			Equity-Livability
Fish Passage	$45	$363	$407			Stewardship
Operational Improvements	$520	$1,139	$1,660			Multimodal
Relinquishments	$59	$46	$105			Stewardship
Roadside Rehabilitation	$197	$3,984	$4,181			Stewardship
Sign Panel Replacement	$128	$824	$952			Stewardship
Storm Water Mitigation	$576	$2,368	$2,944			Stewardship
Transportation Management System Structures	$502	$0	$502			Stewardship
Water and Wastewater Treatment at SRRAs	$50	$193	$243			Stewardship
Needs Assessment Totals	**$23,076**	**$86,816**	**$109,892**	**$4,904**	**$1,515**	
SHOPP Major Program (All SHSMP Objectives)	$23,076	$84,316	$107,392	-	-	
SHOPP Minor Program	-	$2,500	$2,500	-	-	
Major Maintenance and Field Maintenance Crews	-	-	-	$4,904	$1,515	

Table 2-3 Notes:

- The Sub-totals and totals presented in the table may not add due to rounding.
- Cost estimates shown in the Pipelined Projects column are based on the best available scope of projects in planning and design and may be subject to change.

- Pavement maintenance costs associated with Field Maintenance Crews work are for crack sealing.
- Drainage maintenance costs include State Field Maintenance Crews for assessments, maintenance, repairs, and associated equipment/materials.
- Maintenance performs preventive maintenance checks to keep TMS units functional. Maintenance activities do not change the condition of a TMS unit from poor to good.
- The Maintenance columns in this table reflect the total available funds for the four primary assets. The Maintenance costs in Appendix B, however, reflect the costs associated with only fair to good and poor to good activities and do not include good to good costs.

A summary of 10-year SHOPP needs by strategic goals and objective categories is presented in Figure 2-6.

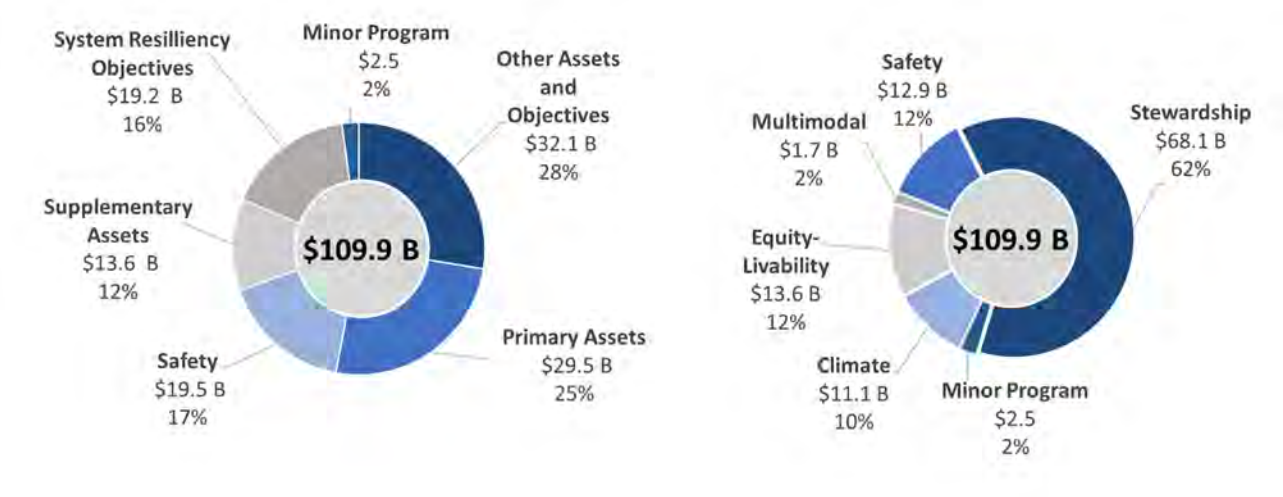

Figure 2-6. 10-Year Major SHOPP Needs by Objective Category (left) and Strategic Goal (right)

2.7 Addressing Needs through Other Programs

While Table 2-3 summarizes the total needs associated with achieving the defined condition and performance targets associated with the existing SHS, there are SHS needs addressed through programs outside of the SHOPP, Major Maintenance, and Field Maintenance Crews. These needs, which fall outside the scope of maintenance and preservation activities, are identified through the STIP, Active Transportation Program, Local Partnership Program, Solutions for Congested Corridors Program, Trade Corridor Enhancement Program, Transit and Intercity Rail Capital Program, and the Self-Help Counties Coalition. Other transportation system improvement needs are identified by Regional Transportation Planning Agencies and Caltrans in regional and interregional improvement plans funded through the STIP and local transportation funding sources. Given the distributed sources of funding, it is difficult to place a specific dollar figure on the value of needs being addressed by these sources. A significant portion of these funds will likely be focused on the SHS. The Commission will approve these projects on an annual basis, therefore, specific dollar figures for the SHS cannot be determined over the SHSMP 10-year planning horizon. Where data is available, condition improvements and related performance gains resulting from work through these other programs are quantified and reflected through the SHSMP analyses.

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3 Revenue and Financial Projections

California's transportation funding for the SHS is derived from a variety of sources. The majority of state and federal transportation funding is collected through fuel taxes. Revenues flow into a set of transportation-related accounts for California.

At the state level the major accounts related to asset management are the State Highway Account (SHA) and the Road Maintenance and Rehabilitation Account (RMRA) established in 2017 through SB 1. These accounts are used to fund maintenance, operations, and capital projects including asset management-related activities. SHOPP and HM jointly fund maintenance, preservation, rehabilitation, and replacement projects, and all are intended to maintain or improve asset condition. The SHSMP Financial Plan connects Caltrans' objectives and targets to investment strategies and project delivery programs. The Financial Plan summarizes both current and future funding sources and uses and outlines the financial constraints under which Caltrans operates. Achieving the targets will depend on future revenues available for maintenance, repair, rehabilitation, and replacement of assets.

3.1 State Highway System Funding

The Federal Highway Trust Fund (Trust Fund), SHA, and RMRA are the main funding sources for the SHOPP and the STIP. For a comprehensive overview of transportation funding and programming in California, refer to Caltrans' annual report *Transportation Funding in California (2020)*[10].

Federal funding is provided through the Federal Highway Administration (FHWA) from federal fuel taxes. Each state collects a federal excise tax of 18.4 cents per gallon of gasoline, and 24.4 cents per gallon of diesel fuel, and remits the revenue to the federal government for deposit into the Trust Fund. Funding is then provided to states for highway and mass transportation (transit) programs. Federal transportation acts outline the uses and distribution of these resources. In addition to federal fuel taxes, both the SHOPP and the Maintenance Programs receive a portion of their funding from a state excise tax on gasoline, which is approximately 18 cents per gallon[11]

3.2 SHOPP Funding

The SHSMP requires a 10-year funding projection for the SHOPP. It represents the best available revenue estimate at the time of SHSMP development. This estimated funding prepared by the Division of Budgets utilizes similar assumptions used for the State Transportation Improvement Program Fund Estimate (STIP FE) in determining expected annual SHOPP capacity and should align closely to the 2022 STIP FE once finalized. When SB 1 was passed in 2017, projected annual funding for the SHOPP was expected to increase to levels above $5 billion. However, due to the decrease in fuel sales and associated tax revenues, the current and near-term fiscal year revenues have gone down. The 10-year funding available for SHOPP projects is estimated to be $45.6 billion. This is exclusive of approximately $618 million for Project Initiation Document (PID) Program support and $5.6 billion for Maintenance Program activities over the 10-year plan period.

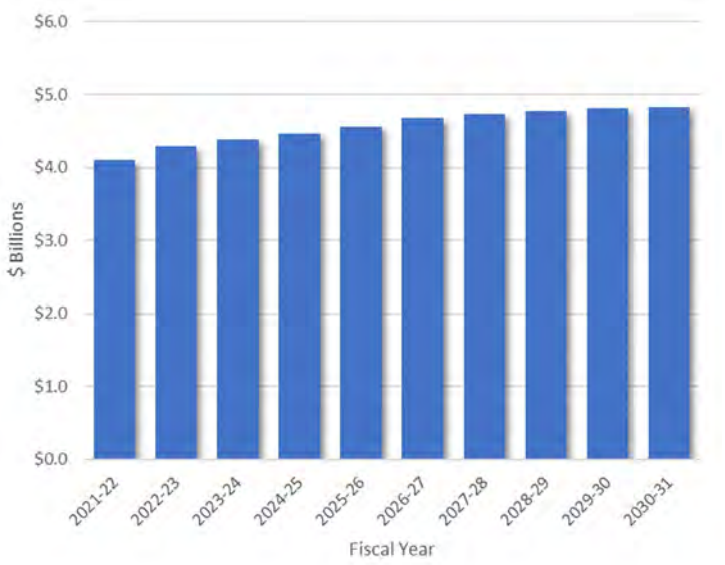


Figure 3-1. 10-Year Annual SHOPP Target Capacity

Figure 3-1 provides the projected annual SHOPP target funding capacity for the next 10 years. In addition to the funding projection, the Investment Plan also considers project portfolio contingencies estimated over the 10-year plan period.

[10] Caltrans, *Transportation Funding in California (2020),* https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/transportation-funding-booklet/2020-final-transportation-funding-a11y.pdf

[11] California Department of Tax and Fee Administration, https://www.cdtfa.ca.gov/taxes-and-fees/sales-tax-rates-for-fuels.htm

Challenges to SHOPP Funding

Various risks exist that may impact the forecasted program capacity for the SHOPP and STIP, including:

COVID-19 Impacts: The COVID-19 pandemic resulted in less vehicle miles travelled which translates to less revenue from fuel and related taxes. While the near-term impacts have been reflected in the 10-year funding projection used in the SHSMP, the longer-term impacts of the ongoing pandemic on revenues are less certain and will need to be reassessed.

Federal Highway Act Expiration: On December 4, 2015, the FAST Act was signed into law. The FAST Act is projected to provide California with authorization of approximately $19.4 billion for the federal-aid highway program from federal fiscal years 2016 to 2020. Multiple continuing resolutions of federal funding have been passed by Congress, but without a new Transportation Act, there is no assurance of consistent federal funding.

Corporate Average Fuel Economy (CAFE) Standards: In 2012, the National Highway Traffic Safety Administration and the Environmental Protection Agency (EPA) issued a joint final rule, establishing new standards to regulate model year 2017 through 2021 passenger cars and light trucks. The new standards' intent is to continue to improve vehicle fuel economy and reduce greenhouse gas emissions. More fuel-efficient vehicles impact transportation funding.

Governor Executive Order N-79-20[12]: In September 2020, Governor Gavin Newsom established an executive order to fight climate change by requiring the sales of all new passenger vehicles to be zero-emission by 2035. This would accelerate the need for the state to continue exploring a tax structure to maintain appropriate transportation revenue levels.

Cost Escalation

The SHSMP incorporates escalated project cost estimates to account for expected cost increases in future year projects. These cost increases result from a combination of inflationary factors, as well as supply and demand of materials and services. The cost to address SHS needs depends highly on cost escalation percentages used. For SHSMP capital project cost projections, an annual cost escalation rate of 3.2 percent is used. This escalation rate was established as the basis for calculations in the *2020 State Transportation Improvement Program Fund Estimate*[13], adopted by the Commission in August 2019, and is used in all current Caltrans project development cost projection calculations.

While this escalation rate is used in the calculations in the SHSMP, the historical trend of the Price Index for Selected California Construction Items[14], as shown in Figure 3-2, indicates that construction costs may soon be outpacing the escalation rate. If this trend continues, adjustments will need to be made in future plans.

Escalation is applied only to future needs because the costs for projects that are programmed in the current SHOPP or are in Transportation Planning's work plan already include escalation. In the calculations presented in the Needs Assessment and Investment Plan chapters, costs are escalated to eight and a half

[12] Governor Executive Order, N-79-20, https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf
[13] Caltrans, 2020 State Transportation Improvement Program Fund Estimate, https://dot.ca.gov/-/media/dot-media/programs/budgets/documents/2020-stip-fe-book-final-ada-with-cover-v2.pdf
[14] Caltrans, Price Index for Selected California Construction Items, http://ppmoe.dot.ca.gov/hq/esc/oe/cost_index/historical_reports/CCI_Q1_2019.pdf

years into the 10-year Plan period which is assumed to the midpoint of the construction period for anticipated project work in the last five years.

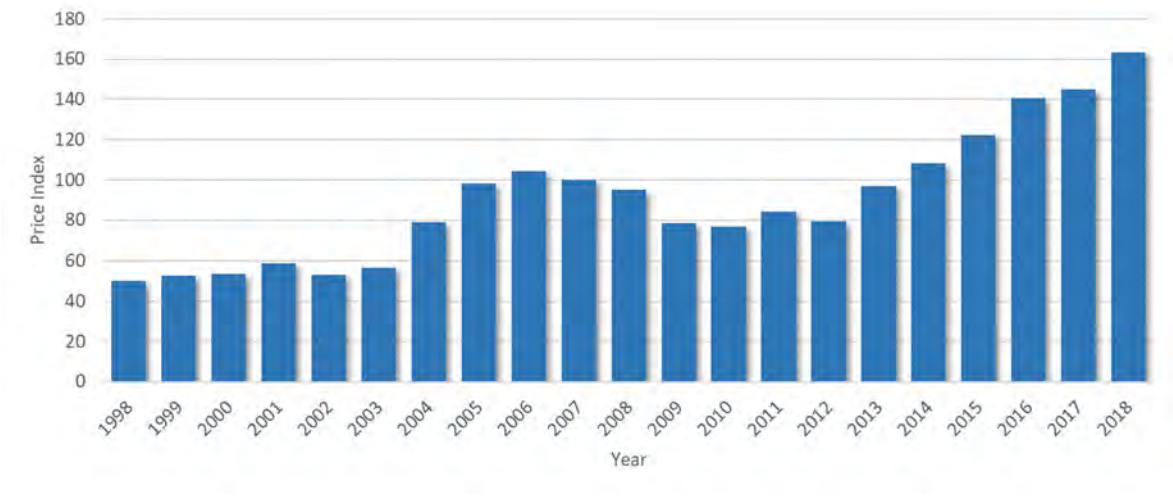


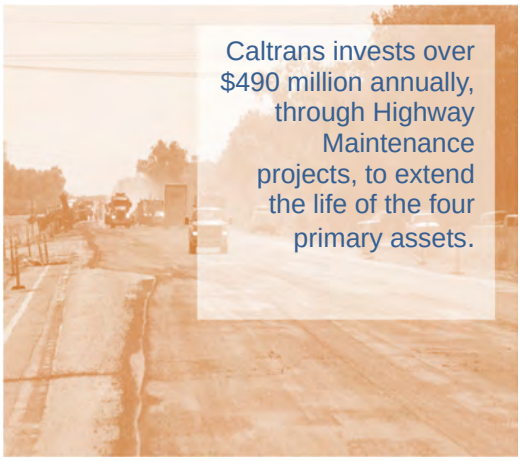
Figure 3-2. Annual Cost Escalation Rate Based on 20-year Price Index

3.3 Maintenance Funding

The Maintenance Program budget comprises Major Maintenance and Field Maintenance Crews. Major Maintenance includes preventive and corrective maintenance activities achieved through HM projects. Field Maintenance Crews are state forces that focus on addressing minor maintenance, repairs, and preservation work.

Major Maintenance

HM projects are selected by evaluating the asset condition at a route-specific level. This approach is needs-based and considers several key factors, including asset age, climate and geographic location, Average Daily Traffic, and projected deterioration. HM projects provide great value and extend the service life of assets at the lowest possible long-term cost.



Highway Maintenance project selection balances the short-term needs of the system, long-term goals and available resources. HM projects, which extend the service life of assets, are the primary SHOPP cost avoidance mechanism in the Maintenance Program.

The SHS needs are assessed in a systematic manner (e.g., using the pavement management system) which includes analysis of these highway deficiencies and their potential solutions. Program advisors review proposed projects and coordinate with districts to select those which maximize maintenance investments.

The estimated HM funding for the SHSMP for the four primary asset classes is over $490 million per year.

Field Maintenance Crews (State Forces)

The Maintenance Program has examined its practices on how it allocates resources for field maintenance activities. This is especially valuable given the present and expected future funding, which could place considerable constraints on maintaining the system.

Development under way to improve these practices will be shaped by considering Level of Service (LOS), condition of assets, and performance while balancing mandated activities and historic demands on maintenance resources (snow, emergency response, customer service requests, etc.) with a commitment to system preservation.

The estimated funding for Caltrans Field Maintenance Crews for the four primary asset classes is over $150 million per year.

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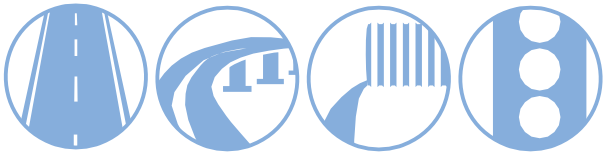

4 Ten-Year Investment Plan & Performance Outcomes

Over the 10-year SHSMP period, analysis shows the total cost of needs for maintaining the SHS exceed available funding and resources.

Key assets such as pavement, bridge, drainage, and TMS are maintained to achieve target performance levels established through the TAMP, and investment trade-off decisions are made for other SHS assets and objectives.

The Investment Plan considers how Caltrans will achieve strategic alignment with safety, multimodal, stewardship, climate, and equity and livability objectives through the allocation of available funding.

4.1 Investment Strategies

Investment strategies developed through the TAMP established the guiding principles that govern overall investment decision-making. Caltrans uses these strategies in combination with Maintenance program-specific strategies to achieve performance targets. 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. These strategies incorporate asset modeling, treatments, and impacts, as well as risks and financial constraints.

Many factors influence the magnitude of investments made towards maintaining the SHS. In some cases, investment levels 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 activities. Beyond these requirements, consequences of not funding certain objectives are a major consideration. Investment decisions are informed by evaluating various investment scenarios that consider long-term life cycle costs, risk, and performance.

The SHSMP ensures that 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 assets with limited funding available and anticipated future funding. The five primary strategies, adapted from the TAMP, used to guide SHOPP and Maintenance investment decision-making, are presented in Table 4-1.

Table 4-1. SHOPP and Maintenance Investment Strategies

Investment Strategies	
Strategy	**Description**
Fix It First	• Prioritize maintenance, rehabilitation, and safety improvements over capacity expansion. • Focus on the right treatment at the right time to preserve or improve condition at optimum time and cost.
Leverage Investments	• Support the full range of Caltrans strategic goals. • Make progress towards multiple goal areas with each SHOPP investment. • Employ innovative and emerging technologies to realize efficiencies in design, construction, and maintenance activities.
Focus on Selected Asset Classes	• Focus on the most important assets on the SHS, as measured by vehicle-miles traveled and by asset value. • Pavement, bridge, drainage, and TMS assets represent a significant portion of SHS maintenance and rehabilitation investments.
Address Environmental Stewardship Priorities	• Reduce environmental impacts through sustainable treatment strategies.

Investment Strategies	
Strategy	**Description**
	• Reduce impacts to air and water quality through best management practices.
Integrate All Transportation Modes for All Users	• Design accessible transportation infrastructure to support all modes for all users and address ADA requirements. • Ensure investments make progress towards broad transportation goals. • Include enhancements to pedestrian, bicycle, and transit infrastructure in multi-objective projects to leverage more efficiency.

Each of the five strategies play a vital role in establishing statewide investments to achieve SHSMP performance targets. For example, Caltrans is continuously striving to identify and adopt innovative and emerging technologies to realize efficiencies in design, construction, and maintenance activities. Caltrans invests approximately $25 million annually in research[15] with outcomes and products that have the potential to improve SHOPP and Maintenance practices (e.g., construction materials, treatment strategies, information technologies, etc.), leveraging available funds, and reducing life cycle costs.

Underlying the investment strategies are performance targets and projections, life cycle planning, risk management analysis, and anticipated funding and cost of future work. The performance gap analysis, informed by life cycle planning, helps define the SHS investment needs. 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 Caltrans to more accurately predict future scenarios. Risk management tempers the analysis, adjusting potential outcomes based on positive and negative risks. While these asset management processes help to inform investment planning, it is these strategies that make the technical details meaningful at a network level and help communicate the message of preserving asset condition and making progress towards the goals in the Caltrans 2020-24 Strategic Plan.

4.2 SHOPP Investment Plan

The SHOPP Investment Plan, presented in Table 4-2, establishes funding levels for each performance objective. Funding levels for each performance objective are established through trade-off analysis, which considers investment strategies, Caltrans strategic goals, statutory and funding constraints, and transportation priorities. The resulting investment allocation across objectives represents an optimal balance of these factors, while assuring key performance targets are met.

The investment level in each performance objective is determined by many factors. These factors include prior programmed work, current condition, judicial or legislatively mandated funding levels, consequences of inaction, past investment levels, and preservation needs versus rehabilitation consideration. Investment

[15] Caltrans, Annual Research Program Highlights, https://dot.ca.gov/programs/research-innovation-system-information/annual-reports

level establishment also considers the investment's impact on the system, existing pipeline of work, expected deterioration rates, and expected growth in inventory. With investment levels established for each performance objective at the statewide level, a comprehensive SHOPP Investment Plan is developed that sets performance targets and funding constraints for each of Caltrans' 12 districts. The SHOPP Investment Plan development process is shown in Figure 4-1.

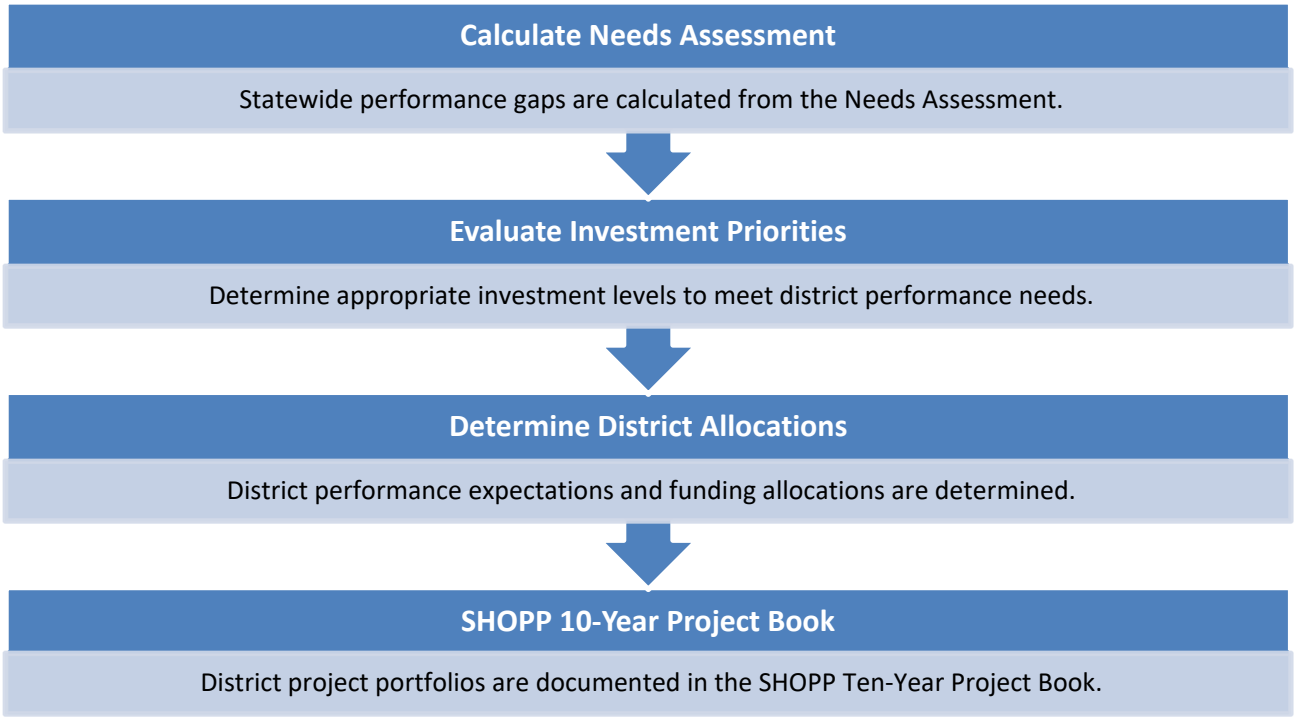

Figure 4-1. Development of the SHOPP Investment Plan

Investment levels for each objective are converted to performance expectations and proportioned out to each of the Caltrans districts. District-level funding is based on outstanding performance gaps, independent of historic district funding levels. District-level funding for each performance objective is calculated using the investment level for the performance objective and the calculated performance gap in each district. Headquarters formalizes the 10-year performance expectations and associated funding allocations with each of the districts. Caltrans districts then use this information to develop multi-year project portfolios that collectively address the performance expectations within given funding constraints. The funding need for each asset type is calculated using average statewide unit costs but vary significantly through various regions and asset types. It is expected that through a combination of multi-objective project planning and SB 1 requirements[16] to improve efficiencies in environmental and design processes, the districts can deliver on performances expectations and meet transportation system needs. These district project portfolios are updated to continually balance performance and available funding, and are published in the SHOPP 10-Year

[16] SB1 Annual Efficiencies Report, 2018-19, https://dot.ca.gov/-/media/dot-media/programs/sb1/documents/sb1-annual-efficiencies-report-2018-19-final.pdf

Project Book on the Caltrans Asset Management website[17]. District-proposed projects advance through formal planning processes for programming in the SHOPP. This approach ensures that the project portfolios proposed in future SHOPP cycles are consistent with statewide goals and objectives and align with TAMP and SHSMP targets.

4.3 Maintenance Investment Plan

The Maintenance Investment Plan represents the funding and resources needed to support preventive maintenance activities for the four primary asset classes under pavement, bridge and tunnel health, drainage restoration, and TMS, and assure that the 10-year TAMP performance targets can be achieved efficiently. These investments are applied across the two preventive maintenance focused strategies: Major Maintenance and Field Maintenance Crews. Investment levels are established for each of the four assets with an overarching goal to maintain good assets in good condition, while addressing fair condition assets where effective. The 5-Year Maintenance Investment Plan including SHOPP avoidance is shown in Appendix C.

Table 4-2 presents Major Maintenance and Field Maintenance Crews funding levels for the four primary assets. It is important to note investments in these four areas represent only a portion of Caltrans' overall maintenance investment and activities. Maintenance resources are applied to many of the other performance objectives listed in Table 4-2. Furthermore, Maintenance addresses several other activities (e.g., guardrail repair and graffiti removal) not listed in Table 4-2.

[17] Caltrans, SHOPP Ten-Year Project Book, https://dot.ca.gov/programs/asset-management

4.4 Summary of SHOPP and Maintenance Investment Plans

Table 4-2 presents the funding associated with the performance objectives for the combined SHOPP and Maintenance Investment Plans.

Table 4-2. 10-Year SHOPP and Maintenance Investment Plan

10-Year SHOPP and Maintenance Investment Plan								
Objectives		SHOPP Investment ($M)			Maintenance ($M)		Amount of Performance Gap Funded	Strategic Goal
		Pipeline	Gap	Total 10-yr	Major Maintenance	Field Maintenance Crews		
Safety		**$3,809**	**$2,667**	**$6,475**				
Proactive Safety		$2,183	$1,067	$3,249			14%	Safety
Reactive Safety		$1,626	$1,600	$3,226			100%	Safety
Primary Assets		**$12,833**	**$13,670**	**$26,503**	**$4,903**	**$1,515**		
Pavement	Class 1	$4,732	$5,279	$10,011	$3,230	$181	100%	Stewardship
	Class 2	$3,034	$3,097	$6,131			100%	Stewardship
	Class 3	$313	$308	$621			100%	Stewardship
Bridge and Tunnel Health		$1,654	$3,003	$4,657	$1,321	$822	56%	Stewardship
Drainage Restoration		$1,766	$1,158	$2,924	$267	$249	92%	Stewardship
Transportation Management Systems		$1,333	$825	$2,158	$85	$263	100%	Stewardship
Supplementary Assets		**$1,565**	**$984**	**$2,549**				
Drainage Pump Plants		$117	$66	$183			54%	Stewardship
Lighting Rehabilitation		$150	$50	$200			3%	Stewardship
Office Buildings		$0	$300	$300			15%	Stewardship
Overhead Sign Structures Rehabilitation		$164	$110	$274			8%	Stewardship

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10-Year SHOPP and Maintenance Investment Plan

Objectives	SHOPP Investment ($M)			Maintenance ($M)		Amount of Performance Gap Funded	Strategic Goal
	Pipeline	Gap	Total 10-yr	Major Maintenance	Field Maintenance Crews		
ADA Pedestrian Infrastructure	$474	$148	$622			18%	Equity-Livability
Safety Roadside Rest Area (SRRA) Rehabilitation	$107	$110	$217			10%	Stewardship
Transportation Related Facilities	$460	$163	$623			3%	Stewardship
Weigh-In-Motion Scales	$92	$37	$130			13%	Stewardship
System Resiliency Objectives	**$1,688**	**$3,798**	**$5,486**				
Bridge Scour Mitigation	$550	$479	$1,029			95%	Stewardship
Bridge Seismic Restoration	$353	$202	$556			17%	Stewardship
Major Damage (Emergency Opening)	$0	$2,388	$2,388			100%	Stewardship
Major Damage (Permanent Restoration)	$705	$700	$1,405			100%	Stewardship
Roadway Protective Betterments	$79	$29	$108			2%	Stewardship
Sea Level Rise Adaptation	$0	$0	$0			0%	Climate
Other Assets and Objectives	**$3,181**	**$2,607**	**$5,788**				
Bridge Goods Movement Upgrades	$574	$0	$574			0%	Stewardship
Commercial Vehicle Enforcement Facilities	$53	$53	$107			7%	Stewardship
Complete Streets (Fix Existing)	$50	$155	$205			46%	Equity-Livability
Complete Streets (Build New)	$428	$956	$1,384			8%	Equity-Livability
Fish Passage	$45	$224	$268			62%	Stewardship
Operational Improvements	$520	$251	$771			22%	Multimodal

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10-Year SHOPP and Maintenance Investment Plan							
Objectives	SHOPP Investment ($M)			Maintenance ($M)		Amount of Performance Gap Funded	Strategic Goal
	Pipeline	Gap	Total 10-yr	Major Maintenance	Field Maintenance Crews		
Relinquishments	$59	$46	$105			100%	Stewardship
Roadside Rehabilitation	$197	$99	$296			2%	Stewardship
Sign Panel Replacement	$128	$45	$173			5%	Stewardship
Storm Water Mitigation	$576	$699	$1,275			30%	Stewardship
Transportation Management System Structures	$502	$0	$502			0%	Stewardship
Water and Wastewater Treatment at SRRAs	$50	$79	$129			41%	Stewardship
Investment Plan Totals	**$23,076**	**$26,226**	**$49,302**	**$4,903**	**$1,515**		
SHOPP Major Program (All SHSMP Objectives)	$23,076	$23,726	$46,802				
SHOPP Minor Program		$2,500	$2,500				
Major Maintenance and Field Maintenance Crews				$4,903	$1,515		

Table 4-2 Notes:

- The total SHOPP Investment Plan differs from the Fund Estimate as a result of various adjustments. The Sub-totals and totals presented in the table may not add due to rounding.
- Cost estimates shown in the Pipelined Projects column are based on the best available scope of projects in planning and design and may be subject to change.

A summary of 5-year Major SHOPP gap investments by objective category, strategic goal, and highest investment levels, is presented in Figure 4-2.

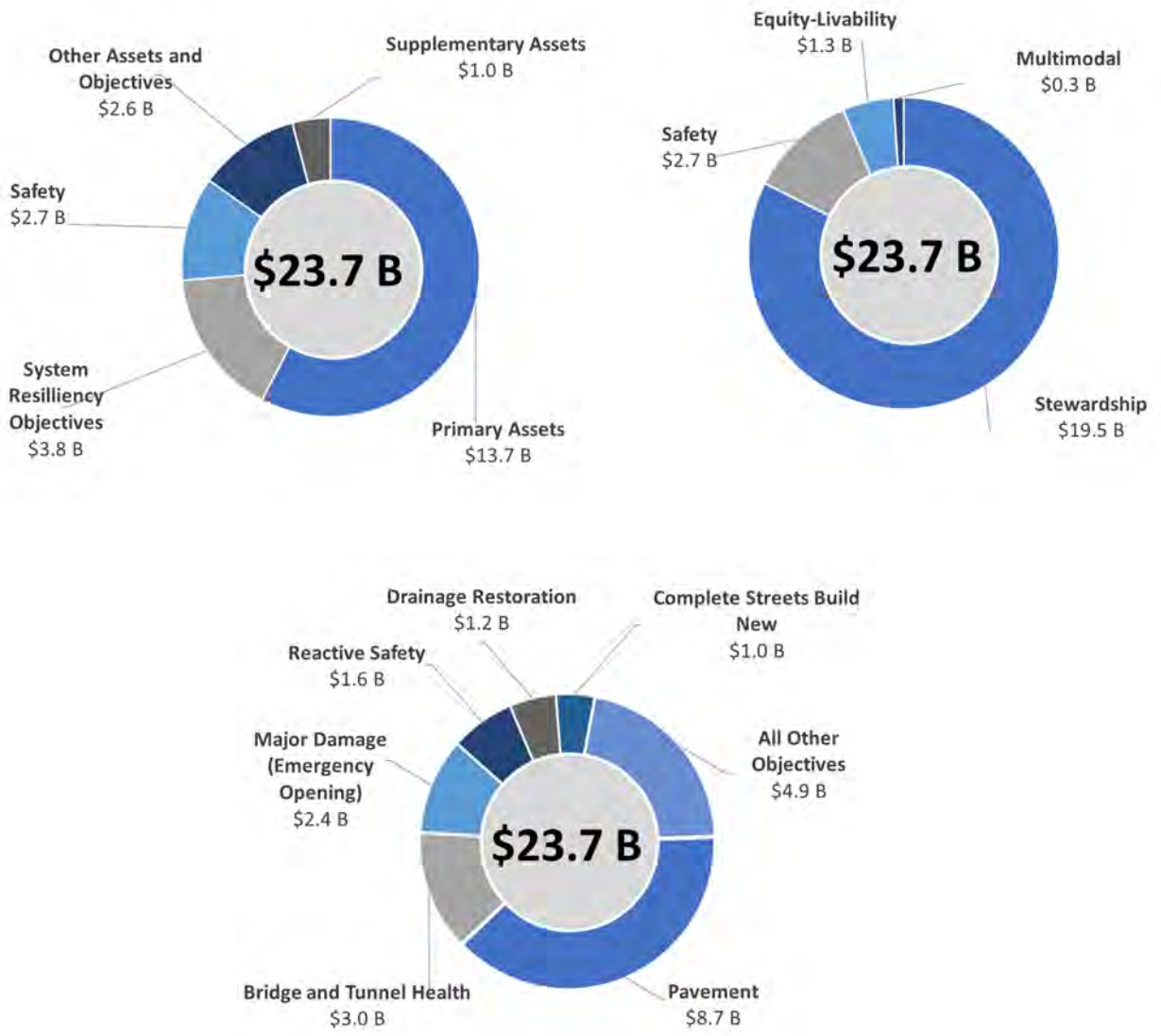

Figure 4-2. 5-Year Major SHOPP Gap Investments by Objective Category (upper left), Strategic Goal (upper right), and Highest Investment Level Objectives (bottom)

4.5 Performance Outcomes

The Investment Plan allocates available funding to specific transportation objectives. These include safety, physical asset condition, system performance, and sustainability goals.

The recommended level of investment in each objective area determines the corresponding accomplishments that can be expected for the investment. Investments may be defined for good, fair and poor condition assets depending on the objectives of the funding programs. Having specific investments addressing physical assets at all levels helps to minimize long-term cost by avoiding a worst first asset management approach. Table 4-3 details the specific quantity and units of performance expected from each of the funding programs.

Quantities presented in Table 4-3 summarize SHOPP and Maintenance performance accomplishments, combining both pipelined project work and planned work. The pipelined work accounts for all work that results in a change to performance relative to the baseline and may also include work completed prior to the 10-year plan period. Maintenance Program activities focus on preventive strategies, keeping good condition assets in good condition.

Table 4-3. Projected 10-Year SHOPP and Maintenance Accomplishments at Recommended Investment Levels

Proposed SHOPP and Maintenance Performance Accomplishments								
Objectives		Unit	SHOPP			Maintenance		
			New	Fair	Poor	Good	Fair	Poor
Safety								
Proactive Safety		Annual Fatal and Serious Injury Collisions	-	-	126			
Reactive Safety		Annual Fatal and Serious Injury Collisions	-	-	120			
Primary Assets								
Pavement	Class 1	Lane Miles	-	9,922	249	13,857	14,100	141
	Class 2	Lane Miles	-	7,444	161			
	Class 3	Lane Miles	-	853	40			
Bridge and Tunnel Health		Square Feet	5,716	9,598,859	3,965,520	127,887,168	70,014,379	6,674,211
Drainage Restoration		Linear Feet	68,655	254,380	689,103	-	1,579,250	281,950
Transportation Management Systems		Each	3,274	-	10,514	800,000	-	-
Supplementary Assets								
Drainage Pump Plants		Locations	-	3	143			
Lighting Rehabilitation		Each	227	8	8,606			
Office Buildings		Square Feet	180,529	450,000	-			
Overhead Sign Structure Rehabilitation		Each	48	79	690			

Proposed SHOPP and Maintenance Performance Accomplishments							
Objectives	Unit	SHOPP			Maintenance		
		New	Fair	Poor	Good	Fair	Poor
ADA Pedestrian Infrastructure	Deficient Elements	8,399	-	29,620			
Safety Roadside Rest Area (SRRA) Rehabilitation	Locations	-	-	15			
Transportation Related Facilities	Square Feet	145,788	704	398,224			
Weigh-In-Motion Scales	Stations	10	1	31			
System Resiliency Objectives							
Bridge Scour Mitigation	Square Feet	409,814	-	2,013,374			
Bridge Seismic Restoration	Square Feet	467,272	-	3,614,981			
Major Damage (Emergency Opening)	-	-	-	-			
Major Damage (Permanent Restoration)	-	-	-	-			
Roadway Protective Betterments	Locations	-	-	12			
Sea Level Rise Adaptation	Deficiency Units	-	-	-			
Other Assets and Objectives							
Bridge Goods Movement Upgrades	Square Feet	492,737	345,392	1,080,616			
Commercial Vehicle Enforcement Facilities	Square Feet	6,030	27,120	17,397			
Complete Streets (Fix Existing)	Linear Feet	-	51	491,959			
Complete Streets (Build New)	Linear Feet	-	-	4,987,503			
Fish Passage	Locations	-	-	36			
Operational Improvements	Daily Vehicle Hours of Delay	1,258	-	54,199			
Relinquishments	Center Line Miles	-	-	-			
Roadside Rehabilitation	Acres	-	8	1,759			
Sign Panel Replacement	Each	2,020	135	21,624			
Storm Water Mitigation	Compliance Unit	-	-	12,462			
Transportation Management System Structures	Each	3,274	-	-			
Water and Wastewater Treatment at SRRAs	Locations	-	-	49			

4.6 Aligning Investments with Performance Targets

A balanced investment plan was developed to assure that projected funding over the next ten years is aligned to the work needed to achieve performance targets. The TAMP and SB 1 established 10-year performance targets for the four primary asset classes (Pavement, Bridge, Drainage, and Transportation Management Systems) and several supplementary asset classes (Drainage Pump Plants, Highway Lighting, Office Buildings, Overhead Sign Structures, Roadside Rest Facilities, Transportation Related Facilities, Weigh in Motion Scales). SB 1 requires specific targets to be achieved by 2027.

Current baseline and projected asset conditions in fiscal years 2026/27 and 2030/31 are presented in Table 4-4 for the primary and supplementary assets. Condition is presented in the tables in percentages of good, fair, and poor, at three points in time. For purposes of investment planning over the 10-year period, condition improvements are estimated in the fiscal year in which the projects are advertised for construction, also referred to as the Ready-to-List (RTL) date. This approach differs from the annual performance benchmarks reporting, where the measure used is the condition improvement anticipated at the Expected Construction Work Complete (ECWC) date. This is the date when the traveling public would recognize the improvements resulting from the project.

Table 4-4. Projected Conditions in Fiscal Years 2026/27 and 2030/31 Based on Expected Project Advertisement Date

Projected Conditions in Fiscal Years 2026/27 and 2030/31 Based on Expected Project Advertisement Date													
Objectives		Baseline Condition			RTL FY 2026/27			RTL FY 2030/31			Performance Targets		
		Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Primary Assets													
Pavement	Class 1	66.2%	32.6%	1.2%	63.7%	35.9%	0.4%	62.5%	36.9%	0.6%	60.0%	39.0%	1.0%
	Class 2	46.8%	52.4%	0.9%	60.3%	39.4%	0.3%	63.0%	36.5%	0.5%	55.0%	43.0%	2.0%
	Class 3	44.7%	54.4%	1.0%	60.5%	39.4%	0.1%	52.7%	47.0%	0.3%	45.0%	53.0%	2.0%
Bridge and Tunnel Health		54.1%	42.5%	3.5%	52.7%	44.8%	2.5%	46.0%	51.0%	2.9%	48.5%	50.0%*	1.5%
Drainage Restoration		74.0%	16.7%	9.3%	73.7%	18.2%	8.0%	72.0%	20.0%	8.0%	70.0%	20.0%*	10.0%
Transportation Management Systems		71.1%	0.0%	28.9%	90.0%	0.0%	10.0%	90.0%	0.0%	10.0%	90.0%	0.0%	10.0%
Supplementary Assets													
Drainage Pump Plants		15.3%	34.4%	50.3%	51.2%	30.5%	18.4%	62.2%	28.6%	9.3%	80.0%	20.0%	0.0%
Lighting Rehabilitation		53.3%		46.7%	51.7%		48.3%	46.9%		53.1%	100.0%		0.0%
Office Buildings		43.6%	28.9%	27.6%	28.3%	43.9%	27.7%	47.1%	26.2%	26.7%	60.0%	40.0%	0.0%
Overhead Sign Structures Rehabilitation		92.9%		7.1%	87.4%		12.6%	82.9%		17.1%	100.0%		0.0%
Safety Roadside Rest Area (SRRA) Rehabilitation		36.0%	36.0%	27.9%	36.3%	27.0%	36.7%	32.6%	20.9%	46.5%	80.0%	20.0%	0.0%
Transportation Related Facilities		22.8%	17.6%	59.6%	25.8%	18.5%	55.7%	23.1%	19.5%	57.4%	60.0%	40.0%	0.0%
Weigh-In-Motion Scales		44.3%	17.9%	37.9%	39.7%	34.0%	26.3%	28.0%	46.0%	26.0%	90.0%	10.0%	0.0%

*Note: The 50% fair target for Bridge and Tunnel Health objective and the 20% fair target for Drainage Restoration objective are pending approval by the California Transportation Commission. Poor targets remain unchanged from the TAMP.

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5 Programs & Performance Objectives

The California Transportation Commission (Commission) adopted four primary asset classes in accordance with California Government Code (CGC)[18]. The four asset classes – pavements, bridges, culverts, and TMS – were selected because they represent a significant portion of California's annual transportation investments. Assets are also selected in part because of federal legislation which prioritizes safety, pavements, bridges, and those assets related to system performance. In total, the 2021 SHSMP identifies 34 Program Objectives, including those which continue from the 2019 SHSMP.

This Chapter presents the 34 Performance Objectives in the same order as shown in Table 2-1. It recognizes that many of these objectives cross over multiple program areas and goals. They are discussed in relation to the performance models used to analyze needs and set performance targets. Three different performance models were used in the analysis: Physical Asset, Deficiency, and Reservation. The key parameters for both Physical Assets and Deficiency Performance Models are shown below. Additional details for each Program Objective can be found in Appendix B, Performance Management Summary Sheets.

- Overview
- Performance Metrics
- Inventory and Condition/Inventory of Deficiencies
- Performance Targets
- Other Performance Management Parameters
- Typical Treatments

[18] California Government Code Section 14526.5, http://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=14526.5.&lawCode=GOV

5.1 Safety First

Goal: Safety First

Safety activities are carried out to reduce fatalities and injuries and to minimize the number and severity of accidents. Engineered safety activities improve the safety of the transportation system for all modes of transportation. Caltrans' ongoing commitment to transportation safety requires continual SHS monitoring for changing conditions or use patterns that would necessitate engineered safety solutions. As these situations are identified, improvements are carried out through both the SHOPP and the Maintenance Programs as appropriate for the specific circumstances.

Caltrans' strategic goal of "Safety First" focuses on several key initiatives:

- Leverage proven practices
- Accelerate advanced technology
- Lead safety culture change
- Partner on traffic safety legislation and enforcement
- Increase collaboration with external organizations to identify and implement best practices, technology, and lessons learned
- Advance delivery of safety enhancements in, and that are responsive to, the priorities of underserved communities

Safety is a top priority and integrated across all program objectives. Safety work activities may include:

- Installation of center dividing barriers, guardrails, and rumble strips
- Upgrading bridge rails to meet current standards
- Protection for bicyclists and pedestrians through protected bicycle lanes and pedestrian signals
- Worker protection activities
- Installing signals
- Geometric changes to the roadway
- Construction of bicycle and pedestrian facilities such as sidewalks, crosswalks, and bike lanes

Caltrans measures progress towards its safety goal by the reduction in the number of fatal and serious injury collisions, consistent with the federal Safety Performance Management rule. It is estimated the State will reduce fatalities by three percent and serious injuries by one and a half percent annually over the next 10 years.

The SHSMP addresses the safety goal through two objectives, Proactive Safety and Reactive Safety, focusing on reducing the number of fatal and serious injury collisions. Two separate objectives were necessary for 10-year strategic investment planning purposes.

Proactive Safety projects implement countermeasures to reduce the likelihood of future traffic collisions. These projects can be a part of a systemic safety effort or alternatively target spot locations where existing highway infrastructure could be enhanced and made safer for travelers. Applying improvements systemically across an entire corridor or network allows Caltrans to proactively address locations that have not had crash concentrations in the past, but have similar features as those currently experiencing high levels of crashes. In addition, even though a spot location improvement may be based on historical crash information, making improvements based on countermeasures with proven crash reduction factors at their highest crash locations can proactively reduce the likelihood of future crashes.

Performance targets and associated funding allocations for the Proactive Safety objective are determined for each of the districts in proportion to each district's share of locations where crash history or potential is higher and safety improvements are possible. This investment approach considers historic traffic and accident data in addition to physical roadway attributes.

Reactive Safety funding is held in a statewide SHOPP funding reservation and used to initiate safety projects as needs arise. The primary intent of the reservation is to address urgent traffic safety issues on the system through the implementation of systemic low-cost countermeasures. These needs are typically associated with recent crashes or specific crash concentrations triggering safety investigations. The allocation of reactive safety funding amongst the districts is managed to address these safety needs while also insuring regional equity across the investments.

Caltrans adopts a safety investment approach, where 40% of the overall safety goal investment is towards Proactive Safety and 60% is towards Reactive Safety.

Table 5-1 summarizes the key details of the two safety objectives.

Table 5-1. Proactive and reactive safety strategies

"Safety First" Objectives		
	Proactive Safety	Reactive Safety
Performance Measure	Reduction in fatal and serious injury collisions	Reduction in fatal and serious injury collisions
Performance Management Model	Deficiency Model	Reservation Model
SHOPP Investment Split	40%	60%
Focus	Systemic Safety Improvements: Address locations that have not had crash concentrations in the past, but have similar features as those currently experiencing high levels of crashes	Triggered Safety Improvements at Locations: Address locations with recent crashes or specific crash concentrations triggering safety investigations

Both Proactive and Reactive Safety projects are evaluated by the extent to which fatal and serious injury collisions are reduced. The effectiveness of safety-related infrastructure improvements implemented in projects, referred to as countermeasures, are assessed through analyses using Crash Modification Factors (CMF), Crash Reduction Factors (CRF), and other information specific to each countermeasure type.

Proactive Safety

Safety First

Overview

Caltrans develops proactive safety projects in the SHOPP under the State Highway Safety Improvement Program (HSIP), a core Federal-aid program with the purpose to achieve a significant reduction in traffic fatalities and serious injuries on all public roads. These improvement types are proactive, often part of larger systemic improvement effort, with a goal of reducing the potential and the severity of traffic collisions. These projects differ from reactive safety projects where collision history is a required criterion. These projects must be consistent with California's Strategic Highway Safety Plan (SHSP). Projects are implemented to create a "forgiving quality" for the roadsides. The idea of creating safer roadsides for highways and the design for safety concepts have been incorporated in the Caltrans HDM.

A key program goal is to keep the vehicles on the road. However, should a vehicle leave the road, it is desirable to provide an area clear of fixed objects adjacent to the roadway to for a recovery zone. Where practical Caltrans removes, relocates, makes breakaway, shields or delineates fixed objects along the roadside. These projects may also include systemic proactive pedestrian and wrong-way driving improvement monitoring programs which identify and address pedestrian and wrong-way driving-related locations based on a data-driven safety analysis.

Caltrans' influence on reducing fatalities and serious injuries is focused on improving infrastructure. Approximately 34 percent of crashes can be attributed to infrastructure. The other two causes of road collisions are attributed to vehicle problems or driver error. Between 2016 to 2019 there were 1,292 average fatal collisions and 4,512 average serious injury collisions reported on the SHS.

Typical countermeasures in SHOPP projects include improving highway geometry, enhancing roadway surface friction, applying roadway shoulder treatment, installing or upgrading guardrail and crash cushions, installing rumble strips, providing enhanced shoulder or in-lane delineation and markings for sharp curves, rock fall mitigation, improving pedestrian safety at intersections, and signing and striping enhancement to prevent wrong way collisions. SHOPP projects may also include other countermeasures, such as:

- Adding, upgrading, modifying, or removing traffic signals
- Installing cable or other types of median barriers
- Clear zone improvements
- Horizontal curve signs
- Installing or improving lighting
- Installing or improving pavement markings or delineation
- Installing or improving signing
- Pavement and shoulder widening
- Safety Edge
- Rehabilitating traffic control devices
- Wrong way driving treatments
- Leading Pedestrian Signal (LPI)
- Bicycle lane, glare screen
- Installing pedestrian signals and pedestrian overcrossing
- Installing truck escape ramps
- Left turn channelization
- End treatment

Improving Safety for Workers on the Roadside

Caltrans strives to reduce roadside worker fatalities to zero and reduce employee injury rates by minimizing the frequency and duration of highway worker exposure to traffic. Roadside safety improvements are an effective means to improve worker safety and reduce fatality and injury rates as determined by site specific factors. These improvements provide comprehensive solutions for worker safety issues by reducing or eliminating recurrent maintenance activities which reduces the frequency and duration of worker exposure to traffic. Improving highway worker safety also improves safety for travelers on the SHS by eliminating collision hazards. Collectively, the goals of reducing worker exposure are summarized here, referred to as "SAFER":

- Site - Improve safety by locating features in safe locations.
- Accessible - Provide safe worker access to the roadside and highway features.
- Facilitate - Accommodate mechanized maintenance activities and understand equipment constraints.
- Eliminate - Implement design decisions that eliminate the maintenance activity and the need for workers on foot adjacent to the travel way.

- Relocate - Minimize the need for recurrent damage repair by relocating equipment and irrigation systems out of the clear recovery zone and away from traffic.

Over 25,000 locations have been identified statewide as candidates for worker safety improvements. These improvements are achieved through the SHOPP as well as in Major Maintenance projects where roadside safety concepts are always considered for inclusion.

Treatment strategies may include access gates in right of way fence, light duty maintenance vehicle trails, shoulder widening/turnouts, maintenance vehicle pullouts and barriers improvements. Other strategies that reduce, or eliminate, maintenance worker exposure, include paving beyond the gore, vegetation control to minimize herbicide use and erosion, vegetation control beneath guardrail, preserving sign visibility, maintaining sight distance requirements, and minimizing unauthorized access to the highway right of way. Additionally, these projects may also include miscellaneous types of work to improve worker safety by reducing opportunities for the graffiti of facilities and equipment.

Improving and Replacing Bridge Rail

Bridge rails serve an important safety function, both on the bridge and at the approaches, redirecting errant vehicles and protecting the traveling public. Bridge rails are assessed based on federal crash standards for crashworthiness for posted roadway speeds. Bridge rails that do not meet the standards are improved or replaced.

There are 13,189 bridges on the SHS with over 8.7 million linear feet of bridge rail. Bridge rail inventory data is recorded and/or updated during biennial routine bridge inspections. All bridges on the SHS are included in the inventory with the exception of the Bay Area Toll Authority and Golden Gate Transportation District bridges and bridges built and maintained under Public Private Partnerships.

The SHOPP funds projects that primarily address replacement or upgrade of bridge rails by treatments that meet current roadside safety hardware device standards, as described in the American Association of State Highway and Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH). Other types of bridge rail upgrade projects could require bridge widening to meet current shoulder width standards, as described in the Caltrans Highway Design Manual (HDM)[19].

[19] Caltrans, Highway Design Manual, 7th Edition July 2, 2020, https://dot.ca.gov/-/media/dot-media/programs/design/documents/hdm-complete-final-070120-a11y.pdf

In some cases, widening a bridge deck to meet current shoulder standards or widening the existing sidewalk to meet current ADA standards or Complete Streets criteria may also require additional superstructure and substructure modifications which are much costlier to build. There are some scenarios in which existing rail is included in bridge structural wall elements (e.g., masonry arch culverts), and upgrading the railing requires a full bridge replacement project.

Performance Metrics

The condition designations for the Proactive Safety objective are based on a deficiency model. A deficiency that still exists is designated as poor, while deficiencies that have been addressed through safety countermeasures are designated as good. The fair designation does not apply in the deficiency model. Table 5-2 describes the performance metrics for determining good, fair, and poor.

Table 5-2. Proactive Safety Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Deficiency has been addressed through an applied safety countermeasure**
Fair	**N/A**
Poor	**Deficient**

Inventory of Deficiencies

Between 2015 to 2019 there were 1,273 average fatal collisions and 4,134 average serious injury collisions reported on the SHS. The baseline number of fatal and serious injury collisions as of 2019 is presented in Table 5-3.

Table 5-3. Proactive Safety Baseline Inventory

Inventory of Deficiencies					
Objective (unit of measure)	Inventory	Good	Fair	Poor	
Proactive Safety (Annual Fatal and Serious Injury Collisions)	**5,406**	**N/A**	**N/A**	**100.0%**	

Performance Targets

The Proactive Safety objective performance target is to reduce annual fatal collisions by 1 percent and serious injury collisions by 0.5 percent through infrastructure improvements. This represents a third of the overall safety goal of reducing annual fatal collisions by 3 percent and serious injury collisions by 1.5 percent. By 2031 the combined reduction in fatal and serious injury collisions would need to be 401 collisions per year. This target equates to reducing the total number of annual fatal and serious injury collisions by 7.4 percent over 10 years. Table 5-4 presents the statewide asset performance targets.

Table 5-4. Proactive Safety Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Proactive Safety (Annual Fatal and Serious Injury Collisions)	**7.4%**	**N/A**	**92.6%**	

Other Performance Management Parameters

Several other parameters are required in performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP and potentially maintenance and other contributions.

Unit costs for Proactive Safety are based on an analysis of historical cost data composed of the capital construction and support costs. Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction includes work associated with the construction of safety improvement elements, traffic handling, mobilization, supplemental work, and contingencies.

Reactive Safety

Safety First

Overview

Reactive safety has been an important component of the SHOPP as a responsive strategy of reducing the number of fatal and serious injury collisions. This objective is set up under a reservation model, where funding is set aside over the ten-year plan period and allocated to districts as needed in response to urgent safety needs.

Safety Improvement (triggered safety) projects within the Highway Safety Improvement Program (HSIP) are Caltrans' highest priority, and all efforts are made to expedite programming and delivery. When a safety improvement project is recommended, the project is evaluated for SHOPP eligibility based on collision history and the degree to which the improvement reduces the number and/or severity of collisions.

HSIP eligible projects must address a Strategic Highway Safety Plan (SHSP)[20] priority, be identified through a data-driven process, and contribute to a reduction in fatalities and serious injuries.

Two different methodologies are used to qualify locations for Safety Improvements in the SHOPP: 1) Traffic Safety Index and 2) Monitoring Programs. Triggered safety improvements must meet Federal HSIP eligibility criteria. In addition, under the HSIP, annual targets are required to track safety progress. For further information regarding methodologies or eligibility requirements, refer to the Caltrans HSIP website.[21]

[20] Caltrans, 2020–2024 California Strategic Highway Safety Plan (SHSP), https://dot.ca.gov/programs/safety-programs/shsp
[21] Caltrans, HSIP website; https://dot.ca.gov/programs/local-assistance/fed-and-state-programs/highway-safety-improvement-program

Typical Treatments

Field Maintenance Crews work daily to preserve the safety of our roadways. Typical treatments to improve safety through maintenance include repainting or adding wrong-way pavement arrows, reorienting, relocating, or adding wrong-way sign packages, modifying trailblazing freeway entrance packages, placing edge lines and pavement markers, and upgrading signs with high intensity reflective sheeting.

The SHOPP funds safety projects that include treatments such as new and modification of traffic signals, roundabouts and wet improvement treatments such as high friction surface and open-graded asphalt concrete surface treatments. Other treatment strategies may also include improving highway geometry, applying roadway shoulder treatments, installing/upgrading guardrail and crash cushions, bicycle and pedestrian safety improvements, and installing rumble strips. SHOPP also funds projects providing enhanced shoulder or in-lane delineation and markings for sharp curves, and projects that address multi-lane cross-median, cross-centerline, wrong-way and roadway departure collisions.

5.2 Stewardship & Efficiency

Goal: Strengthen Stewardship and Drive Efficiency

Stewardship activities are carried out primarily to minimize long-term costs of ownership of physical assets. These activities generally maintain or improve the asset's condition which often improves system reliability and safety at the same time. Stewardship needs continue to increase as the transportation system demand grows and the infrastructure ages. Failure to perform timely stewardship investments in the transportation system increases long-term costs of ownership, reduces the system reliability and safety, and will ultimately take even greater investments to restore the condition in the future.

Caltrans' stewardship strategic goal focuses on several key initiatives:

- Standardize and modernize our equipment, facilities, technology, and supporting work practices.
- Enhance asset management and decision support tools.
- Develop and implement a methodology to allocate resources to support strategic priorities.
- Promote and implement innovative and creative solutions.
- Enhance diversity, equity, and inclusion for contracting and procurement.

Stewardship activities may include:

- Rehabilitation or replacement of pavements, bridges, culverts, buildings, etc.
- Maintaining pavement, bridges, and culverts
- Applying protective coatings, protection systems, or overlays
- Maintenance and rehabilitation of pedestrian and bicycle facilities
- Maintenance and rehabilitation of Roadside Rest Area facilities
- Performing maintenance on state-owned office buildings, maintenance stations, equipment shops, transportation management centers, and labs
- Maintaining and replacing signs and lighting
- Emergency restoration of damaged infrastructure

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Bridge and Tunnel Health

Primary Asset

Overview

Bridges and tunnels are critical components of California's infrastructure and provide safe and efficient movement of people, goods, and services. They provide road network connectivity, allow pedestrian access, span water bodies and other natural features, pass through mountains, and span rail lines and other highways or local facilities.

New bridges are designed with an expected design life of 75 years, and in practice, many bridges remain in service for much longer. However, bridges and tunnels require periodic maintenance to rehabilitate or replace individual components (such as bridge decks) subject to deterioration resulting in a shorter life than the bridge itself. The most cost-efficient way to maintain a bridge or tunnel's structural integrity is through timely preservation work prior to the occurrence of significant deterioration. 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 delays and/or detours for the traveling public. Thus, maintaining bridges in good condition pays off–resulting in the lowest long-term costs both to transportation agencies and road users. Bridges and tunnels in good condition allow access to essential services and have a positive impact on the economy.

The focus of the Bridge and Tunnel Health objective is to identify and address structural needs of SHS bridges and tunnels to maintain their structural integrity. With the implementation of MAP-21 requirements, the bridge health performance measure for bridge health is based on the total deck area, and for tunnel health is based on the total structure's liner area, both rated in good, fair, or poor condition.

Caltrans reports bridge and tunnel asset condition data annually to FHWA as part of the National Bridge Inventory (NBI), an FHWA database that includes data on all bridges and culverts longer than 20 feet on the nation's public roads, and as part of the National Tunnel Inventory (NTI) for all tunnel assets. Bridges with a span shorter than 20 feet are not included in NBI submittals. Caltrans' SHSMP bridge and tunnel inventory also includes railroad and pedestrian bridges and is therefore larger than the NBI inventory which does not include these additional bridges.

Performance Metrics

Caltrans and local agencies follow FHWA NBI and NTI standards for inspecting all California bridges and tunnels. Inventory condition data is based on the most recent Bridge Inspection Reports (bridge and tunnel inspections are typically scheduled every two years) that document condition states of each individual structural element per these federal guidelines. The condition state of appropriate individual elements is then mathematically converted to a condition state (good, fair or poor) of three categories for bridges (deck, superstructure and substructure) and a single condition state for either tunnels or culverts. Good, fair, and poor NBI ratings for bridge condition are shown in Figure 5-1. A calculated value of 7 or greater is classified as being in good condition; 5 or 6 is classified as being in fair condition; and 4 or less is classified as being in poor condition. A bridge in poor condition is considered structurally deficient (SD) by federal guidelines. Thus, if any major component is classified as being in poor condition, the bridge will be considered SD. Being classified as SD does not imply a bridge is unsafe, just that deficiencies have been identified that require maintenance, rehabilitation, or replacement. A graphical depiction of the three bridge components is shown in Figure 5-2.

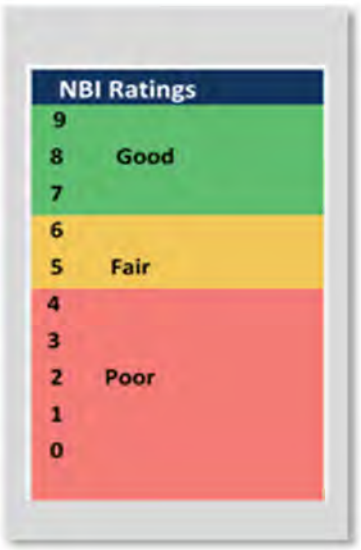

Figure 5-1. NBI Ratings for Bridge Condition

As a bridge is assigned a condition state for the deck, superstructure, and substructure individually, the lowest of the three ratings determines the overall rating of the bridge. Caltrans maintains all data in the Structures Maintenance and Investigations (SM&I) bridge management system databases. Table 5-5 and Table 5-6 describe the performance metrics that define the criteria for determining condition for good, fair, and poor Bridge and Tunnel Health.

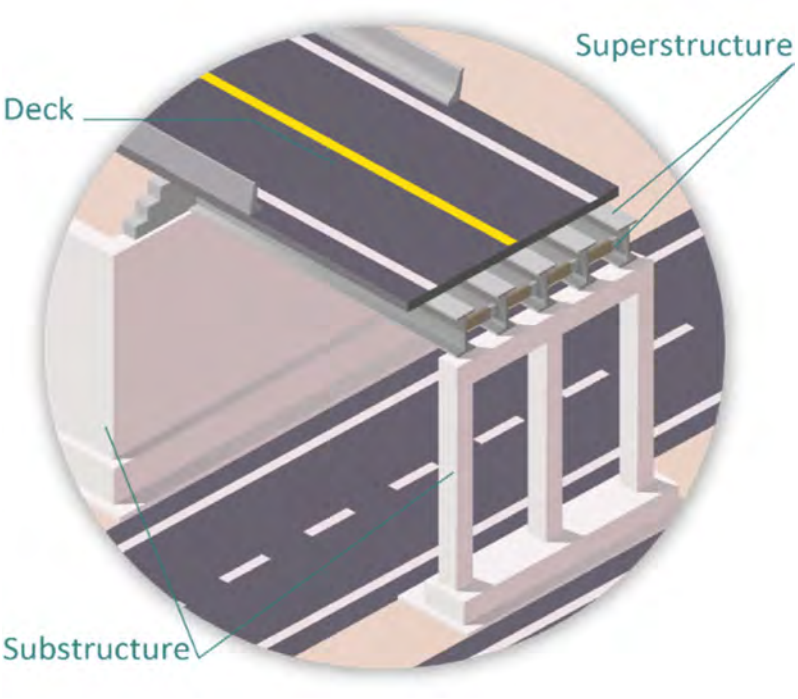

Figure 5-2. NBI Ratings for Bridge Condition and Bridge Components

Table 5-5. Bridge Health Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	Deck, superstructure, and substructure ratings are all Good, or the culvert rating is Good
Fair	The lowest of the three ratings for deck, superstructure, and substructure is Fair, or the culvert rating is Fair
Poor	The lowest of the three ratings for deck, superstructure, and substructure is Poor, or the culvert rating is Poor

Table 5-6. Tunnel Health Performance Metrics

Performance Metrics	
Condition	**Metrics**
Good	Less than 20% of the elements are classified as deteriorated
Fair	More than 20% of the elements are classified with minor deterioration
Poor	More than 20% of the elements are classified with significant deterioration

Inventory and Conditions

Caltrans is currently responsible for the maintenance of 13,246 SHS bridges totaling over 251 million square feet of bridge deck area. These bridges are an average of 48 years old which typically results in increasing maintenance needs. Caltrans also maintains 57 tunnels totaling approximately 5 million square feet of liner area. The tunnel liner area is calculated using the surface area of the liner supporting the mountain or roadway above the driving surface.

All SHS bridges and tunnels are included in the inventory, with the exception of Bay Area Toll Authority and Golden Gate Transportation District bridges, and bridges built and maintained under Public Private Partnerships.

In addition to condition classification, maintenance needs are also identified and documented during regular, routine bridge and tunnel inspections, and when applicable, during specialty investigations which include hydraulic, underwater, and fracture critical inspections. These Bridge Inspection Reports document the needs as work recommendations in addition to coding changes to the individual structural elements. The inventory and conditions of Bridge and Tunnel Health, as of June 2020, are presented in Table 5-7.

Table 5-7. Bridge and Tunnel Health Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	Inventory	Good	Fair	Poor	
Bridge and Tunnel Health (square feet)	**251,703,052**	**54.1%**	**42.4%**	**3.5%**	

Performance Targets

Table 5-8 presents the asset performance targets for Bridge and Tunnel Health, including a revision to the fair target to 50% (pending approval by the California Transportation Commission). The poor target remains unchanged, as established in the TAMP.

Table 5-8. Bridge and Tunnel Health Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Bridge and Tunnel Health (square feet)	**48.5%**	**50.0%***	**1.5%**	

*Note: Pending approval by the California Transportation Commission

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

On an annual basis, a percentage of bridge assets in good condition deteriorates to fair condition, while a percentage of assets in fair condition deteriorates to poor. The deterioration rates for bridges are based on the life cycle of the asset.

Unit costs for bridge health are based on an analysis of historical cost data composed of the capital construction and support costs. Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction cost includes the structure costs and an applied factor to account for associated roadway items, traffic handling, mobilization, supplemental work, and contingencies. It is assumed that all fair assets require preservation or rehabilitation, addressed through a combination of HM Program and SHOPP projects. Those addressed under the HM program are typically preservation activities, while those addressed under the SHOPP typically require more significant rehabilitation. In addition, it is assumed 75 percent of the poor assets would require rehabilitation while the remaining 25 percent would require replacement of the existing structure.

Typical Treatments

Bridge maintenance treatments include repairs that require immediate attention and other minor maintenance, including joint repairs, spalls, and paint needs, as well as deck overlays and repairs. When minor defects are not addressed quickly and efficiently, the resulting damage often requires major structural rehabilitation or replacement which not only costs more than preventive maintenance, but can cause significant long-term disruptions to the traveling public. As the bridge inventory increases and continues to age, preventive maintenance strategies are imperative to maintain or improve the structural condition of the inventory and slow the growth of major rehabilitation needs.

The first stage of preventive maintenance is the work performed by bridge Maintenance Field Crews to address minor maintenance repairs that require immediate attention. Bridge preventive maintenance needs beyond the scope of bridge Maintenance Field Crews are combined into maintenance projects completed by contractors. Bridges that have damage or deterioration that can be addressed through preventive maintenance activities, which include bridges in good condition and a portion of the bridges in fair condition, are funded through the Major Maintenance projects or through the SHOPP.

Bridges that have deteriorated structurally or have been damaged by other causes, which include bridges in poor condition and a portion of the bridges in fair condition, are addressed with SHOPP-funded major rehabilitation or replacement activities. When bridges require major rehabilitation or replacement, it is sometimes appropriate to make additional geometric or structural improvements. Such improvements are permissible, however, the primary purpose for the work and treatment strategies shall be to address the condition of the bridge's structural elements.

Since the implementation of the 2017 SHSMP, the federally mandated Tunnel Inspection Program has been fully implemented and the complete tunnel inventory has been identified and inspected for condition assessments. Based on the current tunnel inventory conditions, it is assumed that tunnel health maintenance needs will typically be preventive maintenance strategies to address minor deterioration.

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Bridge Goods Movement Upgrades

Other Assets and Objectives

Overview

The Bridge Goods Movement Upgrades objective is to identify and address geometric restrictions to permit vehicle traffic on the SHS. Bridge Goods Movement Upgrades address restrictions from reduced vertical clearance as established in the Caltrans HDM, and load capacity restrictions as identified by federal guidelines. The emphasis of this objective is to address poor condition bridges impacting Interstate mainline traffic.

Performance Metrics

The condition designations for Bridge Goods Movement Upgrades are determined through assessments of a bridge's two possible restrictions to goods movement: vertical clearance (VC) and permit vehicle rating based on load capacity. Each bridge is analyzed for these individual criteria.

The rating of good, fair, and poor for vertical clearance is determined based on conformance with HDM standards for the functional classifications of the roadway beneath the structure. The rating of good, fair, and poor for permit vehicle rating is a function of load capacity restrictions on the structure as identified in federal guidelines. Once classified for the two individual aspects (VC and permit vehicle rating), the overall rating for the bridge is assigned by the lower of the two individual ratings. Table 5-9 describes the performance metrics for determining condition for good, fair, and poor Bridge Goods Movement Upgrades.

Table 5-9. Bridge Goods Movement Upgrades Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Both VC and permit condition ratings are Good**
Fair	**The lowest of the VC or Permit rating is Fair**
Poor	**The lowest of the VC or Permit rating is Poor**

Inventory and Conditions

The Bridge Goods Movement Upgrade inventory data are based on both VC and permit vehicle capacity restrictions. Vertical clearance restrictions are documented and/or updated during biennial routine bridge inspections. The minimum VC and the classification of the roadway beneath the structure are entered in SM&I's bridge management system using the SMART database. In addition, all bridges are periodically analyzed for permit vehicle load capacity per federal guidelines through a load rating summary of the structure, performed by SM&I's Load Rating Unit. All bridges on the SHS are included in the inventory with the exception of Bay Area Toll Authority and Golden Gate Transportation District bridges and bridges built and maintained under Public Private Partnerships. The inventory and conditions for Bridge Goods Movement Upgrades, as of March 2020, are presented in Table 5-10.

Table 5-10. Bridge Goods Movement Upgrades Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	**Inventory**	**Good**	**Fair**	**Poor**	
Bridge Goods Movement Upgrades (square feet)	**246,802,941**	**79.2%**	**7.9%**	**12.9%**	

Performance Targets

Table 5-11 presents the statewide asset performance targets for Bridge Goods Movement Upgrades.

Table 5-11. Bridge Goods Movement Upgrades Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Bridge Goods Movement Upgrades (square feet)	**75.0%**	**15.0%**	**10.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

Bridge Goods Movement Upgrades conditions do not follow a deterioration model. New needs are identified based on changes in legislation regarding allowable permit vehicles or changes in design standards for VC. For example, if California bridges are required to accommodate heavier truck loads to comply with rules imposed by the federal government, the needs under this objective would increase. Currently, heavier trucks are allowed only through the issuance of a permit. Should these trucks become legal loads and be allowed to travel without restriction on the SHS, the load carrying capacity of California bridges will be decreased and bridge needs to strengthen or replace bridges will be greatly increased.

Unit costs for the Bridge Goods Movement Upgrades are based on an analysis of historical data composed of the capital construction and support costs. Support costs are associated with engineering and/or oversight work to design and construct the project. The Capital construction cost includes the structure costs and an applied factor to account for associated roadway items, traffic handling, mobilization, supplemental work and contingencies. It is assumed that all fair deficiencies would require rehabilitation, and half of the poor deficiencies would require rehabilitation, while the other half would require replacement of the existing structure.

Typical Treatments

The SHOPP funds projects and treatments that either improve VC or improve the load capacity of the bridge. Fair condition bridge restrictions for VC indicate that the elevation of the existing structure is typically within six inches of the vertical clearance standards in the HDM and may restrict larger vehicles traveling under the structure. Fair condition bridge restrictions for load capacity indicates that five and seven axle vehicles have no restrictions when traveling over the structure while larger vehicles are impacted.

Poor condition bridge restrictions for VC indicate that the elevation of the existing structure is typically posted with identified reduced VC signage. Poor condition bridge restrictions for load capacity indicates

that all permit vehicles have some level of restriction when traveling over the structure. Typical treatments and the work to address these restrictions require either rehabilitation or replacement of the structures. Rehabilitation for VC restrictions typically requires a lowering of the roadway beneath the structure or a raising of the deck and superstructure of the bridge above the roadway. Rehabilitation for load capacity restrictions typically requires a strengthening of deck and superstructure to handle the increased loading.

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Bridge Scour Mitigation

System Resiliency Objective

Overview

The Bridge Scour Mitigation objective is to prevent catastrophic failure from natural disasters, such as floods and storm events. Bridge Scour Mitigation addresses bridges over water where bridge foundations have been determined to be unstable for potential assessed or calculated scour conditions (scour critical) per federal guidelines.

Only bridges with foundations within a waterway are reviewed for scour vulnerability. Those bridges that are calculated or assessed to be scour critical under the FHWA Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges manual are addressed under this objective.

Performance Metrics

Bridges are assessed for scour with the following criteria: an NBI rating of 7, 8, or 9 is classified as good where foundations are determined to be stable for assessed or calculated scour conditions or scour countermeasures have been installed; a rating of 4, 5, or T is classified as fair where foundations are determined to be stable for calculated scour conditions; a rating of 6 or U is classified as fair until the bridge is evaluated for scour or for a bridge with unknown foundation, respectively, and a rating of 0, 1, 2, or 3 is classified as poor where foundations are determined to be unstable for calculated scour conditions (i.e. bridge is scour critical). As only poor bridges are considered vulnerable (unstable) for scour, the scour vulnerability conditions are shown in a deficiency model. Table 5-12 describes the performance metrics for determining condition for good, fair, and poor bridge scour mitigation.

Table 5-12. Bridge Scour Mitigation Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**No scour potential or countermeasures installed (NBI rating of 7, 8, or 9)**
Fair	**Stable for assessed scour (NBI rating of 4, 5, or T)**
Poor	**Unstable for assessed scour, scour critical (NBI rating of 0, 1, 2, or 3)**

Inventory of Deficiencies

The Bridge Scour Mitigation inventory data include the total deck area (square footage) of bridges that have been assessed to be unstable for scour (scour critical or poor). Caltrans performs scour analyses for all bridges that cross over waterways. These analyses are completed to evaluate whether a bridge is unstable for potential assessed or calculated scour conditions (scour critical) per federal guidelines. A scour critical bridge is one with abutment or pier foundations which are rated as unstable due to (1) observed scour at the bridge site or (2) a scour potential as determined from a scour evaluation study. When bridges are assessed for scour, the findings are documented with a Specialty Investigation Bridge Inspection Report. Any recommended work to protect for scour is documented within the report. If the bridge is assessed to be unstable for scour, a Scour Plan of Corrective Action is also documented. All bridges on the SHS are included in this inventory with the exception of Bay Area Toll Authority and Golden Gate Transportation District bridges and bridges built and maintained under Public Private Partnerships. Only bridges that have been assessed as scour critical (poor) are included in this inventory. Table 5-13 presents an inventory of the proportion of current deficiencies, as of March 2020.

Table 5-13. Bridge Scour Mitigation Inventory of Deficiencies

Inventory of Deficiencies					
Objective (unit of measure)	**Inventory**	**Good**	**Fair**	**Poor**	
Bridge Scour Mitigation (square feet)	**2,181,193**	**0.0%**	**N/A**	**100.0%**	

Performance Targets

Ideally, the goal of the Bridge Scour Mitigation objective would be to address all identified scour critical (poor) bridges. Due to the dynamic nature of identification of scour critical bridges (major flooding or storm events) and the time required for the project delivery process, it is not realistic to assume that at the end of the 10-year cycle all scour critical bridges would be addressed. The Bridge Scour Mitigation target is to reduce scour critical bridges to 10 percent of the projected 10-year scour critical need. Table 5-14 presents the statewide asset performance targets for Bridge Scour Mitigation.

Table 5-14. Bridge Scour Mitigation Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Bridge Scour Mitigation (square feet)	**90.0%**	**N/A**	**10.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

Projected Needs for bridge scour mitigation are estimated based on historical trends but may increase with major storm events that occur within the next 10 years. Scour typically has no deterioration model, because it is not possible to control either the weather or the migration of streams and channels.

Unit costs for the Bridge Scour Mitigation objective are based on an analysis of historical data composed of the capital construction and support costs. Support costs are those associated with engineering and/or oversight work to design and construct the project. The estimated capital construction cost includes the structure costs and an applied factor to account for associated roadway items, traffic handling, mobilization, supplemental work, and contingencies. It is assumed that half the identified deficiencies would require rehabilitation and the other half would require replacement of the existing structure.

Typical Treatments

The SHOPP funds projects that may include various treatments such as bridge scour improvements from rehabilitation measures (such as rock slope protection of the channel walls and/or floors) to extensive foundation rehabilitations (which may include modifying or adding foundation elements such as piles, pier walls or footings) or could include projects that require full bridge replacement. Many factors play a role in addressing scour vulnerabilities such as the health condition of the structure or possible seismic vulnerabilities of the substructure as they may be subject to liquefaction in a seismic event.

DRAFT for CTC Review

Bridge Seismic Restoration

System Resiliency Objective

Overview

The focus of the Bridge Seismic Restoration objective is to mitigate catastrophic bridge failures from seismic events (earthquakes). Bridge Seismic Restoration addresses bridges assessed to be vulnerable to potential seismic activity through screening processes implemented by Caltrans. Periodic rescreening of state bridges is conducted to assess the structures for seismic vulnerabilities using the most current seismic criteria. The most recent rescreening was completed in 2020.

Performance Metrics

Bridges are assessed for seismic vulnerability based on the screenings performed by the Offices of Earthquake Engineering Analysis and Research (OEEAR) and Geotechnical Services (OGS). If a bridge is assessed to have potential seismic vulnerabilities, the bridge is classified as poor. If there is no potential vulnerability, the bridge is classified as good. The fair designation is not used. As only poor bridges are considered vulnerable for seismic events, seismic vulnerability conditions are shown in a deficiency model. Table 5-15 describes the performance metrics for determining condition for good, fair, and poor bridge seismic restoration.

Table 5-15. Bridge Seismic Restoration Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**No assessed seismic vulnerability**
Fair	**N/A**
Poor	**Potential seismic vulnerability**

Inventory of Deficiencies

The bridge seismic restoration inventory data include the total deck area (square footage) of bridges assessed to be vulnerable to seismic events. These assessments are conducted for ground motion and seismic movement. For bridges with foundations in or near a waterway, the potential for soil liquefaction is also analyzed. Those that are found to have a potential vulnerability for seismic activity combined with potential ground shaking are identified and classified as a potential need. All SHS bridges are included in this inventory with the exception of Bay Area Toll Authority, Golden Gate Transportation District bridges, and bridges built and maintained under Public Private Partnerships. Only bridges that have been assessed with a potential seismic vulnerability (poor) are included in this inventory. OEEAR and OGS are continually rescreening and evaluating bridges for their potential vulnerabilities to seismic events based on the most current seismic criteria. Based on the most recent seismic screening, a new seismic priority list was developed in 2020. In an effort to focus on the highest priority seismic work first, a financially constrained prioritized list was developed resulting in a reduction of the total seismic need identified in the SHSMP. As seismic work is completed, this financially constrained list will be amended to incorporate lower priority identified seismic needs. The deficiency of Bridge Seismic Restoration, as of March 2020, is presented in Table 5-16.

Table 5-16. Bridge Seismic Restoration Inventory of Deficiencies

Inventory of Deficiencies					
Objective (unit of measure)	**Inventory**	**Good**	**Fair**	**Poor**	
Bridge Seismic Restoration (square feet)	**7,908,244**	**0.0%**	**N/A**	**100.0%**	

Performance Targets

Ideally, the goal of the Bridge Seismic Restoration objective is to address all seismically vulnerable (poor) bridges identified in the preliminary screening process. The screening process is a preliminary review of bridges that may be seismically vulnerable based on the element configuration of the structure and the surrounding soil prior to detailed seismic analyses being completed. Because bridges identified in the screening process may be found to not require seismic restoration during detailed seismic analysis, and due to the length of the time required for the project delivery process, it is not realistic to assume that at the end of the 10-year cycle all currently identified seismically vulnerable bridges would be addressed. Therefore, the Bridge Seismic Restoration target is to reduce seismically vulnerable bridges to 30 percent of the projected 10-year seismic need. In an effort to reduce the number of potentially seismically vulnerable bridges that drop out of the project development process once a detailed analysis is performed, and to better estimate retrofit costs, the top 100 bridges on the seismic priority list were evaluated at pre-strategy meetings. These meetings developed the most likely retrofit alternative as well as a more refined cost estimate for use during APS or PIR Cost Estimate development. Table 5-17 presents the statewide asset performance targets for bridge seismic restoration.

Table 5-17. Bridge Seismic Restoration Performance Targets

Desired State of Repair				
Objective (unit of measure)	**Good**	**Fair**	**Poor**	
Bridge Seismic Restoration (square feet)	**70.0%**	**N/A**	**30.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

Unit costs for Bridge Seismic Restoration are based on an analysis of historical cost data composed of the capital construction and support costs. Support costs are those associated with engineering and/or oversight work to design and construct the project. The estimated capital construction cost includes the structure costs and an applied factor to account for associated roadway items, traffic handling, mobilization, supplemental work and contingencies. Historical trends of previously delivered projects, including the previously completed Tier I and Tier II retrofit programs, are used to estimate these costs. It is assumed that 80% of the identified deficiencies would require rehabilitation and the other 20% would require replacement of the existing structure.

Typical Treatments

The SHOPP funds projects that address bridges found to be vulnerable to seismic events. The retrofit treatments can vary from rehabilitation measures, such as catcher blocks or retrofit of the substructure or superstructure of the structure, to full bridge replacement. Many factors play a role in addressing seismic vulnerabilities, such as the health condition of the structure, assessed scour vulnerability, and proximity to substantial fault lines.

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Commercial Vehicle Enforcement Facilities

Other Assets and Objectives

Overview

The Commercial Vehicle Enforcement Facilities (CVEF), commonly called Weigh Stations, are owned by Caltrans and operated by California Highway Patrol (CHP). CHP monitors and inspects trucks using the State Highway System (SHS) to ensure that they are operating safely, licensed properly, and conform to legal size and weight, which ensures that bridge and pavement assets are not damaged prematurely by overweight trucks. The presence of CVEFs helps in preserving state infrastructure, improving truck operations, and enhancing the safety of the traveling public. Caltrans and CHP work cooperatively to ensure that all facilities are in good operational condition for truck enforcement efforts.

Performance Metrics

Table 5-18 describes the performance metrics for determining condition for good, fair, and poor for CVEF.

Table 5-18. Commercial Vehicle Enforcement Facilities Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	• Facility is either new or recently completed with major rehabilitation • Has no known building or pavement issues • Facility is in good operational condition • Meets most functional needs of the CHP
Fair	• Requires minor building modification • Requires minor upgrade in pavement, inspection bay, or technology • Some known building or pavement issues that can be fixed via building maintenance • Still meets most of the functional needs of the CHP
Poor	• Requires major building rehabilitation • Location needs upgrade in classification • Functionally obsolete • Facility needs technology expansion to meet CHP operations

Inventory and Conditions

There are 54 CVEF stations in California ranging from Class A to Class D.

- **Class A –** are located at strategic ports of entry into the State and have independent CHP command identity and normally operate 24 hours per day, 7 days per week. There are five class A CVEF in the State.
- **Class B-** are located along major highway routes and have an independent CHP command identity and may operate 24 hours per day, 7 days per week. There are fifteen Class B CVEF.
- **Class C-** are located at strategic points on major highway routes and may operate 24 hours per day, 5 or 7 days per week, predicated upon variable factors such as the average daily truck traffic and peak commercial traffic hours. There are fifteen Class C CVEF statewide.
- **Class D-** are located at strategic points on major and secondary highway routes and operational hours are based on such factors as: the average daily truck traffic, peak truck traffic hours, and seasonal needs. There are nineteen CVEF of this class.

The condition of CVEFs is based on survey information from CHP commanders at each facility. Additional information is also gathered from recently completed CVEF projects, field inspections by Caltrans Maintenance Staff and District Program Advisors, Google map photo observation, and age of the facility. The inventory and conditions of Commercial Vehicle Enforcement Facilities, as of April 2020, are presented in Table 5-19.

Table 5-19. Commercial Vehicle Enforcement Facilities Inventory and Condition

Inventory and Conditions					
Objective (unit of measure)	Inventory	Good	Fair	Poor	
Commercial Vehicle Enforcement Facilities (square feet)	**309,395**	**35.3 %**	**40.8%**	**23.9%**	

Performance Targets

Table 5-20 presents the statewide asset performance targets for CVEFs.

Table 5-20. Commercial Vehicle Enforcement Facilities Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Commercial Vehicle Enforcement Facilities (square feet)	**60.0%**	**40.0%**	**0.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, and potentially maintenance and other contributions.

The deterioration rate for CVEF is based on the age/life cycle of the building, pavement, landscape, and other inspection equipment at the CVEF station. Specifically, on an annual basis, a percentage of the CVEFs that is in good condition deteriorates to fair condition, and a percentage of the CVEFs in fair condition deteriorates to poor condition. SHOPP projects primarily address CVEF in poor or fair condition and restore the condition of the asset. Maintenance primarily focuses on maintaining CVEF in good condition as well as addressing facilities in fair condition.

Unit cost for CVEF is based on an analysis of historical cost data composed of the capital construction and support costs. Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction cost includes work associated with the construction of commercial vehicle enforcement stations including traffic handling, mobilization, supplemental work, and contingencies.

Typical Treatments

The Inventory of Needs Report specifies the Inter Agency Agreement (IAA) and is the mechanism for joint operations pertaining to maintenance of the CVEFs. The IAA establishes the responsibility for specified repairs and maintenance at these facilities. Items specific to building interiors such as plumbing repair, water quality testing, and minor roof and flooring repair are procured by CHP. IAA maintenance funds can be used to reimburse the CHP for such expenses. Additionally, Caltrans Field Maintenance Crews may be dispatched on an as-needed basis to address general items such as building exteriors or minor site work on the property.

Projects designed to construct new CVEFs, to relocate existing CVEFs for more efficient operations, and to upgrade/rehab existing CVEFs are all treatments funded in the SHOPP. Major rehab includes the upgrade of the CVEF classification, expanding the building structure for administration offices or inspection bays, or upgrading technology to improve truck operations. The CVEF projects as prioritized by the 2019 Inventory of Need have been incorporated into SHOPP projects, and are in various phases of project development.

Additionally, some CVEF improvements and treatments strategies, such as pavement rehab, ADA, landscape and drainage correction, signing and striping, weight scale replacement, and other electrical or electronic elements, are funded and completed through Minor SHOPP projects. Also, some CVEF improvements are included in pavement projects or other multi-objective type projects in the SHOPP.

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Drainage Pump Plants

Supplementary Asset

Overview

Drainage Pump Plants' primary objective is to replace or rehabilitate in-place drainage pump plants and related elements that have lost serviceability because of age, wear, or degradation, and for reduction of long-term maintenance costs. Upgrades or modifications of the drainage pump plants are included; however, the priority is addressing the poor condition pump plants. The criteria used to define the performance target is intended to eliminate from the inventory all known poor condition pump plants to ensure efficient operations of the facility.

Performance Metrics

The condition of drainage pump assets is based on the service life of the asset, which is estimated at 50 years. It is also based on the engineering inspector's assessment of the failure or defects found on the pump plants and the level of mechanical and electrical failures or deficiencies. Each attribute or element of the pump plant is scored, and an overall health score is assigned on a scale of 0 to 100. Table 5-21 describes the performance metrics for determining condition for good, fair, and poor Drainage Pump Plants.

Table 5-21. Drainage Pump Plants Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Overall health score between 80 to 100**
Fair	**Overall health score between 50 to 79**
Poor	**Overall health score between 0 to 49**

Inventory and Conditions

Drainage Pump Plants, which include the facility structure, pumps, electrical, mechanical, plumbing, and appurtenances, are an integral part of the SHS. The inventory and conditions of Drainage Pump Plants, as of May 2020, are presented in Table 5-22.

Table 5-22. Drainage Pump Plants Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	**Inventory**	**Good**	**Fair**	**Poor**	
Drainage Pump Plants (each)	**288**	**15.3%**	**34.4%**	**50.3%**	

Performance Targets

Table 5-23 presents the statewide asset performance targets for Drainage Pump Plants.

Table 5-23. Drainage Pump Plants Performance Targets

Desired State of Repair				
Objective (unit of measure)	**Good**	**Fair**	**Poor**	
Drainage Pump Plants (each)	**80.0%**	**20.0%**	**0.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

The deterioration rates for Drainage Pump Plants are based on the service life of the asset, pump and controller types. Specifically, on an annual basis, a percentage of assets in good condition deteriorate to fair condition, while a percentage of assets in fair condition deteriorate to poor. Failure of pumping equipment and controls may cause roadway flooding which could result in unacceptable consequences and property damage.

Unit costs for Drainage Pump Plants are based on an analysis of historical data comprised of the capital construction and support cost. Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction cost includes work associated with the construction of drainage pump plants, traffic handling, mobilization, supplemental work and contingencies.

Typical Treatments

Field Maintenance Crews address the good or fair pump plants with significant remaining service life. Some typical examples of work treatments done by Field Maintenance Crews are to inspect drainage pump plants and perform minor maintenance work, including cleaning and minor repairing, especially before the seasonal rains begin.

Major Maintenance projects include any work that maintains the SHS pump plants to a safe and useable condition; it does not include reconstruction, major structural deficiencies or other improvements. These projects primarily deal with preventive and corrective maintenance and preservation strategies to maintain the pump plants in good and fair condition. These projects usually do not require additional permanent right of way, change hydraulic capacity, or involve environmental consequences greater than those addressed in a categorical exemption. Some typical treatments in Major Maintenance projects for Drainage Pump Plants include cleaning to remove excessive debris build-up in the drainage pump building and stairwells, and repair of drainage pump electrical and mechanical deficiencies. Typical projects have a two fiscal year cycle for project development, project design, and construction.

SHOPP projects primarily address rehabilitative and replacement remedial work to correct a specific condition, such as restoring drainage pumps from poor to good condition. The priority is on pumps in poor condition. Rehabilitation and replacement of Drainage Pump Plants are typical types of projects. These projects restore the drainage system, repair structural deficiencies in the building housing the drainage pumps, and may involve improving the inlet and outlet flow, storage and collection basins.

DRAFT for CTC Review

Drainage Restoration

Primary Asset

Overview

The primary objective of Drainage Restoration is to provide for the replacement or in-place rehabilitation of culverts and other highway drainage system elements that have lost serviceability because of age, wear, or degradation. Drainage Restoration culverts, inlets, outlets, headwalls, endwalls, junction boxes and other major drainage system elements. The other drainage objective is Drainage Pump Plants. Typical culvert work includes upgrades or modifications of culverts and other highway drainage system elements to increase flow or improve drainage alignment, with the priority of addressing the poor condition culverts. Projects to abandon culverts are also included. The criterion used to define the Drainage Restoration performance target was to minimize all known poor condition culverts from the inventory. The target was set using Commission and Caltrans' program management guidance and engineering judgment.

If a culvert becomes clogged, deteriorates, or fails because of rust or other factors, and no longer conveys water away from the highway, water may then flood the highway or erode highway foundations or adjacent slopes resulting in road washouts and closures. Culverts require periodic maintenance to avoid costly replacement and possible future catastrophic failure. The repairs of catastrophic events are far more expensive than providing adequate funding to maintain and upgrade culverts. Caltrans uses a proactive inspection program to measure the drainage systems' health, prioritize potential culvert projects based on several factors including condition, cost, hydraulic capacity, and traveler delay. The program tracks maintenance work accomplishments and delivery schedules.

Performance Metrics

The health condition assessment of Drainage Restoration assets is based on a visual inspection of five attributes: waterway adequacy, joints, materials, shape, and culvert alignment. Each attribute is scored, and culvert condition is calculated using a weighted average of attribute scores. Table 5-24 describes the performance metrics for determining condition for good, fair, and poor Drainage Restoration.

Table 5-24. Drainage Restoration Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Overall health score between 80 to 100**
Fair	**Overall health score between 50 to 79**
Poor	**Overall health score between 0 to 49**

Inventory and Condition

The SHS includes 212,759 culverts, totaling overestimated 22 million linear feet as of June 2020, that drain rainwater, drainage channels, streams, and rivers away from highways in a controlled manner.

A typical culvert is a 12 to 60-inch diameter (or width) pipe or box culvert. Any culvert with structure length that spans 20 feet or longer is classified as a bridge and recorded on the NBI. A diagram showing typical drainage details is presented in Figure 5-3.

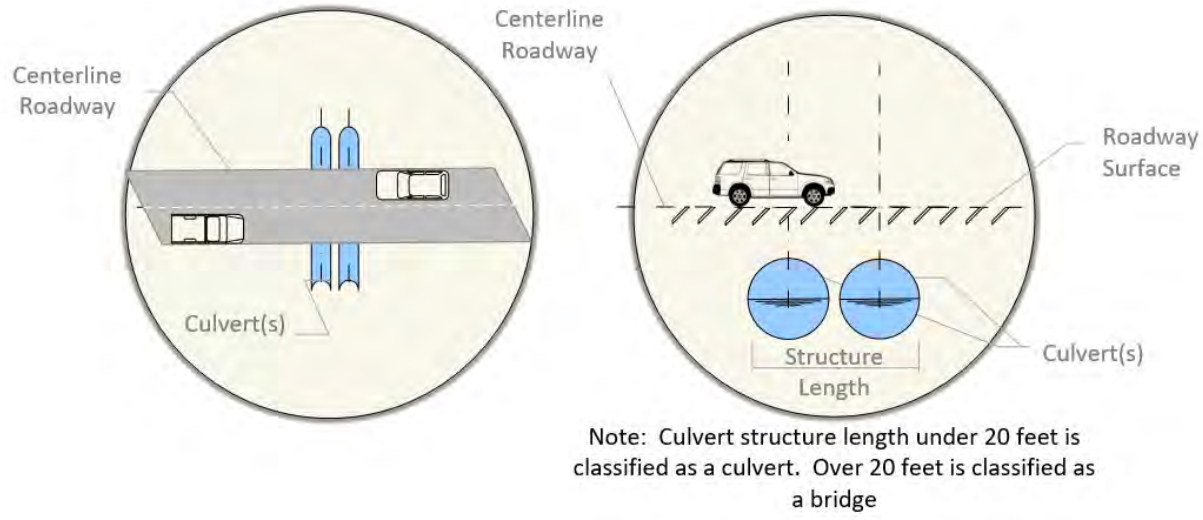


Figure 5-3. Typical Drainage Details

The culvert inventory condition assessment has grown by over 5.7 million linear feet between 2017 and 2020. Efforts are continuing to complete the inventory and condition assessment. In the past fiscal year, over 26,000 culverts (approximately 2.5 million linear feet) were inspected. Inspection production rates are dependent on many factors, including accessibility, right-of-way constraints, environmental permits, multi-year mitigation permits, and traffic considerations. Caltrans has increased the number of inspections for the purpose of condition assessments and anticipates completion by the end of 2023.

The inventory and conditions of Drainage Restoration, as of June 2020, are presented in Table 5-25. Condition percentages are based on the estimated culvert lengths, pending verification. The average culvert length of 98.9 linear feet is assumed for locations where the actual culvert length still needs to be verified.

Table 5-25. Drainage Restoration Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	Inventory	Good	Fair	Poor	
Drainage Restoration (linear feet)	**22,402,404**	**74.0%**	**16.7%**	**9.3%**	

Performance Targets

Table 5-26 presents the statewide asset performance targets for Drainage Restoration, including a revision to the fair target to 20% (pending approval by the California Transportation Commission). The poor target remains unchanged, as established in the TAMP.

Table 5-26. Drainage Restoration Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Drainage Restoration (linear feet)	**70.0%**	**20.0%***	**10.0%**	

*Note: Pending approval by the California Transportation Commission

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

Until the remaining SHS culvert assessments have been completed, historical assessment rates and anticipated deterioration rates create an annual increase of approximately 364,000 linear feet (3,680 culverts) in the fair category and an annual increase of approximately 198,000 linear feet (2,000 culverts) in the poor category. Remaining assessments are scheduled to be completed by the end of 2023.

Deterioration rates for culverts are based on the asset's service life. Specifically, on an annual basis a percentage of assets in good condition deteriorates to fair, while a percentage of assets in fair condition deteriorates to poor.

Unit costs for Drainage Restoration are based on an analysis of historical cost data composed of the capital construction and support costs. Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction cost includes work associated with construction of drainage system elements, traffic handling, mobilization, supplemental work and contingencies.

Typical Treatments

Field Maintenance Crews focus on minor maintenance work which may include treatment strategies of cleaning and minor repairing of culverts. In particular, field maintenance crews are involved in the cleaning of clogged culverts where the only known deficiency of the culvert is waterway adequacy. Thus, cleaning will result in the condition of some of these culverts changing from fair or poor to good, pending a culvert inspection. The work done by Field Maintenance Crews work is also preventive maintenance, addressing good or fair culverts which have significant service life remaining.

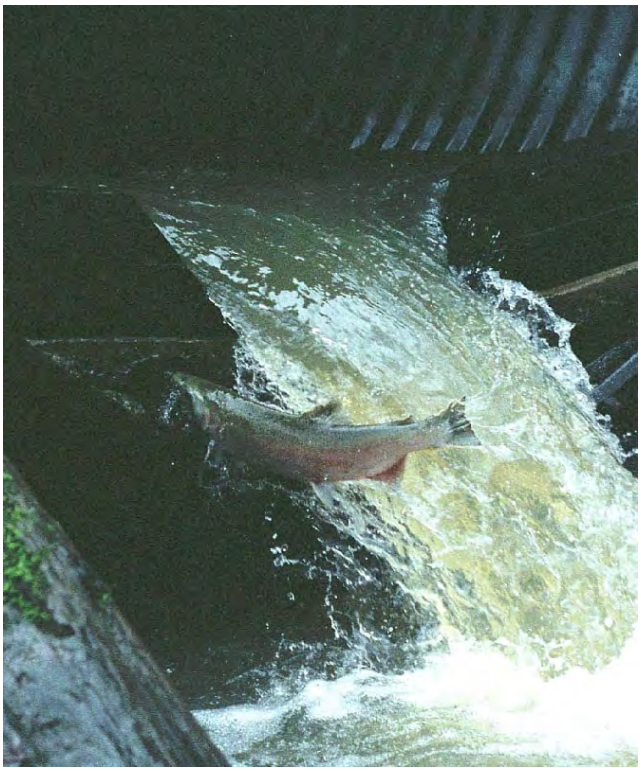
Major Maintenance projects include any work that maintains SHS drainage systems to a safe and useable condition; it does not include reconstruction, major structural deficiencies or other improvements. These projects primarily deal with treatment strategies such as preventive and corrective maintenance and preservation strategies to maintain the drainage system in good and fair condition. HM projects usually do not require additional permanent right of way, change hydraulic capacity or involve environmental consequences greater than those addressed in a categorical exemption. The types of projects and treatments used in Major Maintenance include the repair of culverts, such as repairing damaged end treatments, inverts or connections, ramming, or lining the culverts. They may also include erosion and scour issues, installing debris protection systems, and cleaning to remove excessive debris build-up and improve capacity. Typical projects have a two FY cycle for project development, project design, and construction.

SHOPP projects primarily address rehabilitative and replacement work and restore culverts from fair or poor to good condition. Treatments are similar to Major Maintenance but are typically much larger in scope and may involve right-of-way and have environmental issues. SHOPP projects also involve the addition of new culverts and the extension of existing culverts.

Fish Passage

Other Assets and Objectives

Overview



The goal of Fish Passage Priority barrier remediation on the SHS, is to aid in the recovery of salmon and Steelhead species listed as threatened and endangered by the California Endangered Species Act (CESA).

Streets and Highways Code, Section 156.1 (SB 857, Kuehl, Chapter 589, Statutes of 2005), prohibits the new construction or continued maintenance or upgrades of SHS facilities that prevent or impede the passage of salmon and Steelhead from gaining access to upstream or downstream habitats.

Caltrans maintains and constructs new road/stream crossings on thousands of stream crossings on the SHS. As of August 2020, approximately 556 unresolved barriers to salmon and Steelhead have been identified on the SHS, blocking access to hundreds of miles of salmon and Steelhead habitat in California.

To meet the requirements of Streets and Highways code, Section 156.1, Caltrans prepares an annual report to the Legislature describing the status of progress in assessing, funding, and remediating barriers to fish passage. The bill requires Caltrans to report:

- Completed assessments of potential barriers to anadromous fish prior to commencing any project using state or federal transportation funds;
- Submit assessments to the Passage Assessment Database; and
- Construct all new projects in a way that does not pose or create a barrier to fish passage.

Performance Metrics

The condition designations for Fish Passage Priorities are based on a barrier assessment, which identified that a location is a barrier to fish and Priority designation in the annual report to Legislature. Culverts, bridges or other facilities where a fish passage barrier has been identified are designated as poor, while elements with deficiencies that have been addressed are designated as good. The fair designation does not apply in the deficiency model. Table 5-27. below describes the performance metrics for determining the condition for fish passage barriers.

Table 5-27. Fish Passage Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Deficiency has been addressed**
Fair	**N/A**
Poor	**Deficient Location**

Inventory of Deficiencies

As of August 2020, 65 Priority barrier locations have been identified for funding salmon and Steelhead fish passage remediation projects, and 18 Priority barrier locations have been funded and are currently in project delivery for remediation. An additional 461 other identified barriers locations are being investigated by the Fish Passage Advisory Committees (FishPAC), for habitat suitability verification and prioritization efforts. Table 5-28 presents the Priority and Active barriers, per the report to Legislature.

Table 5-28. Fish Passage Inventory of Deficiencies

Inventory of Deficiencies					
Objective (unit of measure)	**Inventory**	**Good**	**Fair**	**Poor**	
Fish Passage Priorities (Locations)	**83**	**N/A**	**N/A**	**100.0%**	

Performance Targets

The Priority fish passage objective is to aid in the recovery of threatened and endangered salmon and Steelhead habitat recovery. In the 14 years since SB 857 was passed, Caltrans has partially or fully remediated 51 barriers on the SHS and identified an additional 556 barriers to salmon and Steelhead. At a rate of 4.11 remediation locations per year, the current identified barriers (556) would take approximately 135 years to remediate. For a 40-year target, approximately 14 barriers would need to be addressed

annually. For a 50-year target, approximately 11 locations need to be remediated annually. Table 5-29 presents the statewide asset performance targets based on the priority fish passage locations that have a transportation maintenance or replacement need (34), and the current funded pipeline projects (18).

Table 5-29. Fish Passage Performance Targets

Desired State of Repair				
Objective (unit of measure)	**Good**	**Fair**	**Poor**	
Fish Passage Priorities (10 year) (Locations)	**62.7%**	**N/A**	**37.3%**	

Other Performance Management Parameters

Priority locations are integral to the recovery of salmon and Steelhead in California, because "priority" status indicates the locations with the highest quality of habitat for threatened and endangered species. Where feasible, long-term, full-span bridge and culvert solutions would be most meaningful for the recovery of salmon and Steelhead populations across California.

Four standard fish passage solutions and respective average costs were used as the basis for the unit price determination. These are the solutions predominantly addressed through SHOPP projects. SHOPP project cost data from previous fish passage projects were used as a basis, as well as DES Structures preliminary estimates for ABC pre-design small bridges (20 to 115 feet). Historic cost data and current hydraulic engineering costs were provided by Districts for bottomless culvert and long-term hydraulic solutions, where full-span solutions were infeasible due to deep fill slope or other development. The unit cost associated with each of the four outlined solutions were based on identified solutions and cost estimates for each of the current 65 Priority locations as well as historic funding data with escalation. The unit cost is composed of capital construction and support costs. Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction cost includes work associated with the construction, traffic handling, mobilization, supplemental work, and contingencies.

Typical Treatments

SHOPP projects include full-span small and large bridges, bottomless culverts and long-term hydraulic solutions. These solutions include structures and culverts that span the active channel width and don't impede flow or natural stream processes. The pre-designed ABC small bridges (20 to 115-feet), can be modified for site specific needs to include length, skew, foundation type, rail and abutment depth. Identified foundations are either drilled or driven deep-water piles that avoid scour risk and rock slope protection that is required for shallow, slab foundations which are often barriers to fish. Finally, long-term, full-span solutions will reduce field maintenance related to under-sized culverts and bridges due to scour risk and debris or sediment issues.

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Lighting Rehabilitation

Supplementary Asset

Overview

The Lighting Rehabilitation objective includes rehabilitation and replacement of roadway lighting systems (poles, foundations, luminaires, etc.) that have damage or deteriorated conditions because of aging, weather or other factors. Roadway lighting systems include streetlights, lights underneath overpasses, and lights in tunnels.

Lighting systems need to be updated to current technology and/or structural requirements to prevent structural failure, improve operational reliability, and reduce the use of electricity. Caltrans has converted significant portions of the SHS to Light-Emitting Diode (LED) lighting, and we continue to look at adaptive lighting solutions to further reduce power demand. The primary factor for this activity is asset age, since many of the points of deterioration are directly associated with system age. As lighting systems age, metal fatigue can set in, corrosion weakens the pole or base bolts, and wire can deteriorate to the point of insulation failure which will cause electrical failure.

Performance Metrics

The lighting systems' condition is primarily based on age. Age is calculated based on the original installation date of the lighting system. The replacement of the light by LED for tunnel or soffit lighting will change its condition to good. However, only replacing the lights by LED alone for other lighting systems is not considered as overall condition rating upgrade. Table 5-30 describes the performance metrics for determining condition for good, fair, and poor Lighting Rehabilitation.

Table 5-30. Lighting Rehabilitation Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Age of lighting system < 30 years**
Fair	**30 years ≤ Age of lighting system < 40 years**
Poor	**Age of lighting system ≥ 40 years**

Inventory and Condition

The SHS lighting systems' inventory is maintained in Caltrans Integrated Maintenance Management System (IMMS) and updated quarterly based on project accomplishments. Inventory and conditions for Lighting Rehabilitation, as of 2021, are presented in Table 5-31.

Table 5-31. Lighting Rehabilitation Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	**Inventory**	**Good**	**Fair**	**Poor**	
Lighting Rehabilitation (each)	**97,745**	**37.9%**	**15.3%**	**46.7%**	

Performance Targets

Table 5-32 presents the asset performance targets for Lighting Rehabilitation.

Table 5-32. Lighting Rehabilitation Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Lighting Rehabilitation (each)	**100.0%**		**0.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

Deterioration rates for lighting are based on the service life of the asset. Specifically, on an annual basis a percentage of assets in good condition deteriorates to fair condition, while a percentage of assets in fair condition deteriorates to poor.

Unit costs are based on an analysis of historical cost data composed of capital construction and support costs. Support costs are those associated with engineering and oversight work to design and construct the project. The capital construction cost includes work associated with the construction, traffic handling, mobilization, supplemental work and contingencies.

In addition, lighting rehabilitation unit cost is based on two factors, highway lighting, and tunnel/soffit lighting. The highway lighting unit cost is calculated using an estimator tool employed by the electrical designers. The tunnel and soffit cost were based on a PID estimate for a tunnel lighting system in District 4. These were weighted together based on the performance gap quantities.

Typical Treatments

Maintenance work, either with Field Maintenance Crews or Major Maintenance projects, is limited to treatment strategies such as re-lamping or replacing luminaires when they fail or when scheduled for mass replacement (end of life of the luminaire or lamp, but infrastructure is still in acceptable condition). Field Maintenance Crews may also replace individual poles that get damaged by others, but these repairs would not include upgrading the pole to current standard.

SHOPP projects include treatment strategies that completely rehabilitate and replace the existing lighting asset to current standards. For pole mounted roadway lighting, work would include replacing the foundation, pole, luminaire, and associated electrical wire. It may include underground components such as electrical conduit if it is not usable. For tunnel and soffit lighting, work would include replacement of the existing luminaire and electrical wire. Tunnel lighting control systems would also be upgraded by SHOPP. New control systems are needed to properly control new lighting technology such as LED and to make the system as efficient as possible.

Major Damage

System Resiliency Objective

Overview

The Major Damage Restoration objective was established in the 2017 SHSMP as a Reservation Model performance objective. Major Damage Restoration consists of Emergency Opening and Permanent Restoration. These components are identified as separate SHOPP funding programs with distinct objectives.

A Director's Order is a formal document that grants legal authority by state Public Contract Code 10122 to set aside normal procedures for the advertising, bidding, and awarding of construction contracts because of an emergency or an urgent situation that is assessed as in the best interest of the state. This type of work may be eligible for federal assistance by either FHWA or Federal Emergency Management Agency (FEMA) depending on the significance of the incurred cost and Governor's Proclamation or President's Declaration.

From an asset management perspective, the condition of the state highway assets damaged in a catastrophic event may deteriorate drastically. However, following Caltrans emergency response, the conditions may go from poor, fair, or even good to the desired Good condition. In the case of a Permanent Restoration response, it is expected that the conditions of the restored assets become Good.

Emergency Opening

The Emergency Opening objective includes emergency repair of assets damaged or imminently threatened by natural or human-caused events. Qualifying repairs include those needed to restore essential travel. To be considered, the work is typically tied to an identifiable natural event such as a storm, flood, fire, earthquake, tsunami, or volcanic action. Human-caused events such as vehicle collisions, explosions, civil

unrest and acts of war or terrorism are included. Repair to current design standards is allowed. The level of repairs needed varies depending on the situation. Funding needs are estimated in real-time when the event(s) occur, based on the damage experienced and cost of repair. The goal is to repair 100 percent of damaged assets as soon as possible.

Permanent Restoration

The Permanent Restoration objective includes permanent repair and restoration of assets to pre-emergency condition and either follows or runs concurrently with the emergency opening phase. Restoration to current design standards is allowed and may include elements of betterments. These projects go through the project development process and are mitigated in more depth than typical Emergency Opening projects. However, they can be expedited into construction when the immediacy of an emergency arises during the design phase. The funding needs are more detailed and accurate compared to an EO project.

Typical Treatments

Field Maintenance Crews may respond as necessary to assist in clearing the roadway and providing for essential traffic after a natural or human-made emergency event. In some cases, Major Maintenance projects are also used. Emergency Opening projects typically include any work or treatment that allows the roadway to open to essential traffic. This work may include earthwork, demolition, drainage, flood protection, or other major structural work or treatment. Any disaster-generated debris removal work is also allowed. In Permanent Restoration, projects are handled similarly to any other competitively bid and awarded contract. Typical work involves the reconstruction or replacement of the transportation facility.

DRAFT for CTC Review

Office Buildings

Supplementary Asset

Overview

The Office Buildings objective includes major rehabilitation and/or replacement projects for Caltrans Office Buildings. The Administration Program, Division of Business Operations, is responsible for Caltrans Statewide Office Buildings (District and Headquarters). Some projects require external approvals, including from the State Transportation Agency, Department of General Services, Department of Finance, and the Legislature. The Division of Business Operations must be consulted for all SHOPP related projects for Office Buildings. As office building infrastructure deteriorates or becomes obsolete, the SHOPP objective will include major repair or replacement projects to address the facility operational and useful life issues. Projects may include those that improve building conditions or address critical infrastructure deficiencies, such as fire, life safety, seismic, code, or building system deficiencies. In light of COVID-19, projects will reflect Caltrans' shift towards telework, the modified use of workstations, and the reevaluation of space needs.

Performance Metrics

The inventory of Office Buildings in good condition remains fundamentally unchanged since the last SHSMP. In the event that an office building is damaged, the damaged location is considered to be in poor condition and will require restoration or replacement. The goal is to award construction contracts within three years of damaging events for all known needs.

Table 5-33 describes the performance metrics that define the criteria for determining good, fair, and poor Office Building condition.

Table 5-33. Office Building Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Fixed buildings 25 years old or less, modular buildings 10 years old or less**
Fair	**Fixed buildings between 26 and 50 years old, modular buildings between 11 and 20 years old**
Poor	**Greater than 50 years old for fixed buildings, greater than 20 years for modular buildings, or fixed/modular with critical infrastructure deficiencies**

Inventory and Conditions

There are 10 primary Office Buildings in Caltrans' portfolio, including district and headquarters Office Buildings that are Caltrans owned and operated. Leased locations and Department of General Services owned locations are not included. Caltrans owns approximately 2.7 million square feet of Office Buildings. The inventory and conditions for Office Buildings, as of 2020, are presented in Table 5-34.

Table 5-34. Office Buildings Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	**Inventory**	**Good**	**Fair**	**Poor**	
Office Buildings (square feet)	**2,669,524**	**43.6%**	**28.9%**	**27.6%**	

Performance Targets

Table 5-35 presents the statewide asset performance targets for Office Buildings.

Table 5-35. Office Buildings Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Office Buildings (square feet)	**60.0%**	**40.0%**	**0.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and, potentially, maintenance and other contributions.

Deterioration rates for Office Buildings are based on the asset's age. Specifically, on an annual basis, a percentage of assets in good condition deteriorates to fair condition, while a percentage of assets in fair condition deteriorates to poor. SHOPP projects primarily address assets in poor condition and restore the condition of the asset through rehabilitation or replacement. Maintenance activities focus on maintaining assets to be safe and functional for Caltrans employees, regardless of asset condition.

Unit costs for Office Buildings are based on estimates from the Department of General Services, which must be consulted for Office Building renovation and replacement projects. The unit costs are inclusive of both capital construction and support costs. Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction cost includes work associated with the construction of Office Buildings, traffic handling, mobilization, supplemental work and contingencies.

Typical Treatments

The SHOPP may fund treatment strategies for Office Buildings that need major rehabilitation and/or replacement and that have deteriorated conditions or critical infrastructure deficiencies, such as fire, life safety, seismic, code, or other building deficiencies. Additionally, Government Code and State policy requires Department of Finance and Department of General Services approval and oversight for Office Building renovation and replacement projects. Reconstruction of Office Buildings is not completed by Field Maintenance Crews or by Major Maintenance projects.

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Overhead Sign Structures Rehabilitation

Supplementary Asset

Overview

The Overhead Sign Structure Rehabilitation objective includes replacement and upgrade of overhead sign structures (which support overhead sign panels) that have damage or have deteriorated because of aging, weather, or other factors. Overhead sign structures in the inventory generally fall into one of five categories: Truss, Tubular, Box Beam, Closed Truss, Bridge Mounted, and Lightweight.

Sign structures are susceptible to corrosion and metal fatigue and are exacerbated by the age of the structure. Many older structures were designed to previous standards and are at risk of failure because of metal fatigue from constant vibration.

Performance Metrics

The conditions of Overhead Sign Structure assets are based on a visual inspection of the structural elements (foundations, anchor bolts, base plates, column supports, arm/chord members and connection, etc.). classified as Good, Fair or Poor. The condition categories and condition criteria have been modified since the 2019 SHSMP. These conditions are not only based on inspections, but also on recommendations by Caltrans Division of Engineering Services on what types of structures are no longer acceptable and warrant replacement. Table 5-36 describes the performance metrics for determining condition for good, fair, and poor Overhead Sign Structure Rehabilitation.

Table 5-36. Overhead Sign Structures Rehabilitation Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	Elements in new or like-new condition with no significant deficiencies
Fair	Structures requiring minor repair of the structural members or some degree of cleaning and painting.
Poor	Structures requiring removal/replacement or major on-site repair of the structural members. In addition, structure types that are known to be deficient such as box beam and tapered pole type of structures.

Inventory and Condition

The inventory and condition survey of overhead sign structures, conducted by the Caltrans Division of Maintenance, SM&I, is updated every four years. The current cycle of inspection is in progress, so the complete inventory was not available at the time this document was prepared. Instead, the latest inventory was based on inspections performed between 2016 and present. The inventory includes all overhead sign structures within the SHS right-of-way.

The inventory and conditions of Overhead Sign Structure Rehabilitation, based on the most recent inspection cycle, are presented in Table 5-37.

Table 5-37. Overhead Sign Structures Rehabilitation Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	**Inventory**	**Good**	**Fair**	**Poor**	
Overhead Sign Structures Rehabilitation (each)	**16,433**	**57.3%**	**35.5%**	**7.1%**	

Performance Targets

Table 5-38 presents the statewide asset performance targets for Overhead Sign Structure Rehabilitation.

Table 5-38. Overhead Sign Structures Rehabilitation Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Overhead Sign Structures Rehabilitation (each)	**100.0%**		**0.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

Due to the modifications to the condition criteria for overhead sign structures, deterioration is based on the expected design life of the structures. With this as the basis for deterioration, we expect to see a four percent annual deterioration from Good to Fair, and a four percent deterioration from Fair to Poor. This is consistent with general observations that the deteriorating rates are expected to accelerate as sign structures become older.

Unit costs are based on an analysis of historical cost data composed of capital construction and support costs. There is a wide variability in the cost of an overhead sign structure. It depends on many factors including the number of sign panels it is intended to support, and if it is attached to a bridge. Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction cost includes work associated with the construction, traffic handling, mobilization, supplemental work and contingencies.

Typical Treatments

Typical SHOPP treatment will include upgrading or reconstructing existing overhead sign structures to meet current design standards. Reconstruction of these structures is not completed by either Field Maintenance Crews or by Major Maintenance projects.

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Pavement (Class 1, 2, and 3)

Primary Asset

Overview

Pavement is designed to support anticipated traffic loads and provide a safe and smooth driving surface. Keeping pavements in good condition lengthens its life, enhances safety, helps reduce user's operating costs, and reduces vehicle emissions. Rough roads cause more wear and tear on vehicles, increasing user costs, environmental impacts, and in some cases hindering mobility.

The SHS consists of two pavement surface types: asphalt and concrete. Types of asphalt pavements include pavement surfaced with conventional Hot Mix Asphalt (either open-graded or dense-graded), Rubberized Hot Mix Asphalt (either open-graded or gap-graded), chip seal, slurry seal, bonded wearing course, or other asphaltic materials. Concrete pavement types include Jointed Plain Concrete Pavement (JPCP), Continuously Reinforced Concrete Pavement (CRCP), and Precast Panel Concrete Pavement (PPCP).

Performance Metrics

Caltrans collects pavement condition data through APCS[22]. The APCS uses high definition cameras and lasers to capture roadway and pavement images and measure pavement profiles and distresses for both NHS and SHS routes. Caltrans began this data collection effort as a pilot in 2011 and currently has data for 2015, 2016, 2018 and 2019. Caltrans reports pavement condition data to the Highway Performance Monitoring System (HPMS)[23], a national database maintained by FHWA.

Figure 5-4. Examples of Pavement Conditions

Pavement condition is assessed based on the final rule of the Federal MAP-21 performance measures as of January 2017. Fatigue Cracking, Rutting, and International Roughness Index (IRI) metrics are used to assess the condition of asphalt pavement; while transverse cracking, faulting and IRI metrics are used to assess the condition of JPCP. For CRCP, longitudinal cracking, punchouts, spalling, or other visible defects are considered instead of transverse cracking. For each of these metrics, FHWA has established thresholds as shown in Figure 5-4. For each tenth-mile long section, condition is rated good if all three metrics for this section are rated good; poor if two or more metrics are rated poor; and fair, otherwise. 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. Caltrans uses additional metrics, beyond federal requirements, to assess pavement condition. For asphalt pavement, MAP-21 assessment does not include notable distresses such block cracking, longitudinal cracking, transverse cracking, potholes, bleeding, and raveling. For concrete pavement, MAP-21 assessment does not include notable distresses such as corner cracking and 3rd stage cracking. Table 5-39 describes MAP-21 performance metrics for determining condition for good, fair, and poor pavement.

[22] Automated Pavement Condition Survey (APCS), https://dot.ca.gov/programs/maintenance/pavement/pavement-management
[23] Highway Performance Monitoring System (HPMS), https://www.fhwa.dot.gov/policyinformation/hpms.cfm

Table 5-39. Pavement Performance Metrics

Performance Metrics			
Metrics	**Good**	**Fair**	**Poor**
IRI (inches/mile) all pavement types	**<95**	**95-170**	**>170**
Cracking (%)			
Asphalt	<5	5-20	>20
Jointed Concrete	<5	5-15	>15
Continuously Reinforced Concrete	<5	5-10	>10
Rutting (inches) asphalt only	**<0.20**	**0.20-0.40**	**>0.40**
Faulting (inches) JPCP only	**<0.10**	**0.10-0.15**	**>0.15**

Inventory and Condition

The SHS includes 49,672 lane miles of assessed pavements, based on APCS data collected from January to November 2019, following Caltrans' 2014 Linear Referencing System. Bridge decks and approach slabs are not included in the pavement inventory. SHS Pavements is associated with one of three primary classes, based on the functional classification of the roadway to which they belong. Throughout the SHSMP a shortened naming convention (e.g., "Pavement Class 1") is used in lieu of the full descriptive phrase (e.g., "Pavement on Roadway Class 1"). Figure 5-5 describes these primary classes and shows the percentage of lanes miles in each classification.

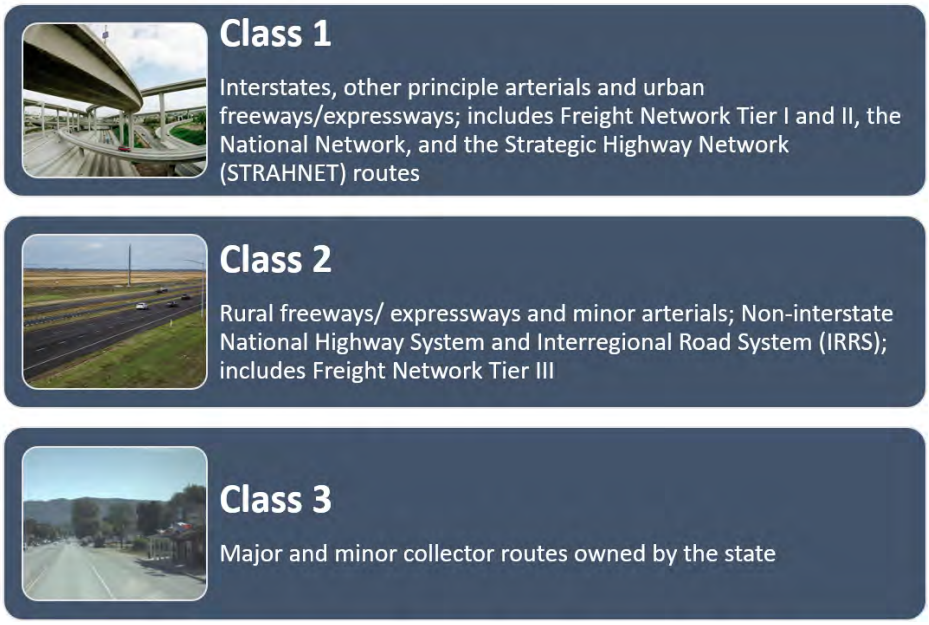

Figure 5-5. Pavement Classifications and Percentages of Pavement in Each Class

The number of surveyed lane miles of pavement may vary between successive years due to accessibility. Fluctuations in the surveyed lanes miles may be attributed to lane closures due to active construction, weather-related safety issues, traffic accident, as well as lane relinquishments.

Caltrans strives to effectively manage the SHS pavement with the most cost-effective strategies over the long term. To maintain the system health, Caltrans has invested in Ground Penetrating Radar (GPR) and APCS and developed the Pavement Management System (PaveM). APCS data, along with GPR data, can be used to assess pavement condition and predict future performance. PaveM stores APCS data and can analyze pavement performance for every mile of roadway pavement. PaveM uses pavement condition, climate, traffic loading, and pavement history to recommend potential treatment locations and levels of investment considering performance and budgetary constraints.

Pavement condition changes over time because of construction activities, traffic loading, and environmental factors, such as aging and changes in temperature and moisture. These changes are captured over time as new data become available. The pavement inventory and conditions, as of 2019, are presented in Table 5-40.

Table 5-40. Pavement Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	**Inventory**	**Good**	**Fair**	**Poor**	
Pavement Class					
Total	**49,672**	**57.0%**	**42.0%**	**1.0%**	
Class 1 (lane miles)	**26,895**	**66.2%**	**32.6%**	**1.2%**	
Class 2 (lane miles)	**16,056**	**46.8%**	**52.4%**	**0.9%**	
Class 3 (lane miles)	**6,721**	**44.7%**	**54.4%**	**1.0%**	

Performance Targets

Table 5-41 presents the statewide asset performance targets for each Pavement class.

Table 5-41. Pavement Performance Targets

Desired State of Repair				
Objective (unit of measure)	**Good**	**Fair**	**Poor**	
Pavement Class				
Class 1 (lane miles)	**60.0%**	**39.0%**	**1.0%**	
Class 2 (lane miles)	**55.0%**	**43.0%**	**2.0%**	
Class 3 (lane miles)	**45.0%**	**53.0%**	**2.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

On an annual basis, a percentage of pavement assets in good condition naturally deteriorate to fair condition, while a smaller percentage of assets in fair condition deteriorates to poor. The term "deterioration" is generally used to refer to the loss of either the structural or functional qualities of the pavement that are often manifested as surface distresses or degradation of ride comfort and skid resistance. The design life of a pavement treatment is the time duration between construction and the time each performance indicator (e.g., cracking, IRI, etc.) reaches a pre-selected performance threshold. Therefore, for a given pavement treatment there are a number of performance life spans; each depending on the performance being tracked in the analysis. PaveM utilizes performance modeling to project future pavement condition. Performance models are a function of pavement material, prior work, age, climate, truck traffic levels, treatment strategies, and investment levels.

Unit costs used to allocate funds for pavement repairs are composed of analyzed capital construction cost and support costs. Support costs are those associated with engineering and oversight work to design and construct the project. The capital construction cost is based on PaveM recommended treatments. This cost includes work associated with the construction of pavement, traffic management plans, stage construction, traffic handling and detours, mobilization, supplemental and state furnished work, contingencies, and other related costs typical encountered in pavement work. These related costs may include some earthwork, drainage, and landscape; traffic signing and striping such as striping, markings, delineators, signs, barricades, traffic control systems, changeable message signs, crash cushions, , guard rails, and barriers; ADA Items such as curb ramps; curb and gutter items; and medians and islands

Typical Treatments

Caltrans' Maintenance Program strives to use maintenance resources effectively to slow down pavement deterioration and maintain the SHS at the lowest possible long-term cost. The SHSMP uses preservation strategies on pavement conditions which benefit from this philosophy. PaveM is used to identify the right locations and times to perform pavement preservation to minimize future costs in the SHOPP (SHOPP avoidance). Pavement identified in fair condition may be targeted for no action or various preservation, corrective or rehabilitation strategies.

Field Maintenance Crews perform treatment strategies such as crack sealing, digouts, pothole fixes, and spall repairs. Caltrans conducts an annual LOS evaluation to assess maintenance needs along the SHS. LOS is another way Caltrans measures pavement health or condition.

Major Maintenance projects are used to meet longer-term SHS maintenance needs. Preventive maintenance treatments include seal coats and thin overlays for asphalt pavements, or joint seal installation, grinding, and individual slab replacement for concrete pavements. Corrective maintenance treatments include dig-outs, cold in-place recycling, grinding, and individual slab replacements. By efficiently using these treatments, Caltrans can avoid more costly repairs in the future.

Capital Preventive Maintenance (CAPM) projects involve lower cost minor rehabilitation strategies for pavements that exhibit surface wear because of weather, aging, and traffic. CAPM-level projects typically have limited or minor structural damage that is more than what can be cost effectively addressed with Major Maintenance but less than needed for major pavement rehabilitation. CAPM strategies are intended to extend project service life for 5-15 years. CAPM strategies typically include pavement grinding to improve smoothness, individual slab replacements, and medium overlays. CAPM projects target primarily pavement work (thus are less expensive than a rehabilitation project), but can include safety/maintenance upgrades such as guardrails, worker safety, sign panels, striping, ADA curb ramps, and other items which do not require widening or realigning the roadway. CAPM projects are generally more costly than Major Maintenance projects and often require a longer lead-time to prepare the projects, due to the inclusion of other work.

The SHOPP funds treatment strategies such as rehabilitation projects that include major rehabilitation and replacement of pavement with significant structural distress (damage impacting the underlying layers of pavement) because of repeated loading and wear from trucks along with impacts from weather and aging of the pavement. A rehabilitated roadway should provide at least 20-40 years of service life with relatively low maintenance expenditures (not requiring an additional SHOPP project during its life cycle). Rehabilitation strategies include lane replacement and thick overlays.

When pavement requires major rehabilitation or replacement, it may be appropriate to include other work items to make operational and performance improvements, such as guardrail modifications, pedestrian and bicycle improvements, storm water or other environmental enhancements, shoulder improvements, and other valued transportation enhancements. These projects may require expensive environmental and cultural resource mitigation and longer development time.

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Relinquishments

Other Assets and Objectives

Overview

The Relinquishment objective was established in the 2017 SHSMP as a Reservation Model performance objective. California SHC, Sections 73 and 73.5 defines the Commission's role and authority to relinquish a state highway. There are three types of relinquishments:

- Deletion of a state highway by legislative enactment.
- Superseding the existing state highway by relocation.
- Agreement with a local agency to accept a collateral facility that is not part of the main traveled way constructed by a state highway project.

The primary purpose is to relinquish state highway routes or portions of a route that no longer serve regional and statewide transportation needs. Relinquishments funded through the SHOPP are "in the best interest of the State." Additional benefits include:

- Eliminates the need for state encroachment permits, resulting in cost savings to the taxpayer.
- Reduction of ongoing state maintenance costs.
- Reduction in state tort liability.
- Decrease in incident response efforts.
- Decrease competition for capital funds for regional and statewide improvements.

Legislative relinquishments may require negotiation between Caltrans and a local agency. The associated cost to relinquish shall be based on a benefit-cost analysis using a 10-year analysis period, assumed interest rate based on the escalation rate used in the STIP, and appropriate costs and benefits specific to the portion of the state highway considered for relinquishment.

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Roadside Rehabilitation

Other Assets and Objectives

Overview

The Roadside Rehabilitation objective is to reduce the long-term cost of maintaining almost 34,000 acres of highway planting and related roadside infrastructure due to damage from extreme weather, acts of nature, or deterioration. This objective is met through the replacement, restoration and rehabilitation of existing highway planting – bringing roadside planting to an established condition that requires minimal ongoing maintenance.

The Roadside Rehabilitation objective includes:

- Roadside improvements that help integrate the facility with the adjacent community and surrounding environs.
- Roadside rehabilitation activities that maintain the classified landscaped freeway designation and comply with mandates.
- Improvements for Water Conservation:
    - Reduce the amount of potable water used to irrigate roadside planting.
    - Meet Caltrans 50% water use reduction goal (compared with the 2013 baseline).
    - Expedite conversion of all irrigation systems to non-potable water sources, towards meeting our goal of 100% conversion to non-potable water by 2036.

Performance Metrics

Roadside rehabilitation condition is assigned, based on total score developed from criteria unique to Irrigated Roadside Rehabilitation areas, Non-Irrigated Roadside Rehabilitation areas, and Water Conservation areas. Table 5-42 describes the performance metrics that define the criteria for determining good, fair, and poor Roadside Rehabilitation.

Table 5-42. Roadside Rehabilitation Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Total score greater than or equal to 2.6**
Fair	**Total score greater than or equal to 1.6**
Poor	**Total score less than or equal to 1.5**

Irrigated Roadside Rehabilitation Areas

For Irrigated Roadside Rehabilitation areas, the condition of the asset is determined from visual inspections and professional judgment that considers five primary factors:

1. Smart Controller – presence or absence of smart irrigation controller.
2. Irrigation Infrastructure - the operational condition of the irrigation delivery system.
3. Plant Health and Longevity – the general health of plant material.
4. Tree Canopy - percentage of canopy covering the roadside area.
5. Ground Plane - percentage of ground cover and shrub covering the ground.

Each of these criteria is evaluated and the roadside is assigned a condition based on the total of these evaluations. For additional detail on calculating the performance measure score, contact the Landscape Architecture Program.

Non-Irrigated Roadside Rehabilitation Areas

For Non-Irrigated Roadside Rehabilitation areas, the asset condition rating is determined from visual inspections and expert judgment that considers three primary factors:

1. Tree Canopy - percentage of canopy covering the roadside area.
2. Ground Plane - percentage of ground cover and shrub covering the ground.
3. Plant Health and Longevity – the general health of plant material.

Each of these criteria is evaluated and the roadside is assigned a condition based on the total of these evaluations. For additional detail on calculating the performance measure score, contact the Landscape Architecture Program.

Water Conservation

Caltrans is the second largest water user amongst State Departments. In California, water conservation needs to be a way of life rather than an extraordinary activity. Establishing water conservation as a performance measure helps ensure that Caltrans continues to reduce the amount of potable water consumed annually.

This objective is typically met by converting from potable to recycled water sources (when reasonable cost feasible), upgrading existing irrigation facilities with newer water conserving versions such as smart

controllers, placing inert materials (such as gravel mulch) to reduce evapotranspiration, and replacing high water use plants with native or drought tolerant plant material.

For Water Conservation areas, the asset condition rating is determined from visual inspections and expert judgment that considers four primary factors:

1. Water Source – type of water used – recycled or non-potable well water.
2. Irrigation Controller Type – extent of use of "smart" irrigation controllers.
3. Inert Material Use – extent of use of inert materials (gravel or rock mulch) as ground cover.
4. Water Efficient Plant Use – extent of use of native or drought tolerant plants.

Each of these criteria is evaluated and the roadside is assigned a condition based on the total of these evaluations. For additional detail on calculating the performance measure score, contact the Landscape Architecture Program.

Inventory and Conditions

The inventory of Roadside Rehabilitation areas is surveyed by Caltrans districts, compiled by the Caltrans Landscape Architecture Program, and updated every two years. The inventory includes existing highway planting in all classified landscaped freeways. The inventory and conditions of Roadside Rehabilitation, as of July 2020, are presented in Table 5-43.

Table 5-43. Roadside Rehabilitation Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	**Inventory**	**Good**	**Fair**	**Poor**	
Roadside Rehabilitation (acres)	**33,997**	**8.2%**	**19.2%**	**72.6%**	

The total acres reported in July 2020 for Roadside Rehabilitation has increased from 29,937 to 33,995. Previous estimates of Roadside Rehabilitation acreage were estimated by multiplying post miles by the assumed typical width of roadside planting. The revised estimate for Roadside Rehabilitation is more accurate, as it was determined by delineating all roadside planted areas using Geographic Information System (GIS) software. Future roadside rehabilitation acreage estimates may change slightly as audits of the classification of these roadside areas continue.

The overall condition of Roadside Rehabilitation has declined significantly since a 2018 survey. This decline in condition is due to three reasons:

1. Increased disturbance of roadside vegetated areas due to homeless encampments which damage electrical and irrigation equipment.
2. Ongoing drought which increases plant stress and reduces longevity.
3. Reduced roadside maintenance due to reduced maintenance worker staff.

Performance Targets

Table 5-44 presents the statewide asset performance targets for Roadside Rehabilitation.

Table 5-44. Roadside Rehabilitation Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Roadside Rehabilitation (acres)	**60.0%**	**30.0%**	**10.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

The future condition of roadside rehabilitation assets is projected using the effective annual deterioration rate as of 2019 SHSMP, which was based on the service life of the asset.

Unit costs for roadside rehabilitation are based on an analysis of historical cost data composed of the capital construction and support costs. Support costs are those associated with engineering and oversight work to design and construct the project. The capital construction cost includes work associated with the construction, traffic handling, mobilization, supplemental work, and contingencies.

Typical Treatments

Field Maintenance Crews provide maintenance operations limited to those activities or treatments necessary to maintain a healthy roadside planting. These activities include minor repairs necessary to keep the irrigation system functioning.

Major Maintenance funds treatments related to the preservation of roadside elements to maintain and protect the overall integrity of the adjacent properties and the environment. These maintenance projects address specific items of concern for maintenance that need immediate attention and that, if not performed, could result in increased preservation needs requiring SHOPP funding in the future.

The SHOPP Roadside Rehabilitation program funds projects that include treatment strategies for the replacement, restoration, and rehabilitation of existing highway planting to preserve or improve the functional aspects of the planting. Typical projects include strategies for water conservation, achieved by; upgrading or replacing irrigation facilities; replacing planting to native or drought tolerant plant materials, and conversion to a non-potable water source.

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Roadway Protective Betterments

System Resiliency Objective

Overview

Protective Betterments (PB) objective refers to the Department's proactive approach to avert emergencies through the identification of existing vulnerabilities along highways and to reduce risk to the existing SHS assets.

Protective Betterments improve the overall condition of the SHS by correcting reoccurring deficiencies and mitigate the loss or impairment of life, health, property, or essential public services by:

- Installing new protective features within the SHS, or
- Modifying the existing function or character of the SHS asset to reduce or eliminate damages by natural or human-made events.

Performance Metrics

Roadway Protective Betterment is based on a deficiency model. Locations where a deficiency exists are designated as poor, while locations with deficiencies that have been addressed are designated as good. The fair designation does not apply in the deficiency model. Table 5-45 describes the performance metrics for determining condition for good, fair, and poor Roadway Protective Betterments.

Table 5-45. Roadway Protective Betterments Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Deficiency has been addressed**
Fair	**N/A**
Poor	**Deficient location**

Inventory of Deficiencies

In 2018, the districts assessed and identified vulnerable roadways locations that could be reinforced for protection against failure during natural extreme events.

Although deficiencies are being addressed through various projects, new vulnerable locations, discovered during the most recent highway system assessment with a focus on repeatedly damaged facilities, were added to the overall deficient locations. The deficiency of Roadway Protective Betterments, as of 2020, is presented in Table 5-46.

Table 5-46. Roadway Protective Betterments Inventory of Deficiencies

Inventory of Deficiencies					
Objective (unit of measure)	Inventory	Good	Fair	Poor	
Roadway Protective Betterments (locations)	**175**	**N/A**	**N/A**	**100.0%**	

Performance Targets

Ideally, the goal of the Roadway Protective Betterment objective would be to address all identified vulnerable locations in the roadway system. However, due to the dynamic nature of natural events that often expose more vulnerable locations or the discovery of new, vulnerable locations, it is not realistic to assume that at the end of the 10-year cycle all vulnerabilities would be addressed. Table 5-47 presents the statewide asset performance targets for Roadway Protective Betterments.

Table 5-47. Roadway Protective Betterments Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Roadway Protective Betterments (locations)	**100.0%**	**N/A**	**0.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

Unit costs are based on an analysis of historical data composed of capital construction and support costs. Support costs are those associated with engineering and oversight work to design and construct the project. The estimate capital construction cost includes work associated with the construction, traffic handling, mobilization, supplemental work and contingencies.

Typical Treatments

Protective Betterment protects infrastructure at vulnerable locations to reduce risk of roadway closures during anticipated natural events (storms, floods, landslides, etc.) or human-caused events. Typical SHOPP-funded treatments or projects may include: protecting rock slopes, preventing rock fall, stabilizing slopes and trenches, improving retaining walls, improving pumping stations at depressed sections, and security improvements.

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Safety Roadside Rest Area Rehabilitation

Supplementary Asset

Overview

The Safety Roadside Rest Area (SRRA) system is a safety component of the State Highway System (SHS) which provides facilities to improve safety for the traveling public by allowing travelers to safely stop, rest, manage their travel needs and return to the highway more alert. California law states that SRRAs "should be provided so that, in combination with other stopping facilities, there shall be facilities available at intervals of approximately one-half hour's normal driving time."

The SRRA Rehabilitation objective is to reduce long-term maintenance costs by restoring facilities to a more maintainable condition, correcting deficiencies to comply with regulatory mandates, and improve comfort station capacity and site functionality at the 86 active SRRA locations in the SHS.

This objective includes addressing the following needs:

- Structure Improvements
    - Comfort Station reconstruction (teardown and rebuild)
    - Comfort Station renovation (restoration of existing structures)
    - Comfort Station capacity expansion
    - Auxiliary building reconstruction/renovation
    - Associated building utilities (electrical, sewer, water)
- Site Improvements, may include:
    - Shade Structures
    - Planting and inert materials.
    - Pedestrian circulation (sidewalks, trails, pedestrian core areas)
    - Misc. site furnishings (trash/recycling receptacles, bike racks, and benches)
    - Pet Areas
    - Signage (traffic, pedestrian and way finding,)

  - Traveler information displays and interpretive panels
  - Maintenance access roads/trails
- Utilities/Facilities
  - Irrigation System
  - Lighting (pedestrian, parking lot, and ramp)
  - Utility modifications resulting from building and site work (electrical, sewer, water). Note: Major water and wastewater system upgrades are funded by the Water and Wastewater Treatment at Safety Roadside Rest Areas Program objective.
- Compliance with regulatory mandates
  - Americans with Disabilities Act (ADA)
  - Water Quality mandates and Regional Water Quality Control Board (RWQCB) regulations
  - California Division of Occupational Safety and Health (Cal/OSHA) regulations

When the existing SRRA facilities cannot be kept open, in an operational and maintainable condition, to meet the needs of the traveling public at its current location, the SRRA may be relocated. This objective will fund the relocation of an existing facility.

Caltrans is committed to the preservation and enhancement of California's resources and assets by minimizing the environmental impacts of projects. To help achieve this goal, all new and renovated safety roadside rest area buildings will be designed, constructed, and operated at a "LEED Silver" or higher standard, using the applicable version of LEED.

This objective does not address water and wastewater treatment system rehabilitation beyond that which is necessary to reconstruct or renovate the buildings. Water and wastewater treatment systems are included in the Water and Wastewater at Safety Roadside Rest Areas Program objectives.

This objective does not address parking lot rehabilitation and/or expansion including any ramp modifications that may be necessary to meet design standards. A paved parking area is a primary component of a SRRA facility. Keeping these paved parking areas in good condition lengthens its life, enhances safety, helps reduce user's operating costs. Rough pavements cause more wear and tear on vehicles, increasing user costs and in some cases hindering mobility. Performance metrics used for assessing the pavement condition will be developed in coordination with the Pavement program. Additionally, this objective does not include the needs associated with Vista Point rehabilitation and/or parking and Park & Ride facility rehabilitation.

Performance Metrics

The SRRA assets' condition is primarily age-based. Age is estimated from the original reconstruction or restoration date. Age-based rating alone is too simplistic to accurately assess the condition of each SRRA. For instance, intensity of use, local climatic conditions, as well as maintenance practices within each district impact the deterioration rate of the facility. The final asset condition is based on all of these criteria, which were determined based on inspection and maintenance reports and dialog with Structures and District staff. The interplay of these criteria is complex including the weighting of different criteria. For tables that describe these criteria, and how the criteria were weighted to provide SRRA condition ratings, contact the Landscape Architecture Program.

Table 5-48 describes the basic performance metrics for determining condition for good, fair, and poor Safety Roadside Rest Areas.

Table 5-48. Safety Roadside Rest Area Rehabilitation Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Age of building since reconstruction < 20 years (including additional criteria)**
Fair	**20 yrs ≤ Age of building since reconstruction < 30 yrs.** **or** **Age of building since renovation < 20 yrs.**
Poor	**Age of building since reconstruction ≥ 30 years** **or** **Age of building since renovation ≥ 20 years**

Inventory and Conditions

The Landscape Architecture Program had developed this initial inventory and condition assessment of SRRAs on the SHS. The inventory of SRRAs is consistent with little to no fluctuation in the number of SRRAs from one year to the next. The inventory condition ratings will be updated annually between January and June by each of the Districts with input from the Landscape Architecture Program, Structures, and District staff. Due to the complexity of the SRRAs, it is anticipated that the condition rating criteria and weighting of those criteria will be re-evaluated with each SHSMP cycle. This may result in the modification of the criteria and weights as well as the overall condition ratings for each SRRA with each future SHSMP development. A major renovation of a SRRA facility in poor condition, which does not involve the reconstruction the existing structure(s), may improve the condition of that facility to "Fair" It is anticipated that this facility would require major work at a shorter interval than a facility that is fully restored and brought to "Good" condition.

A number of SRRA facilities, because of a combination of low intensity use (due mostly to seasonal closures) as well as ongoing facility upkeep, are deteriorating at a slower rate than the expected statewide average. It is anticipated these facilities will be held at a condition rating of "Fair". If during review, Landscape Architecture Program, Structures, and District staff determine the facility has reached an unmaintainable state, the facility will move to a "Poor" rating. The inventory and conditions of Safety Roadside Rest Area Rehabilitation, as of 2020, are presented in Table 5-49.

Table 5-49. Safety Roadside Rest Area Rehabilitation Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	Inventory	Good	Fair	Poor	
Safety Roadside Rest Area Rehabilitation (locations)	**86**	**36.0%**	**36.0%**	**27.9%**	

Performance Targets

Table 5-50 presents the statewide asset performance targets for Safety Roadside Rest Area Rehabilitation.

Table 5-50. Safety Roadside Rest Area Rehabilitation Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Safety Roadside Rest Area Rehabilitation (locations)	**70.0%**	**30.0%**	**0.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These include deterioration rates, capital and support unit costs, and other SHOPP and maintenance project contributions.

The condition of SRRA assets in the future is projected using the effective annual deterioration rate as of 2021 SHSMP, which was primarily based on the service life of the asset.

Unit costs for SRRAs are based on an analysis of historical cost data composed of the capital construction and support costs. A general correlation exists between the size of the SRRA and capital construction costs. This variation in capital costs is somewhat related to the physical size of a SRRA site, but more importantly to the size of the comfort station structure(s) required to support the needed volume of visitors. The visitor volume is estimated based on key factors of the highway the SRRA supports, mainly the average daily traffic, SRRA stopping factor, and estimated yearly traffic volume increase. It is policy that the SRRA supports an estimated volume of visitors for at least twenty years from the end of construction of a major rehabilitation project. SRRAs typically fall into three size categories (small/medium/large) but for the 2021 SHSMP the medium and large were combine for simplification. A future visitor volume was estimated for each SRRA for the year 2050 and placed into one of the two categories. District specific unit costs were developed based on this breakdown.

Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction cost includes work associated with the construction of SRRA, traffic handling, mobilization, supplemental work, and contingencies.

Typical Treatments

Field Maintenance Crews provide maintenance operations limited to those activities or treatments necessary to maintain safe and functioning SRRA facilities. Maintenance funded projects are used for projects related to the preservation, maintenance, and protection of the overall integrity of the SRRA facilities. These are minor projects that address specific items of concern for maintenance that need immediate attention and that, if not performed, could result in increased preservation needs requiring SHOPP funding in the future.

Sign Panel Replacement

Other Assets and Objectives

Overview

The Sign Panel Replacement objective is to replace all large overhead and roadside signs to meet federal requirements for retro-reflectivity which reduces the need for overhead sign lighting. Federal requirements for retro-reflectivity are in place to ensure that signs are visible even during night and in inclement weather. The goal is to replace all signs with the current standard for high performance retro-reflective sheeting. The use of this type of sheeting will increase sign service life 15 to 20 years. This will reduce annual replacement needs. Removal of the catwalks should reduce the potential for graffiti and the need for graffiti mitigation. In addition, the elimination of overhead sign lighting will reduce Caltrans' maintenance and utility costs and contribute to Caltrans' goal for reduced GHG footprint.

Performance Metrics

The condition of sign panel assets is based on if the sign panel has been replaced by Type XI sheeting. Table 5-51 describes the performance metrics for determining good, fair, and poor Sign Panel Replacement.

Table 5-51. Sign Panel Replacement Performance Metrics

Performance Metrics	
Condition	**Metrics**
Good/Fair	**Sign has Type XI sign panel sheeting less than 20 years old**
Poor	**Sign does not have Type XI sign panel sheeting or has Type XI sign panel sheeting 20 years of age or older**

Inventory and Conditions

The inventory of large sign panels in the SHS is maintained in Caltrans IMMS and the number of the signs is updated periodically and manually by local supervisors. The sign panels considered include overhead and roadside two-post, ground mounted sign panels, and exclude one-post sign panels which are typically small and relatively inexpensive. The inventory and conditions for Sign Panel Replacement, as of 2021, are presented in Table 5-52.

Table 5-52. Sign Panel Replacement Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	**Inventory**	**Good**	**Fair**	**Poor**	
Sign Panel Replacement (each)	**87,131**	**10.2%**	**0.0%**	**89.8%**	

Performance Targets

Caltrans has established a goal to replace all signs with the current standard for high performance retro-reflective sheeting or Type XI sheeting with no change from the 2017 SHSMP. Table 5-53 presents the statewide asset performance targets for Sign Panel Replacement.

Table 5-53. Sign Panel Replacement Performance Targets

Desired State of Repair				
Objective (unit of measure)	**Good**	**Fair**	**Poor**	
Sign Panel Replacement (each	**100.0%**		**0.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

The deterioration rates for sign panel are based on the service life of the asset once it is replaced by Type XI sheeting. Specifically, on an annual basis a percentage of assets in good condition deteriorates to fair condition, while a percentage of assets in fair condition deteriorates to poor. It is anticipated that the service life of a sign with a new Type XI sheeting replacement will have an extended life of 15 to 20 years.

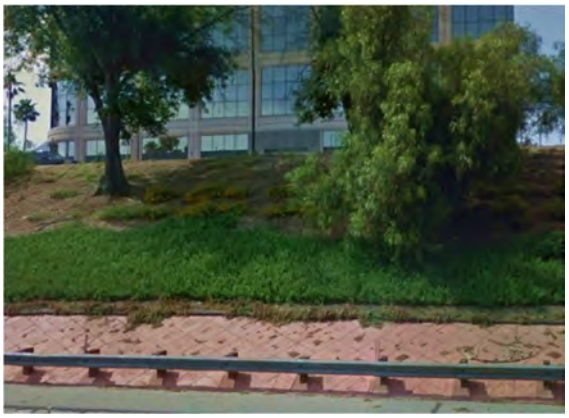
Unit costs are composed of the capital construction and support costs. Support costs are those associated with engineering and oversight work to design and construct the project. The capital construction cost includes work associated with the construction of sign panel replacement, traffic handling, mobilization, supplemental work and contingencies. Separate average unit costs were calculated for overhead panels and two-post roadside panels.

Typical Treatments

In addition to large signs (overhead and roadside two-post, ground mounted sign panels), Caltrans owns nearly 500,000 small signs (one post signs; stop signs, speed limit signs, route shield signs, etc.), which are difficult to locate and track. Any of these signs can be maintained by Caltrans Field Maintenance Crews or funded by the SHOPP. Replacement of large signs is primarily completed through the SHOPP. Field Maintenance Crews replace and update small signs on a continuous basis.

Storm Water Mitigation

Other Assets and Objectives



Overview

The Storm Water Mitigation objective ensures that Caltrans storm water discharges to waters of the State or waters of the United States meet the applicable water quality standards, through construction of control measures to meet the current National Pollutant Discharge Elimination System (NPDES) Permit requirements and other state and federal laws, such as the Porter-Cologne Water Quality Control Act, the Clean Water Act and evolving storm water requirements.

Performance Metrics

The condition designations for storm water mitigation are based on a deficiency model. Locations where a deficiency still exists as identified by the NPDES Permit are designated as poor, while locations with deficiencies that have been addressed are designated as good. The fair designation does not apply in the deficiency model. Table 5-54 describes the performance metrics for determining condition for good and poor storm water mitigation locations.

Table 5-54. Storm Water Mitigation Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	Deficiency has been addressed
Fair	N/A
Poor	Deficient element

Inventory of Deficiencies

Currently, Storm Water mitigation is mandated by the NPDES Permit and other applicable Water Boards' orders to address 3 categories of inventory: a) Total Maximum Daily Loads (TMDLs) as well as Areas of Special Biological Significance (ASBS), b) Significant Trash Generating Areas (STGAs) within Caltrans ROW other than the Bay Area and the existing trash TMDLs in District 7, and c) District 4 trash treatment area mandated by the Cease and Desist Order (CDO) No. R2-2019-0007. These categories are further described below.

TMDLs

A Compliance Unit (CU) is defined as one acre of Caltrans right-of-way from which runoff is retained, treated, and/or otherwise controlled prior to discharge to a water body with an established TMDL or from areas which have been identified as STGAs. The NPDES Permit requires Caltrans to achieve 1,650 TMDL CUs annually to improve water quality statewide starting from FY 2014-15. Failure to achieve annual CU requirements could result in NPDES permit non-compliance and increased project delivery costs, including penalties. TMDL CUs may be credited to Caltrans for the following actions:

- Multiple objective projects that incorporate storm water Best Management Practices (BMP) retrofits
- SHOPP Financial Contribution Only (FCO) projects
- Stand-alone BMP retrofits
- Post-construction treatment beyond permit requirements
- Fish passage projects in TMDL watersheds that also improve water quality
- Projects in TMDL watersheds that place open-graded friction course (OGFC) pavement
- Trash control BMPs
- Cooperative implementation with local agencies
- Other pollution reduction practices necessary to comply with TMDL

The current inventory for TMDL is 16,610 acres. There are 4,294 acres that have been planned or programmed in the SHOPP, resulting in a total statewide deficiency balance of 12,316 acres. Table 5-55 presents an assessment of the proportion of current TMDL deficiencies relative to the proportion of deficiencies that have been addressed.

Table 5-55. Storm Water Mitigation TMDL Inventory of Deficiencies

Inventory of Deficiencies					
Objective (unit of measure)	Inventory	Good	Fair	Poor	
Storm Water Mitigation (TMDL, acres)	**16,610**	**N/A**	**N/A**	**100%**	

STGAs

On April 7, 2015 the State Water Resource Control Board (SWRCB) adopted statewide Trash Control Provisions (Trash Provisions) by amending the Water Quality Control Plan for the Ocean Waters of California to Control Trash and Part 1 Trash Provisions of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California. Based on the Trash Provisions and the California Water Code Section 13383, the SWRCB issued a Trash Control Order (Order) to Caltrans on June 2, 2017 requiring Caltrans to initiate compliance efforts to meet the Trash Provisions.

Per the Order, Caltrans submitted a Statewide Trash Implementation Plan dated April 12, 2019, to the SWRCB. The Statewide Trash Implementation Plan outlines the specific locations of STGAs within Caltrans right-of-way and provides an overview of Caltrans' plan for demonstration of compliance with the Trash Provisions. Caltrans identified a total of 16,645 acres of STGAs.

Caltrans estimates that fifty percent (50%) of the total acres of STGAs or 8,223 acres out of the 16,445 acres can be addressed through trash capture projects. Caltrans estimates that It will not be feasible to install trash capture devices at all STGAs due to cost concerns, right-of-way constraints, design considerations, and safety concerns associated with the maintenance of trash capture BMPs.

Currently, there are 450 acres of STGAs that have been planned or programmed in the SHOPP project delivery, resulting in a total statewide deficiency balance of 7,773 acres. Table 5-56 presents an assessment of the proportion of current STGA deficiencies relative to the proportion of deficiencies that have been addressed.

Table 5-56. Storm Water Mitigation STGA Inventory of Deficiencies

Inventory of Deficiencies					
Objective (unit of measure)	Inventory	Good	Fair	Poor	
Storm Water Mitigation (STGA; acres)	**8,223**	**0%**	**N/A**	**100%**	

District 4 CDO

On February 13, 2019, the San Francisco Bay Regional Water Quality Control Board (RWQCB-R2) issued a Cease and Desist Order (CDO) No. R2-2019-0007. The District 4 CDO requires Caltrans to implement structural and non-structural trash controls to meet full trash capture equivalency in CDO mandated areas no later than the following benchmark acreages and dates:

- 2,000 acres or more by June 30, 2020;
- 4,000 acres or more by June 30, 2022;
- 6,000 acres or more by June 30, 2024;
- 8,800 acres or more by June 30, 2026; and
- All additional STGAs identified by visual assessments conducted in 2021, 2025, and 2029 by December 2, 2030.

Caltrans plans to address 2,196 acres of District 4 CDO area with SHOPP projects. Currently, there are 1,619 acres of the 2,196 acres have been programmed in the SHOPP, resulting in a total deficit balance of 577 acres.

Table 5-57 presents an assessment of the proportion of current D4 CDO deficiencies relative to the proportion of deficiencies that have been addressed.

Table 5-57. Storm Water Mitigation D4 CDO Inventory of Deficiencies

Inventory of Deficiencies					
Objective (unit of measure)	Inventory	Good	Fair	Poor	
Storm Water Mitigation (District 4 CDO; acres)	**2,196**	**0%**	**N/A**	**100%**	

Performance Targets

The goal of the Storm Water Mitigation objective is to close the following gaps: a) 12,316 TMDL acres, b) 7,774 acres of STGAs statewide (other than District 4 CDO and District 7 trash TMDLs), and c) 577 acres within District 4 CDO area. Total of these 3 categories are 20,667 acres. The performance targets over the 10-year Plan period are presented in Table 5-58.

Table 5-58. Storm Water Mitigation Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Storm Water Mitigation (acres treated)	**100.0%**	**N/A**	**0.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

The requirements of the storm water regulations are dynamic in nature. For example, the SWRCB recently issued Trash Provisions Order 13383, which requires Caltrans to implement trash control measures statewide. In addition, the cost of delivering storm water improvements can vary significantly, so performance is planned to be achieved through a cost-effective mix of multi-objective asset management projects, FCO projects, and stand-alone BMP retrofit projects.

Storm water quality improvements can also be constructed economically by addressing this deficiency as a satellite need to an anchor project belonging to a major asset category.

Typical Treatments

In consultation with the SWRCB, Caltrans uses the following four methods to address TMDL pollutant load reduction and trash control requirements:

- Caltrans SHOPP projects (storm water mitigation stand-alone and multi-objective projects).
- Caltrans SHOPP storm water FCO projects (in partnership with local agencies).
- Caltrans SHOPP projects, such as fish passage projects, also improving water quality; projects that include post-construction storm water BMPs; and pavement projects placing OGFC in TMDL watersheds.
- Other Non-SHOPP projects that pursue partnerships with local agencies.
- Non-structural controls which require enhanced litter removal to meet visual assessment standards.

Caltrans prioritizes its storm water related activities and addresses TMDLs and STGAs through implementation of source control measures, BMPs, and other pollutant reduction activities. Caltrans will use asset management principles and multi-objective decision analysis during project planning and programming to optimize the achievement of CUs or acres treated through the SHOPP program. Caltrans will continue to collaborate with the SWRCB and Regional Water Quality Control Boards to achieve maximum water quality benefit economically and efficiently.

DRAFT for CTC Review

Transportation Management Systems

Primary Asset

Overview

A Transportation Management System (TMS) is a vast connected system of electrical/electronic and advanced vehicle detection technologies that work together to reduce highway user delay, enable optimization of traffic flow, provide traveler information and safety alerts, collect information on traffic behavior and contribute to the reduction of greenhouse gas emissions. These TMS units are an integral part of the SHS, performing critical functions that keep people, vehicles, and goods moving.

TMS unit types include several different TMS field units defined further in the Inventory and Condition Section, but also include the associated communications infrastructure and central system servers and software that support their operation and connection to the district Transportation Management Centers (TMCs). TMS units such as traffic signals and ramp meters control the flow of traffic on the SHS to optimize efficiency. Central and communications systems that connect to TMS units enable system operators to detect highway incidents and dispatch assistance or provide information about detours to minimize congestion related to incidents, estimated by FHWA to account for approximately one-third of delay on any highway system. In addition to providing real-time data for system operators and travelers, TMS units also provide historical data to help system planners and engineers forecast and plan projects.

The existing inventory of TMS units represents a significant historical investment by Caltrans and its partners. Many of these units are over ten years old and approaching the end of their expected life cycles. They will require replacement in the next five to ten years.

TMS units are also collectively referred to nationally as Intelligent Transportation Systems (ITS). For the purposes of asset management, performance targets focus on the nine core types of TMS units. In addition, there are several types of central system software and communications systems (including leased lines, dedicated fiber, and microwave links) that are required to manage the TMS units remotely. While not currently explicitly enumerated as core TMS units, these systems are integral to remotely managing and monitoring TMS units and are often included as part of TMS projects or separate projects altogether.

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

Caltrans works diligently to keep TMS units functioning as intended. In addition to performing preventive maintenance checks, per Chapter K of the Maintenance Manual, Volume 1[24], Caltrans has developed active monitoring and regular functional check programs to maintain and continuously improve the TMS up-time health.

Performance Metrics

For asset management purposes, TMS units are categorized as being in either good or poor condition. The condition of a TMS unit is based on the unit being within its expected life cycle and its functional availability. A TMS unit is functionally available if it doesn't have chronic downtime issues as determined by the District Maintenance and Traffic Operations staff.

Table 5-59 describes the performance metrics for determining good and poor Transportation Management Systems. Table 5-60 further illustrates the criteria for determining good and poor condition.

Table 5-59. Transportation Management Systems Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Within expected life cycle and consistent functional availability**
Fair	**N/A**
Poor	**Beyond expected life cycle or is not meeting functional availability because of chronic down time**

Table 5-60. Transportation Management Systems Unit Condition

Unit Condition				
Criteria	**Good**	**Poor**		
Is the Unit within Life Cycle?	**Yes**	**No**	**Yes**	**No**
Is the Unit consistently functionally available?	**Yes**	**Yes**	**No**	**No**

[24] Caltrans Maintenance Manual, Chapter K, Volume 1, https://dot.ca.gov/-/media/dot media/programs/maintenance/documents/27-chpt-k-july-2014-a11y.pdf

Inventory and Conditions

There are over 20,000 TMS units on the SHS. The nine core types of TMS units include:

- Traffic signals
- Freeway ramp meters
- Changeable message signs
- Extinguishable message signs
- Closed circuit televisions
- Traffic monitoring detection stations
- Traffic census stations
- Roadway weather information systems
- Highway advisory radios

In the future, TMS units such as central systems, broadband telecommunication systems, and newer TMS unit technologies may be included, expanding the list of core TMS units. As TMS technologies are improved, the need for broadband along the SHS will increase and broadband will be expanded to cover the strategic corridors. Newer technologies such as off-pavement detection or multi-function TMS such as a camera that provides both high definition video and detection data will require more bandwidth, as they capture and send more data back to the TMCs. As adaptive traffic signal and freeway ramp metering methods are adopted and deployed, the bandwidth will need to be supported by broadband technologies. The inventory and conditions for TMS, as of 2020, are presented in Table 5-61.

Table 5-61. Transportation Management Systems Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	Inventory	Good	Fair	Poor	
Transportation Management Systems (each)	**20,816**	**71.1%**	**N/A**	**28.9%**	

Performance Targets

Table 5-62 presents the statewide asset performance targets for TMS.

Table 5-62. Transportation Management Systems Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Transportation Management Systems (each)	**90.0%**	**N/A**	**10.0%**	

Caltrans has established two targets to bring 90 percent TMS units to good condition:

1. TMS Life Cycle Health – 90 percent within expected life cycle
2. TMS Up-time Health – 90 percent TMS units functional

For Caltrans to meet these targets, a collaborative effort between Caltrans Division of Traffic Operations and Division of Maintenance is required. Traffic Operations is focusing on the Life Cycle Health target and Maintenance is focusing on the Up-time Health target.

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

By 2031, approximately a over 11,000 TMS will have gone beyond their life cycles and deteriorated to poor condition. The Life Cycle Health is based on the life cycle of the technological components of a TMS (i.e., camera, controller, other electronics) and because of the electronic nature of the components, condition can go from good to poor quickly and there is no intermediate condition. Technological life cycles may be affected by industry obsolesce, changes in standards, geographical location, and environmental factors.

The deterioration rate of a TMS unit is based on the service life of the unit as compared to either the original installation date, technology refresh date, or the most recent life cycle replacement date. SHOPP life cycle replacement projects primarily address TMS units in Poor Life Cycle Health condition and restore the Life Cycle Health condition of the unit. Field Maintenance Crews primarily focus on keeping the TMS units functional and prolonging their service life. The functional availability of a TMS unit is an indicator of its condition. A TMS unit that does not meet the functional availability criteria is flagged to be experiencing chronic down time, an indicator of poor health, and may need an early life cycle replacement through a SHOPP project.

Unit costs are based on an analysis of historical cost data composed of the communication, capital construction, and support costs. Communication costs are those associated with providing communication for the TMS. Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction cost includes work associated with TMS such as traffic handling, mobilization, supplemental work, and contingencies.

Typical Treatments

Field Maintenance Crews perform preventive maintenance on a regular basis to maintain the up-time health of the system, and to achieve maximum service life of the TMS Units. TMS units require, on an average, 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. Maintenance checks for traffic signals take priority over other TMS units, ensuring safety to the traveling public. Maintenance uses a combination of treatments by Field Maintenance Crews and on call service contracts to maintain TMS units. Field Maintenance Crews address preventive maintenance checks and repairs. On-call maintenance service contracts are used for overflow repairs beyond the scope of our Field Maintenance Crews and for the field units associated with the Traffic Operations Systems Network (TOSNET), which include the maintenance of wireless units, fiber optic cables, copper cable, and communications hubs. Without active monitoring, preventive maintenance, and regular functional checks, TMS units may not function properly, may decline to poor condition sooner, and may not provide reliable data to the TMCs or be able to provide accurate and reliable information to the motoring public.

The SHOPP typically addresses units which are at the end of life, obsolete, or otherwise non-functional because of chronic operational issues. These projects could include treatments that address system failures, systemic repairs, replacements, or upgrades. The goal is to bring 90 percent of TMS units in good condition by end of year 2027.

Transportation Management System Structures

Other Assets and Objectives

Overview

The infrastructure supports of Transportation Management Systems (TMS) are the physical structure support components which the TMS may typically be mounted on. These units may be the steel pole, mast arms, foundation, pull boxes, conduit, or other non-technology components of a TMS. TMS units are an integral part of the SHS, performing critical functions that keep people, vehicles, and goods moving.

The existing inventory of TMS units represents a significant historical investment by Caltrans and its partners. A number of these TMS Structures are over forty years old and approaching the end of their fifty year expected life cycles. They will require replacement in the next five to ten years.

Performance Metrics

For asset management purposes, TMS Structure components are categorized as being in either good or poor condition. The condition of the structure components of a TMS unit is based on the unit being within its expected life cycle. Table 5-63 describes the performance metrics for determining good and poor Transportation Management System Structures.

Table 5-63. Transportation Management System Structures Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Within expected life cycle of 50 years**
Fair	**N/A**
Poor	**Beyond expected life cycle**

Table 5-64 further illustrates the criteria for determining good and poor condition.

Table 5-64. Transportation Management System Structures Unit Condition

Unit Condition		
Criteria	**Good**	**Poor**
Is the Unit within Life Cycle?	**Yes**	**No**

Inventory and Conditions

The inventory and conditions for TMS structure components, as of June 2020, are presented in Table 5-65.

Table 5-65. Transportation Management Systems Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	**Inventory**	**Good**	**Fair**	**Poor**	
Transportation Management System Structures (each)	**20,816**	**98.1%**	**N/A**	**1.9%**	

Performance Targets

Table 5-66 presents the statewide asset performance targets for TMS Structures.

Table 5-66. Transportation Management System Structures Performance Targets

Desired State of Repair				
Objective (unit of measure)	**Good**	**Fair**	**Poor**	
Transportation Management System Structures (each)	**90.0%**	**N/A**	**10.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

By 2031, over 1,000 TMS Structures will have gone beyond their expected life cycles and deteriorated to poor condition. Structural components life cycles may be affected by changes in standards, geographical location, and environmental factors.

The deterioration rate of a structural component of a TMS Structures unit is based on the expected service life of the unit as compared to either the original installation date or the most recent life cycle replacement date. SHOPP life cycle replacement projects primarily address TMS Structures units in Poor Life Cycle Health condition and restore the Life Cycle Health condition of the unit. Although not common, structural issues can affect the functional availability of a TMS Structures unit. As an example, structural components that are frequently getting damaged by vehicular impacts (knockdown) may be an indicator that the TMS Structures unit is installed at a bad location, and as a result, may not be able to consistently perform its function.

Unit costs are based on an analysis of historical cost data composed of the capital construction and support costs. Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction cost includes work associated with TMS Structures such as traffic handling, mobilization, supplemental work, and contingencies.

Typical Treatments

Field Maintenance Crews perform preventive maintenance on a regular basis to maintain up-time health of the system and to achieve a maximum service life of the TMS Units. TMS units require, on an average, 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. Maintenance treatments for structural issues mostly involve maintaining the structures to prevent premature deterioration, such as minor painting to slow corrosion. Maintenance check activities include monitoring the structures for signs of deterioration and reporting to appropriate engineering units if significant issues are noticed. Maintenance will also replace structural components if damaged by vehicular impacts (knockdowns).

The SHOPP typically addresses units which are at the end of life or are flagged by Maintenance in poor condition due environmental factors or had been installed at a bad location and getting frequently knocked down by travelling vehicles. These projects could include treatments that address system failures, systemic repairs, replacements, or upgrades. The goal is to bring 90 percent of TMS Structures units in good condition by end of year 2027.

DRAFT for CTC Review

Transportation Related Facilities

Supplementary Asset

Overview

The Transportation Related Facilities (TRF) objective includes correcting building and site deficiencies associated with worker safety, Cal/OSHA and ADA, as well as improve operational efficiency at equipment shops, maintenance facilities, transportation management centers and transportation material and testing laboratories. The goal is to have no TRFs in poor condition.

Performance Metrics

The condition of TRF is based on the age of the building. Table 5-67 describes the performance metrics for determining condition for good, fair, and poor TRFs.

Table 5-67. Transportation Related Facilities Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Buildings less than or equal to 20 years old**
Fair	**Buildings between 20 and 40 years old**
Poor	**Buildings greater than 40 years old**

Inventory and Conditions

Caltrans owns over 4 million square feet of Transportation Related Facilities. Although TRF condition is based on building age for this SHSMP, a Facility Condition Index (FCI) tool has been developed by a consultant to provide a more comprehensive approach for assessing facility conditions. The FCI tool is based on industry standards for prioritizing maintenance planning and budgeting for facility conditions. The FCI tool is currently being reviewed for approval for statewide implementation. The inventory and conditions of Transportation Related Facilities, as of June 2020, are presented in Table 5-68.

Table 5-68. Transportation Related Facilities Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	Inventory	Good	Fair	Poor	
Transportation Related Facilities (square feet)	**4,382,000**	**22.8%**	**17.6%**	**59.6%**	

Performance Targets

Table 5-69 presents the statewide asset performance targets for Transportation Related Facilities.

Table 5-69. Transportation Related Facilities Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Transportation Related Facilities (square feet)	**60.0%**	**40.0%**	**0.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, potentially maintenance and other contributions.

Deterioration rates for TRF are based on the age of the asset. Specifically, on an annual basis a percentage of assets in good condition deteriorates to fair condition, while a percentage of assets in fair condition deteriorates to poor. SHOPP projects primarily address assets in poor condition and restore the condition of the asset, while maintenance focuses on maintaining assets in good condition as well as addressing assets in fair condition.

Unit costs for TRFs for the 2021 SHSMP are based on the average costs of past programmed SHOPP projects to design and construct TRFs, which include the engineering and oversight work and the construction capital costs to build the facilities.

Typical Treatments

Major Maintenance projects are used for the repair and replacement of defective, obsolete, or worn-out building components, or site features, at Transportation Related Facilities. Proposed projects target building infrastructure that enables or enhances program delivery. Such projects include treatment strategies that repair and replace lighting, heating ventilation and air conditioning and cooling, utilities (sewer, water, electrical), reroofing, and remodeling of interior space to increase efficiency.

Typical SHOPP projects include treatment strategies to rehabilitate, restore, and replace existing facilities, or the construction of new facilities to current design standards that provide a safe and functional working environment to meet operational needs.

DRAFT for CTC Review

Water and Wastewater Treatment at Safety Roadside Rest Areas

Stewardship

Overview

The Water/Wastewater Treatment at Safety Roadside Rest Areas (SRRA) objective is to maintain the traveler safety benefits provided by the SRRA System by preventing closures due to noncompliance with drinking water quality and wastewater treatment standards or the failure of these systems. All Americans with Disabilities Act (ADA) and structural deficiencies at SRRAs are addressed in the Safety Roadside Rest Area Rehabilitation Program objectives. Water provided at the SRRAs is from surface, ground, or municipal sources. The sanitary or wastewater generated is treated on-site using one or a combination of; septic tank, leach field, sewer ponds, seepage pit, wetlands or other advanced treatment methods, self-contained in portables, or diverted off-site through a municipal sewer connection.

All SRRA facilities must comply with RWQCB regulations. When the existing SRRA facilities cannot be kept open, operational and maintainable to meet the needs of the traveling public at its current location, the SRRA may be relocated as part of the Safety Roadside Rest Area Rehabilitation Program objective. This objective will fund the Water and Wastewater Treatment at the relocated facility.

This objective is not intended to address SRRA Building or site deficiencies. Additionally, this objective is not intended to address parking lot rehabilitation or expansion. Work intended to address those types of deficiencies are included in the Safety Roadside Rest Area Rehabilitation objective.

Performance Metrics

The condition of water and wastewater treatment assets is primarily age-based. Age is calculated from the original construction date, or a complete reconstruction date. Age-based rating alone is too simplistic to accurately assess the condition of each SRRA treatment facility. For instance, intensity of use, local climatic and geographic conditions, as well as maintenance practices within each district impact the deterioration rate of the facility. In addition, achieving RWQCB compliance may require additional capital investment in wastewater treatment facilities. The final asset condition is based on all of these criteria, which were determined based on inspection and maintenance reports and dialogue with Design and Engineering Services (DES) Water and Wastewater Branch, and District Staff. The interplay of these criteria is complex including the weighting of different criteria. For tables that describe these criteria, and how the criteria were weighted to provide SRRA Water and Wastewater condition ratings, contact the Landscape Architecture Program.

Table 5-70 describes the basic performance metrics for determining condition for good, fair, and poor water and wastewater treatment at SRRAs.

Table 5-70. Water and Wastewater Treatment at Safety Roadside Rest Areas Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Age of treatment system < 20 years**
Fair	**20 years ≤ Age of treatment system < 30 years**
Poor	**Age of treatment system ≥ 30 years**

Inventory and Conditions

The Landscape Architecture Program had developed this initial inventory of Water and Wastewater Treatment at SRRAs on the State Highway System (SHS). There are 86 SRRAs on the State Highway System SHS. All SRRA locations have on-site water and/or wastewater treatment facilities (including municipal connections). The inventory of water and wastewater treatment facilities at SRRAs on the SHS is consistent with little to no fluctuation from one year to the next. As explained above, the Water and Wastewater Treatment at SRRA assets' condition is based on a number of weighted criteria including age as defined in the table above. The inventory condition ratings will be updated annually between January and June by each District with input from the Landscape Architecture Program, Division of Engineering Services (DES) Water and Wastewater Branch, and District staff. Due to the complexity of the Water and Wastewater Treatment at SRRAs, it is anticipated that the condition rating criteria and weighting of those criteria will be re-evaluated with each SHSMP cycle. This may result in the modification of the criteria and weights as well as the overall condition ratings for each SRRA with each future SHSMP development.

Because of a combination of low intensity use (due mostly to seasonal closures) as well as ongoing facility upkeep, a number of Water and Wastewater Treatment at SRRA facilities are deteriorating at a slower rate than the anticipated statewide average. If during review, Landscape Architecture Program, DES Water and

Wastewater Branch, and District staff determine the facility has reached an unmaintainable state, the facility will move to a "Poor" rating. The inventory and conditions of Water and Wastewater Treatment at SRRAs, as of 2020, are presented in Table 5-71.

Table 5-71. Water and Wastewater Treatment at Safety Roadside Rest Areas Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	Inventory	Good	Fair	Poor	
Water and Wastewater Treatment at Safety Roadside Rest Areas (locations)	**86**	**20.9%**	**22.1%**	**57.0%**	

Performance Targets

Table 5-72 presents the statewide asset performance targets for Water and Wastewater Treatment at Safety Roadside Rest Areas.

Table 5-72. Water and Wastewater Treatment at Safety Roadside Rest Areas Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Water and Wastewater Treatment at Safety Roadside Rest Areas (locations)	**80.0%**	**20.0%**	**0.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, and other SHOPP and maintenance project contributions.

The condition of the water and wastewater treatment assets in the future is projected using the effective annual deterioration rate as of 2021 SHSMP, which was primarily based on the service life of the asset.

Unit costs are based on an analysis of historical cost data composed of the capital construction and support costs. The capital construction cost for water systems at a SRRA is generally consistent from one location to the next. A correlation though, exists between the type of Wastewater Treatment systems and the capital construction costs. This variation in capital costs is generally related to the complexity of the Wastewater Treatment system and required infrastructure. SRRAs typically fall into four treatment categories (Municipal/Primary Treatment System/Pond Treatment System/Advanced Treatment System). Utilizing input from DES Water and Wastewater Branch, an anticipated future Wastewater Treatment system category was determined. District specific unit costs were developed based on this breakdown.

Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction cost includes work associated with the construction, traffic handling, mobilization, supplemental work and contingencies.

Typical Treatments

Field Maintenance Crews provide maintenance operations limited to those activities or treatments necessary to maintain safe and functioning SRRA facilities. Major Maintenance projects are used for projects related to the preservation, maintenance, and protection of the overall integrity of the SRRA facilities. These projects address specific items of concern for maintenance that need immediate attention and which, if not performed, could result in increased preservation needs requiring SHOPP funding in the future.

The SHOPP funds projects that include treatment strategies such as installing, replacing or upgrading drinking water systems, and those treatments associated with the installation, replacement, or upgrade of wastewater treatment systems.

DRAFT for CTC Review

Weigh-In-Motion Scales

Supplementary Asset

Overview

Weigh-In-Motion (WIM) Scales are devices installed in the SHS pavement to weigh and classify vehicles as they travel at highway speeds. These systems can calculate the gross vehicle weight of any car or truck, the speed, and measure the individual axle weights and spacing to determine vehicle classifications. This information is used to fulfill federal mandates and to determine enforcement needs. It is also used to collect data needed to calculate bridge and pavement conditions, to better perform safety analysis, and to meet the special operational needs of trucks. WIM data is processed, validated, and disseminated to other Caltrans areas that utilize the data such as HPMS, Highway Cost Allocation Studies (HCAS), Structures, Transportation System Network (TSN) and Pavement Analysis and Vehicle Enforcement Strategic Information (PAVES-IT).

Performance Metrics

The WIM Scales' condition is based on the age of WIM, equipment functionality, and semi-annual onsite field maintenance inspections. Based on historical data, a typical California WIM life cycle is 20 years. Any WIM stations older than 20 years are considered in poor condition and need to be replaced. Per FHWA WIM pocket guide, the life expectancy of WIM scales are approximately 10 years. Per FHWA, any WIM that are less than 10 years old are considered to be in good condition.[25]

Table 5-73 describes the performance metrics for determining condition for good, fair, and poor WIM Scales.

[25] Weigh-in-Motion Pocket Guide Part 1 WIM Technology, Data Acquisition, And Procurement Guide, https://www.fhwa.dot.gov/policyinformation/knowledgecenter/wim_guide/wim_guidebook_part1_070918_(508_compliant).pdf

Table 5-73. Weigh-In-Motion Scales Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	• **WIM is less than or equal to 10 years old** • **All sensors and frames are secured, and electronics are functional** • **No known issues and meets standard Portland Cement Concrete (PCC) length (ASTM E1318) and smoothness** • **No surface cracking or noticeable movement of PCC panels** • **Weigh sensor panel(s) does not have cracks**
Fair	• **WIM is older than 10 years but less than or equal to 19 years** • **All sensors and frames are secured, and electronics are functional** • **No known issues and meets standard PCC length (ASTM E1318) and smoothness** • **Minor surface cracking without noticeable movement at PCC panels not near the WIM sensors** • **Weigh sensor panel(s) does not have cracks**
Poor	• **WIM is older than 20 years** • **Any sensors and frames are not secured and/or electronics are not functional** • **Substandard PCC length and/or smoothness as outlined in standard (ASTM E1318)** • **Cracking or potholes of PCC in any of the approach and departure concrete slabs** • **Cracking exists beneath the scale frames in the PCC** • **Weigh sensor panel rocking as traffic drives across WIM**

Inventory and Conditions

Currently, there are 140 WIM Scales located over 635 lanes on the mainline SHS. A typical WIM Scale is comprised of various instrumentation, such as associated concrete pavement, piezoelectric sensors, electronics, poles, mast arms, conduits, and controller cabinets. The mainline Scales consist of 111 "Data" and 38 "Bypass" WIMs, which include eight WIMs that are both "Data" and "Bypass."

In the 2017 SHSMP, the inventory count was listed as 176 WIM Scales instead of the current count of 140. This was because the piezoelectric sensor locations were counted as their own stations. However, this method of counting is not accurate because the piezoelectric sensor is a component of the "Bypass" WIM and cannot function independently. Thus "Bypass" WIM with piezoelectric sensors are now counted as one complete WIM station in the current inventory. It should be noted that there will be future changes to the number of WIM locations inventory due to new installations and/or abandonment of existing stations.

The condition of WIM Scales is based on the age of the WIM, equipment functionality, and semi-annual onsite field maintenance inspections. Based on historical data, a WIM life cycle is 20 years. Any WIM Scale older than 20 years is considered in poor condition and needs to be replaced. The inventory and conditions of WIM Scales, as of 2018, are presented in Table 5-74.

Table 5-74. Weigh-In-Motion Scales Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	Inventory	Good	Fair	Poor	
Weigh-In Motion Scales (stations)	**140**	**44.3%**	**17.9%**	**37.9%**	

Performance Targets

Table 5-75 provides the statewide asset performance targets for WIM Scales.

Table 5-75. Weigh-In-Motion Scales Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Weigh-In-Motion Scales (stations)	**90.0%**	**10.0%**	**0.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

The deterioration rate for WIM Scales is based on the asset's service life. Specifically, on an annual basis, a percentage of assets in good condition deteriorate to fair condition while a percentage of assets in fair condition deteriorate to poor. SHOPP projects primarily replace assets in poor condition, while maintenance focuses on maintaining assets in good condition as well addressing assets in fair condition.

The unit cost for WIM Scales is based on an analysis of historical data composed of the capital construction and support costs. Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction includes work associated with the average construction cost of a four lane WIM Scale project that includes traffic handling, mobilization, supplemental work, and contingencies.

Typical Treatments

Typical WIM Scale maintenance treatments are routinely performed by a WIM maintenance service contract. However, Field Maintenance Crews may be needed to assist with issues such as pull-box repairs, cabinet replacements, communication line work, and other minor repairs.

The SHOPP funds projects designed to build new WIM Scales or to reconstruct existing poor condition sites. Typical treatments include rehabilitating existing WIM systems with minor concrete to improve smoothness and surface crack corrections, or to improve the non-standard pavement roadway length of the WIM. In addition, some WIM installations are handled as Minor A projects funded by SHOPP reservations.

5.3 Climate Action

Goal: Lead Climate Action

Caltrans' climate change efforts are include three strategic initiatives: to provide climate leadership related to the transportation sector in California, to create and maintain sustainable practices to reduce greenhouse gas emissions from transportation operations and projects; and to 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 resiliency and health.

This strategic goal focuses the department's efforts to:

- 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)

Reducing Greenhouse Gas Emissions

Numerous executive orders and legislative bills have been passed to reduce emissions statewide. Standards to reduce GHG emissions were initially established under AB 32 – California's Global Warming Solutions Act of 2006, which sets the GHG emission target to 1990 levels by 2020. Additional legislation was passed in 2016, SB 32, which established GHG emission reduction targets of 40 percent below 1990 levels by 2030. SB 32 was preceded by Executive Order (EO) B-30-15[26], which also mandated state agencies "take climate change into account in their planning and investment decisions and employ full life-cycle accounting to evaluate and compare infrastructure investments and alternatives."

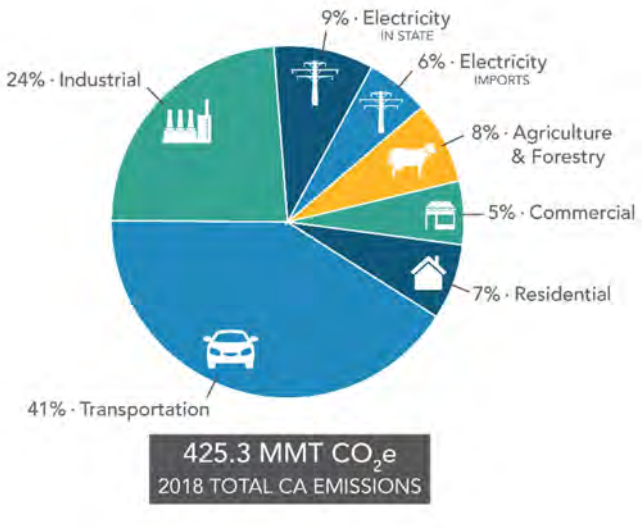


Figure 5-6. 2018 Air Resources Board GHG Emissions by Main Economic Sector

In September 2019, Governor Newsom signed Executive Order N 19-19 calling on state agencies to redouble "efforts to reduce greenhouse gas emissions and mitigate the impacts of climate change while building a sustainable, inclusive economy" for California. The Executive Order called on the Transportation Agency to leverage more than $5 billion in discretionary state transportation funds to reduce GHG emissions in the transportation sector and adapt to climate change. The Executive Order directs CalSTA to align transportation spending with the State's Climate Change Scoping Plan where feasible; direct investments to strategically support smart growth to increase infill housing production; reduce congestion through strategies that encourage a reduction in driving and invest further in walking, biking, and transit; and ensure that overall transportation costs for low-income Californians do not increase as a result of these policies.

Additionally, EO N-79-20 moves the transportation sector toward a zero-emission future by requiring all new cars sold in the state to be zero-emission by 2035 and all commercial trucks sold to be zero-emission by 2045. EO N-79-20 also reiterates the message of EO N-19-19 and emphasizes the urgency of CalSTA's implementation efforts on creating additional clean transportation options, acknowledging that ZEV implementation alone will not result in California accomplishing its transportation related climate goals.

In response to the direction outlined in these two executive orders, CalSTA is creating the Climate Action Plan for Transportation Infrastructure (CAPTI), which will outline specific strategies and actions for implementation by July 15, 2021.

Consistent with the Executive Orders noted above and with CAPTI, a number of strategies have been put into place to curb transportation related Greenhouse Gas Emissions. Caltrans has been expanding bicycle, pedestrian and transit transportation options as one strategy to reduce overall transportation emissions.

[26] Governor's Office, Executive Order B-30-15, 2015, https://www.ca.gov/archive/gov39/2015/04/29/news18938/

Other strategies include the promotion of Zero Emission Vehicle (ZEV) charging facilities throughout California to enable convenient fueling and support wider adoption of battery electric and fuel cell vehicles, acquisition of zero emission vehicles in the Caltrans fleet, support for low-carbon transit investments among other activities[27]. Policy strategies have been initiated to focus on land use planning, nature based solutions for carbon sequestration and required environmental mitigation for transportation projects that increase vehicle miles traveled. The successfulness of these policies and strategies are will determine the extent to which adaptation measures will be needed to address the direct impacts of climate change on the transportation system.

Executive Order N-79-20 set new statewide goals for phasing out gasoline-powered cars and trucks in California. Under the Order, 100% of in-state sales of new passenger cars and trucks sold are to be zero-emission by 2035; 100% of in-state sales of medium- and heavy-duty trucks and bus sold and operated are to be zero-emission by 2045, but only where feasible; and 100% of off-road vehicles and equipment sales are to be zero-emission by 2035 where feasible. The Governor also directed the California Air Resources Board ("CARB") and other state agencies to develop regulations or take other steps within existing authority to achieve these goals. The Order builds on a series of emission reduction legislation and executive orders in recent years intended to drastically reduce greenhouse gas ("GHG") emissions from sources within the state. For example, in 2016, Senate Bill 32 set a statewide target to reduce GHG emissions to 40% below 1990 levels by 2030. The 100 Percent Clean Energy Act of 2018 set a statewide target that all retail sales of electricity in California come from eligible renewable energy and zero-carbon resources by 2045. Executive Order B55-18, also issued in 2018, set a statewide target to achieve carbon neutrality no later than 2045.

In October 2016, Governor Brown released its updated ZEV Action Plan, setting new strategies and targets to help accelerate the adoption of zero-emission technologies in California. Consistent with the Governor's ZEV Action Plan, Caltrans programmed 14 projects in the 2018 SHOPP that included a component to install

[27] Caltrans Greenhouse Gas Emissions and Mitigation Report, August 2020, https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/office-of-smart-mobility-and-climate-change/ghg-emissions-and-mitigation-report-final-august-2-2020-revision9-9-2020-a11y.pdf

publicly accessible, fast-charging DC stations for electric vehicles at 40 Caltrans-owned locations. These projects, which include work unrelated to ZEV, have a total cost of $54.7 million.

In January 2016, Caltrans' executive management issued a memo to include project-level performance data, including GHG emissions, in the SHOPP. While climate change has been incorporated and considered in Caltrans California Environmental Quality Act (CEQA) documents since 2010, Caltrans expanded consideration of GHG emissions during the PID process in 2016. In addition, Caltrans modified its project performance tracking to enable the consideration of project level GHG emissions.

Addressing System Resiliency to Climate Change Impacts

System resiliency activities include proactive treatments that strengthen or protect existing transportation system components from natural or man-made threats. Historically, the SHOPP has funded resiliency activities such as sea walls that protect coastal highways, slope erosion protection, bridge seismic retrofits, flood protection, and vessel protection systems. With the increasing frequency and severity of impacts to highways resulting from global climate change, Caltrans is adapting strategies in the SHOPP. For instance, the 2021 SHSMP has been expanded to include a new objective for sea level rise and storm surge adaptation.

Climate change and extreme weather events are increasingly gaining attention worldwide as one of the greatest challenges facing modern society. California and the nation's changing climate have led to increases in wildfires, increased temperatures, droughts, changing precipitation patterns, sea level rise and increased storm surge. These stressors have already impacted the SHS and are projected to increase in duration and frequency in the future.

Implementing 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[28] in all 12 districts to identify SHS segments vulnerable to sea level rise, 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 this SHSMP.

Vulnerability assessments identify SHS segments where adaptation measures may be necessary, based on the collected data outcomes. Caltrans is in the process of developing adaptation priority reports for all 12 districts. Each district faces its own unique set of challenges regarding future climate projections and potential weather-related disruptions. The adaptation plans will incorporate identified vulnerabilities and district specific geography, and transportation needs, such as redundant routes, freight corridors, population hubs, among other considerations. As district information is developed, activities will be considered for inclusion in projects.

While these vulnerability assessments will help guide future practices and strategies, Caltrans has already put in place or is 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.

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

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.

Implementation of climate change elements into asset management performance objectives will ensure consistent inclusion of risk-based climate concerns in multi-objective SHOPP projects. With the introduction of the Sea Level Rise Adaptation objective in this SHSMP, Caltrans is proactively working towards quantifying the scope and costs of impacts from climate change.

Improving Roadside Resilience Strategies

State highway assets are constructed in a natural context that is under intensifying climate stress, particularly from wildfire and post-fire changes in the watershed condition. Assets within moderate to severe Fire Hazard Severity Zones (FHSZ) are vulnerable to frequent damage from wildfire, which increases when high fuel loading is not managed or maintained along highways, particularly in wildland-urban-interface areas (WUI) where urban development transitions to open space.

Climate adaptation action and planning by initiating natural resource management and maintenance for roadside resilience ensures the users of the state highways system and assets are better protected from wildfire impacts, with a reduction in threat to life and life cycle long-term.

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. This area is distinct from, and larger than that described under the Roadside Rehabilitation objective and is minimally maintained.

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

- 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.

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, that considers several factors:

- Fire behavior modeling at the watershed and sub-watershed scale, using state fully HUC-8 (HUC-8) delineations
- Fire history and frequency, also known as Fire Return Interval Departure (FRID)
- Identification of the state highway corridor as an emergency evacuation transportation route by Division of Traffic Operations including Average Daily Traffic (ADT)
- Identification of the state highway within the County as a primary or secondary emergency evacuation route in the County Local Hazard Mitigation Plans (LHMP) or Community Wildfire Protection Plans (CWPP)

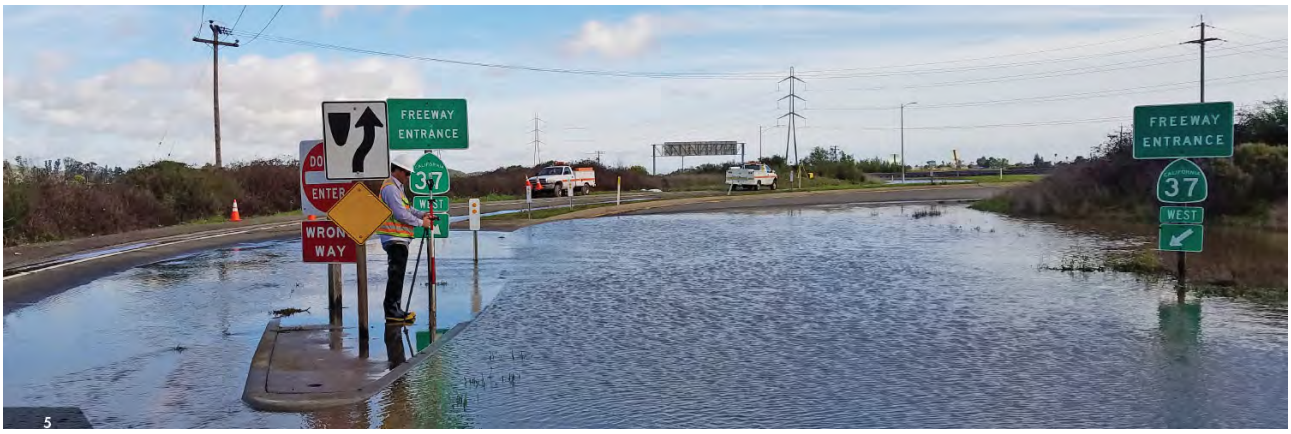
An initial baseline inventory of roadside resilience is expected to be completed by 2022 for all 350,000 acres of the state highway right of way, using existing geospatial vegetation-type datasets, and peer-reviewed for quality assurance/quality control. This is expected to lead to a new performance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

Sea Level Rise

Sea Level Rise Adaptation is being introduced in the SHSMP as a new performance objective for the 2021 Ten-Year Plan. This objective implements findings and recommendations from the recently completed 2019 "Caltrans Climate Change Vulnerability Assessment"[29] reports and the sea level rise and storm surge data sets underlying these analyses. The reports adopt the latest advances from the scientific community in projecting how much sea levels may rise, impacts of inundation and storm surge on the highway infrastructure, quantification of risk tolerance, and overall strategies to inform transportation decision making.

Sea level rise represents a long-term threat to coastal areas and 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, with state highway facilities providing much of the access to the coastal 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 coastal roads, bridges and supporting facilities could face risk of inundation or damage in the future.

[29] Climate Change, https://dot.ca.gov/programs/transportation-planning/office-of-smart-mobility-climate-change/climate-change



Sea level rise and storm surge projections are derived from combinations of two primary factors, specifically:

- Emissions Scenarios. Scenarios are developed for projected future CO_2 levels, ranging from a high estimate (RCP 8.5) consistent with a future in which there are no significant global efforts to limit or reduce emissions, to a low estimate (RCP 2.6) which is a stringent emissions reduction scenario that assumes that global greenhouse gas emissions will be significantly curtailed.
- Risk Tolerance Scenarios. A suite of discreet probabilistic scenarios (e.g., "5% probability sea level rise meets or exceeds…") and a single deterministic worst-case scenario (H++) that covers the range from low risk aversion to extreme risk aversion.

These sea level rise projections are presented in the "State of California Sea Level Rise Guidance, 2018 Update"[30] which provides statistical ranges of sea level rise for future years based on the latest science outlined in Ocean Protection Council's 2017 report, "Rising Seas in California."[31] Figure 5-7 shows an example of projections of sea level rise for San Francisco, considering the combinations of risk and emissions factors. Figure 5-8 shows a matrix of scenarios, considering the two primary factors driving projections.

[30] State of California Sea-Level Rise Guidance, 2018 Update, https://opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf

[31] Rising Seas in California: An update on Sea-Level Rise Science, April 2017, https://www.opc.ca.gov/webmaster/ftp/pdf/docs/rising-seas-in-california-an-update-on-sea-level-rise-science.pdf

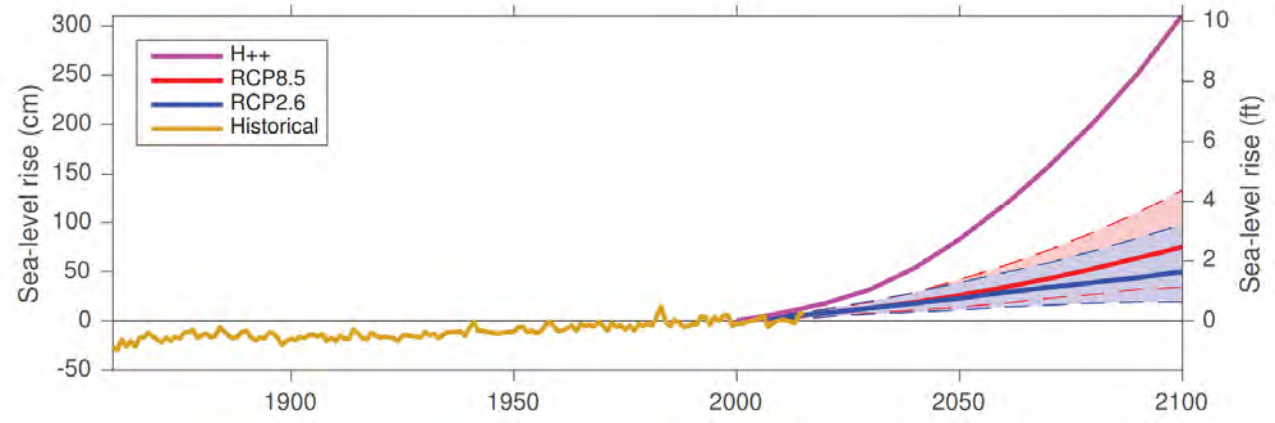


Figure 5-7. Projected Sea Level Rise in San Francisco for range of emissions and risk parameters

Estimating the costs of adapting the highway system to sea level rise is extremely challenging due to the range of scientific and cost factors that compound uncertainties at every step in the calculations. The leading environmental models to predict sea level rise can have a large range of expected impacts to the highway system due primarily to inundation and storm surge. Furthermore, the strategies to mitigate these impacts also cover a broad range of costs and can be very different depending on numerous site-specific factors, such as the type of infrastructure, the surrounding terrain, and community concerns, to name a few.

		Probability Scenario/Risk Tolerance		
		Likely Low Risk Aversion 17% Exceedance	**Medium to High** Medium to High Risk Aversion 0.5% Exceedance 1-in-200	**Extreme** High Risk Aversion H++ Deterministic
Projected Emissions	**Low** RCP 2.6 Assumes that global annual GHG emissions will peak in the next few years and then begin to decline substantially.	**Estimated Likely Range of Sea Level Rise** Likely range of sea level rise for this emissions scenario, which assumes an unlikely decrease in emissions. Represents the lowest value to be considered for any project.	**Low Probability/High Estimate of Sea Level Rise** High value for this emissions scenario.	**N/A**
	High RCP 8.5 Assumes that high GHG emissions will continue to the end of the century	**Estimated Likely Sea Level Rise** Likely range of sea level rise for this emissions scenario, which assumes an increase in emissions to the end of century.	**Low Probability/High Estimate of Sea Level Rise** High value for this emissions scenario. Recommended to be incorporated into decisions for long-term efforts where the potential impacts may be high.	**Extreme Estimate of Sea Level Rise (H++ Scenario)** Highest estimated value. This value is recommended when considering assets that will be in place long-term and are of a critical nature where impacts could be significant.

Figure 5-8. Scenarios evaluated based on range of emissions and risk parameters

Typical Treatments

While four broad categories of adaptation strategies are available to mitigate roadway and bridge impacts, only a subset were considered for this analysis, as shown in Table 5-76. Furthermore, only some of the adaptation options were considered from a practical standpoint, as this was required to facilitate a uniform cost estimating approach at a regional and statewide level in the absence of site-specific conditions and constraints.

Table 5-76. Roadway and Bridge Adaptation Strategies

Approach	Adaptation Option	Considered in Analysis?
Defend	Provide major structural protection	**Yes**
	Provide protection at existing elevations/locations	**Yes**
Accommodate	Elevate the infrastructure above the impact zone	**Yes**
	Enhance drainage to minimize closure time and/or deterioration levels	No
Retreat	Abandon infrastructure	No
	Relocate infrastructure (horizontally)	**Yes**
	Temporarily restrict use of infrastructure	No
Changes in policies or practices	Increase the infrastructure's maintenance and inspection interval and continue to monitor/evaluate	No
	Modify land use and development policies to account for future impacts	No

Sea Level Rise and Storm Surge Mitigation Cost Estimates

Given that the cost estimates carry large uncertainties that are difficult to quantify, the costs presented here should be viewed as rough order of magnitude estimates. As the science evolves, realized emission reductions and more site-specific adaptation studies are carried out by Caltrans, the cost estimates will improve to reflect the best available information.

Cost estimates were developed considering impacts to two primary highway assets – roadways and bridges. These highway assets are expected to be subjected to the damaging effects of climate change and sea level rise producing coastal flooding, inundation, storm surge, erosion, landslides, and cliff failures. The adaptation options considered were generally those that entail protecting, reconstructing, or relocating existing roadways and bridges. Other options, such as nature based solutions, were not considered in the development of these cost estimates. Inundation is the most immediately recognizable impact to roadways. When water levels rise above the surface of the roadways, they become impassable. Storm surge can add to inundation, raising water levels and introducing surge forces. The roadways can also be impacted well before the water level rises above the roadway surface. Pavement subgrade materials can degrade causing increased maintenance costs and shortened service life. Drainage system can become ineffective exacerbating water damage. Other ancillary roadway assets can be damaged from inundation,

such as traffic detection systems, underground communications systems, signs, signals, roadside rest areas, embankments, guardrails, walls, landscaping, etc.

Bridges and large culverts are vulnerable to impacts of sea level rise and storm surge. Rising groundwater can saturate bridge foundation systems, leading to loss of stability, corrosion, and other material erosion. Inundated foundations in waterway crossings can accelerate scour at bridge foundations. Bridge approaches (where the roadway transitions to the bridge deck) can become exposed to storm surge and damage. Surge and wave effects can damage various bridge components (e.g., rails, bearings). These impacts can all lead to a bridge being unavailable for use. Furthermore, rising sea levels can impair ship passage in key freight waterways.

Cost estimates were developed for the five scenarios for projections of sea level rise and storm surge in years 2030, 2050, and 2100, and are presented in Figure 5-9. These costs represent full project costs, including capital construction costs, support, contingency, and escalation to the midpoint of construction assuming the work would be carried out in the 2021 ten-year plan period. Adaptation costs for 2030 are projected to range from $9.7B to $11.1B. Adaptation costs for 2100 are projected to be as much as $45.2B. For purposes of the 2021 SHSMP, the 2030 projection with a cost of $11.1B is used, representing the scenario with high future emission projections (RCP 8.5) and extreme (H++) high risk aversion scenario. These estimated costs would be incurred if policies and avoidance strategies are unable to mitigate the need for engineered solutions to protect critical transportation assets.

The unit cost is comprised of capital construction and support costs. Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction cost includes work associated with the construction, traffic handling, mobilization, supplemental work, and contingencies.

The adaptation options considered were generally those that entail protecting, reconstructing, or relocating existing roadways and bridges. These strategies include constructing levees or walls to protect the existing highway infrastructure, elevating roadways on fill or constructing causeways to accommodate rising water levels, reconstructing bridges vulnerable to inundation and storm surge impacts, or relocating roadways to higher ground away from the water line. For the 2021 SHSMP, the mitigation cost estimates were developed 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. Future costs estimates will consider a broader range of strategies, including nature-based solutions, and greater project level specificity as this work is undertaken.

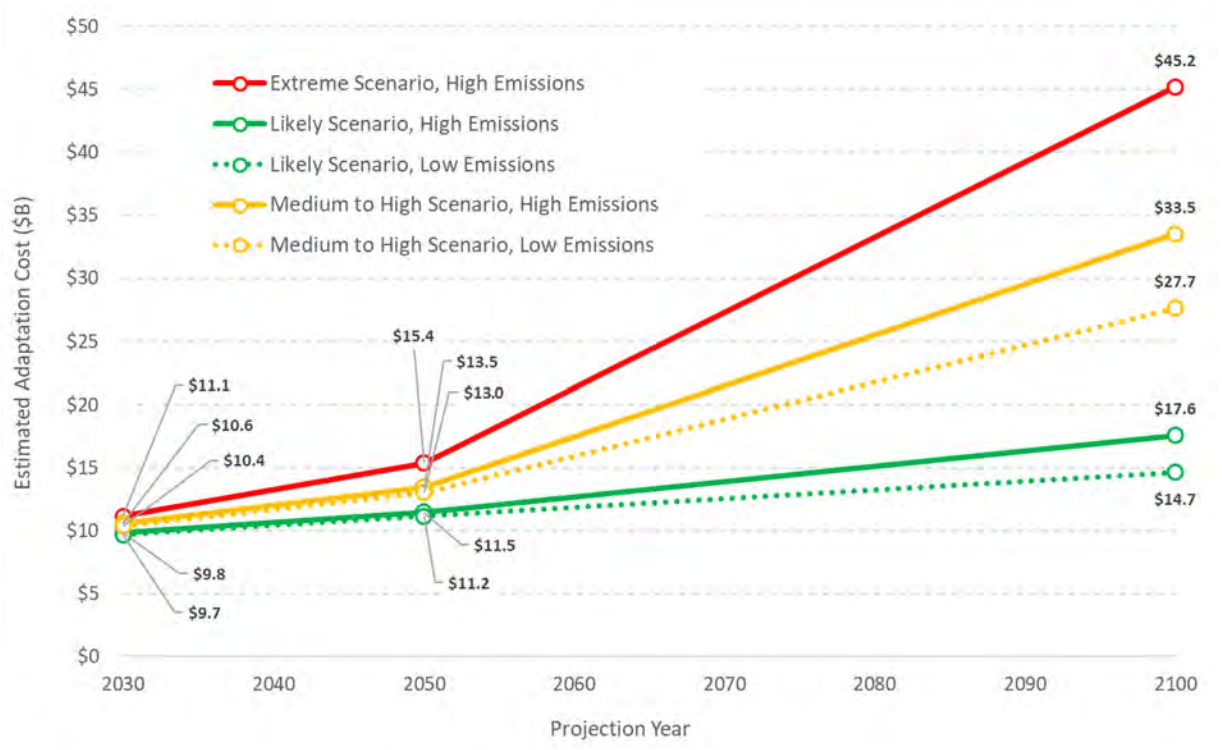


Figure 5-9. Estimated Statewide Adaptation Cost for SHS Roadways and Bridges from Sea Level Rise + Storm Surge

Performance Metrics

Adaptation costs were developed from a combination of roadway centerline miles and square feet of bridge deck area. The measurement unit is the equivalent to the estimated cost to adapt one centerline mile of roadway ($63 million per centerline mile) or an equivalent of 40,000 square feet of bridges ($1,577 per square foot of deck area). Assets are designated as requiring mitigation or not. For the SHSMP framework, unmitigated assets are considered to require mitigation by 2030.

Inventory of Unmitigated Assets

Using the Ocean Protection Council sea level rise models with the worst case rise predictions and the lowest risk tolerance results in 135 units requiring mitigation by 2030.

Performance Targets

The goal of the Sea Level Rise Adaptation objective is to address the projected needs for 2030.

5.4 Equity & Livability

Goal: Advance Equity and Livability in All Communities

Caltrans proactively engages with affected community groups with a focus on those in disadvantaged and under-served communities so that their transportation related needs and concerns are addressed. By Caltrans recognizing disparities and addressing them in transportation investments and new projects, vibrant and livable places are developed for all Californians.

This strategic goal focuses the department's efforts to:

- Avoid, and work to address, transportation-related disparities in underserved communities on all new projects.
- Plan and design transportation facilities to support vibrant livable places, with a focus on addressing the needs and concerns of underserved communities.
- Collaborate with partner agencies to make equity and inclusion central in funding decisions.

Efforts to advance racial and social equity and environmental justice in Caltrans has begun in earnest. In the last couple of years, Caltrans has participated in a Government Alliance on Race and Equity (GARE) that focuses on increasing awareness of race and equity issues within organizations and giving them tools and resources to advance equity solutions. In addition, a Race and Equity Action Plan (REAP)[32] was developed, focusing on improving communications through training and resources for staff, initiating pilot projects for equity focused solutions in areas where data can be collected and tracked over time, and institutionalizing changes by creating an equity policy and an internal structure to support the needed work.

Caltrans works towards advancing equity and livability goals through activities in the SHOPP and Major Maintenance under the Americans with Disabilities Act (ADA) Pedestrian Infrastructure and Complete Streets performance objectives. These objectives shape transportation investment decisions to ensure that the SHS is accessible, safe, and efficient for all users, in particular disadvantaged and under-served communities, across an integrated multimodal transportation system that includes vehicle, bike, and pedestrian facilities.

[32] Caltrans Race and Equity Action Plan (REAP), https://dot.ca.gov/-/media/dot-media/programs/sustainability/documents/2019_12_11-race_and_equity_actionplan-a11y.pdf

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Americans with Disabilities Act Pedestrian Infrastructure

Supplementary Asset

Overview

The goal of the Americans with Disabilities Act (ADA) Pedestrian Infrastructure objective is to provide improvements to existing pedestrian infrastructure to make the path of travel safe and accessible in compliance with ADA regulations on the SHS. Pedestrian facilities include sidewalks, crosswalks, curb ramps, pedestrian overcrossings and under crossings, park and ride lots, driveways, accessible parking lots and accessible pedestrian signals. While the ADA pedestrian objective is mandated by state and federal law, Caltrans has additional requirements to implement ADA improvements as part of a settlement agreement, the Californians for Disability Rights, Inc. v. California Department of Transportation (2010), Case No.: C 06 5125[33]. This settlement agreement requires that a total of $1.1 billion be spent over a 30-year period beginning in FY 2010/11, with annual spending increasing from $25 million the first five FYs to $45 million the last five FYs. For each year the required amount is not met, the remaining balance rolls over to the next FY year towards the following types of activities:

- Project development and construction costs (including staffing costs) associated with the covered program access improvements.
- Establish and maintain accessibility grievance procedures, including a system to process other access requests.

[33] Californians for Disability Rights, Inc. v. California Department of Transportation (2010), Case No.: C 06 5125, https://dot.ca.gov/-/media/dot-media/programs/civil-rights/documents/settlement-agreement-a11y.pdf

Performance Metrics

The condition designations for ADA Pedestrian Infrastructure elements are based on a deficiency model. Elements where a deficiency still exists are designated as poor, while elements with deficiencies that have been addressed are designated as good. The fair designation does not apply in the deficiency model. Table 5-77 describes the performance metrics for determining the condition for ADA assets.

Table 5-77. Americans with Disabilities Act Pedestrian Infrastructure Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Deficiency has been addressed**
Fair	**N/A**
Poor	**Deficient element**

Inventory of Deficiencies

Caltrans implemented the ADA Pedestrian Infrastructure program in July 2010 and determined there were 206,922 non-compliant elements/barriers within pedestrian facilities statewide. Since 2010, through the end of FY 2018-19, Caltrans has upgraded 5,987 curb ramps, 454,400 linear feet of sidewalk, 4,714 pedestrian signals, and 31 park and ride lots through various ADA and non-ADA projects along with CAPM. The total accomplishments statewide are compiled from ADA program annual reports[34]. Table 5-78 presents the unaddressed proportion of ADA deficiencies relative to the proportion of deficiencies that have been addressed.

Table 5-78. Americans with Disabilities Act Pedestrian Infrastructure Inventory of Deficiencies

Inventory of Deficiencies					
Objective (unit of measure)	**Inventory**	**Good**	**Fair**	**Poor**	
Americans with Disabilities Act Pedestrian Infrastructure (deficient elements)	**189,541**	**N/A**	**N/A**	**100.0%**	

[34] Caltrans, ADA Annual Reports, https://dot.ca.gov/programs/civil-rights/ada-infrastructure-program

Performance Targets

The ADA pedestrian infrastructure objective must meet the annual statewide expenditure amount (ranging between $25 million - $45 million) required by the court settlement ruling from FY 2010-11 with expected contribution of each District defined below. Except for the allowance of limited costs ($8.75 million total) associated with CAPM projects, costs associated with new construction and those associated with alterations of pedestrian facilities or park and ride lots undertaken for purposes other than ADA access improvements do not count towards the annual expenditure amount. In addition, projects originally programmed as stand-alone ADA infrastructure improvements combined during project delivery for multi-asset construction are exempt from counting towards the settlement agreement. Table 5-79 presents the statewide asset performance targets for ADA Pedestrian Infrastructure.

Table 5-79. Americans with Disabilities Act Pedestrian Infrastructure Performance Targets

Desired State of Repair				
Objective (unit of measure)	**Good**	**Fair**	**Poor**	
Americans with Disabilities Act Pedestrian Infrastructure (deficient elements)	**25.0%**	**N/A**	**75.0%**	

In addition to establishing a deficiency model for improving ADA infrastructure, a performance monitoring program has been established to ensure that the ADA settlement agreement is reached. This program requires expected annual spending of stand-alone ADA infrastructure projects for each Caltrans District. This is based on an analysis of actual expenditures and estimated expenditures of currently programmed and planned stand-alone ADA infrastructure projects. An expected contribution from each District is included in the Table 5-80.

Table 5-80. Annual District-level Investments in Standalone ADA Projects

ADA Monitoring Program	
District	Settlement Agreement Expected Contribution (S)
1	$1,400,000
2	$1,400,000
3	$2,800,000
4	$7,700,000
5	$2,100,000
6	$2,100,000
7	$5,600,000
8	$2,800,000
9	$1,400,000
10	$2,100,000
11	$2,800,000
12	$2,800,000
Total	$35,000,000

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

Four primary elements, curb ramps, driveways, pedestrian paths, and ramps, were used as the basis for the unit price determination. These are the elements predominantly addressed through SHOPP projects. SHOPP project cost data are analyzed to establish average statewide unit costs. A weighted average was then calculated based on proportion of these deficient elements. The unit cost associated with pedestrian paths was based on an average length of 30 feet per element and considers that approximately 10 percent of the sidewalks can have a higher unit cost. The unit cost is composed of capital construction and support costs. Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction cost includes work associated with the construction, traffic handling, mobilization, supplemental work, and contingencies.

Typical Treatments

SHOPP projects include treatment strategies that correct ADA-related deficiencies with curb ramps, sidewalks, driveways, and other pedestrian infrastructure. These fixes include correcting grade breaks, lowering pedestrian push buttons, upgrading marker lines for crosswalks, straightening curbs or defining edges, correcting cross slope, running slope or gutter slope, install detectable warning surfaces, fixing transitions, gaps or clear width, removing obstructions, or removing abrupt level changes. ADA projects specifically address these deficient elements, but other work by SHOPP projects and Field Maintenance Crews would include upgrading ADA issues.

The ADA work achieved by Field Maintenance Crews includes paint marking and installing sign identification and wheel stop for accessible parking spaces along with lowering pedestrian push buttons and installing handrails. This work sometimes includes removing abrupt transitions or filling in gaps in sidewalk.

Complete Streets (Fix Existing)

Other Assets and Objectives

Overview

A Complete Street is a transportation facility that is planned, designed, constructed, operated, and maintained to provide safe mobility for all users, including bicyclists, pedestrians and transit riders. Complete Streets shifts the focus of transportation policy from vehicle movement as the primary goal toward the movement of people.

Complete Streets are comprised of pedestrian, bicycle, and transit facilities that vary depending on location and facility type. For Caltrans, they are typically state highways that function as Main Streets, but opportunities are also present at freeway on-and-off ramps, over-and-under crossings, shoulders, bridges and in some cases, off-system roads. Approximately 30,000 linear miles of the SHS are accessible to bicyclists and pedestrians. Common elements include sidewalks, crosswalks, bikeways, bicycle/pedestrian striping, signage and signalization.

Caltrans' Complete Streets Policy adopted in 2008[35] requires Caltrans to provide for the needs of travelers of all ages and abilities on the SHS. Caltrans views all projects as opportunities to improve safety, access, and

[35] California, Department of Transportation *Deputy Directive (DD) 64-R2*, 2008, available at https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/dd-64-r2-a11y.pdf

mobility for all travelers. The current Caltrans Strategic Plan has the goal of increasing the annual number of Complete Streets projects by 20%.

Complete Streets is legislated into several state policies, including the California Road Repair and Recovery Act[36] 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[37] and Executive Order N-79-20[38] both direct the Department to fund bicycle, pedestrian and transit projects as part of the State's larger goals around climate change.

Current efforts related to Complete Streets include the establishment of twelve District Caltrans Active Transportation (CAT) Plans[39] that will identify walking and biking needs on the SHS to inform current and future iterations of Complete Streets performance targets. In the meantime, Caltrans has identified a $100M funding reservation for Complete Streets in the 2020 SHOPP to enhance and supplement District projects for the planning years outside of the 2021 SHSMP. Additionally, a Complete Streets Program will be developed to support the implementation of Complete Streets performance management. For a full list of efforts related to Complete Streets, see the Mode Share Action Plan 2.0[40].

[36] SB 1, Beall. Transportation funding., 2017 Chapter 2.Section 36. 2030(f), https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1

[37] Executive Order N-19-19. September 20, 2019, https://www.gov.ca.gov/wp-content/uploads/2019/09/9.20.19-Climate-EO-N-19-19.pdf

[38] Executive Order N-79-20. September 23, 2020, https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf

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

[40] California, Department of Transportation. *Mode Share Action Plan 2.0,* June 2020, available at https://dot.ca.gov/-/media/dot-media/programs/sustainability/documents/modeshareactionplan-wnewactions-final_signed.pdf

Performance Metrics

The condition assessment of complete streets assets is based on inventory collected as part of the Active Transportation Asset Inventory Pilot (ATAIP), a planning-led process to collect bicycle and pedestrian asset information and facility conditions on the SHS. The ATAIP was carried out in two phases – the first utilized Google and Caltrans imagery to identify locations of Complete Streets assets and mapped them using Geographic Information System (GIS) software; the second requested Districts to review assets captured through the first phase for accuracy and assess the features' condition using photo imagery through Pathweb software. Through this effort, over 26,000 bike and pedestrian assets were collected on the SHS. For the purposes of the SHSMP, data was only collected on bikeways (Class I-IV), sidewalks and crosswalks.

The ATAIP was loosely based on two UC Berkeley studies that evaluated and recommended an approach for collecting bicycle and pedestrian infrastructure on the SHS. Caltrans created a simplified data collection framework and trained staff to enter information into a GIS-based platform. The information collected during this pilot is currently being assessed for inclusion in other Caltrans databases, such as the Traffic Accident Surveillance and Analysis System - Transportation System Network (TASAS-TSN).

Some limitations of the ATAIP are that it does not include on/off-ramps or over/under-crossings, facilities that are not visible using aerial imagery (including some Class I facilities if not immediately adjacent to the roadway), and shoulder data (available in TSN). In the future, bicycle and pedestrian asset location and condition data will likely be collected by the Asset Collection Survey that uses LiDAR data to collect a variety

of asset information. However, this contract is not set to begin until late 2020, so the ATAIP was the best tool available to use for bicycle and pedestrian inventory data.

Table 5-81 describes the performance metrics for determining condition of good, fair, and poor Complete Streets (Fix Existing) for bikeways, sidewalks, and crosswalks.

Table 5-81. Complete Streets (Fix Existing) Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Pavement markings and/or colorized treatment show little to no visible wear and are 75- 100% present. Pavement or concrete surface is smooth, free of potholes, and has uniform pavement edges.**
Fair	**Pavement markings and/or colorized treatment show typical wear but is still 50-75% present. Pavement or concrete surface shows some roughness and is not completely uniform, but few to no potholes or irregularities are present.**
Poor	**Pavement markings and/or colorized treatment is less than 50% present. Pavement or concrete surface has major imperfections or irregularities including utility covers not to grade, potholes, etc.**

Inventory and Condition

The SHS is accessible to bicyclists and pedestrians unless explicitly prohibited by signage or other access-control methods. Roughly 23,148 miles of the SHS permit bicyclists and/or pedestrians. Of this, the ATAIP identified 331 miles of existing bikeways, 965 miles of existing sidewalks and 148 miles of existing crosswalks. Condition data was collected as part of the ATAIP effort by each District utilizing Google Earth, GIS, and other imagery.

Table 5-82 below details the total linear feet of Complete Streets (Fix Existing) for bikeways, sidewalks, and crosswalks in Good, Fair and Poor condition, as reported by the Districts for the ATAIP effort.

Table 5-82. Complete Streets (Fix Existing) Inventory and Conditions

Inventory and Conditions					
Objective (unit of measure)	**Inventory**	**Good**	**Fair**	**Poor**	
Complete Streets (Fix Existing) (linear feet)	**7,623,345**	**70.6%**	**22.5%**	**6.9%**	

Performance Targets

Table 5-83 presents the statewide asset performance targets for Complete Streets (Fix Existing), specific to the desired state of repair of existing assets. Rather than provide separate targets for sidewalks, bikeways, and crosswalks, targets have been rolled up into one broader target for Complete Streets (Fix Existing), that combines all three of these assets to allow flexibility for Districts to implement according to their individual needs.

Table 5-83. Complete Streets (Fix Existing) Performance Targets (Desired State of Repair)

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Complete Streets (Fix Existing) (linear feet)	**69.0%**	**29.0%**	**2.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

Unit costs for Complete Streets (Fix Existing) are based on an analysis of historical data comprised of the capital construction and support costs and were calculated using an inventory weighted approach. Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction cost includes work associated with the construction of fixing existing complete streets, traffic handling, mobilization, supplemental work and contingencies.

Typical Treatments

In the Complete Streets (Fix Existing) objective, Fair to Good improvements should be covered by Maintenance Field Crews under the Highway Maintenance (HM) program. This includes routine maintenance work such as sweeping, re-striping, and minor repairs. Poor to Good improvements will be covered under the SHOPP and include major rehabilitative and replacement work to bring existing Complete Streets to a state of good repair.

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Complete Streets (Build New)

Other Assets and Objectives

Overview

It has been a long-term goal of the Department to establish targets for Complete Streets to be able to strategically allocate funding for the development of new bicycle and pedestrian facilities on the SHS.

Beginning with the 2018 SHOPP, Caltrans initiated a more robust data analysis of Complete Streets features, tracking 45 elements, 10 multi-objective activities, and 13 ADA activities. Caltrans also required project managers to indicate whether Complete Streets features were feasible on each project.

With the introduction of the 2021 SHSMP, targets are established for the first time to track progress on the development of new bikeways, sidewalks and crosswalks in the SHOPP in order to advance the Department's goals toward increasing multi-modal transportation.

For more information on Complete Streets and related policies, please refer to the overview in the previous section, Complete Streets (Fix Existing).

Performance Metrics

Estimating the quantities of new Complete Streets needs was based on preliminary data from existing Caltrans Active Transportation (CAT) Plans[41] to predict the needs for walking and biking infrastructure. The CAT plans consider factors such as level of traffic stress (LTS), safety, gaps, and barriers that generate a list of location-based needs used in the analysis. Because the CAT plans are not complete for all 12 Districts, CAT plans from District 4, 5 and 10 were used along with data from the District 4 Bike Plan to generate a percentage of walking and biking needs on the SHS that considered areas not prohibited to bicyclists/pedestrians and where no facilities currently exist. An extrapolation method was then used by applying these percentages identified by the three plans to comparable districts to approximate the number of linear miles of walking and biking needs one would expect to see in each district.

In future iterations of the SHSMP, as more CAT Plans are completed, these targets will be further refined to reflect additional data and other considerations such as public input.

The condition designations for Complete Streets (Build New) needs are based on a deficiency model. Existing deficiencies are designated as poor, while deficiencies that have been addressed are designated as good. The fair designation does not apply in the deficiency model. Table 5-84 describes the performance metrics for Complete Streets (Build New) for bikeways, sidewalks, and crosswalks.

Table 5-84. Complete Streets (Build New) Performance Metrics

Performance Metrics – Bikeways, Sidewalks, Crosswalks	
Condition	**Criteria**
Good	Deficiency has been addressed
Fair	N/A
Poor	Deficient

Inventory of Deficiencies

Table 5-85 details total estimated walking and biking needs for all Districts based on a combination of preliminary CAT Plan data, as well as the extrapolation analysis.

Table 5-85. Complete Streets (Build New) Inventory of Deficiencies

Inventory of Deficiencies					
Objective (unit of measure)	**Inventory**	**Good**	**Fair**	**Poor**	
Complete Streets (Build New) (linear feet)	**24,202,691**	**N/A**	**N/A**	**100.0%**	

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

Performance Targets

Targets were established based on the extrapolated needs analysis detailed in the previous section. They are specific to the development of new sidewalks, crosswalks and bikeways where a facility does not currently exist, as well the re-classification of an asset to a preferred facility (i.e. a Class III facility to a Class II facility, or a standard crosswalk to a high-visibility crosswalk). Rather than provide separate targets for sidewalks, bikeways and crosswalks, performance targets have been rolled up into one broader target for building new Complete Streets to allow greater flexibility for the Districts to implement based on their individual needs.

Table 5-86 presents the statewide asset performance targets for Complete Streets (Build New).

Table 5-86. Complete Streets (Build New) Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Complete Streets (Build New) (linear feet)	**100.0%**	**0.0%**	**0.0%**	

Counting performance toward Complete Streets (Build New) targets is comprised of the following types of asset improvements:

- Sidewalk will be counted as “new” if developed where one does not currently exist. Widening or repair of an existing sidewalk is addressed through Complete Streets (Fix Existing).
- Crosswalk will be counted as “new” if striped in an area without an existing crossing (midblock or intersection), or if an existing standard crosswalk is upgraded to a high-visibility crossing. Targets for crosswalks are specific to striping, but additional crossing enhancements, such as pedestrian signals, are encouraged where needed.
- “New” bikeways include the development of new Class I, Class II, Class II buffered, or Class IV facilities, or the re-classification of a bikeway to a preferred facility (i.e. Class III to Class II). Class III bikeways will not count toward targets in the build new objective but will still be captured by the Asset Management Tool (AMT).
- “Downgrading” a facility to a less-preferred alternative (i.e. Class II to Class III) will not be counted as part of the build-new targets

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions.

Unit costs for Complete Streets (Build New) are based on an analysis of historical data comprised of the capital construction and support cost. Support costs are those associated with engineering and oversight work to design and construct the project. The estimated capital construction cost includes work associated with the construction of new complete streets, traffic handling, mobilization, supplemental work and contingencies.

Typical Treatments

The Complete Streets (Build New) objective includes the development of any new sidewalks, bikeways or crosswalks. This includes any project where there wasn't already an existing asset, or reclassification, such as converting a bikeway to a preferred classification (i.e. Class III to Class II) or replacing an existing crosswalk with high visibility striping.

5.5 Multimodal Network

Goal: Enhance and Connect the Multimodal Transportation Network

A connected and efficient multimodal transportation network maximizes use of the existing system while diversifying mode choice for users, providing more reliable travel times, and minimizing delay associated with congestion. As available funding programs for the maintenance, rehabilitation and replacement of transportation assets prohibit the expansion of the highway system lanes, the state's priorities have shifted away from adding new highway lanes to making the most efficient use of the existing system and diversifying mode choice.

This strategic goal focuses the department's efforts to:

- Use operational strategies and incentives to reduce vehicle miles traveled (VMT) through increased high occupancy modes, active transportation, and other Transportation Demand Management (TDM) methods.
- Improve network operations and invest in networks for walking, cycling, transit, and multimodal trips.
- Better utilize technology and data to create a seamless multimodal travel experience and improve travel demand management.
- Optimize and expand equitable pricing.

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Operational Improvements

Other Assets and Objectives

Overview

The Operational Improvement objective includes projects which reduce highway user delay by delivering improvements that alleviate localized congestion on the SHS. Projects tend to be low-cost, high benefit investments for a corridor. Delay is typically calculated by summing the amount of time vehicles spend below 60 mph on monitored freeway sections of the SHS.

In addition to the typical low-cost operational improvements such as adding an auxiliary lane to improve weaving operations, there is a full set of system management and operational strategies to maintain and even restore the performance of the existing transportation system before extra capacity is needed. This set of strategies is called the Transportation System Management and Operations (TSMO) as defined by the Federal Highway Administration (FHWA). TSMO focuses on getting the most performance out of the transportation facilities we already have. TSMO strategies may include, but not limited to work zone management, traffic incident management, special event management, road weather management, transit management, freight management, traffic signal coordination, traveler information, ramp management, congestion pricing, active transportation and demand management, integrated corridor management, access management, improved bicycle and pedestrian crossings, connected and automated vehicle deployment. TSMO strategies deliver system improvement not only in terms of delay reduction, but also in terms of safety, reliability and sustainability benefits.

Performance Metrics

Operational Improvements use a deficiency model and a performance metric of Daily Vehicle Hours of Delay (DVHD). A deficiency of DVHD that still exists and has not improved is designated as poor, while DVHD that have been improved are designated as good. The fair designation does not apply in the deficiency model.

Table 5-87 describes the performance metrics for determining good, fair, and poor operational improvements.

Table 5-87. Operational Improvements Performance Metrics

Performance Metrics	
Condition	**Criteria**
Good	**Daily Vehicle Hours of Delay Deficiency has been improved**
Fair	**N/A**
Poor	**Daily Vehicle Hours of Delay Deficiency has not been improved**

Inventory of Deficiencies

The current transportation system deficiency or need for the nine districts that have automated detection on freeway portions of the SHS reporting to Caltrans' Performance Measurement System (PeMS) is based on data reported in the first quarter Mobility Performance Report (MPR) of 2020. For the three Caltrans' districts that do not have automated detection reporting to PeMS (Districts 1, 2, and 9) the current transportation system deficiency or need is based on traffic volumes that are obtained from a variety of sources; primarily from Traffic Census detection. The method for measuring transportation system deficiency or need using PeMS represents delay only on freeway portions of the SHS where automated detection has been installed. This method excludes delay occurring on conventional highway facilities and on freeway segments where automated freeway detection has not been installed.

The deficiency is presented in terms of DVHD: the average weekday amount of time vehicles spend below 60 mph on the SHS. DVHD is further broken down by vehicle speed under two operating conditions. The first condition is delay that occurs over 35 mph and under 60 mph. Under this condition, while vehicles are delayed and operating at slower than 60 mph speeds; traffic flow is generally constant, with few rapid fluctuations in speed. The second condition is severe delay, or delay that occurs at or under 35 mph. Severe delay occurs when there is greater demand than available capacity, and is characterized by frequent fluctuations in vehicle speeds, including 0 mph or stop conditions. This roadway condition is colloquially referred to as "stop-and-go" traffic. The sum of both conditions is the total DVHD under 60 mph.

In the future, the deficiency of all modes including cars, trucks, transit, bicyclists, pedestrians and other modes will be defined and evaluated, expanding the system performance and improvement consideration to be a multimodal one.

The deficiency of Operational Improvements, as of March 2020, is presented in Table 5-88.

Table 5-88. Operational Improvements (DVHD) Inventory of Deficiencies

Inventory of Deficiencies					
Objective (unit of measure)	Inventory	Good	Fair	Poor	
Total	**1,367,097**	**0.0%**	**N/A**	**100.0%**	
Operational Improvements (Delay under 60 mph and over 35 mph)	**954,577**	**0.0%**	**N/A**	**69.8%**	
Operational Improvements (Severe delay under 35 mph)	**412,520**	**0.0%**	**N/A**	**30.2%**	

Performance Targets

Caltrans has established a goal to improve the deficient condition (DVHD hours) by 10 percent, or approximately one percent annually over 10-years. Table 5-89 presents the statewide asset performance targets for Operational Improvements.

Table 5-89. Operational Improvements Performance Targets

Desired State of Repair				
Objective (unit of measure)	Good	Fair	Poor	
Operational Improvements (DVHD)	**10.0%**	**N/A**	**90.0%**	

Other Performance Management Parameters

Several other parameters are required in the performance management analysis. These may include key performance measure deterioration rates, capital and support unit costs, SHOPP, and potentially maintenance and other contributions. Operational improvements are based on existing data and estimated project improvements resulting from traffic analyses and engineering judgment. During times of economic growth, demand on the State's transportation system typically increases, while during times of economic decline, demand on the State's transportation system decreases. California's economy has experienced growth over the past several years and an analysis of existing traffic data indicates that for each of the past two-years, DVHD on the State Freeway System has increased five and six percent respectively. It is anticipated that fluctuations in the State's economy will continue to impact DVHD over the 10-year Plan period of the SHSMP, therefore a more modest two to three percent annual growth rate in DVHD is forecast

over the 10 years. The unit cost estimate is based on the capital costs of the SHOPP Operational Improvement projects programmed in the adopted 2018 SHOPP divided by the total DVHD reduction associated with the programmed projects. This cost includes work for the construction of operational improvements, traffic handling, mobilization, supplemental work, and contingencies.

Typical Treatments

Operational Improvement projects improve transportation system performance on the SHS by reducing delay and operational deficiencies and improve the reliability and efficiency of people and goods movement. Reduced congestion and delay improve safety, the environment and livability and facilitate economic development. The SHOPP funds projects to accomplish these goals through typical treatments such as traffic monitoring system improvement, ramp metering, traffic management and control strategies such as signal coordination, auxiliary lane construction, roundabout construction, widening of on/off-ramps or shoulders, improvements of lane/shoulder/turning radius dimensions for trucks, installation or extension of acceleration or turn lanes, and alteration of High Occupancy Vehicle (HOV) lane access configuration. With the fast development and deployment of Connected and Autonomous Vehicle (CAV) and Vehicle-to-Everything (V2X) technologies, transportation system performance may see unprecedented improvement when these technologies become typical treatments in the future.

5.6 Cross-Cutting

Goal: Achieve multiple strategic goals

While the primary focus of the SHSMP is to maintain the condition and safety of the SHS, Caltrans also considers other key cross-cutting focus areas identified throughout Caltrans policies and guidance and includes them in appropriate projects carried out through the Program Objectives. These cross-cutting focus areas are considered and included at the project level, where feasible, and help Caltrans achieve broader strategic goals. Cross-cutting focus areas include:

- Advance Mitigation
- Environmental Stewardship
- Freight Mobility

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Advance Mitigation

Cross Cutting

Overview

The Advance Mitigation objective was established in the 2017 SHSMP as a Reservation Model performance objective. Beginning with the 2019 SHSMP and continuing in the 2021 SHSMP, programming new stand-alone advance mitigation projects may be allowed to provide for early implementation of anticipated mitigation requirements associated with SHOPP transportation projects. Neither a separate reserve nor performance objective has been set.

Advance Mitigation, funded by the Advance Mitigation Account established by SB 1, will be eligible for use by SHOPP projects if they fully reimburse the Advance Mitigation Program. The SB 1 program manages mitigation efforts that include developing stand-alone compensatory mitigation projects that help to ensure the right type and quantity of environmental mitigation are available for future transportation projects, in advance of funding those projects.

Currently, the statutory requirement for compensatory mitigation due to unavoidable impacts to jurisdictional resources can significantly increase the uncertainty related to a project's scope, schedule, and cost. However, having available mitigation reserves in place reduces the risk to a transportation project's cost and schedule, and reduces project delays.

The means to implement advance mitigation includes, but is not limited to:

- Conservation or mitigation banks (either by creating new banks or through bulk credit purchases from existing banks)
- In-lieu fee programs (either by creating new in-lieu fee programs or through bulk credit purchases from existing in-lieu fee programs)
- Contributions/fees to Habitat Conservation Plans or Natural Communities Conservation Plans
- Identified activities in Regional Conservation Investment Strategies that yield Mitigation Credit Agreements or permittee responsible mitigation (i.e., mitigation on public or private lands including restoration property acquisitions and transfers with conservation easements or deed restrictions)

Planning for the advance mitigation goal is based on the acreage of estimated potential compensatory mitigation need for the future transportation projects in the SHSMP. The estimated need is informed by long range plans and mitigation needs assessments. The magnitude of the need is dependent on project delivery mitigation requirements that can use credits developed through this program.

Environmental Stewardship

Cross Cutting

Overview

Caltrans facilitates transportation for the people of California while striving to minimize the environmental harm and integrating the transportation system into California's environment. Caltrans seeks opportunities to incorporate environmental enhancements into its roadway improvement projects. Such opportunities may include, but are not limited to, green infrastructure; remediating fish passage barriers; historic architectural elements to bridges; or enlarging culverts to make the State's highways more permeable to wildlife. Many environmental resources and laws are considered during the project delivery process. However, Caltrans is striving to consider environmental factors earlier in the project planning and nomination processes through more informed decision making and earlier coordination with state and federal resource agencies. Several cross-cutting objectives in the environmental stewardship category would benefit from early, multidisciplinary consideration before projects are scoped and programmed.

Fish Passage

Culverts and bridges over waterways can alter the natural streambed elevation over time. Caltrans has identified a number of locations where transportation facilities are limiting the natural migration of certain fish species. When working on these facilities, Caltrans is required to eliminate fish migration barriers. These activities are eligible for SHOPP funding as part of any rehabilitation or replacement project. The 2021 SHSMP introduces a performance objective to specifically address priority fish passage needs.

Wildlife Crossings

Larger mammals attempting to cross highways, railroad tracks, or other similar transportation facilities may pose a safety risk to vehicle operators and the animals. Constructing wildlife crossings may be appropriate in cases where the potential for impact with horses, bears, deer, or other large animals pose an above average safety risk to the driving public. Additionally, improving SHS permeability and providing crossing opportunities for other wildlife, particularly threatened and endangered species, is good environmental stewardship and is aligned with the Caltrans Strategic Plan, the FAST Act, and state and federal environmental laws. Constructing wildlife connectivity into transportation projects can benefit project delivery by reducing permitting timelines and offsite mitigation requirements. Additionally, it is good practice to avoid new impacts to wildlife connectivity and migration by favoring the installation of more permeable infrastructure, such as selecting Midwest Guardrail System over concrete median barriers or incorporating crossing features when a roadway is being widened or a new facility is being constructed. Careful consideration should be given to projects located in rural areas, along streams and rivers, and areas with open space. Project features that promote safe wildlife passage can include directional fencing to

existing bridges and culverts; escape ramps; larger culverts; longer bridges that fully span a waterway; large overpasses; animal detection and warning systems.

SR-58 Wildlife Crossing installed specifically for desert tortoises to offset impacts for the Realignment and Widening of SR 58 in San Bernardino County

Other Environmental Stewardship Activities

Caltrans also strives to avoid environmental impacts by considering the natural environment during project planning. Examples of good environmental stewardship include siting projects to avoid and minimize impacts to environmental resources, avoiding wetlands, sites with hazardous waste or contamination issues, threatened and endangered species, cultural sites, historic architectural elements to bridges, tribal lands, and others. Caltrans recommends including environmental planners on all project planning teams to facilitate the identification of environmental features along a corridor and recommend strategies to avoid these resources while implementing planned projects.

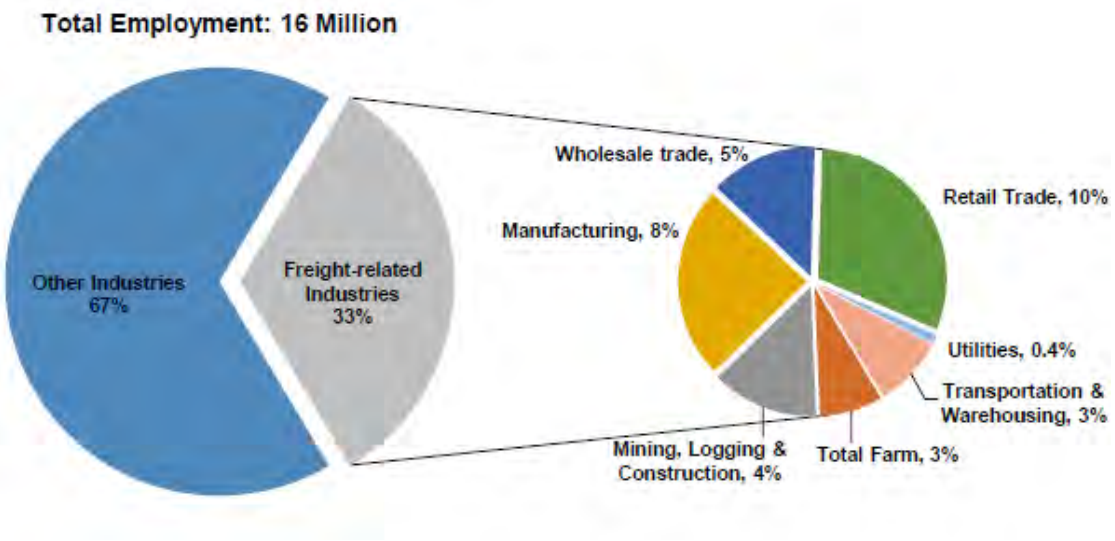
Freight

Cross Cutting

Overview

Caltrans uses a variety of programs to improve freight mobility. Several SHSMP objectives address freight needs, for example improving vertical clearance of bridges, building truck climbing lanes, and reducing wear and tear on truck components through pavement improvements.

California is currently the nation's largest gateway for international trade and domestic commerce. As shown in Figure 5-10, freight-related industries accounted for more than 5 million jobs in 2014.



Data source: State of California Employment Development Department, Labor Market Information Division

Figure 5-10. California Industry Employment Composition, 2014

California's freight transportation vision is reflected in the California Freight Mobility Plan (CFMP)[42] completed in 2020. Table 5-90 presents the Freight Mobility Plan 2020 Goals.

[42] Caltrans, "California Freight Mobility Plan", 2020, https://dot.ca.gov/programs/transportation-planning/freight-planning/cfac/cfmp-2020

Table 5-90. Freight Mobility Plan 2020 Goals

California Freight Mobility Plan 2020 Goals	
Goal	**Description**
Multimodal Mobility	Strategic investments to maintain, enhance, and modernize the multimodal freight transportation system to optimize integrated network efficiency, improve travel time reliability, and to achieve congestion reduction.
Economic Prosperity	Grow the economic competitiveness of California's freight sector through increased system efficiency, productivity, and workforce preparation.
Environmental Stewardship	Support strategies that reduce, avoid, and/or mitigate adverse environmental impacts from the freight transportation system.
Healthy Communities	Enhance community health and well-being by mitigating the negative impacts of the goods movement system across California's communities.
Safety and Resiliency	Reduce freight-related deaths/injuries and improve system resilience by addressing infrastructure vulnerabilities associated with security threats, effects of climate change impacts, and natural disasters.
Asset Management	Maintain and preserve infrastructure assets using cost beneficial treatment as indicated in the State Highway System Management Plan (SHSMP), per the federal FAST Act, California Streets and Highway Code §164.6, Caltrans Director's Policy 35 Transportation Asset Management (DP35), and other applicable state and federal statutes and regulations.
Connectivity and Accessibility	Provide transportation choices and improve system connectivity for all freight modes.

The CFMP is updated every five years, as required by federal and state law. The FAST Act transforms the National Freight Policy provisions of MAP-21 into a new program that funds freight-related projects. It authorizes a five-year total of $6.2 billion for the program nationwide. The FAST Act created two new freight programs: (1) NHFP and (2) FASTLANE Grants. FAST Act requires the CFMP to include a Freight Investment Plan (FIP), which is the list of projects as adopted by the Trade Corridor Enhancement Program (TCEP) which combined the SB 1 TCEP with NHFP. Caltrans is working closely with all regional agencies, under the direction of California State Transportation Agency (CalSTA) to develop the FIP. These projects are required to align with the federally designated National Highway Freight Network (including the Critical Urban and Rural Freight Corridors to be cooperatively designated by Caltrans and Metropolitan Planning Organizations (MPOs)). The FIP will aid Caltrans in meeting the goals and objectives that guide the CFMP.

Complementing the CFMP is the interagency California Sustainable Freight Action Plan (CSFAP)[43] published in July 2016. The CSFAP includes a long-term 2050 vision and guiding principles for California's future freight transport system along with targets for 2030. The objectives of the plan are laid out in Governor's Executive Order B-32-15, which seeks to improve freight efficiency, transition to zero-emission technologies, and increase competitiveness of California's freight system. California freight transport system's transition to

[43]California Sustainable Freight Action Plan, https://dot.ca.gov/programs/transportation-planning/freight-planning/california-sustainable-freight-action-plan

zero emission technologies is essential to support the state's economic development in coming decades, while reducing harmful pollution that impacts many California communities.

In collaboration with CalSTA, Caltrans established the California Freight Advisory Committee (CFAC) in response to guidance provided in MAP-21. The CFAC consists of cross-section representatives from public and private sectors freight stakeholders, including representatives of ports, shippers, carriers, freight-related associations, the freight industry workforce, Caltrans, and local governments. The CFAC is a platform for freight industry leaders to share and provide input for local, regional, state, and national freight initiatives.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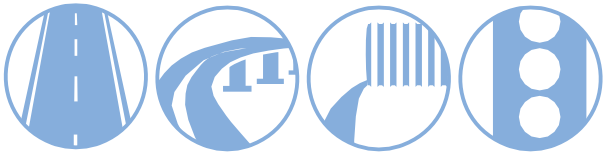


6 Life Cycle Planning Strategies

The basis of Life Cycle Planning (LCP) is doing the right treatment at the right time, while minimizing cost.

LCP is the process to estimate the cost of an asset over its whole life while preserving or improving condition at optimum time and cost. Cost effective investment strategies consider the whole life cycle of an asset and are critical in managing transportation assets across the entire transportation system.

In the development of performance and risk-based asset management plans, LCP guides the development of investment strategies by using asset condition data, deterioration rates, and treatment options to determine the most cost-effective approach to achieve the Desired State of Repair (DSOR) and sustain Caltrans investment in transportation assets. LCP is critical for achieving the lowest practical cost for improving and preserving the transportation system.

6.1 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 of individual assets as an implementation strategy for life cycle planning (LCP) which includes evaluating multiple assets and its impact to system-wide performance. An LCP is a strategy for managing an asset over its life to achieve a target level of performance while minimizing life cycle costs.

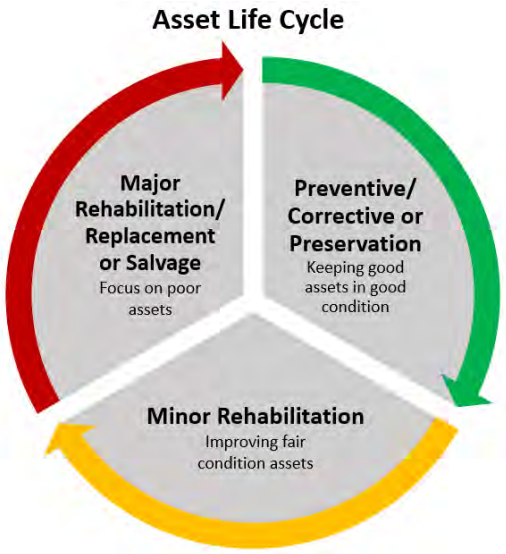


Figure 6-1. Asset Life Cycle

Life Cycle Planning vs. Life Cycle Cost Analysis

LCP focuses on general network-level asset management strategies, that is, the best sequence of maintenance and rehabilitation treatments for a given asset type. Figure 6-1 describes Caltrans' Asset Life Cycle, which begins with the asset's initial construction through maintenance, preservation, repair, rehabilitation, reconstruction, replacement, or removal. Figure 6-2 provides a more detailed look at LCP for pavements. 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 while maintaining or even extending the life of the asset. 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."[44] LCCA can be used 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 cost over the life cycle.

Typical Asphalt Pavement Life Cycle Planning Treatments to Extend the Life of Assets

Primary Asset	Preservation	Minor Rehabilitation	Major Rehabilitation or Replacement
• Pavements	• Seal Coat • Crack Seal • Dig-out	• Capital Preventive Maintenance • Medium Overlay	• Thick Overlay • Full Depth Reclamation • New Construction

Figure 6-2. Typical Asphalt Pavement Life Cycle Planning Treatments

[44] Asset Management Plan Definitions. 23 CFR § 515.5. October 24, 2016, https://www.federalregister.gov/documents/2016/10/24/2016-25117/asset-management-plans-and-periodic-evaluations-of-facilities-repeatedly-requiring-repair-and

Life Cycle Planning Modeling

LCP should be based on a good understanding of the costs and life spans of different types of treatments. It involves use of predictive models for how assets will deteriorate depending on the different types of treatments selected. Ideally, these models are developed based on several years of data on effectiveness and longevity of the applied treatments and the resulting measured condition.

In practice, LCP models are typically based on a combination of data and expert judgment. The Director's Office of Asset Management worked with Caltrans Headquarters Program Managers and Caltrans district staff to update and verify the following elements needed for a network level LCP process in this SHSMP:

- Identification of deterioration models
- Potential work types, including treatment options and unit costs
- Strategies for minimizing life cycle costs and achieving performance targets
- Asset performance targets

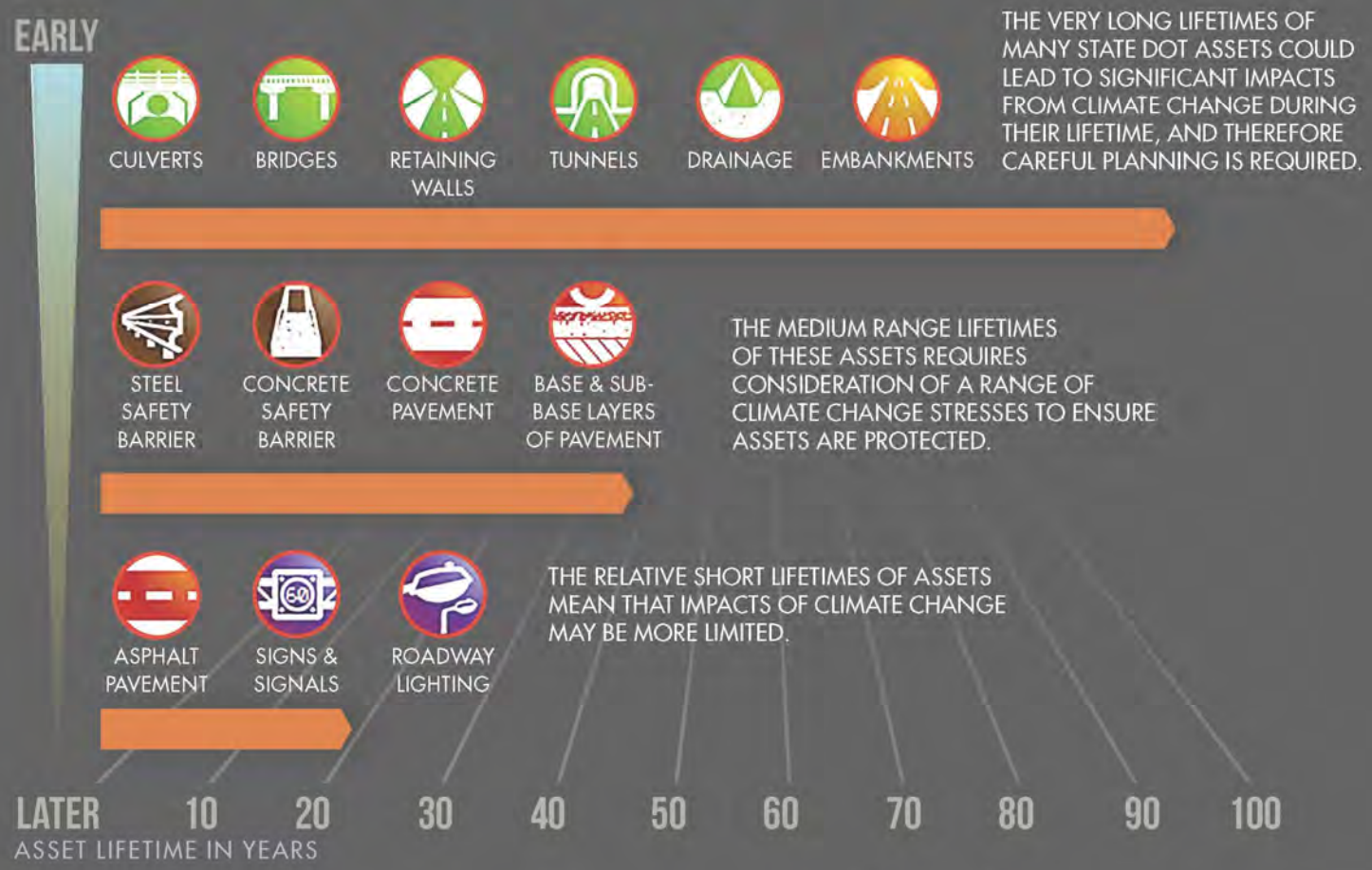
Factors to Consider in Life Cycle Planning

LCP is intended to help achieve asset performance targets. District Performance Plans, as described in Section 4.2, guide districts to achieve target expectations within the budget constraints. They articulate how districts will incorporate life cycle planning to minimize long term costs of asset ownership and document the decision-making process relative to less expensive short-term repairs versus more expensive long-term fixes. In addition, Life Cycle Plans would be developed by Program Managers in HQ that would lay out sound policies to assist districts in minimizing the life cycle cost of their assets. Furthering this effort, LCCA would be ideally implemented across all performance objectives to improve upon the procedures already in place.

Early identification of changes in traffic demand, environmental conditions including extreme weather events, climate change, and seismic activity are also important aspects of any LCP. Vulnerability assessments provide an evaluation of the asset's risk to these types of exposures. Figure 6-3, from the vulnerability assessments, presents how they can be used for managing pavements. The figure identifies various roadway assets and how planning and designing for uncertainties are impacted by asset life spans. In the case of pavements, it shows that climate change could affect pavement climate zones influencing pavement design and treatment decisions.

Figure 6-4 presents the LCP development considerations.

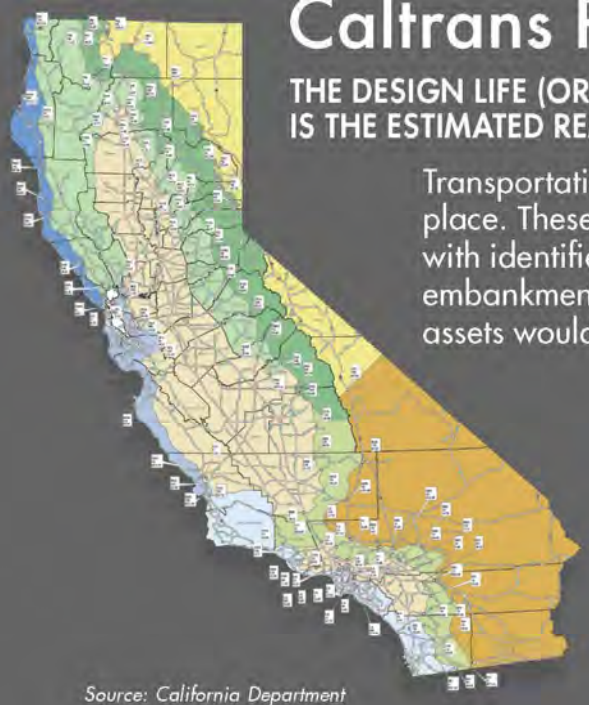
Timeframe for Decision-Making - Planning/Designing to Uncertainties



Caltrans Pavement Regions

THE DESIGN LIFE (OR "USEFUL LIFE") OF TRANSPORTATION INFRASTRUCTURE IS THE ESTIMATED REMAINING TIME THAT AN ASSET WILL BE IN SERVICE.

Transportation assets have differing periods of useful life once put in place. These timeframes should be a factor when planning in areas with identified climate change concerns. Roadway alignments and embankments could be in place for a century or beyond, while other assets would have a less or much less useful life.



Source: California Department of Transportation

- North Coast
- Central Coast
- Inland Valley
- Low Mountain
- High Mountain
- Desert
- High Desert
- South Coast
- South Mountain

Note: Markers indicate County/Route/Post Mile of State Hwys. at region boundaries. When there is no marker, the region follows a county boundary.

Figure 6-3. Pavement Climate Zone Uncertainties

Life Cycle Plan Development Considerations

IN DEVELOPING A LIFE CYCLE PLAN, ONE SHOULD CONSIDER THE FOLLOWING QUESTIONS:

- How is the life-cycle cost of an asset impacted by using more frequent maintenance activities over the assets' life span versus doing a full rehabilitation at optimum time?
- What is the remaining service life (RSL) of a bridge and when should the RSL be considered for replacing a bridge due to sea level rise?
- Is there redundancy built into the transportation system? Are there regions and routes that need to have systematic treatments to maintain an assets' condition over the typical and standard treatments due to safety, climate change or other risks?
- Are we making the right investment decision to rehabilitate all lanes of a highway irrespective of their condition instead of lane by lane treatments based on their condition? What about other strategies that could be implemented to reduce cost?
- What impacts and risks can be identified at the corridor and network level that would provide for better asset management and life-cycle decisions?

Figure 6-4. Life Cycle Plan Development Considerations

Life Cycle Planning Maturity

The results of a Caltrans completed self-assessment of LCP maturity for the California TAMP are shown in Figure 6-5. Caltrans has been able to improve the maturity of LCP by requiring District Performance Plans and by identifying additional strategies, such as development of Program LCPs and the use of LCCA for all performance objectives.

The primary elements of the LCP Maturity Model are described below:

LEVEL 1

Single Asset Based Needs include the inventory and condition assessment of a single asset over the useful life of the asset, considering the cost of the treatment and deterioration that occurs over time.

LEVEL 2

Project Level LCCA includes performing a project-level LCCA compliant with environmental, economic, and legislative requirements that considers treatments evaluated over an analysis period, taking into account traffic and user costs. A strong LCCA policy would be strategically implemented across all assets and programs.

LEVEL 3

Corridor LCP includes elements of Level 2, but includes a strong LCP Policy that will focus on improving and preserving major corridors and Strategic Highway Network (STRAHNET) routes. Investment strategies are considered for long-term asset investment needs and maximize performance with constrained funding. At this level, multi-asset investment decisions are incorporated, and performance gaps are eliminated. Internal and external stakeholders are emphasized. Reducing the annual cost of preservation through more research and innovated practices is prevalent and risk sharing is stressed between public and private sector.

LEVEL 4

Network Level LCP includes Level 2 and 3 elements, considering long-term focus on improving and preserving the system and network conditions achieved through different levels of funding where conditions are optimized with multi-asset investment. Improvements to policy through research and partnerships are emphasized.

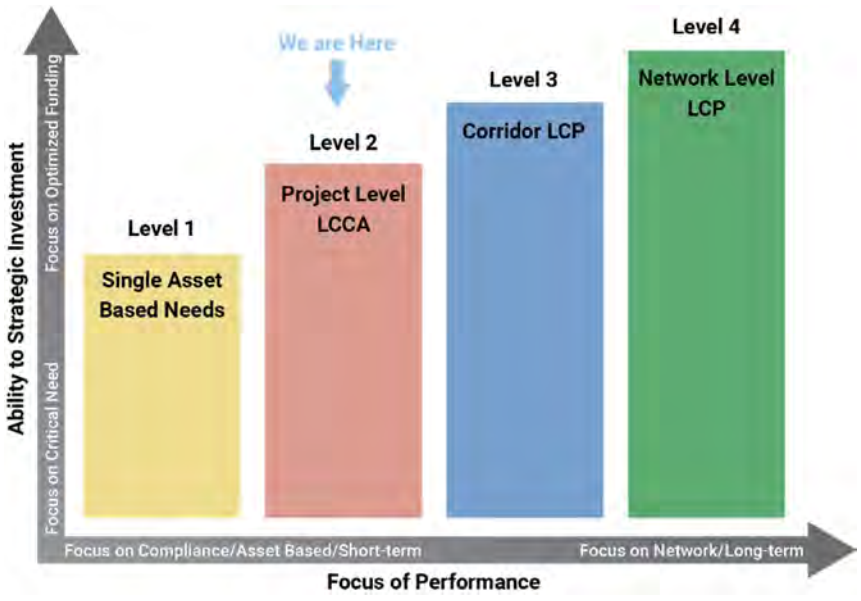


Figure 6-5. Life Cycle Planning Maturity Model

6.2 Cost Effectiveness

California Government Code requires Caltrans to identify strategies to control costs associated with the SHS maintenance. Figure 6-6 identifies a number of strategies being used in the SHOPP or the Maintenance Program for each asset class:

Pavements

- Improve effectiveness of pavement projects through detailed selection of project limits and treatment combinations.
- Perform life cycle cost analysis in design.
- Use appropriate 3 to 20-year cycle of preservation treatments.
- Recycled materials to reduce the impact on new materials and the environment while maintaining the same or better performance.

Bridges

- Select new materials that last longer and are easier to apply.
- Establish policies to ensure that new projects are built with cost-effective and easily maintained elements.
- Implement accelerated bridge construction (ABC) techniques where appropriate to minimize the impact of the construction on the traveling public.

Culverts

- Use remote controlled cameras and equipment for culvert inspections to reduce worker exposure.
- Clean ditches and culverts on an annual basis to prolong the service life of the culverts.
- Use trenchless culvert replacement and lining techniques to help minimize disruptions to the ground surface and the infrastructure above it.

Transportation Management Systems

- Execute on-call service contracts to supplement state forces which help to minimize administrative costs.
- Implement Trouble Ticket system to ensure problems are reported as expeditiously as possible, and minimizes inaccurate trouble reporting, and duplication of efforts.

Figure 6-6. Cost Effective Strategies Used in the SHOPP and Maintenance Programs for Maintaining the SHS

6.3 Incorporating Life Cycle Planning into Asset Management Practices

An overall framework was established during development of the 2021 SHSMP for collecting the major components and building blocks for a more comprehensive cost-effective approach in the management of transportation assets at the network level. This framework aligns with both federal asset management guidelines on life cycle planning and the Commission requirement to define the life spans of a project included in the SHOPP. Looking forward, it will be utilized for development of the upcoming enterprise Transportation Asset Management System (TAMS) for optimizing the scope and delivery of projects.

These building blocks include the treatments or type of work to maintain and improve condition of the assets, unit costs of the treatments and their life spans, and the amount of work that is being accomplished through different funding streams. In working across multiple objectives of the SHSMP, the following example of the building blocks for life cycle planning were collected as shown in Table 6-1.

Table 6-1. Example of the building blocks for life cycle planning

Drainage Restoration SHOPP and Maintenance Unit Costs by Treatment/Work Type for Inland Valley Region										
	SHOPP				Maintenance				Service Life (Years)	
Treatment/Work Type	Poor Split	Fair Split	Unit Cost/LF	Percent Used	Poor Split	Fair Split	Unit Cost/LF	Percent Used	Min	Max
Replace or Install Culvert	58%	42%	$1,610	85%	68%	32%	$1,033	83%	50	60
Cure-in-Place Culvert Liner	59%	41%	$1,159	12%	69%	32%	$603	11%	40	50
Slip Line Culvert	100%	0%	$1,159	4%	$0	78%	$613	6%	40	50

In a current white paper produced by FHWA's Asset Management Expert Task Group on life cycle planning, agencies should consider a continuous improvement process to maximize the benefits of life cycle planning. For example, during each SHSMP cycle, review of the treatment selections, timing of treatments, allocation of funds, and the delivery of projects should be reviewed to slow down deterioration and prevent a worst-first approach to the preservation of assets. Focusing not only on short-term conditions but forecasting to understand whether current plans will result in long-term performance and conditions to achieve agency objectives and performance goals.

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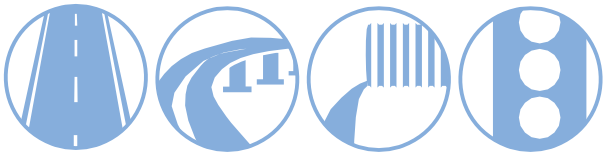

7 Risk Management

Risk management strengthens life cycle planning and asset management by explicitly recognizing that any objective faces uncertainty and by identifying strategies to reduce either uncertainty or its effects, it will lead to better decision making.

Being proactive rather than reactive in managing risk, and avoiding “management by crisis,” helps Caltrans to best use available resources to address, minimize, and respond to risk thereby increasing public trust.

7.1 Major Transportation System Risks

Caltrans manages a variety of risks such as enterprise risks, information technology risks, emergency and safety risks, but in developing asset management plans, only certain risks are associated with asset and system performance management. The following risks were identified as part of an initial risk register for the 2018 TAMP.

Asset and System Performance Risks

- Consistency and reliability of state and federal revenues over the plan period
- Construction inflation which can increase costs and reduce buying power
- Reliable project delivery
- Natural events such as floods, fires, and earthquakes, and the negative impacts of climate change
- Lack of asset management maturity
- Changing priorities that drive investment and project decision making
- Incomplete inventory and condition assessment of assets,
- Availability and quality of data, models, and information

A risk register is a simple spreadsheet or matrix that summarizes an organization's risks, shows how they are analyzed, and records how they will be managed. This assessment will prioritize which of these risks can be mitigated through risk mitigation strategies.

	Likelihood Rating				
Aggregate Impact (actions across all impact types)	**Rare**	**Unlikely**	**Possible**	**Likely**	**Very Likely**
Very Significant	M	M	H	VH	VH
Major	L	M	M	H	VH
Moderate	L	M	M	M	H
Minor	L	L	L	M	M
Insignificant	L	L	L	L	M
L: Low; M: Medium; H: High; VH: Very High					

Figure 7-1. Risk Assessment Model

Prioritizing Caltrans' risks also includes reviewing the likelihood and significance of the risks and groups the risks into low, medium, high, and very high categories, similar to Figure 7-1, which is based on the National Cooperative Highway Research Project 08-93, "Managing Risk Across the Enterprise: A Guidebook for State Departments of Transportation"[45].

A significant challenge for Caltrans is the uncertainty of changing climate and rising seas that pose numerous risks to the transportation network. These impacts along with others could have a cascading effect, including increased erosion rates, exacerbated bridge scour, intensified and enlarged geo-hazards, expanded areas vulnerable to flooding, and impacts due to wildfires. The costs associated with these risks have the potential to consume a constrained transportation budget through significant mitigation, relocation, resilience, and reconstruction costs and therefore need to be included in asset management policies and process.

7.2 Incorporating Risk into Asset Management Practices

Caltrans has completed vulnerability assessments for all 12 Districts. These reports identify vulnerabilities and assess the impacts and risk to the SHS[46] related to climate change. The vulnerability assessment process proposed in these reports is presented in Figure 7-2. It was developed to help guide future planning and programming processes. It outlines actions to be taken to achieve long-term highway system resiliency.

Figure 7-2. Vulnerability Assessment Process

Building from the vulnerability assessments, the Division of Transportation Planning has work underway to develop Adaptation Priorities Reports for each of the districts. These studies pick up where the vulnerability assessments left off and considers the implications of the impacts on Caltrans and the traveling public, so

[45] National Cooperative Highway Research Project 08-93, "Managing Risk Across the Enterprise: A Guidebook for State Departments of Transportation", 2016, http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3635
[46] 2019 Climate Change Vulnerability Assessments, https://dot.ca.gov/programs/transportation-planning/2019-climate-change-vulnerability-assessments

that facilities with the greatest potential risk receive the highest priority for adaptation. Once completed, these reports will help inform investment decision-making and prioritization.

The SHSMP has been expanded to capture risks and vulnerabilities associated with sea level rise. While this is a significant step forward to strengthen consideration of risks in asset management practices, there remains a need for a systematic approach to prioritize various statewide risks and vulnerabilities across multiple assets for the selection of projects and for investment planning purposes. An on-going research project to establish a statewide risk scale is being developed that will consider factors such as asset vulnerabilities to a given risk and risk tolerance. It will also consider the consequences of risks such as traffic detours associated with bridge closures. The outcome of this research is expected to provide not only a methodology for a statewide risk scale but will identify vulnerability gaps that need to be considered.

Federal regulation 23 CFR part 667 requires State DOTs to perform periodic evaluations of facilities repeatedly requiring repair and reconstruction due to emergency events and consider alternatives to partially or fully mitigate the root cause of the damage. The Protective Betterment objective is improved under this plan to align with this federal rule and focus on the location of assets repeatedly damaged and to scope projects to mitigate the risk of recurring damage. Recent guidelines for the program have been developed that provide further details on eligible work and a method for the Districts to prioritize protective betterment projects.

Moving forward, asset management practices will continue to adapt and more fully incorporate risk and life cycle planning methods. As availability and quality of data become available, and models and analysis methods mature, an improved risk-based asset management process will be achieved.

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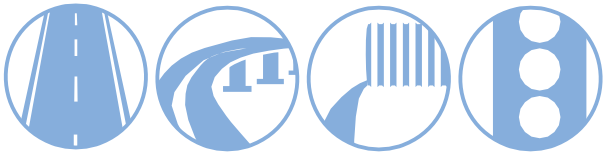

8 Conclusion

The SHSMP presents a performance driven and integrated management plan for the SHS that considers needs, investments, and resulting performance projections for the 10-year period spanning July 2021 – June 2031. The SHSMP builds from the Caltrans 2020-24 Strategic Plan to align California's investments in transportation infrastructure with strategic goals, while addressing state and federal requirements. The Plan expands upon a framework introduced in 2017 and strengthens integration with the 2018 California TAMP.

The SHSMP implements a performance-based asset management approach comprised of several key analysis steps. These steps include defining the inventory and condition of assets, establishing condition targets, determining the magnitude of condition gaps, developing cost estimates to close the gaps to determine needs, and producing a constrained investment plan.

The Needs Assessment provides a comprehensive picture of the total needs on the SHS, unconstrained by currently available funding. The majority of the SHS needs is determined through a gap analysis, considering projected asset condition, project work underway, and performance targets. The 10-year Major and Minor SHOPP need for the 2021 SHSMP is estimated at $109.9 billion, an increase of about 32 percent from the prior 2019 SHSMP. Maintenance needs constitute $6.4 billion over the 10-year Plan period. Combined, the total SHOPP and Maintenance needs are estimated to be $116.3 billion.

The SHSMP presents an Investment Plan that defines the distribution of available funding from the SHA and the RMRA established in 2017 through SB 1. These accounts are used to fund maintenance, operations, and capital projects including asset management-related activities. The SHOPP and the HM jointly fund maintenance, preservation, rehabilitation, and replacement projects; all are intended to maintain or improve asset condition. The SHOPP is the single largest funding source available to address rehabilitation needs on the SHS. The SHOPP Investment Plan, including the Minor Program, is approximately $49.3 billion over the 10-year Plan period.

Maintenance and SHOPP funds are committed to treatments and strategies that extend the service life of existing assets. In the SHSMP, over 80 percent of available SHOPP funding is focused on stewardship and fixing the existing transportation system. The SHSMP fully implements the performance management

requirements of MAP-21 and the FAST Act. This strategic way of looking at performance-based infrastructure management has resulted in a plan that is consistent in approach across assets and deficiencies in addition to being fully transparent in its analysis. The performance management approach implemented in this Plan supports the ongoing implementation of Transportation Asset Management in California. Together, these pieces along with others are building the structure for sound asset management of the state highway system in California.


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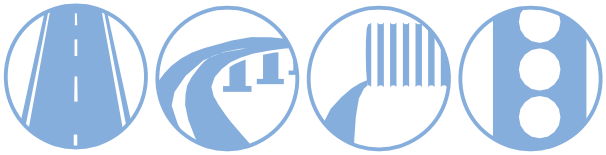

Appendices

Appendix A: Statutory Requirements

The State Highway System Management Plan incorporates guidance from many sources. The Appendix includes summaries or links to the most influential guiding documents for preparing the SHSMP. It lists federal and state legislation, including Senate Bills 1 and 486, and the Commission TAMP Guidelines and Actions which directed the state specific aspects of the Plan.

Americans with Disabilities Act (ADA)

Governs accessibility services and facility requirements for individuals with disabilities.

42 U.S.C. Section 12101 et seq.
http://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title42-section12101&num=0&edition=prelim

California Endangered Species Act (CESA)

Protects and preserves all native species threatened by extinction or experiencing a significant decline which, if not halted, would lead to a threatened or endangered designation.

Fish and Game Code sections 2050-2068
http://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=FGC&division=3.&title=&part=&chapter=1.5.&article=1.

California Environmental Quality Act (CEQA)

CEQA requires state and local agencies to identify the significant environmental impacts associated with their activities and to mitigate those impacts.

Public Resources Code Section 21000-21177
http://leginfo.legislature.ca.gov/faces/codes_displayexpandedbranch.xhtml?tocCode=PRC&division=13.&title=&part=&chapter=&article=

California Ocean Plan

The California Ocean Plan contains standards that protect the beneficial uses of California's marine waters through establishing water quality objectives and implementation provisions in statewide water quality control plans and polices.

https://www.waterboards.ca.gov/water_issues/programs/ocean/

Capital Improvement Projects

Amends California Government Code section 14526.5 to include capital improvement projects relative to the operation of state highways and bridges.

Assembly Bill 2289, Chapter 76, Statutes of 2016
http://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB2289

California Transportation Commission: Interim SHOPP Guidelines, Resolutions, and Delegations

The guidelines, resolutions, and delegations describe the policy, standards, criteria and procedures for the development, adoption, and management of the SHOPP by the Commission. This includes requirements for the SHSMP and TAMP.

State Highway Operation and Protection Program Guidelines (June 2020)
https://catc.ca.gov/programs/state-highway-operation-and-protection-program

Transportation Asset Management Plan, Guidelines and Performance Measures
https://catc.ca.gov/programs/state-highway-operation-and-protection-program

Federal Comprehensive Environmental Response Compensation and Liability Act (CERCLA)

Governs hazardous waste site cleanup resulting from accidents, spills, and other emergency releases of pollutants and contaminants into the environment.

42 U.S.C. Section 9601 et seq.
http://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title42-section9601&num=0&edition=prelim

Federal Endangered Species Act

Governs conservation of threatened and endangered ecosystems that species of fish, wildlife, and plants depend.

16 U.S.C. Section 1531 et seq.
http://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title16-section1531&num=0&edition=prelim

Federal Water Pollution Control Act (Clean Water Act)

Governs surface water pollution as enforced by the Environmental Protection Agency (EPA).

33 U.S.C. Section 1251
http://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title33-section1251&num=0&edition=prelim

Fish and Wildlife Protection and Conservation

Requires written notification when an activity/project may substantially divert or obstruct the natural flow of any river, stream, or lake.

Fish and Game Code Section 1602
http://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=1602.&lawCode=FGC

Fish Passage

Senate Bill 857 requires Caltrans to prepare an annual report to the Legislature regarding fish passage. Caltrans is tasked with locating, assessing, and remediating fish passage barriers. SB 857 adds Article 3.5 (commencing with Section 156) to Chapter 1 of Division 1 of, the Streets and Highways Code, relating to fish passages. Transportation projects will be assessed for fish passage barriers and designed to remediate barriers or not create new barriers to fish on the SHS.

Senate Bill 857, Chapter 589, Statutes of 2005
http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200520060SB857

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 10 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)].

Public Law 114-94
https://www.govinfo.gov/content/pkg/PLAW-114publ94/html/PLAW-114publ94.htm

Highway Users Tax Account (HUTA)

Explains fuel tax revenue uses and establishes county apportionment amounts in accordance with various tax laws.

Streets and Highways Code sections 2104-2108
http://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=SHC&division=3.&title=&part=&chapter=3.&article=

Moving Ahead for Progress in the 21st Century Act (MAP-21)

MAP-21 authorizes the federal surface transportation programs for highways, highway safety, and transit and provides funding of over $105 billion for the federal fiscal years 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.

Public Law 112-141
https://www.govinfo.gov/content/pkg/PLAW-112publ141/html/PLAW-112publ141.htm

National Pollutant Discharge Elimination System (NPDES)

Governs construction and maintenance activities that impact storm water quality.

33 U.S.C. Section 1342
http://uscode.house.gov/view.xhtml?req=(title:33%20section:1342%20edition:prelim)%20OR%20(granuleid:USC-prelim-title33-section1342)&f=treesort&edition=prelim&num=0&jumpTo=true

Pavement and Bridge Performance Management

The Pavement and Bridge Performance Management Final Rule was established to implement MAP-21 and FAST Act performance management requirements.

23 Code of Federal Regulations Part 490
https://www.federalregister.gov/documents/2017/01/18/2017-00681/national-performance-management-measures-assessing-performance-of-the-national-highway-system

Railroad Crossings

Outlines construction practices surrounding railroad crossings, including policy development by CTC in consultation with Caltrans.

Public Utilities Code sections 1201-1220
http://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=PUC&division=1.&title=&part=1.&chapter=6.&article=

Railway-Highway Crossings

Requires states to make safety improvements at public railroad-highway crossings and submit an annual progress report to FHWA.

23 U.S.C. Section 130
https://uscode.house.gov/view.xhtml?req=(title:23%20U.S.C.%20%20section:130%20edition:prelim)%20OR%20(granuleid:USC-prelim-title23%20U.S.C.%20-section130)&f=treesort&edition=prelim&num=0&jumpTo=true

Resource Conservation and Recovery Act (RCRA)

Governs hazardous and non-hazardous solid waste management.

42 U.S.C. Section 6901 et seq.
http://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title42-section6901&num=0&edition=prelim

Road Repair and Accountability Act of 2017

SB 1 provides the first significant, stable, and on-going increase in state transportation funding in more than two decades.

Senate Bill 1, Chapter 5, Statutes of 2017
https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1

Safety Roadside Rest Areas

Streets and Highways Code Section 218 requires the Commission and Caltrans to plan, design, and construct safety roadside rest areas outside the state park system units. In addition, Caltrans must maintain safety roadside rest areas on the State Highway System.

Streets and Highways Code Section 218 et seq.
http://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=SHC&division=1.&title=&part=&chapter=1.&article=7

State Highway Operation and Protection Program (SHOPP)

The State Highway Operation and Protection Program (SHOPP) is a four-year document of projects that is adopted by the California Transportation Commission (Commission). California Government Code requires Caltrans to prepare a state highway operation and protection program and submit to the Commission for adoption no later than January 31 of each even-numbered year.

California Government Code Section 14526.5
http://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=14526.5.&lawCode=GOV

State Highway System Management Plan (SHSMP)

The State Highway System Management Plan (SHSMP) presents a performance driven and integrated management plan for the State Highway System (SHS) in California.

Streets and Highways Code Section 164.6 requires Caltrans to prepare a 10-year state rehabilitation plan and a five-year maintenance plan that addresses rehabilitation and maintenance needs of the state highway system.

Assembly Bill 515
https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB515

Streets and Highways Code Section 164.6
http://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=164.6.&lawCode=SHC

Statewide Potable Urban Water Usage Reduction

Requires State Water Resources Control Board (SWRCB) to reduce statewide water usage by 25 percent.

Executive Order B-29-15
https://www.ca.gov/archive/gov39/wp-content/uploads/2017/09/4.1.15_Executive_Order.pdf

Surface Mining and Reclamation Act of 1975 (SMARA)

SMARA establishes surface mining and reclamation policy to regulate surface mining operations to minimize adverse environmental impacts and ensure reclaimed mined lands are in a usable condition.

Public Resources Code Section 2710 et. seq.
http://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=PRC&division=2.&title=&part=&chapter=9.&article=1

Transportation Asset Management Plan (TAMP)

The Transportation Asset Management Plan (TAMP) Final Rule establishes the processes State departments of transportation must use to develop a TAMP. Each state is required to develop a risk-based TAMP for the National Highway System (NHS) to improve or preserve the assets' condition and the performance of the system in accordance with Moving Ahead for Progress in the 21st Century (MAP-21) § 1106(a), codified as 23 U.S.C. 119 (e) and (t).

Senate Bill 486 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 (SHOPP).

23 Code of Federal Regulations Part 515
https://www.federalregister.gov/documents/2016/10/24/2016-25117/asset-management-plans-and-periodic-evaluations-of-facilities-repeatedly-requiring-repair-and

Senate Bill 486, Section 6, Statutes of 2014
https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB486

23 Code of Federal Regulations Part 119
https://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title23-section119&num=0&edition=prelim

Appendix B: Performance Management Summary Sheets

The Performance Management Summary Sheets included in Appendix B summarize the inventory and conditions, deterioration rates, pipelined work, desired state of repair targets, unit costs to address needs, statewide cost, and district-level breakdowns for each of the 34 Performance Objectives identified in the 2021 SHSMP. Table B-1 identifies the page number in which each Summary Sheet is in the appendix. The Summary Sheets are separated into sections (A-K). Table B-2 provides a description for each section.

Table B-1. Performance Management Summary Sheets – Page Numbers

Performance Management Summary Sheets – Page Numbers	
Performance Objectives	**Page Number**
Safety (Safety First)	
Proactive Safety	B-5
Reactive Safety	B-6
Stewardship (Strengthen Stewardship and Drive Efficiency)	
Bridge and Tunnel Health	B-7
Bridge Goods Movement Upgrades	B-8
Bridge Scour Mitigation	B-9
Bridge Seismic Restoration	B-10
Commercial Vehicle Enforcement Facilities	B-11
Drainage Pump Plants	B-12
Drainage Restoration	B-13
Fish Passage	B-14
Lighting Rehabilitation	B-15
Major Damage (Emergency Opening)	B-16
Major Damage (Permanent Restoration)	B-17
Office Buildings	B-18
Overhead Sign Structures Rehabilitation	B-19
Pavement Class 1	B-20
Pavement Class 2	B-21
Pavement Class 3	B-22
Relinquishments	B-23

Performance Management Summary Sheets – Page Numbers	
Performance Objectives	**Page Number**
Roadside Rehabilitation	B-24
Roadway Protective Betterments	B-25
Safety Roadside Rest Area (SRRA) Rehabilitation	B-26
Sign Panel Replacement	B-27
Storm Water Mitigation	B-28
Transportation Management Systems	B-29
Transportation Management System Structures	B-30
Transportation Related Facilities	B-31
Water and Wastewater Treatment at SRRAs	B-32
Weigh-In-Motion Scales	B-33
Climate (Lead Climate Action)	
Sea Level Rise Adaptation	B-34
Equity/Livability (Advance Equity and Livability in All Communities)	
ADA Pedestrian Infrastructure	B-35
Complete Streets Fix Existing	B-36
Complete Streets Build New	B-37
Multimodal (Enhance and Connect the Multimodal Transportation Network)	
Operational Improvements	B-38

Table B-2. Performance Management Summary Sheets – Legend

Performance Management Summary Sheets - Legend
Description
(A) Baseline Inventory The total quantity of physical assets or asset/performance deficiencies at the start of the 10-year Plan period.
(B) Projected Inventory The total quantity of physical assets or asset/performance deficiencies expected at the end of the 10-year Plan period, resulting from the addition of new assets from the pipeline.
(C) Baseline Performance The breakdown of the Baseline Inventory (A) by quantity and percentage in terms of good, fair, and poor performance measures. Asset/performance deficiencies are reported as poor.
(D) Desired State of Repair (DSOR) Target Performance The fiscally unconstrained performance target, with a breakdown of the Projected Inventory (B) inventory by quantity and percentage in terms of good, fair, and poor performance measures.
(E) Effective Deterioration The effective deterioration of a physical asset in a 10-year do-nothing scenario is presented as an average annual rate. The “Into Fair” average annual rate represents the percentage of the Baseline Performance (C) good-condition assets which deteriorate into a fair condition per year. The “Into Poor” average annual rate represents the percentage of the Baseline Performance (C) fair condition assets which deteriorate into a poor condition per year. The “10-Year Deterioration” column represents the sum of the annual deteriorations using a simple, non-compound rate calculation.
(F) Projected Performance The projected future condition of a physical asset in a 10-year do-nothing scenario is determined using the Baseline Performance (C) and adding/subtracting the Effective Deterioration (E).
(G) Pipelined Projects Performance Committed projects which improve the condition of physical assets or remove asset/performance deficiencies, and their accomplishments are not reflected in the baseline performance, regardless of fund source. The performance of pipelined projects is quantified by performance measures (fair, poor, new) and fund source or maintenance strategy.
(H) Performance Gap The difference between the Projected Performance (F) and the DSOR Target Performance (D), subtracting the Pipelined Projects Performance (G) and excluding negative district-level gaps in the District Breakdown (K). A fair, poor, or new gap in each district is the estimated work which should be accomplished in addition to the pipelined projects to ensure that the district will reach the statewide DSOR target performance at the end of the 10-year Plan period.

Performance Management Summary Sheets - Legend
Description
(I) Average Un-escalated Capital Unit Cost and Support Ratio These costs are presented by performance measures (fair, poor, new) and maintenance strategy (SHOPP, HM). These are the escalated costs to 8.5 years in the 10-year the Plan. Capital unit costs include material, labor, mobilization, traffic control, contingency (5%), supplemental work, right of way, state-furnished material and labor, and any other construction costs. Support costs include Project Approval and Environmental Documentation (PA&ED), Plan, Specification and Estimate (PS&E), right of way support, and construction support costs. Do not use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.
(J) Estimated SHOPP and Maintenance Costs for 10 Years The 10-year total of SHOPP and Maintenance needs in the SHSMP is summarized in this section. This total includes both the cost of the unfunded pipelined projects (in the first five-years) and the performance gap for the SHOPP (last five-years) and Maintenance (all 10-years). The cost of unfunded pipelined SHOPP projects consists of: the total (escalated capital and support) cost of programmed SHOPP projects with an Ready to List (RTL) FY 2021/22, 2022/23, and 2023/24; the total (escalated capital and support) cost of SHOPP projects in the SHOPP Ten-Year Project Book with an RTL FY 2024/25 and 2025/26, and the PA&ED cost of long lead projects with an RTL FY within the SHSMP. The cost of unfunded pipelined Maintenance work is typically zero, because Maintenance allocations are determined annually.
(K) District Breakdown This section presents a district-level breakdown of inventory, gaps, total (capital and support) unit costs, and performance gap costs. The performance gap costs include the costs to address the gap through the SHOPP, Maintenance, and other programs.

Note: A negative gap in a district indicates that the projected future performance of this objective in the district, after accounting for the accomplishments of pipelined projects, will surpass the statewide DSOR target performance at the end of the Plan.

Proactive Safety

(A) Baseline Inventory	
5,406	Annual Fatal & Serious Injury Collisions

(B) Projected Inventory (in 2031)	
5,406	Annual Fatal & Serious Injury Collisions

(C) Baseline Performance		
Good	N/A	N/A
Fair	N/A	N/A
Poor	5,406	100.0%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	401	7.4%
Fair	N/A	N/A
Poor	5,005	92.6%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	N/A	N/A

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	N/A	N/A
Fair	N/A	N/A
Poor	5,406	100.0%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	160
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**160**
Add New	Any SHOPP or 2022 PID Work Plan	N/A

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	241	48/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**241**	**N/A**
Add New	SHOPP for the Last 5 Years	N/A	N/A

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$16,295,223	46.0%
	Maintenance	N/A	N/A
Add New	SHOPP	N/A	N/A

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$2,182,567,723
	5-Year Performance Gap	$7,482,390,363
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$9,664,958,086**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	TBD	N/A	N/A	N/A	N/A	TBD	N/A	N/A	$31,095,002	TBD
D2	TBD	N/A	N/A	N/A	N/A	TBD	N/A	N/A	$31,095,002	TBD
D3	TBD	N/A	N/A	N/A	N/A	TBD	N/A	N/A	$31,095,002	TBD
D4	TBD	N/A	N/A	N/A	N/A	TBD	N/A	N/A	$31,095,002	TBD
D5	TBD	N/A	N/A	N/A	N/A	TBD	N/A	N/A	$31,095,002	TBD
D6	TBD	N/A	N/A	N/A	N/A	TBD	N/A	N/A	$31,095,002	TBD
D7	TBD	N/A	N/A	N/A	N/A	TBD	N/A	N/A	$31,095,002	TBD
D8	TBD	N/A	N/A	N/A	N/A	TBD	N/A	N/A	$31,095,002	TBD
D9	TBD	N/A	N/A	N/A	N/A	TBD	N/A	N/A	$31,095,002	TBD
D10	TBD	N/A	N/A	N/A	N/A	TBD	N/A	N/A	$31,095,002	TBD
D11	TBD	N/A	N/A	N/A	N/A	TBD	N/A	N/A	$31,095,002	TBD
D12	TBD	N/A	N/A	N/A	N/A	TBD	N/A	N/A	$31,095,002	TBD
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**5,406**	**N/A**	**N/A**	**N/A**	**N/A**	**241**	**N/A**	**N/A**	**N/A**	**$7,482,390,363**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Safety Reactive

(A) Baseline Inventory	
N/A	N/A

(B) Projected Inventory (in 2031)	
N/A	N/A

(C) Baseline Performance		
Good	N/A	N/A
Fair	N/A	N/A
Poor	N/A	N/A

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	N/A	N/A
Fair	N/A	N/A
Poor	N/A	N/A

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	N/A	N/A

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	N/A	N/A
Fair	N/A	N/A
Poor	N/A	N/A

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Add New	Any SHOPP or 2022 PID Work Plan	N/A

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Add New	SHOPP for the Last 5 Years	N/A	N/A

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Add New	SHOPP	N/A	N/A

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$1,625,982,000
	5-Year Performance Gap	$1,600,000,000
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$3,225,982,000**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Bridge and Tunnel Health

(A) Baseline Inventory	
251,703,052	Square Foot

(B) Projected Inventory (in 2031)	
251,703,052	Square Foot

(C) Baseline Performance		
Good	136,073,579	54.1%
Fair	106,895,617	42.5%
Poor	8,733,856	3.5%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	122,075,980	48.5%
Fair	125,851,526	50.0%
Poor	3,775,546	1.5%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario		
	Average Annual Rate	10-Year Deterioration
Into Fair	5.0%	68,036,790
Into Poor	0.7%	7,482,693

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	68,036,790	27.0%
Fair	167,449,713	66.5%
Poor	16,216,549	6.4%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	7,602,409
	Maintenance through 2020/21	12,929,782
	Other (STIP, Local, etc.)	518,401
	Total	**21,050,592**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	2,865,385
	Maintenance through 2020/21	2,594,686
	Other (STIP, Local, etc.)	11,238
	Total	**5,471,309**
Add New	Any SHOPP or 2022 PID Work Plan	25,865

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	3,259,888	651,978/year
	Maintenance for 10 Years	18,472,696	1,847,270/year
	Other	0	N/A
	Total	**21,732,584**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	3,136,363	627,273/year
	Maintenance for 10 Years	3,833,331	383,333/year
	Other	0	N/A
	Total	**6,969,694**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$420	32.0%
	Maintenance	$22	43.0%
Fix Poor to Good	SHOPP	$536	40.0%
	Maintenance	$31	43.0%
Add New	SHOPP	$536	40.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$1,654,395,757
	5-Year Performance Gap	$5,435,330,536
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$879,196,955
	Total	**$7,968,923,249**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	5,941,595	$980	$5,821,943,457	0	701,260	196,733	$980	$140	$469	$190,533,404
D2	5,879,613	$980	$5,761,209,648	0	752,933	180,669	$980	$140	$469	$190,225,406
D3	22,572,715	$980	$22,118,146,795	0	2,892,355	492,347	$980	$140	$469	$636,054,978
D4	55,385,147	$980	$54,269,803,682	0	7,825,866	2,682,199	$980	$140	$469	$2,354,800,027
D5	7,625,223	$980	$7,471,666,641	0	308,625	231,804	$980	$140	$469	$152,032,593
D6	11,106,705	$980	$10,883,038,731	0	395,783	195,200	$980	$140	$469	$147,048,643
D7	63,819,806	$980	$62,534,605,942	0	2,637,504	488,065	$980	$140	$469	$598,367,703
D8	22,270,935	$980	$21,822,444,026	0	1,912,791	459,679	$980	$140	$469	$483,587,055
D9	966,398	$980	$946,936,725	0	88,851	3,669	$980	$140	$469	$14,161,217
D10	9,908,900	$980	$9,709,355,068	0	1,395,093	598,229	$980	$140	$469	$476,158,566
D11	26,110,039	$980	$25,584,236,342	0	730,829	672,932	$980	$140	$469	$418,237,174
D12	20,115,976	$980	$19,710,881,482	0	2,090,694	768,168	$980	$140	$469	$653,320,726
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**251,703,052**	**N/A**	**$246,634,268,540**	**0**	**21,732,584**	**6,969,694**	**N/A**	**N/A**	**N/A**	**$6,314,527,492**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Bridge Goods Movement Upgrades

(A) Baseline Inventory	
246,802,941	Square Foot

(B) Projected Inventory (in 2031)	
246,802,941	Square Foot

(C) Baseline Performance		
Good	195,414,113	79.2%
Fair	19,551,889	7.9%
Poor	31,836,939	12.9%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	185,102,206	75.0%
Fair	37,020,441	15.0%
Poor	24,680,294	10.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	0.0%	0
Into Poor	0.0%	0

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	195,414,113	79.2%
Fair	19,551,889	7.9%
Poor	31,836,939	12.9%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	345,392
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	8,762
	Total	**354,154**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	1,194,951
	Maintenance through 2020/21	9,795
	Other (STIP, Local, etc.)	116,714
	Total	**1,321,460**
Add New	Any SHOPP or 2022 PID Work Plan	492,737

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	0	0/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**0**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	10,238,748	2,047,750/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**10,238,748**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$315	40.0%
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$420	40.0%
	Maintenance	N/A	N/A
Add New	SHOPP	$420	40.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$573,918,228
	5-Year Performance Gap	$7,868,674,985
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$8,442,593,213**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	5,789,206	$769	$4,449,116,282	0	-544,689	-109,784	$769	$576	$769	$0
D2	5,775,141	$769	$4,438,307,059	0	-548,021	-355,734	$769	$576	$769	$0
D3	22,514,020	$769	$17,302,457,876	0	-610,215	556,472	$769	$576	$769	$427,659,447
D4	52,496,683	$769	$40,344,711,707	0	-3,159,760	4,442,216	$769	$576	$769	$3,413,928,531
D5	7,598,053	$769	$5,839,250,031	0	-492,057	55,616	$769	$576	$769	$42,741,967
D6	11,106,705	$769	$8,535,716,652	0	-943,577	346,911	$769	$576	$769	$266,607,783
D7	62,762,772	$769	$48,234,398,776	0	-3,721,201	4,744,076	$769	$576	$769	$3,645,913,753
D8	22,227,334	$769	$17,082,134,165	0	-2,397,306	-1,711,036	$769	$576	$769	$0
D9	966,398	$769	$742,695,471	0	-125,036	-70,042	$769	$576	$769	$0
D10	9,908,900	$769	$7,615,180,445	0	-766,928	93,457	$769	$576	$769	$71,823,504
D11	25,835,501	$769	$19,855,079,980	0	-2,396,138	-905,118	$769	$576	$769	$0
D12	19,822,228	$769	$15,233,763,894	0	-2,003,443	-1,251,849	$769	$576	$769	$0
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**246,802,941**	**N/A**	**$189,672,812,337**	**0**	**0**	**10,238,748**	**N/A**	**N/A**	**N/A**	**$7,868,674,985**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Bridge Scour Mitigation

(A) Baseline Inventory	
2,181,193	Square Foot

(B) Projected Inventory (in 2031)	
2,181,193	Square Foot

(C) Baseline Performance		
Good	N/A	N/A
Fair	N/A	N/A
Poor	2,181,193	100.0%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	1,963,074	90.0%
Fair	N/A	N/A
Poor	218,119	10.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	N/A	N/A

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	N/A	N/A
Fair	N/A	N/A
Poor	2,181,193	100.0%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	1,615,011
	Maintenance through 2020/21	10,592
	Other (STIP, Local, etc.)	0
	Total	**1,625,603**
Add New	Any SHOPP or 2022 PID Work Plan	N/A

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	419,329	83,866/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**419,329**	**N/A**
Add New	SHOPP for the Last 5 Years	N/A	N/A

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$630	46.0%
	Maintenance	N/A	N/A
Add New	SHOPP	N/A	N/A

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$550,196,813
	5-Year Performance Gap	$504,110,485
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$1,054,307,298**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	156,044	N/A	N/A	N/A	N/A	51,671	N/A	N/A	$1,202	$62,118,034
D2	49,203	N/A	N/A	N/A	N/A	7,319	N/A	N/A	$1,202	$8,798,782
D3	660,549	N/A	N/A	N/A	N/A	-66,055	N/A	N/A	$1,202	$0
D4	216,708	N/A	N/A	N/A	N/A	129,960	N/A	N/A	$1,202	$156,235,793
D5	150,114	N/A	N/A	N/A	N/A	30,487	N/A	N/A	$1,202	$36,650,974
D6	91,698	N/A	N/A	N/A	N/A	82,528	N/A	N/A	$1,202	$99,213,816
D7	96,747	N/A	N/A	N/A	N/A	-9,675	N/A	N/A	$1,202	$0
D8	676,441	N/A	N/A	N/A	N/A	103,610	N/A	N/A	$1,202	$124,558,252
D9	4,101	N/A	N/A	N/A	N/A	3,691	N/A	N/A	$1,202	$4,437,260
D10	18,309	N/A	N/A	N/A	N/A	10,063	N/A	N/A	$1,202	$12,097,574
D11	0	N/A	N/A	N/A	N/A	0	N/A	N/A	$1,202	$0
D12	61,279	N/A	N/A	N/A	N/A	-6,128	N/A	N/A	$1,202	$0
HQ	N/A	N/A	N/A	N/A	N/A	0	N/A	N/A	N/A	N/A
Statewide Totals	**2,181,193**	**N/A**	**N/A**	**N/A**	**N/A**	**419,329**	**N/A**	**452,222**	**N/A**	**$504,110,485**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Bridge Seismic Restoration

(A) Baseline Inventory	
7,908,244	Square Foot

(B) Projected Inventory (in 2031)	
7,908,244	Square Foot

(C) Baseline Performance		
Good	N/A	N/A
Fair	N/A	N/A
Poor	7,908,244	100.0%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	5,535,771	70.0%
Fair	N/A	N/A
Poor	2,372,473	30.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario		
	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	N/A	N/A

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	N/A	N/A
Fair	N/A	N/A
Poor	7,908,244	100.0%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	3,210,079
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	81,635
	Total	**3,291,714**
Add New	Any SHOPP or 2022 PID Work Plan	N/A

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	2,381,778	476,356/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**2,381,778**	**N/A**
Add New	SHOPP for the Last 5 Years	N/A	N/A

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$273	40.0%
	Maintenance	N/A	N/A
Add New	SHOPP	N/A	N/A

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$353,351,973
	5-Year Performance Gap	$1,189,787,465
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$1,543,139,438**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	715,183	N/A	N/A	N/A	N/A	266,030	N/A	N/A	$500	$132,891,965
D2	482,848	N/A	N/A	N/A	N/A	57,604	N/A	N/A	$500	$28,775,359
D3	457,648	N/A	N/A	N/A	N/A	-16,028	N/A	N/A	$500	$0
D4	2,856,618	N/A	N/A	N/A	N/A	1,298,022	N/A	N/A	$500	$648,410,685
D5	272,394	N/A	N/A	N/A	N/A	-9,825	N/A	N/A	$500	$0
D6	16,975	N/A	N/A	N/A	N/A	-4,662	N/A	N/A	$500	$0
D7	1,529,189	N/A	N/A	N/A	N/A	352,949	N/A	N/A	$500	$176,311,267
D8	743,797	N/A	N/A	N/A	N/A	241,130	N/A	N/A	$500	$120,453,481
D9	0	N/A	N/A	N/A	N/A	0	N/A	N/A	$500	$0
D10	452,451	N/A	N/A	N/A	N/A	-66,027	N/A	N/A	$500	$0
D11	243,879	N/A	N/A	N/A	N/A	166,043	N/A	N/A	$500	$82,944,708
D12	137,262	N/A	N/A	N/A	N/A	-41,179	N/A	N/A	$500	$0
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**7,908,244**	**N/A**	**N/A**	**N/A**	**N/A**	**2,381,778**	**N/A**	**N/A**	**N/A**	**$1,189,787,465**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Commercial Vehicle Enforcement Facilities

(A) Baseline Inventory	
309,395	Square Foot

(B) Projected Inventory (in 2031)	
315,425	Square Foot

(C) Baseline Performance		
Good	108,490	35.3%
Fair	125,225	40.8%
Poor	73,480	23.9%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	189,255	60.0%
Fair	126,170	40.0%
Poor	0	0.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	6.7%	73,830
Into Poor	2.9%	35,814

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	36,860	11.9%
Fair	163,241	52.8%
Poor	109,294	35.3%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	27,120
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**27,120**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	9,190
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**9,190**
Add New	Any SHOPP or 2022 PID Work Plan	6,030

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	29,716	5,943/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**29,716**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	100,103	20,021/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**100,103**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$2,537	66.0%
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$2,977	66.0%
	Maintenance	N/A	N/A
Add New	SHOPP	$2,977	66.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$53,486,611
	5-Year Performance Gap	$810,247,982
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$863,734,593**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	900	$6,460	$5,813,936	0	-113	530	$6,460	$5,505	$6,460	$3,423,763
D2	39,518	$6,460	$255,283,491	0	7,638	0	$6,460	$5,505	$6,460	$42,047,984
D3	13,850	$6,460	$89,470,022	0	-8,939	3,752	$6,460	$5,505	$6,460	$24,237,655
D4	81,550	$6,460	$526,807,244	0	5,424	33,553	$6,460	$5,505	$6,460	$246,609,695
D5	0	$6,460	$0	0	0	0	$6,460	$5,505	$6,460	$0
D6	11,000	$6,460	$71,059,224	0	3,454	3,146	$6,460	$5,505	$6,460	$39,337,567
D7	23,202	$6,460	$149,883,282	0	-7,692	5,771	$6,460	$5,505	$6,460	$37,280,253
D8	59,780	$6,460	$386,174,580	0	-3,020	28,296	$6,460	$5,505	$6,460	$182,790,163
D9	4,350	$6,460	$28,100,693	0	1,366	1,244	$6,460	$5,505	$6,460	$15,556,124
D10	13,020	$6,460	$84,108,281	0	3,860	3,852	$6,460	$5,505	$6,460	$46,133,349
D11	66,275	$6,460	$428,131,822	0	7,445	19,959	$6,460	$5,505	$6,460	$169,919,230
D12	1,980	$6,460	$12,790,660	0	529	0	$6,460	$5,505	$6,460	$2,912,200
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**315,425**	**N/A**	**$2,037,623,235**	**0**	**29,716**	**100,103**	**N/A**	**N/A**	**N/A**	**$810,247,982**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Drainage Pump Plants

(A) Baseline Inventory	
288	Location

(B) Projected Inventory (in 2031)	
288	Location

(C) Baseline Performance		
Good	44	15.3%
Fair	99	34.4%
Poor	145	50.3%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	230	80.0%
Fair	58	20.0%
Poor	0	0.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	2.5%	11
Into Poor	2.5%	25

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	33	11.5%
Fair	85	29.6%
Poor	170	58.9%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	3
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**3**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	98
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**98**
Add New	Any SHOPP or 2022 PID Work Plan	0

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	25	5/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**25**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	73	15/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**73**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$275,670	57.0%
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$711,156	57.0%
	Maintenance	N/A	N/A
Add New	SHOPP	$5,627,750	57.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$117,164,328
	5-Year Performance Gap	$120,670,118
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$237,834,446**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	0	$11,548,136	$0	0	0	0	$11,548,136	$565,674	$1,459,291	$0
D2	0	$11,548,136	$0	0	0	0	$11,548,136	$565,674	$1,459,291	$0
D3	43	$11,548,136	$496,569,832	0	0	16	$11,548,136	$565,674	$1,459,291	$23,348,659
D4	68	$11,548,136	$785,273,223	0	8	20	$11,548,136	$565,674	$1,459,291	$33,711,219
D5	10	$11,548,136	$115,481,356	0	0	1	$11,548,136	$565,674	$1,459,291	$1,459,291
D6	74	$11,548,136	$854,562,037	0	7	20	$11,548,136	$565,674	$1,459,291	$33,145,545
D7	52	$11,548,136	$600,503,053	0	4	9	$11,548,136	$565,674	$1,459,291	$15,396,319
D8	2	$11,548,136	$23,096,271	0	0	0	$11,548,136	$565,674	$1,459,291	$0
D9	0	$11,548,136	$0	0	0	0	$11,548,136	$565,674	$1,459,291	$0
D10	21	$11,548,136	$242,510,848	0	-1	2	$11,548,136	$565,674	$1,459,291	$2,918,582
D11	5	$11,548,136	$57,740,678	0	3	1	$11,548,136	$565,674	$1,459,291	$3,156,315
D12	13	$11,548,136	$150,125,763	0	3	4	$11,548,136	$565,674	$1,459,291	$7,534,188
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**288**	**N/A**	**$3,325,863,062**	**0**	**25**	**73**	**N/A**	**N/A**	**N/A**	**$120,670,118**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Drainage Restoration

(A) Baseline Inventory	
22,402,404	Linear Foot

(B) Projected Inventory (in 2031)	
22,630,062	Linear Foot

(C) Baseline Performance		
Good	16,570,480	74.0%
Fair	3,747,608	16.7%
Poor	2,084,316	9.3%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	15,841,044	70.0%
Fair	4,526,012	20.0%
Poor	2,263,006	10.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	2.0%	3,314,096
Into Poor	2.0%	749,522

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	13,484,042	59.6%
Fair	6,312,182	27.9%
Poor	2,833,838	12.5%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	205,062
	Maintenance through 2020/21	16,774
	Other (STIP, Local, etc.)	1,858
	Total	**223,694**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	468,420
	Maintenance through 2020/21	39,644
	Other (STIP, Local, etc.)	7,922
	Total	**515,986**
Add New	Any SHOPP or 2022 PID Work Plan	227,658

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	0	0/year
	Maintenance for 10 Years**	1,562,476	156,248/year
	Other	0	N/A
	Total	**3,825,482**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	277,040	55,408/year
	Maintenance for 10 Years	242,306	24,231/year
	Other	0	N/A
	Total	**519,346**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$1,565	57.0%
	Maintenance**	$146	28.3%
Fix Poor to Good	SHOPP	$2,208	57.0%
	Maintenance	$177	40.4%
Add New	SHOPP	$2,208	57.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$1,766,136,129
	5-Year Performance Gap	$1,255,068,163
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$412,721,475
	Total	**$3,433,925,767**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	990,377	$4,530	$4,486,681,034	0	121,412	64,430	$4,530	$219	$2,553	$191,046,723
D2	1,464,048	$4,530	$6,632,545,907	0	207,603	185,421	$4,530	$219	$2,553	$518,748,141
D3	1,769,850	$4,530	$8,017,913,579	0	100,673	96,163	$4,530	$219	$2,553	$267,500,590
D4	2,770,418	$4,530	$12,550,765,001	0	202,752	-105,909	$4,530	$219	$2,553	$44,400,197
D5	1,632,517	$4,530	$7,395,756,838	0	133,327	38,979	$4,530	$219	$2,553	$128,690,723
D6	1,924,967	$4,530	$8,720,635,322	0	266,507	124,318	$4,530	$219	$2,553	$375,681,586
D7	3,871,285	$4,530	$17,537,997,547	0	167,757	-53,728	$4,530	$219	$2,553	$36,736,722
D8	2,220,413	$4,530	$10,059,086,203	0	74,726	-119,576	$4,530	$219	$2,553	$16,364,076
D9	519,461	$4,530	$2,353,303,235	0	15,043	-31,003	$4,530	$219	$2,553	$3,294,232
D10	946,309	$4,530	$4,287,043,557	0	70,172	10,035	$4,530	$219	$2,553	$40,980,760
D11	2,638,430	$4,530	$11,952,820,475	0	163,458	-74,692	$4,530	$219	$2,553	$35,795,294
D12	1,881,986	$4,530	$8,525,920,241	0	39,046	-79,592	$4,530	$219	$2,553	$8,550,594
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**22,630,062**	**N/A**	**$102,520,468,940**	**0**	**1,562,476**	**519,346**	**N/A**	**N/A**	**N/A**	**$1,667,789,638**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

(**)The maintenance Fix-Fair-to-Good unit cost, support ratio, and performance gap represent the contributions of both Major Maintenance and Field Maintenance Crews.

Fish Passage

(A) Baseline Inventory	
83	Location

(B) Projected Inventory (in 2031)	
83	Location

(C) Baseline Performance		
Good	N/A	N/A
Fair	N/A	N/A
Poor	83	100.0%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	52	62.7%
Fair	N/A	N/A
Poor	31	37.3%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	N/A	N/A

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	N/A	N/A
Fair	N/A	N/A
Poor	83	100.0%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	15
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	3
	Total	**18**
Add New	Any SHOPP or 2022 PID Work Plan	N/A

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	34	7/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**34**	**N/A**
Add New	SHOPP for the Last 5 Years	N/A	N/A

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$4,078,748	100.0%
	Maintenance	N/A	N/A
Add New	SHOPP	N/A	N/A

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$44,515,000
	5-Year Performance Gap	$362,504,380
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$407,019,380**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	27	N/A	N/A	N/A	N/A	12	N/A	N/A	$10,661,894	$127,942,722
D2	14	N/A	N/A	N/A	N/A	8	N/A	N/A	$10,661,894	$85,295,148
D3	1	N/A	N/A	N/A	N/A	1	N/A	N/A	$10,661,894	$10,661,894
D4	12	N/A	N/A	N/A	N/A	1	N/A	N/A	$10,661,894	$10,661,894
D5	17	N/A	N/A	N/A	N/A	7	N/A	N/A	$10,661,894	$74,633,255
D6	0	N/A	N/A	N/A	N/A	0	N/A	N/A	$10,661,894	$0
D7	11	N/A	N/A	N/A	N/A	4	N/A	N/A	$10,661,894	$42,647,574
D8	0	N/A	N/A	N/A	N/A	0	N/A	N/A	$10,661,894	$0
D9	0	N/A	N/A	N/A	N/A	0	N/A	N/A	$10,661,894	$0
D10	1	N/A	N/A	N/A	N/A	1	N/A	N/A	$10,661,894	$10,661,894
D11	0	N/A	N/A	N/A	N/A	0	N/A	N/A	$10,661,894	$0
D12	0	N/A	N/A	N/A	N/A	0	N/A	N/A	$10,661,894	$0
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**83**	**N/A**	**N/A**	**N/A**	**N/A**	**34**	**N/A**	**N/A**	**N/A**	**$362,504,380**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Lighting Rehabilitation

(A) Baseline Inventory	
97,745	Each

(B) Projected Inventory (in 2031)	
97,997	Each

(C) Baseline Performance		
Good	37,090	37.9%
Fair	15,003	15.3%
Poor	45,652	46.7%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	0	0.0%
Fair	97,997	100.0%
Poor	0	0.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario		
	Average Annual Rate	10-Year Deterioration
Into Fair	5.0%	18,545
Into Poor	10.0%	15,003

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	18,804	19.2%
Fair	18,538	18.9%
Poor	60,655	61.9%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	8
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**8**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	6,998
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	19
	Total	**7,017**
Add New	Any SHOPP or 2022 PID Work Plan	227

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	0	0/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**0**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	53,638	10,728/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**53,638**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$15,777	50.0%
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$15,777	50.0%
	Maintenance	N/A	N/A
Add New	SHOPP	$15,777	50.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$150,166,660
	5-Year Performance Gap	$1,659,105,280
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$1,809,271,941**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	1,469	$30,932	$45,438,414	0	-1,259	736	$30,932	$30,932	$30,932	$22,765,604
D2	2,365	$30,932	$73,153,063	0	-1,919	1,000	$30,932	$30,932	$30,932	$30,931,528
D3	7,412	$30,932	$229,264,483	0	-6,247	3,316	$30,932	$30,932	$30,932	$102,568,946
D4	23,121	$30,932	$715,167,851	0	-18,865	15,135	$30,932	$30,932	$30,932	$468,148,671
D5	3,159	$30,932	$97,712,696	0	-2,637	1,779	$30,932	$30,932	$30,932	$55,027,188
D6	5,970	$30,932	$184,661,220	0	-4,221	2,378	$30,932	$30,932	$30,932	$73,555,173
D7	24,470	$30,932	$756,894,482	0	-21,113	15,460	$30,932	$30,932	$30,932	$478,201,418
D8	8,650	$30,932	$267,557,714	0	-7,086	2,794	$30,932	$30,932	$30,932	$86,422,688
D9	498	$30,932	$15,403,901	0	-422	222	$30,932	$30,932	$30,932	$6,866,799
D10	3,372	$30,932	$104,301,111	0	-3,014	1,442	$30,932	$30,932	$30,932	$44,603,263
D11	8,481	$30,932	$262,330,286	0	-6,277	3,775	$30,932	$30,932	$30,932	$116,766,517
D12	9,030	$30,932	$279,311,695	0	-6,407	5,601	$30,932	$30,932	$30,932	$173,247,486
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**97,997**	**N/A**	**$3,031,196,916**	**0**	**0**	**53,638**	**N/A**	**N/A**	**N/A**	**$1,659,105,280**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Major Damage (Emergency Opening)

(A) Baseline Inventory	
N/A	N/A

(B) Projected Inventory (in 2031)	
N/A	N/A

(C) Baseline Performance		
Good	N/A	N/A
Fair	N/A	N/A
Poor	N/A	N/A

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	N/A	N/A
Fair	N/A	N/A
Poor	N/A	N/A

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	N/A	N/A

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	N/A	N/A
Fair	N/A	N/A
Poor	N/A	N/A

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Add New	Any SHOPP or 2022 PID Work Plan	N/A

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Add New	SHOPP for the Last 5 Years	N/A	N/A

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Add New	SHOPP	N/A	N/A

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$0
	5-Year Performance Gap	$2,388,000,000
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$2,388,000,000**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Major Damage (Permanent Restoration)

(A) Baseline Inventory	
N/A	N/A

(B) Projected Inventory (in 2031)	
N/A	N/A

(C) Baseline Performance		
Good	N/A	N/A
Fair	N/A	N/A
Poor	N/A	N/A

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	N/A	N/A
Fair	N/A	N/A
Poor	N/A	N/A

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	N/A	N/A

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	N/A	N/A
Fair	N/A	N/A
Poor	N/A	N/A

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Add New	Any SHOPP or 2022 PID Work Plan	N/A

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Add New	SHOPP for the Last 5 Years	N/A	N/A

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Add New	SHOPP	N/A	N/A

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$705,214,000
	5-Year Performance Gap	$700,000,000
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$1,405,214,000**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Office Buildings

(A) Baseline Inventory	
2,669,524	Square Foot

(B) Projected Inventory (in 2031)	
2,669,524	Square Foot

(C) Baseline Performance		
Good	1,163,096	43.6%
Fair	770,395	28.9%
Poor	736,033	27.6%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	1,601,714	60.0%
Fair	1,067,810	40.0%
Poor	0	0.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	9.3%	1,082,296
Into Poor	0.3%	24,571

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	80,800	3.0%
Fair	1,828,120	68.5%
Poor	760,604	28.5%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	0
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**0**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	0
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**0**
Add New	Any SHOPP or 2022 PID Work Plan	0

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	1,081,320	216,264/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**1,081,320**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	760,604	152,121/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**760,604**	**N/A**
Add New	SHOPP for the Last 5 Years	484,381	96,876/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$5	29.0%
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$1,256	0.0%
	Maintenance	N/A	N/A
Add New	SHOPP	$1,256	0.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$0
	5-Year Performance Gap	$2,052,881,801
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$2,052,881,801**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	91,456	$1,642	$150,134,074	0	-30,102	4,176	$1,642	$8	$1,642	$6,855,317
D2	55,581	$1,642	$91,241,711	47,027	-22,232	55,581	$1,642	$8	$1,642	$168,441,185
D3	0	$1,642	$0	0	0	0	$1,642	$8	$1,642	$0
D4	750,000	$1,642	$1,231,199,215	0	450,000	0	$1,642	$8	$1,642	$3,793,584
D5	41,700	$1,642	$68,454,676	45,783	-16,680	41,700	$1,642	$8	$1,642	$143,612,001
D6	64,374	$1,642	$105,676,291	149,348	-25,750	64,374	$1,642	$8	$1,642	$350,845,811
D7	716,200	$1,642	$1,175,713,170	0	429,720	0	$1,642	$8	$1,642	$3,622,619
D8	336,000	$1,642	$551,577,248	0	201,600	0	$1,642	$8	$1,642	$1,699,525
D9	37,545	$1,642	$61,633,833	0	-15,018	37,545	$1,642	$8	$1,642	$61,633,833
D10	90,804	$1,642	$149,063,751	0	-36,322	90,804	$1,642	$8	$1,642	$149,063,751
D11	0	$1,642	$0	0	0	0	$1,642	$8	$1,642	$0
D12	0	$1,642	$0	0	0	0	$1,642	$8	$1,642	$0
HQ	485,864	$1,642	$797,593,834	242,223	-$174,906	466,424	$1,642	$8	$1,642	$1,163,314,173
Statewide Totals	**2,669,524**	**N/A**	**$4,382,287,803**	**484,381**	**1,081,320**	**760,604**	**N/A**	**N/A**	**N/A**	**$2,052,881,801**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Overhead Sign Structures Rehabilitation

(A) Baseline Inventory	
16,433	Each

(B) Projected Inventory (in 2031)	
16,433	Each

(C) Baseline Performance		
Good	9,422	57.3%
Fair	5,837	35.5%
Poor	1,174	7.1%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	0	0.0%
Fair	16,433	100.0%
Poor	0	0.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	4.0%	3,769
Into Poor	4.0%	2,335

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	5,653	34.4%
Fair	7,271	44.2%
Poor	3,509	21.4%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	79
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**79**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	440
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	20
	Total	**460**
Add New	Any SHOPP or 2022 PID Work Plan	52

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	0	0/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**0**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	3,065	610/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**3,065**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$214,200	60.0%
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$214,200	60.0%
	Maintenance	N/A	N/A
Add New	SHOPP	$214,200	60.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$164,230,038
	5-Year Performance Gap	$1,372,926,712
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$1,537,156,750**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	62	$447,937	$20,912,170	0	-26	25	$447,937	$447,937	$447,937	$11,198,423
D2	121	$261,402	$34,505,081	0	-59	36	$447,937	$447,937	$447,937	$16,125,730
D3	1,437	$261,402	$327,275,466	0	-806	113	$447,937	$447,937	$447,937	$50,616,874
D4	2,862	$261,402	$713,889,215	0	-1,637	871	$447,937	$447,937	$447,937	$390,153,072
D5	272	$261,402	$65,611,934	0	-162	85	$447,937	$447,937	$447,937	$38,074,640
D6	1,175	$261,402	$283,882,712	0	-550	347	$447,937	$447,937	$447,937	$155,434,117
D7	4,612	$261,402	$1,219,179,531	0	-2,729	819	$447,937	$447,937	$447,937	$366,860,352
D8	1,786	$261,402	$445,952,033	0	-975	198	$447,937	$447,937	$447,937	$88,691,514
D9	5	$261,402	$2,614,021	0	-3	0	$447,937	$447,937	$447,937	$0
D10	488	$261,402	$122,859,001	0	-273	100	$447,937	$447,937	$447,937	$44,793,694
D11	2,127	$261,402	$543,193,625	0	-1,201	263	$447,937	$447,937	$447,937	$117,807,414
D12	1,486	$261,402	$361,519,145	0	-820	208	$447,937	$447,937	$447,937	$93,170,883
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**16,433**	**N/A**	**$4,141,393,935**	**0**	**0**	**3,065**	**N/A**	**N/A**	**N/A**	**$1,372,926,712**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Pavement Class 1

(A) Baseline Inventory	
26,895	Lane Mile

(B) Projected Inventory (in 2031)	
26,895	Lane Mile

(C) Baseline Performance		
Good	17,801	66.2%
Fair	8,781	32.6%
Poor	314	1.2%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	16,137	60.0%
Fair	10,489	39.0%
Poor	269	1.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	8.4%	14,107
Into Poor	0.9%	830

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	2,864	10.6%
Fair	22,888	85.1%
Poor	1,144	4.3%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	4,669
	Maintenance through 2020/21	739
	Other (STIP, Local, etc.)	14
	Total	**5,422**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	216
	Maintenance through 2020/21	9
	Other (STIP, Local, etc.)	0
	Total	**225**
Add New	Any SHOPP or 2022 PID Work Plan	0

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	5,253	1,051/year
	Maintenance for 10 Years	1,321	132/year
	Other	0	N/A
	Total	6,574	N/A
Fix Poor to Good	SHOPP for the Last 5 Years	33	7/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	33	N/A
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$644,406	18.0%
	Maintenance	$97,377	18.0%
Fix Poor to Good	SHOPP	$1,144,913	18.0%
	Maintenance	$97,377	18.0%
Add New	SHOPP	$1,100,000	18.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$4,732,206,248
	5-Year Performance Gap	$5,278,940,031
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$177,680,103
	Total	**$10,188,826,382**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	1,046	$1,696,493	$1,774,484,370	0	411	7	$1,696,493	$872,954	$2,159,887	$372,696,316
D2	980	$1,696,493	$1,662,222,326	0	384	0	$1,696,493	$957,671	$1,744,330	$366,005,680
D3	1,850	$1,696,493	$3,138,476,766	0	531	1	$1,696,493	$897,142	$1,635,355	$476,967,262
D4	3,682	$1,696,493	$6,247,247,937	0	1,382	3	$1,696,493	$725,496	$900,970	$1,000,275,003
D5	1,209	$1,696,493	$2,051,139,996	0	512	13	$1,696,493	$687,491	$1,227,151	$366,725,418
D6	2,056	$1,696,493	$3,487,528,543	0	494	0	$1,696,493	$678,706	$1,685,021	$333,023,224
D7	4,490	$1,696,493	$7,616,477,408	0	418	5	$1,696,493	$1,125,203	$2,526,623	$481,055,251
D8	4,615	$1,696,493	$7,828,532,270	0	963	0	$1,696,493	$744,460	$779,429	$714,908,047
D9	1,551	$1,696,493	$2,630,553,493	0	418	2	$1,696,493	$1,020,144	$2,118,167	$429,182,992
D10	1,253	$1,696,493	$2,126,225,088	0	547	0	$1,696,493	$676,367	$731,643	$369,157,310
D11	2,719	$1,696,493	$4,613,312,938	0	325	2	$1,696,493	$1,138,853	$2,995,101	$374,769,204
D12	1,445	$1,696,493	$2,451,732,932	0	189	0	$1,696,493	$912,518	$1,716,569	$171,854,428
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**26,895**	**N/A**	**$45,627,934,067**	**0**	**6,574**	**33**	**N/A**	**N/A**	**N/A**	**$5,456,620,134**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Pavement Class 2

(A) Baseline Inventory	
16,056	Lane Mile

(B) Projected Inventory (in 2031)	
16,056	Lane Mile

(C) Baseline Performance		
Good	7,509	46.8%
Fair	8,409	52.4%
Poor	138	0.9%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	8,831	55.0%
Fair	6,904	43.0%
Poor	321	2.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	9.4%	6,196
Into Poor	1.0%	843

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	470	2.9%
Fair	14,606	91.0%
Poor	981	6.1%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	3,907
	Maintenance through 2020/21	948
	Other (STIP, Local, etc.)	11
	Total	**4,866**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	90
	Maintenance through 2020/21	12
	Other (STIP, Local, etc.)	0
	Total	**102**
Add New	Any SHOPP or 2022 PID Work Plan	0

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	3,537	707/year
	Maintenance for 10 Years	1,509	151/year
	Other	0	N/A
	Total	5,046	N/A
Fix Poor to Good	SHOPP for the Last 5 Years	71	14/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	71	N/A
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$553,053	18.0%
	Maintenance	$100,558	18.0%
Fix Poor to Good	SHOPP	$731,301	18.0%
	Maintenance	$100,558	18.0%
Add New	SHOPP	$1,000,000	18.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$3,034,378,215
	5-Year Performance Gap	$3,096,980,634
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$209,597,340
	Total	**$6,340,956,189**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	732	$1,542,267	$1,128,477,964	0	197	2	$1,542,267	$487,340	$994,239	$96,067,974
D2	1,800	$1,542,267	$2,776,129,110	0	673	2	$1,542,267	$556,116	$744,965	$372,243,275
D3	1,856	$1,542,267	$2,861,837,488	0	481	4	$1,542,267	$603,610	$1,222,984	$292,103,838
D4	2,006	$1,542,267	$3,093,530,647	0	720	18	$1,542,267	$641,530	$887,817	$475,647,899
D5	1,299	$1,542,267	$2,002,852,094	0	456	16	$1,542,267	$696,556	$1,484,216	$338,592,298
D6	1,579	$1,542,267	$2,435,436,264	0	383	3	$1,542,267	$599,352	$1,024,444	$230,569,221
D7	1,311	$1,542,267	$2,021,488,842	0	330	6	$1,542,267	$778,004	$878,899	$261,270,052
D8	1,667	$1,542,267	$2,570,449,361	0	559	7	$1,542,267	$623,194	$1,566,202	$356,350,295
D9	578	$1,542,267	$891,633,635	0	174	0	$1,542,267	$567,026	$673,315	$97,335,007
D10	1,666	$1,542,267	$2,568,766,748	0	548	12	$1,542,267	$719,746	$922,874	$404,199,966
D11	1,050	$1,542,267	$1,619,733,038	0	297	1	$1,542,267	$874,962	$1,595,012	$260,050,380
D12	514	$1,542,267	$792,538,383	0	228	0	$1,542,267	$540,280	$690,599	$122,147,771
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**16,056**	**N/A**	**$24,762,873,574**	**0**	**5,046**	**71**	**N/A**	**N/A**	**N/A**	**$3,306,577,974**

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Pavement Class 3

(A) Baseline Inventory	
6,720	Lane Mile

(B) Projected Inventory (in 2031)	
6,720	Lane Mile

(C) Baseline Performance		
Good	3,002	44.7%
Fair	3,654	54.4%
Poor	64	1.0%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	3,024	45.0%
Fair	3,562	53.0%
Poor	134	2.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	9.3%	2,359
Into Poor	1.2%	437

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	207	3.1%
Fair	6,013	89.5%
Poor	501	7.5%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	569
	Maintenance through 2020/21	760
	Other (STIP, Local, etc.)	0
	Total	**1,329**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	30
	Maintenance through 2020/21	22
	Other (STIP, Local, etc.)	0
	Total	**52**
Add New	Any SHOPP or 2022 PID Work Plan	0

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	284	57/year
	Maintenance for 10 Years	1,764	176/year
	Other	0	N/A
	Total	2,048	N/A
Fix Poor to Good	SHOPP for the Last 5 Years	10	2/year
	Maintenance for 10 Years	22	2/year
	Other	0	N/A
	Total	32	N/A
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$673,486	18.0%
	Maintenance	$113,240	18.0%
Fix Poor to Good	SHOPP	$856,990	18.0%
	Maintenance	$113,240	18.0%
Add New	SHOPP	$1,000,000	18.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$312,995,732
	5-Year Performance Gap	$308,206,307
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$279,357,709
	Total	**$900,559,748**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	545	$1,542,267	$841,218,484	0	116	1	$1,542,267	$268,182	$174,646	$29,515,371
D2	1,173	$1,542,267	$1,809,842,064	0	204	4	$1,542,267	$174,646	$174,646	$32,534,380
D3	697	$1,542,267	$1,075,447,129	0	301	4	$1,542,267	$270,317	$894,569	$79,784,367
D4	363	$1,542,267	$559,535,840	0	239	6	$1,542,267	$533,750	$1,036,022	$131,066,045
D5	642	$1,542,267	$990,764,358	0	199	7	$1,542,267	$337,662	$252,406	$66,044,654
D6	1,360	$1,542,267	$2,097,078,410	0	300	4	$1,542,267	$318,563	$894,232	$94,187,151
D7	228	$1,542,267	$352,193,528	0	112	4	$1,542,267	$505,807	$174,646	$56,473,956
D8	319	$1,542,267	$492,195,857	0	142	2	$1,542,267	$174,646	$174,646	$22,523,802
D9	419	$1,542,267	$646,248,234	0	177	0	$1,542,267	$199,166	$1,282,150	$32,171,416
D10	579	$1,542,267	$892,506,558	0	167	0	$1,542,267	$191,839	$1,280,762	$29,029,084
D11	393	$1,542,267	$605,458,368	0	91	0	$1,542,267	$174,646	$1,268,269	$14,233,791
D12	1	$1,542,267	$2,066,637	0	0	0	$1,542,267	$971,559	$1,212,748	$0
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**6,712**	**N/A**	**$10,364,555,466**	**0**	**2,048**	**32**	**N/A**	**N/A**	**N/A**	**$587,564,017**

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Relinquishments

(A) Baseline Inventory	
N/A	N/A

(B) Projected Inventory (in 2031)	
N/A	N/A

(C) Baseline Performance		
Good	N/A	N/A
Fair	N/A	N/A
Poor	N/A	N/A

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	N/A	N/A
Fair	N/A	N/A
Poor	N/A	N/A

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	N/A	N/A

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	N/A	N/A
Fair	N/A	N/A
Poor	N/A	N/A

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Add New	Any SHOPP or 2022 PID Work Plan	N/A

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Add New	SHOPP for the Last 5 Years	N/A	N/A

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Add New	SHOPP	N/A	N/A

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$58,549,000
	5-Year Performance Gap	$46,000,000
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$104,549,000**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

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Roadside Rehabilitation

(A) Baseline Inventory	
33,997	Acre

(B) Projected Inventory (in 2031)	
33,997	Acre

(C) Baseline Performance		
Good	2,777	8.2%
Fair	6,522	19.2%
Poor	24,698	72.6%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	20,398	60.0%
Fair	10,199	30.0%
Poor	3,400	10.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	2.9%	811
Into Poor	5.8%	3,802

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	1,966	5.8%
Fair	3,531	10.4%
Poor	28,500	83.8%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	8
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**8**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	1,163
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	60
	Total	**1,223**
Add New	Any SHOPP or 2022 PID Work Plan	0

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	13	3/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**13**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	23,876	4,775/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**23,876**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$86,209	48.0%
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$86,209	48.0%
	Maintenance	N/A	N/A
Add New	SHOPP	$86,209	48.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$197,038,867
	5-Year Performance Gap	$3,983,737,629
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$4,180,776,496**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	902	$166,760	$150,417,822	0	-41	556	$166,760	$166,760	$166,760	$92,718,746
D2	429	$166,760	$71,540,183	0	11	234	$166,760	$166,760	$166,760	$40,856,282
D3	1,380	$166,760	$230,129,261	0	2	538	$166,760	$166,760	$166,760	$90,050,581
D4	7,340	$166,760	$1,224,020,855	0	-2,130	6,294	$166,760	$166,760	$166,760	$1,049,589,545
D5	716	$166,760	$119,400,399	0	-52	269	$166,760	$166,760	$166,760	$44,858,530
D6	1,638	$166,760	$273,153,428	0	-479	1,459	$166,760	$166,760	$166,760	$243,303,328
D7	7,278	$166,760	$1,213,681,714	0	-1,513	5,083	$166,760	$166,760	$166,760	$847,642,780
D8	3,491	$166,760	$582,160,327	0	-812	2,722	$166,760	$166,760	$166,760	$453,921,630
D9	0	$166,760	$0	0	0	0	$166,760	$166,760	$166,760	$0
D10	350	$166,760	$58,366,117	0	-90	262	$166,760	$166,760	$166,760	$43,691,208
D11	8,364	$166,760	$1,394,783,437	0	-1,327	5,763	$166,760	$166,760	$166,760	$961,039,807
D12	2,109	$166,760	$351,697,545	0	-246	696	$166,760	$166,760	$166,760	$116,065,193
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**33,997**	**N/A**	**$5,669,351,089**	**0**	**13**	**23,876**	**N/A**	**N/A**	**N/A**	**$3,983,737,629**

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Roadway Protective Betterments

(A) Baseline Inventory	
175	Location

(B) Projected Inventory (in 2031)	
175	Location

(C) Baseline Performance		
Good	N/A	N/A
Fair	N/A	N/A
Poor	175	100.0%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	175	100.0%
Fair	N/A	N/A
Poor	0	0.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	N/A	N/A

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	N/A	N/A
Fair	N/A	N/A
Poor	175	100.0%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	9
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**9**
Add New	Any SHOPP or 2022 PID Work Plan	N/A

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	166	33/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**166**	**N/A**
Add New	SHOPP for the Last 5 Years	N/A	N/A

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$5,040,000	48.0%
	Maintenance	N/A	N/A
Add New	SHOPP	N/A	N/A

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$79,075,871
	5-Year Performance Gap	$1,618,369,805
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$1,697,445,676**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	77	N/A	N/A	N/A	N/A	76	N/A	N/A	$9,749,216	$740,940,393
D2	15	N/A	N/A	N/A	N/A	12	N/A	N/A	$9,749,216	$116,990,588
D3	5	N/A	N/A	N/A	N/A	4	N/A	N/A	$9,749,216	$38,996,863
D4	14	N/A	N/A	N/A	N/A	11	N/A	N/A	$9,749,216	$107,241,373
D5	11	N/A	N/A	N/A	N/A	11	N/A	N/A	$9,749,216	$107,241,373
D6	3	N/A	N/A	N/A	N/A	2	N/A	N/A	$9,749,216	$19,498,431
D7	19	N/A	N/A	N/A	N/A	19	N/A	N/A	$9,749,216	$185,235,098
D8	11	N/A	N/A	N/A	N/A	11	N/A	N/A	$9,749,216	$107,241,373
D9	11	N/A	N/A	N/A	N/A	11	N/A	N/A	$9,749,216	$107,241,373
D10	5	N/A	N/A	N/A	N/A	5	N/A	N/A	$9,749,216	$48,746,078
D11	1	N/A	N/A	N/A	N/A	1	N/A	N/A	$9,749,216	$9,749,216
D12	3	N/A	N/A	N/A	N/A	3	N/A	N/A	$9,749,216	$29,247,647
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**175**	**N/A**	**N/A**	**N/A**	**N/A**	**166**	**N/A**	**N/A**	**N/A**	**$1,618,369,805**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Safety Roadside Rest Area (SRRA) Rehabilitation

(A) Baseline Inventory	
86	Location

(B) Projected Inventory (in 2031)	
86	Location

(C) Baseline Performance		
Good	31	36.0%
Fair	31	36.0%
Poor	24	27.9%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	69	80.0%
Fair	17	20.0%
Poor	0	0.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	5.8%	18
Into Poor	10.0%	31

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	13	15.1%
Fair	18	20.9%
Poor	55	64.0%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	0
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**0**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	10
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**10**
Add New	Any SHOPP or 2022 PID Work Plan	0

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	5	1/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**5**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	45	9/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**45**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$8,248,800	104.0%
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$8,248,800	104.0%
	Maintenance	N/A	N/A
Add New	SHOPP	$17,358,600	43.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$107,098,983
	5-Year Performance Gap	$1,099,685,181
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$1,206,784,164**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	6	$32,443,534	$194,661,206	0	-1	6	$32,443,534	$21,993,704	$21,993,704	$131,962,222
D2	20	$32,443,534	$648,870,688	0	-1	15	$32,443,534	$21,993,704	$21,993,704	$329,905,554
D3	11	$32,443,534	$356,878,878	0	0	5	$32,443,534	$21,993,704	$21,993,704	$109,968,518
D4	3	$32,443,534	$97,330,603	0	1	0	$32,443,534	$21,993,704	$21,993,704	$21,993,704
D5	5	$32,443,534	$162,217,672	0	1	2	$32,443,534	$21,993,704	$21,993,704	$65,981,111
D6	9	$32,443,534	$291,991,810	0	1	4	$32,443,534	$21,993,704	$21,993,704	$109,968,518
D7	0	$32,443,534	$0	0	0	0	$32,443,534	$21,993,704	$21,993,704	$0
D8	15	$32,443,534	$486,653,016	0	-1	7	$32,443,534	$21,993,704	$21,993,704	$153,955,925
D9	5	$32,443,534	$162,217,672	0	0	3	$32,443,534	$21,993,704	$21,993,704	$65,981,111
D10	6	$32,443,534	$194,661,206	0	-1	2	$32,443,534	$21,993,704	$21,993,704	$43,987,407
D11	6	$32,443,534	$194,661,206	0	2	1	$32,443,534	$21,993,704	$21,993,704	$65,981,111
D12	0	$32,443,534	$0	0	0	0	$32,443,534	$21,993,704	$21,993,704	$0
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**86**	**N/A**	**$2,790,143,958**	**0**	**5**	**45**	**N/A**	**N/A**	**N/A**	**$1,099,685,181**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Sign Panel Replacement

(A) Baseline Inventory	
87,131	Each

(B) Projected Inventory (in 2031)	
90,043	Each

(C) Baseline Performance		
Good	8,854	10.2%
Fair	0	0.0%
Poor	78,277	89.8%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	0	0.0%
Fair	90,043	100.0%
Poor	0	0.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	6.7%	5,906
Into Poor	20.0%	0

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	2,948	3.4%
Fair	5,906	6.8%
Poor	78,277	89.8%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	135
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	29
	Total	**164**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	18,388
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	1,027
	Total	**19,415**
Add New	Any SHOPP or 2022 PID Work Plan	2,020

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	0	0/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**0**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	58,862	11,772/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**58,862**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$8,243	30.0%
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$8,243	30.0%
	Maintenance	N/A	N/A
Add New	SHOPP	$8,243	30.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$128,016,262
	5-Year Performance Gap	$824,355,898
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$952,372,160**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	5,583	$14,005	$78,189,307	0	-5,535	2,551	$14,005	$14,005	$14,005	$35,726,477
D2	7,460	$14,005	$104,476,487	0	-7,132	5,449	$14,005	$14,005	$14,005	$76,312,651
D3	6,884	$14,005	$96,409,670	0	-6,378	5,702	$14,005	$14,005	$14,005	$79,855,889
D4	13,895	$14,005	$194,597,961	0	-12,880	12,057	$14,005	$14,005	$14,005	$168,856,972
D5	4,560	$14,005	$63,862,303	0	-3,543	2,317	$14,005	$14,005	$14,005	$32,449,333
D6	7,192	$14,005	$100,723,177	0	-6,704	5,106	$14,005	$14,005	$14,005	$71,508,974
D7	17,346	$14,005	$242,928,840	0	-16,436	11,388	$14,005	$14,005	$14,005	$159,487,699
D8	8,783	$14,005	$123,004,958	0	-8,252	6,222	$14,005	$14,005	$14,005	$87,138,432
D9	1,512	$14,005	$21,175,395	0	-1,481	1,225	$14,005	$14,005	$14,005	$17,155,992
D10	4,623	$14,005	$64,744,611	0	-4,453	3,061	$14,005	$14,005	$14,005	$42,868,972
D11	8,296	$14,005	$116,184,576	0	-7,933	1,255	$14,005	$14,005	$14,005	$17,576,138
D12	3,909	$14,005	$54,745,119	0	-3,575	2,529	$14,005	$14,005	$14,005	$35,418,370
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**90,043**	**N/A**	**$1,261,042,406**	**0**	**0**	**58,862**	**N/A**	**N/A**	**N/A**	**$824,355,898**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Storm Water Mitigation

(A) Baseline Inventory	
27,030	Compliance Unit

(B) Projected Inventory (in 2031)	
27,030	Compliance Unit

(C) Baseline Performance		
Good	N/A	N/A
Fair	N/A	N/A
Poor	27,030	100.0%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	27,030	100.0%
Fair	N/A	N/A
Poor	0	0.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	N/A	N/A

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	N/A	N/A
Fair	N/A	N/A
Poor	27,030	100.0%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	6,365
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**6,365**
Add New	Any SHOPP or 2022 PID Work Plan	N/A

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	20,665	4,133/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**20,665**	**N/A**
Add New	SHOPP for the Last 5 Years	N/A	N/A

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$60,879	44.0%
	Maintenance	N/A	N/A
Add New	SHOPP	N/A	N/A

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$575,948,000
	5-Year Performance Gap	$2,367,788,128
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$2,943,736,128**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	1,036	N/A	N/A	N/A	N/A	855	N/A	N/A	$114,580	$97,965,587
D2	1,558	N/A	N/A	N/A	N/A	1,311	N/A	N/A	$114,580	$150,213,900
D3	2,147	N/A	N/A	N/A	N/A	2,040	N/A	N/A	$114,580	$233,742,453
D4	4,885	N/A	N/A	N/A	N/A	3,218	N/A	N/A	$114,580	$368,717,261
D5	576	N/A	N/A	N/A	N/A	549	N/A	N/A	$114,580	$62,904,219
D6	73	N/A	N/A	N/A	N/A	73	N/A	N/A	$114,580	$8,364,313
D7	8,452	N/A	N/A	N/A	N/A	5,347	N/A	N/A	$114,580	$612,657,301
D8	2,948	N/A	N/A	N/A	N/A	2,396	N/A	N/A	$114,580	$274,532,802
D9	0	N/A	N/A	N/A	N/A	0	N/A	N/A	$114,580	$0
D10	744	N/A	N/A	N/A	N/A	704	N/A	N/A	$114,580	$80,664,062
D11	2,599	N/A	N/A	N/A	N/A	2,305	N/A	N/A	$114,580	$264,106,055
D12	2,012	N/A	N/A	N/A	N/A	1,867	N/A	N/A	$114,580	$213,920,176
HQ	N/A	N/A	N/A	N/A	N/A	0	N/A	N/A	N/A	N/A
Statewide Totals	**27,030**	**N/A**	**N/A**	**N/A**	**N/A**	**20,665**	**N/A**	**N/A**	**N/A**	**$2,367,788,128**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Transportation Management Systems

(A) Baseline Inventory	
20,816	Each

(B) Projected Inventory (in 2031)	
24,230	Each

(C) Baseline Performance		
Good	14,801	71.1%
Fair	N/A	N/A
Poor	6,015	28.9%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	21,807	90.0%
Fair	N/A	N/A
Poor	2,423	10.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	4.7%	7,004

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	7,797	37.5%
Fair	N/A	N/A
Poor	13,019	62.5%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	4,798
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	83
	Total	**4,881**
Add New	Any SHOPP or 2022 PID Work Plan	3,274

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	5,716	1,143/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**5,716**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$81,788	35.0%
	Maintenance	N/A	N/A
Add New	SHOPP	$81,788	35.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$1,333,139,864
	5-Year Performance Gap	$824,880,706
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$2,158,020,570**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	294	$144,311	$42,427,384	0	N/A	107	$144,311	N/A	$144,311	$15,441,259
D2	435	$144,311	$62,775,211	0	N/A	187	$144,311	N/A	$144,311	$26,986,125
D3	1,775	$144,311	$256,151,724	0	N/A	181	$144,311	N/A	$144,311	$26,120,260
D4	5,770	$144,311	$832,673,491	0	N/A	2,630	$144,311	N/A	$144,311	$379,537,484
D5	878	$144,311	$126,704,909	0	N/A	117	$144,311	N/A	$144,311	$16,884,367
D6	1,384	$144,311	$199,726,189	0	N/A	372	$144,311	N/A	$144,311	$53,683,629
D7	4,698	$144,311	$677,972,281	0	N/A	277	$144,311	N/A	$144,311	$39,974,100
D8	2,252	$144,311	$324,987,990	0	N/A	423	$144,311	N/A	$144,311	$61,043,481
D9	230	$144,311	$33,191,491	0	N/A	125	$144,311	N/A	$144,311	$18,038,854
D10	1,788	$144,311	$258,027,764	0	N/A	652	$144,311	N/A	$144,311	$94,090,661
D11	2,326	$144,311	$335,666,991	0	N/A	539	$144,311	N/A	$144,311	$77,783,538
D12	2,400	$144,311	$346,345,993	0	N/A	106	$144,311	N/A	$144,311	$15,296,948
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**24,230**	**N/A**	**$3,496,651,417**	**0**	**N/A**	**5,716**	**N/A**	**N/A**	**N/A**	**$824,880,706**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Transportation Management System Structures

(A) Baseline Inventory	
20,816	Each

(B) Projected Inventory (in 2031)	
24,230	Each

(C) Baseline Performance		
Good	20,424	98.1%
Fair	N/A	N/A
Poor	392	1.9%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	21,807	90.0%
Fair	N/A	N/A
Poor	2,423	10.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario		
	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	0.4%	826

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	23,012	95.0%
Fair	N/A	N/A
Poor	1,218	5.0%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	0
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**0**
Add New	Any SHOPP or 2022 PID Work Plan	3,274

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	0	0/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**0**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$352,721	35.0%
	Maintenance	N/A	N/A
Add New	SHOPP	$352,721	35.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$501,783,020
	5-Year Performance Gap	$0
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$501,783,020**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	294	$622,362	$182,974,324	0	N/A	-4	$622,362	N/A	$622,362	$0
D2	435	$622,362	$270,727,316	0	N/A	-12	$622,362	N/A	$622,362	$0
D3	1,775	$622,362	$1,104,691,921	0	N/A	-39	$622,362	N/A	$622,362	$0
D4	5,770	$622,362	$3,591,026,694	0	N/A	-333	$622,362	N/A	$622,362	$0
D5	878	$622,362	$546,433,525	0	N/A	-35	$622,362	N/A	$622,362	$0
D6	1,384	$622,362	$861,348,517	0	N/A	-50	$622,362	N/A	$622,362	$0
D7	4,698	$622,362	$2,923,855,010	0	N/A	-46	$622,362	N/A	$622,362	$0
D8	2,252	$622,362	$1,401,558,426	0	N/A	-118	$622,362	N/A	$622,362	$0
D9	230	$622,362	$143,143,178	0	N/A	-21	$622,362	N/A	$622,362	$0
D10	1,788	$622,362	$1,112,782,622	0	N/A	-152	$622,362	N/A	$622,362	$0
D11	2,326	$622,362	$1,447,613,187	0	N/A	-184	$622,362	N/A	$622,362	$0
D12	2,400	$622,362	$1,493,667,949	0	N/A	-212	$622,362	N/A	$622,362	$0
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**24,230**	**N/A**	**$15,079,822,670**	**0**	**N/A**	**0**	**N/A**	**N/A**	**N/A**	**$0**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Transportation Related Facilities

(A) Baseline Inventory	
4,382,000	Square Foot

(B) Projected Inventory (in 2031)	
4,527,788	Square Foot

(C) Baseline Performance		
Good	1,000,078	22.8%
Fair	769,806	17.6%
Poor	2,612,116	59.6%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	2,716,673	60.0%
Fair	1,811,115	40.0%
Poor	0	0.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	5.0%	500,039
Into Poor	5.0%	384,903

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	500,039	11.4%
Fair	884,942	20.2%
Poor	2,997,019	68.4%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	704
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**704**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	303,967
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**303,967**
Add New	Any SHOPP or 2022 PID Work Plan	145,788

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	6,651	1,330/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**6,651**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	2,693,054	538,611/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**2,693,054**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$742	78.0%
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$742	78.0%
	Maintenance	N/A	N/A
Add New	SHOPP	$742	78.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$460,366,535
	5-Year Performance Gap	$4,658,581,844
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$5,118,948,380**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	182,262	$1,726	$314,509,342	0	-64,034	151,400	$1,726	$1,726	$1,726	$261,254,208
D2	525,714	$1,726	$907,166,411	0	-78,416	335,080	$1,726	$1,726	$1,726	$578,210,436
D3	566,229	$1,726	$977,078,658	0	-182,438	449,874	$1,726	$1,726	$1,726	$776,297,725
D4	601,617	$1,726	$1,038,143,810	0	-141,005	399,151	$1,726	$1,726	$1,726	$688,770,663
D5	238,033	$1,726	$410,747,179	0	-77,426	107,327	$1,726	$1,726	$1,726	$185,202,314
D6	261,445	$1,726	$451,146,674	0	-67,168	166,199	$1,726	$1,726	$1,726	$286,791,203
D7	532,261	$1,726	$918,463,844	0	-41,646	211,125	$1,726	$1,726	$1,726	$364,315,024
D8	353,520	$1,726	$610,030,301	0	-57,285	163,306	$1,726	$1,726	$1,726	$281,799,073
D9	258,011	$1,726	$445,221,000	0	-6,140	42,044	$1,726	$1,726	$1,726	$72,550,673
D10	273,056	$1,726	$471,182,490	0	-88,917	208,504	$1,726	$1,726	$1,726	$359,792,255
D11	266,966	$1,726	$460,673,652	0	-27,185	180,355	$1,726	$1,726	$1,726	$311,218,644
D12	206,252	$1,726	$355,906,228	0	6,651	22,467	$1,726	$1,726	$1,726	$50,245,707
HQ	262,422	$1,726	$452,832,574	0	-$101,869	256,222	$1,726	$1,726	$1,726	$442,133,921
Statewide Totals	**4,527,788**	**N/A**	**$7,813,102,162**	**0**	**6,651**	**2,693,054**	**N/A**	**N/A**	**N/A**	**$4,658,581,844**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Water and Wastewater Treatment at SRRAs

(A) Baseline Inventory	
86	Location

(B) Projected Inventory (in 2031)	
86	Location

(C) Baseline Performance		
Good	18	20.9%
Fair	19	22.1%
Poor	49	57.0%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	69	80.0%
Fair	17	20.0%
Poor	0	0.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	5.7%	10
Into Poor	10.0%	19

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	8	9.0%
Fair	10	12.0%
Poor	68	79.1%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	0
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**0**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	36
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**36**
Add New	Any SHOPP or 2022 PID Work Plan	0

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	0	0/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**0**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	32	6/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**0**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$2,888,936	60.0%
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$2,888,936	60.0%
	Maintenance	N/A	N/A
Add New	SHOPP	$2,888,936	60.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$49,916,796
	5-Year Performance Gap	$193,323,820
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$243,240,616**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	6	$6,041,369	$36,248,216	0	-1	3	$6,041,369	$6,041,369	$6,041,369	$18,124,108
D2	20	$6,041,369	$120,827,388	0	-1	9	$6,041,369	$6,041,369	$6,041,369	$54,372,324
D3	11	$6,041,369	$66,455,063	0	-1	4	$6,041,369	$6,041,369	$6,041,369	$24,165,478
D4	3	$6,041,369	$18,124,108	0	0	2	$6,041,369	$6,041,369	$6,041,369	$12,082,739
D5	5	$6,041,369	$30,206,847	0	-1	0	$6,041,369	$6,041,369	$6,041,369	$0
D6	9	$6,041,369	$54,372,324	0	-1	0	$6,041,369	$6,041,369	$6,041,369	$0
D7	0	$6,041,369	$0	0	0	0	$6,041,369	$6,041,369	$6,041,369	$0
D8	15	$6,041,369	$90,620,541	0	-1	6	$6,041,369	$6,041,369	$6,041,369	$36,248,216
D9	5	$6,041,369	$30,206,847	0	-1	5	$6,041,369	$6,041,369	$6,041,369	$30,206,847
D10	6	$6,041,369	$36,248,216	0	0	0	$6,041,369	$6,041,369	$6,041,369	$0
D11	6	$6,041,369	$36,248,216	0	0	3	$6,041,369	$6,041,369	$6,041,369	$18,124,108
D12	0	$6,041,369	$0	0	0	0	$6,041,369	$6,041,369	$6,041,369	$0
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**86**	**N/A**	**$519,557,767**	**0**	**0**	**32**	**N/A**	**N/A**	**N/A**	**$193,323,820**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Weigh-In-Motion Scales

(A) Baseline Inventory	
140	Station

(B) Projected Inventory (in 2031)	
150	Station

(C) Baseline Performance		
Good	62	44.3%
Fair	25	17.9%
Poor	53	37.9%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	135	90.0%
Fair	15	10.0%
Poor	0	0.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	10.0%	62
Into Poor	6.8%	17

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	10	6.7%
Fair	70	46.7%
Poor	70	46.7%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	1
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**1**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	22
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**22**
Add New	Any SHOPP or 2022 PID Work Plan	10

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	55	11/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**55**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	48	10/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**48**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	$708,016	66.0%
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$1,915,918	66.0%
	Maintenance	N/A	N/A
Add New	SHOPP	$1,915,918	66.0%

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$92,288,851
	5-Year Performance Gap	$284,015,228
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$376,304,079**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	4	$4,156,833	$16,627,330	0	0	3	$4,156,833	$1,536,132	$4,156,833	$12,470,498
D2	8	$4,156,833	$33,254,661	0	3	3	$4,156,833	$1,536,132	$4,156,833	$17,078,894
D3	12	$4,156,833	$49,881,991	0	7	1	$4,156,833	$1,536,132	$4,156,833	$14,909,757
D4	30	$4,156,833	$124,704,977	0	16	7	$4,156,833	$1,536,132	$4,156,833	$53,675,941
D5	4	$4,156,833	$16,627,330	0	2	1	$4,156,833	$1,536,132	$4,156,833	$7,229,097
D6	8	$4,156,833	$33,254,661	0	1	5	$4,156,833	$1,536,132	$4,156,833	$22,320,295
D7	18	$4,156,833	$74,822,986	0	9	1	$4,156,833	$1,536,132	$4,156,833	$17,982,021
D8	26	$4,156,833	$108,077,647	0	11	8	$4,156,833	$1,536,132	$4,156,833	$50,152,113
D9	1	$4,156,833	$4,156,833	0	-1	1	$4,156,833	$1,536,132	$4,156,833	$4,156,833
D10	10	$4,156,833	$41,568,326	0	1	7	$4,156,833	$1,536,132	$4,156,833	$30,633,960
D11	17	$4,156,833	$70,666,154	0	0	11	$4,156,833	$1,536,132	$4,156,833	$45,725,158
D12	12	$4,156,833	$49,881,991	0	5	0	$4,156,833	$1,536,132	$4,156,833	$7,680,660
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**150**	**N/A**	**$623,524,886**	**0**	**55**	**48**	**N/A**	**N/A**	**N/A**	**$284,015,228**

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Sea Level Rise

(A) Baseline Inventory	
135	Deficiency Unit

(B) Projected Inventory (in 2031)	
135	Deficiency Unit

(C) Baseline Performance		
Good	N/A	N/A
Fair	N/A	N/A
Poor	135	100.0%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	135	100.0%
Fair	N/A	N/A
Poor	0	0.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	N/A	N/A

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	N/A	N/A
Fair	N/A	N/A
Poor	135	100.0%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	0
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**0**
Add New	Any SHOPP or 2022 PID Work Plan	N/A

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	135	27/year
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**135**	**N/A**
Add New	SHOPP for the Last 5 Years	N/A	N/A

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$63,000,000	0.0%
	Maintenance	N/A	N/A
Add New	SHOPP	N/A	N/A

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$0
	5-Year Performance Gap	$11,120,000,000
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$11,120,000,000**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	17	N/A	N/A	N/A	N/A	17	N/A	N/A	$82,341,349	$1,370,000,000
D2	0	N/A	N/A	N/A	N/A	0	N/A	N/A	$82,341,349	$0
D3	4	N/A	N/A	N/A	N/A	4	N/A	N/A	$82,341,349	$330,000,000
D4	52	N/A	N/A	N/A	N/A	52	N/A	N/A	$82,341,349	$4,270,000,000
D5	5	N/A	N/A	N/A	N/A	5	N/A	N/A	$82,341,349	$380,000,000
D6	0	N/A	N/A	N/A	N/A	0	N/A	N/A	$82,341,349	$0
D7	22	N/A	N/A	N/A	N/A	22	N/A	N/A	$82,341,349	$1,790,000,000
D8	0	N/A	N/A	N/A	N/A	0	N/A	N/A	$82,341,349	$0
D9	0	N/A	N/A	N/A	N/A	0	N/A	N/A	$82,341,349	$0
D10	7	N/A	N/A	N/A	N/A	7	N/A	N/A	$82,341,349	$560,000,000
D11	13	N/A	N/A	N/A	N/A	13	N/A	N/A	$82,341,349	$1,100,000,000
D12	16	N/A	N/A	N/A	N/A	16	N/A	N/A	$82,341,349	$1,320,000,000
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**135**	**N/A**	**N/A**	**N/A**	**N/A**	**135**	**N/A**	**N/A**	**N/A**	**$11,120,000,000**

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ADA Pedestrian Infrastructure

(A) Baseline Inventory	
189,541	Deficient Elements

(B) Projected Inventory (in 2031)	
189,541	Deficient Elements

(C) Baseline Performance		
Good	N/A	N/A
Fair	N/A	N/A
Poor	189,541	100.0%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	47,385	25.0%
Fair	N/A	N/A
Poor	142,156	75.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario		
	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	N/A	N/A

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	N/A	N/A
Fair	N/A	N/A
Poor	189,541	100.0%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	25,640
	Maintenance through 2020/21	15
	Other (STIP, Local, etc.)	172
	Total	**25,827**
Add New	Any SHOPP or 2022 PID Work Plan	N/A

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	22,117	4,423/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**22,117**	**N/A**
Add New	SHOPP for the Last 5 Years	N/A	N/A

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$14,480	97.0%
	Maintenance	N/A	N/A
Add New	SHOPP	N/A	N/A

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$473,853,000
	5-Year Performance Gap	$824,586,145
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$1,298,439,145**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	4,603	N/A	N/A	N/A	N/A	-83	N/A	N/A	$37,283	$0
D2	6,296	N/A	N/A	N/A	N/A	-313	N/A	N/A	$37,283	$0
D3	14,757	N/A	N/A	N/A	N/A	2,502	N/A	N/A	$37,283	$93,281,844
D4	48,435	N/A	N/A	N/A	N/A	6,339	N/A	N/A	$37,283	$236,336,374
D5	11,074	N/A	N/A	N/A	N/A	995	N/A	N/A	$37,283	$37,096,497
D6	15,706	N/A	N/A	N/A	N/A	3,449	N/A	N/A	$37,283	$128,588,760
D7	37,407	N/A	N/A	N/A	N/A	2,922	N/A	N/A	$37,283	$108,940,666
D8	17,505	N/A	N/A	N/A	N/A	2,535	N/A	N/A	$37,283	$94,512,180
D9	1,444	N/A	N/A	N/A	N/A	-161	N/A	N/A	$37,283	$0
D10	10,092	N/A	N/A	N/A	N/A	185	N/A	N/A	$37,283	$6,897,339
D11	10,554	N/A	N/A	N/A	N/A	1,474	N/A	N/A	$37,283	$54,955,011
D12	11,668	N/A	N/A	N/A	N/A	1,716	N/A	N/A	$37,283	$63,977,475
HQ	N/A	N/A	N/A	N/A	N/A	0	N/A	N/A	N/A	N/A
Statewide Totals	**189,541**	**N/A**	**N/A**	**N/A**	**N/A**	**22,117**	**N/A**	**N/A**	**N/A**	**$824,586,145**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Complete Streets Fix Existing

(A) Baseline Inventory	
7,623,345	Linear Foot

(B) Projected Inventory (in 2031)	
7,623,345	Linear Foot

(C) Baseline Performance		
Good	5,379,773	70.6%
Fair	1,718,043	22.5%
Poor	525,529	6.9%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	5,260,108	69.0%
Fair	2,210,770	29.0%
Poor	152,467	2.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	2.6%	1,398,741
Into Poor	2.2%	377,969

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	3,981,032	52.2%
Fair	2,738,815	35.9%
Poor	903,498	11.9%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	51
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**51**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	247,008
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**247,008**
Add New	Any SHOPP or 2022 PID Work Plan	0

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	0	0/year
	Maintenance for 10 Years	0	0/year
	Other	530,491	N/A
	Total	**530,491**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	537,235	107,447/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**537,235**	**N/A**
Add New	SHOPP for the Last 5 Years	0	0/year

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$243	100.0%
	Maintenance	N/A	N/A
Add New	SHOPP	N/A	N/A

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$49,712,631
	5-Year Performance Gap	$340,917,151
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	$390,629,782

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	224,492	$549	$123,233,160	0	20,242	-4,389	$549	N/A	$635	$0
D2	380,984	$549	$209,138,243	0	36,932	49,573	$549	N/A	$635	$31,457,902
D3	713,643	$549	$391,748,848	0	(2,496)	140,267	$549	N/A	$635	$89,010,258
D4	1,591,221	$549	$873,488,555	0	182,407	214,698	$549	N/A	$635	$136,242,483
D5	525,026	$549	$288,208,993	0	13,383	-7,640	$549	N/A	$635	$0
D6	568,414	$549	$312,026,503	0	33,010	27,095	$549	N/A	$635	$17,193,873
D7	1,430,792	$549	$785,422,287	0	99,302	-21,182	$549	N/A	$635	$0
D8	623,131	$549	$342,062,980	0	37,583	23,950	$549	N/A	$635	$15,198,127
D9	147,095	$549	$80,746,671	0	10,485	4,082	$549	N/A	$635	$2,590,345
D10	483,191	$549	$265,243,991	0	25,850	9,355	$549	N/A	$635	$5,936,471
D11	348,840	$549	$191,493,041	0	63,070	65,157	$549	N/A	$635	$41,347,155
D12	586,516	$549	$321,963,457	0	8,227	3,058	$549	N/A	$635	$1,940,537
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**82,560**	**N/A**	**$4,184,776,728**	**0**	530,491	537,235	N/A	N/A	N/A	$340,917,151

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Complete Street Build New

(A) Baseline Inventory	
24,202,691	Linear Foot

(B) Projected Inventory (in 2031)	
24,202,691	Linear Foot

(C) Baseline Performance		
Good	N/A	N/A
Fair	N/A	N/A
Poor	24,202,691	100.0%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	24,202,691	100.0%
Fair	N/A	N/A
Poor	0	0.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	N/A	N/A

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	0	0.0%
Fair	N/A	N/A
Poor	24,202,691	100.0%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	3,245,087
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	0
	Total	**3,245,087**
Add New	Any SHOPP or 2022 PID Work Plan	N/A

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	20,957,603	4,192,521/year
	Maintenance for 10 Years	0	0/year
	Other	0	N/A
	Total	**20,957,603**	**N/A**
Add New	SHOPP for the Last 5 Years	NA	N/A

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$210	100.0%
	Maintenance	N/A	N/A
Add New	SHOPP	N/A	N/A

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$427,744,713
	5-Year Performance Gap	$11,504,515,317
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$11,932,260,029**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	1,476,389	N/A	N/A	N/A	N/A	1,447,153	N/A	N/A	$549	$794,403,532
D2	2,557,237	N/A	N/A	N/A	N/A	2,463,170	N/A	N/A	$549	$1,352,138,267
D3	1,636,147	N/A	N/A	N/A	N/A	1,484,340	N/A	N/A	$549	$814,817,051
D4	3,569,755	N/A	N/A	N/A	N/A	3,177,892	N/A	N/A	$549	$1,744,479,423
D5	1,115,030	N/A	N/A	N/A	N/A	973,627	N/A	N/A	$549	$534,465,069
D6	2,367,737	N/A	N/A	N/A	N/A	2,003,573	N/A	N/A	$549	$1,099,846,021
D7	2,221,357	N/A	N/A	N/A	N/A	2,052,654	N/A	N/A	$549	$1,126,788,659
D8	2,045,412	N/A	N/A	N/A	N/A	581,330	N/A	N/A	$549	$319,116,642
D9	1,517,135	N/A	N/A	N/A	N/A	1,493,848	N/A	N/A	$549	$820,036,394
D10	2,359,738	N/A	N/A	N/A	N/A	2,046,040	N/A	N/A	$549	$1,123,157,955
D11	3,140,386	N/A	N/A	N/A	N/A	3,111,629	N/A	N/A	$549	$1,708,104,858
D12	196,368	N/A	N/A	N/A	N/A	122,347	N/A	N/A	$549	$67,161,447
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**24,202,691**	**N/A**	**N/A**	**N/A**	**N/A**	20,957,603	N/A	N/A	N/A	$11,504,515,317

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

Operational Improvements

(A) Baseline Inventory	
1,367,097	Daily Vehicle Hours of Delay

(B) Projected Inventory (in 2031)	
1,367,097	Daily Vehicle Hours of Delay

(C) Baseline Performance		
Good	N/A	N/A
Fair	N/A	N/A
Poor	1,367,097	100.0%

(D) Desired State of Repair (DSOR) Target Performance		
Good or New	136,710	10.0%
Fair	N/A	N/A
Poor	1,230,387	90.0%

(E) Effective Deterioration (by 2031) - Do Nothing Scenario	Average Annual Rate	10-Year Deterioration
Into Fair	N/A	N/A
Into Poor	N/A	N/A

(F) Projected Performance (in 2031) - Do Nothing Scenario		
Good	N/A	N/A
Fair	N/A	N/A
Poor	1,367,097	100.0%

(G) Pipelined Projects Performance		
Fix Fair to Good	Any SHOPP or 2022 PID Work Plan	N/A
	Maintenance through 2020/21	N/A
	Other (STIP, Local, etc.)	N/A
	Total	**N/A**
Fix Poor to Good or Fair	Any SHOPP or 2022 PID Work Plan	49,140
	Maintenance through 2020/21	0
	Other (STIP, Local, etc.)	127,703
	Total	**176,843**
Add New	Any SHOPP or 2022 PID Work Plan	N/A

(H) Performance Gap			
Fix Fair to Good	SHOPP for the Last 5 Years	N/A	N/A
	Maintenance for 10 Years	N/A	N/A
	Other	N/A	N/A
	Total	**N/A**	**N/A**
Fix Poor to Good	SHOPP for the Last 5 Years	23,000	4,600/year
	Maintenance for 10 Years	0	0/year
	Other	68,993	N/A
	Total	**91,993**	**N/A**
Add New	SHOPP for the Last 5 Years	N/A	N/A

(I) Average Un-escalated Capital Unit Cost and Support Ratio*			
Fix Fair to Good	SHOPP	N/A	N/A
	Maintenance	N/A	N/A
Fix Poor to Good	SHOPP	$30,081	26.0%
	Maintenance	N/A	N/A
Add New	SHOPP	N/A	N/A

(J) Estimated SHOPP and Maintenance Costs for 10 Years		
SHOPP	Unfunded Pipelined Projects	$520,162,000
	5-Year Performance Gap	$1,139,387,742
Maintenance	Unfunded Pipelined Work	$0
	10-Year Performance Gap	$0
	Total	**$1,659,549,742**

(K) District Breakdown

District	Projected Inventory	Replacement Total Unit Cost*	Asset Valuation	Performance Gap			Average of Escalated SHOPP & Maint Total Unit Costs			SHOPP & Maint Gap Cost
				New	Fair	Poor	New	Fair	Poor	
D1	0	N/A	N/A	N/A	N/A	-144	N/A	N/A	$49,539	$0
D2	0	N/A	N/A	N/A	N/A	-15	N/A	N/A	$49,539	$0
D3	58,000	N/A	N/A	N/A	N/A	3,038	N/A	N/A	$49,539	$37,649,334
D4	310,000	N/A	N/A	N/A	N/A	27,604	N/A	N/A	$49,539	$341,865,861
D5	11,517	N/A	N/A	N/A	N/A	1,135	N/A	N/A	$49,539	$14,068,962
D6	20,544	N/A	N/A	N/A	N/A	-571	N/A	N/A	$49,539	$0
D7	592,000	N/A	N/A	N/A	N/A	43,710	N/A	N/A	$49,539	$541,357,793
D8	134,000	N/A	N/A	N/A	N/A	7,940	N/A	N/A	$49,539	$98,334,116
D9	0	N/A	N/A	N/A	N/A	0	N/A	N/A	$49,539	$0
D10	32,036	N/A	N/A	N/A	N/A	-1,196	N/A	N/A	$49,539	$0
D11	126,000	N/A	N/A	N/A	N/A	8,566	N/A	N/A	$49,539	$106,111,676
D12	83,000	N/A	N/A	N/A	N/A	-130,200	N/A	N/A	$49,539	$0
HQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Statewide Totals	**1,367,097**	**N/A**	**N/A**	**N/A**	**N/A**	**91,993**	**N/A**	**N/A**	**N/A**	**$1,139,387,742**

(*) DO NOT use these unit costs or support ratios for planning or project-level estimates. They represent a multi-year, programmatic-level average which includes numerous possible treatments.

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Appendix C: 5-Year Maintenance Investment Plan

State statute requires the State Highway System Management Plan (SHSMP) include a 5-year Maintenance Investment Plan. To comply with state statutes, annual funding levels from the 10-Year Maintenance Investment Plan shown in Chapter 4 were used. A SHOPP cost avoidance analysis was performed and supports the funding levels identified in the 5-year Maintenance Investment Plan for the four primary asset classes under pavement, bridge and tunnel health, drainage restoration, and TMS. The analysis considers the historic investments in preventive maintenance and the degree to which those investments reduce the need for more costly capital improvements through the SHOPP. The 10-year Maintenance Investment Plan in Chapter 4 is the recommended Plan for achieving performance targets.

"The State Highway System Management Plan … shall identify projected future State Highway Operation and Protection Program costs that would be avoided by increasing maintenance spending."

California Streets and Highways Code, Section 164.6(c), updated by AB 515

Table C-1. 5-Year Maintenance Investments for SHOPP Cost Avoidance

5-Year Maintenance Investments for SHOPP Cost Avoidance				
Objectives	Major Maintenance ($M)	Field Maintenance Crews ($M)	Total ($M)	SHOPP Cost Avoidance ($M)
Pavement	**$1,615**	**$91**	**$1,706**	**$5,117**
Bridge and Tunnel Health	**$661**	**$411**	**$1,072**	**$12,858**
Drainage Restoration	**$134**	**$125**	**$258**	**$1,032**
Transportation Management Systems	**$43**	**$132**	**$174**	**-**
Total	**$2,452**	**$758**	**$3,209**	**-**

Table C-1 Notes:

- The estimated SHOPP Cost Avoidance is calculated using cost projection ratios (3:1 pavement, 12:1 bridge, and 4:1 drainage) supported by analyses by the Caltrans Programs and applied in prior 5-year Maintenance Plans. These ratios generally consider preservation treatments costs relative to rehabilitation costs.
- The 5-year costs shown for Major Maintenance and Field Maintenance are calculated as half of the 10-year costs presented in Figure 4-2.

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Appendix D: Summary of Feedback

California Transportation Commission

In the _____ meeting of the California Transportation Commission, the Commissioners approved the transmittal of formal comments for incorporation into the Final 2021 SHSMP. _____ comments were provided in a letter dated _____ from the Commission to the Caltrans Director, based on a review of the _____ 2021 Draft SHSMP. Responses are provided in Table D-1 below addressing each comment.

Table D-1. Response to California Transportation Commission Comments

Responses to California Transportation Commission Comments	
Comment	**Response**

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Public Review Comments

The Draft 2021SHSMP was published on the Caltrans internet for public review, and an online comment submission system was made available between _____through _____. All California MPOs and RTPAs were invited to participate in the public review. The sole survey response was received from Mono County, however, no changes to the document were recommended.

Appendix E: Acronyms and Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
AB	Assembly Bill
ABC	Accelerated Bridge Construction
ADA	Americans with Disabilities Act
APCS	Automated Pavement Condition Survey
ASBS	Areas of Special Biological Significance
ASTM	American Society for Testing and Materials
BMP	Best Management Practices
CAFE	Corporate Average Fuel Economy
Cal/OSHA	California Division of Occupational Safety and Health
CALGreen	California Green Building Standards
CalSTA	California State Transportation Agency
Caltrans	California Department of Transportation
CAPM	Capital Preventive Maintenance
CAPTI	Climate Action Plan for Transportation Infrastructure
CCA	Construction Contract Acceptance
CCPI	California Consumer Price Index
CEQA	California Environmental Quality Act
CFAC	California Freight Advisory Committee
CFMP	California Freight Mobility Plan
CHP	California Highway Patrol
CIA	Cooperative Implementation Agreement
CIP	Caltrans Improvement Projects
Commission	California Transportation Commission
CRCP	Continuously Reinforced Concrete Pavement
CSFAP	California Sustainable Freight Action Plan
CU	Compliance Unit
CVEF	Commercial Vehicle Enforcement Facilities
DSOR	Desired State of Repair
DVHD	Daily Vehicle Hours of Delay
ELI	Element Level Inspection

EO	Executive Order
EPA	Environmental Protection Agency
ECWC	Expected Construction Work Complete
FAST Act	Fixing America's Surface Transportation Act
FCI	Facility Condition Index
FCO	Financial Contribution Only
FE	Fund Estimate
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIP	Freight Investment Plan
FY	Fiscal Year
GHG	Greenhouse Gas
GPR	Ground Penetration Radar
HCAS	Highway Cost Allocation Studies
HDM	Caltrans Highway Design Manual
HFST	High Friction Surface Treatments
HM	Highway Maintenance
HOV	High Occupancy Vehicle
HPMS	Highway Performance Monitoring System
HSIP	Highway Safety Improvement Program
IAA	Inter-Agency Agreement
ICM	Integrated Corridor Management
IMMS	Integrated Maintenance Management System
IRI	International Roughness Index
ISO	International Standards Organization
ITS	Intelligent Transportation Systems
JPCP	Jointed Plain Concrete Pavement
LCCA	Life Cycle Cost Analysis
LCP	Life Cycle Planning
LED	*Light-Emitting Diode*
LEED	Leadership in Energy and Environmental Design
LOS	Level of Service
MAP-21	Moving Ahead for Progress in the 21st Century Act
MASH	Manual for Assessing Safety Hardware

MBP	Mobility Performance Report
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
NBI	National Bridge Inventory
NHFP	National Highway Freight Program
NPDES	National Pollution Discharge Elimination System
NTI	National Tunnel Inventory
OGFC	Open Graded Friction Course
PA&ED	Project Approval and Environmental Documentation
PaveM	Pavement Management System
PAVES-IT	Pavement Analysis and Vehicle Enforcement Strategic Information
PCC	Portland Cement Concrete
PeMS	Performance Measurement System
PID	Project Initiation Document
PPCP	Precast Panel Concrete Pavement
PS&E	Plan, Specification and Estimate
RTL	Ready to List
RICS	Remote Irrigation Control System
RMRA	Rehabilitation Account
RMRP	Road Maintenance and Rehabilitation Program
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SD	Structurally Deficient
SHA	State Highway Account
SHC	Streets and Highway Code
SHOPP	State Highway Operation and Protection Plan
SHS	State Highway System
SHSMP	State Highway System Management Plan
SHSP	Strategic Highway Safety Plan
SM&I	Structures Maintenance and Investigations
SMART	Structures Maintenance Automated Report Transmittal
SRRA	Safety Roadside Rest Area
STIP	State Transportation Improvement Program
STRAHNET	Strategic Highway Network

SWRCB	State Water Resources Control Board
TAMP	California Transportation Asset Management Plan
TCEP	Trade Corridor Enhancement Program
TMC	Transportation Management Center
TMDL	Total Maximum Daily Load
TMS	Transportation Management System
TOSNET	Traffic Operations Systems Network
TRF	Transportation Related Facility
Trust Fund	Federal Highway Trust Fund
VC	Vertical Clearance
WIM	Weigh-In-Motion
ZEV	Zero-Emission Vehicles

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Executive Team

David S. Kim, Secretary, California State Transportation Agency

Elissa Konove, Undersecretary, California State Transportation Agency

Toks Omishakin, Director, Caltrans

James E. Davis, Chief Deputy Director, Caltrans

Steven Keck, Chief Financial Officer, Caltrans

Michael B. Johnson, State Asset Management Engineer, Caltrans

Caltrans Project Team

Loren Turner, Supervising Transportation Engineer

Dawn Foster, Senior Transportation Engineer

Youwei Zhou, Senior Transportation Engineer

Mara Chaudhari, Transportation Engineer

Zhenyu Zhu, 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

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California Department of Transportation
1120 N Street
Sacramento, CA 95814
www.dot.ca.gov