

Caltrans Efficiencies Report 2022 - 2023

Table of Contents

- Caltrans Efficiencies Report 2022 - 2023..... 1**
- Executive Summary 3**
 - Type One Efficiencies3
 - Type Two Efficiencies4
 - Type Three Efficiencies.....4
- Background..... 6**
- Six-Year Summary 6**
- FY 2022-23 Efficiencies Report 7**
 - Report Organization.....7
 - Type One Efficiencies7
 - Type Two Efficiencies7
 - Type Three Efficiencies.....7
- FY 2022-23 Efficiencies: Type One 7**
 - Longer-Life Pavement Rehabilitation7
 - High Reflective Materials for Striping10
 - Value Analysis (Caltrans Expanded)10
 - Fish Passage Projects12
 - Construction Manager/General Contractor (CM/GC).....13
 - Job Mix Formula Change15
 - Value Engineering Change Proposals17
 - Mobile Field Devices (Tablets)18
 - Unmanned Aerial Systems (UAS)19
 - Fleet Management via Global Positioning Systems (GPS)20
 - Americans with Disabilities Act (ADA) Data Collection.....20
 - Negotiated Software Savings.....22
 - Innovative Change Orders23
 - Bulk Information Technology (IT) Procurement.....23
 - X-Ray Fluorescence (XRF) Technology25

Automated Machine Guidance	27
Concrete Cylinder Testing.....	29
Zero-Emission Vehicle (ZEV) Fuel Savings.....	30
Electronic Submittal and Review	32
Early Design	32
Office Space Lease Reductions.....	33
Managerial Selection Program (MSP) Process Improvements	33
Advance Mitigation Credits	35
Electronic Signatures for Construction Contracts.....	36
Virtual Vehicle Inspections	37
Paleontology Geographic Information System (GIS) Tool.....	38
Diverging Diamond Interchange	39
Innovative Drilling Adapter	41
Nondestructive Testing (NDT) Reduction	42
Clean California Mobile App	44
Steel Shot Blaster.....	45
Virtual On-Site Visits	46
Software and License Reductions	47
National Environmental Policy Act (NEPA) Process Improvement	48
Electronic Contract Files	49
Electronic Environmental Documents	50
Safety and Management Services Process Improvement.....	51
Small Business Council Virtual Meetings	52
Cost Estimates Toolbar.....	53
Driver Certification Process Improvement	53
<i>Type Two Efficiencies.....</i>	<i>54</i>
Value Analysis (Federally Mandated).....	54
Municipal Coordination Grant Program	56
National Environmental Policy Act (NEPA) – Streamlined Environmental Review	57
Partnering	58
Reclaimed Asphalt Pavement	58

Highway Lighting – Light-Emitting Diode (LED) Retrofit	59
Cold Recycling.....	60
Smart Water Controllers	61
Electronic Plans and Quantities (P&Q) Submittal Process	62
<i>FY 2022-23 Efficiencies: Type Three.....</i>	62
Orange Lane Striping on I-5 in San Diego County	62
Halo Helmet Lighting.....	63
The California Integrated Travel Project (CAL-ITP)	63
Renewable Diesel	64
Caltrans Internal Audits Office (CIAO)	64
Laser Cutter	64
Project End Date (PED) Extension Tool.....	65
Supervisory Control and Data Acquisition System (SCADA).....	65

Executive Summary

Senate Bill 1 (SB 1) (Beall, Chapter 5, Statutes of 2017), also known as the Road Repair and Accountability Act of 2017, increases funding for California’s world-class transportation network by an average of \$5 billion annually, and specifies that the California Department of Transportation (Caltrans) implement efficiency measures with the goal of generating at least \$100 million in annual savings to be invested into the state highway system.

In general, efficiencies are new tools, materials, technologies, and improved processes that produce a cost savings or cost avoidance. The definition of efficiencies, as approved by the Caltrans Financial Policy Board, is steps that may result in cost avoidance or a reduction in support or capital costs will be considered. Efficiency savings claimed in this report occurred in Fiscal Year (FY) 2022-23, unless otherwise noted. Efficiencies in this report are considered a cost savings or avoidance.

SB 1 Legislation states: “The department shall implement efficiency measures with the goal to generate at least one hundred million dollars (\$100,000,000) per year in savings to invest in maintenance and rehabilitation of the state highway system. These savings shall be reported to the commission.”

Efficiencies are categorized by three types:

Type One Efficiencies

Efficiencies that are invested back into the maintenance and rehabilitation of the state highway system and are included in SB 1 reporting.

Type Two Efficiencies

Efficiencies that are invested back into the maintenance and rehabilitation of the state highway system and contribute to the overall efficiencies total.

Type Three Efficiencies

These efficiencies provide benefits to Caltrans and taxpayers but may be qualitative in nature.

For FY 2022-23, Caltrans is reporting \$318 million in total efficiencies savings, of which \$138 million is included in SB 1 reporting (Type One). Type Two savings are \$180 million and Type Three savings are counted by number of efficiencies, as these efficiencies are more qualitative in nature.

Type One Efficiencies	Number of Efficiencies	Cost Savings or Avoidance
New	16	\$16,921,753
Ongoing	26	\$121,548,534
Total	42	\$138,470,287

Type Two Efficiencies	Number of Efficiencies	Cost Savings or Avoidance
New	0	\$0
Ongoing	9	\$180,431,897
Total	9	\$180,431,897
Type One and Two Total	51	\$318,902,184

Type Three Efficiencies	Number of Efficiencies	Cost Savings or Avoidance
New	8	Efficiencies, practices, trends, and innovations that provide qualitative benefits to Caltrans and taxpayers. Savings are not quantified.
Ongoing	0	
Total	8	

The following table shows FY 2022-23 Type One and Type Two efficiencies and amounts saved.

Type One Efficiencies	Savings
Longer -Life Pavement Rehabilitation	\$35,747,357
High Reflective Materials for Striping	\$34,000,000
Value Analysis (Caltrans Expanded)	\$17,013,800
Fish Passage Projects	\$11,501,600
Construction Manager/General Contractor (CM/GC)	\$7,050,000
Job Mix Formula Change	\$5,180,000
Value Engineering Change Proposals	\$4,091,169
Mobile Field Devices (Tablets)	\$3,526,210
Unmanned Aerial Systems	\$2,356,087

Fleet Management via Global Positioning Systems (GPS)	\$2,302,397
Americans with Disabilities Act (ADA) Data Collection	\$2,106,037
Independent Assurance Program	\$1,999,920
Negotiated Software Savings	\$1,900,000
Innovative Change Orders	\$1,748,362
Bulk IT Procurement	\$1,487,771
X-Ray Fluorescence (XRF) Technology	\$789,796
Traffic Data Improvement Initiative	\$685,000
Automated Machine Guidance	\$579,964
Concrete Cylinder Testing	\$487,000
Zero-Emission Vehicle (ZEV) Fuel Savings	\$443,188
Electronic Submittal and Review	\$442,489
Early Design	\$397,980
Office Space Lease Reductions	\$388,764
Managerial Selection Program (MSP) Process Improvements	\$374,083
Advance Mitigation Credits	\$278,830
Electronic Signatures for Construction Contracts	\$239,361
Virtual Vehicle Inspections	\$232,900
Paleontology GIS Mapping Tool	\$219,055
Diverging Diamond Interchange	\$216,050
Innovative Drilling Adapter	\$167,188
Nondestructive Testing (NDT) Reduction	\$97,920
Clean California Mobile App	\$61,869
Steel Shot Blaster	\$53,950
Virtual On-Site Visits	\$50,000
Software and License Reductions	\$49,108
NEPA Process Improvement	\$46,346
Electronic Contract Files	\$41,641
Electronic Environmental Documents	\$41,080
Safety and Management Services Process Improvement	\$30,156
Small Business Council Virtual Meetings	\$24,131
Cost Estimates Toolbar	\$12,000
Driver Certification Process Improvement	\$9,728
Type One Total	\$138,470,287

Type Two Efficiencies	Savings
Value Analysis (Federally Mandated)	\$74,308,140
Municipal Coordination	\$31,028,000
National Environmental Policy Act (NEPA) – Streamlined Environmental Review	\$25,830,554
Partnering	\$20,862,410
Reclaimed Asphalt Pavement	\$10,001,610

Highway Lighting LED Retrofit	\$9,088,901
Partial Depth Recycling (Cold in-place Recycling)	\$5,041,292
Smart Water Controllers	\$4,253,340
Electronic P&Q Submittal	\$17,650
Type Two Total	\$180,431,897
Overall Total	\$318,902,184

Background

Caltrans manages more than 50,000 lane-miles of California’s highway and freeway lanes, provides inter-city rail services, permits more than 400 public-use airports and special-use hospital heliports, and works closely with local agencies on a variety of projects. Caltrans accomplishes its mission to “provide a safe and reliable transportation network that serves all people and respects the environment,” through 12 district offices geographically located throughout the State and support programs administered from Headquarters in Sacramento.

As written in the SB 1 legislation, “The department shall implement efficiency measures with the goal to generate at least one hundred million dollars (\$100,000,000) per year in savings to invest in maintenance and rehabilitation of the state highway system. These savings shall be reported to the commission.”

Caltrans has increased the number of efficiencies annually and exceeded the \$100 million savings goal each year since SB 1 was enacted in 2017.

The dedication of Caltrans leadership and staff to the efficiencies effort is vital for success in achieving these goals. Caltrans continually pursues new approaches to deliver transportation projects in a more efficient and effective way to reduce costs and accelerate project delivery.

The Division of Research, Innovation and System Information supports programs designed to encourage employees to drive innovative ideas and improve practices and processes. Caltrans also utilizes resources from the Federal Highway Administration and other states to improve efficiencies reporting processes and best practices. Caltrans has hosted peer exchanges in every year since 2020, working with other State Departments of Transportation to share ideas and foster open communication to improve how efficiencies are identified, tracked, and reported.

Six-Year Summary

	Number of Efficiencies	Type 1	Type 2	Total
FY 2017-2018	6	\$133	\$0	\$133
FY 2018-2019	13	\$233	\$0	\$233
FY 2019-2020	22	\$195	\$145	\$340
FY 2020-2021	24	\$177	\$209	\$386
FY 2021-2022	38	\$124	\$190	\$314

FY 2022-2023	51	\$138	\$180	\$318
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FY 2022-23 Efficiencies Report

Report Organization

Efficiencies are counted and reported as Type One efficiencies, Type Two efficiencies, and Type Three efficiencies.

Type One Efficiencies

Efficiencies that are invested back into the maintenance and rehabilitation of the state highway system and are included in SB 1 reporting.

Type Two Efficiencies

Efficiencies that are invested back into the maintenance and rehabilitation of the state highway system and contribute to the overall efficiencies total.

Type Three Efficiencies

These efficiencies provide benefits to Caltrans and taxpayers and may be qualitative in nature.

FY 2022-23 Efficiencies: Type One

Type One Efficiencies	Number of Efficiencies	Cost Savings or Avoidance
New	16	\$16,921,753
Ongoing	26	\$121,548,534
Total	42	\$138,470,287

Longer-Life Pavement Rehabilitation

Cost savings or avoidance	\$35,747,357
Submitted by	Division of Maintenance
Qualitative benefits	<ul style="list-style-type: none"> • Safety • Positively impacts the environment • Saves time or future delays

Highway pavements were historically designed and constructed to provide 20 years of service life. While Caltrans has been investigating the design and construction of longer-life pavements for several years, the Caltrans Highway Design Manual was revised in 2021 to mandate longer-life pavement for virtually all new pavement construction and rehabilitation projects. The use of long-life pavements has proven to minimize maintenance and rehabilitation costs and reduce public user delays due to road closures, particularly on high-volume roads, and will produce savings for many years after construction. In addition, shorter maintenance activity periods reduce risks to construction workers.

Over the past decade, the Caltrans Pavement Program, in collaboration with the University of California Pavement Research Center (UCPRC), has developed several tools, specifications, guidance manuals, and test methods to support and facilitate the design and construction of longer-life pavements. In 2022, the 40-year design strategies were utilized in six pavement rehabilitation projects that started construction, shown in Table 1, with a total of 220.724 lane-miles achieving \$35,747,357 in savings over their anticipated service lives. The savings are achieved through significantly less maintenance and rehabilitation over the 40-year analysis period compared with 20-year design life pavement.

Table 1. Pavement Rehabilitation Projects with Longer-Life Design

Project	County	Route	Type	Lane-miles
1H520	SIS	3	Lane Replacement	5.594
1C082	RIV	10	Lane Replacement	114.036
0K122	SBD	15	Lane Replacement	53.434
1C170	MER	99	Lane Replacement	18.806
42370	SD	8	Lane Replacement	22.8
43051	SD	15	Lane Replacement	6.054
Total				220.724

The recently developed web-based mechanistic-empirical design catalog for concrete pavements, namely CalRigid, was used to check the designs performed by District staff and to determine performance estimates and the required future maintenance activities for the pavements.

The cost calculation approach used in these analyses followed Caltrans’ life cycle cost analysis (LCCA) procedures. The key parts of LCCA are the initial construction cost using typical materials and construction specifications, the estimated performance of the 20-year and 40-year alternatives and the frequency of maintenance treatments, and the resulting maintenance cost over the life cycle. The summary of the LCCA is presented in Table 2.

Additional qualitative benefits are realized by reduced traffic delays and inconvenience to the traveling public because of less frequent maintenance and rehabilitation over the pavement’s life cycle. Road user cost savings are estimated at \$669 million, following Federal Highway Administration (FHWA) guidelines.

Table 2. Pavement Life Cycle Costs in Present Value

Project	Initial Construction Cost	Initial Construction Cost	Additional Construction Cost	Maintenance Cost (over the Life Cycle)	Maintenance Cost (over the Life Cycle)	Maintenance Cost Savings
	20-Year Design	40-Year Design	40-Year Design	20-Year Design	40-Year Design	40-Year Design
1H520	\$5,605,857	\$6,182,930	\$577,073	\$1,855,025	\$69,839	\$1,785,186
1C082	\$156,291,564	\$184,860,990	\$28,569,426	\$51,718,193	\$2,088,104	\$49,630,089
0K122	\$75,596,125	\$98,432,454	\$22,836,329	\$25,015,393	\$1,111,847	\$23,903,546
1C170	\$27,029,581	\$28,272,320	\$1,242,739	\$7,689,190	\$284,876	\$7,404,315
42370	\$28,626,752	\$32,016,762	\$3,390,010	\$8,143,542	\$322,605	\$7,820,937
43051	\$8,101,232	\$8,501,293	\$400,061	\$2,304,583	\$85,660	\$2,218,923
Sum	\$301,251,110	\$358,266,749	\$57,015,639	\$96,725,927	\$3,962,931	\$92,762,996
Net Savings						Maintenance Cost Savings - Additional Construction Cost = \$35,747,357

Savings are captured using net present values. Savings may not be realized for several years (beginning in 2042) but will bear future savings throughout the project life cycle. These savings are anticipated to be available for investment in future maintenance and rehabilitation projects. Due to deliberate decisions and actions taken in 2022, Caltrans finds it appropriate to report savings in the year of initial construction using the net present value approach.

High Reflective Materials for Striping

Cost savings or avoidance	\$34,000,000
Submitted by	Division of Maintenance
Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays • Positively impacts the environment • Positively impacts safety

Caltrans has historically used 4-inch-wide painted stripes to delineate both edge and lane lines on state highways. In 2017, Caltrans began deploying 6-inch-wide striping that uses more durable materials such as high reflective thermoplastic and tape. Both high reflective thermoplastic and tape materials are embedded with glass beads to enhance reflectivity for better visibility at night and during inclement weather. The new materials are also more durable, lasting up to six years compared to one year with painted stripes. The more durable pavement markings reduce the need for ongoing annual maintenance and frequent replacement, lowering both labor and material cost. The baseline used for the savings calculation was the bid cost of paint traffic stripes. The savings is the cost difference of maintaining and replacing lane miles.

The savings are realized by longer lasting material and decreased maintenance.

- In FY 2017-18, a total of 16,602 lane miles were striped with the reflective material achieving \$16.5 million in savings per year for six years.
- In FY 2018-19, a total of 9,026 lane miles were striped with the reflective material achieving \$12.4 million in savings per year for six years.
- In FY 2019-20, a total of 3,209 lane miles were striped with the reflective material achieving \$5.1 million in savings per year for six years.

	FY 2017-18 Savings	FY 2018-19 Savings	FY 2019-20 Savings	FY 2020-21 Savings	FY 2021-22 Savings	FY 2022-23 Savings
FY 2017-18 Striping Contracts	\$16.5	\$16.5	\$16.5	\$16.5	\$16.5	\$16.5
FY 2018-19 Striping Contracts		\$12.4	\$12.4	\$12.4	\$12.4	\$12.4
FY 2018-19 Striping Contracts New Strategies		\$27				
FY 2019-20 Striping Contracts			\$5.1	\$5.1	\$5.1	\$5.1
Total (in millions)	\$16.5	\$55.9	\$34	\$34	\$34	\$34

Value Analysis (Caltrans Expanded)

Cost savings or avoidance:	\$17,013,800
Submitted by:	Division of Design
Qualitative Benefit:	<ul style="list-style-type: none"> • Saves time or future delays

Caltrans uses the Value Analysis (VA) study on individual projects to drive efficiency and add value or performance. VA is a systematic process of review and evaluation early in the project

lifecycle and it is one of the most important processes used in project delivery to achieve efficiencies. Conducted by a multidisciplinary team during the environmental and design phase, the goal is to identify innovative approaches that improve the overall value of the project. The team applies their knowledge in a systematic approach by utilizing function analysis tools to improve the value of a project. VA methodology is optimized by refining the design to increase performance and/or decrease costs, analyzing lifecycle costs, user benefits, and overall return on investment. Value is added by improving functionality and/or reducing cost while maintaining the safety, necessary quality, and environmental attributes of the project. The team consists of independent subject-matter experts who are not directly involved in the project and will offer new perspectives.

Once the study is completed, a final report documents the process, results, decisions made, and implementation plans for moving the project forward. Recommendations, in most cases, reduce project costs but in some cases, the result is an increase to the overall cost of the project but improved overall performance. Federal regulations mandate that all projects on the National Highway System receiving federal funds with an estimated total project cost exceeding \$50 million perform a VA. These efficiencies are counted as Type Two efficiencies as they are mandated.

To further generate efficiencies, Caltrans issued an internal policy in February 2019 requiring VA studies to be performed on projects where the total estimated project cost is \$25 million or more, and the benefit of VA is likely to exceed the cost. Caltrans generates Type One savings by performing these non-mandated VAs.

Caltrans identified eight projects that were awarded in FY 2022-23. Seven out of the eight projects achieved savings and one project did not achieve savings but improved performance. For accountability and transparency purposes, Caltrans is including all eight of the projects in the savings calculation. Associated costs for VA studies consist of the cost of the study and Caltrans support costs. Associated costs were subtracted from the savings to arrive at the net savings for FY 2022-23. Net savings for the eight projects is \$91.3 million, with \$17 million counting towards the SB 1 goal.

No.	Project Description	Total Project Cost	VA Savings	Associated Cost	Type One Project Savings (Non-Federal Mandated VA)	Type Two Project Savings (Federal Mandated VA)
1	D3 – EA3F060-SR162 - Butte City Bridge Replacement	\$56,745,000	\$44,213,000	\$47,018		\$44,165,982
2	D3 – EA3H330 – US50 - Install Transportation Management System (TMS) field elements.	\$37,500,000	\$10,271,000	\$71,600	\$10,199,400	

3	D6 – EA0V120 – SR99 – Cottonwood Creek Bridge Replacement	\$36,437,000	\$5,616,000	\$82,868	\$5,533,132	
4	D7 - EA34280 - SR14 - Permanent Restoration between Newhall Avenue and Placerita Canyon Road	\$19,350,000	(\$13,000)	\$62,952	(\$75,952)	
5	D11 – EA43051 - I15 - Concrete Lane Replacement Project	\$74,860,000	\$9,467,000	\$69,812		\$9,397,188
6	D11 - EA42370 - I8 - Pavement Rehabilitation near Alpine from Viejas Creek Bridge to Pine Valley Creek Bridge	\$53,459,000	\$20,845,000	\$100,030		\$20,744,970
7	D11 – EA42320 - SR125 Pavement Rehabilitation including SR125 and SR94	\$43,950,000	\$1,383,000	\$59,540	\$1,323,460	
8	D12- EA0R200 - I5 - Pavement Rehabilitation between Cristianitos Road and El Camino Real	\$21,650,000	\$110,000	\$76,240	\$33,760	
	Totals	\$343,951,000	\$91,892,000	\$570,060	\$17,013,800	\$74,308,140

Fish Passage Projects

Cost savings or avoidance	\$11,501,600
Submitted by	Division of Environmental Analysis
Qualitative benefits	<ul style="list-style-type: none"> • New • Positively Impacts the Environment

Caltrans is required to comply with the National Pollutant Discharge Elimination System (NPDES) Permit issued by the State Water Resources Control Board (SWRCB) that regulates stormwater discharges from Caltrans right of way (ROW). The SWRCB adopted the Caltrans 2022 NPDES Permit on June 22, 2022, however the Caltrans 2012 NPDES Permit was still effective until December 31, 2022. Caltrans continued to implement 2012 Permit provisions until December 2022 and switched to the 2022 Permit effective January 1, 2023. The NPDES Permit requires Caltrans to capture and remove pollutants such as toxic metals, oil, and

sediment from stormwater runoff from roadways by constructing roadside treatment devices such as biofiltration swales and sand filters. Caltrans secures NPDES Permit compliance credits by constructing stormwater treatment devices in water quality-impaired Total Maximum Daily Load (TMDL) areas. In addition, the removal of fish passage barriers also provides water quality benefits in certain TMDL watersheds.

Caltrans continues to locate, assess, and remediate barriers to fish passage. Per the Caltrans 2012 NPDES Permit, fish passage credits in TMDL watersheds are allocated based on the Compliance Unit (CU) credit equivalence that allows Caltrans to receive one CU credit per \$88,000 spent on such projects. For FY 2021-22, Caltrans reported 130.7 CUs from fish passage projects, creating savings of \$11,501,600.

Cost Savings per CU credited 130.7 (CUs) x \$88,000 per acre	\$11,501,600
Total Cost Avoidance	\$11,501,600

Most efficiencies in this report account for savings occurring in FY 2022-23. However, specific to this efficiency, credit for the savings occurs when the CUs are approved by the SWRCB, which occurs the following FY. Therefore, the reported savings in this report are for FY 2021-22 and were certified on June 13, 2023. This is consistent with the calculation, methodology, and reporting in previous efficiencies reports.

Construction Manager/General Contractor (CM/GC)

Cost savings or avoidance	\$7,050,000
Submitted by	Division of Design
Qualitative benefits	• Saves time or future delays

An innovative method of project delivery known as Construction Manager/ General Contractor (CM/GC) enables Caltrans to engage the construction manager early to provide input during the design process. Under the traditional means of contracting for the construction of highway improvement projects, construction of any portion of the project cannot begin until the implementing agency has developed complete plans and specifications for the entire project, placed the contract out for bid, and awarded the contract. Engaging the construction manager early allows the project team to work collaboratively to develop the project scope, optimize design, improve quality, manage costs, and share risks.

Savings are achieved due to the CM/GC contractor’s input during the design, resulting in a more constructible project, reduced costs, and a reduction in change orders. Caltrans hires an independent cost estimator to provide independent estimates and to advise Caltrans on cost-related issues. The construction manager and independent cost estimator independently prepare a cost estimate and schedule based on the draft construction plans and specifications. The team meets to review pricing assumptions and attempt to reconcile price differences. The CM/GC contractor develops an innovation register that identifies proposed innovations, including the value of the idea, and identifies which innovations were incorporated into the

final design and construction documents. The independent cost estimator reviews the innovation register to ensure that the estimated savings are reasonable and supported. When the design is approximately 90 to 95 percent complete, the CM/GC contractor will provide a price to build the project. If the proposed price is acceptable, the CM/GC contractor becomes the general contractor and delivers the project.

Savings are achieved and reported at two different stages, when the construction contract is awarded (e.g., innovations) and at the completion of construction (reduction in change orders and claims). The CM/GC contractor develops and maintains an innovation register that identifies proposed innovations, including the value of the idea, and identifies which innovations were incorporated into the final design and construction documents. The independent cost estimator reviews the innovation register to validate that the estimated savings are reasonable and supported. After award of the project, the district submits the final innovation log to the CM/GC Program.

The CM/GC Program reviewed the list of projects for which the CM/GC method was used and determined that three projects were awarded construction contracts during FY 2022-23, achieving savings of \$7 million. Savings are considered a cost avoidance resulting in a reduction in construction capital. The three projects are listed in the table below:

Project	Innovations	Capital Cost	Project Savings
<p>San Gabriel Bridge Hinge Diaphragm Reconstruction</p> <p>This project will reconstruct hinge diaphragms at hinges 4 and 6, upgrade median barriers at hinge reconstruction areas, upgrade bridge railing, install new electroliers, and replace existing storm drainage.</p>	<p>Implementation of an overhanging bucket and specialized demolition tools will allow for demolition to be completed in one environmental window instead of two.</p> <p>Modification of the hinge rebar configuration will reduce concrete pours and significantly shorten the extended weekend closure time.</p> <p>Providing a material staging area reduces handling of material and increases productivity.</p>	<p>\$16.9 million</p>	<p>\$1.7 million</p>

Project	Innovations	Capital Cost	Project Savings
Saratoga Creek Bridge Rehabilitation This project will construct a new two-span steel girder bridge within the confines of the spandrel walls and arch barrels of the existing stone arch bridge.	Additional testing and geotechnical investigation will lead to the reduction of Cast-In-Drilled-Hole pile length and elimination of permanent steel casing. Design of a trestle on top of the existing bridge will allow for more efficient access to Pier 2. Using Economy Forms Corporation forms to protect the stone facia will result in fewer rods being drilled into the stone arch.	\$11.9 million	\$0.75 million
Yreka Rehabilitation Project This project will reconstruct the roadway to meet the current design standards on Route 3 from 0.4 miles north of Laura Lane to Juniper Drive and on Route 263 from Route 3 to 1 mile south of Long Gulch Road.	Placing Staging area within the project segments. Moved concrete pavement in Segment 3 to east of project and replace Hot Mix Asphalt (HMA) with Jointed Plain Concrete Pavement. Minimize structural section by removing the aggregate base to minimize the utility relocation. Eliminate K-rail for staging and replace with alternative traffic handling elements Use non modified binder instead of modified HMA Base Course. Change structural section, use Class 3 AB under sidewalk instead of Class 2 AB; use Lean Concrete Base Course instead of HMA under Rigid Steel Conduit.	\$63.7 million	\$4.6 million
Total		\$92.5 million	\$7.0 million

Job Mix Formula Change

Cost savings or avoidance	\$5,180,000
Submitted by	Divisions of Construction and Engineering Services
Qualitative benefits	<ul style="list-style-type: none"> • Safety • Saves time or future delays

In February 2021, the Pavement Materials Partnering Committee, consisting of Caltrans and industry partners, collaborated to evaluate the Hot Mix Asphalt (HMA) Job Mix Formula (JMF) renewal process. Following discussions with representatives from material suppliers and paving

contractors in the construction industry, a proposal was made to extend the HMA JMF validation time from 12 months to 24 months. This change received unanimous support from all parties involved, as they recognized the numerous benefits it would bring to Caltrans and industry partners.

By extending the validation time of HMA JMFs, significant advantages are realized for all stakeholders. This new process reduces costs associated with HMA JMFs, resulting in cost savings for both Caltrans and industry partners. Additionally, this extension plays a crucial role in reducing greenhouse gas (GHG) emissions linked to the production of HMA JMF verification asphalt mixtures. Processes such as the extraction and processing of asphalt binder and mineral aggregates, which contribute to GHG emissions, are reduced by half through this extended validation period.

Initially for FY 2021-22, the savings were estimated based on the survey data obtained from industry partners. The surveyed data indicated that there are approximately 40 HMA producers in California, with each producer generating an average of 20 JMFs within a 12-month period, resulting in a total of 800 HMA JMFs per year.

To calculate the efficiency for FY 2022-23, real data was collected by reaching out to all Caltrans district lab managers and district materials engineers. Data collected from June 2022 to May 2023 was used to estimate the HMA JMF verifications. Based on the data collected, the total number of HMA JMFs verified for FY 2022-23 is 259.

Using this information, it was determined that there would have been potentially 518 HMA JMFs per year prior to implementing the change to a 24-month HMA JMF validation time. Since producing a HMA JMF requires two hot drops, Caltrans calculated that there would have been 1036 hot drops per year. A hot drop is the field production of an asphalt mix sample that is used for the development and verification of a JMF. Assuming an average cost of \$10,000 per hot drop, the statewide annual cost of JMF validation would have been \$10,360,000.

However, with the implementation of 24-month HMA JMF validation time, the number of HMA JMFs and hot drops per year is reduced by half. The annual statewide savings resulting from the 24-month HMA JMF validation time for FY 2022-23 is \$5,180,000.

HMA JMF verified in FY 2022-23

Districts	JFM Verified Lab	Number of HMA JMF Verified (06/01/2022-05/31/2023)	Comments
D-01	D-01	18	
D-02	D-02	9	
D-03	D-03	23	
D-04	D-04	28	
D-05	D-05	21	
D-06	D-06	18	

D-07	SRL		Included with SRL Data
D-08	SRL	35	
D-09	D-09	9	
D-10	D-10	39	
D-11	D-11	50	
D-12	SRL		Included with SRL Data
Translab	Translab	9	
Total HMA JMF Verified		259	

Value Engineering Change Proposals

Cost savings or avoidance	\$4,091,169
Submitted by	Division of Construction
Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays

Caltrans encourages contractors to develop and implement innovative approaches to construction of projects through Value Engineering Change Proposals (VECP). The VECP process encourages contractors to find innovative methods, materials, and technologies that are new and unique to reduce cost, save time, reduce congestion, and improve quality and safety. When these new approaches result in construction cost savings, Caltrans and contractors share the cost savings. The VECP is a formal process whereby the innovation is proposed in writing to Caltrans and the merits of the approach are examined. If the innovation is accepted by Caltrans, a change order is prepared to authorize the VECP so that the work can begin. Money saved through VECP enables Caltrans to reinvest construction dollars into additional transportation projects, and the new innovative construction solutions may be applied to future projects. Efficiency savings were calculated based on 19 accepted VECPs in FY 2022-23, representing \$4 million in savings. Below is the list of the 19 VECPs, along with a description of the VECP, the date the VECP change order was approved, and the amount of savings.

No.	District	Change Order Number	VECP Description	Approval Date	Savings Amount
1	08	012	VECP to eliminate temporary 2' shoulder widening in stage 1.	7/6/2022	\$43,761
2	10	005	VECP to perform work shown in stage 3 before the work shown in stage 2/2a, to eliminate the temporary paving on the northbound shoulder.	5/10/2022	\$196,619
3	02	011	VECP to revise the traffic handling plans that resulted in a decrease in placement of temporary barrier and efficiencies in placement of permanent barrier.	7/28/2022	\$379,805

4	03	010	VECP to use a combination of silt fence and high-visibility fence to delineate environmental sensitive areas.	8/19/2022	\$46,891
5	08	046	VECP to revise structural sections 4 & 5.	8/3/2022	\$121,569
6	03	019	VECP to receive credit because of increased use of recycled class 2 aggregate base.	9/29/2022	\$104,967
7	03	005	VECP to utilize cured-in-place pipeliner in lieu of new reinforced concrete pipe.	9/7/2022	\$48,060
8	04	028	VECP to merge stages 1 & 2 construction.	10/13/2022	\$86,058
9	04	025	VECP to revise the typical pavement structural section no.1.	10/20/2022	\$1,812,617
10	04	017	VECP to eliminate temporary pavement structural section.	5/13/2022	\$92,422
11	07	066	VECP to delete the temporary drainage for stage 2 construction, and instead utilize the drainage inlets installed during stage 1 construction.	10/7/2022	\$362,576
12	01	002	VECP to modify traffic control and flagging.	11/8/2022	\$120,981
13	03	003	VECP for sewer pipe material substitution.	12/8/2022	\$12,571
14	06	005	VECP to change from precast girders to cast-in-place bridge decks.	2/13/2023	\$145,238
15	04	015	Approved VECP additional cost savings.	3/17/2023	\$75,000
16	12	007	VECP to remove a portion of the existing joint armor at abutment 1 and piers 2-4 rather than moving the joint armor system.	3/8/2023	\$212,891
17	02	001	VECP for building changes.	4/6/2023	\$64,136
18	04	033	VECP to delete temporary drainage.	5/8/2023	\$147,700
19	12	070	VECP to eliminate removal of median jointed planed concrete pavement.	5/23/2023	\$17,307
				Total	\$4,091,169

Mobile Field Devices (Tablets)

Cost savings or avoidance	\$3,526,210
Submitted by	Division of Construction
Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays • Positively impacts the environment

As part of an ongoing effort to improve the project delivery process by effectively leveraging new technology, the Division of Construction purchased and deployed 1,300 mobile field

devices (tablets) in 2018 to construction staff to help administer construction projects remotely. Tablets enable field inspectors, resident engineers, and construction managers access to electronic documents and administer construction contracts directly from the job site. The ability to remotely access needed documentation significantly reduces trips between the field office and job site and allows construction staff to better utilize their time for other work activities. The tablets also eliminate printing hard copies of documents, saving thousands of dollars in paper and printing costs. In addition to the initial purchase and deployment of 1,300 mobile devices in 2018, Caltrans deployed 400 additional tablets in FY 2021-22, bringing the total to 1,700 tablets used in the field. This equates to 75 percent of construction staff having access to a tablet which increases efficiency savings. The savings derived for FY 2022-23 is \$3,526,210.

Source	Yearly Savings
Vehicle Fuel & Maintenance (4.4 trips)	\$4,342,650
Yearly Paper Savings	\$28,560
Device costs (\$1,250 per tablet x 1,700 staff) / 5-year lifespan	(\$425,000)
Device Support, Training & Apps	(\$420,000)
Total Savings	\$3,526,210

Unmanned Aerial Systems (UAS)

Cost savings or avoidance:	\$2,356,087
Submitted by:	Divisions of Aeronautics, Engineering Services, Right of Way and Land Surveys, and Construction
Qualitative benefits:	<ul style="list-style-type: none"> • Safety • Saves time or future delays • Positively impacts the environment

Since 2019, the use of Unmanned Aerial Systems (UAS) has increased throughout Caltrans field operations in areas such as surveying, bridge inspection, construction, and steep terrain investigation. The use of UAS improves safety, boosts efficiency, decreases costs, and can be used to capture photos and videos to generate terrain models. UAS can access hard-to-reach locations such as slopes, culverts, and the underside of bridges, collecting imagery rapidly and reducing worker exposure to hazardous conditions.

Drones perform a variety of tasks and require less manpower to carry out duties performed by specialists, such as steep terrain rockfall assessment crews, construction workers, surveyors, engineers, and maintenance personnel. Savings are generally captured by requiring less equipment and staff to perform duties, while improving safety and reducing delays to the traveling public. Savings vary based on the specific task and are captured by comparing the use of drones as opposed to traditional methods.

For FY 2022-23, four Caltrans Programs reported UAS efficiencies:

Program / Division	Savings
Office of Geotechnical Engineering – Division of Engineering Services	\$1,807,668
Office of Earthquake Engineering – Division of Engineering Services	\$31,123
Office of Land Surveys - Division of Right of Way and Land Surveys	\$331,600
Division of Construction	\$185,696
Total	\$2,356,087

Fleet Management via Global Positioning Systems (GPS)

Cost savings or avoidance	\$2,302,397
Submitted by	Division of Equipment
Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays • Positively impacts the environment

In 2019, Caltrans assisted the Department of General Services in writing a mandatory statewide telematics contract. That contract was awarded to a vendor on January 24, 2020, for three years with seven potential one-year extensions. This contract and technology eliminates the need for manual logging of vehicle usage by staff and the cost of smog checks because vehicles equipped with a telematics device do not need to have a physical biennial smog inspection. Vehicles equipped with a telematics device send engine diagnostic information that is accepted in lieu of the physical inspection. Furthermore, telematics devices dramatically improve operator safety through automatic alerts of vehicle diagnostics and location.

Caltrans staff would have spent 27,196 hours manually logging vehicle usage each year. More than \$1.8 million is saved annually by eliminating these manual logs. Additional savings are achieved by the elimination of smog inspections.

Efficiency savings in FY 2022-23:

Item	Savings
Elimination of Manual Usage Reporting (car tags)	\$1,849,317
Elimination of Annual Smog Inspections	\$453,080
Total Savings	\$2,302,397

Americans with Disabilities Act (ADA) Data Collection

Cost savings or avoidance	\$2,106,037
Submitted by	Division of Asset Management (District 6)
Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays • Positively impacts the environment • Positively impacts safety

Asset Management has designed and is continuing to improve on a scalable solution utilizing a suite of ArcGIS Enterprise applications to satisfy the business needs of construction, design, and the Caltrans Americans with Disabilities Act (ADA) Transition Plan. The solution has four primary

components and objectives; convert inspection from being paper-centric to a digital-centric workflow, digitize the ADA review and certification workflow in real-time, reconcile ADA data into a single relational database addressing the needs of all divisions, and allow ADA data to be spatially available, accessible, and transparent.

Based on an evaluation of the ADA inventory, Asset Management determined a cost savings of \$2.1 million in District 6 alone in FY 2022-23. When the solution is implemented statewide, the cost savings will be significantly greater.

Using the ADA Transition Plan inventory for District 6, the savings for FY 2022-23 are \$2,106,037 for creating accessible authoritative records and ADA compliance.

Category	Existing (Paper)	New (Digital)	Savings
Preliminary Field Inspection	\$568,950	\$142,238	\$426,712
Project Scoping and Coordination	\$853,425	\$284,475	\$568,950
Construction Inspection	\$568,950	\$341,370	\$227,580
ADA Certification and Reporting	\$711,188	\$284,475	\$426,713
Records Request	\$995,662	\$227,580	\$768,082
Upfront Development Cost			(\$312,000)
		Total Savings FY 2022-23	\$2,106,037

Independent Assurance Program

Cost savings or avoidance	\$1,999,920
Submitted by	Division of Engineering Services
Qualitative Benefit	• Saves time or future delays

Caltrans Materials Engineering and Testing Services (METS) is responsible for managing the statewide Independent Assurance Program (IAP) mandated by Title 23 Code of Federal Regulations, Part 637 Subpart B. The IAP provides guidance for independent quality assurance of materials testing functions on highway construction projects. Originally, this program was administered within each district by varying numbers of employees, depending on the district. In late 2019, the IAP and related functions were consolidated within METS which led to improved efficiencies, greater independence, and better statewide consistency. The consolidation also allowed for the strategic placement of staff statewide, resulting in a personnel reduction from 33 to 22, achieving 11 personnel years (PYs) savings. The PY savings equates to an annual efficiency savings of \$1,999,920 in FY 2022-23.

In calculating savings, Caltrans totaled the potential monthly compensation for 11 staff as summarized in the table:

Classification	Loaded Monthly Salary	PYs Saved	Monthly Savings	Annual Savings
Transportation Engineering Technician (TET)	\$11,195	2	\$22,390	\$268,680

Materials and Research Engineering Associate (MREA)	\$13,020	4	\$52,080	\$624,960
Transportation Engineer (Civil)	\$18,438	5	\$92,190	\$1,106,280
	Total	11	\$166,660	\$1,999,920

Caltrans used its Statewide Independent Assurance Database to generate workload estimates, which substantiate the IAP consolidation and reduction in 11 PYs. Since the start of 2020, the program has operated with improved effectiveness and efficiency with this major change.

Negotiated Software Savings

Cost savings or avoidance	\$1,900,000
Submitted by	Division of Infrastructure Management
Qualitative Benefit	<ul style="list-style-type: none"> • New • Positively impacts the environment

During the pandemic, when Caltrans quickly transitioned to telework, the video conferencing platform played a vital role in enabling efficiencies for organizations and helping them adapt to remote work seamlessly.

Caltrans swiftly transitioned to remote work to ensure the safety and well-being of its employees, while continuing to perform essential duties. Caltrans quickly implemented a video conferencing application so staff could seamlessly collaborate, hold meetings, and communicate effectively, regardless of their physical locations.

The application offered a range of features that contributed to increased efficiencies through telework. These features provided audio and video conference capabilities, allowing team members to connect face-to-face virtually. Caltrans could continue to work as close to business-as-usual with the features provided by the application.

Caltrans Information Technology leveraged a strong and long-standing strategic partnership and negotiated with the video conferencing provider for a substantial cost reduction for the application. The result was a significant price discount of the Manufacturer’s Suggested Retail Price of \$1,500,000 annually, to a cost of \$550,000 annually through FY 2024-25. This substantially discounted subscription resulted in an annual savings of \$950,000 to Caltrans. Savings began in FY 2021-22 but were not included in the FY 2021-22 report due to publishing deadlines. Therefore, for this instance, the savings for this efficiency includes both FY 2021-22 and FY 2022-23 savings and will be counted annually moving forward.

	Proposed Cost	Negotiated Cost	Savings
Application Cost FY 2021-22	\$1,500,000	\$550,000	\$950,000
Application Cost FY 2022-23	\$1,500,000	\$550,000	\$950,000

Total Savings			\$1,900,000
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Innovative Change Orders

Cost savings or avoidance	\$1,748,362
Submitted by	Division of Construction
Qualitative Benefit	• Saves time or future delays

Historically, Caltrans has tracked construction cost savings from value engineering change proposals (VECP) change orders, which are initiated by contractors. VECP construction savings are then split evenly between Caltrans and the contractor. The reporting of VECPs does not capture savings that result from innovative changes initiated by Caltrans construction staff that maintain project function and performance.

Beginning in March 2021, the Caltrans Division of Construction started tracking staff-initiated innovative contract change orders that provide cost savings. Savings due to staff-initiated changes are not split with the contractor. Examples of innovation change orders that create savings are modifications of contract staging, means, methods, or materials, and changes that provide equivalent function and service life at a lower construction cost.

Efficiency savings were calculated based on five approved innovative change orders in FY 2022-23, representing \$1,748,362 in savings. Below is the list of approved innovative change orders, along with a description of the change, the date the change order was approved, and the amount of savings.

Number	District	Innovative Change Order Description	Approval Date	Savings Amount
1	10	Sell wood chips	9/12/2022	\$67,573
2	05	Revisions to retaining wall	11/17/2022	\$322,422
3	12	Concrete changes	11/18/2022	\$190,668
4	05	Revise cold planing	1/25/2023	\$60,274
5	04	Revise work items of metal fence and gate	5/1/2023	\$1,107,425
			Total	\$1,748,362

Bulk Information Technology (IT) Procurement

Cost savings or avoidance	\$1,487,771
Submitted by	Division of Infrastructure Management
Qualitative Benefit	• Saves time or future delays

Historically, each Division and functional unit across Caltrans has been responsible for procuring the Information Technology (IT) endpoint equipment, such as mobile phones, tablets, and computers, that are needed for staff to fulfill their duties. Orders were done on an as-needed basis, to procure equipment for new positions or refresh equipment that was at the end of useful life.

Opportunities to improve this process were identified and realized in FY 2021-22 with the onset of telework. With the higher number of orders being placed each year, IT decided to take advantage of cost savings that come with ordering in bulk (100 or more items), while trimming down the number of requests processed by the Department at the same time.

Caltrans IT has extended the implementation of the bulk procurement process on a larger scale, recognizing the cost-saving benefits and efficiencies yielded in FY 2022-23. Previously, each Division within each District and Headquarters had to place orders for computer equipment separately. However, with this new procurement strategy, Caltrans can now take advantage of its statewide buying power, which not only results in supply-chain enhancements due to the volume of equipment ordered at once, but also allows for significant discounts on equipment that were previously unavailable.

Caltrans expects to continue to realize savings due to its equipment lifecycle refresh schedule. By adhering to a bi-annual purchase schedule, Caltrans has saved \$1.4 million statewide for FY 2022-23, ensuring that purchases are prioritized based on the scale and urgency of work. Using this process, Caltrans can continue to serve the residents of California more efficiently and effectively.

The following tables display a comprehensive breakdown of the different equipment types ordered, the corresponding quantities, the total cost without considering the bulk savings, and the total cost with the bulk pricing applied.

Bulk Procurement # 1 (August 2022)

Item	Quantity	Total w/ Contract Price	Total w/ Bulk Price	Savings
Laptops (various models)	2,116	\$4,319,436	\$3,524,571	\$794,866
Docking Stations (various models)	3462	\$910,578	\$840,795	\$69,783
Peripherals (various models)	4,025	\$129,944	\$119,096	\$10,848
Monitors (various models)	2,950	\$930,493	\$865,194	\$65,299
			Savings	\$940,796

Bulk Procurement # 2 (January 2023)

Item	Quantity	Total w/ Contract Price	Total w/ Bulk Price	Savings
Laptops (various models)	1,343	\$2,732,842	\$2,240,489	\$492,353
Docking Stations (various models)	1,523	\$405,565	\$374,823	\$30,742
Peripherals (various models)	1,559	\$57,360	\$52,803	\$4,557
Monitors (various models)	1,059	\$281,967	\$262,644	\$19,323
			Savings	\$546,975
			Overall Savings	\$1,487,771

X-Ray Fluorescence (XRF) Technology

Cost savings or avoidance	\$789,796
Submitted by	Division of Environmental Analysis
Qualitative Benefit	<ul style="list-style-type: none">• Safety• Positively impacts the environment• Saves time and future delays

Caltrans is required to comply with the Department of Toxic Substances Control's (DTSC) Soil Management Agreement for Aerially Deposited Lead (ADL) Contaminated Soils. The Agreement requires that Caltrans manage all ADL contaminated soils on the state highway system with elevated lead derived from leaded fuel tailpipe emissions. To fulfill this requirement, Caltrans previously used hazardous materials consultant task orders to collect field samples, analyze them in a laboratory, and develop the necessary reports.

Hazardous materials consultant task orders for ADL studies are costly depending on the size and complexity of the project. The 2016 ADL Agreement lowered the hazardous waste threshold and imposed additional export restrictions for excess soil now considered regulated, resulting in increased ADL testing requirements impacting all projects that disturb soil or generate excess soil. To explore efficiencies and innovative technology, District 11 conducted a multiyear study to evaluate the use of X-Ray Fluorescence (XRF) technology as an additional screening tool for areas expected to have low levels of lead. The results of the study indicated relatively consistent correlation between the XRF analysis and the lab data.

Caltrans submitted the results of the study to the DTSC and requested approval to use XRF technology for predetermined low risk projects. DTSC approved Caltrans staff to use XRF technology in place of previously required laboratory analytical methods through a borehole consultant. XRF technology is a handheld tool that evaluates total lead concentrations in seconds, providing an economically viable alternative to costly and expensive laboratory analysis. The use of XRF technology by Caltrans trained personnel, has eliminated the need for borehole consultant support on low-risk projects on a case-by-case basis using desktop criteria. Additionally, the XRF technology provides real time data to screen projects that are considered non-hazardous, eliminating the need for a comprehensive field investigation supported by expensive and time-consuming laboratory analysis. The XRF technology can justify the unrestricted soil classification and can also be used to respond to emergency projects. Savings for FY 2022-23 using XRF technology is \$789,796.

District 5:

Caltrans' use of XRF technology to screen low-risk projects confirmed their generator knowledge that there was no potential to excavate regulated levels of ADL-contaminated soil on six projects located in District 5. Caltrans calculated savings by comparing the average borehole consultant cost to the cost of Caltrans personnel using XRF technology on 6 projects in FY 2022-23.

The cost of the XRF technology and associated equipment and service plan is \$40,342 and is deducted from the savings. Using XRF technology eliminated the need to analyze data from an estimated 420 borehole locations. District 5 also achieved additional savings from the use of the tool to analyze lead paint on structures.

	Number of Projects	Savings
ADL sampling	6	\$280,000
Lead Paint sampling	3	\$24,000
	Total Savings	\$304,000
	Cost of XRF	(\$40,342)
	Net Savings	\$263,658

District 11:

Caltrans calculated savings by comparing the average borehole consultant cost to the cost of Caltrans personnel using XRF technology on 16 projects in FY 2022-23. Using XRF technology eliminated the need for additional analysis on eight of these projects, resulting in savings of \$1,600/borehole at 260 locations. On the remaining projects, data from XRF indicated the need for additional lab analysis, which produced savings of \$528 at 285 locations.

	# of Boreholes	Savings/Borehole	
Screened out from additional analysis	260	\$1,600	\$416,000
With additional analysis	285	\$528	\$150,480
		Total	\$566,480
		Cost of XRF	(\$40,342)
		Net Savings	\$526,138

District 5 Savings	\$263,658
District 11 Savings	\$526,138
Total XRF Savings	\$789,796

Traffic Data Improvement Initiative

Cost savings or avoidance	\$685,000
Submitted by	Division of Traffic Operations
Qualitative Benefit	<ul style="list-style-type: none"> • Safety • New • Saves time and future delays

In an ongoing effort, Caltrans has been automating several data reporting processes in the Division of Traffic Operations to eliminate hours of manual labor. Traffic count data files for the Traffic Census program are sent in by district engineers to Headquarters staff for upload to the

Transportation System Network. The automation process reduced the need to manually save and upload each individual data file to only one file per district, reducing the usual 15-20 hours of work per week to less than half an hour. The monthly Federal Highway Administration station data report was also automated into an auto-processed and interactive data dashboard. This eliminates all manual processing of data and subsequent plotting, introduces data availability checks on 54,665 federally mandated locations statewide, and implements a periodic data quality check. Additional automated data dashboards also include monthly Type 4 and 5 traffic census station status reports, Traffic Management System assets health reports and Weigh-In-Motion (WIM) station health reports. All three automated dashboards have eliminated manual processing of data and subsequent plotting. Reports generated by a third-party software are now being recreated using in-house software, which eliminates the need to pay for third-party software. The savings for FY 2022-23 is \$685,000.

Previously, the annual personnel services cost for Caltrans staff to perform the traffic data upload, analysis, and reporting was \$663,000. Currently, the annual personnel services cost to perform these tasks by Caltrans staff is \$78,000. The difference is \$585,000.

The annual material cost associated with the previous third-party report generation is \$100,000. There will no longer be a need for this software for report generation purposes and will be replaced with software already in use.

	Pre-Data Initiative Cost	After Data Initiative Cost	Savings
Labor	\$663,000	\$78,000	\$585,000
Material	\$100,000		\$100,000
Total	\$763,000	\$78,000	\$685,000

Automated Machine Guidance

Cost savings or avoidance	\$579,964
Submitted by	Division of Construction
Qualitative Benefit	<ul style="list-style-type: none"> • Safety • Saves time and future delays

In FY 2022-23, Caltrans completed several projects using Automated Machine Guidance (AMG). AMG is a technology that uses positioning devices, singly or in combination, such as Global Positioning Systems, total stations, or rotating laser levels to determine and control the real-time position of construction equipment such as bulldozers, blades, scrapers, and paving machines. This technology reduces the number of survey stakes needed during rough grading, minimizes the number of re-staking requests, and provides records for volume computations. AMG has been shown to reduce the number of construction working days as well as reducing survey and construction support costs.

Caltrans introduced AMG to its projects five years ago and established a methodology in FY 2018-19. The benefits come from changes in how Caltrans provides survey data on the project, how inspectors verify grades during rough grading, and more efficient quantity estimation methods.

AMG efficiencies and benefits:

- Increased productivity and improved accuracy
- Increased safety of field staff on construction projects
- Survey and construction support savings
- More efficient use of survey resources
- Keeps accurate electronic records of material volumes

Savings were first calculated by analyzing five projects from the North Region that were completed in FY 2018-19 to calculate an average percentage of savings for construction and survey support. However, this methodology has changed with the introduction of the Real-Time Kinematic (RTK) rovers, which logs actual time used in the field or Real-Time Network (RTN).

Using RTK rovers to verify grades is roughly one-fourth of the time as using a smart level. As Caltrans transitions to the use of RTK field measurement procedures, and moving forward, the utilization time logged by the RTN will be used as the basic metric to estimate the AMG efficiency.

There are several construction projects where the RTN is not available since the use of the RTN is dependent on the availability of a cellular network. Major projects in Districts 1, 2, 9, and 11 are using AMG equipment outside of the RTN and actual usage data is unavailable for these projects. Conservatively, these projects account for approximately 15 percent of the total usage and have been included in the support savings.

Additional savings considered include reducing the need to close lanes when surveys are being conducted adjacent to traffic to provide for the safety of surveyors. One work shift to close one lane of traffic could cost a minimum of \$1,000 per shift.

The \$817,360 savings represents projects using the RTN network between 06/01/22 and 05/31/23. An additional savings of 15 percent has been included for projects where the RTN is not available due to the lack of cellular coverage.

Support savings on all earthwork projects using the RTN over a full year	\$817,360
Approximate support savings on earthwork projects using AMG (non-RTN) over a full year (~15%)	\$122,604
Equipment costs	(\$360,000)
Total Savings	\$579,964

Concrete Cylinder Testing

Cost savings or avoidance	\$487,000
Submitted by	Division of Engineering Services
Qualitative Benefit	<ul style="list-style-type: none"> • New • Safety • Saves time and future delays

Traditionally, Caltrans has used flexural strength to accept concrete pavements. Flexural strength testing is typically performed on concrete beams measuring 6x6x20 inches in dimensions. In an effort to improve the existing testing and acceptance practices, the pavement and materials partnering committee (PMPC) investigated the feasibility of implementing compressive strength test data for the purpose of accepting concrete materials used in rigid pavement construction. The labor and handling costs associated with concrete cylinder testing, which measure 4x8 inches, are 50 percent lower than the costs associated with concrete beam testing due to the simpler curing and testing processes. There are two main benefits to the change in specifications:

- Compressive strength test samples are much safer to handle by the technicians. The reduced potential for physical strain on technicians incurred during fabrication and handling is in alignment with Caltrans' safety goals.
- Beam specimens used for flexural strength testing are highly sensitive to the curing and testing environments. The use of compressive strength will reduce the potential for variability of test data to about half of the flexural strength and helps with accelerating the acceptance process.

To calculate the efficiency of using concrete cylinder testing, Caltrans compared the costs associated with both testing methods. The costs associated with each testing method have been broken down into the following categories:

- Testing costs
- Labor and handling costs
- Dispute resolution

The annual cost difference breakdown is summarized in the table below:

Testing:

Cost Item	Beams	Cylinders	(+) Savings (-) Loss
Cost per Test	\$110	\$42	
Number of Tests	2,000	3,000	
Subtotal	\$220,000	\$126,000	\$94,000

Labor and Handling:

Cost Item	Beams	Cylinders	(+) Savings (-) Loss
Loaded rate (TET)	\$67/hr	\$67/hr	
Hours	2 hr	1 hr	
Item Cost	\$134	\$67	

Number of Items	2,000	3,000	
Subtotal	\$268,000	\$201,000	\$67,000

Dispute Resolution:

Preparation Cost per Dispute			
Cost Item	Beams	Cylinders	(+) Savings (-) Loss
Hours	40 hr	40 hr	
Rate (TEC)	\$111/hr	\$111/hr	
Cost	\$4,440	\$4,440	

Cost per Dispute			
Cost Item	Beams	Cylinders	(+) Savings (-) Loss
Testing	\$110	\$42	
Labor & Handling (MREA)	\$78	\$78	
Prep	\$4,440	\$4,440	
Cost	\$4,628	\$4,560	

Number of Disputes			
Cost Item	Beams	Cylinders	(+) Savings (-) Loss
Tested Items	2,000	3,000	
Dispute Rate	5%	1%	
Disputes	100	30	

Subtotal Dispute Costs			
Cost Item	Beams	Cylinders	(+) Savings (-) Loss
Disputes	100	30	
Cost per Dispute	\$4,628/item	\$4,560/item	
Total Dispute Cost	\$462,800	\$136,800	\$326,000

Total Costs			
Cost Item	Beams	Cylinders	(+) Savings (-) Loss
Testing	\$220,000	\$126,000	
Labor & Handling	\$268,000	\$201,000	
Disputes	\$462,800	\$136,800	
Total	\$950,800	\$463,800	\$487,000

Zero-Emission Vehicle (ZEV) Fuel Savings

Cost savings or avoidance	\$443,188
Submitted by	Division of Equipment
Qualitative Benefit	• New

- Positively impacts the environment

In an ongoing statewide effort, Caltrans has been transitioning from internal combustion engine vehicles (ICE) to zero-emission vehicles (ZEV) during fleet replacement cycles. Caltrans has been using ICE vehicles since its inception in 1972. ICE vehicles are a type of engine that burns fuel to power a vehicle, such as gasoline or diesel fuel, and are commonly used in cars, trucks, buses, and other vehicles. Caltrans currently spends more than \$51 million dollars on fuel annually.

The cost of fuel itself has continued to go up over the years. In recent years, Caltrans has been moving towards ZEV vehicles that include electric vehicles (EV) to reduce its carbon footprint, improve air quality, reduce noise pollution, and save on long-term costs. These cost savings come from reduced maintenance and repair costs, reduced fuel costs, longer vehicle life spans, and increased resale values. The typical EV battery will last far beyond 200,000 miles. Only the most well-maintained and better built ICE vehicles can last as long. The Division of Equipment (DOE) recently had the largest known Government ZEV purchase, 399 ZEVs, during the FY 2022-23 Fleet Acquisition Plan. Of those ZEVs, 384 replaced older ICE vehicles. DOE calculated that going forward DOE will save \$610,647 in fuel expenses annually from this group of 384 new vehicles.

In calculating savings, Caltrans compared the actual fuel costs of the equivalent ICE vehicles that were replaced and sold using the latest data on gasoline costs and typical maintenance costs.

- Fuel Costs - \$4.90 a gallon, which is the average unleaded fuel cost since the beginning of FY 2022-23. DOE used both commercial and bulk fuel prices of unleaded and averaged based on gallons.
- Maintenance Costs – Sedans average 8,100 miles a year in the fleet, per the March Caltrans Fleet Optimization Utilization Report (F.O.U.R.). Based on those vehicles requiring 2.5 oil changes each year, at a rate of \$80 each for time and labor, \$200 is saved per vehicle on oil change maintenance costs.
- According to a Consumer Reports study, EV owners spend 60 percent less to fuel their vehicles with electricity than with gasoline.

Vehicle Type	Amount Delivered	Average Gallons of Fuel for ICE Equivalent	Total Fuel Saved as Group	Average Cost of Unleaded Fuel in FY 2022-23	Sub Total of ICE Fuel Cost	Sub Total of ZEV Fuel Cost (60% less fuel cost for EV)	Total Fuel Cost Savings	Yearly Maintenance Savings	Total Cost Savings
Electric Sedan	383	324	124,092	\$4.90	\$608,050	\$243,220	\$364,830	\$76,600	\$441,430
Electric Pickup	1	530	530	\$4.90	\$2,597	\$1,039	\$1,558	\$200	\$1,758
Grand Total	384		124,622	\$4.90	\$610,647	\$244,259	\$366,388	\$76,800	\$443,188

Electronic Submittal and Review

Cost savings or avoidance	\$442,489
Submitted by	Division of Environmental Analysis
Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays

Caltrans Cultural Studies Office (CSO), Division of Environmental Analysis (DEA), and the California Office of Historic Preservation (OHP) have developed an electronic submittal and review process for Caltrans and Local Agency documents (for which Caltrans has NEPA and Section 106 oversight) that also includes the use of electronic signatures on documents that previously required wet ink signatures. The new process provides time and cost savings associated with publishing, printing, mailing, revising, and approving hard copy compliance documentation by the Districts and Headquarters Cultural Studies Office.

Using the typical number of project reports and agreement documents that are required to be reviewed by CSO and OHP on an annual basis (n=163), the following savings were derived for printing and mailing costs that have been saved because of the electronic signature and submittal system.

The savings for FY 2022-23 are \$130,540 in other direct costs (ODC), and 5,856 hours of staff time savings in the amount of \$311,949, totaling \$442,489.

Document Type	Number of Documents	Printing Savings	Mailing Savings	Totals
Originals	163	\$81,500	\$5,705	\$87,205
Revisions (avg. of 50% revision rate of originals)	81	\$40,500	\$2,835	\$43,335
Staff Time				\$311,949
Totals				\$442,489

Early Design

Cost savings or avoidance	\$397,980
Submitted by	District 8 Project Management
Qualitative Benefit	<ul style="list-style-type: none"> • New • Safety • Saves time and future delays

By implementing Early Design on several simple safety projects, Caltrans District 8 Project Management was able to achieve ready-to-list, contract advertisement, and contract award milestones a year ahead of the typical schedule. This enabled Caltrans to save one year of inflation/escalation on these projects.

District 8 implemented Early Design on three safety projects (08-1K790, 08-1L360 & 08-1L640), and Caltrans was able to deliver at least 65 percent of plans, specifications, and estimates during the project approval and environmental document phase.

Based on various posted inflation rates, Caltrans is assuming a capital construction cost savings of one year for the inflation rate of nine percent (at a minimum) in FY 2022-23.

Project	Construction Capital Cost 2022-23 (Award Amount)	Inflation rate	Savings
08-1K790	\$2,170,000	9%	\$195,300
08-1L360	\$849,000	9%	\$76,410
08-1L640	\$1,403,000	9%	\$126,270
Total Savings	\$4,422,000	9%	\$397,980

Office Space Lease Reductions

Cost savings or avoidance	\$388,764
Submitted by	Division of Business Operations
Qualitative Benefit	<ul style="list-style-type: none"> • New • Positively impacts the environment

In an ongoing effort to re-evaluate space needs and usage reflecting Caltrans' shift towards telework, the Division of Business Operations (DBO) identified two leases that could be terminated in FY 2022-23. The leases were at 1616 29th Street and 1823 14th Street in Sacramento. Caltrans employees have been absorbed into other existing office locations. Both terminations were effective February 28, 2023. The Caltrans Administration Program support savings for FY 2022-23 is \$388,767.

The savings amount was calculated by taking the monthly rental rates for both leases, adding them together, and multiplying the result by the number of months remaining in FY 2022-23.

Description	Amount
1616 29th Street Monthly Rent at Termination (A)	\$43,366
1823 14th Street Monthly Rent at Termination (B)	\$53,825
Subtotal (A + B)	\$97,191
Total (Subtotal x 4 Months)	\$388,764

Managerial Selection Program (MSP) Process Improvements

Cost savings or avoidance	\$374,083
Submitted by	Division of Human Resources
Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays • Positively impacts the environment

On September 17, 2001, California Code of Regulations, Title 2, Section 549.90 (2 CCR § 549.90) established the California Department of Transportation Managerial Selection Program (MSP). This regulation requires Caltrans to administer their M01 and M09 examinations on a position-specific basis, which allows for greater flexibility in the hiring process since previous examinations for these classifications were only held every two to three years. From its inception, MSP examinations were administered using a two-phase approach. Phase one consisted of a Statement of Qualifications (SOQ) review, requiring the hiring manager and their chosen screeners to evaluate candidate-submitted responses to the vacancy advertisement.

Once the candidate’s SOQ scores were ranked, those applicants who met or exceed the required scoring threshold progressed to phase two, which consisted of a structured examination interview, known as a Qualifications Appraisal Panel (QAP). Administration of each QAP examination process required numerous labor hours for its development, implementation, and facilitation, as well as travel costs on the part of the Human Resources (HR) exam proctor and executive panel members.

Spurred in part by the trending increase in MSP examinations beginning in 2017, a more efficient, sustainable, and cost-effective method of conducting these examinations needed to be developed. In FY 2018-19, the Education & Experience (E&E) examination format was piloted for all M01 and M09 examinations. The E&E format is comprised solely of an evaluation of a candidate’s education and experience in excess of the Minimum Qualifications (MQs) of the classification of the advertised position. Transitioning the exam evaluation component from the hiring panel to internal HR staff, resulted in the elimination of a multitude of exam preparation and administration processes. Not only has this been effective in streamlining MSP examinations overall but has provided tremendous cost savings to the Department by reducing labor and travel costs. Since implementing the new exam modality for MSP examinations, Caltrans has saved \$1,376,178, and the savings for FY 2022-23 is \$374,083.

In calculating the cost savings for this examination conversion, the Division of Human Resources looked at the cost of preparing, assembling, and administering a QAP examination and multiplied that by the number of MSP examinations administered during the FY as shown in below table.

FY Cost Savings for MSP Examination Format Conversion

Cost Description	Savings per MSP Exam	Savings for All FY 2022-23 MSP Exams
Exam Assembly & Shipping	\$71	\$11,014
Proctor Travel Costs	\$300	\$19,200
Proctor Labor Hours	\$499	\$77,842
Panel Member Labor Hours	\$1,705	\$266,027
	Total Savings for FY 2022-23	\$374,083

Advance Mitigation Credits

Cost savings or avoidance	\$278,830
Submitted by	Division of Environmental Analysis
Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays • Positively impacts the environment

The Caltrans Advance Mitigation (AM) Program was established by the Road Repair and Accountability Act of 2017, authorizing Caltrans to plan and implement advanced mitigation solutions for its future transportation projects. This business practice allows Caltrans to reduce delays by proactively obtaining environmental mitigation in advance of, rather than during, transportation projects. The Caltrans Division of Environmental Analysis (DEA) administers the Program and supports Caltrans Districts interested in planning and delivering advance mitigation projects.

The primary goal of the Program is to address longer-term future environmental mitigation needs resulting in improved environmental, economic, and project delivery outcomes. By consolidating the forecasted mitigation needs of multiple future transportation projects, Caltrans can potentially provide strategically placed and environmentally sound replacement habitat and shorten project delivery timelines, resulting in both time and cost savings. Ultimately, the Program aims to help Caltrans meet conservation goals in addition to regulatory requirements.

Advanced mitigation purchases can save money by bundling the credits into one larger purchase for a potentially discounted price and by purchasing credits early before prices increase. The price of mitigation credits is based on supply and demand, so as the need for mitigation credits increases, the price does as well. By purchasing them in advance, there is a financial benefit as the cost of mitigation credits usually increases over time. Additionally, by purchasing the credits in bulk, banks will often negotiate a price reduction which provides an additional cost-savings benefit for advance mitigation purchases.

The transportation projects yield a net savings of \$239,788 in Right-of-Way Capital (Efficiency A) and a net savings of \$39,042 in Capital Support Cost (Efficiency B). Net savings per each project is summarized by the following list:

- 02-1H640 - \$19,943 Efficiency A, \$13,014 Efficiency B, for a total savings (Efficiency A and B) of \$32,957;
- 03-3F070 - \$30,229 Efficiency A, \$13,014 Efficiency B, for a total savings (Efficiency A and B) of \$43,243; and
- 05-1H810 - \$189,616 Efficiency A, \$13,014 Efficiency B, for a total savings (Efficiency A and B) of \$202,630.

The total net savings for the AM Program for FY 2022-23 = \$278,830

Electronic Signatures for Construction Contracts

Cost savings or avoidance	\$239,361
Submitted by	Division of Engineering Services
Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays • Positively impacts the environment

Historically, Caltrans approves construction contracts via paper copies, wet signatures, and receiving packages in the mail from contractors. There has been an effort to update the process by allowing contracts to be awarded and approved with electronic signatures. The Division of Engineering Services, Office Engineer (OE), piloted approving construction contracts with Adobe Sign (eSignature) on November 1, 2021. The implemented process yielded \$239,361 in cost savings in FY 2022-23.

In calculating the efficiency, OE focused on the number of construction contract awards using eSignature and the number of approvals using eSignature separately. In FY 2022-23 (July 1, 2022, to June 23, 2023), 475 contracts were awarded using eSignature, and 217 construction contract approvals utilized eSignature. Savings are realized through reduced labor in the award and approval stage, and also through materials and mail for the award and approval stage. The time savings in the awarding process due to eSignature implementation is five hours per contract. The time savings in the approval process due to eSignature implementation is 3.5 hours per contract.

The labor savings realized during the award process are \$166,250 (5 hours x \$70 per hour x 475 contracts). The labor savings realized during the approval process is \$53,165 for 217 contract approvals (3.5 hours x \$70 per hour x 217 contracts).

The material savings for paper, print costs, and mail expenses are counted separately by awards and approvals.

Award savings are calculated at 150 pages per contract x \$.05 per page x 475 contracts (\$3,562).

Approval savings are calculated at 75 pages per approval x \$.05 x 217 approvals (\$814). Each party receives a copy of the approval (\$814 x 2 = \$1,628). The combined total of awards and approvals is \$3,562 + \$1,628 = \$5,190.

Labor costs based on \$70 per hour	Labor Award (475 contracts x \$350)	Labor Approval (217 contracts x \$245)	Material Savings (Awards and Approvals)	Approval Mailing Savings	Total Savings
Savings Amount	\$166,250	\$53,165	\$5,190	\$14,756	\$239,361

The approval mailing savings are \$6,532 based on overnight mailing costs of approvals at \$34 each. Copies of approvals are mailed once for signatures and again after execution, so \$34 is counted twice per approval ($\$34 \times 217 \times 2 = \$14,756$).

Virtual Vehicle Inspections

Cost savings or avoidance	\$232,900
Submitted by	Division of Traffic Operations
Qualitative Benefit	<ul style="list-style-type: none"> • New • Saves time or future delays • Positively impacts the environment

Caltrans Transportation Permits vehicle inspectors are responsible to inspect certain vehicles and/or loads for extralegal transportation permit eligibility. Historically, such initial inspections were conducted by three inspectors traveling physically across the state. Customers had to schedule an appointment two weeks ahead of time, bring their vehicle or load to the designated location for inspection, and wait for their vehicle inspection by a Caltrans staff person.

In order to promote the timely issuance of transportation permit and reduce the risks and costs associated with traveling, the Office of Commercial Vehicle Operations piloted virtual vehicle inspections in January 2020. The Office developed different types of fillable forms for each type of fixed load or vehicle to be filled out by the customers. After receiving complete information provided on the form, along with supporting documents (such as photos and/or diagrams of the vehicle or load), the vehicle inspector reviews, verifies, and issues a vehicle inspection report to the customer. The pilot proved to be a success and the Office decided to maintain virtual inspection permanently. The Transportation Permits Manual was updated in April 2021 to include virtual inspection.

Before implementing virtual vehicle inspections, the cost was \$32,000 for three inspectors to travel annually (per diem, hotel, and airfare). There is no longer a need to travel to conduct inspections.

The annual personnel services cost to conduct in-person inspections by three Transportation Engineering Technicians is \$347,400. Currently, the annual personnel services cost to conduct virtual inspections by a Transportation Engineer (50 percent of their time) and a Transportation Engineering Technician is \$188,500. Through utilizing virtual inspections, Caltrans saves \$158,900 annually.

Annual costs (fuel, maintenance, and depreciation) for a state vehicle for inspection purposes is \$14,000. There were three state vehicles used for in-person inspections, costing \$42,000 annually. There is no longer a need for state vehicles to utilize for virtual inspections. The savings for FY 2022-23 is \$232,900 and will be used to reduce the time it takes to get vehicles inspected.

	Physical Vehicle Inspection Cost	Virtual Vehicle Inspection Cost	Savings
Labor Cost	\$347,400	\$188,500	\$158,900
Travel Cost	\$32,000	\$0	\$32,000
Vehicle Expense	\$42,000	\$0	\$42,000
Total	\$421,400	\$188,500	\$232,900

Paleontology Geographic Information System (GIS) Tool

Cost savings or avoidance	\$219,055
Submitted by	Division of Environmental Analysis
Qualitative Benefit	<ul style="list-style-type: none"> • New • Saves time and future delays

As part of the environmental compliance process and to comply with relevant NEPA and California Environmental Quality Act (CEQA) statutes, Caltrans is required to assess projects for paleontological (paleo) resources. Past practice involved review of various databases and site-specific history to determine if a particular project would require additional paleontological study. The Geographic Information System (GIS) tool developed by the Hazardous Waste Air Quality Noise and Paleontology office provides substantial time savings for this effort. It does this by allowing the analyst to perform a comprehensive survey of the protentional of paleontological resources from a single GIS database, as opposed to checking multiple sources of information. Total savings for FY 2022-23 are \$219,055 due to staff time savings using the GIS tool instead of the prior process. Not included in this efficiency calculation is an additional estimated \$300,000 to \$500,000 cost savings realized by developing the GIS tool inside Caltrans rather than using external consultants.

Cost avoidance was calculated as a measure of hours saved per environmental document.

- Labor Costs – An assumed rate for staff time was \$125.49 per hour for an Engineering Geologist (mid-range salary). Projects with no significant paleo resources had fewer cost savings than those that did.
- Total number of environmental documents were determined by reviewing FY 2022-23 State Highway Operations and Protection Program projects and removing projects such as pavement and mitigation which are not expected to require a more extensive analysis.

	Hours Saved/Report	Savings/Report	Number of Env Docs	Savings
No Significant Paleo Resources	4	\$502	368	\$184,721
Significant Paleo Resources	12	\$1,506	22.8	\$34,334
			Total	\$219,055

Diverging Diamond Interchange

Cost savings or avoidance	\$216,050
Submitted by	District 11
Qualitative Benefit	<ul style="list-style-type: none"> • New • Safety • Saves time and future delays • Positively impacts the environment

The Enrico Fermi Diverging Diamond Interchange (DDI) is located near Otay Mesa, the busiest commercial land port of entry (POE) in California. The POE ranks second among all U.S.-Mexico border crossings in total truck volume and is notorious for generating extreme vehicle congestion within surrounding communities. A traffic study determined that a conventional diamond interchange at Enrico Fermi could result in a queue length up to 1,000 feet, causing trucks to back up to the Otay Mesa Commercial Vehicle Enforcement Facility (CVEF), exceeding storage capacity, causing safety concerns, and hindering efficient movement of people and goods through this critical route.

A diverging diamond interchange allows two directions of traffic to temporarily cross to the left side of the road. It moves high volumes of traffic through an intersection without increasing the number of lanes and traffic signals. This movement provides easier access to State Route 11 (SR-11). The DDI Project design divides and transposes traffic to opposite sides of the interchange and eliminates separate left-turn movements from signal phasing. This allows longer green time to improve throughput and turning movements. The diverging diamond interchange provides a free left turn onto SR-11 for the many trucks exiting the CVEF and reduces speed and crossing conflicts throughout the interchange.

Quantifiable savings related to the DDI were from direct costs (construction related capital costs) and qualitative benefits. The total quantifiable savings from this project is \$216,050 in FY 2022-23.

The unit prices for fencing and concrete barrier were based on the contract bid items. The Right of Way savings were based on the price paid per square foot for the parcels adjacent to the interchange.

Fencing – A conventional diamond interchange alternative would have required chain link railing (Type 7), sconces, and tubular handrailing. The DDI alternative did not require those items resulting in the following savings to the project:

Item	Quantity	Unit	Unit Price per Linear Foot (LF)	Estimated Cost for Conventional Alternative	Estimated Cost for DDI Alternative	Savings
Chain Link Railing	470	LF	\$160/LF	\$75,200	\$0	\$75,200
Tubular Handrailing	104	LF	\$250/LF	\$26,000	\$0	\$26,000
Sconces	6	EA	\$7,000	\$42,000	\$0	\$42,000

					Total	\$143,200
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Concrete Barrier – A conventional diamond interchange alternative would have required the use of Type 732SW Modified concrete barrier at \$335/LF. The DDI alternative uses Type 736 Modified concrete barrier at \$180/LF. This was a savings of \$72,850 to the project.

Item	Quantity	Unit	Unit Price	Estimated Cost for Conventional Alternative	Estimated Cost for DDI Alternative	Savings
Concrete Barrier 732SW Modified	470	LF	\$335	\$157,450		
Concrete Barrier 736 Modified	470	LF	\$180		\$84,600	\$72,850
					Total	\$72,850

The objective of the DDI was not necessarily to reduce construction costs, but rather to reduce congestion and queue lengths for commercial vehicles exiting the Otay Mesa CVEF. The following section summarizes the overall DDI-related qualitative efficiencies.

Safety:

A diverging diamond interchange allows free-flowing turns when entering and exiting an interstate, eliminating the left turn against oncoming traffic and limiting the number of traffic signal phases. It is easy to navigate, eliminates last-minute lane changes, and provides better sight distance at turns, resulting in fewer crashes.

- The design reduces congestion and better moves high volumes of traffic without the need to increase the number of lanes in an interchange.
- In a national study, the design reduced crashes by an average of 37 percent after it was constructed at 26 interchanges across the United States. The design also reduced injury and fatal crashes by an average of 54 percent. (Source: 2019 article published in the Transportation Research Record, the journal for the Transportation Research Board).

Economic Benefits:

United States - Mexico trade has increased by 45 percent over the past decade. This increased demand impedes mobility in the San Diego - Baja California region. Insufficient capacity at the border crossings costs both countries billions of dollars annually in foregone economic output. As part of the SR-11 corridor, the diverging diamond interchange mitigates the increased demand for California-Mexico trade. The diverging diamond interchange design reduces economic loss resulting from border wait times for both commercial and passenger vehicles. It also promotes the economic competitiveness of the region, state, and country by expanding employment and production through improved freight movement.

Reduced Time/Mitigation of Delays To The Traveling Public and Green House Gas Emissions

The efficient delivery of products is critical to customer satisfaction and the success of individual businesses and urban and global economies. Goods distributors face significant challenges across urban and metropolitan environments, regional highway networks, and bottlenecked ports. In Otay Mesa, cars and trucks regularly waited hours to cross the border, causing air pollution and health impacts due to idling, traffic congestion, safety concerns, and severe economic consequences. This diverging diamond interchange traffic pattern along with the Border Wait Time Technologies and Information Systems have facilitated continuous movement from Mexico into the State transportation system. Reduced border wait times at the Otay Mesa POE have reduced the air quality impact of moving travelers and goods throughout the country.

As part of the SR-11 Project, the Enrico Fermi DDI satisfies the increasing demand for California-Mexico trade at the Otay Mesa POE crossing. The project reduces the economic loss because of existing border wait times for both commercial and passenger vehicles. This will reduce the number of idling vehicles that have a negative impact on air quality. Globally, this will promote economic growth and innovation for the region.

Innovative Drilling Adapter

Cost savings or avoidance	\$167,188
Submitted by	Division of Engineering Services
Qualitative Benefit	<ul style="list-style-type: none"> • New • Safety • Saves time or future delays • Positively impacts the

Geoprosessionals in the Office of Geotechnical Design use Drilling Services to drill borings to obtain subsurface information for a variety of geotechnical projects including bridge foundations, retaining wall design, and emergency storm damage. The borings are drilled using two types of drilling methods: Mud rotary drilling is a wet method as it uses a drilling slurry and is typically used for deeper borings or borings drilled in dense soil or rock. Hollow-stem auger drilling is a dry method (no drilling slurry) and is typically used for shallower borings or borings drilled in less dense soils.

During drilling of the borings, one key design measurement needed by the Geoprosessionals is the depth to groundwater. The depth to groundwater can be measured during drilling when using the auger method, but not using the mud rotary method due to the presence of the drilling slurry. Temporary piezometers can be installed into the boring after drilling with mud rotary to measure the depth to groundwater, but this method has become more difficult due to County permitting restrictions. Instead, Geoprosessionals have typically opted to use auger drilling until groundwater is reached and then switch over to mud rotary drilling for the remainder of the boring.

The process to switch from auger to mud rotary drilling, or vice versa, involves attaching or removing a large fitting to the drill head that the augers are connected to. The fitting weighs more than 200 pounds, has eight bolts that need to be inserted or removed, and requires two to three drillers to manage. The process takes 45 minutes and must be done very carefully as there is potential for injury while lifting and attaching such a heavy fitting. The fitting must be attached or removed every time the drilling method is switched.

Caltrans staff designed and fashioned a new apparatus that replaces the large, heavy fitting with a smaller, lighter one that remains attached to the drill head. Switching from auger to mud rotary or back to hollow stem is now done by sliding the drill rod up or down through the new fitting and attaching or removing the auger with only two bolts. The process can be performed by one driller without any heavy lifting and only takes about ten minutes. There is a cost savings from using the new system, as it reduces drilling and lane closure time and associated labor costs of drilling personnel. The savings derived for FY 2022-23 is \$167,188.

The efficiency savings is calculated using the time savings from using the new adapter versus the old fitting multiplied by the labor cost of all personnel working at the drilling site. The personnel working at the drilling site, consists of one Foundation Driller Leadworker, two Foundation Drillers, one Geoprofessional (Engineering Geologist or Transportation Engineer), one Consultant C-57 Liaison, and a Consultant Traffic Control crew (traffic control needed on 75 percent of drilling jobs). The old fitting takes 45 minutes (0.75 hours) to install or remove, whereas the new adapter takes ten minutes (0.167 hours). On average, three borings are drilled per week, 50 weeks out of the year.

Drilling time saved per year (hours)	Labor cost for drilling personnel (Dollar/hour)	Total yearly savings
175	\$955.36	\$167,188

Nondestructive Testing (NDT) Reduction

Cost savings or avoidance	\$97,920
Submitted by	Division of Engineering Services
Qualitative Benefit	<ul style="list-style-type: none"> • New • Safety • Saves time and future delays • Positively impacts the environment

Nondestructive testing (NDT) is a set of techniques used to evaluate the properties of a material, component, welds, or system without causing damage. NDT is used in a wide variety of industries, including aerospace, automotive, construction, and manufacturing.

NDT can help identify defects in materials or structures that could lead to failure, used to monitor the condition of materials or structures over time to ensure that they are still safe and reliable, and can verify the quality of materials or structures that have been manufactured or repaired.

There are many different types of NDT techniques and equipment, each with advantages and disadvantages. Some of the most common NDT techniques include:

- Visual inspection: This is the simplest and most basic type of NDT. It involves visually inspecting the material or structure for any obvious defects.
- Radiography Testing (RT): This technique uses X-rays to create images of the inside of a material or structure. This can be used to detect internal defects that are not visible from the outside.
- Ultrasonic Testing (UT): This technique uses sound waves to create images of the inside of a material or structure. This can be used to detect cracks, voids, and other defects.
- Magnetic Particle Testing (MT): This technique uses a magnetic field to detect cracks and other defects in ferromagnetic materials.
- Penetrant Testing (PT): This technique uses a liquid dye to detect surface cracks and other defects.

NDT is an essential tool for ensuring the safety and reliability of materials and structures. In the construction industry, NDT is used to inspect bridges, buildings, and other structures for defects that could cause a collapse or failure.

The 2013 American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, Section 5.15.5 – Weld Inspection states “Full penetration groove welds associated with tube-to-transverse-plate connection details having a constant amplitude fatigue threshold (CAFT) of 10 ksi or less shall be ultrasonically inspected for toe cracks after galvanizing.” The 2020 AASHTO Interim Revisions to the Load and Resistance Factor Design (LRFD) Specifications, and the 2020 AASHTO Interim Revisions to the Standard Specifications state “Full penetration groove welds associated with multisided tube-to-base-plate and multisided tube-to-arm-plate connection details having a CAFT of 10 ksi or less shall be ultrasonically inspected for toe cracks after galvanizing.”

The clarification of multisided means that Caltrans no longer needs to perform post-galvanization toe crack inspections on round standards and poles with non-destructive equipment.

Based on the 2020 AASHTO Interim Revisions to the LRFD, and Standard, Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, there was a change to the amount of NDT requirements for the baseplate to pole welds. Prior to the revisions, Quality Control (QC) was to perform 100 percent UT and MT where required, and Department Verification was to perform 25 percent UT and MT. Now these NDT requirements are only for multisided poles.

Each month, Materials Engineering and Testing Services (METS) would be at three facilities to perform these inspections. At one facility, an inspector would spend eight hours a week mapping, preparing, and performing these inspections. Conservatively, over the course of a

month, that equates to 32 hours or 384 hours per year. For three facilities that equates to 1,152 hours yearly. At \$85 per hour (loaded rate of \$85 per hour based on labor cost per classification provided by DES for the Associate Steel Inspector for Caltrans), that equates to a savings of \$97,920 per year in inspection services.

Clean California Mobile App

Cost savings or avoidance	\$61,869
Submitted by	District 7 Maintenance
Qualitative Benefit	<ul style="list-style-type: none"> • New • Saves time and future delays • Positively impacts the environment

The Adopt-A-Highway (AAH) Program provides an avenue for individuals, organizations, and businesses to volunteer their services to help maintain sections of California’s highways. As part of the Clean California Program, AAH Program participants can receive a stipend of up to \$250 per month for litter cleanup events. The District 7 Clean California Geographic Information System (GIS) team designed and implemented a GIS-based mobile app for stipend program participants (AAH volunteers and contractors) to take photos and input information directly from the field. The photos are watermarked with date and time and geotagged to confirm validity. Because the interface of the AAH Stipend app is form-based, it eliminates problems that are likely to occur if a manual process was used, such as incomplete information, inaccurate or no photo submitted, unnecessary information, and back-and-forth emails. To complement the mobile app, GIS-based dashboards were configured for Caltrans staff to verify, review, and track litter collection activities. The data collected in the field with the mobile app is available in real-time, and associated dashboards are components of a workflow that makes data collection, management, and reporting more efficient and enhances transparency and accountability. The time savings equates to \$61,869 for FY 2022-23.

Time Saved per each AAH location – 15 minutes are saved when the app is used. 196 permits are reviewed twice a month, for a total of 98 hours. Using an average monthly salary of \$6,874 (\$39.66/hour), yearly savings associated with individual activity and site review is \$46,640.

For other monthly tasks and processing, an estimated 32 hours saved per month, resulting in a savings of \$15,229 per year (using the same average salary).

The app and associated dashboards were developed and implemented by District 7 Maintenance staff. The data is stored and managed in an online cloud. This platform has been in use at Caltrans for several years requiring no additional up-front costs to implement and maintain the app and dashboards.

Locations	Minutes Saved per Location	Hours Saved Per Month (2	Monthly Savings (\$39.66 per Hour)	Savings per Year
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		Reviews per Month)		
196	15	98	\$3,886.68	\$46,640
Additional Staff Time Savings		32 hours	\$1,269.12	\$15,229
			Total	\$61,869

Steel Shot Blaster

Cost savings or avoidance	\$53,950
Submitted by	Division of Equipment
Qualitative Benefit	<ul style="list-style-type: none"> • Safety • Saves time and future delays

The Division of Equipment (DOE) purchases, fabricates, maintains, and repairs fleet equipment for Caltrans. The fleet is comprised of over 12,000 pieces of equipment. The Division is comprised of approximately 730 professionals, including more than 400 heavy equipment mechanics around the state who maintain and repair equipment, and a Headquarters staff located in Sacramento.

As part of the paint preparation process for vehicles, the DOE must prepare several items by sanding and grinding steel parts. The amount of time, effort, and cost to produce finished quality parts for the production line was a challenge. Each piece required mechanical grinding and sanding to remove mill scale and sharp edges before sending to the paint booth. Getting into the small corners to produce a smooth finish was difficult with a six-inch orbital sander. The potential for employee injury due to the constant vibration from the hand sanders over a prolonged window of time was a concern, as well as handling parts that were not smooth or finished in the interior areas. Mechanics on the assembly line were at increased risk of hands getting injured or cut.

A DOE employee researched alternative techniques and materials and found a vendor who manufactures steel shot blaster cabinets. These cabinets can sand and prepare parts significantly faster, safer, and with fewer resources such as sanders and sandpaper. Using the cabinets reduces labor expenses while increasing productivity.

Prior to the installation of the blasting equipment, the painters would spend an average of six to eight hours for each steel cross member to be refinished. They would use a combination of a two-inch, five-inch, and six-inch air sander to get the metal prepared for painting. The steel shot blaster cabinets have significantly reduced the paint production time for each new vehicle that is built at the DOE Headquarters by over 50 hours each. The new blast time of four to eight minutes inside the equipment, plus the final paint finish of 30 minutes to one hour, allows for the shop to move more vehicles at a substantial time reduction. The finished product is superior as well. The final epoxy primer and paint product goes on quicker, producing a long-lasting finished piece of equipment.

The original cost of the cabinet, purchased and piloted in July 2016, was \$271,195 and is accounted for in the table below. Savings were realized beginning in FY 2021-22 and saved \$53,950 in FY 2022-23.

Numbers are Paint Preparations per Truck (based on average of 40 parts to be blasted per 3-axle plow truck)	Manual Cost per Truck	Steel Shot Blaster Cost per Truck	Savings per Truck
Sandpaper (80 grit)	\$102	\$0	\$102
Sandpaper (180 grit)	\$94	\$0	\$94
Grinding Discs	\$65	\$0	\$65
Steel Shot Blast Material	\$0	\$1	-\$1
Labor Hours (\$39.33 per hour)	16 Hours = \$629	1.5 Hours = \$59	\$570
Total Cost Per Truck	\$890	\$60	\$830

FY 2016-17 to 2020-21, 5-year totals (Average Number of Trucks per Year = 65)

FY 2016-17 to 2020-21 Cost for Manual Delivery	\$289,250	\$0	
FY 2016-17 to 2020-21 Cost of Steel Shot Blaster Delivery	\$0	\$19,500	
Total Savings Since 2016-17 to 2020-21		\$269,750	
Cost of the Steel Shot Blaster Machine		\$271,195 (paid off in FY 21-22)	
Based on 65 trucks per year	Manual Cost per Year	Steel Shot Blaster Cost per Year	Total Savings per Year
FY 2022-23 Savings	\$57,850	\$3,900	\$53,950

Virtual On-Site Visits

Cost savings or avoidance	\$50,000
Submitted by	Office of Civil Rights
Qualitative Benefit	<ul style="list-style-type: none"> • New • Safety • Saves time and future delays • Positively impacts the environment

Caltrans Certification Branch within the Office of Civil Rights (OCR) is the primary agency responsible for certifying small businesses that want to become a certified Disadvantaged Business Enterprise (DBE). As a recipient of federal funding, Caltrans must administer a DBE program according to regulations described in the Code of Federal Regulations (CFR) Part 26. The goal of the DBE program is to increase the participation of Small Business (SB), Disadvantaged Business Enterprise (DBE), and Disabled Veteran Business Enterprise (DVBE) firms in both Federal and State contracting and procurement.

When evaluating a firm’s eligibility for DBE or Airport Concessions Disadvantage Business Enterprise (ACDBE) certification, 49 CFR 26.83(c)(1)(i) requires recipients to perform an on-site visit to the firm’s principal place of business, interview the principal officers and other key personnel, and visit job sites where the firm is working at the time of the eligibility investigation in the appropriate jurisdiction or local area.

Previously, an analyst would need to travel to the firm’s office, which can be located anywhere in the state, to conduct the on-site visit. Currently, the on-site visit is done virtually.

The Certification Branch now utilizes computers, tablets, and mobile device technologies to interview firm owners and key personnel and take virtual tours of office space, equipment, and job sites. This helps to save on travel expenses, work time, and shortens the time to certify the firm's DBE Certification application.

In previous years, travel costs to conduct on-site visits exceeded \$50,000 per year. By conducting on-site visits virtually, Caltrans is saving the allotted \$50,000 in FY 2022-23.

Yearly DBE Applications Received (average)	Travel Savings \$1,000 per visit x 50 (average cost per on-site visit)	Total
50	\$50,000	\$50,000

Software and License Reductions

Cost savings or avoidance	\$49,108
Submitted by	Division of Procurement and Contracts
Qualitative Benefit	• New

The Division of Procurement and Contracts (DPAC) Communications Branch stopped using three paid tools in favor of free equivalents that have created qualitative and quantitative efficiencies.

The Communications Branch maintains four ongoing surveys and creates ad-hoc surveys as needed by DPAC staff. A third-party software was used to develop these surveys, which required an annual purchase order process to renew the subscription. DPAC learned that existing software service subscriptions can be used to develop surveys. After thorough testing, it was determined that the existing software had the features needed to meet DPAC’s survey needs. This allowed the Communications Branch to discontinue purchasing the third-party software in favor of the existing software system which resulted in a cost savings of \$720. In the development of training and marketing materials, the Communications Branch often needs access to high-quality images. An online stock photography company had been the primary source for images and required an annual purchase order process to renew the subscription. With the availability of open-source images through free websites there was no longer a business need to pay for access. The subscription was not renewed in FY 2022-23, saving \$372.

Historically the primary eLearning development tool used by the Communications Branch was a paid third-party software. The Communications Branch has moved away from paid software in favor of more modern and agile eLearning tools. The Branch opted not to renew the agreement for access to the software when it expired, resulting in a savings of \$48,016. A new learning platform is now used by DPAC to house its trainings, which has been made available by the Office of Project Delivery Professional Development (PDPD).

The savings derived for FY 2022-23 is \$49,108.

In calculating savings, the Caltrans subtracted the cost of the licenses specified below that were not renewed which has saved the Communications Branch \$49,108.

Cost Savings

Change to Software / Subscription	Recurring Cost Type	Previous Annual Cost	Cost Savings
Replace Paid Software with Existing Software	2-year encumbrance	\$48,016	\$48,016
Replace Paid Software with Free Software	Yearly renewal	\$372	\$372
Replace Paid Software with Free Software	Yearly renewal	\$720	\$720
		Total	\$49,108

National Environmental Policy Act (NEPA) Process Improvement

Cost savings or avoidance	\$46,346
Submitted by	Divisions of Environmental Analysis and Local Assistance
Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays • Positively impacts the environment

As a result of the efforts of the National Environmental Policy Act (NEPA) Process Improvement Team, the requirement to prepare a multiple-page annotated checklist for every categorical exclusion was eliminated on March 2, 2021. The Categorical Exclusion (CE) Checklist was originally mandated after an FHWA audit in the initial year of the NEPA Assignment Program (then a pilot program). Caltrans has now been successfully delivering projects under the NEPA Assignment Program for over 12 years and after comparing its processes to those implemented in other NEPA Assignment states, as well as weighing the maturity of Caltrans’ environmental project delivery program, the decision was made to eliminate the checklist as a requirement. This allows for less paperwork and staff time and returns the documentation needed to the categorical exclusion itself.

Caltrans’ NEPA Assignment Program is also required to perform self-monitoring of its performance under the program. In the past, self-monitoring included staff reviewing the

adequacy of the completed CEs. Eliminating the requirement to complete the CEs also eliminates the monitoring of the checklists. Therefore, staff time savings include savings related to preparation time, supervisor review time, and NEPA Assignment monitoring staff time. The savings for FY 2022-23 is \$46,346.

The savings for FY 2022-23 was \$46,346 and the number of categorical exclusions approved by Caltrans was 656.

Although many environmental staff were reclassified to environmental scientist classifications in FY 2022-23, to keep with a conservative estimate of savings and to reflect that our reports do not detail the classification of staff that worked on a particular CE, the Division of Environmental Analysis maintained the use of the environmental planner series in the calculations. The average hourly wage was determined based on the published CalHR Civil Service Payscale starting July 1, 2022, which showed the following monthly salaries:

- Associate Environmental Planner \$6,387 - \$7,999
- Senior Environmental Planner \$7,563 - \$9,398

To calculate an average monthly wage, the lowest and highest monthly salaries were simply averaged resulting in the following:

- Associate Environmental Planner \$7,193
- Senior Environmental Planner \$8,481

Based on the State of California Payroll Calendar, 176 hours was used as the number of work hours per month. This resulted in the following average hourly wages:

- Associate Environmental Planner \$40.87
- Senior Environmental Planner \$48.19

Type of Time Savings	Avg Hourly Wage	Hours Saved	Number of Categorical Exclusions FY 2022-23	Total Savings
Preparation	\$40.87	0.75	656	\$20,108
Supervisor Review	\$48.19	0.33	656	\$10,432
Monitoring Review	\$48.19	0.5	656	\$15,806
			Total	\$46,346

Electronic Contract Files

Cost savings or avoidance	\$41,641
Submitted by	Division of Procurement and Contracts
Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays • Positively impacts the environment

The Division of Procurement and Contracts (DPAC) is responsible for the acquisition of goods and services to support Caltrans programs and districts while meeting business and

performance goals. As such, DPAC processes and tracks an average of 6,800 purchase orders (PO) and 2,500 contract acquisitions each FY.

Historically, DPAC has processed and maintained hard copy PO and contract files. Effective September 1, 2020, DPAC stopped creating hard copy PO and contract files and started creating electronic contract files.

During FY 2019-20, DPAC spent \$43,534 on supplies for PO and contract files (e.g., paper, toner, folders, and labels). During FY 2020-21, DPAC spent \$8,316 on supplies for PO and contract files, with a cost savings of \$35,218 between the two FYs. DPAC did not spend any funds on contract file supplies in FY 2021-22. During FY 2022-23, DPAC spent \$1,529 on supplies (banker boxes) and \$364 on toner.

The savings calculation is based on DPAC spending during FY 2022-23, using FY 2019-20 as a baseline. Both FY 2020-21 and 2021-22 are included to reflect consistent savings since the baseline year.

Fiscal Year	Expenditures	Savings
2019-20	\$43,534	\$0
2020-21	\$8,316	\$35,218
2021-22	\$0	\$43,534
2022-23	\$1,893	\$41,641
Total (4 years)		\$120,393

Electronic Environmental Documents

Cost savings or avoidance	\$41,080
Submitted by	Division of Environmental Analysis
Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays • Positively impacts the environment

The Environmental Management Office (EMO) within the Division of Environmental Analysis (DEA) is responsible for the submittal of environmental documents for which Caltrans is the California Environmental Quality Act (CEQA) lead agency to the California Transportation Commission (CTC) for their approval as a responsible agency. Environmental documents must be sent to the CTC whenever a project requires the CTC to program and allocate funds, approve a route adoption, or approve a new road connection. Previously, Districts printed hard copies of the required submittal packages and mailed them to the CTC Liaison in EMO for review and circulation through the various divisions at Headquarters for required approvals.

In 2020, this process was converted to an online and electronic submittal process, including electronic signatures for approvals. Districts no longer have to print or mail environmental documents (in many instances requiring overnight or express services) and HQ staff no longer need to route hard copies to the different divisions. All submittals and approvals are handled

100 percent electronically, resulting in a much faster review and approval process. This efficiency is permanent and there is no expectation to return to paper submittals.

EMO has also integrated a spreadsheet to track CTC submittals into a statewide project tracking tool used by environmental personnel. Districts can now access information in the tool, such as CTC resolution numbers, following each CTC meeting. Prior to this integration, districts called or emailed DEA for this information, and the spreadsheet itself contained duplicate fields already present in the tool that had to be manually filled in, such as project names, identification numbers, locations, and other information.

Finally, another efficiency includes the creation of an ADA-compliant map template for CTC submittals, which are posted on the DEA’s webpage for districts to use. This efficiency was developed in 2021. Prior to creation of the template, DEA received maps from districts but was responsible for modifying them to meet CTC requirements and verifying compliance. Districts can now prepare maps themselves using a simple, step-by-step process, and ensure that they are fully compliant prior to submittal.

Average number of submittals per meeting based on meetings from January to December 2020: 13 (12.9 rounded up; 11 Initial Studies (IS), two Environmental Impact Reports (EIR)). Number of CTC meetings per year: eight.

Item	Old Process	New Process	Savings
EIR/IS Printing Cost with Labor	\$23,200	0	\$23,200
Processing	\$8,904	\$1,424	\$7,480
Mailing	\$10,400	0	\$10,400
Total	\$42,504	\$1,424	\$41,080

Safety and Management Services Process Improvement

Cost savings or avoidance	\$30,156
Submitted by	Division of Safety and Management Services
Qualitative Benefit	• Saves time or future delays

The Office of Safety and Management Services was able to work with the State Personnel Board to update its processes. This resulted in removing duplicative steps and less paperwork. The process improvement produced a ten percent savings in staff time to carry out its duties. Applying the ten percent gains in time savings to its process yielded more than \$30,000 in savings in FY 2022-23.

- Documents drafted by Staff Services Manager I (SSMI) Specialists, the mid-pay range is \$7,178 per month.
- Drafting documents takes up 50 percent of the SSMI Specialist’s time, \$3,589 in labor hours per month for that specific job function.

- Ten percent is a savings of \$359 per month, per SSMI Specialist.
- There are seven SSMI Specialists, $\$359 \times 7 = \$2,513$ in labor dollars saved per month.
- $\$2,513 \times 12$ months = $\$30,156$ annual efficiency savings.

Small Business Council Virtual Meetings

Cost savings or avoidance	\$24,131
Submitted by	Office of Civil Rights
Qualitative Benefit	<ul style="list-style-type: none"> • New • Safety • Saves time and future delays • Positively impacts the environment

The purpose of the Caltrans Statewide Small Business Council (SBC) is to encourage the participation of small businesses (SB), inclusive of Micro-Businesses, limited contracting small business enterprises, lesbian, gay, bisexual, transgender, or queer (LGBTQ) businesses, Disadvantaged Business Enterprises (DBE), Disabled Veteran Business Enterprises (DVBE), and other disadvantaged groups, with contracting opportunities and to provide a forum to comment and provide feedback on Caltrans policies and practices that affect or impact small business utilization and participation in Caltrans contracts and projects.

For more than two decades, from 1999 to 2020, the SBC held in-person meetings six times a year at different districts throughout California.

In-person meetings involved extensive planning, coordination, and significant financial resources. The council had to secure conference rooms, arrange accommodations for members traveling from various cities, and coordinate transportation logistics for Caltrans staff as well as SBC members.

Shifting to virtual meetings in FY 2020-21 led to savings in terms of time, productivity, and travel expenses. In the past, Caltrans staff and SBC members would spend hours traveling to and from meeting locations, which often disrupted their schedules and limited their availability for other responsibilities. Caltrans staff and members now attend the Thursday committee meetings and Friday full council meetings virtually via WebEx from the comfort of their own offices or homes, allowing them to allocate their time more efficiently and participate in a larger number of activities. In FY 2022-23, three of the six meetings were held virtually and saved \$24,131.

In calculating savings, Caltrans estimated the amount of time saved by staff not having to travel to the SBC meetings and the cost of the travel reimbursement to the Small Business Council members. Reimbursement costs include fuel, airfare, local transportation, hotels, and meals.

Number of SBC Meetings Held Virtually	Average Time Spent Traveling (hours)	Caltrans Staff Labor Savings per SBC Meeting	Travel Reimbursement Savings (SBC Members)	Total
3	4	\$4,931	\$19,200	\$24,131

Cost Estimates Toolbar

Cost savings or avoidance	\$12,000
Submitted by	Division of Engineering Services
Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays

In an effort to improve structure cost estimating practices and better align engineers' estimates with bid results, the Division of Engineering Services (DES), Structure Office Engineer, Cost Estimate Branch, adopted probabilistic cost estimate practices ten years ago. These practices were responsible for providing structure cost estimates in ranges with associated confidence levels. The branch chose to use a paid software for predictive modeling, forecasting, simulation, and optimization. It gave unparalleled insight into the critical factors affecting risk using Monte-Carlo simulation and providing structure cost estimates in ranges. At that time, the branch purchased the software, tested the software, and provided training to 25 DES cost estimators. In 2019, the Division of Engineering Services staff developed an in-house software to replace the paid software, hence saving the Department \$12,000 per year in software maintenance fees and future purchases of new licenses.

Driver Certification Process Improvement

Cost savings or avoidance	\$9,728
Submitted by	Division of Safety and Management Services
Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays

The Division of Safety and Management Services manages the driver certification program for Caltrans. Safety and Management Services developed a new process that reduces time and resources needed to prepare documents related to driver certification. The process was implemented in FY 2021-22 and reduces the process by four days for each task. The reduction in staff time saved is \$9,728 in FY 2022-23.

Previous Five-Day Process Amount	New One Day Process Amount	FY 2022-23 Amount Saved per New Process	FY 2022-23 Process Tasks (\$1,216 x 8) = Total Amount Saved
\$1,520	\$304	\$1,216	\$9,728

Type Two Efficiencies

Type Two Efficiencies	Number of Efficiencies	Cost Savings or Avoidance
New	0	\$0
Ongoing	9	\$180,431,897
Total	9	\$180,431,897

Value Analysis (Federally Mandated)

Cost savings or avoidance	\$74,308,140
Submitted by	Division of Design
Qualitative Benefit	• Saves time or future delays

Caltrans uses the Value Analysis (VA) study on individual projects to drive efficiency and add value or performance. VA is a systematic process of review and evaluation early in the project lifecycle and it is one of the most important processes used in project delivery to achieve efficiencies. Conducted by a multidisciplinary team during the environmental and design phase, the goal is to identify innovative approaches that improve the overall value of the project. The team applies their knowledge in a systematic approach by utilizing function analysis tools to improve the value of a project. VA methodology is optimized by refining the design to increase performance and/or decrease costs, analyzing lifecycle costs, user benefits, and overall return on investment. Value is added by improving functionality and/or reducing cost while maintaining the safety, necessary quality, and environmental attributes of the project. The team consists of independent subject-matter experts who are not directly involved in the project and will offer new perspectives.

Once the study is completed, a final report documents the process, results, decisions made, and implementation plans for moving the project forward. Recommendations, in most cases, reduce project cost but in some cases, the result is an increase to the overall cost of the project but improved overall performance. Federal regulations mandate that all projects on the National Highway System receiving federal funds with an estimated total project cost exceeding \$50 million perform a VA. These efficiencies are counted as Type Two efficiencies as they are mandated and equate to \$74,308,140 in FY 2022-23.

Number	Project Description	Total Project Cost	VA Savings	Associated Cost	Type One Project Savings (Non-Federal Mandated VA)	Type Two Project Savings (Federal Mandated VA)
1	D3 – EA3F060-SR162 - Butte City Bridge Replacement	\$56,745,000	\$44,213,000	\$47,018		\$44,165,982

2	D3 – EA3H330 – US50 - Install Transportation Management System (TMS) field elements.	\$37,500,000	\$10,271,000	\$71,600	\$10,199,400	
3	D6 – EA0V120 – SR99 – Cottonwood Creek Bridge Replacement	\$36,437,000	\$5,616,000	\$82,868	\$5,533,132	
4	D7 - EA34280 - SR14 - Permanent Restoration between Newhall Avenue and Placerita Canyon Road	\$19,350,000	(\$13,000)	\$62,952	(\$75,952)	
5	D11 – EA43051 - I15 - Concrete Lane Replacement Project	\$74,860,000	\$9,467,000	\$69,812		\$9,397,188
6	D11 - EA42370 - I8 - Pavement Rehabilitation near Alpine from Viejas Creek Bridge to Pine Valley Creek Bridge	\$53,459,000	\$20,845,000	\$100,030		\$20,744,970
7	D11 – EA42320 - SR125 Pavement Rehabilitation including SR125 and SR94	\$43,950,000	\$1,383,000	\$59,540	\$1,323,460	
8	D12- EA0R200 - I5 - Pavement Rehabilitation between Cristianitos Road and El Camino Real	\$21,650,000	\$110,000	\$76,240	\$33,760	

	Totals	\$343,951,000	\$91,892,000	\$570,060	\$17,013,800	\$74,308,140
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Municipal Coordination Grant Program

Cost savings or avoidance	\$31,028,000
Submitted by	Division of Environmental Analysis
Qualitative Benefit	<ul style="list-style-type: none"> • Positively impacts the environment

Caltrans is required to comply with the National Pollutant Discharge Elimination System (NPDES) Permit issued by the State Water Resources Control Board (SWRCB) that regulates stormwater discharges from Caltrans right of way (ROW). The NPDES Permit requires Caltrans to capture and remove pollutants such as toxic metals, oil, and sediment from stormwater runoff from roadways by constructing roadside treatment devices such as biofiltration swales and sand filters, also known as Best Management Practices, or BMPs.

In addition to removing stormwater pollutants in TMDL-impaired areas, the NPDES Permit requires trash removal from all significant trash generating (STGAs) areas within Caltrans ROW through construction of roadside trash capture devices by 2030. As per the 2012 NPDES Permit, Caltrans is required to treat 1,650 compliance units (CUs) annually from their ROW in impaired watersheds through implementation of treatment devices. For each acre that is treated, Caltrans receives one CU. The 2012 NPDES Permit encourages Caltrans to partner with local municipalities and provide funding for regional water quality treatment facilities in impaired watersheds in which Caltrans is a listed stakeholder.

The NPDES Permit allows Caltrans to partner with local municipalities to fund regional water quality treatment projects to facilitate a cost-effective approach to Permit compliance. Off-system projects provide substantial benefits to water quality as they treat both Caltrans and local municipality ROWs while maximizing the return on investments.

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Municipal Coordination Expenditures & Equivalent Compliance Units:

	Compliance Units Granted per each \$88K	Invoiced Expenditures
FY 2021-22	352.6	\$31,028,800

Most efficiencies in this report account for savings occurring in FY 2022-23. However, specific to this efficiency, credit for the savings occurs when the CUs are approved by the SWRCB, which occurs the following FY. Therefore, the reported savings in this report are for FY 2021-22 and

were certified on June 13, 2023. This is consistent with the calculation, methodology, and reporting in previous efficiencies reports.

National Environmental Policy Act (NEPA) – Streamlined Environmental Review

Cost savings or avoidance	\$25,830,554
Submitted by	Division of Environmental Analysis
Qualitative Benefit	• Saves time or future delays

In 2007, Caltrans established a Memorandum of Understanding with the Federal Highway Administration (FHWA) to assume responsibility for the National Environmental Policy Act (NEPA). The assumption of this federal responsibility is commonly referred to as “NEPA Assignment.” NEPA Assignment streamlines the federal environmental review and approval process by eliminating FHWA project-specific review and approval. NEPA Assignment does not alter federal environmental protection standards. California assumes sole responsibility and liability for its NEPA decisions and is required to waive its right to sovereign immunity against NEPA related actions brought in federal court.

Since 2007, Caltrans has achieved significant time savings by completing environmental documents 15.3 months earlier with NEPA Assignment. For projects that were determined to be exempt from preparing a major environmental document, or “Categorically Excluded,” the review processing time savings is estimated at one month. The time savings during the environmental review has allowed construction to begin sooner, avoiding cost escalation of capital construction costs, as identified in the cost calculations beginning in FY 2017-18 in support of Senate Bill 1. Processing projects utilizing NEPA Assignment saves money through cost avoidance.

Projects that utilized NEPA assignment and completed the Project Approval and Environmental Document phase during FY 2022-23 are identified. Categorical exclusions are estimated to save one month in time savings and environmental assessments achieve 15.3 months in time savings. The time savings were multiplied by the approved capital cost escalation rate to determine cost savings. The Caltrans Legal Division provided the associated legal costs, which were subtracted from the savings. In addition, Caltrans subtracted the support costs for the program and the consultant costs associated with NEPA Assignment. As shown in the table below, there were 92 environmental approvals completed utilizing NEPA Assignment achieving \$25.8 million in savings in FY 2022-23.

Highway Rehabilitation, Reconstruction and Replacement Projects	Number of Projects	Savings	Associated Costs	Savings
Categorical Exclusions-1 Month	81	\$3,426,651		
Environmental Assessments-15.3 Months	11	\$23,036,047		

Legal Expenses			(\$117,338)	
Program Staff Support			(\$350,744)	
Consultant Costs			(\$164,062)	
Total Savings	92	\$26,462,698	(\$632,144)	\$25,830,554

Partnering

Cost savings or avoidance	\$20,862,410
Submitted by	Division of Construction
Qualitative Benefit	• Saves time or future delays

Owners of construction projects across the country pay tens of billions of dollars each year in interest and legal costs for claims that go unresolved for long periods of time. This is money that could be used to fund additional projects. Partnering is used to prevent this from happening or to help resolve the situation if it does occur.

Partnering is simply a way of conducting business in which two or more organizations make long-term commitments to achieve mutual goals. This requires changing traditional adversarial relationships into team-based relationships. Partnering promotes open communication, trust, understanding, and teamwork among participants. Partnering on construction contracts leads to fewer disputes on contracts and better cost and schedule certainty.

Professionally facilitated project partnering is mandatory on all projects with a total bid greater than ten million dollars and 100 or more working days. Although optional, it is encouraged on all projects with a total bid greater than one million dollars and up to ten million dollars. The Resident Engineer is required to extend a formal invitation to the contractor to partner on all projects with a total bid greater than one million dollars. Application of partnering concepts on projects with a total bid of one million dollars or less is also encouraged, even if a professional facilitator is not used.

The savings are cost avoidance through avoidance of change orders and claims on partnered projects. The savings are estimated by the project team (both Caltrans and the contractor) at the end of the project. The total cost of professionally facilitated partnering is subtracted from the estimated savings identified by the project team to find the savings due to partnering. The remaining project allocation is also used to validate the estimated savings.

Savings from the projects receiving a Caltrans Excellence in Partnering Award in FY 2022-23 is \$20,862,410.

Reclaimed Asphalt Pavement

Cost savings or avoidance	\$10,001,610
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Submitted by	Division of Maintenance
Qualitative Benefit	• Positively impacts the environment

The vision for the Caltrans Pavement Program is to improve pavement quality across California. The Caltrans Standard Specifications allow contractors to use recycled materials in State highway pavement projects which has been shown to have yielded considerable savings. Using recycled material in pavement projects reduces project capital costs. Reclaimed Asphalt Pavement (RAP) is old pavement that is removed and processed for immediate reuse or stockpiled for future construction projects. Current standard specifications allow contractors to use recycled material such as RAP. Savings are calculated from industry practice and past studies.

Since 2009, Caltrans allowed contractors to substitute RAP aggregate as part of the virgin aggregate in hot mix asphalt (HMA) in a quantity not exceeding 15 percent of the aggregate blend by weight. In 2017, the allowable RAP aggregate in HMA increased to 25 percent. Caltrans is working with the asphalt industry to determine if it is possible to further increase the percentage of RAP without negatively affecting long-term pavement performance.

When properly crushed and screened, RAP consists of high-quality, well-graded aggregates coated by asphalt binder. With a good mix design, RAP will decrease project costs by replacing some virgin aggregate and virgin asphalt binder. The primary efficiency of recycled materials in pavement projects is reducing project capital costs. However, other benefits include diverting solid waste from landfills and reduced greenhouse gas emissions due to the reduced movement of removal and delivery of new material.

Caltrans uses current industry practices, past studies, and correlations with available data to calculate savings.

Efficiency savings for the use of RAP in Caltrans paving projects for FY 2022-23 is \$10,001,610

RAP Efficiency Savings Summary

1	Total Amount of Type A HMA in tons	1,975,624
2	Total Amount of Type A HMA with RAP in tons (75% of Line 1) in tons	1,481,718
3	Total Amount of RAP in tons (15% of Line 2) in tons	222,258
4	Savings in using 1 ton of RAP instead of 1 ton of virgin mix (dollar/ton)	\$45
	Cost Savings (Line 3 multiplied by Line 4)	\$10,001,610

Highway Lighting – Light-Emitting Diode (LED) Retrofit

Cost savings or avoidance	\$9,088,901
Submitted by	Division of Maintenance
Qualitative Benefit	• Safety

	• Positively impacts the environment
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In an ongoing statewide effort, Caltrans has been replacing existing high-pressure sodium (HPS) fixtures with light-emitting diode (LED) lighting on streets and highways statewide. HPS fixtures have been a mainstay for more than 30 years, however, LEDs are a superior alternative. LED fixtures are designed to operate for a minimum of 15 years with little or no maintenance, compared to HPS lighting which requires replacement every four years. A reduction in maintenance on LED fixtures also lessens the frequency of lane closures and reduces the exposure of maintenance workers to the hazards of working in live traffic. LED lights are also far more energy-efficient, reducing energy usage by 50 to 60 percent. Reducing electricity usage results in a positive impact to the environment.

In calculating savings, Caltrans subtracted the cost of replacing lighting using the traditional HPS materials and method as compared to LED lighting.

	FY 2022-23 LED Savings
Energy Cost	\$7,864,128
Labor Cost	\$1,484,440
Vehicle Expense	\$209,667
Higher fixture cost of LEDs vs. HPS	(\$469,334)
Total Savings Using LED vs. HPS	\$9,088,901

Cold Recycling

Cost savings or avoidance	\$5,041,292
Submitted by	Division of Maintenance
Qualitative Benefit	• Positively impacts the environment

Caltrans employs various strategies and materials to maintain and rehabilitate pavement throughout the State Highway System. Cold Recycling (CR) is a strategy for pavement maintenance and rehabilitation. The process consists of grinding the existing pavement, processing material, mixing with stabilizing agents, spreading recycled mixture, and compacting. The entire recycling operation is performed without heat. A hot mix asphalt overlay is then constructed on top of the recycled layer as a new wearing course.

Cold Recycling includes technologies such as Partial Depth Recycling (PDR), Full Depth Recycling (FDR), and Cold Central Plant Recycling (CCPR). Comparable conventional all-HMA strategies include mill and fill, medium or thick overlays, or HMA rehabilitation, depending on the CR strategy. A mill and fill is a pavement treatment that removes the existing surface layer and replaces it with a new thin asphalt layer. A medium or thick overlay involves a thicker HMA strategy. Finally, HMA rehabilitation involves reconstructing the pavement and may include underlying layers.

Using CR instead of mill and fill, medium overlay, or HMA rehabilitation saved Caltrans \$5,041,292 in FY 2022-23. Additional benefits of CR include diverting material solid waste from landfills, reduced greenhouse gas emissions, faster construction schedules, and fewer closure impacts to the traveling public.

The efficiency savings calculation compares the bid item cost for CR versus an all-HMA strategy. Cold Recycling was used in five projects in FY 2022-23. The Pavement Program reviewed CR data for projects with awarded dates in FY 2022-23 and found savings in the projects listed below:

Project Location and Description	All Hot Mix Strategy Total Cost	Cold Recycling Strategy Total Cost	Cost Savings
District 9 – PDR in Mono County, State Route 395	\$3,993,625	\$3,403,038	\$590,587
District 9 – PDR in Inyo County, State Route 127	\$13,108,493	\$11,453,885	\$1,654,608
District 9 – PDR in Kern County, State Route 14	\$5,406,397	\$4,664,729	\$741,668
District 5 – PDR in San Luis Obispo County, State Route 58	\$3,630,143	\$2,740,220	\$889,923
District 2 – PDR in Lassen County, State Route 139	\$3,622,582	\$2,458,076	\$1,164,506
		Total Savings	\$5,041,292

Smart Water Controllers

Cost savings or avoidance	\$4,253,340
Submitted by	Division of Maintenance
Qualitative Benefit	<ul style="list-style-type: none"> • Safety • Positively impacts the environment

In 2014, Caltrans responded to the drought by investing in Smart Irrigation Controller technology to meet Caltrans’ goal of reducing statewide potable irrigation water consumption by 50 percent, utilizing 2013 water use data as a baseline. Between calendar years 2015-2022, Caltrans has met and achieved this goal by saving 33.4 billion gallons of water.

In an ongoing statewide effort, Caltrans has been replacing existing stand-alone irrigation controllers with smart controllers. Smart irrigation controllers have proven to be a valuable tool for maintenance personnel by providing real-time data regarding the condition of the irrigation infrastructure. The smart controllers generate alerts that identify issues such as lateral line breaks, sprinkler flow issues, broken heads, and power outages. In case of a mainline break, the smart controller is capable of automatically shutting down the irrigation system to prevent major damage. This technology allows field personnel to safely and efficiently manage irrigation systems that exist throughout highway roadsides.

The savings are calculated utilizing 2013 water cost data that was made available by Caltrans accounting. Water utilities that were paid in 2013 showed a total cost of \$22,126,165. The total water cost in 2022 was \$17,872,825. Subtracting the 2022 amount from the 2013 amount, the difference is \$4,253,340 in savings for calendar year 2022.

Electronic Plans and Quantities (P&Q) Submittal Process

Cost savings or avoidance	\$17,650
Submitted by	Division of Engineering Services
Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays • Positively impacts the environment

In 2016, the Structure Office Engineer implemented an electronic Plans & Quantities (P&Q) submittal process. Instead of Bridge Design staff submitting hard copies of the plans, quantities, foundation reports, hydraulic reports, etc., the Bridge Design branches were directed to submit all items required at the P&Q milestone electronically. Not only did this save staff time but this also saved in the cost of paper, toner, and wear on the printers. The FY 2022-23 savings are \$17,650.

The savings are largely due to savings in staff time. Structure Office Engineer receives approximately 150 P&Q submittals each year. Before this electronic submittal process was implemented, engineers had to print out two copies of the plans, quantities, foundation reports, hydraulic reports, etc., and submit these hard copies to Structure Office Engineer. For this efficiency calculation, it was conservatively assumed that each project took about one hour to print, assemble, and submit the hard copy P&Q submittal.

Calculated at \$111/hour as the loaded rate for a TE (Civil). 150 projects x 1 hour x \$111/hour = \$16,650.

Note: Conservative time estimates were used for one hour to put together a hardcopy P&Q submittal package.

	Hard Copy Processing	Electronic Processing	Savings
Labor Cost	\$16,650	\$0	\$16,650
Material Cost	\$1,000	\$0	\$1,000
Total	\$17,650	\$0	\$17,650

FY 2022-23 Efficiencies: Type Three

These efficiencies provide benefits to Caltrans and taxpayers and may be qualitative in nature.

Orange Lane Striping on I-5 in San Diego County

Qualitative Benefit	<ul style="list-style-type: none"> • Safety
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Staff in Caltrans District 11 (San Diego and Imperial Counties) implemented orange lane striping in construction zones on Interstate 5. The brightly colored road markings aid in the prevention of work zone related traffic incidents.

Orange lane striping alerts the public about the construction zone and is meant to be a visual reminder to reduce speeds and exercise caution around road workers. These stripes are the same shade of orange as traffic cones and signs, drawing on drivers' familiarity with what the color represents to protect workers. These highly visible road markings distinguish the correct travel path for drivers through construction zones and enhance both daytime and nighttime visibility.

This innovative striping technique also benefits emerging technologies like connected and automated vehicles (CAVs). These high-visibility roadway markings have the potential to improve CAV lane detection technology, as well as provide improved advanced warnings to the driver and other CAVs of the upcoming construction zone. This use of orange lane striping is in its infancy and is being tested in California among many other states.

Halo Helmet Lighting

Qualitative Benefit	<ul style="list-style-type: none"> • Safety
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During a recent Safety Summit, a discussion evolved regarding the implementation of active lighting on safety personal protection equipment (PPE). This led to an investigation into a limited pilot program in District 11. After initial positive feedback, the new device was tested in Districts 3, 4 and 7 for a larger sample size. After a successful pilot in those districts resulting in more positive feedback, it was decided to implement statewide. The statewide rollout of halo helmet lighting provides a 360° flood light that illuminates the surrounding area at roughly eye level.

The halo helmet lighting is a personal lighting system providing 360° of personal and situational awareness, visible up to ¼ of a mile away. The integrated spotlight also provides task lighting up to 50 feet. The lighting uses a removeable 18650 Lithium Ion battery that is rated for 1.5 - 120 hours of use, meeting the demands of various Caltrans crews. The removeable battery allows for swapping out an expended battery during extended work shifts with ease.

The California Integrated Travel Project (CAL-ITP)

Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays • Positively impacts the environment
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The Cal-ITP added six transit agencies who now accept passenger fares by bank cards. Transit agencies that agreed to participate include, Santa Barbara Clean Air Express, Santa Barbara Metropolitan Transit District, Monterey-Salinas Transit District, SacRT light rail, Capitol Corridor Joint Powers Authority and Coast Regional Transit Authority in Myrtle Beach, South Carolina.

This effort helps to remove obstacles in the customer experience and provides a digital option for payment.

Renewable Diesel

Qualitative Benefit	• Positively impacts the environment
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The Division of Construction piloted 14 projects since 2019 that required the use of renewable diesel in off-road diesel construction equipment. Based on what was learned from the renewable diesel pilots, a new standard special provision, “Renewable Diesel Required Use,” was developed and published for use on projects advertised after October 24, 2022.

Caltrans Internal Audits Office (CIAO)

On July 1st, 2022, Caltrans established an Internal Audits Office in the Administration Program. Additionally, the Caltrans Internal Audits Office (CIAO) assumed some of the responsibilities from the Independent Office of Audits and Investigations (IOAI). CIAO provides Caltrans with objective assurance and consulting services designed to add value and improve Caltrans’ operations.

The CIAO team works to create positivity and efficiency and will help Caltrans accomplish its objectives by evaluating and improving the effectiveness of governance, risk management, and internal control processes. Quantitative savings may be realized through CIAO activities and may be included in future efficiencies reports.

Laser Cutter

Qualitative Benefit	• Safety • Saves time or future delays
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The Division of Equipment (DOE) Headquarters Paint & Final Shop is tasked with cutting and applying reflective tape for logos, stripes, and other markings on Caltrans vehicles. Reflective tape is used to improve reflective brightness and enhances the visual effect of vehicles and equipment on the roadway to improve the safety of Caltrans employees and the traveling public.

In October 2022, the DOE started a process to purchase a laser cutter that would cut the reflective material, with the main goal of reducing employee injuries due to manual cutting of the tape and reducing the amount of time spent having to manually cut each decal.

Prior to purchasing the laser cutter, the Paint & Final technician would measure out and cut the amount of material needed by hand to complete each job. This was typically a 2-hour process to cut the tape, plus another 2 hours to install the material onto the equipment.

The laser cutter offers speed-cutting technology and heat to seal the cut edges of the tape. Built in the United States, the laser cutter reduces the amount of labor required to complete

each vehicle and has improved safety for workers. Quantitative savings may be realized in the future, as accounting for the upfront cost of the equipment does not yet yield a net savings.

Project End Date (PED) Extension Tool

Qualitative Benefit	<ul style="list-style-type: none"> • Saves time or future delays • Positively impacts the environment
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A Project End Date (PED) is the final date when a recipient, or Local Public Agency, may perform work to be allowable for reimbursement on a federally funded project. The project end date is part of the scope of the project and is defined as the date after which no additional costs may be incurred.

When a project end date extension is needed, the recipient is required to provide a justification to the Division of Local Assistance (DLA) and the Federal Highway Administration for review and approval. The prior PED process was done manually, requiring recipients to fill out forms and mail them.

The new electronic process, using the PED Extension Tool, saves time and money by avoiding mail costs, delivery time, and paper costs. Districts are also no longer part of the authorization process, saving review time by district staff. Using the new PED Extension Tool allows for one individual to process extension requests received directly from the recipient, eliminating reviews by District Local Assistance Engineers. This tool also allows DLA to track and monitor the status of Extension Requests.

The PED Extension Tool was implemented in late FY 2022-23 and may produce quantifiable savings in the future.

Supervisory Control and Data Acquisition System (SCADA)

Qualitative Benefit	<ul style="list-style-type: none"> • Safety • Saves time or future delays • Positively impacts the environment
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The Caltrans Office of Electrical, Mechanical, Water, and Wastewater Engineering (OEMWW) manages about 300 pump plants, 86 Safety Roadside Rest Areas (SRRAs), 212 maintenance stations, various vehicular tunnels, movable bridges, equipment repair shops, toll plazas and administration buildings, truck weigh and inspection facilities, and transit light rail and bus stations within Caltrans. OEMWW is responsible for designing and implementing the Supervisory Control and Data Acquisition (SCADA) systems to monitor, gather, control, and process data from intelligent field equipment located at transportation-related facilities statewide. SCADA is a software system Caltrans uses to remotely monitor the status of pump plants and sewage lift stations. SCADA can be applied to any automated process with sensors and motors, including a variety of processes and equipment typically found in industrial applications.

SCADA replaces a manual process and consolidates siloed SCADA systems from third-party vendors with an enterprise SCADA solution, Ignition software. Replacing this manual process with a centralized system that can be designed, developed, maintained, and supported by Caltrans employees, decreases the dependency on costly service contracts for consulting services. SCADA benefits include:

- Allows every District the flexibility to configure SCADA systems using the same platform, processes, protocols, and standards on many different industrial applications.
- Implements preventative measures for unforeseen weather conditions that lead to equipment failure, such as freeway flooding.
- Improves employee safety by reducing trips to and from remote transportation related facilities to conduct daily manual check-ins and repairs.
- Protects public safety and health by providing a robust monitoring system to alert District Maintenance staff of potential equipment failures, such as a broken water main at an SRRA.

For more information on efficiencies listed in this report, email contact.sb1@dot.ca.gov.

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