CALTRANS EFFICIENCIES REPORT

2021-22

TABLE OF CONTENTS

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 Caltrans will consider efficiencies that result in cost avoidance or a reduction in support or capital costs.

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

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."

Fiscal year 2021-22 efficiencies are categorized in three types:

1

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.

2

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.

3

Type Three Efficiencies

Efficiencies, practices, trends, and innovations that benefit Caltrans and taxpayers.

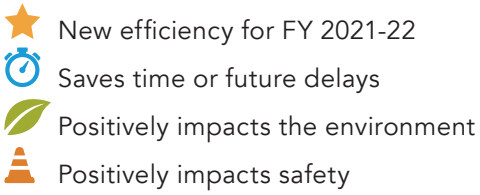
For Fiscal Year (FY) 2021-22, Caltrans is reporting $314 million in total efficiencies savings, of which $124 million is included in SB 1 reporting (Type One). Type Two savings are $190 million and Type Three savings are counted by number of efficiencies, as these efficiencies are more qualitative in nature.

Type One Efficiencies	Number of Efficiencies	Cost Savings or Avoidance
New	12	$20,257,822
Ongoing	14	$103,780,151
Total	26	$124,037,973

Type Two Efficiencies	Number of Efficiencies	Cost Savings or Avoidance
New	2	$357,822
Ongoing	10	$189,769,759
Total	12	$190,127,581
Type One & Two Total	**38**	**$314,165,554**

Type Three Efficiencies	Number of Efficiencies	Cost Savings or Avoidance
New	8	These efficiencies may be legacy practices, difficult to quantify, or represent savings outside of reinvestment in the state highway system.
Ongoing	3	
Total	11	

The following table shows FY 2021-22 Type One and Type Two efficiencies and amounts saved. There are icons adjacent to the efficiency to show the qualitative benefit of the efficiency:



Efficiency Title - Type One	Qualitative Benefit	Savings
High Reflective Materials for Striping		$34,000,000
Value Analysis (Caltrans Expanded)		$33,714,300
Value Engineering Change Proposals		$12,579,657
Two-Year Job Mix Formula Change		$8,000,000
Cone Penetration Technology		$7,059,700
Automated Machine Guidance		$6,925,000
Open-Graded Friction Course		$3,414,400
Mobile Field Devices (Tablets)		$3,082,110
Municipal Coordination Grant Program		$2,895,109
Unmanned Aircraft Systems		$2,110,578
Americans with Disabilities Act Data Collection		$2,106,037
Independent Assurance Program		$1,894,968
Fleet Management via Global Positioning Satellites		$1,763,021
Bulk Information Technology Procurement		$1,119,984
Innovative Change Orders		$895,958
Accelerated Bridge Construction		$757,340
X-Ray Fluorescent Technology		$736,658
Electronic State Historic Preservation Office Electronic Submittal		$391,712
Advance Mitigation Credits		$260,638
Electronic Signatures for Construction Contract Approval		$147,495
Steel Shot Blaster		$52,505
Electronic Environmental Document Submittal and Approval		$40,992
National Environmental Policy Act Process Improvement		$39,699
Safety and Management Services Process Improvement		$34,464
Cost Estimates Toolbar		$12,000
Driver Certification Process Improvement		$3,648
Type One Total		$124,037,973

Efficiency Title – Type Two	Qualitative Benefit	Savings
Value Analysis (Federally Mandated)		$54,498,100
Construction Manager/General Contractor		$47,300,000
Municipal Coordination Grant Program		$30,756,697
Partnering		$23,418,496
National Environmental Policy Act - Streamlined Environmental Review		$14,901,579
Reclaimed Asphalt Pavement		$9,669,670
Highway Lighting - Light Emitting Diode Retrofit		$7,519,337
Partial Depth Recycling		$1,224,380
SMART Water Controllers		$458,000
Managerial Selection Program Process Improvements		$279,070
Division of Procurement and Contracts Electronic Contract Files		$78,752
Electronic Plans and Quantities Submittal		$23,500
Type Two Total		$190,127,581
Overall Total		**$314,165,554**

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."

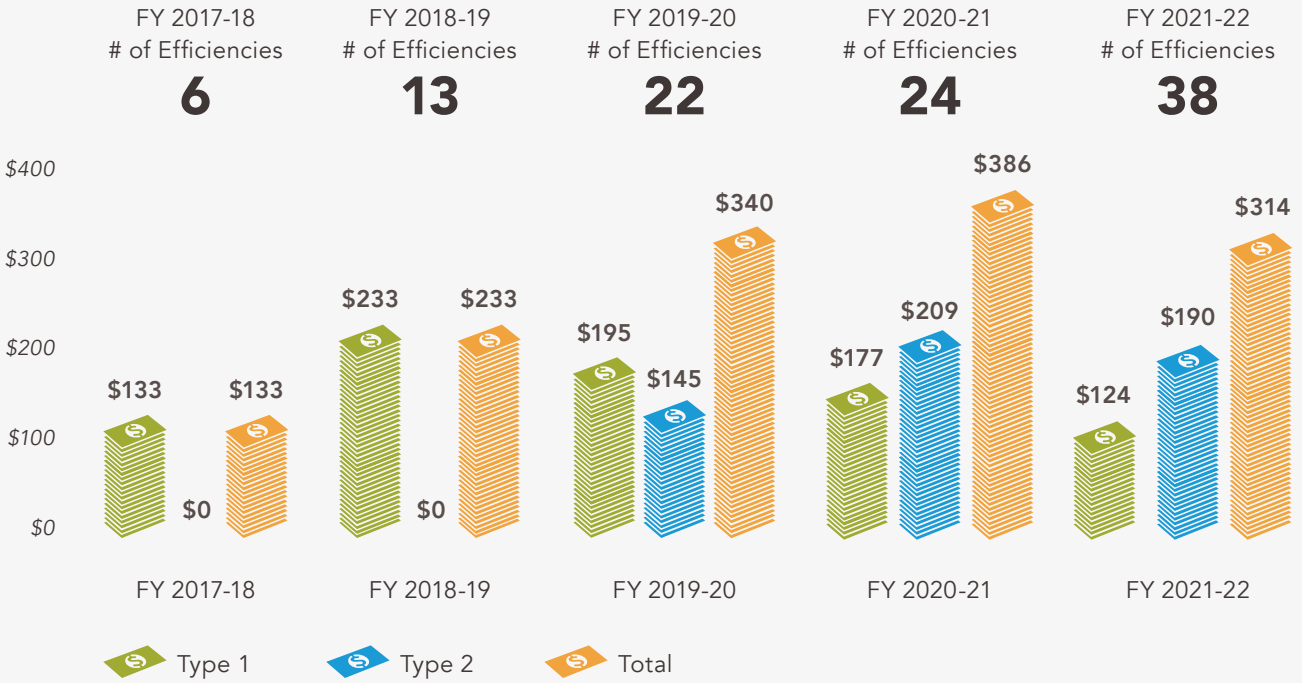
Caltrans has increased the number of efficiencies annually and exceeded the $100 million savings goal each year since SB 1 was enacted in 2017.

The dedication of Caltrans leadership and employees 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 hosted peer exchanges in 2020 and 2021, working with other State Departments of Transportation to share ideas and foster open communication to improve how efficiencies are identified, tracked, and reported.

Five-Year Summary



Report Organization

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

1

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.

2

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

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Efficiencies, practices, trends, and innovations that benefit Caltrans and taxpayers.

FY 2021-22 EFFICIENCIES: TYPE ONE

Type One Efficiencies	Number of Efficiencies	Cost Savings or Avoidance
New	12	$20,257,822
Ongoing	14	$103,780,151
Total	26	$124,037,973

High Reflective Materials for Striping

Cost savings or avoidance	**$34,000,000**
Submitted by	Division of Maintenance

Caltrans has historically used 4-inch-wide painted stripes to delineate both edge and lane lines on the State Highway System (SHS). 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.

In addition to increased safety, 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.

Efficiency Calculation Methodology:

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 an average of $16.50 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 an average of $12.40 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 2017-18 Striping Contracts	$16.50	$16.50	$16.50	$16.50	$16.50
FY 2018-19 Striping Contracts		$12.40	$12.40	$12.40	$12.40
FY 2018-19 Striping Contracts New Strategies		$27.00			
FY 2019-20 Striping Contracts			$5.10	$5.10	$5.10
Total	$16.50	$55.90	$34.00	$34.00	$34.00

Value Analysis (Caltrans Expanded)

Cost savings or avoidance	**$33,714,300**
Submitted by	Division of Design

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 life-cycle 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 analyses tools to improve the value of a project. VA methodology is optimized through refining the design to increase performance, decrease costs, analyze lifecycle costs, user benefits, and overall return on investment. Value is added by improving functionality 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 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 with 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 2 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 from voluntarily performing these non-mandated VAs.

Caltrans identified 13 projects that were awarded in 2021-22. Eight of 13 projects were not mandated to have a VA but were performed by Caltrans. 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 the FY. Net savings for all 13 projects is $88.2 million, with $33.7 million counting towards the SB 1 goal. Type Two savings ($54,498,100) are captured later in this report.

Value Engineering Change Proposals

Cost savings or avoidance	**$12,579,657**
Submitted by	Division of Construction

Caltrans encourages contractors to develop and implement innovative approaches to construction of projects through the 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 traffic delays, and improve quality and safety. When these new approaches result in construction cost savings, Caltrans and contractors share the cost savings 50/50.

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 the number of projects that had accepted VECPs for FY 2021-22. There were 23 accepted VECPs for the FY, representing $12,579,657 in savings. Support costs for general review of VECP proposals and processing change orders is not considered in the change order savings. If Caltrans performs an engineering review and approval for a VECP, those costs are deducted before the split cost savings is calculated in the VECP change order.

Two-Year Job Mix Formula Change

Cost savings or avoidance	**$8,000,000**
Submitted by	Division of Construction

As part of the Pavement Materials Partnering Committee effort, Caltrans and industry partners worked together to evaluate the Job Mix Formula (JMF) renewal process and proposed to change the JMF validation time from 12 months to 24 months. This was discussed with industry members representing material suppliers and paving contractors. All parties supported this change with the understanding that extending the life of JMFs by 12 months will result in multiple benefits to Caltrans and industry partners. Costs related to Hot Mix Asphalt (HMA), JMF and Greenhouse Gas emissions associated with the production of JMF verification asphalt mixtures, including the extraction and processing of asphalt binder and mineral aggregates, are cut in half.

There are approximately 40 Hot Mix Asphalt producers in California and each of them produces about an average of 20 JMF in 12 months, which total 800 JMF per 12 months. To produce a JMF, there needs to be an average of two "hot drops." A hot drop is the field production of an asphalt mix sample that is used for the development and verification of a JMF. These hot drops are calculated to be 1,600 hot drops per 12 months. The average cost of a hot drop is $10,000. Therefore, the statewide annual cost of JMF validation is $16,000,000. Annual statewide savings from 24 months JMF validation time is $8,000,000.

Cone Penetration Technology

Cost savings or avoidance	**$7,059,700**
Submitted by	Division of Engineering Services, Geotechnical Services/Design, South

The State Route 405 project in Orange County California is a mega project with a budget of over $2 billion dollars. Cone Penetration Test (CPT) technology was used extensively to define the geotechnical site characteristics where a total of 30 bridge structures were either replaced, widened, or newly constructed along a 16 mile long freeway. In addition, CPT was used in direct design of the bridge

deep foundations. This methodology and technology have not been used before in any project of such magnitude and scope in California. CPT is a method used to determine the geotechnical engineering properties of soils, delineating soil stratigraphy and characterizing subsurface conditions, without necessarily taking a soil sample.

The test method consists of pushing an instrumented cone, with the tip facing down, into the ground at a controlled rate. CPT evaluates the cone tip resistance, the sleeve friction and the dynamic pore pressure during the geotechnical investigation. CPT is economical and convenient, which allows the design team to deliver more miles of highway and more bridge structures for the same project delivery budget. This is especially true in highly urbanized areas of the coastal zones in Southern California, where innovative and alternative project deliveries are increasingly playing an important role. Another element that is important to consider is the role of CPT in reducing design and construction risk, which translates into time and dollars. In the right situations, CPT is used to provide a more complete picture of the subsurface conditions, thereby reducing uncertainties in design and risk in construction.

The savings is in time, traffic control, and drill cutting costs:

Borings

Depth (ft)	Boring Duration in Shifts	Drilling and Logging Cost	Soil Disposal Cost	Traffic Control Cost (1-lane)	Laboratory Testing	Boring (subtotal)
150	3	$12,000	$2,000	$12,000	$1,000	$27,000
100	2	$8,000	$1,500	$8,000	$1,000	$18,500
75	1	$4,000	$1,000	$4,000	$500	$9,500
50	0.75	$3,000	$1,000	$4,000	$500	$8,500

CPT

Depth (ft)	CPT Duration in Shifts	CPT Rig Cost	Soil Disposal Cost	Traffic Control Cost (1-lane)	Laboratory Testing	CPT (subtotal)
150	0.75	$4,500	$0	$3,000	$0	$7,500
100	0.50	$3,000	$0	$2,000	$0	$5,200
75	0.35	$2,100	$0	$1,400	$0	$3,500
50	0.25	$1,500	$0	$1,400	$0	$2,900

Summary

Depth (ft)	Boring (subtotal)	CPT(subtotal)	Savings
150	$27,000	$7,500	$19,500
100	$18,500	$5,200	$14,300
75	$9,500	$3,500	$6,000
50	$8,500	$2,900	$5,600

The CPT technology was used 622 times in lieu of borings. An average of the CPT savings ($45,400/4 depth types = **$11,350**) multiplied by **622** equals a total of **$7,059,700**.

Automated Machine Guidance

Cost savings or avoidance	**$6,925,000**
Submitted by	Division of Construction

In FY 2021-22, 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.

Caltrans introduced AMG to its projects four years ago and contractors have been using it for more than a decade for rough grading. The benefits for Caltrans come as a result of changes in the way 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, safety, and accuracy
- Survey and construction support savings
- More efficient use of survey resources
- Keeps accurate electronic records of material volumes

Support Savings all earthwork projects over a full year	$4,990,000
Working Days – 258 days at $7,500 per day	$1,935,000
Total Savings	$6,925,000

Open-Graded Friction Course

Cost savings or avoidance	**$3,414,400**
Submitted by	Division of Environmental Analysis

Caltrans is committed to treating stormwater that is discharged from the SHS to improve water quality for all Californians. Stormwater treatment devices can be very expensive to construct which motivated Caltrans to work in partnership with the State Water Resources Control Board (SWRCB) to explore innovative and cost-effective alternatives to capture stormwater pollutants prior to reaching water bodies.

Open-Graded Friction Course (OGFC) is a porous pavement that acts as an effective treatment control Best Management Practice (BMP) that is widely used by municipalities for water quality.

OGFC is most effective on roads and highways with a speed limit of 50 miles per hour or greater and also offers additional benefits:

» Re-configuration or modification of existing drainage facilities are not required.

» OGFC does not have any space or additional ROW constraints.

» OGFC improves visibility during heavy rains due to the reduction of splash or spray and reduces the probability of hydroplaning.

» OGFC helps in reducing traffic noise.

Caltrans is required to comply with the National Pollutant Discharge Elimination System (NPDES) permit issued by the SWRCB that regulates stormwater discharges from Caltrans Right of Way. Caltrans OGFC pavements perform as an approved treatment BMP and qualify for stormwater treatment compliance credit in Total Maximum Daily Load (TMDL) impaired watersheds.

In FY 2020-21*, Caltrans secured 19.4 acres of stormwater treatment compliance credits utilizing OGFC pavements constructed to address pavement preservation needs. The financial equivalent for treatment devices within Caltrans right of way is $176,000 per Compliance Unit (CU).

On average, Caltrans spends approximately $176,000 in construction capital costs to treat stormwater runoff from one acre of Caltrans Right of Way through traditional treatment devices. Caltrans does not have to construct traditional stormwater treatment devices to address 19.4 acres of Right of Way where OGFC credits have been granted resulting in cost avoidance efficiency.

Cost of Traditional Treatment Device / 19.4 acres (CUs) x $176,000 per acre	$3,414,400
Total Cost Avoidance	$3,414,000

* Most efficiencies in this report account for savings occurring in FY 2021-22. 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 2020-21 and were certified on June 20, 2022. This is consistent with the calculation, methodology, and reporting in previous efficiencies reports.

Mobile Field Devices (Tablets)

Cost savings or avoidance	**$3,082,110**
Submitted by	Division of Construction

As part of an ongoing effort to improve the project delivery process by effectively leveraging new technology, the Division of Construction procured and deployed 1,700 mobile field devices (tablets) in 2018 to construction staff as a device to help administer construction projects remotely. The mobile field devices enable field inspectors, resident engineers, and construction managers access to electronic documents and to administer construction contracts directly from the job site.

The ability to remotely access needed documentation significantly reduced the otherwise frequent trips between the field office and job site and allowed construction staff to better utilize their time for high priority activities. The mobile field devices also eliminate the need for 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 around 75 percent of construction staff having access to a mobile device, which increases efficiency savings. The savings derived for FY 2021-22 is $3.08 million compared to $2.6 million per year in previous years.

Caltrans conducted a survey in 2018 and found that each mobile field device user saved 4.4 roundtrips weekly between the field office and the job site.

The average distance between office and job site is 17 miles. Caltrans calculated the mileage savings per year and subtracted the cost of the device and servicing per year. Based on the data collected, each mobile field device user can save an average of $1,813 per year over the expected life of the device which is 5 years. In total,1,700 devices are producing a net savings of $15.4 million over their expected 5-year life span or $3.08 million per year.

	Yearly Costs	Yearly Savings
Vehicle Fuel & Maintenance (4.4 trips)		$3,878,550
Yearly Paper Savings		$28,560
Device costs ($1,250 per tablet x 1,700 staff) / 5 year lifespan	-$425,000	
Device Support, Training & Apps	-$400,000	
Total Savings		$3,082,110

Municipal Coordination Grant Program

Cost savings or avoidance	**$2,895,109**
Submitted by	Division of Environmental Analysis

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. Caltrans secures NPDES Permit compliance credits by constructing stormwater treatment devices in water quality impaired Total Maximum Daily Load (TMDL) areas.

In addition to removing stormwater pollutants in TMDL impaired areas, the NPDES Permit, as amended in 2017, requires trash removal from all significant trash generating (STGAs) areas within Caltrans ROW through construction of roadside trash capture devices by 2030. Annually, Caltrans is required to treat 1,650 compliance units (CUs) from their right-of-way (ROW) in impaired watersheds through implementation of treatment devices. For each acre that is treated, Caltrans receives one CU. The Caltrans NPDES Permit encourages Caltrans to partner with local municipalities and to provide funding for regional water quality treatment facilities in impaired watersheds in which Caltrans is a listed stakeholder.

The average unit cost to construct a traditional on-system treatment device is $176,000 / treatment acre. The SWRCB acknowledges a 50 percent discount by granting compliance units at a rate of 1 CU for every $88,000 of funding contribution toward municipal partnership projects. The net cost avoidance is realized when Caltrans receives CUs from the SWRCB for the off-system projects funded through submission of Annual Total Maximum Daily Load Status Reports.

In FY 2020-21*, Caltrans received a total of 337.1 CUs from reimbursement of funding commitments with municipal partnership projects. There are 33 CUs from the trash provision amendment to the statewide stormwater permit which was signed in November 2017. The separate trash control implementation projects are listed below with the number of CUs listed separately from the overall total of 337.1. As the trash provision projects were implemented after the 2017 amendment, the credits qualify as a Type One efficiency. The remaining 304.1 CUs are counted as a Type Two efficiency later in this report.

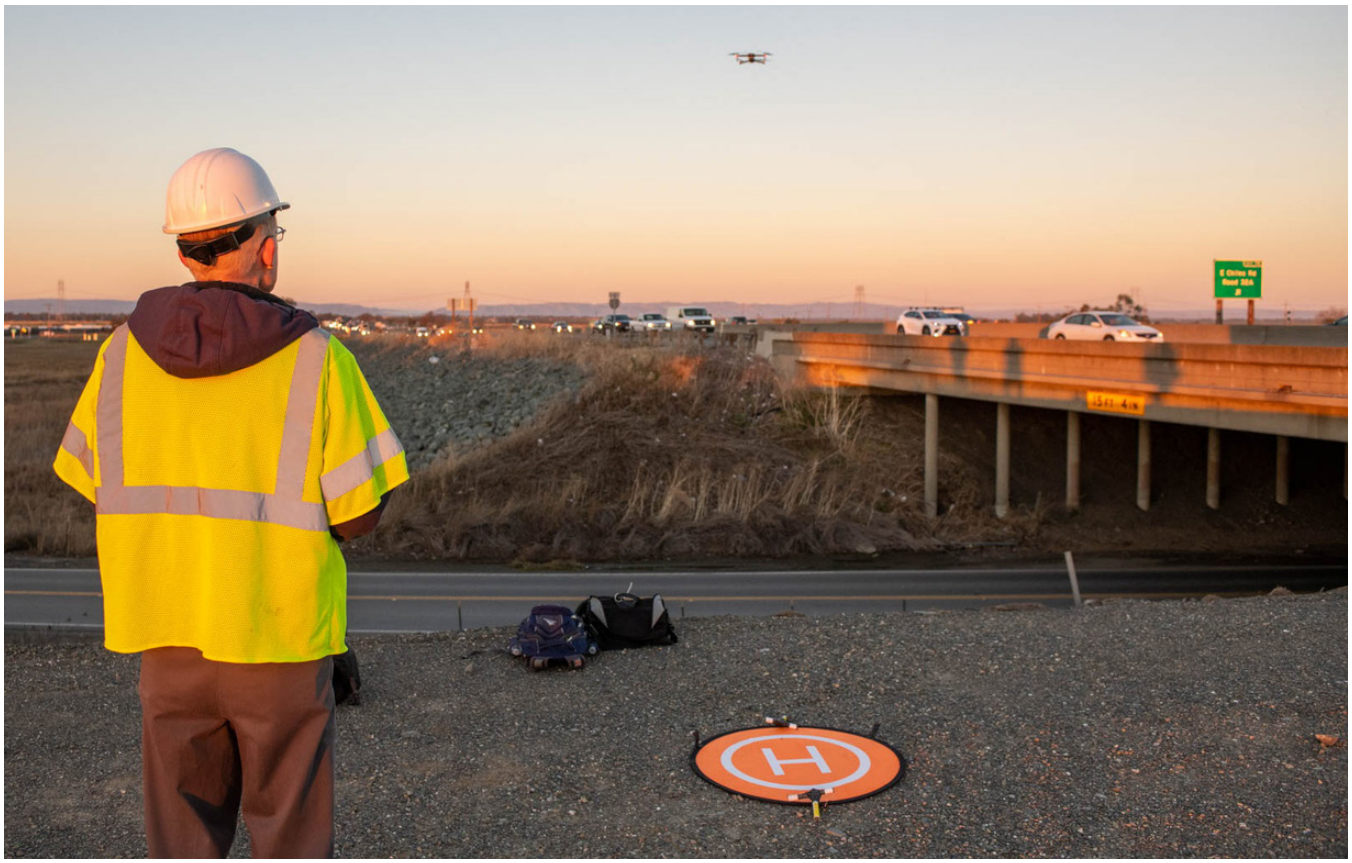
Caltrans does not have to construct on-system treatment devices to address 33 acres of ROW where municipal coordination compliance unit credits have been granted, resulting in $2,895,109 in cost avoidance in FY 2020-21.

Permittee	Project Description	Total Invoice Amount for FY 2020-21	CUs
City of South San Francisco	Orange Park Memorial (Phase I)	$598,661	7
City of Richmond	Meeker Ditch & Bayview – Regatta Blvd	$2,314,230	26
Total		$2,912,891	33
Trash control Implementation Plan Projects Grand Total		$2,912,891	
Caltrans On-System cost to deliver 33 CUs @ $176,000/acre		$5,808,000	
Cost Avoidance		$2,895,109	

*Most efficiencies in this report account for savings occurring in FY 2021-22. 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 2020-21 and were certified on June 20, 2022. This is consistent with the calculation, methodology, and reporting in previous efficiencies reports.

Unmanned Aircraft Systems

Cost savings or avoidance	**$2,110,578**
Submitted by	Divisions of Right of Way and Land Surveys, Engineering Services, and Aeronautics



Unmanned Aircraft Systems (UAS) is an essential tool for surveying, bridge inspection, construction, and steep terrain investigation. The use of UAS improves safety, boosts efficiency, and decreases costs. UAS can be used to capture photos and videos and generate terrain models. UAS can access hard to reach locations (such as steep slopes, culverts, and the underside of bridges), while collecting imagery rapidly and reducing worker exposure to hazardous conditions.

There were two Programs that reported UAS efficiency savings for FY 2021-22.

» Steep Terrain Investigations (statewide)

» Surveys (North Region)

Additionally, Steep Terrain Investigations generated savings from FY 2020-21 that are being included in this report (FY 2021-22) as final numbers were not available at the time of publication for the FY 2020-21 report.

Surveys (North Region)

Item	Savings
UAS (49 flights)	$468,708
Depreciation	-$30,000
Total Savings	$438,708

Steep Terrain Savings Summary

Item		FY 2020 -21	FY 2021-22
Savings	Rockfall Hazard Assessment	$320,340	$404,640
	Landslide Hazard Assessment	$383,284	$420,376
	Traffic Control	$121,866	$141,364
Costs	Pilot Development	-$60,000	-
	Equipment	-$40,000	-
	Software	-$10,000	-$10,000
Total		$715,490	$956,380

Savings Summary

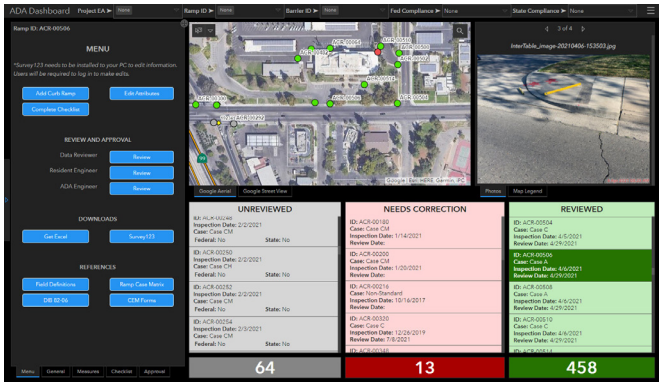
Source	Fiscal Year	Amount
Steep Terrain Investigations (Statewide)	FY 2020-21	$715,490
Steep Terrain Investigations (Statewide)	FY 2021-22	$956,380
Surveys (North Region)	FY 2021-22	$438,708
Total		$2,110,578

Americans with Disabilities Act Data Collection

Cost savings or avoidance	**$2,106,037**
Submitted by	Division of Asset Management (District 6)

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 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 cost savings of $2.1 million in District 6 alone. The cost savings are anticipated to be approximately 50 to 75 percent per element



compliance inspection in perpetuity. When the solution is implemented statewide, the cost savings will be significantly greater.

Using the Caltrans ADA Transition Plan inventory for District 6, the savings are as follows 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			$2,106,037

Independent Assurance Program

Cost savings or avoidance	**$1,894,968**
Submitted by	Division of Engineering Services

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. 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 improved 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 savings of $1.89 million for FY 2021-22.

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

Classification	Loaded Monthly Salary	PYs Saved	Monthly Savings	Annual Savings
Transportation Engineering Technician (TET) - Range C	$9,608	2	$19,216	$230,592
Materials and Research Engineering Associate (MREA)	$12,762	4	$51,048	$612,576
Transportation Engineer (Civil) - Range D	$17,530	5	$87,650	$1,051,800
Total		11	$157,914	$1,894,968

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

Fleet Management via Global Positioning Satellites

Cost savings or avoidance	**$1,763,021**
Submitted by	Division of Equipment

In 2019, Caltrans assisted the Department of General Services in writing a mandatory statewide telematics contract. That contract was awarded to Geotab 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 incurred close to 21,000 hours manually logging vehicle usage each year. Over $1 million is saved annually by eliminating these manual logs. Additional savings are achieved by the elimination of smog inspections.

Efficiency savings for FY 2021-22:

Item	Savings
Elimination of Manual Usage Reporting	$1,245,110
Elimination of Annual Smog Inspections	$517,911
Total Savings	$1,763,021

Bulk Information Technology Procurement

Cost savings or avoidance	**$1,119,984**
Submitted by	Division of Infrastructure Management

Historically, each division and functional unit across Caltrans have been responsible for procuring 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 replace machines that were at the end of useful life.

Opportunities to improve this process were identified and realized in 2020 due to a large amount of staff working remotely. With the number of orders being placed each year, IT decided to take advantage of cost savings that result from ordering in bulk (100 or more items), while trimming down the number of requests processed by individual areas within Caltrans.

As a result, Caltrans IT implemented a bulk procurement effort starting in FY 2021-22, resulting in a savings of $1,119,984.

In calculating savings, Caltrans took the cost of each laptop model quoted for the bulk procurement and subtracted that figure from the state contract price. Ordering equipment is now done twice per FY, instead of being done on as-needed basis. Procurement number one is done in July, and procurement number two is done in January.

Bulk Procurement # 1 (July 2021)

Laptop	Quantity	Regular Price	Bulk Price	Savings
HP EliteBook 840 G8 Laptop (standard, non-touchscreen)	578	$1,446.07	$1,311.41	$77,833.48
HP EliteBook x360 1040 G8 Laptop (standard, touchscreen)	468	$1,803.59	$1,534.71	$125,835.84
HP Zbooks Laptops - Design/CADD	452	$2,029.50	$1,498.70	$239,921.60
Total		$2,597,242.58	$2,153,651.66	$443,590.92
			Percentage Saved	17.08%

Bulk Procurement # 2 (January 2022)

Laptop	Quantity	Regular Price	Bulk Price	Savings
HP EliteBook 840 G8 Laptop (standard, non-touchscreen)	1023	$1,446.07	$1,311.41	$137,757.18
HP EliteBook x360 1040 G8 Laptop (standard, touchscreen)	691	$1,803.59	$1,534.71	$185,796.08
HP Zbooks Laptops - Design/CADD	541	$2,029.50	$1,377.30	$352,840.20
Total		$3,823,569.80	$3,147,176.34	$676,393.46
			Percentage Saved	17.69%
			July and January Procurements Combined Total	$1,119,984.38

Innovative Change Orders

Cost savings or avoidance	**$895,958**
Submitted by	Division of Construction

Historically, Caltrans has tracked construction cost savings from value engineering change proposals (VECP) change orders, which are initiated by contractors. VECP construction savings are included in the annual efficiencies reporting in accordance with Senate Bill 1. The reporting of VECPs does not capture savings that result from innovative changes initiated by Caltrans construction staff that maintain project function and performance.

Starting in March 2021, the Caltrans Division of Construction started tracking Caltrans 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 modification of contract staging, means, methods, or materials; and provide equivalent function and service life at lesser construction cost.

Efficiency savings were calculated based on the number of projects that had approved innovative contract change orders for FY 2021-22. There were six approved innovative change orders for FY 2021-22, representing $895,958 in savings.

Below is the list of the 6 approved innovative change orders, along with a description of the change, the date the change order was approved, and the amount of savings.

No.	District	CCO No.	Sup CCO No.	Innovative Change Order Description	Approval Date	Savings Amount
1	05	003	00	Decreasing the length of soil nail wall and replacing with type 60mc (mod) concrete barrier.	9/20/2021	$30,052.90
2	05	004	00	Adjust inlets using polyester concrete to better seal inlets, increasing durability and seal cracks.	11/8/2021	$3,865.88
3	06	109	00	Use of existing asphalt structural section.	10/1/2021	$78,214.30
4	06	003	00	Replace plan sheet 2 w/ sheet 2 of 2 to incorporate cross slope corrections.	8/12/2021	$681,010.00
5	10	008	00	Eliminate bid item #128, "modify fiber optic cable system." Push and protect this fiber optic cable in place.	9/30/2021	$94,425.00
6	10	09	00	Eliminate items 37, 38, 64, and 69 because design for future fiber optic line changed and steel casing no longer needed.	7/2/2021	$8,390.00
Total						$858,958

Accelerated Bridge Construction

Cost savings or avoidance	**$757,340**
Submitted by	Division of Engineering Services

Accelerated Bridge Construction (ABC) uses the most efficient combination of innovative planning, design, materials, and construction techniques to significantly reduce construction related impacts.

In 2021, a multidisciplinary team was formed to quantify project efficiencies, or cost savings, related to ABC. The team consisted of Caltrans personnel from the North Region and Division of Engineering Services with expertise in construction, environmental, traffic, structures, and accelerated bridge construction. The team evaluated completed ABC projects in the North Region. The direct cost savings calculated for Echo Summit Sidehill Viaduct (Replace) (03-3F5304) and 21st Avenue UC (Replace) (03-0H3424) are presented in this report.

To determine the cost savings, the actual completed ABC scope of each project was compared with a hypothetical conventionally constructed alternative. The conventionally constructed alternative was selected from the alternatives considered during the preliminary design phase. Information was collected from project documents and by conferring with project personnel.

The Echo Summit project used an innovative design to accelerate the construction of the bridge. The accelerated schedule and unique design resulted in a cost savings on some bid items while incurring additional cost for other items. Below is a summary of savings related to both capital and support costs:

Echo Summit Sidehill Viaduct (Replace)

	ABC Construction	Conventional Construction Cost	Savings	Assumptions
Ultra-high performance concrete (UHPC)	$115,900	$0	-$115,900	Ultra-high performance concrete (UHPC) would not have been used for a conventionally constructed alternative.
Mock-up for UHPC	$50,000	$0	-$50,000	A UHPC mock-up would not have been needed for a conventionally constructed bridge.
Furnishing Precast Prestressed Concrete Box Girders	$805,000	$460,000	-$345,000	Conventional alternative assumes 4 bulb tee girders priced at $115,000 each.
Erecting Precast Prestressed Concrete Box Girders	$105,000	$126,000	$21,000	The conventional alternative assumes construction completed in stages. Assume additional 20% for extra mobilization costs as well as bracing/support costs.
Structural polymer fiber concrete for bridge deck	$0	$180,000	$180,000	Assume a non-ABC alternative would have 5" cast-in-place concrete bridge deck priced at $1,800/CY.
Progress Schedule (Critical Path Method)	$5,000	$6,000	$1,000	A longer duration project would have more monthly updates to the CPM schedule.
Time-related overhead	$700,000	$875,000	$175,000	The bid item for TRO compensates the Contractor for overhead expenses. The contract was advertised with 200 working days. It is assumed that the conventional alternative would have taken 245 to 268 days to complete. Add 50 working days to this item for the conventional alternative.
Traffic Control System	$905,000	$1,086,000	$181,000	Assume 20% increase based on the additional number of working days.
Construction support costs			$640,000	Based on resource estimating norms, an additional 4.2 PYs would have been resourced for the non-ABC alternative.
Total Savings			$687,100	

The 21st Ave UC superstructure was replaced in one 104-hour closure of Route 99. To determine the ABC-related cost savings, the completed project was compared against the preliminary design which assumed the work would be done during three separate 55-hour closure windows.

21st Avenue UC (Replace)

	ABC Construction	Staged Construction Alternative	Savings	Assumptions
Light rail service during closure	$10,000	$16,500	$6,500	Sacramento Regional Transit provided light rail service for free of charge during the full closure. This cost the state a lump sum of $10,000. Assume three consecutive 55-hour weekend closures would cost $16,500.
Temporary K-rail	$3,200	$3,840	$640	Shifting lanes and temporary traffic staging would increase the cost of this item. Assume a 20% increase.
Erecting Precast Prestressed Concrete Box Girders	$133,000	$146,300	$13,300	Assume a 10% increase to the cost for this item had the project been staged with multiple mobilizations of equipment.
Ultra-high performance concrete mixer	$1,800	$5,400	$3,600	Assume the mixer would have been required for three weeks in the staged alternative vs. one week in the ABC alternative.
Ultra-high performance concrete technical representative	$9,600	$28,800	$19,200	The UHPC used on this project is a proprietary item and requires an on-site technical representative during construction. Staged construction would increase this cost.
Mobilization	$270,000	$297,000	$27,000	With the full freeway closure, the contractor was able to work more efficiently, minimizing some of the assembly and prep work that would have been required with staged construction under limited lane closures. Assume a 10% cost savings to this item to account for the efficiencies gained from the full closure.
Total Savings			$70,240	

X-Ray Fluorescent Technology

Cost savings or avoidance	**$736,658**
Submitted by	Division of Environmental Analysis

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 SHS 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 multi-year 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. 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 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.

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.

To establish a baseline, Caltrans evaluated 918 boreholes from ADL task orders in FY 2019-20 and calculated the cost to be an average of $1,500 per borehole in District 11.

Traditionally, XRF technology savings have only been captured in District 11. For FY 2021-22, the program was expanded to the North Region (which include Districts 1, 2, and 3). In the North Region, Caltrans evaluated 240 boreholes from ADL task orders and calculated the cost to be an average of $1,000 per borehole. Caltrans is seeking to expand the program statewide to capture more savings in the future.

North Region:

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 14 projects located in the North Region. Caltrans calculated savings by comparing the average borehole consultant cost to the cost of Caltrans personnel using XRF technology on 14 projects in FY 2021-22. 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 during 2021-22. The North Region utilizes the same XRF tool across multiple Caltrans districts to further increase the efficiency outcome.

North Region	Boreholes[1]	Savings
Consultant Borehole Cost avoided for 14 projects	420	$420,000
Initial Cost for XRF tool		($40,342)
Avoidance Savings		$379,658

[1] Using XRF eliminates an estimated 30 boreholes per project and saves $1,000 per borehole

District 11:

Caltrans calculated savings by comparing the average borehole consultant cost to the cost of Caltrans personnel using XRF technology on seven projects in FY 2021-22 Using XRF technology eliminated the need to analyze data from 238 borehole locations during FY 2021-22. The cost of the XRF technology and associated equipment and service plan is $40,342 and the upfront cost has been negated through savings since being implemented in FY 2019-20.

District 11	Boreholes[1]	Savings
Consultant Borehole Cost avoided for 7 projects	238	$357,000
Avoidance Savings		$357,000

[1] Using XRF in lieu of each borehole saves $1,500 per use

The difference in cost savings per borehole differs from the North Region ($1,000 per borehole) and District 11 ($1,500 per borehole) due to local economic conditions and consultant rates.

Combined Savings	
North Region	$379,658
District 11	$357,000
Total	$736,658

Electronic State Historic Preservation Office Electronic Submittal

Cost savings or avoidance	**$391,712**
Submitted by	Division of Environmental Analysis

Caltrans Cultural Studies Office (CSO), Division of Environmental Analysis and the California Office of Historic Preservation (SHPO) 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 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 CSO.

Based on the typical number of project reports and agreement documents that are required to be reviewed by CSO and SHPO on an annual basis (n=144), the FY 2021-22 savings is $115,560 in other direct costs (ODC), 5,184 hours of staff time savings in the amount of $276,152, totaling $391,712.

Based on the typical number of project reports and agreement documents that are required to be reviewed by CSO and OHP on an annual basis (n=144), the following estimates were derived for printing and mailing costs that have been saved because of the electronic signature and submittal system.

Document Type	Number of Documents	Printing Savings	Mailing Savings	Totals
Originals	144	$72,000	$5,040	$77,040
Revisions (avg. of 50% revision rate of Originals)	72	$36,000	$2,520	$38,520
Staff Time				$276,152
Total	216	$108,000	$7,560	$391,712

The 5,184 hours of staff time savings consider the production time for the draft and final technical documents and the time spent preparing draft and final documents for mailing. Work is conducted primarily by Associate Environmental Planners, but also by Entry level Environmental Planners, Senior Environmental Planners, and Supervising Environmental Planners. The cost savings related to 5,184 hours of staff time savings is $276,152, using the conservative average hourly wage for an Associate Environmental Planner of $53.27 per hour.

Advance Mitigation Credits

Cost savings or avoidance	**$260,638**
Submitted by	Division of Environmental Analysis

The Caltrans Advance Mitigation Program was established by the Road Repair and Accountability Act of 2017 authorizing Caltrans to plan and implement advance mitigation solutions for its future

transportation projects. This new 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 potential discounted price and 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 because typically the cost of mitigation credits increases over time. Additionally, by purchasing the credits in bulk, the banks will often negotiate a price reduction which provides an additional cost-savings benefit for advance mitigation purchases.

Three projects in District 3 combined to save $260,638 through the Advance Mitigation Program.

The table below shows credit savings multiplied by credits used to determine capital savings. Support savings is based on 200 hours per project multiplied by the hourly rate of $65.07 which is $13,014 per project. Project 03-0H650 used two different types of credits, therefore the support was split between the two credit types for the same project:

Project	Original Credit Cost	Current Credit Cost	Credit Savings	Credits Used	Total Capital Savings	Support Savings	Combined Savings
03-0H650	$48,128	$90,000	$41,872	.05	$2,094	$6,552	$8,646
03-0H650	$162,747	$200,000	$37,253	1.6	$59,605	$6,552	$66,157
03-0F070	$163,347	$200,000	$36,653	2.8	$102,628	$13.014	$115,642
03-4F380	$163,347	$200,000	$36,653	1.56	$57,179	$13,014	$70,193
Total							$260,638

The processing time and support costs associated with individual projects would require similar hours, costs, and duration. The costs in the table would be saved since the purchase was a bulk credit purchase. These costs are specific to the project functional units working on the deliverables to the Division of Procurement and Contracts (DPAC), this does not include cost expenditures associated with the DPAC unit development and processing of the contracts. Additional potential overhead expenditure cost savings are not quantified.

Electronic Signatures for Construction Contract Approval

Cost savings or avoidance	**$147,495**
Submitted by	Division of Engineering Services

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), has piloted approving construction contracts with Adobe Sign (eSignature). The electronic process went live on November 1, 2021. The realized cost savings for FY 2021-22 is $147,495.

In calculating the efficiency, OE focused on the number of construction contract awards using eSignature and the number of approvals using eSignature separately. Out of the 321 contracts OE processed, 231 contracts were awarded using eSignature, and 75 construction contract approvals utilized eSignature in FY 2021-22. 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 5 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 $115,500 (5 hours x $100 per hour x 231 contracts). The labor savings realized during the approval process are $26,250 for 75 contract approvals (3.5 hours x $100 per hour x 75 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 231 contracts ($1,732.50). Approval savings are calculated at 75 pages per approval x $.05 x 75 approvals ($281.25). Each party receives a copy of the approval ($281.25 x 2 = $562.50). The combined total of awards and approvals $1,732.50 + $562.50 = $2,295.

The approval mailing savings are $3,450 based on overnight mailing costs of approvals at $23 each. Copies of approvals are mailed once for signatures and again after execution, so $23 is counted twice per approval ($23 x 75 x 2 = $3,450).

Labor costs based on $100 per hour	Labor Award (231 contracts x $500)	Labor Approval (75 contracts x $350)	Material Savings (Awards & Approvals)	Approval Mailing Savings	Total Savings
Savings Amount	$115,500	$26,250	$2,295	$3,450	$147,495

Steel Shot Blaster

Cost savings or avoidance	**$52,505**
Submitted by	Division of Equipment

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 DOE 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 alternatives to these processes and materials. The employee identified a vendor who manufactures steel shot blaster cabinets. These cabinets can sand and prepare parts much faster, safer, and uses less materials like sanders and sandpaper. Labor costs are greatly reduced by using the cabinets which increases production.

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 a six-inch air sander to get the metal prepared for painting. This new piece of equipment has 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 50 units of production 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 FY 2016-17, was $271,195 and is accounted for in the table below:

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	$0	$269,750	
Cost of the Steel Shot Blaster Machine	$0	$271,195	
Based on 65 trucks per year	Manual Cost per Year	Steel Shot Blaster Cost per Year	Total Savings per Year
FY 2021-22 Savings	$57,850	$3,900*	$52,505**

*Does not include $1,445 remaining amount to cover initial cost of the Steel Shot Blaster

**Includes additional $1,445 deduction to account for the cost of the Steel Shot Blaster. The $1,445 will not need to be accounted for starting in FY 22-23. Future savings per year will be $53,950 going forward.

Electronic Environmental Document Submittal and Approval

Cost savings or avoidance	**$40,992**
Submitted by	Division of Environmental Analysis

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.

Additionally, EMO has integrated an excel spreadsheet used to track CTC submittals into the Standard Tracking and Exchange Vehicle for Environmental (STEVE) tool. The STEVE is a statewide project tracking tool used by environmental personnel. Information in the tool, such as CTC resolution numbers, is now available to districts after each CTC meeting. Prior to this tool, districts called or emailed DEA for this information, while the excel spreadsheet itself contained fields already available in STEVE that had to be manually filled in, like 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 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 adjusting them to fit CTC requirements and ensuring they were compliant. Districts are now able to prepare the maps themselves using a short, step-by-step process, and make them fully compliant prior to submittal.

Average number of submittals based on meetings from January to December 2020: 13 (12.9 rounded up; 11 Initial Studies (IS), 2 Environmental Impact Reports (EIR)). Number of CTC meetings per year: 8.

Printing Costs with Labor

- IS Printing/Production (1 day) with Labor: $200 x 11 x 8 = **$17,600**
- EIR Printing/Production (1 day) with Labor: $350 x 2 x 8 = **$5,600**

Processing

- Processing hardcopy submittals Districts (staff level and management): 25 hours
  - Average Associate/Senior EP Salary: $7,646/$44 per hour
  - 25 hours x $44 = $1,100
  - 8 meetings x $1,100 = **$8,800**
- Processing digital: 4 hours
  - Average Associate/Senior EP Salary: $7,646/$44 per hour
  - 4 hours x $44 = $176
  - 8 meetings x $176 = **$1,408**

Mailing

- Average IS printing cost $200-(no tech studies included)
  - Average Associate/Senior EP Salary: $7,646/22 = $348; $348/8 = $44
- Average EIR cost $350 (no tech studies included)
- Mailing: $100 for overnight
  - $100 x 13 (every document mailed) x 8 = **$10,400**

	Old Process	New Process	Savings
EIR/IS Printing Cost with Labor	$23,200	0	$23,200
Processing	$8,800	$1,408	$7,392
Mailing	$10,400	0	$10,400
Total	$40,680	0	$40,992

National Environmental Policy Act Process Improvement

Cost savings or avoidance	**$39,699**
Submitted by	Division of Environmental Analysis

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 Checklist was originally mandated after the FHWA audit in initial year of the NEPA Assignment Program (then a pilot program). Caltrans has been successfully delivering projects under the NEPA Assignment Program for over 12 years. After reviewing its processes against 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 just 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 Categorical Exclusion Checklists. Eliminating the requirement to complete the Categorical Exclusion Checklist 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. Total savings for fiscal year 2021-22 are conservatively estimated at $39,699.

Type of Time Savings	Avg Hourly Wage	Hours Saved	Number of Categorical Exclusions FY 2021-22	Total Savings
Preparation	39.87	0.75	576	$17,224
Supervisor Review	47.01	0.33	576	$ 8,936
Monitoring Review	47.01	0.5	576	$13,539
Total				$39,699

Safety and Management Services Process Improvement

Cost savings or avoidance	**$34,464**
Submitted by	Division of Safety and Management Services

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 improvement produced a 10 percent savings in staff time and resources to carry out its duties. Documents drafted by SSMI Specialists, mid pay range is $7,178 per month.

» Drafting documents takes up about 50 percent of the SSMI Specialists 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 8 SSMI Specialists, $359 x 8 = $2,872 in labor dollars saved per month.

» $2,872 x 12 months = $34,464 annual efficiency savings

Cost Estimates Toolbar

Cost savings or avoidance	**$12,000**
Submitted by	Division of Engineering Services

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 approximately 10 years ago. These practices were responsible for providing structure cost estimates in ranges with associated confidence levels. The branch chose to use the Oracle Crystal Ball software, which is the leading spreadsheet-based application for predictive modeling, forecasting, simulation, and optimization. It gives 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, Division of Engineering Services staff developed an in-house software to replace the Oracle Crystal Ball software, hence saving Caltrans $12,000 per year in software maintenance fees and future purchases of new licenses.

Driver Certification Process Improvement

Cost savings or avoidance	**$3,648**
Submitted by	Division of Safety and Management Services

The Division of Safety and Management Services manages the 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 reduction in time saved is $3,648 in FY 2021-22.

Previous Five-Day Process Amount	New One Day Process Amount	FY 2021-22 Amount Saved per New Process	FY 2021-22 Three Process Tasks ($1,216 x 3) = Total Amount Saved
$1,520	$304	$1,216	$3,648

FY 2021-22 EFFICIENCIES: TYPE TWO

Type Two Efficiencies	Number of Efficiencies	Cost Savings or Avoidance
New	2	$357,822
Ongoing	10	$189,769,759
Total	12	$190,127,581

Value Analysis (Federally Mandated)

Cost savings or avoidance	**$54,498,100**
Submitted by	Division of Design

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 life-cycle 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 analyses tools to improve the value of a project. VA methodology is optimized through 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.

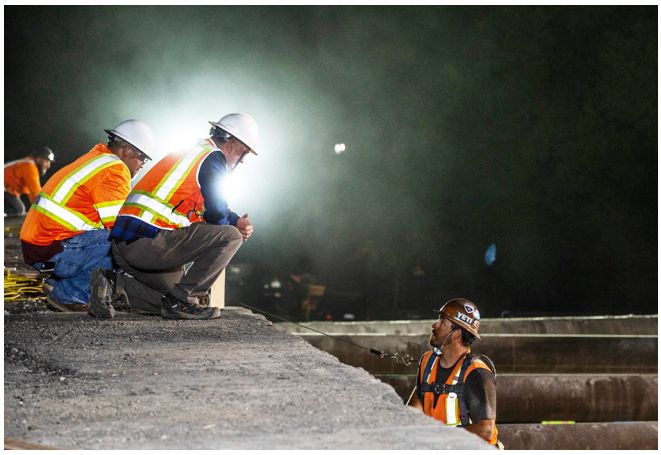
Once the study is completed, a final report documents the process, results, decisions made, and implementation plans for moving the project forward. Recommendations, in most cases, reduce project cost but in some cases, the result is an increase to the overall cost of the project but improved overall 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.

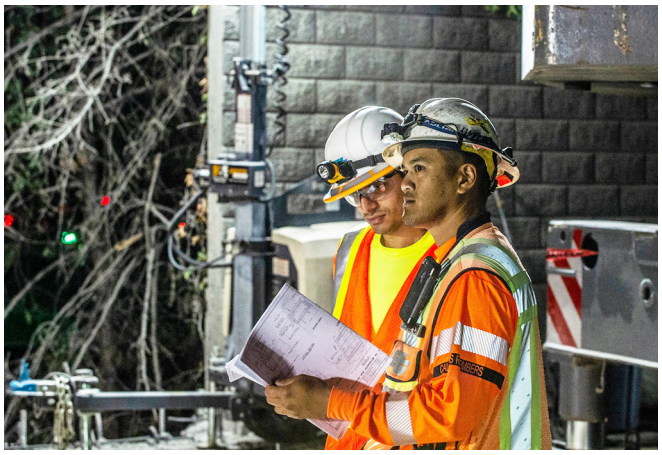
Caltrans identified 13 projects that were awarded in FY 2021-22. Nine out of the 13 projects achieved savings and the other four projects did not achieve savings but improved performances. For accountability and transparency purposes, we are including all thirteen projects in our calculation of savings. 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 the fiscal year. Net savings for the thirteen projects is $88.2 million, with $33.7 million in Type One savings counting towards the SB 1 goal (reported in the Type One section previously in this report), and $54.4 million counted as Type Two savings.

No.	Project Description	Total Project Cost	VA Savings	Associated Cost	Type 1 Project Savings (Non-Federal Mandated VA)	Type 2 Project Savings (Federal Mandated VA)
1	PLA/NEV 80 Replace and Rehabilitate Bridges at four locations Improvement: Bridge Replacement and Rehabilitation	$26,091,000	$8,500	$52,300	$(43,800)	
2	BUT-70: Widen for two-way-left turn lane, passing lanes and standard shoulders.	$46,050,000	$377,000	$73,900	$303,100	
3	YUB-70: Safety Project: Widen shoulders and improve clear recovery zone.	$109,982,000	$4,335,700	$46,000		$4,289,700
4	Solano County I-80 Express Lanes	$35,824,000	$(5,159,000)	$69,900	$(5,228,900)	
5	Paint I-80 Bayshore & US 101 Central Viaducts	$46,445,103	$10,345,000	$117,400	$10,227,600	
6	SR 17 CAPM - Hebard Road to SR 17/I-280/I-880 Junction	$41,043,031	$(633,000)	$62,000	$(695,000)	
7	South Coast 101 Rehabilitation Improvement: Construct HOV lane	$78,402,000	$9,357,000	$99,100		$9,257,900
8	SR 99 Tulare to Goshen Six Lane Improvement: Add two lanes	$74,466,000	$9,100,000	$66,300		$9,033,700
9	TUL-245 - Woodlake Bridge Replacement	$17,300,000	$4,601,000	$81,000	$4,520,000	
10	SR 71 HOV Conversion	$85,920,262	$1,691,000	$110,000		$1,581,000
11	Trancas Bridge Replacement	$51,748,000	$27,021,300	$66,300	$26,955,000	
12	SBD-15 Roadway Rehab existing mainline & ramp pavement	$121,672,000	$30,443,000	$107,200		$30,335,800
13	John Erreca SRRA Rehab	$30,973,000	$(2,227,000)	$96,700	$(2,323,700)	
	Total	$765,916,396	$ 89,260,500	$1,048,100	$33,714,000	$54,498,100

Construction Manager/General Contractor

Cost savings or avoidance	**$47,300,000**
Submitted by	Division of Design





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 the 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 which 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 which 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 2021-22 achieving savings of $47.3 million. Savings are considered a cost avoidance resulting in a reduction in construction capital.

Project Name	Work Description	Capital Cost	Project Savings
Ven-1 Slope Restoration Innovations: Change from cantilever secant wall design with steel beam and reinforcement cages to secant pile with steel beam and ground anchors to improve the method of construction and decrease the number of potential contract changes due to driving pile conditions. Implement boring program to further understand the geotechnical profile and provide opportunity to reduce pile shaft lengths. Develop maintenance of traffic strategy to avoid summer shutdown. Reconfigure staging operations to reduce frequency of hauling beams. Redesign of secant wall section on eroded slope to avoid delays during construction.	This project will construct two secant pile retaining walls and provide permanent restoration of damaged slope along Route 1 between postmile 4.0 and 4.2.	$42.5 M	$27.2 M
San Dieguito Lagoon Restoration Project Innovations: Use of existing site soils and augmenting instead of importing topsoil. Improve irrigation design to reduce damage to new habitat.	This project will create and maintain wetland and other native habitats within a specific portion of the San Dieguito Lagoon system.	$66.1 M	$13.6 M
North Coast Corridor-Segment 4 Innovations: Optimize jointed plain concrete pavement by replacing stainless steel with epoxy coded rebar and using an onsite batch plant. Use of geogrid to reduce pavement structural section thickness. Reduced roadway export by using excess material in other corridor segments. Eliminated off-site disposal of aerially deposited lead material by keeping material in the corridor.	This project is a 27-mile long project that proposes improvements to I-5 coastal rail and transit enhancements, environmental protection and costal access improvements. Segment 4 will construct a high occupancy vehicle lane in each direction from Palomar Airport Road to State Route 78.	$61.8 M	$6.5 M
Total		$170.4 M	$47.3 M

Municipal Coordination Grant Program

Cost savings or avoidance	**$30,756,697**
Submitted by	Division of Environmental Analysis

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. Caltrans secures NPDES Permit compliance credits by constructing stormwater treatment devices in water quality impaired Total Maximum Daily Load (TMDL) areas.

In addition to removing stormwater pollutants in TMDL impaired areas, the NPDES Permit, as amended in 2017, requires trash removal from all significant trash generating areas (STGAs) within Caltrans ROW through construction of roadside trash capture devices by 2030. Annually, Caltrans is required to treat 1,650 compliance units (CUs) from their right-of-way (ROW) in impaired watersheds through implementation of treatment devices. For each acre that is treated Caltrans receives one CU. The Caltrans NPDES Permit encourages Caltrans to partner with local municipalities and to provide funding for regional water quality treatment facilities in impaired watersheds in which Caltrans is a listed stakeholder.

The average unit cost to construct a traditional on-system treatment device is $176,000 / treatment acre. The SWRCB acknowledges a 50% discount by granting compliance units at a rate of 1 CU for every $88,000 of funding contribution toward municipal partnership projects. The net cost avoidance is realized when Caltrans receives CUs from the SWRCB for the off-system projects funded through submission of Annual Total Maximum Daily Load Status Reports.

In FY 2020-21*, Caltrans received a total of 337.1 CUs from reimbursement of funding commitments toward the success of municipal partnership projects. There are 33 CUs from the trash provision amendment to the statewide stormwater permit which was signed in November 2017. The separate trash control implementation projects are counted as a Type One efficiency earlier in this report. The remaining projects and CUs are listed below as a Type Two efficiency as these project were part of the Municipal Coordination Program that was implemented prior to SB 1 in 2017, but still count towards the overall efficiencies total.

Caltrans does not have to construct on-system treatment devices to address 304.1 acres of ROW where municipal coordination compliance unit credits have been granted, resulting in $30,756,697 in cost avoidance for FY 2020-21.

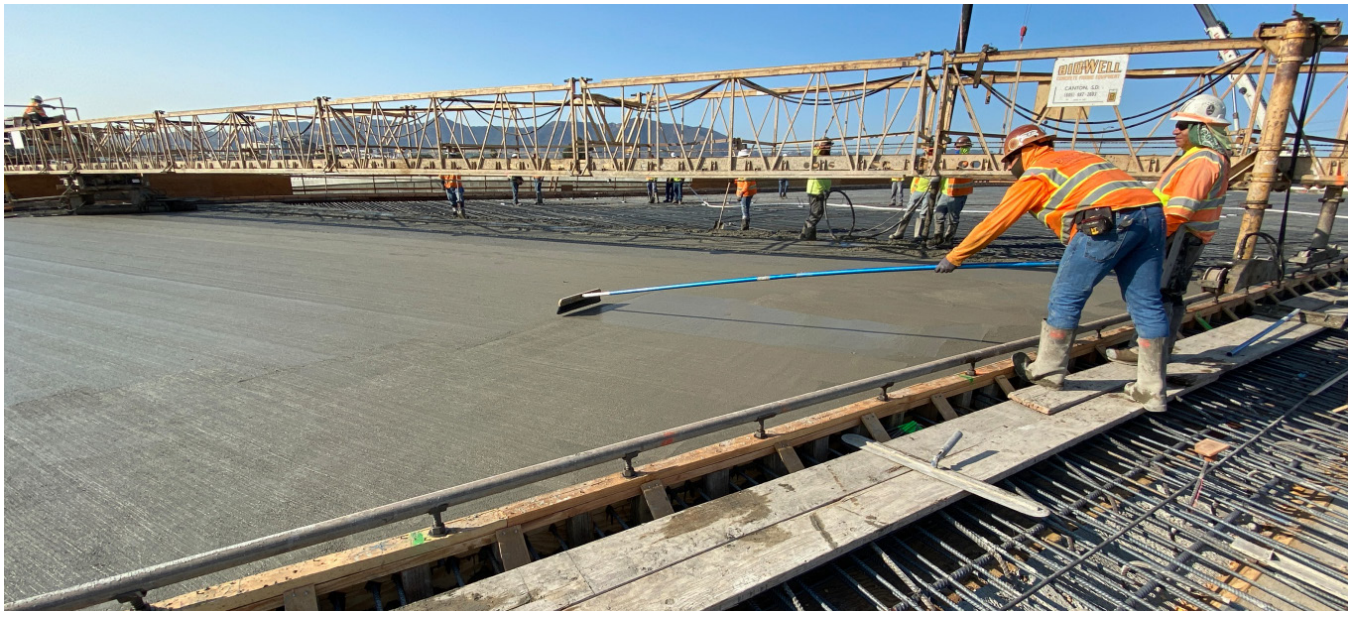
*Most efficiencies in this report account for savings occurring in fiscal year 2021-22. However, specific to this efficiency, credit for the savings occurs when the CUs are approved by the SWRCB, which occurs the following fiscal year. Therefore, the reported savings in this report are for fiscal year 2020-21 and were certified on June 20, 2022. This is consistent with the calculation, methodology, and reporting in previous efficiencies reports.

Permittee	Project Description	Total Invoice Amount for Fiscal Year 2020-2021	CUs
City of Long beach	Long Beach Municipal Urban Stormwater Treatment (MUST) Project	$4,871,585	
City of Bellflower	Bellflower Water Capture Facility Project (Caruthers Park)	$3,117,071	
City of Lakewood	Mayfair Park Water Capture Facility Project	$4,477,247	
Los Angeles County Department of Public Works	Adventure Park	$6,299,000	
Total		$18,764,903	213.2
*Los Peñasquitos Lagoon Foundation	Los Peñasquitos Lagoon Restoration Project	$4,000,000	90.9
	Municipal Coord Projects Grand Total	$22,764,903	$3,04.1
	Caltrans On-System Cost to Deliver 304.1 CUs @ $176,000/acre	$53,521,600	
	Cost Avoidance	$30,756,697	

*Stormwater Grant Program Funded $4,00,000 to Los Penasquitos Lagoon project (awarded 45.45 CUs) and the Twenty Beaches and Creeks project (awarded 45.45 CUs) resulting in 90.9 CUs.

Partnering

Cost savings or avoidance	**$23,418,496**
Submitted by	Division of Construction



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 turn the situation around 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 traditionally adversarial relationships into team-based relationships. Partnering promotes open communication, trust, understanding, and teamwork among participants. Including partnering on construction contracts leads to less disputes on contracts and better cost and schedule certainty.

Professionally facilitated project partnering is mandatory on all projects with a total bid greater than $10 million and 100 or more working days. Although optional, it is encouraged on all projects with a total bid greater than $1 million and up to $10 million. The Resident Engineer is required to extend a formal invitation to the contractor to partner on all projects with a total bid greater than $1 million. Application of partnering concepts on projects with a total bid of $1 million or less is also encouraged, even if a professional facilitator is not used.

Savings from the projects receiving a Caltrans Excellence in Partnering Award in FY 2021-22 is $23.4 million.

Streamlined Environmental Review – National Environmental Policy Act

Cost savings or avoidance	**$14,901,579**
Submitted by	Division of Environmental Analysis

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. Caltrans has established internal teams that are working on various strategies to further streamline NEPA Assignment. These strategies will be implemented in future fiscal years.

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 fiscal year 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 fiscal year 2021-22 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 218 environmental approvals completed utilizing NEPA Assignment, achieving $14.9 million in savings. An escalation rate of 3.2 percent was also used in the calculation.

Highway Rehabilitation, Reconstruction and Replacement Projects	No. of Projects	Savings	Associated Costs	Total Savings
Categorical Exclusions-1 Month	212	$9,246,819		
Environmental Assessments-15.3 Months	6	$6,265,289		
Legal Expenses			($100,328)	
Program Staff Support			($297,454)	
Consultant Costs			($212,747)	
Total Savings	218	$15,512,108	($610,529)	$14,901,579

Reclaimed Asphalt Pavement

Cost savings or avoidance	**$9,669,670**
Submitted by	Division of Maintenance

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 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. Starting in 2017, the allowable RAP aggregate in HMA has 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.

RAP is old pavement that is removed and processed for reuse. 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 practice, past studies, and correlations with available data to calculate savings.

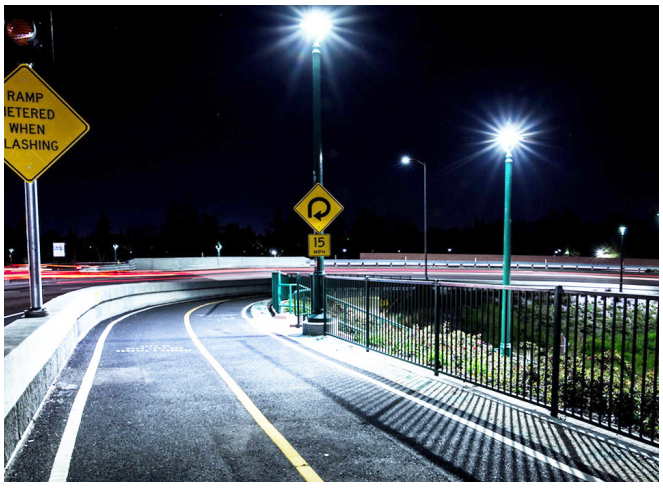
Efficiency savings for the use of RAP in Caltrans paving projects for FY 2021-22 is $9,669,670.

RAP Efficiency Savings Summary	
Total Amount of Type A HMA in tons	$2,306,834
Total Amount of Type A HMA with RAP in tons (75% of Line 1)	$1,730,125
Total Amount of RAP in tons (15% of Line 2)	$259,519
Savings in using 1 ton of RAP instead of 1 ton of virgin mix ($/ton)	$37.26
Cost Savings (Line 3 multiplied by Line 4)	$9,669,670

Highway Lighting Light Emitting Diode (LED) Retrofit

Cost savings or avoidance **$7,519,337**

Submitted by Division of Maintenance



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 to no maintenance, compared to HPS lighting which require replacement every four years. LED lights are also far more energy-efficient, reducing energy usage by 50 to 60 percent. 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. The production of electricity is a major contributor to greenhouse gas emissions, therefore, lowering energy usage also results in a positive impact to the environment.

In calculating savings, Caltrans subtracted the cost of replacing lighting using the traditional method as compared with LED lighting.

	Savings
Energy Cost	$6,323,184
Labor Cost	$1,434,120
Vehicle Expense	$188,700
Higher fixture cost of LEDs vs. HPS	-$426,667
Total Savings	**$7,519,337**

Partial Depth Recycling

Cost savings or avoidance	**$1,224,380**
Submitted by	Division of Maintenance

Caltrans employs a variety of strategies and materials in maintaining and rehabilitating pavement throughout the SHS. Partial Depth Recycling (PDR) is a strategy for pavement maintenance and rehabilitation. The process consists of grinding the existing pavement, processing material, mixing with stabilizing agents, spreading PDR mixture, and compacting in-place using a continuous train operation. The entire recycling operation is performed without heat. A thin hot mix asphalt overlay is then constructed on top of the recycled layer as a new wearing course.

In addition to PDR, Caltrans allows the use of several other in-place recycling strategies for pavement rehabilitation and maintenance such as Full Depth Recycling and Cold Central Plant Recycling. The use of PDR, instead of "Mill and Fill" with 20 percent digouts, saved Caltrans $1.2 million in FY 2021-22. A mill and fill is a pavement treatment that removes the existing surface layer and replaces it with a new asphalt layer. Additional benefits include diversion of material solid waste from landfills, reduced greenhouse gas emissions, faster construction schedules, and less closure impacts to the traveling public.

The efficiency savings calculation compares the bid item cost for PDR versus the cost of a mill and fill with 20 percent digouts. PDR was used in five projects in FY 2021-22. The Pavement Program reviewed PDR data for five projects with awarded bid dates in FY 2021-22 and found the following:

Project Location and Description	PDR + Capping Layer Total Cost	Mill and Fill + Digouts Cost	Cost Savings
District 8 – In Riverside and San Bernardino County, State Route 62 and 177	$3,944,515	$3,649,330	-$295,185
District 5 - In San Luis Obispo County, State Route 166	$2,141,304	$2,142,756	$1,452
District 3 - In Colusa and Yolo County, State Route 16	$2,468,898	$2,879,864	$410,966
District 11 – In Imperial County, State Route 78	$3,943,379	$4,599,783	$656,403
District 2 – In Lassen County, State Route 139	$1,898,211	$2,348,954	$450,744
Total Savings			$1,224,380

SMART Water Controllers

Cost savings or avoidance	**$458,000**
Submitted by	Division of Maintenance

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 2015-2021, Caltrans has met and achieved this goal by saving 33.4 billion gallons of water and nearly $29 million dollars.

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 such as broken heads, and power outages. In severe cases, such as 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.

Since 2015, Caltrans has saved an accumulated total of over 28.9 million dollars (vs. 2013). In calendar year 2021, the savings was $458,394.

Managerial Selection Program Process Improvements

Cost savings or avoidance	**$279,070**
Submitted by	Division of Human Resources

On September 17, 2001, California Code of Regulations, Title 2, Section 549.90 (2 CCR § 549.90) established the Caltrans Managerial Selection Program (MSP). This regulation requires Caltrans to administer examinations on a position-specific basis, which allows for greater flexibility in the hiring process since previously 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's submitted responses to the vacancy advertisement. Once the candidate's SOQ scores were ranked, those applicants who met or exceeded 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 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 was identified. In FY 2018-19, the Education & Experience (E&E) examination format was piloted for 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 a tremendous cost savings to Caltrans by reducing labor and travel costs. Total savings for Caltrans in FY 2021-22 is $279,070, and over $1 million since FY 2018-19.

FY 2021/2022	
Savings Per MSP Exam	Savings for All FY MSP Exams
$70.48	$8,140.06
$300.00	$17,325.00
$493.31	$56,977.52
$1,702.40	$196,627.20
Total	$279,069.78

Fiscal Year (FY) Cost Savings for MSP Examination Format Conversion

Division of Procurement and Contracts Electronic Contract Files

Cost savings or avoidance	**$78,752**
Submitted by	Division of Procurement and Contracts

The Division of Procurement and Contracts (DPAC) is responsible for the acquisition of goods and services to support Caltrans programs and districts and meet business and performance objectives. 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.

Year*	Expenditures	Savings
FY 2019-20	$43,534	$0
FY 2020-21	$8,316	$35,218
FY 2021-22	$0	$43,354
Total 20-21 & 21-22		$78,572

*Both fiscal years 2020-21 and 2021-22 are included as the 2020-21 savings occurred during the second half of the fiscal year, and to ensure the new expenditures baseline was accurate and permanent.

Electronic Plans & Quantities Submittal Process

Cost savings or avoidance	**$23,500**
Submitted by	Division of Engineering Services

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 2021-22 savings is $23,500.

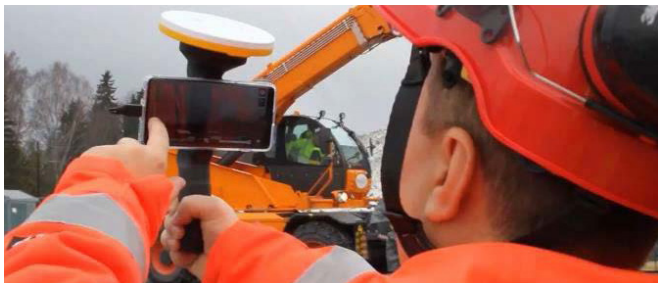
	Hard Copy Processing	Electronic Processing	Savings
Labor Cost	$22,500	$0	$0
Material Cost	$1,000	$0	$35,218
Total	$23,500	$0	$23,500

FY 2021-22 EFFICIENCIES: TYPE THREE

Type Three efficiencies can be difficult to tie directly to a cost savings or avoidance that gets invested back in the SHS and may be more qualitative in nature.

Type three Efficiencies	Number of Efficiencies	Cost Savings or Avoidance
New	8	These efficiencies may be legacy practices, difficult to quantify, or represent savings outside of reinvestment in the state highway system.
Ongoing	3	
Total	11	

Trimble SiteVision



This solution utilizes augmented reality to visualize a new roadway, structure, utility or feature in the actual dimensional space upon which it will be built. One can visualize and measure position using Global navigation satellite system (GNSS), Electronic Distance measurement and augmented reality technology as one explores the project site. The previous method would have been to install survey stakes to see the alignment and use 2D plans to try to visualize what the new roadway or structure would look like.

State Route 118 Wildlife Passage Modifications Project

The Caltrans District 7 Wildlife Connectivity Team constructed wildlife passage modifications on State Route 118 at five locations within unincorporated Ventura County. Modifications included fencing installation to funnel wildlife to safe passages, and construction of rip-rap, concrete, and steel ramps, to improve wildlife connectivity within the region. Improvements at the underpasses will likely reduce the number of Wildlife-Vehicle Collisions that occur along State Route 118, increasing safety for animals and motorists, while reducing costs for drivers through collision avoidance.

Caltrans Virtual Reality: Interactive Projects Simulations

In an interactive web-based interface, stakeholders can explore an existing corridor in 360 degrees. They can turn on simulations illustrating such impacts as sea-level rise and see the inundation of the existing roadway. Stakeholders can fly through design alternatives with video simulations that clearly illustrate the design proposal. See a simulation here: https://youtu.be/6NAY77gkWi4

District 4 Hazardous Materials Data Viewer

The implementation of the District 4 Hazardous Materials Data Viewer ensures the Office of Environmental Engineering's information assets are stored in one digital database that is accessible to all environmental staff to conduct initial site assessments and service public records requests.

Approval of Low-Carbon Cement

In January 2022, Caltrans announced approval for the use of low-carbon cement to help reduce the carbon footprint of California's transportation system. By advancing the use of portland limestone cement, Caltrans' road construction and maintenance projects can generate less carbon dioxide with the same high performance standards at a slightly lower cost. This change has the potential to reduce carbon dioxide emissions by 28,000 tons a year — the equivalent of removing more than 6,000 cars off the road.

Remote Control Construction Equipment

Implemented remote controlled equipment such as excavators, dump trucks, and loaders used within a slide zone when conditions prohibit crew operations, increases safety and allows work to continue through remote controlled equipment.

Caltrans QuickMap Enhancements

Caltrans has launched a new push notification feature on its QuickMap app that allows drivers to automatically receive real-time notifications about nearby road closures, emergencies and other traffic updates. QuickMap also has a border wait time feature which allows drivers and freight carriers to make better informed travel decisions. These features may reduce greenhouse gas emissions based on less idling in stopped traffic and help the flow of traffic and goods to continue.

AASHTOWare Project

The Division of Engineering Services replaced the 40-year-old Basic Engineering Estimating System used to create the engineer's estimate for highway construction contracts, and the system used in the creation of highway contract bid packages, with AASHTOWare Project (AWP). AWP is a software as a service that pools knowledge and resources with other American Association of State Highway and Transportation Officials (AASHTO) members. Caltrans has realized cost savings and received a quality software that matches its precise needs.

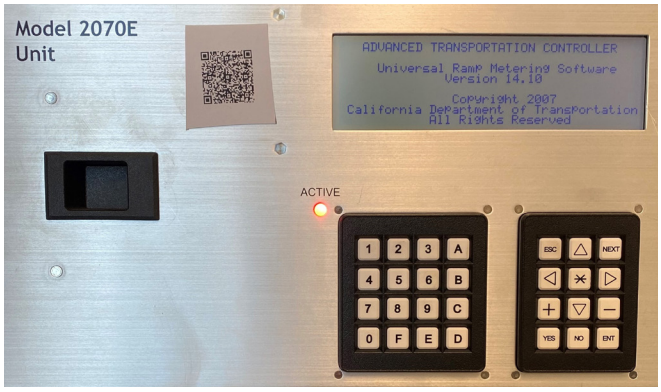
Conference Line Conversion to Online Meeting Platforms

Caltrans saved time and money by discontinuing unnecessary conference lines and converting to online meetings via Cisco Webex and Microsoft Teams. Staff time savings include scheduling meetings and finding appropriate meeting conference room space, and cost savings are associated with reduced phone line usage.

Contract Administration and Tracking System Upgrade

For more than two decades, the Division of Procurement and Contracts (DPAC) used the legacy Contract Administration and Tracking System (CATS) to administer contracts for Caltrans. Legacy CATS was used to capture and track contract data from contract creation to execution for records retention and reporting purposes. On January 25, 2021, DPAC implemented the new CATS II system. Prior to implementation of CATS II, DPAC staff spent an average of 38 hours per month pulling data and compiling reports from legacy CATS. Since CATS II was implemented, DPAC staff now spends approximately 12.7 hours per month pulling and compiling reports.

Digital Cabinet Documents Using QR Codes



Caltrans has historically needed 12-14 pages of documents that contain controller programming in each ramp metering and traffic monitoring station cabinet. Every time there was a change to the controller, new documents needed to be printed and driven out to the station to be put in the cabinet. District 12 is now putting a QR Code on the controller that can be accessed with a mobile phone over the Caltrans VPN to make cabinet documents available digitally in the field. This small change saves on printing and paper costs and assures that the latest information is always available to the engineer in the field. There are also safety and GHG benefits achieved by not having to drive in the field.


Caltrans