Memorandum

To: CHAIR AND COMMISSIONERS **CTC Meeting**: January 27-28, 2021

From: MITCH WEISS, Executive Director

Reference Number: 4.6, Information

Prepared By: Tim Sobelman
Chief Engineer

Published Date: January 22, 2021

Subject: Caltrans Efficiency Report

Summary:

As required by Streets and Highways Code section 2032.5(d), the California Department of Transportation (Caltrans) has prepared its Senate Bill 1 (SB 1) Annual Efficiencies Report for fiscal year 2019-20. Caltrans is reporting $195 million in new and recurring efficiencies for fiscal year 2019-20. Commission staff found several instances where Caltrans excelled in the development and implementation of efficiencies; however, Commission staff also note areas where additional information or clarity can be provided in support of the Caltrans identified efficiencies. Attachment A contains Commission staff's analysis of the report. Commission staff will work with Caltrans attempt to reach agreement on assumptions and methodologies before the 2020-21 Efficiencies Report is completed.

Background:

The Road Repair and Accountability Act (Senate Bill 1, Beall, 2017) added Streets and Highways Code section 2032.5(d), requiring Caltrans to implement efficiency measures with the goal to generate at least $100 million per year in savings to invest in maintenance and rehabilitation of the state highway system. It also requires Caltrans to report these savings to the Commission.

The SHOPP Guidelines require these savings be reported to the Commission annually by November 1st of each year. Caltrans did not submit the 2019-20 Efficiencies Report by the required deadline. Commission staff received the 2019-20 Efficiencies Report on December 1, 2020.

Statute does not require Commission approval of the Efficiencies Report; however, a staff analysis of the report is included in Attachment A.

In addition, the Inspector General released the Senate Bill 1 2018-19 Efficiencies Audit Report on January 11, 2021. The audit determined that Caltrans was able to support $90.7 million of the $94.4 million in reported savings which is a cost avoidance that would be available for reinvestment in the maintenance and rehabilitation of the state highway system. In addition, the Inspector General recommends five areas be addressed in future Efficiencies Reports. The full report is included as Attachment B.

- For transparency purposes, Caltrans should report significant methodology changes to efficiencies reported in previous fiscal years.
- Maintain a complete and accurate list of projects used to calculate savings, as recommended in the Inspector General's previous audit.
- Clearly document and report in the Annual Efficiencies Report the specific "efficiency measures" implemented and if reported as an "Innovative Tool" explain how the efficiency is innovative in nature.
- Continue to evaluate and adopt best practices and parameters used by other organizations for reporting efficiency savings and documenting validation efforts. The adopted best practices and parameters should specifically include process improvements or innovations, and the number of years an efficiency can be reported.
- Efficiency savings for striping contracts should be calculated using 2017-18 winning bid prices (since innovative strategies were implemented after 2017-18) as a baseline to compare to current fiscal year winning bid prices as recommended in the Inspector General's previous audit of Value Analysis efficiencies.

Attachments:

- Attachment A: CTC Staff Analysis of Caltrans' SB 1 Annual Efficiencies Report 2019-20
- Attachment B: Inspector General FY 2018-19 Efficiencies Final Audit Report

California Transportation Commission
Analysis of Caltrans' SB 1 Annual Efficiencies Report 2019-20

NEW EFFICIENCIES

1. **Stormwater Permit Credits for Open Graded Friction Course**
   Cost Avoidance = $85.7 M
   As a result of a multi-year statewide field study, the State Water Resources Control Board and Regional Water Quality Control Boards agreed to accept Open Graded Friction Course pavement as a stormwater treatment device in certain watershed areas. As such, Caltrans was able to claim 530 acres of stormwater treatment credits using Open Graded Friction Course pavement that had already been constructed to address other pavement needs. These credits reduce the need to otherwise construct traditional stormwater treatment devices to meet statewide compliance requirements.

   Commission staff has no concerns with this efficiency based on the information provided in the efficiencies report.

2. **Project Bundling** **Monetary Savings = $40.2 M**
   Caltrans looked at the efficiency of combining projects that have an overlap of project limits and contain similar scopes of work. The combining of projects occurred during the design phase or at the time of construction allocation. The basis for savings on this reported efficiency is the difference between the award amount of the combined contracts and the amount allocated for construction for those projects.

   Commission staff agrees project bundling can result in efficiencies. However, with bid savings being common on many Caltrans projects, it is unclear what amount of the claimed efficiency savings is solely due to the projects being bundled and what amount is from the normal bidding environment. A more detailed analysis should be included in future efficiency reports.

3. **Pavement Research – Long-Life Pavement** **Cost Avoidance = $37 M**
   Caltrans worked with the University of California Pavement Research Center to utilize a new method of pavement design to develop supplemental specifications for the three types of Long-Life Hot Mix Asphalt Materials This new approach is being applied to the Interstate 5 Capital Corridor Enhancement Project in Sacramento.

Caltrans aims to achieve 60 years of pavement service from a 40-year pavement design. The 20-year difference in pavement life avoids $37 million in capital that would be spent on this portion of Interstate 5 to rehabilitate and maintain.

While Commission staff agrees this Long-Life Pavement strategy should provide efficiency savings over time, much of the savings will be realized in the distant future and over many years. The justification for claiming the full amount of future savings rather than one year of savings is unclear. This should be clarified or corrected in future efficiency reports.

4. Automated Machine Guidance **Cost Avoidance = $5 M**

Auto Machine Guidance is a technology 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. Caltrans' efficiency from Automated Machine Guidance is based on 20 projects completed in 2019-20, from increased productivity and improved accuracies, survey and construction support savings, and accurate electronic records of material volumes.

Commission staff has no concerns with this efficiency based on the information provided in the efficiencies report.

5. X-Ray Fluorescence Technology **Monetary Savings = $2.4 M**

Caltrans conducted a multi-year study to evaluate the use of X-Ray Fluorescence technology as an additional screening tool for areas expected to have low levels of lead. Caltrans submitted the results of the study to the Department of Toxic Substances Control and received approval to use of X-Ray Fluorescence technology for predetermined low risk projects. The basis of the savings is a comparison of using the X-Ray Fluorescence technology to the utilization of consultant task orders to conduct the Aerially Deposited Lead analysis.

Commission staff has no concerns with this efficiency based on the information provided in the efficiencies report.

6. Independent Assurance Program **Monetary Savings = $1.8 M**

The Caltrans Materials Engineering and Testing Services is responsible for managing the Independent Assurance Program statewide which provides guidance for independent quality assurance of testing functions on roadway construction projects. The Independent Assurance Program was consolidated in the Caltrans Headquarters Division of Engineering Services. By housing the division in Caltrans Headquarters, Caltrans was able to reduce the resources necessary to implement the program.

Commission staff has no concerns with this efficiency based on the information provided in the efficiencies report.

7. On-Call Culvert Lining Service Contract **Cost Avoidance = $800 k**

Caltrans developed a pilot on-call culvert cleaning and lining contract in 2019. The on-call contract was used to cover work that would have been done through a highway maintenance project. The efficiencies will be realized through the reduction of the total number of individual culvert lining projects, which will reduce support costs and time savings for completing the Plans, Specifications, and Estimates phase for each project.

Commission staff agrees it should be more efficient to administer a single on-call contract than many individual contracts. More information related to the on-call contract (total value, duration, oversight costs) is needed to effectively evaluate the amount of savings being claimed. This should be clarified in future efficiency reports.

8. Unmanned Aircraft Systems **Cost Avoidance = $682 k**

Caltrans is utilizing Unmanned Aircraft Systems, also known as drones, in various districts to record video and capture imagery to assist in such areas as construction monitoring, biological studies, slope monitoring, and emergency response. Efficiencies claimed were from three major construction contracts and from 31 missions for mapping purposes.

Commission staff has no concerns with this efficiency based on the information provided in the efficiencies report.

9. Project Initiation Proposal Improvements **Cost Avoidance = $663 k**

A Lean 6 Sigma process improvement identified areas in the development of the Project Initiation Proposal (Pre-planning) that typically resulted in increased costs for rework during the Project Initiation Document phase. By making improvements to the Project Initiation Proposal process, staff time needed for rework during the Project Initiation Document phase can be reduced.

Commission staff agrees that process improvements can result in efficiency savings and supports Caltrans efforts to identify those opportunities. However, based on the information provided, it is unclear if the resources to develop and implement the improved Project Initiation Proposal were accounted for in the amount of savings being claimed. This should be clarified in future efficiency reports.

10. Reduction in Local Project Agreements and Processing **Cost Avoidance = $10 k**

The Division of Local Assistance reduced the processing time of Program Supplement Agreements from 76 days to 20 days which allows faster reimbursement to local agencies. The improvements to the Program Supplement Agreements process reduced the time to process the agreements, resulting in savings to operating expenses and improved customer service to local agencies.

Commission staff has no concerns with this efficiency based on the information provided in the efficiencies report.

RECURRING EFFICIENCIES

This is a new section for the Caltrans SB1 Efficiencies Report. This section includes ongoing savings from efficiencies previously implemented or reported in a past Efficiencies Report. Caltrans is counting these savings towards achieving the $100 million annual requirement.

Commission staff will work with Caltrans to determine at what point in time the recurring efficiencies should be considered a standard business practice.

1. **Highway Lighting LED Retrofit** **Monetary Savings = $6.4 M**
   Caltrans has been replacing existing high-pressure sodium fixtures with light emitting diode fixtures on highways statewide. The light emitting diode fixtures are designed to operate for a minimum of 15 years with little to no maintenance, as compared to high-pressure sodium lighting which requires replacement every four years. The monetary savings are calculated through reduced costs for energy, labor, and material, as well as, lower maintenance vehicle usage.

   Commission staff agrees that the LED Retrofit can be an efficiency. However, it is unclear whether the savings is based on the lighting being replaced during the 2019-20 fiscal year or the savings is based on reduced energy, labor and material from prior retrofits. This should be clarified in future efficiency reports. Further, based on the information presented, it is unclear if, rather than an efficiency, this instead represents a longstanding standard business practice.

2. **High Reflective Material for Striping** **Monetary Savings = $5.1 M**
   Caltrans has begun deploying 6-inch wide thermoplastic striping and tape to replace the historically used 4-inch wide painted striping to delineate both edge and lane lines on state highways. Caltrans expects all 50,000 lane miles of the State Highway System will be restriped within a decade. The monetary savings are based on the cost difference in maintaining and replacing older painted striping versus more durable thermoplastic striping. The savings is based on the amount of new striping replaced during the 2019-20 fiscal year.

   Commission staff has no concerns with this recurring efficiency based on the information provided in the efficiencies report.

3. **Value Engineering Change Proposals** **Monetary Savings = $4.2 M**
   Caltrans has encouraged and implemented the Value Engineering Change Proposals process, in which contractors find innovative methods, materials, and technologies to reduce cost and save time. These types of proposals have a formal process whereby the contractor's innovation is proposed in writing to Caltrans and processed in the form of a contract change order. Efficiency savings were calculated based on the number of projects that accepted Value Engineering Change Proposals for 2019-20 fiscal fear.

   Commission staff agrees Value Engineering Change Proposals can result in efficiency savings. However, it is unclear whether support costs related to coordinating and evaluating

proposals or processing the change orders were included in the calculation for determining the claimed savings. This should be clarified in future efficiency reports.

4. Mobile Field Devices **Monetary Savings = $2.6 M**

As part of an ongoing effort to improve the project delivery process, Caltrans deployed 1300 iPads to construction staff as a device to help administer construction projects remotely. The iPads enable construction staff to gain access of electronic documents and administer construction contract information directly from the job site, as opposed to traveling to-and-from the site to their field offices. Monetary savings were based on office-to-site travel mileage savings per year, less the cost of the devices.

Commission staff agrees the Mobile Field Devices can result in efficiency savings. However, additional detail is necessary to evaluate the amount of savings claimed. For example, were the 1,300 iPads newly purchased in 2019-20 Fiscal Year? This should be clarified in future efficiency reports.

5. Global Positioning Satellites in Fleet **Monetary Savings = $1.9M**

Caltrans has implemented global positioning satellite devices in its fleet for the purposes of automated vehicle usage reporting. These devices have effectively eliminated the need for manual reporting of vehicle usage, while providing more accurate data collection, such as frequency of smog checks. The devices now send engine diagnostic information that is accepted in lieu of the costly inspections. Cost savings were based on elimination of manual reporting and of biennial physical smog inspections.

Based on the information provided, this appears to be a standard business practice and as such should not claimed as a future efficiency.

6. High Performance Reflective Signs **Monetary Savings = $226 K**

Caltrans is now implementing high-performance reflective materials that are more visible at night and do not require the attached lighting fixtures associated with the existing reflective sign sheeting for overhead and roadside signs. Caltrans anticipates that it may take up to a decade to fully replace the approximately 20,000 overhead signs with the new high-performance reflective signs. Savings are based on reduced costs for energy, labor, maintenance, materials, and equipment, while taking into consideration the cost of the high-performance sign material.

Commission staff agrees High Performance Reflective Signs can result in efficiency savings. However, it is unclear if the labor costs associated with replacing the old signs and installing the new signs was accounted for in the savings claimed. This should be clarified in future efficiency reports.

7. Advance Mitigation Credits **Monetary Savings = $52K**

Advance mitigation credit purchases can save money by bundling the credits into one larger purchase for a potential discounted price and purchasing credits early before prices increase. Caltrans utilized mitigation credits purchased in 2017 and used them in early

2020. This resulted in a savings of the mitigation credit cost and the resources that would have been necessary to purchase credits for an individual project.

Commission staff has no concerns with this efficiency based on the information provided in the efficiencies report. However, it is unclear whether support costs from the Advance Mitigation Program to process the advance mitigation credit purchases were included in the savings claimed. This should be clarified in future efficiency reports.

ADDITIONAL EFFICIENCIES

This is a new section for the Caltrans SB1 Efficiencies Report. This section represents the application of a variety of existing tools Caltrans utilizes to be good stewards of taxpayer dollars. Caltrans is not counting these savings towards achieving the $100 million annual requirement but included them in the report as evidence of how they are continuing to use proven tools to invest taxpayer dollars efficiently and effectively.

1. **Value Analysis** **Cost Avoidance = $72.5 M**
   Federal Highway Administration requires an analysis be conducted for projects on the National Highway System receiving federal assistance with an estimated total cost of $50 million or more. All projects listed in the report are in excess of this federal requirement.

   While commission staff supports Caltrans efforts, all of the reported projects were required by the Federal Highway Administration to undergo a Value Analysis. Therefore, this is a standard business practice. Only savings from Value Analyses performed over and above the federal requirements should be considered in future efficiency reports.

2. **Construction Manager/General Contractor** **Cost Avoidance = $36.4 M**
   Caltrans continues to utilize the Construction Manager/General Contractor project delivery method that results in design innovations to improve constructability. Efficiency savings were calculated based on two projects awarded during the 2019-20 Fiscal Year.

   Commission staff supports Caltrans efforts to utilize Construction Manager/General Contractor delivery method.

3. **Streamlining Environmental Review** **Cost Avoidance = $21.8 M**
   Caltrans has a Memorandum of Understanding with the Federal Highway Administration (FHWA) to assume responsibility for the National Environmental Policy Act (NEPA). This assumption of this federal responsibility is commonly referred to as “NEPA Assignment.” This Assignment streamlines the federal environmental review and approval process by eliminating FHWA project-specific review and approval.

   While commission staff supports these efforts by Caltrans, NEPA assignments had been ongoing for many years. Rather than an efficiency, this should be considered a standard business practice.

4. Reclaimed Asphalt Pavement **Cost Avoidance = $12.7 M**

Caltrans continues to utilize recycled material in pavement projects to reduce project capital costs. Caltrans does not collect information on how much recycled materials contractors use on projects but instead use current industry practice, past studies, and correlations with available data to calculate savings.

While commission staff supports the efforts by Caltrans to utilize recycled materials, this should be considered a standard business practice unless it occurs at levels above historical past practice.

5. Cold In-Place Recycling **Cost Avoidance = $2 M**

Caltrans employs a variety of strategies and materials in maintaining and rehabilitating the State Highway Systems pavement. Cold In-Place Recycling (CIR) is one strategy consisting of grinding the existing pavement, processing material, mixing with stabilizing agents, spreading CIR mixture, and compacting in-place using a continuous train operation. Caltrans utilized the Cold In-Place Recycling process for six projects in 2019-2020 Fiscal Year.

While commission staff supports the efforts by Caltrans to utilize efficient pavement strategies, this should be considered a standard business practice unless it occurs at levels above historical past practice.

SB 1 EFFICIENCIES REPORT

2019-20

EXECUTIVE SUMMARY

Senate Bill (SB) 1 (Beall, Chapter 5, Statutes of 2017), increases funding for California's transportation system by an average of $5.4 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 reinvested into the maintenance and rehabilitation of the State Highway System. The legislation requires that Caltrans report efficiency savings to the California Transportation Commission annually.

The first Annual Efficiencies Report for fiscal year 2017-18 identified $133 million in efficiencies. The second Annual Efficiencies Report for fiscal year 2018-19, identified $233 million in efficiencies. Both reports surpassed the $100 million goal specified in SB 1. Caltrans achieved these efficiencies through a combination of process improvements, new technology, and innovative project delivery methods.

SB 1 Efficiency Category Definitions

For the 2019-20 SB 1 Efficiencies Report Caltrans has taken a new approach to categorizing our efficiencies. The new categories are New Efficiencies, Recurring Efficiencies, and Additional Efficiencies. The New and Recurring efficiencies are counted towards the SB 1 efficiency goal. Definitions for the new categories are as follows:

New Efficiencies include, but are not limited to, ideas, innovative tools or processes, materials, or applied research that avoid or reduce costs — in either capital or support areas which have not been identified in a prior efficiency report.

Recurring Efficiencies are ongoing savings from efficiencies previous implemented or reported in an efficiency report. An example of a recurring efficiency is ongoing utility cost savings from the installation of Light Emitting Diode (LED) bulbs.

Additional Efficiencies represent the application of a variety of tools Caltrans utilizes to be good stewards of taxpayer dollars. These include legacy tools applied in new ways or to new projects. Examples of Additional Efficiencies are Value Analysis, Construction Manager/General Contractor (CM/GC), National Environmental Policy Act (NEPA) assignment which allows Caltrans to streamline environmental review, and other tools Caltrans frequently employs to invest taxpayer dollars efficiently and effectively. These additional efficiencies are not counted towards achieving the SB 1 efficiency goal; however, these efficiencies represent strategic efficient investments.

Caltrans has identified total savings of $340.1 million for the current Annual Efficiencies Report for fiscal year 2019-20, with $195 million towards the SB 1 efficiency goal. Caltrans continues to build upon the efficiencies from prior years and actively seeks to identify new areas to assist the organization to become more efficient in operations and innovations. Caltrans identified 10 new efficiencies for this fiscal year and 7 recurring efficiencies. Additionally, Caltrans included efficiencies with existing tools that continue to realize savings with new projects each fiscal year.

This year, the largest efficiency of $85.7 million in savings came from implementing innovative, cost effective strategies for storm water mitigation as a result of Caltrans' Division of Environmental Analysis' work with the State Water Resources Control Board. Other noteworthy efficiencies came from project bundling and research efforts. Project bundling draws upon efficiencies through project delivery streamlining and is also part of the innovations included in the Federal Highway Administration's Every Day Counts Program. Caltrans achieved $40.2 million in savings with project bundling. Research efforts are the result of a comprehensive program to develop, test, and evaluate transportation innovations. This year, Caltrans achieved $37 million in savings from research efforts. For the third year, Caltrans exceeded the $100 million savings goal specified in SB 1.

Caltrans continues to identify efficient ways of doing business. This year Caltrans will host a Peer Exchange with FHWA, other states, regional partners, and stakeholders to focus on efficiencies. This Peer Exchange will provide a forum for Caltrans to share its vision, strategies, and best practices and receive feedback from other experts.

2019-20 Efficiency Summary

SB 1 EFFICIENCY GOAL		ADDITIONAL EFFICIENCIES	TOTAL 2019-20
New for 2019-20: $174.3 Million	Recurring: $20.5 Million	$145.3 Million	$340.1 Million

SB 1 Efficiency Goal

NEW EFFICIENCIES FOR 2019-20 (*SHOWN IN 000'S)	
1. Storm Water Permit Credits for OGFC	$85,700
2. Project Bundling	$40,205
3. Research – Long-Life Asphalt Pavement	$37,000
4. Automated Machine Guidance	$5,000
5. X-Ray Fluorescence Technology	$2,400
6. Independent Assurance Program	$1,800
7. On-Call Culvert Lining Service Contract	$800
8. Unmanned Aerial Systems	$682
9. Project Initiation Proposal Improvements	$663
10. Reduction in Local Project Agreements and Processing	$10
Sub-Total	$174,260

RECURRING EFFICIENCIES (*SHOWN IN 000'S)	
1. Highway Lighting LED Retrofit	$6,400
2. High Reflective Materials for Striping	$5,100
3. Value Engineering Change Proposals	$4,200
4. Mobile Field Devices	$2,600
5. Global Positioning Satellites (GPS)	$1,900
6. High Performance Reflective Signs	$226
7. Advance Mitigation Credits	$50
Sub-Total	$20,500

ADDITIONAL EFFICIENCIES (*SHOWN IN 000'S)	
Value Analysis	$72,500
Construction Manager/ General Contractor	$36,400
Streamlining Environmental Review – NEPA	$21,800
Reclaimed Asphalt Pavement	$12,600
Cold in-place Recycling	$2,000
Sub-Total	$145,300

INTRODUCTION

For fiscal year 2019-20, Caltrans identified savings of $340.1 million. SB 1, (Beall, Chapter 5, Statutes of 2017), also known as the Road Repair and Accountability Act of 2017, provides mechanisms for increasing funding for California's transportation system by an average of $5.4 billion annually. SB 1 specifies that Caltrans implement efficiency measures with the goal of generating at least $100 million in savings annually. The $100 million in savings are to be redirected towards the maintenance and rehabilitation the State Highway System. SB 1 further mandates Caltrans report savings to the California Transportation Commission annually.

Caltrans issued its first Annual Efficiency Report in October 2018 identifying $133 million in efficiencies. Based on this report, approximately $123 million was available for reinvestment in the maintenance and rehabilitation of the State Highway System. Recommendations from subsequent audit reports were incorporated into the second Annual Efficiencies report for 2018-19 and are reflected in this report as well.

The 2018-19 Annual Efficiencies Report was published and presented to the Commission in December 2019. The report identified $233 million in efficiencies, more than double the statutory goal of $100 million. Caltrans achieved its goal of generating at least $100 million in efficiencies through a combination of innovative tools, new technology, and process improvement methods. The identified efficiencies result in reduced project costs which provides additional funding capacity for the maintenance and rehabilitation of the State Highway System and reduces the unfunded needs reported in the State Highway System Management Plan.

For the third year in a row, Caltrans exceeded the $100 million goal specified in SB 1. This year, the largest efficiency of $85.7 million is the result of Caltrans' Division of Environmental Analysis (DEA) working with the State Water Resources Control Board (SWRCB) to find innovative, cost-effective strategies

for storm water mitigation. The DEA conducted a four-year study to assess the effectiveness of existing Open Grade Friction Course (OGFC) in capturing storm water runoff pollutants from Caltrans roadways. DEA quantified the volume of pollutants captured and presented justifications of the effectiveness of OGFC as a storm water treatment method to the SWRCB and Regional Water Boards. In 2019, the SWRCB and regional water boards granted storm water compliance credits for Caltrans use of existing OGFC as stormwater treatment.

Project bundling is the second largest efficiency this fiscal year with $40.2 million in savings. Project bundling draws upon efficiencies found through project delivery streamlining, as well as benefits from alternative and traditional contracting methods. Caltrans bundled 30 projects into 14 construction contracts this fiscal year achieving significant savings. Project bundling is also an initiative of the Federal Highway Administration's (FHWA) Every Day Counts Program. According to FHWA, project bundling has been successful in Delaware, Pennsylvania, Ohio, Georgia, and Oregon.

Research efforts led to $37 million in savings. Caltrans' Division of Research Innovation and System Information (DRISI) manages a comprehensive program to research, develop, test, and evaluate transportation innovations. DRISI coordinates research activities with the University Transportation Centers (UTC) and with national transportation organizations such as the Transportation Research Board and the American Association of State Highway and Transportation Officials (AASHTO). DRISI worked with the University of California Pavement Research Center (UCPRC) to develop innovations for the design and construction phases of pavement projects that include methods, materials, and technologies that led to efficiencies. The pavement research program works to reduce the cost of constructing and maintaining the roadway system while achieving statewide environmental goals and safety to the public. Current research projects have the potential of identifying the most promising recycled materials to achieve significant cost savings.

BACKGROUND

Caltrans manages more than 50,000 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, sustainable, integrated, and efficient transportation system to enhance California's economy and livability," through 12 district offices geographically located throughout the State and support programs located at its headquarters in Sacramento. Although Caltrans worked to maintain transportation assets, transportation funding had not kept up with inflation to maintain the aging system used by millions of vehicles throughout the State and declining revenues due to vehicles using alternative fuels and increased gas mileage. The passage of SB 1 provided the needed funding to fix California's roads, repair aging bridges, reduce traffic congestion, and improve safety and the movement of goods.

Caltrans has been pursuing new approaches to deliver transportation projects in a more efficient and effective way to reduce costs and accelerate project delivery. Additionally, Caltrans continues to use process improvements such as Value Analysis (VA) and Contract Manager/General Contractor (CM/GC). These specific tools are applied to new projects every year with unique circumstances. In 2019, Caltrans increased the number of VA studies to be performed by lowering the threshold for estimated project costs exceeding $25 million to optimize the ability to generate additional efficiencies. The original threshold to perform VA studies was for estimated total project costs that exceeded $50 million. VA and CM/GC are efficiency saving strategies used by other state departments of transportation. VA is recognized by the FHWA as an industry practice.

Caltrans also encourages its employees to be innovative and to utilize continuous improvements related to business practices and product development. The DRISI supports programs

designed to encourage employees to drive innovative ideas and improve practices and processes, such as the Research Program, the Lean Six Sigma (L6S) and Innovation Station.

The L6S approach is designed to produce substantial results using a data-driven, focused approach to organizational issues. L6S accomplishes process transformations by systematically improving processes.

Innovation Station is a crowdsourcing platform which supports the submission of ideas and the management of those ideas through a defined process. The platform's goals are to encourage a culture of innovation and support statewide collaboration across organizational boundaries, breaking down silos in support of identified efficiencies.

The Research Program develops, tests, and evaluates transportation innovations. These innovations in methods, materials, and technologies enable Caltrans to improve many areas of the department such as pavement. The pavement research program works to reduce the cost of constructing and maintaining the roadway system while achieving statewide environmental goals and safety for the public. Current research projects focusing on pavement have the potential of identifying the most promising recycled materials achieving significant cost savings and environmental benefits.

Caltrans has also been participating in the Federal Highway Administration's (FHWA) Every Day Counts (EDC) Program and the State Transportation Innovation Council (STIC). EDC is a State-based model that identifies and rapidly deploys proven, but underutilized innovations to shorten the project delivery process, enhance roadway safety, reduce traffic congestion, and improve environmental sustainability. Proven innovations promoted through EDC facilitate greater efficiencies, including saving time, money and resources that can be used to deliver more projects. The STIC is a multi-stakeholder leadership team that accelerates the rapid deployment of transportation innovations in California. STIC identifies, evaluates, and implements technologies, tactics, and techniques that have been demonstrated in real world applications and offer improved performance/effectiveness in California.

Caltrans continues to exceed the SB 1 efficiency goal as specified in SB 1. This year Caltrans will host a Peer Exchange with FHWA, other states, regional partners, and stakeholders to focus on efficiencies. This Peer Exchange will provide a forum for Caltrans to share its vision, strategies, and best practices and receive feedback from other experts. Caltrans intends to continue its involvement in peer exchange practices to increase its efficiencies.

METHODOLOGY

The efficiencies outlined in this report were developed by Caltrans Deputy Directors from the various programs and approved by Caltrans' Financial Policy Board (FPB.) The FPB approved the definition of efficiencies as being either "cost avoidance or reduction in support or capital costs (monetary savings.)" Even though Caltrans has been delivering projects more efficiently for many years, fiscal year 2017-18 was the first time that efficiency measures were monitored, quantified, and reported pursuant to SB 1. This is the third Annual Efficiencies Report presented to the Commission.

Since the first Annual Efficiencies Report, Caltrans has continued to identify areas where it can achieve efficiencies. This efficiencies report identifies 10 new efficiencies and 7 recurring efficiencies. Caltrans is pleased to present the 2019-20 efficiencies in the following pages.

NEW EFFICIENCIES FOR 2019-20

1. Stormwater Permit Credits for Open Graded Friction Course

Cost Avoidance	$85.7 Million

Caltrans is committed to being good environmental stewards and ensures water discharged from the State Highway System is treated properly. Stormwater treatment devices can be very expensive to construct, and Caltrans has worked diligently with the State Water Resources Control Board (SWRCB) to explore innovative alternatives to capture stormwater pollutants in a cost-effective manner. In 2019, Caltrans secured 530 acres of stormwater treatment credits utilizing existing Open Grade Friction Course (OGFC) pavements that were constructed to address pavement preservation needs. OGFC pavements that Caltrans constructs also act as stormwater treatment Best Management Practice and qualify for stormwater treatment credits in Total Maximum Daily Load impaired watersheds. The SWRCB and Regional Water Boards agreed to grant stormwater treatment credits for Caltrans' use of OGFC pavements after a multi-year statewide field study was completed. The study assessed the effectiveness of OGFCs in capturing stormwater runoff pollutants from Caltrans roadways.

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. The NPDES permit requires Caltrans to capture and remove pollutants such as toxic metals 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.

It is Caltrans practice to construct OGFC as appropriate to address pavement rehabilitation needs such as drainage improvement, improved visibility and noise reduction. Caltrans learned, through a multiyear statewide field study, that OGFC also provides environmental benefits by removing pollutants from stormwater runoff. Stormwater treatment is achieved by polluted stormwater flowing through the voids of the porous OGFC pavement, pollutants setting on the top of a dense pavement and then clean stormwater discharging from the side of the pavement.

Approval of OGFC as a stormwater treatment best management practice has resulted in efficiency savings. It allowed Caltrans to secure NPDES credits for OGFCs that were already in place. In early 2019, the SWRCB formally granted Caltrans approval for NPDES credits for the 530 acres of existing OGFC pavement in TMDL areas and avoiding the need to construct traditional stormwater treatment devices in those areas.

Savings Calculation Methodology

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. Because Caltrans does not have to construct the traditional devices to address 530 acres of right of way where the OGFC credits have been granted, efficiency savings were realized.

Cost of Traditional Treatment Device 530 acres x $176,000 per acre[1]	$93,280,000
Less Cost of Architectural and Engineering Consultant Resources Pilot Study	($7,500,000)
Total Cost Avoidance	$85,780,000

[1] *Average stormwater treatment device unit cost as noted in the 2012 NPDES Permit.*

Assumptions

The average unit cost for traditional treatment devices will remain at $176,000 per acre. Caltrans will continue to receive credits for OGFC's constructed for pavement preservation purposes and will be allowed to use the credits for storm water treatment.

Savings Available for Reinvestment in the State Highway System

The $85.7 million in cost avoidance achieved with the storm permit credits will be available for the maintenance and rehabilitation of the State Highway System as the funds stay with the project delivery program.

2. Project Bundling

Monetary Savings	$40.2 Million

Project Bundling is a proven practice that draws upon efficiencies found through project delivery streamlining, as well as benefits from alternative and traditional contracting methods. A bundled contract may cover a single county, district, or the state and may be tiered to allow a combination of work types (design, preservation, rehabilitation, or complete replacement).

Caltrans bundles projects to combine projects that have an overlap of project limits and contain similar scopes of work. Projects may be bundled during the design phase or at construction. Bundling design and construction contracts saves procurement time, leverages design expertise, and builds momentum toward keeping critical assets in a state of good repair. Bundling projects with shared features leverages design expertise and achieves economies of scale, including support cost economies. It also minimizes contractor conflicts created when more than one project is being completed within the same area.

Project bundling is also one of the innovations in the FHWA's EDC Program. According to the EDC Program, the following State Departments of Transportation (DOT) have been successful in project bundling:

» Delaware DOT uses a series of bundling contracts to address preservation issues on bridges and culverts.

» Pennsylvania DOT has seen 25-50 percent savings on design and 5-15 percent savings on construction by bundling projects.

» Oregon DOT replaced or repaired 271 bridges using 87 project bundles.

In 2019-20, Caltrans bundled 30 projects at construction into 14 contracts and achieved approximately $40.2 million in savings, as shown below.

	ORIGINAL/COMBINED PROJECT	COUNTY/ ROUTE	CONSTRUCTION ALLOCATION	CONTRACT AWARD FOR COMBINED	SAVINGS
	Lake 29 Expressway Safety	LAK 29	$44,128,000		
	Lake 29 STIP	LAK 29	$25,609,000		
1	**Lake 29 Combined**	**LAK 29**		$58,000,700	$11,736,300
	Eureka Pavement Rehab	HUM 101	$3,301,000		
	4th Street Safety	HUM 101	$6,134,000		
2	**4th Street Safety and CAPM**	**HUM 101**		$10,110,200	$(675,200)
	Lower Fredonyer Shoulder Widening	TEH 036	$5,709,000		
	Goodrich Creek Bridge Replacement	TEH 036	$1,256,000		
3	**Good Fred**	**TEH 036**		$6,732,600	$232,400
	Morgan Summit Curve Improvement	LAS 036	$29,923,000		
	Morgan Climbing Lane	LAS 036	$4,101,000		
4	**Morgan Summit Curve Combined**	**LAS 036**		$32,890,500	$1,133,500
	Sims Road Undercrossing Replacement B	SHA 005	Note 1		
	Crag View Dr UC Replacement	SHA 005	Note 1		
5	**Sims Crag Combine**	**VAR 005**	$20,037,000	$16,303,400	$3,733,600
	Burnt Ranch Install rockfall drapery system	TRI 299	Note 1		
	Junction City Drapery	TRI 299	Note 1		
6	**Burnt Junction Drapery**	**TRI 299**	$7,577,000	$6,954,900	$622,100
	Repair Loop Detectors	VAR	$975,000		
	Repair Field Elements	VAR	$1,464,000		
7	**Repair Loop Detectors and Field Elements**	**VAR**		$2,723,000	$(284,000)
	Camino Safety Project	ED 050	$27,352,000		
	Culvert Rehab and Wildlife Crossing	ED 050	$2,862,000		
8	**Camino Safety Project Combined**	**ED 050**		$28,238,900	$1,975,100

	ORIGINAL/COMBINED PROJECT	COUNTY/ ROUTE	CONSTRUCTION ALLOCATION	CONTRACT AWARD FOR COMBINED	SAVINGS
	State Route 70 Passing Lanes	BUT 070	$8,040,000		
	Palermo Cox Safety Seg 2	BUT 070	$18,700,000		
9	**Hwy 70 Segment 2 Combined**	**BUT 070**		$15,836,500	$10,903,500
	Best Management Practice to reduce Trash Total Management Daily Load	LA 210	$14,079,000		
	Pavement Preservation	LA 210	$140,529,000		
10	**Road Rehab**	**LA 210**		$147,578,000	$7,030,000
	Riverside 10 Beaumont Rehab	RIV 010	$204,521,000		
	Riverside 10 Beaumont Gore Safety Improvement	RIV 010	$1,303,000		
11	**RIV 10 Pavement Replacement**	**RIV 010**		$202,672,800	$3,151,200
	San Bernardino 10 Roadside Safety Imp	SBD 010	Note 1		
	San Bernardino 10 California St UC	SBD 010	Note 1		
	San Bernardino 10 Relocate existing Roadside Facilities	SBD 010	Note 1		
	San Bernardino 10 New York St OC	SBD 010	Note 1		
12	**San Bernardino 10 Worker Safety**	**SBD 010**	$6,032,000	$4,928,100	$1,103,900
	San Bernardino 95 Roadway Rehab	SBD 095	$10,475,000		
	San Bernardino 62 Roadway Rehab	SBD 062	$12,269,000		
13	**San Bernardino 62/95 Roadway Rehab**	**SBD 095**		$23,330,700	$(586,700)
	Culvert Replacement	IMP 078	Note 1		
	Culvert Replacement	IMP 115	Note 1		
14	**Imperial Culvert Replacement**	**IMP VAR**	$1,816,000	$1,686,500	$129,500
				Total:	$40,205,200

Note 1: These projects were combined prior to construction allocation

Efficiency Calculation Methodology:

The savings were calculated by adding the allocation amount of the individual projects and comparing it to the contract award for the bundled project as noted in the chart above.

Assumptions

Projects selected for bundling will generally achieve savings as compared to the individual projects.

Savings Available for Reinvesting in the State Highway System

Because these projects were bundled at construction, the $40.2 million in savings are considered a monetary savings and will be available for reinvesting in the State Highway System.

3. Pavement Research: Long-Life Pavement

Cost Avoidance	$37 Million

The Research Program develops, tests, and evaluates transportation innovations in methods, materials, and technologies to enable Caltrans to improve many areas of the department such as pavement. Caltrans worked with the University of California Pavement Research Center (UCPRC) in the design and construction phases of the Sacramento Interstate 5 Capital Corridor Enhancement Project (Sac-5 Project) that resulted in innovations achieving significant savings. Through this research, UCPRC developed software which uses a new mechanistic-empirical (ME) approach to replace the structural design method Caltrans has been using for several decades. The ME approach considers innovations in materials design lifespan combined with additional test methods, not previously available. In addition to the structural design, the UCPRC, in collaboration with Caltrans staff, developed supplemental specifications for the three types of Long-Life Hot Mix Asphalt materials using the new performance related specification approach. The new approach used on the Sac-5 project has a minimum 40-year design life, and when combined with the final long-life material performance related specifications, will result in an estimated 60-year pavement design life achieving $37 million in savings over the anticipated lifespan of the pavement.

Results from this research project for long-life pavement include new performance standard specifications with the following:

» A new approach for analyzing fatigue testing and a new test for rutting.

» The semi-circular beam test is a new fracture test that resulted from the research. The test gives an improved indication of pavement performance.

» The new specifications allow contractors to use greater percentages of reclaimed asphalt pavement than previous specifications, while ensuring improved performance.

» Performance testing during construction.

Additional improvements resulting from the research project include:

» A new guidance manual for contractors to guide them in changing the mix designs to meet the performance related specifications.

» A communication process for UCPRC and District staff to provide ongoing advice and feedback to the contractors as they tried different alternative mix designs to meet the specifications.

» A newly field recalibrated version of the UCPRC produced mechanistic-empirical design software called CalME was used to check the designs done by District staff using the previous version of the software.

» Information gathered during this project will be used for further improvements in future projects.

Savings Calculation Methodology

The savings were calculated by comparing the 40-year rehabilitation design life pavement using typical asphalt materials and construction specifications. The new approach has a slightly higher (4 percent) initial cost, but requires significantly less maintenance, and no additional rehabilitation over the 60-year analysis period compared with the conventional approach. This results in overall cost savings of approximately 40 percent in net present value.

Additional Savings not included in the calculation:

» Potential Value Engineering Change Proposals will result in additional savings.

» Reduced traffic delay costs to the traveling public because of less frequent maintenance and no additional rehabilitation over the pavement's life cycle.

Assumptions

The cost calculation approach used in these calculations follow Caltrans' life cycle cost analysis procedures. The key parts of life cycle costing are the estimated performance of the alternatives, the initial cost, the resulting frequency of treatments and the cost over the life cycle.

The following assumptions were used:

» CalME was used for estimating pavement costs and anticipated future maintenance frequencies.

» Material costs were taken from bids for Sac-5 for both the Long Life and typical materials included in that project, adjusted for the different densities specified for the typical and long-life asphalt.

Savings Available for Reinvesting in the State Highway System

The $37 million in cost avoidance achieved with this research will be available for the reinvestment in the maintenance and rehabilitation of the State Highway System.

4. Automated Machine Guidance

Cost Avoidance	$5 Million

In 2019-20, Caltrans completed 20 projects with over 5,000 cubic yards of earthwork 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 shown to reduce the number of construction days as well as reducing survey and construction support.

Caltrans introduced AMG to its projects approximately 4 years ago and contractors have been using it for more than a decade for rough grading. The benefits for the department come as a result of the changes in the way Caltrans provides survey data on the project, how inspectors verify grades during rough grading and quantity estimation methods.

AMG efficiencies and benefits:

» Increased productivity and improved accuracies

» Increased safety of field staff on construction projects

» Survey and construction support savings

» More efficient use of survey resources

» Keeps accurate electronic records of material volumes

Savings Calculation Methodology

Savings were calculated by analyzing five projects from the North Region that were completed in 2018-19 to calculate an average percentage of savings for construction and survey support. Savings for working days were calculated by comparing planned with actual working days used for the same five projects. The average percentage was used to calculate support cost savings and working days savings for the 20 contracts completed in 2019-20, of similar size.

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

	WORKING DAYS BID	CONSTRUCTION SAVINGS	SURVEYS SAVINGS	TOTAL SAVINGS
Planned	291	$1,055,704	$417,441	$1,473,145
Used	280	$869,747	$292,867	$1,162,614
Difference/Savings:	11	$185,957	$124,574	$310,531
Percent Savings	4%			21.08%

North Region Contracts with more than 5,000 Cubic Yards of Earthwork

	COUNTY/ ROUTE	NAME/ DESCRIPTION	CUBIC YARDS	ORIGINALLY PLANNED CONST.	SAVINGS[1]	BID DAYS	SAVINGS[2]
1	Lake – 175	Middletown Shoulders	34,000	$1,250,370	$263,578	130	5
2	Lake – 29	Hartman Road Roundabout	7,920	$603,855	$127,293	165	7
3	Lake – 20, 53	Intersection Improvement	9,270	$800,685	$168,784	110	4
4	Plumas – 70	Opapee Curve Improvement	5,990	$253,935	$53,529	50	2
5	Lassen – 139	Lower Antelope Summit Curve Correction	145,000	$235,440	$49,631	70	3
6	Modoc – 299	East Cedar Pass Safety	30,900	$808,650	$170,463	55	2
7	Lassen – 44	Worley Ranch Curve Improvement	55,700	$232,875	$49,090	50	2
8	Shasta – 44	Hat Creek Bridge Replacement	5,240	$302,670	$63,803	85	3
9	Shasta – 5	Clear Recovery Zone	25,200	$268,380	$56,575	85	3
10	Siskiyou – 5	Black Butte OH Bridge Replacement	9,500	$435,240	$91,749	196	8
11	Modoc – 299	Caldwell Bridgeway	55,550	$585,360	$123,394	240	10
12	Trinity – 36	Ditch Gulch Curve Improvement	65,900	$437,805	$92,289	190	8
13	Siskiyou – 5	Southbound Dunsmuir Rehab	169,000	$4,631,310	$976,280	400	16
14	Yolo – 16	Add Turn Lanes, Roundabout, & Align Curve	111,000	$2,283,660	$481,396	140	6
15	Placer – 65	Galleria Auxiliary Lane	29,300	$656,505	$138,391	210	8
16	Sutter – 20	Widen Roadway, Place & Replace Bridge	38,600	$1,574,910	$331,991	150	6
17	Sacto – 99	Construct Auxiliary Lane	8,900	$551,610	$116,279	70	3
18	Placer – 49	Widen Shoulders & Add Retaining Walls	11,100	$1,541,565	$324,962	170	7
19	Yuba, Nevada – 20	Curve Realignment and Shoulder Widening	17,400	$1,580,040	$333,072	155	6
20	Butte – 70	Widen Rdwy, Rdwy Ex, HMA, & Modify Elec System	55,400	$896,670	$189,018	85	3
				TOTAL SAVINGS:	$4,201,568		112

[1] *Support Cost Savings are based on 21.08 percent* [2] *Working Days Savings are based on 4 percent*

Support Savings	$4,201,568
Working Days – 112 days[3] at $7,500 per day	$840,000
Total Savings	**$5,041,568**

[3] Road impact costs and road user costs were used for calculating average savings per day.

Assumptions

In calculating savings, Caltrans assumed that projects with 5,000 cubic yards of earthwork or more will have similar savings based on historical information. Also, the road impact costs and road user costs were estimated at an average of $7,500 per day. The daily cost for most projects is approximately $10,000, but there were cases in which the daily cost was as low as $5,000. Therefore, Caltrans used the conservative average of $7,500 for all 20 projects.

This efficiency also improves safety as there are fewer accidents involving surveyors setting stakes and inspectors checking grades. These savings are not included in the calculation.

Savings Available for Reinvesting in the State Highway System

The savings are considered a cost avoidance and are available for reinvesting in the maintenance and rehabilitation of the State Highway System.

5. X-Ray Fluorescence Technology

Monetary Savings	$2.4 Million

Caltrans is required to comply with the Department of Toxic Substances Control's (DTSC) Soil Management Agreement (Agreement) for Aerially Deposited Lead Contaminated Soils (ADL). The Agreement requires that Caltrans manage all ADL contaminated soils on the State Highway System with elevated lead derived from leaded fuel tailpipe emissions. To fulfill this requirement, Caltrans has been using hazardous materials consultant task orders to collect field samples, analyze them in the 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. 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 to use XRF technology in place of previously required laboratory analytical methods.

XRF technology is a handheld tool that evaluates total lead concentrations in seconds, providing an economically viable alternative to costly and expensive laboratory analysis. The use of XRF technology by Caltrans trained personnel, has eliminated the need for consultant support on low-risk projects on a case by case basis using desktop criteria.

Additionally, the XRF technology provides real time data to screen projects that are considered non-hazardous, eliminating the need for a comprehensive field investigation supported by expensive and time-consuming laboratory analysis. The XRF technology can justify the unrestricted soil classification and can also be used to respond to emergency projects.

Caltrans evaluated 918 boreholes from ADL task orders and calculated the cost to be an average of $1,500 per borehole. Caltrans' use of XRF technology to screen low-risk projects eliminated the need for hazardous consultant task orders.

Efficiency Calculation Methodology

Caltrans calculated savings by comparing the average borehole consultant cost to the cost of Caltrans personnel using XRF technology on 48 projects. The 48 projects had 1,638 borehole locations.

	BOREHOLES[1]	SAVINGS
Consultant Cost avoided for 48 projects	1,638	$2,457,000
Less cost of technology and accessories		($55,000)
Savings		$2,402,000

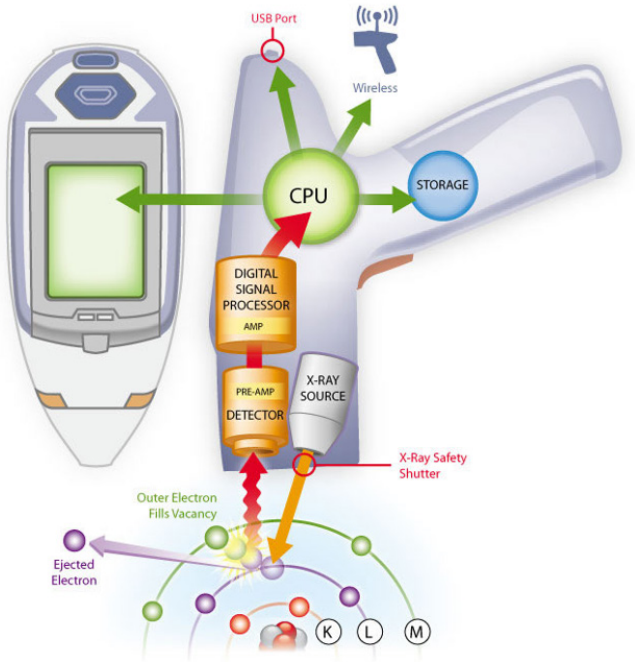
[1] *Each borehole saves an average $1,500*

Assumptions

Caltrans assumed that the 918 boreholes evaluated to determine an average per borehole are representative of most boreholes for low risk projects. Caltrans also assumed that the DTSC will continue to approve the use of XRF technology for all low-risk projects. The use of XRF technology decreased the need for funds allocated for consultant hazardous waste studies.

Savings Available for Reinvesting in the State Highway System

Savings from this efficiency are considered monetary savings and available for the reinvesting in the State Highway System.



6. Independent Assurance Program

Monetary Savings	$1.8 Million

The 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 testing functions on roadway construction projects. Originally this program was administered within each district and then consolidated in the Division of Engineering Services at Headquarters. Consolidating this work improved efficiencies, created greater independence, and improved statewide consistency. By consolidating the Independent Assurance (IA) functions and the strategic placement of staff statewide, METS reduced the total number of IA staff from 33 to 22, achieving 11 personnel years (PYs) savings. The PY savings equates to an estimated annual efficiency savings of $1.77 million.

Caltrans moved IA services from project-specific roles to mitigating project delays associated with obtaining certification and accreditation. Moving IA duties from project-specific duties reduced overall project direct costs by 11 PYs. Consolidation has also fostered statewide consistency and created a true separation of production and quality control. Another benefit from the consolidation is that IA staff are are now able to provide data analytic services across district boundaries.

Additional potential savings include reduction in project delays through allowance of certification and accreditation "off-project", as well as a potential reduction in claims and disputes associated with inconsistencies in performance of quality control and acceptance testing.

Efficiency Calculation Methodology

The IA program staff reduction created approximately $1.77 million in ongoing annual efficiency savings.

Caltrans used its statewide IA database to generate workload estimates, which substantiate the IA consolidation and reduction in 11 PYs. These estimates provided substantiation for the recent IA consolidation and the associated reduction in personnel by 11 PYs. The actual PY savings and the published Caltrans Pay Scales were further analyzed to approximate dollar savings.

Assumptions

The reduction of 11 PYs are assumed to represent two Transportation Engineering Technician Range Cs, four Materials and Research Engineering Associates and five Transportation Engineer (Civil) Range Ds. The loaded rate using a multiplier of 1.6 of the top monthly salary range was used to estimate the monthly then annual savings as shown in the table below.

Savings Available for Reinvesting in the State Highway System

This efficiency is considered a monetary savings and available for reinvesting in the maintenance and rehabilitation from the State Highway System.

CLASSIFICATION	LOADED MONTHLY SALARY	PYS SAVED	MONTHLY SAVINGS	ANNUAL SAVINGS
Transportation Engineering Technician (TET) — Range C	$9,190	2	$18,380	$220,560
Materials and Research Engineering Associate (MREA)	$11,625	4	$46,500	$558,000
Transportation Engineer (Civil) — Range D	$16,600	5	$83,000	$996,000
	Total	11	$147,880	$1,774,560

7. On-Call Culvert Lining Service Contract

Cost Avoidance	$800,000

Reducing the number of individual culvert lining projects into an on-call contract achieved $800,000 in savings. Following similar contracts used by the Department of Water Resources, Caltrans awarded a pilot on-call culvert cleaning and lining contract in 2019. The on-call contract is being monitored and evaluated for additional efficiency savings, improvements, and possible implementation statewide. It is anticipated that the efficiency savings will increase as the contract is fully utilized.

Caltrans is responsible for maintaining approximately 212,181 culverts statewide. A culvert is defined as a tunnel carrying a stream or open drain under a road. Keeping the culvert in good working condition is critical to prevent storm-water runoff from flowing onto the State Highway System. When culverts need to be repaired or replaced, there are several strategies to ensure culverts are in good working condition, field maintenance, Highway Maintenance (HM) and SHOPP projects. Field maintenance crews focus on minor maintenance work which includes minor repairs and preventative maintenance. HM projects are typically performed through a contract and usually include work that maintains the SHS drainage systems to a safe and useable condition. The types of HM projects include repair to the culverts, such as repairing damaged end treatments and lining culverts, erosion and scour issues, installing debris protection systems, and cleaning to remove debris build-up and improve capacity. SHOPP projects primarily address rehabilitative and replacement work and are typically much larger in scope of work. The culvert lining service on-call contract covers work typically covered in a HM project.

The on-call culvert lining contract will achieve savings because Caltrans will no longer have to fund surveying and engineering support through HM. Additionally, the on-call contract will save approximately nine months in procurement time which is the typical procurement time for a HM project.

Efficiencies will be achieved in the following areas:

» Reducing the number of individual culvert lining projects will reduce support cost and approximately nine months per project for the PS&E package in time savings.

» Reducing the construction contract procurement, award time, and associated costs.

Savings Calculation Methodology

Efficiency savings are estimated at $800,000 the first year and about 9 months per year on each individual HM culvert project. The historical support to capital cost ratio for a typical highway maintenance culvert lining project of 4.77 positions per million dollars is used to estimate the potential savings per project per year per district.

Support Savings	$782,280
Contract award support savings	$32,800
Total Estimated Savings Per Culvert	**$815,080**

Assumptions

» Based on historical information, a typical average culvert capital repair cost for highway maintenance is $50,000.

» On average, 10 culverts per project will have a capital cost of $500,000

» The average annual number of culverts lined under a lining contract would be 20. Therefore, total capital cost for a typical 20 culvert project will be $1 million ($500,000 x 2).

» Historical support to capital cost ratio for a typical highway maintenance project has been 4.77 PYs per $1 million in capital cost.

» Historical overhead rate per PY is $164,000. Therefore, anticipated overhead savings are $782,280 (4.77 x 164,000 = 782,280)

» Support savings on contract award are anticipated as well. We are assuming 0.2 PYs for 20 culverts. Therefore, 0.2 x 164,000 = $32,800.

Savings Available for Reinvesting in the State Highway System

Savings achieved from the on-call service lining contract are considered cost avoidance and will stay in the Maintenance program and therefore available for reinvesting in the State Highway System.

8. Unmanned Aircraft Systems

Cost Avoidance	$682,000

Unmanned Aircraft Systems (UAS), also known as drones, have multiple applications for transportation and public works agencies including surveys, bridge inspections, construction monitoring, emergency response, and field investigations. Cameras and sensors mounted on UAS can capture imagery such as photogrammetry, photography, videography, LiDAR, and thermal imagery more effectively and rapidly than traditional ground-based methods. UAS may be used in different phases of project delivery including planning, environmental documentation, design, and construction. Incorporating UAS technology into Caltrans business activities can improve safety, boost efficiency, and decrease costs.

Because UAS applications vary, so do the savings derived from applying UAS. For some applications, future UAS savings could range from 40 to 60 percent over traditional methods. In addition, UAS are reducing the need for field staff to travel as they are now able to view footage remotely taken by a UAS pilot. Additional benefits include having footage for archives and for public display on Caltrans media platforms and available for local news agencies. UAS also replaces the need for aerial photography from helicopters.

Caltrans is utilizing UAS in various Districts to record video and capture imagery to assist in such areas as construction monitoring, biological studies, slope monitoring, and emergency response. Examples include flying State Route 192 following the Montecito mudslides which provided a quick preliminary overview for about six drainages and small bridges impacted by mudslides in San Luis Obispo. Additionally, UAS are being used to assist in field investigations to provide a birds-eye view of steep slopes, such as on Route 33 in Ventura County. As some of these recent savings occurred during COVID-19 travel restrictions, the savings on these projects have not been quantified at the time of publication. Caltrans recently initiated a research project with California State University San Jose - Mineta Institute to evaluate uses of UAS across Caltrans functions. The purpose of the research is to develop a methodology to calculate savings statewide for future documentation.

Savings Calculation Methodology

Savings for 2019-20 were calculated from the North Region. Savings were achieved from three major construction contracts and from 31 missions for mapping purposes.

NORTH REGION SAVINGS:	CONSTRUCTION[1]	SURVEYS[2]	TOTALS
Smartsville Project	$187,000		
Simmerly Slough Project	$37,000		
Timbuctoo Project	$84,000		
31 Survey missions for mapping purposes		$434,000	
Sub-Total	$308,000	$434,000	$742,000
Less cost of equipment			($60,000)
Total Savings			$682,000

[1] Capital and support savings from three projects

[2] Support cost savings when compared to conventional surveys were calculated at $14,000 per mission.

Assumptions

The following assumptions were made in calculating savings:

» Labor rates were used for support cost savings.

» Capital savings were calculated from a combination of change orders and contractor claims and extra work bills that were dismissed resulting from use of UAS.

» Survey savings were calculated using actual hours for 2-member crew using a UAS as compared to a conventional survey that requires a 4-member crew.

The use of UAS will increase statewide for surveys, bridge inspections, construction monitoring, environmental and geological field reviews, and emergency response.

Savings Available for Reinvesting in the State Highway System

Savings from the use of UAS are considered a cost avoidance and can be reinvested in the maintenance and rehabilitation of the State Highway System.

9. Project Initiation Proposal Improvements

Cost Avoidance	$663,000

This Lean Six Sigma (L6S) process improvement identified areas in the Project Initiation Proposal (PIP) that typically resulted in increased costs during the Project Initiation Document (PID) phase. This L6S process improvement identified the reasons projects had to be reworked which increased project costs. The reasons for PIDs needing rework were due to uncertainties of funding, escalation rates, and unknown performance measures from different program advisors

Improving the PIP resulted in cost avoidance and improved transparency during the pre-programming phase. The process improvement has been implemented and savings are being realized. The primary metric was to get PIPs cost estimates within 5 percent of the PID. The results have shown significant improvements resulting in $663,000 savings.

Efficiency Calculation Methodology

Anticipated efficiency savings is calculated by multiplying the personnel years (PYs) by the average annual salary per PY of $150,000. The average salary per PY was taken from the District's Delivery Plan.

Information used for the calculations came from Datalink for actual expenditures and the Project Resource and Schedule Management for estimates.

IDENTIFIED INEFFICIENCIES	UNIT/ OCCURRENCE	COST (HOURS)	TOTAL HOURS (PYS)
Rework due to uncertainties of funding and /or escalation rates.	20	160 Hours	3,200
Rework due to bundling project with other assets and performance targets.	3	1,312	3,930
Other performance measures added	6 Additions	100	600
Total Hours Saved			7,730 hours
Savings in PYs (7,730/1,750 = 4.42)			4.42 PYs
Annual Salary Savings			$663,0001

[1] *Calculated savings using 1,750 annual hours per PY at the average annual salary of $150,000.*

Assumptions

It is assumed that the new process will eliminate rework as more efficient processes are applied.

Savings Available for Reinvesting in the State Highway System

Savings achieved from this efficiency are considered cost avoidance. The staff who were performing the rework will be redirected towards other work in support of project delivery. The savings will not be available for reinvesting in the State Highway System.

10. Reduction in Program Supplement Agreement Processing Time

Cost Avoidance	$10,000

The Division of Local Assistance (DLA) initiated a L6S project to reduce the processing time of Program Supplement Agreements (PSA) from an average of 76 days down to 30 days or less. DLA processes approximately 1,200 PSA's annually. The PSA processing time was reduced from an average 76 days to an average of 20 days. The process improvement streamlined internal processes and allows faster reimbursement to local agencies.

PSA's are project-specific agreements between the Division of Local Assistance and the project sponsor (generally a local or regional agency partner). PSA's supplement Master Agreements and formalize the financial responsibilities and specific provisions for federal-aid or state-funded projects. PSAs also include the agency's specific responsibilities in implementing and maintaining the project, and types and amounts of federal, state and local funds. PSA's are the contractual mechanism for the State to reimburse local agencies for work done.

The L6S Team identified and implemented multiple improvements, the most significant being the following:

» Elimination of hard copies and moving to electronic transactions;

» Reducing redundant steps and reviews;

» E-mail notifications to local agencies, and the creation of a mailbox and webpage; and

» Establishing a process to confirm local agency contact information is correct.

» Improved customer service to local agencies.

Efficiency Calculation Methodology:

On average, improvements reduced processing time by 50 days per PSA, which enables local and regional partners to get reimbursed for their expenses faster. The improvements saved operating costs such as paper, printing, and postage, and also improved customer service in an efficient and streamlined manner. The savings are slightly under $10,000 per year.

Additional savings not quantified are the benefit local and regional agencies will receive by receiving all documents electronically.

Assumptions

Savings from implementing the L6S recommended process include savings in operating expenses such as the reduction in paper, printer, and postage costs. These savings are less than $10,000 per year.

Savings available for the reinvestment in the Highway System

Savings from this efficiency are considered cost avoidance and will not be available for reinvestment in the Highway System.

RECURRING EFFICIENCIES

1. Highway Lighting LED Retrofit

Monetary Savings	$6.4 Million

In an ongoing statewide effort, Caltrans has been replacing existing high-pressure sodium (HPS) fixtures with light emitting diode (LED) lighting on highways statewide. HPS fixtures have been a mainstay on the highways 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, as compared to HPS lighting which require replacement every four years. LEDs lights are also far more energy-efficient, reducing energy usage by 50 to 60 percent. Caltrans maintains approximately 80,000 pole-mounted streetlights statewide. 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 results in a positive impact to the environment.

Savings Calculation Methodology

In calculating savings, we subtracted the cost of replacing lighting using the traditional method as compared with LED lighting as shown below:

	SAVINGS
Energy Cost	5,180,760
Labor Cost	1,434,120
Vehicle Expense	188,700
Minus higher cost of LED	-426,667
Total Savings	$6,376,913

» **Energy Costs** — $5.2 million reduction in energy usage based on lab tested performance and industry data. The savings is the difference between HPS and LED energy usage.

» **Labor Costs** — $1.4 million reduction in labor cost associated with less frequent maintenance and replacement. Replacing HPS lights take approximately 18 staff per year compared to 4 staff time for LED lighting.

» **Vehicle Usage** — $188,700 additional savings due to the reduction of vehicles usage by maintenance crews in replacing highway lighting.

» **Materials** (light fixtures) — LED lighting is more expensive than HPS lighting. Therefore, it is estimated that this cost will be higher by approximately $426,667.

Assumptions

The calculations assume that the inventory of lights will remain the same. There are 80,000 pole mounted streetlights statewide. Replacing HPS lighting with LED lighting will reduce energy needs, labor, equipment, and material costs. The calculation includes lights replaced by the Maintenance Program.

Savings available for the reinvestment in the Highway System

The $6.4 million in savings associated with this efficiency stay in the Maintenance and Operations program and have been redirected to other areas in Maintenance and Operations.

2. High Reflective Material for Striping

Monetary Savings	$5.1 Million

Caltrans has historically used 4 inch wide painted stripes to delineate both edge and lane lines on the state highway. More recently, Caltrans began deploying 6 inch wide striping that uses more durable materials such as thermoplastic (hot when applied, hardens as it cools) and tape. Both thermoplastic and tape materials are embedded with glass beads to enhance reflectivity for better visibility at night and during inclement weather. The new materials are also more durable, lasting between 3 to 6 years, compared to 1 year with painted stripes. This effort is in its early stages of implementation, but Caltrans expects that all 50,000 lane miles of the State Highway System will be restriped within a decade.

Additional benefits with the reflective stripes include:

» Longer preview distance for motorists

» Improved guidance and safety for motorists

» Less impact on motoring public and improved safety

Savings Calculation Methodology

The more durable pavement markings reduce the need for ongoing annual maintenance and frequent replacement, lowering both labor and material cost. The thermoplastic applications will have a life span 6 times the life span of paint and it's guaranteed for six years. The baseline used for the savings calculation was the cost of paint traffic stripes. The savings is the cost difference of maintaining and replacing lane miles. In 2018-19, a total of 16,000 lane miles were stripped with the reflective material achieving an average of $16.5 million in savings. In 2019-20, only 3,199 lane miles were stripped with the reflective material achieving $5.1 million in savings.

	TOTALS
Six-year period using the old process (edge and line paint)	$51,792,199
Less — six-year period with new process, thermoplastic stripes	($21,033,468)
Difference — savings over a six-year period	$30,758,731
Average savings per year/ six years	$5,126,455

Assumptions

The savings calculations assume Caltrans would continue with the old process of staff painting edge and line lanes annually. The savings may vary from year to year, depending on the number of lane miles stripped that particular year.

Savings Available for the Reinvesting in the highway system

The $5.1 million in savings will stay in the Maintenance and Operations program and can be assumed to be available for reinvestment in the maintenance and rehabilitation of the highway system.

3. Value Engineering Change Proposals

Monetary Savings	$4.2 Million

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 congestion and improve quality and safety. When these new approaches result in construction cost savings, Caltrans and contractors may share the cost savings. The VECP is a formal process whereby the innovation is proposed in writing to Caltrans and the merits of the approach are examined. If the innovation is accepted and concurrence is approved, a change order is prepared to authorize the VECP and the work can begin. Money saved through VECP enables Caltrans to get additional value from their highway construction dollars. More projects can be constructed for the same amount of money and new, innovative construction solutions may be applied to future projects.

Savings Calculation Methodology

Efficiency savings were calculated based on the number of projects that had accepted VECPs for fiscal year 2019-20. There was a total of 24 accepted VECPs for the year, representing $4.2 million in savings. Below is the list of the 24 VECPs, along with a description, the date it was approved and the amount of savings.

Assumptions

Money saved through VECP enables Caltrans to get additional value from their highway construction dollars. More projects can be constructed for the same amount of money and new, innovative construction solutions may be applied to future projects.

Savings Available for the Reinvesting in the highway system

Since VECP savings happen at construction, the $4.2 million are considered a monetary savings. The savings can be reinvested into the maintenance and rehabilitation of the State Highway System.

NO.	DISTRICT	CCO NO.	VCEP DESCRIPTION	APPROVAL DATE	SAVINGS AMOUNT
1	2	028	Wall Construction Staging Change	08/27/19	$60,105
2	2	003	Valve Engineering to Revise Traffic Handling Plan	01/09/20	$44,729
3	3	007	Eliminate Over Excavation and Class 2 Base	11/18/19	$230,272
4	3	003	Paving and Grinding Changes	10/01/19	$57,522
5	3	019	State 2 and 3 changes	12/06/19	$6,798
6	3	5	Five Day Delay on Ramp Full Closure	04/16/20	$55,372
7	3	7	Construction Staging	04/30/20	$101,803
8	4	107	Drainage	11/19/19	$48,658
9	4	106	Stage Detour	10/03/19	$18,018
10	4	009	Stage Construction	03/20/20	$167,031
11	4	009	Construction Staging Change	08/15/19	$136,634
12	4	10	Change Cast-in-place Joint Plain Concrete Pavement Transition to a Combination of HMA and CIP JPCP	04/19/20	$1,807,127
13	5	004	Wall Aesthetic	11/27/19	$352,237
14	5	008	Mitigating the Constructability Issues Due Planned Profile Changes	07/05/19	$44,014
15	6	008	Eliminate Temporary Signal	07/03/19	$48,374
16	8	007	Construction Staging Change	08/14/19	$40,057
17	8	022	VCEP 03	01/09/20	$18,311
18	8	004	60-Inch Steel Casing	09/11/19	$27,224
19	8	5	ESA Environmental Sensitive Area	04/14/20	$239,200
20	8	9	Revise Structural Section	05/19/20	$426,556
21	10	10	Eliminate Jacking Superstructure bid Item and Replace this Work with Innovative Falsework System	06/22/20	$19,000
22	11	016	Construct Retaining Wall 425L	07/08/19	$112,259
23	11	014	Construct New Temporary Bike Path Detour	08/27/19	$124,434
24	12	004	Delete Structure Section and Relocate Drainage System	10/29/19	$51,747
				Total Savings:	$4,237,482

4. Mobile Field Devices

Cost Avoidance	$2.6 Million

As part of an ongoing effort to improve the project delivery process by effectively leveraging new technology, the Division of Construction deployed 1,300 mobile field devices (iPads) 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 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 allowed for elimination of unnecessary printing of millions of pages. Caltrans plans to purchase additional devices which will increase the efficiency savings in future years.

Savings Calculation Methodology

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 about 17 miles. We 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 $2,000 per year over the expected life of the device which is 5 years. In total, the 1,300 devices are producing a net savings of $12.9 million over their expected 5-year life span or approximately $2.58 million per year.

Assumptions

It was assumed that all mobile field device users saved 4.4 trips per week as the survey indicated. The mobile field devices have improved the overall contract administration process by enabling construction staff to stay in constant contact with contractors and other interested parties via email.

Savings Available for the Reinvesting in the highway system

The $2.6 million in savings achieved from this efficiency stay within the construction program and can be reinvested in the maintenance and rehabilitation of the highway system.

5. Global Positioning Satellites in Fleet

Monetary Savings	$1.9 million

Caltrans reduced its fleet by approximately 1,300 light-duty vehicles to comply with an executive order that required all state agencies to reassess their vehicle fleet inventory and relinquish any vehicles that were deemed non-essential or not cost-effective. At the same time, Caltrans initiated a pilot program to evaluate the use of global positioning satellite (GPS) devices to improve fleet utilization and automate vehicle usage reporting. The pilot demonstrated that utilizing GPS devices would improve fleet management practices. To date, the GPS devices have effectively eliminated the need for manual reporting of vehicle usage, while providing far more accurate data collection. By reducing the fleet, Caltrans also reduced the cost of the smog checks because vehicles with a GPS do not need to have a physical smog inspection. In addition to transmitting GPS location, vehicles with a GPS send engine diagnostic information that is accepted in lieu of the physical inspection. Furthermore, GPS devices dramatically improve operator safety through automatic alerts of vehicle diagnostics and location.

Savings Calculation Methodology

It is estimated that Caltrans staff spent close to 17,700 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 2019-20, is close to $2 million as shown below:

DESCRIPTION OF SAVINGS FOR 2019-20	SAVINGS
Elimination of Manual Usage Reporting (car tags)	$1,058,670
Elimination of Biennial Smog Inspections	$881,988
Total Savings	$1,940,658

Assumptions

The following assumptions were made in calculating savings for cartags:

» The average mid-range hourly rate for two classifications was used for the calculations. It was assumed that vehicle usage was recorded by employees in many classifications, including transportation engineers and office technicians. ($10,385/ 173.33 hours = $59.91

» It was assumed that staff took one minute to enter each cartag. Each vehicle requires a 125-day minimum use per year with an average of 2 entries per day (total 250 entries.)

» There are approximately 4,241 units using GPS. Therefore 4,241 vehicles times 250 annual entries 1,060,250.

» 1,060,250 minutes divided by 60 minutes = 17,671 hours per year.

» 17,671 hours per year x $59.91 hourly rate = $1,058,670.

Assumptions were made in calculating savings for smog inspections:

» Based on historical information, it was also assumed that it takes an average of two hours for a heavy equipment mechanic to take a vehicle to a smog inspection station.

» The mid-range monthly salary for a heavy equipment mechanic is $9,527 or $54.96 hourly rate (9,527 / 173.33 hours = $54.96)

» 4,644 vehicles equipped with GPS require a biennial smog certificate.

» The cost of a smog certificate ranges from $60 - $100 or an average of $80.

» $80 x 4,644 = $371,520 plus labor $54.96 x 4,644 = $255,234 x 2 hours per vehicle = $881,988.

Savings Available for the Reinvesting in the highway system

The $1.9 million in savings achieved with this efficiency stay in the Maintenance and Operations program and will be reinvested in the highway system.

6. High Performance Reflective Signs

Monetary Savings	$226,000

Caltrans has been using reflective sign sheeting materials on its overhead and roadside signs for more than two decades to enhance the safety of the traveling public. Reflective sheeting uses the light from vehicle headlights to make signs appear brighter and easier to read. Caltrans is now implementing high-performance reflective materials that are more visible at night and do not require attached lighting. Removing the unnecessary light fixtures eliminates the utility, maintenance, and replacement costs associated with lighting the older signs. Implementation of the new signs is still in the early stages. Caltrans anticipates that it may take up to a decade to fully replace the approximately 20,000 overhead signs.

The brighter, more reflective signs allow for greater visibility from longer distances. The ability to see signs from a longer distance allows all drivers the additional time to react to unexpected conditions in a safe manner. The removal of the light fixtures will also reduce lane closures and allow the removal of catwalks from the overhead sign structures, resulting in less graffiti and damage.

Savings Calculation Methodology

Removing the unneeded lights reduces electricity usage. To date, Caltrans has replaced approximately 10 percent of the total signs across the state. Once all signs have been replaced, the potential energy savings will be over $2.1 million annually. Additional savings include eliminating the need for crews to inspect and repair lights and other electrical components. The projected savings, once all the overhead signs have been replaced, is $2,260,195 million annually. Currently only 10 percent of the signs have been replaced, the annual savings are $226,118.

CATEGORY OF EXPENSE	PROJECTED ANNUAL SAVINGS WHEN FULLY IMPLEMENTED	ANNUAL SAVINGS BASED ON 10% IMPLEMENTATION
Energy Cost	$2,128,347	$222,834
Labor Cost	$439,042	$43,904
Material Cost	$81,066	$8,106
Equipment Cost	$32,740	$3,274
Less Cost of Reflective Signs	($421,000)	($42,100)
Total Savings	$2,260,195	$226,118

Assumptions

The brighter, more reflective signs allow for greater visibility from longer distances. The ability to see signs from a longer distance allows all drivers the additional time to react to unexpected conditions in a safe manner.

Savings Available for Reinvesting in the highway system

The $226,118 in savings from this efficiency will stay in the Maintenance and Operations Program and are assumed to be reinvested in the highway system.

7. Advance Mitigation Credits

Monetary Savings	$52,000

Advance 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 increases, the price does as well. Caltrans purchased California red-legged frog mitigation credits from the North Bay Highlands Conservation Bank, approved by the United States Fish and Wildlife Services. A bridge replacement Project on State Route 128 requires mitigation of 4.0 acres. Savings are achieved from the difference in price and the support costs in processing time associated with an individual project.

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.

Caltrans developed an advance mitigation project to purchase California red-legged frog mitigation credits. The project purchased credits from the North Bay Highlands Conservation Bank, approved by the United States Fish and Wildlife Service (USFWS). Caltrans purchased 48.699 credits for $1,266,174 million in December 2017. These credits can provide mitigation for projects in various locations throughout Napa, Sonoma and Marin Counties.

The State Route 128 Capell Creek Bridge Replacement Project required mitigation of 4.0 acres, and Caltrans used mitigation credits from the North Bay Highlands Conservation Bank purchase. This project required a Biological Opinion from USFWS for impacts to the California red-legged frog. In April 2020, Caltrans requested a quote from the North Bay Highlands Conservation Bank to determine current pricing for the credits. The Bank indicated that 4.0 credits purchased in April 2020 would have cost $30,000 per credit.

Savings Calculation Methodology

North Bay Highlands Conservation Bank — Right of Way Capital, Cost Savings

- 2017 — Purchased 48.699 credits. Actual price paid per credit was $26,000.
- 2020 — Price per credit $30,000 if the credits were to be purchased individually three years later.
- Savings per credit if purchased three years later: $30,000 — $26,000 = $4,000 savings per credit
- Capell Creek Bridge Replacement Project required 4 credits for Mitigation
- Total savings: savings per credit $4,000 x 4 total credits needed = $16,000

The Capell Creek Bridge Replacement project initially programmed $115,500 in Right of Way Capital to accommodate anticipated mitigation costs. The project team is currently developing a Project Change Request (PCR) to reduce the amount of Right of Way Capital needed by the project.

Additional savings were realized in support costs from not having to go through the process of purchasing credits for the individual project. It is estimated that nine months were saved in support costs.

CATEGORY OF SAVINGS	UNIT OF SAVINGS	SAVINGS
Support savings for functional units — 9 months	323 Hours[1]	$35,766
Savings achieved with mitigation credits	4 Credits	$16,000
Total Savings		**$51,766**

[1] *Average hourly rate used for functional units $110.73. This does not include the savings associated by the Division of Procurement and Contracts in processing individual project purchases.*

Assumptions

Mitigation credits will be required for future projects and it is assumed that the price will continue being the same. In total, the 48.699 credits purchased at North Bay Highlands Conservation Bank have the potential to save $194,796 if the price per credit remains at $30,000 per credit. Additional savings would be achieved if the price per credit increases over time.

Savings Available for the Reinvesting in the highway system

The $52,000 in savings are a monetary savings and available to be reinvested into the maintenance and rehabilitation of the highway system.

ADDITIONAL EFFICIENCIES

1. Value Analysis

Cost Avoidance	$72.5 M

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 $72.5 million perform a VA.

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. Additional savings are anticipated in future years from the lower $25 million threshold.

Savings Calculation Methodology

Caltrans identified eight projects that achieved "ready to list" (RTL) status in 2019-20 for construction contract advertisement. Projects are RTL when plans, specifications, and estimates are complete, environmental and right-of-way clearances are secured, and all necessary permits are obtained. Four out of the eight projects achieved savings and the other four projects did not achieve savings but improved performances. For accountability and transparency purposes, we are including all eight 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 eight projects is approximately $72.5 million. The efficiency savings from these projects are anticipated to be reinvested in the maintenance and rehabilitation of the State Highway System.

Assumptions

Assumptions related to value analysis studies are unique to each project but typically include similarities such as, construction item quantities, unit costs, overall performance, time savings, and/or other related factors.

Savings Available for the Reinvesting in the highway system

The $72 million in savings are considered a cost avoidance that can be reinvested into the maintenance and rehabilitation of the highway system.

NO.	PROJECT DESCRIPTION	TOTAL PROJECT COST	VA SAVINGS	ASSOCIATED COST	PROJECT SAVING
1	**US 101 San Mateo Managed Lanes** *Improvement:* Change the foundation of the retaining walls to reduce the amount of excavation needed	$439,972,000	$19,260,000	$76,470	$19,183,530
2	**SR 99 Pavement Rehabilitation in and near Atwater** *Improvement:* Reconstruct 4' shoulder by cold plane and paving with 4" HMA	$85,998,000	$(434,000)	$59,000	$(493,000)
3	**Roadway Rehabilitation from Geyserville to Cloverdale** *Improvement:* Eliminate pre-cast panels and use regular pavement structural section before the bridge approach slabs	$100,021,000	$8,627,000	$43,858	$8,583,142
4	**YUB 20 Browns Valley Rehabilitation** *Improvement:* Increase the cut slope from 2:1 to 1:1	$67,900,000	$1,171,000	$42,294	$1,128,706
5	**I-280 Pavement Rehabilitation from Los Altos Hills to Menlo Park** *Improvement:* Pave gore areas to standard specifications	$67,764,000	$(418,000)	$51,090	$(469,090)
6	**SR 23 Pavement Rehabilitation** *Improvement:* Optimize the stormwater facilities	$114,181,000	$847,000	$90,648	$756,352
7	**US101 Alemany Circle Bridge Deck Replacement** *Improvement:* Reconstruct NB direction then SB direction to reduce construction staging	$53,469,000	$(62,000)	$55,591	$(117,591)
8	**LA 210 Roadway Rehabilitation** *Improvement:* Use long term lane closures to minimize use of Rapid Strength Concrete	$185,854,000	$44,062,000	$108,616	$43,953,384
	Totals	**$1,115,159,000**	**$73,053,000**	**$527,567**	**$72,525,433**

2. Construction Manager/ General Contractor

Cost Avoidance	$36.4 M

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. If the CM/GC construction's estimate is not within 10 percent of the independent cost estimator's estimate, 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 Calculation Methodology

Savings are achieved 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 costs associated with CM/GC projects consist of the CM/GC contractor costs, independent consultant estimator costs, ad Caltrans support costs. Costs are tracked and reported when the projects are completed. The associated costs for the two projects will be identified at the completion of construction. We reviewed the list of projects for which the CM/GC method was used and determined that two projects were awarded construction during 2019-20 achieving savings of $36 million. Savings are considered a cost avoidance.

Assumptions

The use of the CM/GC method results in design innovations that improve constructability, a reduction in the number of contract change orders and minimal contractor disputes at contract completion. The above two projects could achieve additional savings when construction is complete.

Savings Available for Reinvesting in the highway system

The $36.4 million in cost avoidance achieved with these two projects can be assumed to be reinvested into the maintenance and rehabilitation of the highway system due to the funding of the projects.

PROJECT NAME	WORK DESCRIPTION	CAPITAL COST	PROJECT SAVINGS
San Mateo State Route 101 — Phase 2 Innovations: » Use Class 90 alt X piles at concrete barrier. » Encapsulated aerially deposited lead on-site instead of hauling off-site. » Increase lane closure to 9 hours for better construction efficiency.	The Project will implement 22 miles of managed lanes each direction on Route 101 within the cities of South San Francisco, San Bruno, Millbrae, Burlingame, San Mateo, Foster City, Belmont, San Carlos, Atherton, Menlo Park and East Palo Alto in San Mateo County, and Palo Alto in Santa Clara County. Phase 2 is to convert the lanes in the northern portion of the project	$325.8 million	$29 million
Santa Barbara Route 101 — Segment 4A » Change from reinforced concrete box culverts to reinforced corrugated pipe. » Optimize continuously reinforced concrete pavement (e.g. replace stainless steel rebar to epoxy coated rebar). » Use geogrid to reduce structural section thickness. » Restage work to avoid utility conflict eliminating one year of delay.	The project will extend High Occupancy Vehicle (HOV) lanes on US Route 101 for 11 miles in each direction. The Project will reconstruct the Cabrillo Boulevard and Sheffield Road interchanges and includes 6.6 miles of rehabilitation. Segment 4A includes 3 miles of HOV and rehabilitation.	$79.7 million	$7.4 million
Total		$405.5 million	$36.4 million

3. Streamlining Environmental Review — NEPA

Cost Avoidance	$21.8M

Caltrans was the first in the nation to sign a Memorandum of Understanding with the Federal Highway Administration (FHWA) to assume responsibility for the National Environmental Policy Act (NEPA). This 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 teams that are working on various strategies to further streamline NEPA Assignment. These strategies will be implemented in future fiscal years.

Caltrans has achieved significant time savings by completing environmental documents approximately 13 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. Processing projects utilizing NEPA Assignment saves money through cost avoidance.

Savings Calculation Methodology

Projects that utilized NEPA assignment and completed the Project Approval and Environmental Document phase during fiscal year 2019-20 were identified. Categorical exclusions are estimated to save one month in time savings and environmental assessments achieve 13 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 151 environmental documents completed utilizing NEPA Assignment achieving $21.8 million in savings.

NEPA ASSIGNMENT CATEGORIES	NUMBER OF PROJECTS	SAVINGS	ASSOCIATED COSTS	TOTAL SAVINGS
Categorical Exclusions – 1 month	144	$3,165,640		
Environmental Assessments – 13 months	7	$19,575,124		
Legal Expenses			$294,079	
Program Staff Support			$278,874	
Consultant Costs			$318,625	
Totals	151	$22,740,764	$891,578	$21,849,186

Assumptions

Time savings during the environmental process allows construction to begin sooner. When construction begins sooner, construction costs are lower due to capital cost escalation rates.

Savings Available for Reinvesting in the State Highway System

The $21.8 million in savings from NEPA Assignment are considered a cost avoidance. The savings will be available for reinvestment in the maintenance and rehabilitation of the State Highway System.

4. Reclaimed Asphalt Pavement

Cost Avoidance	$12.7 million

Using recycled material in pavement projects reduces project capital costs. 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. Contractors have been using RAP for many years, but the savings had not been quantified until now. Savings were calculated from industry practice and past studies

Caltrans' Pavement Program's mission 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. Since 2009 Caltrans allowed contractors to substitute reclaimed asphalt pavement (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. Caltrans is working with the asphalt industry to determine if it's possible to increase the percentage of RAP without negatively affecting performance.

When properly crushed and screened, RAP consists of high-quality, well-graded aggregates coated by asphalt binder. RAP may be immediately reused after processing or stockpiled for future construction projects. 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.

Savings Calculation Methodology

While Caltrans does not collect information on how much recycled materials contractors use on projects, we used 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 2019-20 is approximately $12.67 million.

RAP EFFICIENCY SAVINGS SUMMARY		
1	Total Amount of Type A HMA in tons	3,023,829 tons
2	Total Amount of Type A HMA with RAP in tons (75% of step 1)	2,267,872 tons
3	Total Amount of RAP in tons (15% of step 2)	340,181 tons
4	Savings in using 1 ton of RAP instead of 1 ton of virgin mix ($/ton)	$37.26
	Cost Savings	$12,675,134

Assumptions

» The following percentages were based on industry practice and actual use from a couple of districts and a southern lab in 2019-20.

» 15 percent of RAP replacement in Type A HMA.

» 80-90 percent of projects that use Type A HMA include RAP.

» The calculations used a conservative 75 percent of the total Type A HMA tonnage to calculate tons of Type A HMA with RAP based on the following:

» 100 percent of the projects contain RAP in a southern district

» 78 percent of projects contain RAP in a northern district

» 67 percent of projects contain RAP in a rural district

» Used job mix formulas (JMFs) for Type A HMA with RAP that were paved during 2019-20 from three district offices.

Savings Available for Reinvestment in the State Highway System

The $12.7 million in savings from reclaimed asphalt pavement are considered a cost avoidance and not available for reinvestment in the maintenance and rehabilitation of the State Highway System.

5. Cold In-Place Recycling

Cost Avoidance	$2 Million

Caltrans employs a variety of strategies and materials in maintaining and rehabilitating the State Highway Systems pavement. Cold In-Place Recycling (CIR) is a strategy for pavement maintenance and/or rehabilitation and the process consists of grinding the existing pavement, processing material, mixing with stabilizing agents, spreading CIR 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.

Caltrans allows the use of several other in place recycling strategies for pavement rehabilitation and maintenance such as Full Depth Reclamation and Cold Central Plant Recycling. Additional benefits include: diversion of material solid waste from landfills, reduced GHG emissions, faster construction schedules, and less impact to the traveling public. The use of CIR, instead of "Mill and Fill" with 20 percent digouts, saved the Department approximately $2.05 million in 2019-20.

Savings Calculation Methodology

The efficiency savings calculation compares the bid item cost for CIR versus the cost of a mill and fill with 20 percent digouts. A mill and fill is a pavement treatment that removes the existing surface layer and replaces it with a new asphalt layer. Cold in-place recycling was used in six projects in 2019-20. We reviewed CIR data for projects with open bid dates in 2019-20 and found the following.

PROJECT LOCATION AND DESCRIPTION	CIR +CAPPING LAYER TOTAL COST	MILL AND FILL + DIGOUTS	COST SAVINGS
District 11 — Imperial County State Route 98	$3,700,250	$3,482,850	-$217,400
District 5 — In Santa Barbara County State Route 166	$2,288,250	$2,343,420	$55,170
District 3 — In Butte County State Route 162	$2,076,418	$2,557,796	$481,378
District 9 — In Inyo County, State Route 136	$2,004,963	$2,442,609	$437,646
District 6 — In Fresno County, State Route 33	$3,685,635	$4,373,068	$687,433
District 2 — In Lassen County, State Route 139	$2,665,966	$3,272,200	$606,234
		Total Savings	$2,050,461

Assumptions

The following assumptions are used for CIR efficiency savings calculations:

» 100% of RAP is reused in the CIR layer.

» Linear scaling based on layer thicknesses for conventional technique HMA overlay cost from capping layer cost.

» Cold-planning activities cost $3/SQYD, based on the Caltrans Contract Cost Database.

The mill and fill + 20% dig outs were selected as the comparable design to CIR based on the Highway Design Manual (HDM).

The following steps are used to calculate CIR efficiency savings:

» **Step 1:** Determine the design capping layer thickness and CIR layer thickness from project plans.

» **Step 2:** Use a 0.25' depth for mill and fill.

» **Step 3:** Determine the cost of CIR based on Caltrans Construction Cost Database.

» **Step 4:** Estimate cost of mill and fill.

» **Step 5:** Estimate cost of dig outs = 20 percent x (Cost of mill and fill).

» **Step 6:** Determine the total cost of mill and fill with dig outs.

» **Step 7:** Determine cost savings by subtracting CIR from mill and fill and dig outs strategy.

Savings Available for Reinvesting in the State Highway System

The $2 million in savings from cold in place recycling are considered a cost avoidance. The savings will be available for reinvesting in the maintenance and rehabilitation of the State Highway System.

FUTURE EFFICIENCIES

As specified by SB 1, Caltrans is committed to implementing efficiency measures with the goal of generating at least $100 million dollars annually and reporting to the California Transportation Commission. New opportunities to generate efficiencies are continuously being considered. The following opportunities are being evaluated for potential savings in future years.

1. Advance Mitigation Program

Caltrans established an Advance Mitigation Program to plan and implement advance mitigation solutions for its future transportation projects. The new business practice allows Caltrans to reduce delays by obtaining environmental mitigation in advance of transportation projects. The primary goal of the program is to address long term future environmental needs resulting in improved environmental, economic and project delivery outcomes. Draft guidelines have been developed and are currently moving through the review process. Once fully implemented, the program is expected to achieve savings from faster project delivery.

2. National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) Reciprocity

Receiving approval to use one document, NEPA or CEQA will save staff time and reduce delivery time. NEPA applies to projects receiving federal funding, work or permit. Under NEPA the project may move forward with significant negative environmental impacts, as long as it fully discloses the negative effects. The lead agency for NEPA is FHWA but Caltrans has delegation under a memorandum of understanding. CEQA applies more broadly than NEPA and is used for projects receiving state/local approval, permit, oversight of local or state funding. The CEQA lead agency is usually local or state government. Caltrans is currently looking into NEPA and CEQA reciprocity.

3. Streamlining the Permitting Process

As required by Assembly Bill 1282, a task force was established to develop a detailed analysis of the existing permitting process for transportation projects in California. This effort should result in significant savings as the analysis will identify points of delay where projects can be combined in the project development and permit process. The task force will include management from Caltrans, the State Water Resources Control Board, the California Department of Fish and Wildlife, the California Coastal Commission, and the High- Speed Rail Authority.

4. Streamlined Delivery with "Early Design"

Early Design can reduce project development rework and delays in project delivery timelines; and allows greater opportunity to identify risks earlier in the project, which provides more lead time to develop solutions. Caltrans issued guidance in December 2019, outlining the requirements for implementing Early Design which will reduce overall project delivery timelines in the following areas:

5. Capital Outlay Support Resources

Moving preliminary engineering and design activities into the 0 phase reduces the risk of estimate PS&E development, which could result in a slight reduction in the support costs in design activities.

6. Capital Construction Cost

Moving preliminary engineering and design activities into the 0 phase would result in shorter final design PS&E schedule, and an earlier delivery milestone date for Ready to List. Projects that have an earlier construction start date would see a capital construction cost savings compared to the conventional delivery schedule.

7. Accelerated Bridge Construction (ABC)

ABC can be an effective way to lower direct and indirect project costs through the reduction of construction impacts and on-site construction time while improving site constructability. ABC employs innovative design and construction methods to reduce the number of construction days and construction related impacts. Methods include fabricating bridge parts away from traffic and quickly assembling them onsite in a matter of weeks.

8. Corridor Management

Corridor management looks at entire groups of projects as integrated travel corridors, instead of individual projects. Corridor management can move more effectively to address the needs of the system and improves efficiencies, partnerships, innovation, leadership and teamwork. Corridor management will allow Caltrans to more effectively, plan, and develop an investment strategy for a corridor and obtain buy-in from partnering agencies on projects.

9. Multi-Phase Architectural and Engineering (A&E) Contracts

A&E Multiphase contracts provide phase level deliverables for a specific project under a single contract. Multiphase contracts can procure entire teams of qualified professionals and specific projects can move into construction sooner at a lower cost by avoiding future escalation rates. Multiphase contracts also require less time for in-house oversight of consultants because the Prime consultant manages the work and deliverables of its employees and subconsultants.

10. 3D Design

There are two components to this efficiency. Virtual Design through Construction (VDC) and 3D Model. The VDC research will post the final report in late February. Several years will be necessary to implement any new ideas and determine if efficiencies were achieved. For the 3D Model, efficiencies are anticipated by the construction contractor.

11. Lean Scheduling for SHOPP Projects

Caltrans District 7 is piloting Lean Scheduling on two SHOPP projects. Lean scheduling is a method for developing project schedules using planning methods to identify and refine project schedules based on the task durations and commitments made by the functions as the project progresses. While the initial project is set using more traditional methods, the execution allows for the schedule of individual task to be adjusted as the work is progressing through the functions. Communication is more frequent to allow all functions involved to know the immediate status of the project. As upstream project tasks are being completed, the downstream function can be better prepared for the work coming in since they have a better idea of actual completion dates of the previous task. This creates less waste of resources due to unforeseen delays and work not being available when promised. Efficiencies are realized after the projects are ready for construction and all design support costs can be captured.

12. Transportation System Network (TSN)

TSN is a software application that consists of four separate modules. The focus of the current improvement is on the TSN highway inventory module. The goal of this L6S process improvement is to reduce project hours from 40 hours to 32 hours for a general inventory and from 80 to 64 hours for a realignment/adoption/ network project.

13. Replacing Wood Posts with Steel Posts

Replacing wood posts with steel posts for guardrail will result in efficiencies and increase safety. With most of California prone to fires, replacing wood posts with steel posts would minimize damage and allow roadways to be available to the traveling public faster. Steel posts do not require special handling after a fire, whereas the wood posts are considered hazardous material.

SB 1 ANNUAL EFFICIENCIES REPORT 2018-19

This page intentionally left blank

SB 1 ANNUAL EFFICIENCIES REPORT 2018-19

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Senate Bill (SB) 1 (Beall, Chapter 5, Statutes of 2017), also known as the Road Repair and Accountability Act of 2017, was passed by the California Legislature and signed into law by Governor Edmund G. Brown Jr. on April 28, 2017. SB 1 increases funding for California's transportation system by an average of $5.4 billion annually, and mandates that the California Department of Transportation (Caltrans) implement efficiency measures with the goal of generating at least $100 million in annual savings to be reinvested into the maintenance and rehabilitation of the State Highway System. The legislation requires that Caltrans report efficiency savings to the California Transportation Commission (Commission) annually.

The first Annual Efficiencies Report, for fiscal year 2017-18, identified $133 million in savings which exceeded the goal of generating at least $100 million to be reinvested in the maintenance and rehabilitation of the State Highway System. Caltrans presented the report at the October 2018, Commission meeting. Caltrans achieved these efficiencies through a combination of process improvements and innovative project delivery methods. The Independent Office of Audits and Investigations conducted an audit of the Annual Efficiencies Report and determined that $8.7 million out of the $133 million were overreported and offered recommendations that were incorporated into this report.

Caltrans continues to build upon the efficiencies from last year and look for opportunities within the department where process improvements can be achieved resulting in monetary savings or cost avoidance. Each efficiency specifies how the savings will be reinvested in the maintenance and rehabilitation of the state highway system. This Annual Efficiencies Report contains efficiencies totaling $233 million in the following categories:

EFFICIENCY CATEGORY	SAVINGS
Innovative Tools	$109 million
New Technology	$26 million
Process Improvements	$98 million
Total Savings:	**$233 million**

INTRODUCTION

Caltrans consistently aims to be a good steward of public funds and promote a culture that is innovative and efficient. For fiscal year 2018-19, Caltrans has identified savings of $233 million. Caltrans continues to expand future year opportunities to generate efficiencies by increasing Construction Manager/ General Contractor (CM/GC), as allowed by Senate Bill 1262; increasing the number of Value Analysis (VA) studies performed by lowering the threshold from $50 million to $25 million; establishing teams to develop strategies to further streamline the National Environmental Policy Act (NEPA) assignment; and encouraging employees to continue with process improvements throughout the department.

Senate Bill 1 (SB 1), (Beall, Chapter 5, Statutes of 2017), also known as the Road Repair and Accountability Act of 2017, was passed by the California Legislature and signed into law by Governor Edmund G. Brown Jr. on April 28, 2017. SB 1 provides mechanisms for increasing funding for California's transportation system by an average of $5.4 billion annually. SB 1 requires Caltrans to implement efficiency measures with the goal of generating at least $100 million in savings annually. The $100 million in savings are to be redirected towards maintaining and rehabilitating the state highway system. SB 1 requires that Caltrans report the savings to the California Transportation Commission annually.

Caltrans first Annual Efficiency Report for fiscal year 2017-18 identified $133 million in efficiencies which exceeded the goal of generating at least $100 million. This report outlines $233 million in efficiencies for fiscal year 2018-19, which is more than double the statutory goal of $100 million. These efficiencies result in reduced project costs which provide additional funding capacity for Maintenance and State Highway Operation and Protection Program projects and reduces the unfunded needs reported in the State Highway System Management Plan.

BACKGROUND

Caltrans is responsible for improving, maintaining, and operating California's State Highway System, which includes a network of streets, highways, and freeways across California. Caltrans accomplishes its mission to "provide a safe, sustainable, integrated, and efficient transportation system to enhance California's economy and livability" through 12 district offices located throughout the State and the support programs at its headquarters in Sacramento. Prior to the passage of SB 1, fuel excise tax revenues were declining due to the increase in fuel efficient vehicles and use of alternate fuels. This meant that transportation funding was not keeping up with inflation and the costs to maintain an aging system used by an increasing number of vehicles. SB 1 provides needed funding to fix California's roads, repair aging bridges, reduce traffic congestion, and improve safety and the movement of goods.

Caltrans continues pursuing new approaches to deliver transportation projects in more efficient and effective ways to reduce costs and accelerate project delivery. The use of innovative contracting tools and independent project evaluations, such as CM/GC and VA, have generated significant cost savings.

CM/GC allows Caltrans to engage the contractor during the design process to provide constructability reviews, value engineering input, construction estimates and other construction-related recommendations with the goal of finding more efficient methods and materials. CM/GC contracting results in projects being built faster with reduced costs. Caltrans is increasing its use of CM/GC, as authorized by Senate Bill 1262.

Caltrans and the Federal Highway Administration (FHWA) recognize VA as an effective process to identify innovative approaches that improve the overall value of the project and generate efficiencies. Caltrans reports to FHWA annually on VA accomplishments such as the number of studies conducted, proposed and implemented recommendations, the value of the approved recommendations, the cost to conduct the studies, and the total savings achieved. VA uses independent subject matter expert reviews to improve the performance of projects and reduce project costs. Most recently, Caltrans increased the number of VA studies to be performed by lowering the threshold for estimated project costs exceeding $25 million to optimize the ability to generate additional efficiencies for future years. The original threshold to perform VA studies was for estimated total project costs that exceeded $50 million which is a federal mandate.

Additionally, employees are encouraged to be innovative and to utilize continuous improvements related to business practices and product development. The Division of Research, Innovation and Systems Information supports programs designed to encourage employees to drive innovative ideas and improve practices and processes, such as the Lean 6-Sigma (L6S) and Innovation Station.

The L6S approach is designed to produce substantial results using a data-driven, focused approach to organizational issues. L6S accomplishes process transformations by integrating a set of powerful improvement tools with a five-phase methodology. These five phases are: Define, Measure, Analyze, Improve, and Control. Caltrans has several process improvements statewide in various stages.

Innovation Station is a crowdsourcing platform which supports the submission of ideas and the management of those ideas through a defined process. Caltrans leverages the value of crowdsourcing by supporting staff statewide as a community of participants who generate and discuss ideas. The success of this approach is premised on the assumption that the employees (or "crowd") are the organization's best resource for ideas and have the most relevant knowledge and experience to identify key issues and possible solutions.

The platform's goals are to encourage a culture of innovation and support statewide collaboration across organizational boundaries, breaking down silos in support of identified efficiencies.

METHODOLOGY

The efficiencies outlined in this report were developed by Caltrans Deputy Directors from the various programs and approved by Caltrans' Financial Policy Board (FPB.) The FPB is chaired by the Chief Deputy Director and its members include the Chief Financial Officer and the Deputies for Project Delivery, Maintenance and Operations, Planning and Modal, and Administration. Each program is responsible for developing efficiency measures that result in monetary savings or cost avoidance. Even though Caltrans has been working on delivering projects more efficiently for many years, fiscal year 2017-18, was the first time that efficiency measures were quantified, and reported pursuant to SB 1.

The FPB approved the definition of efficiencies as being either "cost avoidance or a reduction in support or capital costs (monetary savings)." For purposes of this report, we will specify for each efficiency whether the savings is considered a cost avoidance or a monetary savings.

Caltrans has continued to build upon the efficiencies from the previous year and identified areas within the department where additional efficiencies could be achieved resulting in monetary savings or cost avoidance achieving $233 million in savings as outlined at right:

EFFICIENCY DESCRIPTION	SAVINGS
Innovative Tools	
1. Acceleration of Work	$64,000,000
2. Innovative Strategies in Striping Contracts	$30,400,000
3. Construction Manager / General Contractor	$14,400,000
4. Advance Mitigation Credits	$123,000
Sub-total Innovative Tools	**$108,923,000**
New Technology	
1. High Reflective Material for Striping	$16,500,000
2. Highway Lighting LED Retrofit Project	$5,700,000
3. Global Positioning Satellite in Fleet	$2,200,000
4. Mobile Field Devices	$1,500,000
5. High Performance Reflective Signs	$226,000
Sub-total New Technology	**$26,126,000**
Process Improvements	
1. Value Analysis	$49,000,000
2. Streamlining Environmental Review — NEPA	$41,500,000
3. Value Engineering Change Proposal	$4,400,000
4. Lean 6 Sigma Projects ■ Outdoor Advertising Relocation Agreement Time Reduction ■ Encroachment Permitting Time Reduction ■ New Product Evaluation Time Reduction ■ Reduction of Processing Time of Plans, Specifications and Estimates Contract Documents ■ Fleet Acquisition Planning Time Reduction ■ Building Projects Design Time Reduction ■ Asphalt Materials Sample Testing ■ Traffic Investigation Processing Time Reduction ■ Construction Support Costs Reduction ■ Equal Employment Opportunity Program Investigation Process ■ Formal Disciplinary Action Processing Time Reduction ■ Local Assistance Invoice Processing Time Reduction	$3,181,000
Sub-total Process Improvements	**$98,081,000**
TOTAL MONETARY SAVINGS/COST AVOIDANCE	$233.1 MILLION

The Independent Office of Audits and Investigations conducted an audit of the Annual Efficiencies Report (Annual Report) for fiscal year 2017-18. The purpose of the audit was to determine whether the savings reported in the Annual Report was supported and available for reinvestment in the maintenance and rehabilitation of the state highway system, as required by SB 1. The auditors tested approximately $119.5 million out of the $133 million reported in the Annual Report and found that $8.7 million in savings should not have been included. The auditors also found that approximately $1.5 million was not available for reinvestment in the maintenance and rehabilitation of the state highway system and offered recommendations. Therefore, approximately $123 million was available for the reinvestment in the maintenance and rehabilitation of the highway system.

The following recommendations were incorporated into this report.

- Reviewed the NEPA Assignment project list for completeness and accuracy.
- Used programmed capital construction amount instead of the estimated construction amount when calculating NEPA savings.
- Ensured innovation matrix for CM/GC projects is updated with accurate information and based on final unit prices.
- Ensured that cost avoidance estimates for VA studies are detailed, based on final unit prices, and quantities, and the estimates are updated based on final plans and specifications.
- Ensured that efficiency savings specify whether the monetary savings or cost avoidance will be available for reinvestment in the maintenance and rehabilitation of the state highway system.

INNOVATIVE TOOLS

Caltrans encourages its employees to be innovative and to utilize continuous process improvements related to business practices and product evaluations. The following efficiencies fall in the category of innovative tools.

1. Acceleration of Work

COST AVOIDANCE :

$64 MILLION

Caltrans is faced with the reality that construction costs increase over time and many projects require multiple years to complete. Caltrans uses the escalation rate included in the approved Fund Estimate when programming projects to capture future increases in material and labor costs. With the additional resources generated by the passage of Senate Bill (SB) 1, Caltrans saw an opportunity to advance the development and delivery of critical maintenance and rehabilitation projects across the state. Due to the availability of additional funding, projects will move into construction sooner at a lower cost. By accelerating the rehabilitation and maintenance work of the state highway, California drivers can take advantage of the roadway improvements earlier than planned. Well maintained roads allow for decreased commute times, reduced wear and tear on vehicles, and allow for more efficient transport of goods.

Savings Calculation Methodology

Savings are considered a cost avoidance and as a result, related funds that were committed in future years will be

available to fund more highway rehabilitation projects. For 2018-19, the additional funding from SB 1 was $1.5 billion. The additional funding allowed Caltrans to increase the program and avoid the current escalation for one year. The escalation rate approved at the time of programming the 2018 State Highway Operations and Protection Program was 4.25 percent. Caltrans calculated savings of $64 million in cost avoidance by multiplying the additional funding of $1.5 billion for one-year times the 4.25 percent escalation rate.

Assumptions

Accelerating projects will allow construction to begin sooner at a lower cost. It is assumed that the escalation rate will continue being the same as when the projects were programmed.

Savings Available for Reinvesting in the State Highway System

The $64 million in cost avoidance achieved by accelerating work will be available for reinvestment in the maintenance and rehabilitation of the state highway system.

2. Innovative Strategies in Striping Contracts

MONETARY SAVINGS:

$30.4 MILLION

Caltrans has started using high reflective durable material for striping instead of the conventional paint and thermoplastic. Traditionally, Caltrans used four-inch wide painted stripes to delineate both edge and lane lines on the state highway. Caltrans began deploying six-inch wide striping using more durable material and awarded 35 contracts in 2017-18.

The bids for the 35 contracts awarded in 2017-18, came in 4 percent higher than the engineer's estimate. The contract bids were evaluated and contractors were asked for ideas on ways to achieve efficiencies. These improvements were implemented in the 2018-19 striping contracts resulting in cost savings of $30.4 million. Contract working days are estimated by Caltrans engineers based on estimated production rates. Contractors often assume they will be successful bidders in multiple striping contracts at the same time which may cause them to not complete the work within the contract working days and incur liquidated damages. Contractors assume they would get multiple contracts and often bid higher on specific items to cover the cost of potential liquidated damages. The methodology of determining contract working days was improved to more accurately reflect anticipated production rates, which allows the contractor flexibility to manage multiple striping contracts. Additionally, working with the District Traffic Managers, moving lane closures were allowed in some instances instead of stationary lane closures and allowable working hours were increased. The length of the working area was also increased allowing contractors to move at a faster pace. All these strategies resulted in bids coming in an average of 27 percent lower than the Caltrans engineer's estimate.

Savings Calculation Methodology

The 28 statewide striping contracts awarded in 2018-19 achieved $30.4 million in savings using the following strategies:

- Increasing the number of working days allowed the contractors flexibility to manage multiple striping contracts with the same start date for construction. As a result, the bids came in lower for traffic control and other lump sum items.

SB 1 STRIPING PROJECTS 2018-19					
#	**District and Location of Project**	**Lane Miles**	**Caltrans Engineer Estimate**	**Contractor Bid Result**	**Difference**
1	D1 – Del Norte and Humboldt Counties, Routes 199 and 299	179	$2,993,353	$1,988,681	($1,004,672)
2	D1 – Lake and Mendocino Counties, Routes 20, 29 and 273	244	$3,966,605	$2,657,511	($1,309,094)
3	D2 – Shasta and Trinity Counties, Routes 299, 151 and 53	253	$4,125,765	$2,608,794	($1,516,971)
4	D3 – Sacramento County, Route 50	101	$2,031,005	$1,085,370	($945,635)
5	D3 – Sutter and Butte Counties, Route 99	233	$4,185,580	$3,098,747	($1,086,833)
6	D3 – Colusa, Sutter and Yuba Counties, Route 20	105	$1,694,341	$1,297,747	($396,594)
7	D3 – Nevada and Placer Counties, Route 20	65	$1,283,075	$928,831	($354,244)
8	D4 – Santa Clara County, Route 85	108	$2,480,760	$1,904,645	($576,115)
9	D4 – Alameda County, Route 580	93	$2,562,540	$1,657,657	($904,883)
10	D4 – Contra Costa County, Route 680	112	$2,188,170	$1,498,737	($689,433)
11	D5 – Monterey & Santa Cruz Counties, Routes 1 and 156	217	$3,461,349	$2,966,998	($494,351)
12	D5 – San Luis Obispo & Santa Barbara Counties, Routes 46, 166, 154, and 41	284	$4,473,941	$4,452,089	($21,852)
13	D6 – Fresno, King and Madera Counties, Route 41	142	$2,689,669	$2,366,543	($323,126)
14	D6 – Fresno County, Routes 168 and 180	154	$2,665,237	$2,265,554	($399,684)
15	D6 – Kern County, Routes 46 and 58	125	$1,269,316	$1,253,436	($15,880)
16	D7 – Los Angeles County, Route 105	127	$6,922,670	$4,290,710	($2,631,960)
17	D7 – Los Angeles County, Route 405	187	$8,241,860	$5,245,950	($2,995,910)
18	D8 – San Bernardino and Riverside Counties, Routes 60, 91, and 215	268	$6,362,548	$4,484,977	($1,877,571)
19	D8 – San Bernardino and Riverside Counties, Route 215	304	$7,951,715	$4,990,000	($2,961,715)
20	D8 – San Bernardino County, Routes 58, 210, and 395	280	$5,804,150	$3,899,930	($1,904,220)
21	D9 – Kern County, Route 58	225	$5,290,328	$4,728,966	($561,362)
22	D9 – Inyo County, Route 395	267	$5,017,647	$4,298,869	($718,778)
23	D10 – Merced County, Route 152	173	$3,776,058	$3,149,111	($626,947)
24	D10 – San Joaquin County, Routes 580, 205, 120, and 12	168	$3,972,430	$3,551,903	($420,527)
25	D11 – San Diego County, Route 8	225	$6,118,895	$4,038,256	($2,080,639)
26	D11 – San Diego County, Route 8	179	$5,431,678	$3,770,327	($1,661,351)
27	D11 – San Diego County, Route 163	82	$2,857,908	$1,448,560	($1,409,348)
28	D12 – Orange County, Route 91	120	$3,415,782	$2,859,451	($556,331)
Total		**5,020**	**$113,234,375**	**$82,788,350**	**($30,446,026)**

- Increasing the number of working hours and utilizing moving lane closures allowed the contractor to work quickly and efficiently.

- Allowing longer work areas helped the contractor move at a faster pace and avoid continuous resetting of changeable message signs and cones on an hourly basis.

Savings Available for Reinvesting in the State Highway System

The $30.4 million in monetary savings will stay in the Maintenance and Operations Program and will be available for reinvestment in the maintenance and rehabilitation of the state highway system.

3. Construction Manager/ General Contractor

COST AVOIDANCE:

$14.4 MILLION

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 prepares a cost estimate and schedule based on the draft construction plans and specifications. If the CM/GC construction's estimate is not within 10 percent of the independent cost estimator's estimate, 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 constructs the project.

Savings Calculation Methodology

Savings are achieved at two different stages, when the construction contract is awarded (e.g. innovations) and at the completion of construction (e.g. reduction in change orders and claims.) The costs associated with CM/GC projects consists of the CM/GC contractor costs, independent consultant estimator costs, and Caltrans support costs. Costs are tracked and reported when the projects are completed. The associated costs for the two projects will be identified at the completion of construction. We reviewed the list of projects for which the CM/GC method was used and determined that two projects were awarded construction during 2018-19 achieving a savings of $14.4 million.

CONSTRUCTION MANAGER/GENERAL CONTRACTOR PROJECT LIST			
Project Name	**Work Description**	**Capital Cost**	**Project Savings**
San Mateo 101 phase 1 Innovation: ■ Revise highway alignment to avoid reconstruction of a pedestrian overcrossing. ■ Modify light foundation design to minimize drilling. ■ Utilize PVC conduit instead of metal conduit in barrier.	The Project will implement 22 miles of managed lanes each direction on Route 101 within the cities of South San Francisco, San Bruno, Millbrae, Burlingame, San Mateo, Foster City, Belmont, San Carlos, Atherton, Menlo Park and East Palo Alto in San Mateo (SM) County, and Palo Alto in Santa Clara (SCL) County. Package 1 is to convert the lanes in the southern portion of the project.	$ 59.5 million	$7 million
Interstate-5 North Coast Corridor phase 4 Innovation: ■ Incorporate a centralized recycling center to maximize reuse of materials and reduce the need to purchase new materials. ■ Reduce structural section through use of geogrid. ■ Utilize 56-hour closure to perform ramp work.	This project is a 27-mile long project that proposes improvements to I-5 coastal rail and transit enhancements, environmental protection and coastal access improvements over 4 phases. Phase 4 is to widen the highway.	$224 million	$7.4 million
Total		**$283.5 million**	**$14.4 million**

Assumptions

The use of the CM/GC method results in design innovations that improve constructability, a reduction in the number of contract change orders and minimal contractor disputes at contract completion. Once construction is completed, the two projects could achieve additional savings.

Savings Available for Reinvesting in the State Highway System

The $14.4 million in cost avoidance achieved with these two projects will be available for reinvestment in the maintenance and rehabilitation of the state highway system.

4. Advance Mitigation Credits

MONETARY SAVINGS:

$123,000

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.

Caltrans developed an advance mitigation project to purchase California Tiger Salamander mitigation credits. The project purchased credits from two conservation banks, each approved by the California Department of Fish and Wildlife (CDFW) and United States Fish and Wildlife (USFWS). A total of $2,916,000 of credits were purchased in 2018, which would provide mitigation for projects both in the northern and southern portion of San Luis Obispo. Specifically, Caltrans purchased 58 credits from the La Purisima Conservation Bank in Santa Barbara County for $27,000 per credit and 45 credits from the Sparling Ranch Conservation Bank in San Benito and Santa Clara Counties for $30,000 per credit.

The Solomon Canyon paving project, requires mitigation of 15.43 acres, which Caltrans intends to fulfill by utilizing the advance mitigation credit purchase from the La Purisima Conservation Bank. This project required a Biological Opinion from USFWS and form 2081 from CDFW for impacts to the California Tiger Salamander. Caltrans is required to mitigate 15.43 acres. Caltrans intends to fulfill this requirement by utilizing the advanced mitigation credit purchase from La Purisima Conservation Bank. In June 2019, Caltrans requested a quote from the La Purisima Conservation Bank to determine current pricing for the credits. The Bank indicated that those 15.43 credits, if purchased in June 2019, would cost $35,000 per credit.

Savings Calculation Methodology:

Credits were purchased from two different Conservation Banks.

La Purisima Conservation Bank

- 2018 — Purchased 58 credits at La Purisima Conservation Bank. Actual price paid per credit is $27,000.
- 2019 — Price per credit $35,000 at La Purisima Conservation Bank if the credits were to be purchased individually one year later.
- 2020 — Price difference per credit $35,000 – $27,000 = $8,000 savings per credit in future years.

Sparling Ranch Conservation Bank

- 2018 — Purchased 45 credits at Sparling Ranch Conservation Bank. The cost per credit is $30,000.
- 2019 — Price per credit $50,000 at Sparling Ranch Conservation Bank if the credits were to be purchased individually one year later.
- 2020 — Price difference per credit $50,000 – $30,000 = $20,000 savings per credit in future years.

Purchased credits from the conservation banks were applied to the following project:

Cost Savings for Solomon Canyon Project = $123,440

A total of 15.43 credits were required for mitigation. At a savings of $8,000 per credit, there is a savings of $123,440 for this project. Based on the estimated cost for mitigation the Solomon Canyon project initially programmed $542,000 in Right of Way Capital to accommodate anticipated mitigation costs.

Assumptions

Mitigation credits will be required for future projects and it is assumed that the price will continue being the same or increase. In total, the 58 credits purchased at La Purisima Conservation Bank have the potential to save $464,000 if the price per credit remains at $35,000 per credit. Additionally, the 45 credits purchased at the Sparling Ranch Conservation Bank have the potential to save $900,000 if the price per credit remains at $50,000 per credit. Additional savings would be achieved if the price per credit increases over time.

Savings Available for Reinvesting in the State Highway System

The $123,000 in monetary savings realized from purchasing advance mitigation credits will be available for reinvestment in the maintenance and rehabilitation of the state highway system.

NEW TECHNOLOGY

Caltrans identified the following efficiencies that are technology driven to achieve savings. In calculating the efficiencies, the cost of the technology was taken into consideration and subtracted from the savings.

1. High Reflective Material for Striping

MONETARY SAVINGS:

$16.5 MILLION

Caltrans has historically used four-inch wide painted stripes to delineate both edge and lane lines on the state highway. More recently, Caltrans began deploying six-inch wide striping that uses more durable materials such as thermoplastic (hot when applied, hardens as it cools) and tape. Both thermoplastic and tape materials are embedded with glass beads to enhance reflectivity for better visibility at night and during inclement weather. The new materials are also more durable, lasting six years compared to one-year with painted stripes. This effort is in its early stages of implementation, but Caltrans expects that all 50,000 lane miles of the state highway system will be restriped within a decade. To date, Caltrans has used the new reflective material on approximately 16,000 miles (Routes 5, 10, 15, 80, 99, and 101).

Additional benefits with the reflective stripes include:

- Longer preview distance for motorists
- Improved guidance and safety for motorists
- Less impact on motoring public and improved safety

Savings Calculation Methodology

The more durable pavement markings reduce the need for ongoing annual maintenance and frequent replacement, lowering both labor and material cost. The thermoplastic applications will have a life span 6 times the life span of paint and the 16,000 miles of striping is under warrantee for six years. The baseline used for the savings calculation was the cost of painting traffic stripes. The savings is the cost difference of maintaining and replacing approximately 16,000 miles annually with the traditional painted stripes versus thermoplastic and tape over a six-year period. The average annual savings, based on the six-year number, is approximately $16.5 million as shown below.

SAVINGS CALCULATION	TOTALS
Six-year period using the old process (edge and line paint)	$258,013,843
Less – six-year period with new process, thermoplastic stripes	($158,592,556)
Difference – savings over a six-year period	$99,421,287
Average savings per year/ six years	$16,570,214

Assumptions

The savings calculation assumes Caltrans would continue with the old process of staff painting edge and line lanes annually.

Savings Available for Reinvesting in the State Highway System

The $16.5 million in monetary savings will stay in the Maintenance and Operations program and will be available for reinvestment in the maintenance and rehabilitation of the state highway system.

2. Highway Lighting LED Retrofit

MONETARY SAVINGS:

$5.7 MILLION

In an ongoing statewide effort, Caltrans has been replacing existing high-pressure sodium (HPS) fixtures with light emitting diode (LED) lighting on highways statewide. HPS fixtures have been a mainstay on the highways 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, as compared to HPS lighting which require replacement every four-years. LEDs lights are also far more energy-efficient, reducing energy usage by 50 to 60 percent. Caltrans maintains approximately 80,000 pole-mounted streetlights statewide. As of the end of 2018-19, approximately 90 percent of the 80,000 pole mounted street lights have been replaced with LED lighting. Caltrans will continue replacing HPS with LED lighting until all lighting has been converted to LED. 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 results in a positive impact to the environment.

Savings Calculation Methodology

In calculating savings, the cost of replacing lighting using the traditional method was subtracted when compared with LED lighting as shown below:

HIGHWAY LIGHTING LED RETROFIT			
Description	**HPS Cost**	**LED Cost**	**Difference/Savings**
Energy Costs	$9,320,187	$4,660,094	$4,660,093
Estimated Labor Costs	$1,661,197	$371,206	$1,289,991
Vehicle Expenses	$218,579	$48,843	$169,736
Materials (light fixtures)	$683,620	$1,067,407	($383,787)
Total	**$11,883,583**	**$6,147,550**	**$5,736,033**

- Energy Costs — $4.6 million reduction in energy usage based on lab tested performance and industry data. The savings is the difference between HPS and LED energy usage.
- Labor Costs — $1.3 million reduction in labor cost associated with less frequent maintenance and replacement. Replacing HPS lights take approximately 18 staff per year compared to 4 staff time for LED lighting.
- Vehicle Usage — $169,736 additional savings due to the reduction of vehicles usage by maintenance crews in replacing highway lighting.
- Materials (light fixtures) — LED lighting is more expensive than HPS lighting. Therefore, it is estimated that this cost will be higher by approximately $383,787.

Assumptions

The calculations are based on the assumption that the inventory of lights will remain the same. There are 80,000 pole mounted streetlights statewide. Replacing HPS lighting with LED lighting will reduce energy needs, labor, equipment, and material costs.

Savings Available for Reinvesting in the State Highway System

The $5.7 million in monetary savings associated with this efficiency stay in the Maintenance and Operations program and have been redirected to other areas in Maintenance and Operations.

3. Global Positioning Satellites in Fleet

MONETARY SAVINGS:

$2.2 MILLION

In 2013 by executive order, all state agencies were required to reassess their vehicle fleet inventory and relinquish any vehicles that were deemed non-essential or not cost-effective. Caltrans reduced its fleet by approximately 1,300 vehicles, initiated a pilot program to evaluate the use of global positioning satellite (GPS) devices to improve fleet utilization and automate vehicle usage reporting. The pilot demonstrated that utilizing GPS devices would improve fleet management

practices. GPS installation in all light-duty vehicles (passenger cars and trucks) began in late 2013. To date, the devices have effectively eliminated the need for manual reporting of vehicle usage, while providing far more accurate data collection. By reducing the fleet, Caltrans also has reduced the cost of the smog checks. Furthermore, GPS devices dramatically improve operator safety through automatic alerts of vehicle diagnostics and location.

Savings Calculation Methodology

It is estimated that Caltrans has spent close to 17,700 hours manually logging vehicle usage each year. Approximately $1.3 million is saved annually by eliminating these manual logs. Additional savings are achieved by the elimination of smog inspections. The total efficiency savings for 2018-19 is approximately $2.2 million as shown below:

DESCRIPTION OF SAVINGS	SAVINGS
Elimination of Manual Usage Reporting (car tags)	$1,288,392
Elimination of Biennial Smog Inspections	$ 868,892
Total Savings	**$2,157,284**

Assumptions

Because vehicle use is recorded by employees working in many classifications, from Transportation Engineers to Office Technicians, the mid-range salary for the two classifications was used. It was assumed that each car tag entry took one minute per entry. Based on historical information, it was also assumed that it takes an average of two hours for a heavy equipment mechanic to take a vehicle to a smog inspection station.

Savings Available for Reinvesting in the State Highway System

The $2.2 million in monetary savings achieved with this efficiency will stay in the Maintenance and Operations program and will be available for reinvestment in the maintenance and rehabilitation of the state highway system.

4. Mobile Field Devices

COST AVOIDANCE:

$1.5 MILLION

As part of an ongoing effort to improve the project delivery process by effectively leveraging new technology, in 2017-18 Caltrans deployed 1,000 mobile field devices to enable field inspectors, resident engineers, and construction managers complete daily project diaries on site, to access electronic documents and to administer construction contracts directly from the job site. The ability to remotely access needed documentation significantly reduced the frequency of 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 allowed for elimination of unnecessary printing of millions of pages. In addition, the mobiles field devices enabled staff to immediately document on site daily construction activities. Caltrans plans to purchase additional devices which will increase the efficiency savings in future years.

Savings Calculation Methodology

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 about 17 miles. We 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 $1,500 per year over the expected life of the device which is 3 years. In total, the 1,000 devices are producing a net savings of $1.5 million annually and a total of $4.5 million over their expected 3-year life span. Additional savings are achieved from a reduction in printed documents.

Assumptions

It was assumed that all mobile field device users saved 4.4 trips per week as the survey indicated. The mobile field devices have improved the overall contract administration process by enabling construction staff to stay in constant contact with contractors and other interested parties via email.

Savings Available for Reinvesting in the State Highway System

The $1.5 million in cost avoidance achieved from this efficiency stay within the construction program and will be available for reinvestment in the maintenance and rehabilitation of the state highway system.

5. High Performance Reflective Signs

MONETARY SAVINGS:

$226,000

Caltrans has been using reflective sign sheeting materials on its overhead and roadside signs for more than two decades to enhance the safety of the traveling public. The overhead signs had attached lights to enhance visibility for the traveling public. Caltrans is now implementing higher-performance reflective materials that are more visible at night and do not require the attached lighting. The brighter, more reflective signs allow for greater visibility from longer distances. The ability to see signs from a longer distance allows all drivers the additional time to react to unexpected conditions in a safe manner. The new reflective sheeting uses the light from vehicle headlights to make signs appear brighter and easier to read. Removing the unnecessary light fixtures eliminates the utility, maintenance, and replacement costs associated with lighting the older signs. Implementation of the new signs is still in the early stages and it is estimated that it may take up to a decade to fully replace approximately 20,000 overhead signs.

Savings Calculation Methodology

Removing the unneeded lights reduces electricity usage. To date, Caltrans has replaced approximately 10 percent of the total signs across the state. Additional savings include eliminating the need for crews to inspect and repair lights and other electrical components. The projected savings, once all the overhead signs have been replaced, is $2,260,195 million annually. Because only 10 percent of the signs have been replaced, the savings for this fiscal year are $226,118.

HIGH PERFORMANCE REFLECTIVE SIGNS		
Category of Expenses	**Full Implementation Projected Annual Savings**	**Estimated Savings on 10% Implementation**
Energy Cost	$2,128,347	$212,834
Labor Cost	$439,042	$43,904
Material Cost	$81,066	$8,106
Equipment Cost	$32,740	$3,274
Less Cost of reflective signs	($421,000)	($42,100)
Total	**$2,260,195**	**$226,118**

Assumptions

The brighter, more reflective signs allow for greater visibility from longer distances. The ability to see signs from a longer distance allows all drivers the additional time to react to unexpected conditions in a safe manner.

Savings Available for Reinvesting in the State Highway System

The $226,000 in monetary savings from this efficiency will stay in the Maintenance and Operations Program and will be available for reinvestment in the maintenance and rehabilitation of the state highway system.

PROCESS IMPROVEMENTS

Caltrans has been working on making process improvements in many areas of the department. These process improvements have improved productivity and reduced project delivery costs. Some process improvements have also reduced backlog and improved customer service. The following are the process improvements identified for this report.

1. Value Analysis

COST AVOIDANCE:

$49 MILLION

Caltrans uses the Value Analysis (VA) process on individual projects to drive efficiency and add value or performance. VA is a systematic process of review and evaluation early in the project development life-cycle and it is one of the most effective 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

VALUE ANALYSIS PROJECT LIST

	Project Name	Total Project Cost	VA Study Savings	Associated Costs	Project Savings
1	San Bernardino – State Route 60 Truck Climbing and descending lanes *Improvement: Revise vertical profile and horizontal alignments and permanently close one lane in the westbound direction.*	$138,375,000	$13,454,492	$80,306	$13,374,186
2	Madera – State Route 99 Widening *Improvement: Additional Stormwater retention basins.*	$92,567,000	($1,082,550)	$49,144	($1,131,694)
3	Yuba – State Route 70 Replace Simmerly Slough Bridge # 16-0019 *Improvement: Lower entire bridge profile seven feet and shift the bridge alignment seven feet.*	$ 82,900,000	$ 9,080,000	$49,960	$9,030,040
4	Yuba – State Route 20 Timbuctoo Collision Severity Reduction. *Improvement: None of the alternatives were implemented because the project delivery team determined that further analysis was necessary due to the results of the geotechnical studies.*	$67,321,000	$0	$ 51,485	($51,485)
5	Lake – State Route 29 Improvement Project *Improvement: This VA study was combined with the one below.*	$105,218,000	$0	$0	$0
6	Lake – State Route 29 Improvement Project *Improvement: Improve cut slope from original designed slope of 4:1 to 1.5:1.*	$66,050,000	$28,426,000	$95,497	$28,330,503
7	San Diego – State Route 11 New 4 Lane Highway *Improvement: Improved delivery by splitting contracts.*	$142,529,000	$0	$71,650	($71,650)
8	Marin and Solano State Route 101 – Widen for HOV Lanes *Improvement: None of the alternatives were accepted because project phasing was no longer needed.*	$121,525,000	$0	$ 133,105	($133,105)
Total		**$816,485,000**	**$49,877,942**	**$531,147**	**$49,346,795**

forward. Recommendations, in most cases, reduce project costs. 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.

Caltrans recognizes the tremendous value in the VA process and the opportunity to generate future year efficiencies. Therefore, an internal VA policy was issued on February 5, 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 of going through the VA process. Additional savings are anticipated in future years from the lower $25 million threshold.

Savings Calculation Methodology

Caltrans identified eight projects that had VAs and achieved "Ready to List" (RTL) for construction contract advertisement status in 2018-19. Projects are RTL when plans, specifications, and estimates are complete, environmental and right-of-way clearances are secured, and all necessary permits are obtained. Four out of the eight projects achieved savings and the other four projects did not achieve savings but improved performance. For accountability and transparency purposes, we are including all eight 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 eight projects is approximately $49 million.

As recommended by the Independent Office of Audits and Investigations, future VA savings will be reported using actual bid prices when the contract is awarded instead of the current practice.

Assumptions

Assumptions related to value analysis studies are unique to each project but typically include similarities such as, construction item quantities, unit costs, overall performance, time savings, and/or other related factors.

Savings Available for Reinvesting in the State Highway System

The $49 million in savings are considered a cost avoidance that will be available for reinvestment in the maintenance and rehabilitation of the state highway system.

2. Streamlining Environmental Review — NEPA

COST AVOIDANCE:

$41.5 MILLION

Caltrans was the first in the nation to sign a Memorandum of Understanding with the Federal Highway Administration (FHWA) to assume responsibility for compliance with the National Environmental Policy Act (NEPA). This 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 teams that are working on various strategies to further streamline NEPA Assignment. These strategies will be implemented in future fiscal years.

Caltrans has achieved significant time savings by completing environmental documents approximately 13 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. Processing projects utilizing NEPA Assignment saves money through cost avoidance.

Savings Calculation Methodology

Projects that utilized NEPA assignment and completed the Project Approval and Environmental Document phase during fiscal year 2018-19 were identified. Categorical exclusions are estimated to have a one month in time savings and environmental assessments achieve 13 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 189 environmental documents completed utilizing NEPA Assignment achieving over $41 million in savings.

Assumptions

Time savings during the environmental process allows construction to begin sooner. When construction begins sooner, construction costs are lower due to capital cost escalation rates.

Savings Available for Reinvesting in the State Highway System

The $41.5 million in savings from NEPA Assignment are considered a cost avoidance. The savings will be available for reinvestment in the maintenance and rehabilitation of the state highway system.

NEPA ASSIGNMENT CATEGORIES	NUMBER OF PROJECTS	SAVINGS	ASSOCIATED COSTS	TOTAL SAVINGS
Categorical Exclusions – 1 month	174	$6,652,597		
Environmental Assessments – 13 months	13	$35,824,011		
Legal Expenses			($383,953)	
Program Staff Support			($290,234)	
Consultant Costs			($346,342)	
Totals	**187**	**$42,476,608**	**($1,020,529)**	**$41,456,079**

3. Value Engineering Change Proposals

COST AVOIDANCE:

$4.4 MILLION

Caltrans encourages contractors to develop and implement innovative approaches to construction projects through the Value Engineering Change Proposals (VECP). The VECP process encourages contractors to think outside the box and find innovative methods, materials, and technologies that are new and unique to reduce cost, save time, reduce congestion and improve quality and safety. When these new approaches result in construction cost savings, Caltrans and contractors may share the cost savings. The VECP is a formal process whereby the innovation is proposed in writing to Caltrans and the merits of the approach are examined. If the innovation is accepted and concurrence is approved, a change order is prepared to authorize the VECP and the work can begin. Money saved through VECP enables Caltrans to get additional value from their highway construction dollars. More projects can be constructed for the same amount of money and new, innovative construction solutions may be applied to future projects.

Savings Calculation Methodology

Efficiency savings were calculated based on the number of projects that had accepted VECP for fiscal year 2018-19. There was a total of 26 accepted VECP for the year, representing $4.4 million in savings. The list of the 26 VECP, along with a description, the date it was approved, and the amount of savings is shown below.

Assumptions

Money saved through VECP enables Caltrans to get additional value from their highway construction dollars. More projects can be constructed for the same amount of money and new, innovative construction solutions may be applied to future projects.

Savings Available for Reinvesting in the State Highway System

The $4.4 million in savings from VECP are considered a cost avoidance. The savings will be available for reinvestment in the maintenance and rehabilitation of the state highway system.

VALUE ENGINEERING CHANGE PROPOSALS			
#	**District and Description**	**Approval Date**	**Net Amount**
1	D1 – Modification of wall pilasters	03/15/19	($11,182)
2	D1 – Install new drainage system by jack and bore method	04/26/19	($71,348)
3	D2 – Modification of stage construction	08/23/18	($1,122,477)
4	D3 – Modification of stage construction	04/04/19	($19,243)
5	D4 – Drainage inlet adjustment	08/08/18	($41,652)
6	D4 – Modification of stage construction	09/05/18	($57,625)
7	D4 – Replace lean concrete base with class 2 aggregate base	10/25/18	($175,468)
8	D4 – Replace rubberized hot mix asphalt with hot mix asphalt	11/13/18	($85,145)
9	D4 – Eliminate willow median K-rail	11/20/18	($81,323)
10	D4 – Delete stage construction 2-2 temporary work	11/20/18	($334,376)
11	D4 – Stage Construction 2 detour – leave stage construction 1A temporary pavement section in place in lieu of remove and replace detour	12/05/18	($8,113)
12	D4 – Modification of stage construction	05/22/19	($113,578)
13	D4 – Eliminate contract items and provide lane closures	06/11/19	($52,089)
14	D4 – Modify sequence of stage construction, paving limits of hot mix asphalt	06/13/19	($50,995)
15	D6 – Replacement of plan sheet	07/16/18	($1,975)
16	D6 – Accelerated schedule of permanent erosion control	12/15/18	($106,258)
17	D6 – Revise temporary detour structural section	01/22/19	($138,871)
18	D6 – Modification of stage 1 traffic handling plan	04/25/19	($81,610)
19	D7 – Revise roadway structural section	07/30/18	($544,117)
20	D7 – Modification of structural painting requirements	12/11/18	($202,918)
21	D8 – Eliminate imported borrow	04/17/19	($684,302)
22	D8 – Modification of median structural section	05/06/19	($30,643)
23	D11 – Utilization of Tensar fabric in order to reduce aggregate base thickness within state right of way	08/06/18	($18,793)
24	D11 – Revise roadway structural section	08/15/18	($299,737)
25	D11 – Stage construction 2A re-stage by eliminating the stage construction 1A temporary paving	09/21/18	($74,086)
26	D11 – Eliminate planned placement of temporary zone guard barrier system	10/25/18	($26,850)
Total Savings			**$4,434,774**

4. Process Improvements through Lean 6 Sigma

Caltrans was one of several state agencies to pilot the Lean Six Sigma (L6S) program, designed to pinpoint waste and inefficiencies. Since then, Caltrans has completed over 50 projects statewide. The L6S approach is designed to drive innovation and produce substantial results using a data-driven, focused approach to organizational issues. L6S accomplishes process transformations by integrating a set of powerful improvement tools with a five-phase methodology. This methodology forms the roadmap for organizations to transform its processes and culture. The five phases are: Define, Measure, Analyze, Improve, and Control. The following process improvements were identified as having the potential for significant reduction in processing time and potential savings. Some of these process improvements achieved savings and others improved productivity and reduced backlogs.

1. Outdoor Advertising Relocation Agreement Time Reduction

Savings: 25 Days

Caltrans regulates the placement of outdoor advertising displays visible on state highways and regularly reviews and enforces outdoor advertising requirements under the Federal Highway Beautification Act and the State's Outdoor Advertising Act. Caltrans improved customer service by reducing the processing time to reach a settlement agreement to relocate outdoor advertising displays subject to condemnation pending a Caltrans or local highway project. Relocation agreements are now settled following a standardized process which significantly reduced the processing time to reach a settlement and provides consistency and more equitable treatment to industry stakeholders. Relocation agreements normally took an average of 90 days to settle. Three relocation agreements were completed in 2018-19 and took 22, 70 and 153 days to complete. By standardizing and streamlining the process, Caltrans improved their customer service and reduced processing time.

2. Encroachment Permitting Time Reduction

Savings: 55 Days

Caltrans issues encroachment permits when there is a request to encroach on the State right of way either temporarily or permanently. The encroachment permit ensures the safety of the traveling public, highway workers and permittees, and protects the State's and public's investment in the highway facility. The approval or denial of encroachment permit applications were taking an average of 85 days. As part of the L6S effort, the process to review a permit application was streamlined and standard operating procedures were developed and implemented as a pilot. In 2018-19, the pilot issued 1,201 permits. Of those, 1,149 permits were issued within the 30-day timeframe. Lessons learned from this pilot project resulted in modifications to the current process and statewide implementation is expected in 2019-20.

3. New Product Evaluation Time Reduction

Savings: 144 Days

New product evaluations have undergone several changes to improve the program's efficiency and overall effectiveness. The objective of this L6S process was to reduce processing time for 95 percent of new product evaluations. The changes implemented take a proactive approach that places more responsibility on the vendors before submitting products for consideration. As a result, the program has seen improvements in processing as well as a dramatic decrease in the backlog of outstanding submittals. Specifically, a new Vendor Submittal Guide was

created to assist vendors in submitting a new product to the Department. The process distinguishes a new product from a product that meets the criteria for an Authorized Material List (AML). An AML is a family of products that must meet specified authorization criteria. Vendors are required to submit third party laboratory test data to demonstrate conformance, reducing the workload placed on Caltrans' technical committees.

This process improvement reduced the overall turnaround time from an average of 931 days to 144 days. Another benefit from this process improvement was decreasing the backlog of outstanding submittals. The backlog in April 2017 consisted of 284 open submittals and as of July 2019, it is reduced to 98.

4. Reduction of Processing Time of Plans Specifications and Estimates Contract Documents

Cost Avoidance: $1.4 million

Preparing roadway contract documents was taking 24 weeks which increased costs and delays to construction. The objective of this L6S process improvement was to reduce processing time from 24 to 12 weeks. This process improvement recommended revised checklists, templates and clarified requirements. It also scheduled standard safety and constructability reviews early in the process to identify potential issues and reduce re-work by functional groups. Additionally, staff started working on advanced coordination with utility companies, improving the utility mapping process to accelerate resolution conflict relocations with earlier design information, earlier environmental permit application submittals and improving the project initiation document process to better scope, schedule and resource projects with earlier involvement. In addition to the streamlined process described above, Caltrans piloted the use of the "Exception to Advertise before the California Transportation Commission Allocation" on 15 projects in 2017-18 and achieved $526,127 in savings.

In 2018-19, 20 projects followed this process and achieved $1,378,244 in cost avoidance. Additional savings could be achieved from a reduction in change orders due to the improved PS&E quality.

Savings Calculation Methodology: Savings were calculated by multiplying the construction capital amount by the approved escalation rate and the number of days advertised early.

Savings available for Reinvesting in the Highway System: The $1.4 million in cost avoidance achieved with this process improvement will be available for reinvestment in the maintenance and rehabilitation of the state highway system.

5. Fleet Acquisition Planning Time Reduction

Monetary Savings: $191,000

Typically, approval of the Fleet Acquisition Plan (FAP) takes up to two years to obtain approval causing long delays for new vehicles and equipment to be delivered to Caltrans' functional programs. The objective of this L6S process improvement is to reduce this approval time to 6 months. This process improvement reduced the process from 25 steps to 6 steps; updated replacement and retention standards; developed justification templates; and implemented workshops in all districts. Preliminary results show a reduction in processing time from 243 days to 59 days.

Savings Calculation Methodology: Processing time went down from 243 days to 59 days or a reduction of 134.9 days for two staff or $144,882. Additionally, the 5-year Fleet Acquisition plan was delivered which means no FAP was necessary for 2018-19, resulting

in additional savings of $46,504 for a total annual savings of $191,386.

Savings available for Reinvesting in the Highway System: The $191,000 in monetary savings achieved with this process improvement will be available for reinvestment in the maintenance and rehabilitation of the state highway system.

6. Building Projects Design Time Reduction

Savings: Future Years

The Office of Transportation Architecture and Office of Electrical, Mechanical, Water and Wastewater Engineering are responsible for developing Plans, Specifications and Estimates (PS&E) for building projects statewide. Currently, it takes an average of 455 days and includes 14 milestones for a standard building type (e.g. pump houses, equipment shops, roadside rest areas, toll plazas). The objective of this L6S is to reduce the time it takes to deliver PS&E for a standard building project from 455 to 90 calendar days. This process improvement developed standard designs and new plan layouts for non-custom facilities; created a catalog of design options for standard building types and systems selection meeting before starting PS&E; established new process map with an expedited schedule for projects selected from the catalog; and reduced the number of milestones from 14 to 7 or half of the original milestones.

Implementing all these solutions resulted in reducing the average number of days from 455 to 260 days or approximately 43 percent. As the scope of these projects get finalized using the checklist, further efficiencies are anticipated in support costs. It is assumed that customers will select a standard building design from the catalog and the systems in the facility are selected before PS&E starts. Monetary savings or cost avoidance will be calculated in future years when more data is available.

7. Asphalt Materials Sample Testing

Savings: 21 days

The Asphalt Binder Laboratory in the Materials Engineering and Testing Services (METS) Office of Roadway Materials Testing is responsible for testing asphalt materials for quality assurance on construction contracts and for supplier-certification. The purpose of this process improvement was to reduce the time it takes to process asphalt binder samples, from the time the sample is received at Asphalt Binder lab to the time the results are sent to the Resident Engineer. Several critical issues were identified in the old process, clear procedures for sample login, test result reporting and technician back up were developed and implemented.

Process improvements have been implemented and turnaround times improved from 48 to 21 days.

8. Traffic Collision Investigation Report Processing Time Reduction

Monetary Savings: $1 million

Caltrans investigates identified collision locations to reduce the number of fatalities on the State Highway System. Traffic Investigation Reports are used to complete the investigations. As part of the L6S effort, the process to investigate identified collision locations and prepare Traffic Investigation Reports was streamlined and standard procedures were developed. The streamlined process was used in one district as a pilot and it showed a reduction in the average time to complete a Traffic Investigation Report from 57 hours to 26 hours. The lessons learned from this pilot project resulted in modifications to the current process and the modified process is scheduled to be implemented statewide in 2019-20.

Savings Calculation Methodology: Savings were calculated in the pilot district by calculating the traffic investigation report production hours and dividing it by the number of investigation reports. The calculations showed savings of $928,898 in labor hours. These savings will be used to ensure there are no backlog in investigations.

Savings available for Reinvesting in the Highway System: The $1 million in monetary savings achieved with this process improvement may not be available for the reinvestment in the state highway system.

9. Construction Support Costs Reduction

Monetary Savings: $476,000

Caltrans noted a need to reduce construction support costs because they were about 50 percent of project development costs. The objective of this L6S process improvement is to reduce construction support costs for surveys, earthwork, and working days from the current average of 260 days. This process improvement implemented automated machine guidance on the State Route 191 pilot project. The new technology reduced inspection and survey crew time. In addition, the Construction Manual was updated to establish a "level of inspection" standard for item work activities and clarified inspection frequency standards for staff. Implementing this process improvement achieved efficiencies in survey support and construction earthwork support.

Savings Calculation Methodology: Savings were calculated by determining the baseline number of hours and associated cost before the pilot and after the pilot. Overall, there was a reduction of 2,100 hours in survey support representing $210,000 and 2,130 hours in earthwork support representing $266,000. In total the process improvement achieved savings of $476,000.

SAVINGS CALCULATION	SURVEY SUPPORT	EARTHWORK SUPPORT
Baseline before L6S	$300,000	$470,000
Less actual after L6S	($90,000)	($204,000)
Savings	$210,000	$266,000

Savings available for Reinvesting in the Highway System: The $476,000 in savings achieved with this process improvement will be available for reinvestment in the maintenance and rehabilitation of the state highway system.

10. Equal Employment Opportunity (EEO) Program

Monetary Savings: $35,000

The EEO Program implemented a L6S effort for its investigations process and successfully reduced the turn-around time for discrimination complaint investigations. Before the L6S process review, discrimination complaint investigations had a backlog of over 100 cases. The objective of this process improvement was to eliminate the backlog, and complete investigations within 45 days from receipt of complaint without eliminating any of the necessary steps taken in the investigative process. In addition, implemented a timeline with milestones for each investigation and streamlined some of the steps. Before the process improvement, only 7 percent of cases were meeting the 45-day target.

Efficiency Savings Calculation: In 2018-19, the backlog was reduced to zero and 200 out of 309 cases were closed within 45 business days. Efficiency savings are estimated at $35,000 for the 2018-19 fiscal year.

Savings available for Reinvesting in the Highway System: The $35,000 in monetary savings achieved with this process improvement will not be available for the reinvestment in the state highway system.

11. Formal Disciplinary Action Processing Time Reduction

Monetary Savings: $79,000

Formal disciplinary actions were taking an average of 99 days to process. Delays resulted in the perception of ineffectiveness and lack of accountability. Furthermore, failure to address employee issues may potentially effect morale, disrupt the workplace and create a hostile work environment. The objective of this L6S process improvement was to reduce the time of processing the disciplinary actions to an average of 14 days without compromising any of the required steps in the investigative process. The process improvement determined that each case manager was performing 17 percent of unnecessary functions such as duplicate reviews, and other unnecessary administrative functions, to produce one adverse action. The 17 percent spread over 6 case managers equaled one case manager position. Implementing the process improvement reduced the average number of days to process a disciplinary action from 99 days to 15 days for 2018-19.

Efficiency Savings Calculation: Savings associated with one less case manager was calculated at $79,000. Additional benefits include improved morale and more discipline training to the entire department.

Savings available for Reinvesting in the Highway System: The $79,000 in monetary savings achieved with this process improvement will not be available for the reinvestment in the state highway system.

12. Local Assistance Progress Invoice Improvements

Savings: Future Years

Caltrans Local Assistance Program and Local Program Accounting reviews invoices to reimburse local agencies. Invoices submitted typically had errors and omissions that required unnecessary rework, multiple reviews, and delay in processing reimbursement to the local agencies. In addition to invoice errors and omissions, the invoice process needed to be documented and standardized statewide. The L6S team consolidated nine old forms into one dynamic invoice builder form with formulas and warning controls, developed instructions and standard review procedures, and conducted statewide training for districts and local agencies. The objective of this L6S was to reduce errors by 90 percent. The invoice builder was piloted in one district and achieved 70 percent reduction in errors. Savings will be achieved from spending less time correcting invoices by Caltrans and local agencies. The data to establish a baseline to be able to calculate cost savings is still being collected. Savings will be reported in future years.

FUTURE EFFICIENCIES

As required by SB 1, Caltrans is committed to implementing efficiency measures with the goal of generating at least $100 million dollars annually and reporting to the California Transportation Commission. New opportunities to generate efficiencies are being considered and will require implementation strategies. Caltrans continues to evaluate and deploy new technologies, innovative tools, and process improvements to identify efficiencies. The following opportunities are being evaluated for potential savings in future years.

- **Advance Mitigation Program** — Caltrans established an Advance Mitigation Program to plan and implement advance mitigation solutions for its future transportation projects. The new business practice allows Caltrans to reduce delays by proactively obtaining environmental mitigation in advance of transportation projects. The primary goal of the program is to address long term future environmental needs resulting in improved environmental, economic and project delivery outcomes. Draft guidelines have been developed and are currently moving through the review process. Once fully implemented, the program is expected to achieve savings from faster project delivery.

- **Streamlining the Permitting Process** — As required by Assembly Bill 1282, a task force will be developing a detailed analysis of the existing permitting process for transportation projects in California. This effort should result in significant savings as the analysis will identify points of delay where projects can be combined in the project development and permit process. The task force will include management from Caltrans, the State Water Resources Control Board, the California Department of Fish and Wildlife, the California Coastal Commission, and the High- Speed Rail Authority.

- **Project Bundling** — Project bundling is a proven method of streamlining the project delivery process by bringing together multiple projects under a single contract award to achieve time or cost savings. A bundled contract can cover a single county, or district, and may include a combination of work types, including design, preservation, rehabilitation, or complete replacement. Bundling projects expedites timelines by streamlining various requirements, such as environmental agreements and standardized design. In addition, projects with shared features can leverage design expertise to lower overall cost through economies of scale and reduced procurement times. Significant savings are anticipated next fiscal year from two projects. One of the projects will upgrade traffic signals and the other project will improve pedestrian access facilities to reduce collision severity.

- **Unmanned Aircraft Systems (UAS)** — Implementing UAS technology will increase safety, improve efficiency, and decrease operational costs in surveys, bridge inspections, environmental investigations and non-precision aerial photography.

- **Early Design in Project Approval and Environmental Document (PA&ED)** — Implementing early design in PA&ED will shorten design time in the plans, specifications and estimates phase and will accelerate time to get projects into construction.

- **Accelerated Bridge Construction (ABC)** — ABC employs innovative design and construction methods to reduce the number of construction days and construction related impacts. Methods include fabricating bridge parts away from traffic and quickly assembling them onsite in a matter of weeks.

- **Traffic Windows** — Implementing longer traffic windows to reduce construction project duration while minimizing overall traffic impacts will reduce the delay to the public. Efficiencies may arise from reduced design support needed to create traffic management plans.

- **Improved Traveler Information** — A new version of the Caltrans Highway Information Network (CHIN) will be rolled out, allowing data to flow directly from the Traffic Management Centers to the CHIN webpage and phone service. The new CHIN will eliminate the need for Headquarters to manually input the information and Caltrans will be able to improve emergency response time.

- **Corridor Management** — This efficiency will develop and review corridor strategies for defined routes. This will allow Caltrans to more effectively, plan, and develop an investment strategy for a corridor and obtain buy-in from partnering agencies on projects.

- **National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) Reciprocity** — Receiving approval to use one document, NEPA or CEQA will save staff time and reduce delivery time.

- **Printer Efficiency Reduction** — Caltrans Information Technology recently conducted a printer efficiency project that is expected to result in cost savings. The estimated savings are anticipated from having to replace less printers, less use of paper and toner and reduced energy consumption.

- **Architectural and Engineering (A&E) Contracts Process** — The Division of Procurement and Contracts reviewed its A&E contracting process and identified eight areas of improvements. The areas of improvement include eliminating specific forms or combining them to be more efficient, using checklists, where appropriate, and reducing the negotiations phase from 41 days to 11 days.

- **Innovation Station** — Innovation Station is Caltrans' online innovation platform. Employees can collaborate on ideas for a variety of sponsored, targeted initiatives. One of the challenges for the 2018-19 fiscal year was "Better, Faster, Cheaper" which focused on ideas to make Caltrans be more efficient. During the challenge, employees submitted ideas that were subsequently reviewed, and a feasibility study was completed to determine the requirements for implementation. Moving forward a group of subject matter experts will analyze the feasibility of implementing the idea and will recommend implementation or additional vetting with the functional area. Once the ideas are implemented, significant savings can be achieved in future years.