

Caltrans Fiscal Year 2020-21 Efficiencies Report Appendix

Assumptions, Methodologies, Project Lists, and Supporting Information for Fiscal Year 2020-21 Efficiencies. To view the full report visit

<http://rebuildingca.ca.gov/efficiencies>

Type One Appendix

Municipal Coordination Grant Program

Description:

Caltrans is required to comply with the National Pollutant Discharge Elimination System (NPDES) Permit issued by the State Water Resources Control Board (SWRCB) that regulates stormwater discharges from Caltrans right of way (ROW). The NPDES Permit requires Caltrans to capture and remove pollutants such as toxic metals, oil, and sediment from stormwater runoff from roadways by constructing roadside treatment devices such as biofiltration swales and sand filters. Caltrans secures NPDES Permit compliance credits by constructing stormwater treatment devices in water quality impaired Total Maximum Daily Load (TMDL) areas.

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

It is challenging to design, construct, operate, and maintain stormwater treatment devices on Caltrans ROW due to the limited availability of suitable devices appropriate for the high-speed freeway environment. Due to the linear nature of the State Highway System, limited real estate precludes on-system opportunities which may result in safety concerns for the traveling public and crews that maintain these devices.

Local municipalities, on the other hand, have a range of land uses (including open space such as parks) and storm water runoff characteristics that facilitate

implementation of a greater assortment of BMPs feasible for deployment. This includes small footprint BMPs, such as drain inlet inserts and tree/planter boxes, that can be placed lower speed municipal roadways. These devices are not suitable for Caltrans due to their required frequent maintenance and associated safety concerns. Local municipalities also occupy a much greater percentage of the watershed creating opportunities for large scale regional treatment facilities that result in economies of scale, providing a much lower per-acre treatment cost. Off-system devices that remove stormwater pollutants and trash from both Caltrans and local ROWs, that are maintained by local partners, offer a fiscally responsible mechanism for Caltrans to meet NPDES permit obligations while providing the optimized environmental outcome.

The NPDES Permit encourages Caltrans to partner with local municipalities to fund regional water quality treatment projects to facilitate a cost-effective approach to Permit compliance. Off-system projects provide substantial benefit to water quality as they treat both Caltrans and local municipality ROWs while maximizing the return on investments. The State Board allows NPDES Permit compliance through alternative compliance, or “in lieu of Caltrans ROW treatment”, when Caltrans participates as a funding partner for off-system partnership projects; maximizing compliance credits, minimizing cost, and avoiding increased maintenance inventory.

The Caltrans Stormwater Grant Program generates one compliance unit for each \$88,000 that Caltrans contributes towards coordinated water quality efforts, as recognized by the State Water Resources Control Board. Funding projects outside the Caltrans ROW mitigates the limited space, access, or safety concerns within Caltrans ROW; provides opportunities for implementation of BMPs and other solutions not traditionally available to Caltrans; and produces larger scale projects on the watershed level and the associated economies of scale. The financial equivalent for treatment devices within Caltrans ROW is \$176,000 per CU, therefore, the SWRCB acknowledges a 50% discount in the Caltrans Permit toward compliance unit credits when partnering with local municipalities (See Attachment 1).

Between FY 2014/15 to FY 2019/21, Caltrans has provided over \$163 Million in funding contribution toward municipal partnership projects throughout the State that has generated stormwater permit compliance credit for Caltrans through the Stormwater Grant Program.

Table 1: Municipal Coordination Encumbrances

| FY 15 | FY 16 | FY 17 | FY 18 | FY 19 | FY 20 | FY 21 |
|----------|----------|----------|----------|----------|----------|----------|
| \$10.5 M | \$14.7 M | \$28.6 M | \$24.4 M | \$26.5 M | \$27.8 M | \$30.7 M |

Local municipalities are required to submit invoices within three years of the encumbrance date to secure reimbursement as the projects are designed and constructed. Each year, Caltrans is then eligible to secure compliance units for the reimbursement expenditures issued to municipalities at a rate of 1 compliance unit per \$88,000.

Table 2: Municipal Coordination Expenditures & Equivalent Compliance Units

| | Invoiced Expenditures | Compliance Units Granted per each \$88K |
|--------------|-----------------------|---|
| FY 19 | \$20,240,000 | 230 |
| FY 20 | \$ 30,624,000 | 348 |
| Total | \$ 50,864,000 | 578 |

Anticipated Efficiency Avoidance:

The Stormwater Grant Program, as authorized by the NPDES Permit, provides a funding mechanism for off-system regional treatment devices that has resulted in cost avoidance efficiencies that are realized through Caltrans ability to secure CU credits. Caltrans secured CU credits by funding municipal partnership projects and avoided the need to invest funding for traditional on-system stormwater treatment devices in those same watershed areas.

Efficiency Calculation Methodology:

The average unit cost to construct a traditional on-system treatment device is \$176,000 / treatment acre, as documented in the NPDES Permit (Attachment 4). Cost avoidance has been realized by securing NPDES CU credit, by funding municipal partnership projects, at a rate of \$88,000 per compliance unit, as documented in the NPDES Permit (Attachment 1).

The State Board acknowledges a 50% discount by granting compliance units at a rate of 1 CU for every \$88,000 of funding contribution toward municipal partnership projects. The net cost avoidance is realized when Caltrans receives CUs from the SWRCB for the off-system projects funded through submission of Annual Total Maximum Daily Load Status Reports.

In FY 19 and FY 20, Caltrans has received 578 compliance units from reimbursement of funding commitments toward the success of municipal partnership projects. Therefore, Caltrans does not have to construct on-system treatment devices to address 578 acres of ROW where municipal coordination

compliance unit credits have been granted, resulting in \$50,864,000 Million in cost avoidance in FY 19 and FY 20.

Calculation:

- Average Caltrans stormwater treatment device unit cost: \$176,000/acre (Noted in the 2012 NPDES Permit)
 - Average municipal coordination stormwater treatment device unit cost: \$88,000/acre (Noted in the 2012 NPDES Permit)
 - Compliance units are calculated at a discount rate of \$88,000 / CU for municipal coordination (Noted in the 2012 NPDES Permit)
1. Stormwater Grant Program Funded \$50,864,000 resulting in = 578 CUs
 2. Caltrans On-System cost to deliver 578 CUs @ \$176,000/acre= \$101,728,000
 3. Cost Avoidance = \$101,728,000 - \$50,864,000 = **\$50,864,000**

Types of Documentation to Calculate Efficiency:

- Caltrans NPDES Permit, Waste Discharge Requirements in Conformed order 2012-0011-DWQ, as amended by 2014-0006-EXEC, 2014-0077-DWQ, and 2015-0036-EXEC, effective 4/7/2015
- March 2019 SWRCB letter regarding compliance unit credit approval
- July 2021 SWRCB letter regarding compliance unit credit approval
- FY 19, & FY 20 Total Maximum Daily Load Status Reports

Cost Avoidance through Open-Graded Friction Course

Caltrans has worked in partnership with regulatory agencies to explore innovative and cost-effective alternatives to capture stormwater pollutants prior to reaching water bodies. Stormwater treatment devices can be very expensive to construct, and therefore, Caltrans has worked with partners to explore innovative and cost-effective alternatives to capture stormwater pollutants prior to reaching water bodies.

In 2019, Caltrans secured 285 acres of stormwater treatment compliance credits utilizing Open-graded friction course (OGFC) pavements constructed to address pavement preservation needs. Caltrans OGFC pavements perform as an approved treatment Best Management Practice (BMP) and qualify for stormwater treatment compliance credit in Total Maximum Daily Load (TMDL) 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 pollutants from stormwater generated from Caltrans roadways.

Caltrans is required to comply with the National Pollutant Discharge Elimination System (NPDES) permit issued by the State Water Resources Control Board (SWRCB) that regulates stormwater discharges from Caltrans Right of Way. The NPDES permit requires Caltrans to capture and remove pollutants, such as toxic metals and sediment, from roadway stormwater runoff 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 TMDL areas.

It is Caltrans practice to construct OGFC as appropriate to address pavement preservation needs such as drainage improvement, improved visibility, and noise reduction. Caltrans documented the stormwater pollutant removal efficiencies through a multiyear monitoring study throughout the state comparing the effectiveness of OGFC throughout its life cycle. As Stormwater flows through the porous OGFC voids, pollutants are captured with the pavement section, resulting in cleaner stormwater flowing from the side of the pavement.

Approval of OGFC as a stormwater treatment BMP has resulted in cost avoidance efficiencies. OGFC is a treatment tool that Caltrans uses to secure NPDES stormwater credits. Caltrans submitted 285 acres of OGFC compliance unit credits to the SWRCB in the 2018-19 Stormwater Annual Report. Formal compliance credit approval by the SWRCB for the 285 acres of FY 2018-19 OGFC pavement in TMDL areas will avoid the need to construct traditional stormwater treatment devices in those areas. These credits were formerly approved in 2021 and are included in this report.

On average, Caltrans spends approximately \$176,000 in construction capital costs to treat stormwater runoff from one acre of Caltrans Right of Way through traditional treatment devices. Caltrans does not have to construct traditional stormwater treatment devices to address 285 acres of Right of Way where OGFC credits have been granted resulting in cost avoidance efficiency.

| | |
|---|---------------------|
| Cost of Traditional Treatment Device | \$50,160,000 |
| 285 acres x \$176,000 per acre¹ | |
| Total Cost Avoidance | \$50,160,000 |

¹Average stormwater treatment device unit cost as noted in the 2012 NPDES Permit. These 285 compliance units are from new construction and not claimed in previous years. There is one project in District 2, two projects in District 4, and one project in District 5.

OGFC Compliance Unit Summary per District

| District | OGFC Compliance Units (FY 2018-2019) |
|--------------|--------------------------------------|
| 1 | 0 |
| 2 | 57 |
| 3 | 0 |
| 4 | 227.8 |
| 5 | 0.5 |
| 6 | 0 |
| 7 | 0 |
| 8 | 0 |
| 9 | 0 |
| 10 | 0 |
| 11 | 0 |
| 12 | 0 |
| Total | 285 |

The average unit cost for traditional stormwater treatment devices is \$176,000 per acre. Caltrans will continue to receive stormwater TMDL treatment credits for OGFC constructed for pavement preservation purposes.

The \$50.2 Million in State Highway Operation and Preservation Program cost avoidance associated with the OGFC stormwater permit compliance credits will be available for the maintenance and rehabilitation of the State Highway System.

High Reflective Materials for Striping

2017-18 Contract

BASELINE QUANTITY

| MATERIAL TYPE | QUANTITY | QUANTITY | PROCESS |
|--------------------------------|------------|------------|--------------|
| | LINE MILES | LINE FEET | |
| PAINT ALL LINES | 16,602 | 87,657,120 | Old Practice |
| EDGE LINE THERMOPLASTIC | 9,555 | 50,449,200 | New Practice |
| LANE LINE THERMOPLASTIC | 2,823 | 14,905,700 | New Practice |
| LANE LINE TAPE | 4,224 | 22,302,220 | New Practice |

INITIAL APPLICATION COST PER LINEAR FEET

| INITIAL COSTS PER LINEAL FOOT | 6" LANE LINE | 6" EDGE LINE | 6" LANE LINE | 6" EDGE LINE | 6" LANE LINE |
|---------------------------------------|--------------|--------------|--------------|--------------|--------------|
| | PAINT | PAINT | THERMO | THERMO | TAPE |
| INITIAL STRIPING COST PER LINEAL FOOT | \$0.32 | \$0.46 | \$0.56 | \$0.83 | \$1.99 |
| TRAFFIC CONTROL COST (\$/L.F.) | \$0.09 | \$0.09 | \$0.09 | \$0.09 | \$0.09 |
| TOTAL INITIAL COST PER LINEAR FOOT | \$0.41 | \$0.55 | \$0.65 | \$0.92 | \$2.08 |

RE-APPLICATION COST PER LINEAL FOOT

| APPROPRIATE REAPPLICATION MATERIAL | 6" LANE LINE | 6" EDGE LINE | 6" LANE LINE | 6" EDGE LINE | 6" LANE LINE |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|
| | PAINT | PAINT | THERMO | THERMO | TAPE |
| Reapplication Material Life (Yrs.) that maintains minimum reflectivity | 1 | 1 | 3 | 3 | 6 |
| No. Of Reapplications with Appropriate Material | 5 | 5 | 1 | 1 | 0 |
| Reapplication Cost Per Year | \$0.41 | \$0.55 | \$0.65 | \$0.92 | \$0.00 |
| 5 YEARS TOTAL REAPPLICATION COSTS PER LINEAL FOOT | \$2.05 | \$2.75 | \$0.65 | \$0.92 | \$0.00 |
| 6 YEARS TOTAL COSTS PER LINEAL FOOT | | | | | |
| | \$2.46 | \$3.30 | \$1.30 | \$1.84 | \$2.08 |

TOTAL COST USING PAINT FOR A 6 YEAR PERIOD

| OLD PROCESS COST PER 6 YEARS | | | | |
|-------------------------------------|---------------------------|---------------------------|----------------|----------------------|
| | QUANTITY LINE MILE | QUANTITY LINE FEET | COST/LF | TOTAL COST |
| EDGE LINE PAINT | 9,555 | 50,449,200 | \$3.30 | \$166,482,360 |
| LANE LINE PAINT | 7,047 | 37,207,920 | \$2.46 | \$91,531,483 |
| | | | | \$258,013,843 |

| NEW PROCESS COST PER 6 YEARS | | | | |
|-------------------------------------|---------------------------|---------------------------|----------------|----------------------|
| | QUANTITY LINE FEET | QUANTITY LINE MILE | COST/LF | TOTAL COST |
| EDGE LINE THERMOPLASTIC | 9,555 | 50,449,200 | \$1.84 | \$92,826,528 |
| SKIP LINE THERMOPLASTIC | 2,823 | 14,905,700 | \$1.30 | \$19,377,410 |
| SKIP LINE TAPE | 4,224 | 22,302,220 | \$2.08 | \$46,388,618 |
| | | | | \$158,592,556 |

SAVINGS PER 6 YEAR PERIOD = \$258,013,843 - \$158,592,556 = \$99,421,288

SAVINGS PER YEAR = \$99,421,288 / 6 = \$16,570,214

OR \$16.5 Million

| | YEARLY SAVINGS (Millions) | | | | | |
|--|----------------------------------|--------------|--------------|--------------|--------------|--------------|
| | 17-18 | 18-19 | 19-20 | 20-21 | 21-22 | 22-23 |
| SB1 Phase I Striping Projects Efficiencies 17-18 | \$16.50 | \$16.50 | \$16.50 | \$16.50 | \$16.50 | \$16.50 |

2018-19 Contract

BASELINE QUANTITY

| MATERIAL TYPE | QUANTITY LINE MILES | QUANTITY LINE FEET | PROCESS |
|--------------------------------|----------------------------|---------------------------|----------------|
| PAINT ALL LINES | 9026 | 47,658,821 | Old Practice |
| EDGE LINE THERMOPLASTIC | 5,800 | 30,621,960 | New Practice |
| LANE LINE THERMOPLASTIC | 1,182 | 6,243,321 | New Practice |
| EDGE LINE (WARRANTY) | 391 | 2,065,660 | New Practice |
| LANE LINE (WARRANTY) | 1,653 | 8,727,880 | New Practice |

INITIAL APPLICATION COST PER LINEAR FEET

| INITIAL COSTS PER LINEAL FOOT | 6" LANE LINE | 6" EDGE LINE | 6" LANE LINE | 6" EDGE LINE | 6" LANE LINE | 6" EDGE LINE |
|---|---------------|---------------|---------------|--------------|---------------|---------------|
| | PAINT | PAINT | THERMO | THERMO | WARRANTY | WARRANTY |
| INITIAL STRIPING COST PER LINEAL FOOT | \$0.32 | \$0.46 | \$0.65 | \$0.83 | \$1.82 | \$1.97 |
| TRAFFIC CONTROL COST (\$/L.F.) | \$0.17 | \$0.17 | \$0.17 | \$0.17 | \$0.17 | \$0.17 |
| TOTAL INITIAL COST PER LINEAR FOOT | \$0.49 | \$0.63 | \$0.82 | \$1.0 | \$1.99 | \$2.14 |

RE-APPLICATION COST PER LINEAR FEET

| APPROPRIATE REAPPLICATION MATERIAL | 6" LANE LINE | 6" EDGE LINE | 6" LANE LINE | 6" EDGE LINE | 6" LANE LINE | 6" EDGE LINE |
|--|---------------|---------------|---------------|--------------|---------------|---------------|
| | PAINT | PAINT | THERMO | THERMO | WARRANTY | WARRANTY |
| Reapplication Material Life (Yrs.) that maintains minimum reflectivity | 1 | 1 | 3 | 3 | 6 | 6 |
| No. Of Reapplications with Appropriate Material | 5 | 5 | 1 | 1 | 0 | 0 |
| Reapplication Cost Per Year | \$0.49 | \$0.63 | \$0.82 | \$1.0 | \$0.00 | \$0.0 |
| 5 YEARS TOTAL REAPPLICATION COSTS PER LINEAL FOOT | \$2.45 | \$3.15 | \$0.82 | \$1.0 | \$0.00 | \$0.0 |
| | | | | | | |
| 6 YEARS TOTAL COSTS PER LINEAL FOOT | \$2.94 | \$3.78 | \$1.64 | \$2.0 | \$1.99 | \$2.14 |

TOTAL COST USING PAINT FOR A 6 YEAR PERIOD

| OLD PROCESS COST PER 6 YEARS | | | | |
|-------------------------------------|---------------------------|---------------------------|----------------|----------------------|
| | QUANTITY LINE MILE | QUANTITY LINE FEET | COST/LF | TOTAL COST |
| EDGE LINE PAINT | 6,191 | 32,687,620 | \$3.78 | \$123,559,203 |
| LANE LINE PAINT | 2,835 | 14,971,201 | \$2.94 | \$44,015,330 |
| | | | | \$167,574,533 |

| NEW PROCESS COST PER 6 YEARS | | | | |
|-------------------------------------|---------------------------|---------------------------|----------------|---------------------|
| | QUANTITY LINE MILE | QUANTITY LINE FEET | COST/LF | TOTAL COST |
| EDGE LINE THERMOPLASTIC | 5,800 | 30,621,960 | \$2.0 | \$61,243,920 |
| LANE LINE THERMOPLASTIC | 1,182 | 6,243,321 | \$1.64 | \$10,239,046 |
| EDGE LINE WARRANTY | 391 | 2,065,660 | \$2.14 | \$4,420,512 |
| LANE LINE WARRANTY | 1,653 | 8,727,880 | \$1.99 | \$17,368,481 |
| | | | | \$93,271,959 |

SAVINGS PER 6 YEAR PERIOD = \$167,574,533- \$93,271,959= \$74,302,574

SAVINGS PER YEAR = \$74,302,574/ 6 = \$12,383,762

OR \$12.4 Million/Year starting FY 18-19 through FY 23-24

2019-20 Contract

BASELINE QUANTITY

| MATERIAL TYPE | QUANTITY | QUANTITY | PROCESS |
|--------------------------------|------------|------------|--------------|
| | LINE MILES | LINE FEET | |
| PAINT ALL LINES | 3,209 | 16,897,570 | Old Practice |
| EDGE LINE THERMOPLASTIC | 1,852 | 9,779,670 | New Practice |
| LANE LINE THERMOPLASTIC | 266 | 1,405,420 | New Practice |
| EDGE LINE (WARRANTY) | 224 | 1,185,000 | New Practice |
| LANE LINE (WARRANTY) | 857 | 4,527,480 | New Practice |

INITIAL APPLICATION COST PER LINEAR FEET

| INITIAL COSTS PER LINEAL FOOT | 6" LANE LINE | 6" EDGE LINE | 6" LANE LINE | 6" EDGE LINE | 6" LANE LINE | 6" EDGE LINE |
|---------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | PAINT | PAINT | THERMO | THERMO | WARRANTY | WARRANTY |
| INITIAL STRIPING COST PER LINEAL FOOT | \$0.32 | \$0.46 | \$0.31 | \$0.54 | \$1.33 | \$0.65 |
| TRAFFIC CONTROL COST (\$/L.F.) | \$0.10 | \$0.10 | \$0.10 | \$0.10 | \$0.10 | \$0.10 |
| TOTAL INITIAL COST PER LINEAR FOOT | \$0.42 | \$0.56 | \$0.41 | \$0.64 | \$1.43 | \$0.75 |

RE-APPLICATION COST PER LINEAR FEET

| APPROPRIATE REAPPLICATION MATERIAL | 6" LANE LINE | 6" EDGE LINE | 6" LANE LINE | 6" EDGE LINE | 6" LANE LINE | 6" EDGE LINE |
|--|---------------|---------------|---------------|---------------|---------------|---------------|
| | PAINT | PAINT | THERMO | THERMO | WARRANTY | WARRANTY |
| Reapplication Material Life (Yrs.) that maintains minimum reflectivity | 1 | 1 | 3 | 3 | 6 | 6 |
| No. Of Reapplications with Appropriate Material | 5 | 5 | 1 | 1 | 0 | 0 |
| Reapplication Cost Per Year | \$0.42 | \$0.56 | \$0.41 | \$0.64 | \$0.00 | \$0.0 |
| 5 YEARS TOTAL REAPPLICATION COSTS PER LINEAL FOOT | \$2.10 | \$2.80 | \$0.41 | \$0.64 | \$0.00 | \$0.0 |
| | | | | | | |
| 6 YEARS TOTAL COSTS PER LINEAL FOOT | \$2.52 | \$3.36 | \$0.82 | \$1.28 | \$1.43 | \$0.75 |

TOTAL COST USING PAINT FOR A 6 YEAR PERIOD

| OLD PROCESS COST PER 6 YEARS | | | | |
|------------------------------|--------------------|--------------------|---------|---------------------|
| | QUANTITY LINE MILE | QUANTITY LINE FEET | COST/LF | TOTAL COST |
| EDGE LINE PAINT | 2,076 | 10,964,670 | \$3.36 | \$36,841,291 |
| LANE LINE PAINT | 1,123 | 5,932,900 | \$2.52 | \$14,950,908 |
| TOTAL | 3,209 | | | \$51,792,199 |

| NEW PROCESS COST PER 6 YEARS | | | | |
|-------------------------------------|-------------------------------|-------------------------------|----------------|-----------------------|
| | QUANTITY LINE MILE | QUANTITY LINE FEET | COST/LF | TOTAL COST |
| EDGE LINE THERMOPLASTIC | 1,852 | 9,779,670 | \$1.28 | \$12,517,978 |
| LANE LINE THERMOPLASTIC | 266 | 1,405,420 | \$0.82 | \$1,152,444 |
| EDGE LINE WARRANTY | 224 | 1,185,000 | \$0.75 | \$888,750 |
| LANE LINE WARRANTY | 857 | 4,527,480 | \$1.43 | \$6,474,296 |
| | | | | \$21,033,468 |

SAVINGS PER 6 YEAR PERIOD = \$51,792,199- \$21,033,468= \$30,758,731

SAVINGS PER YEAR = \$30,758,731 / 6 = \$5,126,455

OR \$5.1 Million/Year from FY 2019-20 through FY 2024-25

Value Engineering Change Proposals

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 share the cost savings. The VECP is a formal process whereby the innovation is proposed in writing to Caltrans and the merits of the approach are examined. If the innovation is accepted by Caltrans, a change order is prepared to authorize the VECP so that the work can begin. Money saved through VECP enables Caltrans to reinvest construction dollars into additional transportation projects, and the new innovative construction solutions may be applied to future projects.

Savings Calculation Methodology

Efficiency savings were calculated based on the number of projects that had

accepted VECPs for fiscal year 2020-21. There was a total of 38 accepted VECPs for the fiscal year, representing \$18.5 million in savings. Below is the list of the 38 VECPs, along with a description of the VECP, the date VECP change order was approved and the amount of savings.

Assumptions

The efficiency savings is based on the actual approved VECP change orders for fiscal year 2020-2021 data in the Construction Administration System. Support costs for general review of VECP proposals and processing change orders is not taken into account in the change order savings. If the Department performs an engineering review and approval for a VECP, those costs are deducted before the split cost savings is calculated in the VECP change order. The savings are split 50/50 between the contractor and Caltrans. The savings below are the 50 percent savings for Caltrans.

Fiscal Year 20-21 Approved Value Engineering Change Proposals

| NO. | DISTRICT | CONTRACT | CHANGE ORDER NUMBER | VECP DESCRIPTION | APPROVAL DATE | SAVINGS AMOUNT |
|-----|----------|----------|---------------------|---|---------------|----------------|
| 1 | 01 | 0G33U4 | 004 | Replace rammed aggregate columns with stone columns for subsurface reinforcement. | 5/28/2021 | \$4,642 |
| 2 | 01 | 2982U4 | 015 | Relocate drainage systems numbers 46M and 46Q. | 9/4/2020 | \$13,133 |
| 3 | 01 | 2982U4 | 014 | Raise planned roadway vertical profile. | 2/1/2021 | \$385,330 |
| 4 | 02 | 0H9004 | 001 | Use an alternative superstructure for the temporary bridge. | 5/27/2021 | \$38,937 |
| 5 | 02 | 4E46U4 | 014 | Change the planned roadway excavation and Class 2 aggregate base. | 10/5/2020 | \$91,887 |
| 6 | 03 | 0A5704 | 018 | Changes to the stage construction traffic handling. | 4/6/2021 | \$299,495 |
| 7 | 03 | 0H10U4 | 040 | Replace precast concrete pavement with hot mix asphalt-long life pavement. | 7/23/2020 | \$10,324,753 |
| 8 | 03 | 0H10U4 | 046 | Reverse Phase 2 & Phase 3 work. | 10/14/2020 | \$260,109 |
| 9 | 03 | 0H6804 | 003 | Utilize precast concrete in lieu of cast- in-place foundations as part of crash cushion installation. | 11/23/2020 | \$42,630 |
| 10 | 03 | 1E0604 | 021 | Use 55-Hour closure and revise the stage construction and traffic handling. | 8/19/2020 | \$169,650 |
| 11 | 03 | 3F5104 | 018 | Changes to the stage construction traffic handling and typical cross sections. | 8/26/2020 | \$212,541 |

| | | | | | | |
|----|----|--------|-----|---|------------|-----------|
| 12 | 03 | 3F5404 | 021 | Eliminate Stage-2 construction and traffic handling. | 10/21/2020 | \$43,556 |
| 13 | 04 | 0J6424 | 011 | Eliminate removal of existing dike and place hot mix asphalt up to the existing dike. | 9/21/2020 | \$157,426 |
| 14 | 04 | 0J6424 | 026 | Revise portion of drainage system. | 5/3/2021 | \$110,358 |
| 15 | 04 | 0J7104 | 015 | Eliminate jointed plain concrete pavement and rubberized hot mix asphalt (Type G) and replace with hot mix asphalt (Type A). | 6/10/2021 | \$135,641 |
| 16 | 04 | 2640F4 | 019 | Eliminate the need for cross slope correction. | 10/5/2020 | \$117,266 |
| 17 | 04 | 2640F4 | 047 | Eliminate retaining wall No. 2 and install Type 60MC barrier. | 2/17/2021 | \$113,411 |
| 18 | 04 | 2640F4 | 056 | Modify planned MRE3 Line roadway structural sections 2 and 7 to an overlay with rubberized hot mix asphalt (Type G) and (Type O). | 2/17/2021 | \$93,252 |

Fiscal Year 20-21 Approved Value Engineering Change Proposals

| NO. | DISTRICT | CONTRACT | CHANGE ORDER NUMBER | VECP DESCRIPTION | APPROVAL DATE | SAVINGS AMOUNT |
|-----|----------|----------|---------------------|--|---------------|----------------|
| 19 | 05 | 0L7234 | 004 | Detour traffic around bridge and construct bridge in one phase instead of two phases. | 6/9/2021 | \$88,250 |
| 20 | 05 | 1F5004 | 004 | Reduce bridge demolition from 3 operations to 2 and eliminate Stage 1, Phase 1. | 5/3/2021 | \$40,891 |
| 21 | 06 | 0S4604 | 012 | Eliminate Type 6B (Case 1) retaining walls and Midwest guard rail systems, replace them with Type 60MS concrete barrier. | 7/21/2020 | \$313,669 |
| 22 | 06 | 0U4704 | 005 | Revise construction staging. | 11/3/2020 | \$77,208 |
| 23 | 07 | 286204 | 005 | Modify roadway structural section. | 5/26/2021 | \$487,855 |
| 24 | 07 | 302504 | 016 | Replace temporary pavement structural section No. 13 with 0.55' of hot mix asphalt (Type-A). | 6/11/2021 | \$1,756,743 |
| 25 | 07 | 303704 | 006 | Modify roadway structural sections. | 9/29/2020 | \$1,497,343 |
| 26 | 07 | 3096U4 | 014 | Modify roadway structural section. | 12/15/2020 | \$384,402 |
| 27 | 08 | 1C38U4 | 012 | Revise structural Section 7, Segment 1. | 8/24/2020 | \$229,420 |
| 28 | 08 | 1C38U4 | 024 | Revise structural Section 7, Segment 3. | 1/22/2021 | \$219,738 |
| 29 | 08 | 1E5704 | 006 | Access road deletion. | 3/3/2021 | \$96,923 |

| | | | | | | |
|----|----|--------|-----|---|------------|-----------|
| 30 | 08 | 1E5704 | 006 | Eliminate additional items related to deletion of construction access road. | 4/26/2021 | \$59,360 |
| 31 | 08 | 1K0204 | 002 | Reclassify the removal of yellow thermoplastic traffic stripe from hazardous to non-hazardous material. | 9/28/2020 | \$20,200 |
| 32 | 09 | 363404 | 001 | Eliminate the shoulder widening for drainage structures by resequencing stage construction. | 10/28/2020 | \$81,614 |
| 33 | 10 | 0L8704 | 003 | Use of temporary traffic stripe paint in lieu of temporary traffic stripe tape. | 5/18/2021 | \$8,325 |
| 34 | 11 | 410404 | 026 | Eliminating lateral shift of temporary railing (Type K) shown on the Stages 1A and 2A of construction. | 6/15/2021 | \$17,856 |
| 35 | 12 | 0K0214 | 017 | Substitution of polypropylene dual wall pipe (PPP) in lieu of reinforced concrete pipe (RCP). | 1/28/2021 | \$60,560 |
| 36 | 12 | 0K0214 | 026 | Utilize existing concrete pavement in lieu of placing temporary hot mix asphalt structural section. | 6/3/2021 | \$17,863 |
| 37 | 12 | 0K0224 | 024 | Change the wall type of retaining wall No. 102. | 9/4/2020 | \$88,089 |
| 38 | 12 | 0P5804 | 001 | Eliminate hot mix asphalt leveling and replace with rubberized hot mix asphalt (Gap Graded). | 5/10/2021 | \$354,117 |

Total Savings: \$18,514,443

Highway Lighting LED Retrofit

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 | 5,623,560 |
| Labor Cost | 1,434,120 |
| Vehicle Expense | 188,700 |
| Minus higher cost of LED | -426,667 |
| Total Savings | \$6,819,713 |

- Energy Costs - \$5.6 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 - \$1.4 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 that have been replaced. Replacing HPS lighting with LED lighting will reduce energy needs, labor, equipment, and material costs. The calculation includes lights replaced by the Maintenance Program.

Automated Machine Guidance

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 23 contracts completed in 2020-21, of similar size.

| | <i>Working Days Bid</i> | <i>Construction Support Savings</i> | <i>Surveys Support Savings</i> | <i>Total Support Savings</i> |
|-----------------------------|-----------------------------|---|------------------------------------|----------------------------------|
| <i>Planned</i> | 291 | \$1,055,704 | \$417,441 | \$1,473,145 |
| <i>Used</i> | 280 | \$869,747 | \$292,867 | \$1,162,614 |
| <i>Difference/ Savings:</i> | 11 | \$185,957 | \$124,574 | \$310,531 |
| <i>Percent Savings</i> | 4% | 17% | 30% | 21.08% |

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.

Statewide Contracts with more than 5,000 Cubic Yards of Earthwork

| District | County/Rte. | Name/Description | Cubic Yards | Originally Planned Construction (Activity 270 Hours) | Savings ⁽¹⁾ | Bid Days | Savings (Days) ⁽²⁾ |
|----------|-------------|-------------------------------------|-------------|--|------------------------|----------|-------------------------------|
| 2 | LAS/299 | Roadway Rehab | 72,000 | 2,150 | \$45,322 | 180 | 7 |
| 3 | Yub/20 | Realignment/widening | 278,000 | 7,000 | \$147,560 | 350 | 14 |
| 3 | Yub/20 | Rehabilitate roadway | 262,000 | 6,900 | \$145,452 | 315 | 13 |
| 3 | SUT/99 | Rehab and Safety | 58,000 | 2,680 | \$56,494 | 175 | 7 |
| 3 | Yub/70 | Widen Shoulders | 125,000 | 9,030 | \$190,352 | 190 | 8 |
| 3 | VAR/70 | Widen for TWLTL | 41,900 | 3,200 | \$67,456 | 160 | 6 |
| 3 | BUT/162 | Const Turn pockets, widen shoulders | 75,000 | 3,826 | \$80,652 | 120 | 5 |
| 3 | BUT/70 | Const TWLTL | 46,000 | 4,740 | \$99,919 | 130 | 5 |
| 4 | SON/101 | Const HOV lanes | 38,000 | 14,000 | \$295,120 | 660 | 26 |
| 5 | MON/101 | Roadway Rehab | 188,000 | 41,000 | \$864,280 | 440 | 18 |
| 6 | KER/46 | Two-lane to 4-lane widening | 56,000 | 3,700 | \$77,996 | 365 | 15 |
| 6 | Tul/99 | Replace Bridge | 9,300 | 1,360 | \$28,669 | 180 | 7 |
| 7 | LA/210 | Bridge Seismic Retrofit | 8,000 | 1,700 | \$35,836 | 200 | 8 |

| | | | | | | | |
|--------------|---------|--------------------------|---------|--------|--------------------|-----|------------|
| 7 | LA/01 | Bridge replacement | 20,000 | 3,700 | \$77,996 | 151 | 6 |
| 7 | VEN/101 | Rehab. Roadway | 54,000 | 6,400 | \$134,912 | 440 | 18 |
| 8 | SBD/40 | Regrade cross slope | 178,000 | 2,800 | \$59,024 | 250 | 10 |
| 9 | INY/395 | Const. 4-lane expressway | 220,000 | 10,000 | \$210,800 | 210 | 8 |
| 9 | MNO/395 | Widen Shoulders | 125,000 | 2,799 | \$59,003 | 230 | 9 |
| 10 | MER/99 | Roadway Rehab | 190,000 | 10,000 | \$210,800 | 525 | 21 |
| 10 | TUO/108 | Construct Ramps | 90,000 | 1,700 | \$35,836 | 135 | 5 |
| 11 | SD/11 | Construct interchange | 350,000 | 5,100 | \$107,508 | 280 | 11 |
| 11 | SD/125 | Construct Rte 125/905 | 72,000 | 5,000 | \$105,400 | 405 | 16 |
| 11 | SD/05 | Construct HOV lanes | 200,000 | 44,670 | \$941,644 | 365 | 15 |
| TOTAL | | | | | \$4,078,031 | | 258 |

¹ Support Cost Savings are based on 21.08 percent
Cost Saving = (# of Activity 270 Hours) x 0.2108 x \$100/hr.
Assume loaded rate per hour = \$100

²Working Days Savings are based on 4 percent

| | |
|---|--------------------|
| Support Savings | \$4,078,031 |
| Working Days – 258 days ³ at \$7,500 per day | \$1,935,000 |
| Total Savings | \$6,013,031 |

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

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 23 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.

Value Analysis

Caltrans uses the Value Analysis (VA) study on individual projects to drive efficiency and add value or performance. VA is a systematic process of review and evaluation early in the project life cycle and it is one of the most important processes used in project delivery to achieve efficiencies. Conducted by a multidisciplinary team during the environmental and design phase, the goal is to identify innovative approaches that improve the overall value of the project. The team applies their knowledge in a systematic approach by utilizing function

analyses tools to improve the value of a project. VA methodology is optimized through refining the design to increase performance and/or decrease costs, analyzing lifecycle costs, user benefits and overall return on investment. Value is added by improving functionality and/or reducing cost while maintaining the safety, necessary quality, and environmental attributes of the project. The team consists of independent subject-matter experts who are not directly involved in the project and will offer new perspectives.

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

To further generate efficiencies, Caltrans issued an internal policy in February 2019, where VA studies must be considered for all projects over \$25 million. With the \$25 million threshold, Caltrans identified three VA projects that achieved savings in the amount of \$3,139,644 in fiscal year 2020-21, highlighted in green below.

| No. | Project Description | Total Project Cost | VA Savings | Associated Cost | Project Savings |
|-----|--|--------------------|----------------|-----------------|-----------------|
| 1 | SR 57 Lane Replacement from SR 60 South to Los Angeles County Line Improvement: Use CRCP in lieu of JPCP-RSC | \$ 103,913,000 | \$ 22,789,000 | \$ 83,272 | \$ 22,705,728 |
| 2 | SR 14 Rosamond Mojave Pavement Rehabilitation Improvement: Use PCC in lieu of RSC for slab replacement | \$ 73,615,000 | \$ 1,570,000 | \$ 50,348 | \$ 1,519,652 |
| 3 | Integrated Corridor Management System Improvement: Install new fiber for the entire mainline system | \$ 28,480,000 | \$ (1,374,000) | \$ 92,564 | \$ (1,466,564) |
| 4 | SR 73 Collision Severity Reduction Improvement: Working days reduction by increasing work window | \$ 30,788,000 | \$ 485,000 | \$ 96,512 | \$ 388,488 |

| | | | | | |
|----|--|----------------|---------------|------------|---------------|
| 5 | SR 74 Safety Improvements Improvement: Implement five 55-hour weekend closures | \$ 51,766,000 | \$ 927,000 | \$ 97,757 | \$ 829,243 |
| 6 | Alameda Creek Bridge Replacement Improvement: Shift the soil nail retaining wall to reduce import borrow | \$ 40,716,000 | \$ 576,000 | \$ 52,894 | \$ 523,106 |
| 7 | Ventura 101 Pavement Rehabilitation Improvement: Minimize the three-beam replacement | \$ 52,250,000 | \$ 2,253,000 | \$ 77,807 | \$ 2,175,193 |
| 8 | I-10 Roadway Replacement Improvement: Use Rapid Set Concrete In lieu of Precast slabs | \$ 78,485,000 | \$ 654,000 | \$ 71,044 | \$ 582,956 |
| 9 | SR-99 Union Avenue to White Lane 2R Pavement Rehabilitation Improvement: Reconstruct two entire loop ramps in lieu of partial reconstruction | \$ 66,740,000 | \$ (221,000) | \$ 82,100 | \$ (303,100) |
| 10 | SR 62 CAPM Improvement: Eliminate the HMA | \$ 46,920,000 | \$ 4,296,000 | \$ 78,260 | \$ 4,217,740 |
| 11 | Consumnes Bridge Replacement Improvement: Use precast bridge members and ABC methods | \$ 73,767,000 | \$ 19,314,000 | \$ 100,214 | \$ 19,213,786 |
| 12 | SR 99 Selma to Fowler Improvement: Eliminate stage 4 construction by slightly extending the project limit | \$ 99,925,000 | \$ 3,041,000 | \$ 82,384 | \$ 2,958,616 |
| | Totals | \$ 747,365,000 | \$ 54,310,000 | \$ 965,156 | \$ 53,344,844 |

Mobile Field Devices

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. Three hundred more devices were added one year later.

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.

Independent Assurance Program

The Independent Assurance (IA) program staff reduction created approximately \$1.80 million in ongoing annual efficiency savings.

| 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) | \$12,200 | 4 | \$48,800 | \$585,600 |
| Transportation Engineer (Civil) - Range D | \$16,600 | 5 | \$83,000 | \$996,000 |
| Total | | 11 | \$150,180 | \$1,802,160 |

Caltrans used its statewide IA database to generate workload estimates, which substantiate the IA consolidation and reduction in 11 Personnel Years (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 C, 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 above.

Global Positioning Satellites

Caltrans reduced the cost of smog checks because vehicles equipped with a telematics device do not need to have a physical biennial smog inspection. Vehicles equipped with a telematics device send engine diagnostic information that is accepted in lieu of the physical inspection. Furthermore, telematics devices dramatically improve operator safety through automatic alerts of vehicle diagnostics and location.

Savings Calculation Methodology

It is estimated that Caltrans staff would have incurred close to 21,000 hours manually logging vehicle usage last 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 2020-21, is nearly \$2 million as shown below:

| Description of Savings for 2020-21 | Savings |
|--|--------------------|
| Elimination of Manual Usage Reporting (car tags) | \$1,245,110 |
| Elimination of Annual Smog Inspections | \$517,912 |
| Total Savings | \$1,763,022 |

Assumptions

The following assumptions were made in calculating savings for reducing daily vehicle logs:

- 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 \text{ hours} = \59.91)
- It was assumed that staff took one minute to enter each daily vehicle log. Each vehicle requires a 125-day minimum use per year with an average of 2 entries per day for total 250 entries per year.
- There are 4,988 vehicles (GVWR 14,000 and under) using telematics that require daily vehicle logs. Therefore 4,988 vehicles times 250 annual entries equal 1,247,000 minutes or approximately 20,783 hours per year.
- $20,783 \text{ hours per year} \times \$59.91 \text{ hourly rate} = \mathbf{\$1,245,110}$

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 \text{ hours} = \54.96)
- 5,455 vehicles equipped with telematics require a biennial smog certificate. Therefore, about half or 2,727 vehicles require a smog inspection annually.
- The cost of a smog certificate ranges from \$60 - \$100 or an average of \$80.
- Smog certificate cost $\$80 \times 2,727 = \$218,160$
- Labor of 2 hours $\$109.92 \times 2,727 = \$299,751$
- Total of certificate and time saved = **517,911**

Unmanned Aircraft Systems

Savings for FY 2020-21 were provided by the Divisions of Construction and Right-of-Way and Land Surveys.

| Reporting Division | Reported Savings (FY 2020-21) |
|--|----------------------------------|
| Construction¹ | \$212,280 |
| Right of Way and Land Surveys² | \$498,218 |
| Total Savings | \$710,498 |

¹ 67 missions reported. Savings vary based on type of mission.

² 34 missions reported with savings of approximately \$14,600 per mission.

For Construction, we have developed the following **conservative** estimate:

Construction monitoring missions have been estimated at an 8-hour savings @ 145/hr. ~\$1160 EA

Construction Quantities missions (Non-Earthwork) have been estimated at 24 hours savings @ 145/hr. ~ \$3480

Construction Quantities (Earthwork) have been estimated at 48 hours savings @ 145/hr. ~\$6960

67 known construction missions were logged in FY 20/21.

This generated an estimated savings of ~ **\$212,280 for FY 20/21**

This does not include any capital savings related to change orders, claims, etc. which is likely equal or greater. Unfortunately, those situations need to be documented as they occur, and are not reported to HQ.

Assumptions

The following assumptions were made in calculating savings:

- Applicable labor rates were used. Equipment depreciation was included where appropriate.
- Construction UAS savings were generated for routine field duties (such as construction monitoring or quantity calculations).
- Missions to provide imagery and videography (such as those used for

public meetings) were not reflected in this analysis.

The use of UAS will increase statewide for surveys, bridge inspections, construction monitoring, and other field investigations. Additional methodologies are in development to capture savings from those types of missions.

X-Ray Fluorescence Technology

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 District 11 staff 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 determined a baseline by evaluating 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.

Caltrans calculated savings by comparing the average borehole consultant cost to the cost of Caltrans personnel using XRF technology on 17 projects in the 2020/2021 fiscal year. Using XRF technology eliminated the need to analyze data from 318 borehole locations during the 2020/2021 fiscal year.

| | Boreholes ¹ | Savings |
|---|------------------------|-----------|
| Consultant Cost avoided for 17 projects | 318 | \$477,000 |
| Avoidance Savings | | \$477,000 |

¹ Each borehole saves an average \$1,500

Assumptions

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

Repurposed CMS

As part of the effort to upgrade Traffic Management Systems statewide to meet the goal of SB 1 to have 90 percent of these elements in good condition by 2027, Caltrans has been upgrading the existing Changeable Message Signs (CMS) to new technology full color LED CMS 600 style signs. These CMS signs are able to display color pictures and graphics, and District 11 is installing the new technology while removing older technology LED signs, most of which are still functional and have years of life remaining in them. These older signs, which were slated to be disposed of, still have value to other Districts whose CMS signs are older technology but may have failing lights or need a full replacement. Until other districts receive the new technology color screen CMS signs, they can utilize the better condition older signs from District 11 until the new technology is available. District 11 reached out to other districts and discovered there was a need for replacement CMS signs in three Districts. Arrangements were made for the signs to be transported and installed, saving approximately \$65,000 per sign. Instead of disposal, the older signs still have a use and purpose in other districts, instead of simply being disposed of.

Each sign costs approximately \$65,000 and about \$15,000 to transport and reinstall, saving about \$50,000 for each repurposed sign. To date, six signs have been repurposed saving \$300,000.

State Office of Historic Preservation Electronic Form Submittal

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

| Document Type | Number of Documents | Printing Savings | Mailing Savings | Totals |
|--|---------------------|------------------|-----------------|------------------|
| Originals | 144 | \$72,000 | \$5040 | \$77,040 |
| Revisions (avg. of 50% revision rate of Originals) | 72 | \$36,000 | \$2520 | \$38,520 |
| Totals | 216 | \$108,000 | \$7560 | \$115,560 |

Based on 24 hours to prepare each document at \$20.83 per hour, which equates to \$500 in savings per document.

FY 2020-21 CSO and OHP Projects (document types)

NAE-SC-ESA: 38

NAE or AE: 82

5024 24

Total: 144

Original Documents

Printing: Ave. 3 days (24 hours) production time; Ave. \$500 direct production cost per project

Direct Cost: 144 docs x \$500 = \$72,000

Mailing: Average 1-week (40 hours) transit time per project; Ave. \$35 shipping fees per project

Direct Cost: 144 docs x \$35 = \$5,040

Revised Documents: Average of 50% of total projects require revisions; same average time/cost per project

Printing

Direct Cost: \$36,000

Mailing:

Direct Cost: \$2,520

Total Average Cost Savings: \$72,000 + \$5040 + \$36,000 + \$2520 = **\$115,560**

Advance Mitigation Credits

The first project that benefitted from this mitigation acquisition was 08-1C620, which provided sediment stabilization and erosion control on RIV-111. Associated impacts of the off-pavement work would have necessitated compensatory mitigation for HCP resources. If not for the advance mitigation project's financial contribution, Caltrans would have been required to pay a fee of 5% of the project's construction capital cost of \$72,100, via cooperative agreement to the HCP for these impacts. Additionally, because of the advance mitigation financial contribution, 08-1C620 avoided time and support costs of 6-9 months associated with drafting, negotiating, and executing the cooperative agreement that would otherwise have been required.

The RIV-111 transportation project 08-1C620 was included in the project documentation list of anticipated transportation projects to benefit from the advance mitigation project. The project development timing of transportation project 08-1C620 overlapped briefly with the advance mitigation project. As 08-1C620 approached M460 (RTL) the advance mitigation project was beginning M020 (Begin Environmental). However, through coordination with permitting agency partners, it was understood that 08-1C620 would satisfy its HCP mitigation through the subsequent development of the advance mitigation project.

The advance mitigation project avoided the need for 08-1C620 from paying a compensatory mitigation fee equal to 5% of the project cost of \$72,100.

Additionally, without the availability of advance mitigation, the project biologist would have drafted, negotiated, and executed a cooperative agreement to commit the project to paying the fee equal to 5% of the project cost. This

process could range between 6-9 months of support time for individual projects would range between 100-200 hours, at cost of \$14,000-28,000. Since the Advanced Mitigation Project obtained the mitigation one time, there is a cost savings related to the individual projects, thereby eliminating the 5% project fee, and reducing support costs.

Efficiency Calculation Methodology:

**EFFICIENCY 1 – PROJECT MITIGATION FEE SAVINGS – RIGHT OF WAY CAPITAL
[project construction capital cost x 5% = \$72,100]**

EFFICIENCY 2 – SUPPORT COST SAVINGS & SCHEDULE/DURATION SAVINGS

Support Cost Savings* – Project 1C620 (Actuals)¹

The processing time and support costs associated with individual projects would require similar hours, costs, and duration. The costs outlined below would be saved since the purchase was a bulk credit purchase.

| Support Costs – Hours | Support Costs – Dollars | Duration |
|------------------------------|--------------------------------|-----------------|
| 100-200 | \$14,000-\$28,000 | 6-9 months |

**These costs are specific to the project functional units working on the deliverables for DPAC, this does not include cost expenditures associated with the DPAC unit development and processing of the contracts. Additional potential overhead expenditure cost savings are not quantified.*

SOURCE NOTES

¹ WPS Expenditure Data, 3/15/2021

Cost Estimates Toolbar

Oracle Crystal Ball software has an annual maintenance fee which equates to approximately \$10,000 per year to support the 25 copies of the software.

An additional 5 Oracle Crystal Ball software would need to be purchased this fiscal year for the CEB staff which equates to approximately \$12,000.

See the Oracle website for the latest software license and support fees.

Type Two Appendix

Construction Manager/General Contractor

Savings are achieved and reported at two different stages, when the construction contract is awarded (e.g. innovations) and at the completion of construction (reduction in change orders and claims). The CMGC contractor develops and maintains an innovation register which identifies proposed innovations, including the value of the idea and identifies which innovations were incorporated into the final design and construction documents. The independent cost estimator reviews the innovation register to validate that the estimated savings are reasonable and supported. After award of the project, the district submits the final innovation log to the CMGC Program. We reviewed the list of projects for which the CMGC method was used and determined that six projects were awarded construction contracts during 2020-21 achieving savings of \$59.6 million. Savings are considered a cost avoidance.

(supporting documents on next page)

| Project Name | Work Description | Capital Cost | Project Savings |
|--|---|------------------------|----------------------|
| <p>Santa Barbara 101 HOV Project (Seg 4C) Innovations:</p> <ul style="list-style-type: none"> • Use of geogrid to reduce pavement structural section thickness. • Optimize continuously reinforced concrete pavement (e.g. replace epoxy coded rebar with standard black rebar). • Reduce construction staging at Sheffield. • Use of structural concrete barrier to eliminate retaining wall. | <p>The Santa Barbara 101 HOV Project will extend High Occupancy Vehicle HOV lanes on US Route 101 for 11 miles in each direction and rehabilitate 6.6 miles of roadway.</p> <p>Segment 4C will construct HOV lanes from north of Padaro Lane Overcrossing to San Ysidro Creek Bridge, widen bridges at Evans Avenue Undercrossing, construct a new Sheffield Boulevard interchange, improve ramps, and build new sound walls.</p> | <p>\$100.7 million</p> | <p>\$6.2 million</p> |
| <p>Santa Barbara 101 HOV Project (Seg 4B) Innovations:</p> <ul style="list-style-type: none"> • Use of geogrid to reduce pavement structural thickness. • Replace epoxy coded rebar with standard black rebar to optimize continuously reinforced concrete pavement (CRCP). • Change ramp pavement design from CRCP to joint plain concrete pavement to improve constructability. | <p>Segment 4B will construct HOV lanes from south of South Padaro Lane Undercrossing to north of Padaro Lane Overcrossing, construct new bridges over Toro Creek and Arroyo Paredon Creek, replace the South Padaro Lane Undercrossing, improve ramps, and build new sound walls.</p> | <p>\$151.0 million</p> | <p>\$5.0 million</p> |

| | | | |
|--|--|-----------------------|-----------------------|
| <p>I-80/I-680/Route 12 Interchange Project Innovation:</p> <ul style="list-style-type: none"> • Use of embankment material and retaining walls to reduce bridge length. • Combine two adjacent bridges into one bridge. • Use of Mechanically Stabilized Earth retaining walls to eliminate pile driving. • Install wick drains to accelerate settlement period, eliminate retaining wall, and reduce surcharge material. • Enlarge onsite disposal area to eliminate off-site disposal. | <p>The project will construct a new eastbound Route 12 to eastbound I-80 connector, construct an off-ramp from eastbound Route 12 to Green Valley Road, and construct a braided ramp connection for eastbound I-80 and southbound I-680.</p> | <p>\$59.7 million</p> | <p>\$32.7 million</p> |
| <p>Scofield Avenue Undercrossing Seismic Retrofit Project Innovation:</p> <ul style="list-style-type: none"> • Replace soldier pile retaining wall with double twisted wire mesh slope protection system. • Use of vacuum truck to reduces time in roadway excavation under bridge. | <p>The project will seismically retrofit Scofield Avenue Undercrossing in the city of Richmond on Interstate 580.</p> | <p>\$15.9 million</p> | <p>\$1.7 million</p> |

| | | | |
|---|--|-------------------------------|------------------------------|
| <p>Ferguson Slide Project Innovation:</p> <ul style="list-style-type: none"> • Use of slide scan radar and Total Station positioning replaces remote instrument rock excavation with manned rock excavation. • Creation of a Safety Plan Matrix for quick access to action items base on movement or weather events. | <p>The project will restore two-lane access at the Ferguson slide location by removing the existing rock talus material blocking the highway and construct a rock shed structure over the highway in the area susceptible to rockslides.</p> | <p>\$18.4 million</p> | <p>\$1.6 million</p> |
| <p>Cosumnes River Bridge Replacement Project Innovation:</p> <ul style="list-style-type: none"> • Use of buried “dead man” tieback anchors at abutments to reduce footing size and eliminate pile foundations. • Use of Geosynthetic Reinforced Embankment instead of a Type 1 Retaining Wall. • Compared adjacent bridge foundation reports and reduced pile length at one bridge. • Use of temporary alignment to reduce construction from three to two seasons. | <p>The project will replace the northbound and southbound Cosumnes River Bridges and Cosumnes River Overflow Bridges, upgrade bridge rails at the Dillard Road Overcrossing, and construct a new McConnell Overhead.</p> | <p>\$149.5 million</p> | <p>\$12.4 million</p> |
| <p>Total</p> | | <p>\$495.2 million</p> | <p>\$59.6 million</p> |

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 six projects

could achieve additional savings when construction is complete.

Value Analysis

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

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

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

Caltrans identified twelve projects that awarded in 2020-21. Ten out of the twelve projects achieved savings and the other two 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. Savings for the eight projects is approximately \$53.3 million, of which \$3.1 million is counted as a Type One efficiency, leaving the Type Two total as \$50.2 million. Type One efficiencies are highlighted below.

| No. | Project Description | Total Project Cost | VA Savings | Associated Cost | Project Savings |
|-----|--|--------------------|----------------|-----------------|-----------------|
| 1 | SR 57 Lane Replacement from SR 60 South to Los Angeles County Line Improvement: Use CRCP in lieu of JPCP-RSC | \$ 103,913,000 | \$ 22,789,000 | \$ 83,272 | \$ 22,705,728 |
| 2 | SR 14 Rosamond Mojave Pavement Rehabilitation Improvement: Use PCC in lieu of RSC for slab replacement | \$ 73,615,000 | \$ 1,570,000 | \$ 50,348 | \$ 1,519,652 |
| 3 | Integrated Corridor Management System Improvement: Install new fiber for the entire mainline system | \$ 28,480,000 | \$ (1,374,000) | \$ 92,564 | \$ (1,466,564) |
| 4 | SR 73 Collision Severity Reduction Improvement: Working days reduction by increasing work window | \$ 30,788,000 | \$ 485,000 | \$ 96,512 | \$ 388,488 |
| 5 | SR 74 Safety Improvements Improvement: Implement five 55-hour weekend closures | \$ 51,766,000 | \$ 927,000 | \$ 97,757 | \$ 829,243 |
| 6 | Alameda Creek Bridge Replacement Improvement: Shift the soil nail retaining wall to reduce import borrow | \$ 40,716,000 | \$ 576,000 | \$ 52,894 | \$ 523,106 |
| 7 | Ventura 101 Pavement Rehabilitation Improvement: Minimize the three-beam replacement | \$ 52,250,000 | \$ 2,253,000 | \$ 77,807 | \$ 2,175,193 |
| 8 | I-10 Roadway Replacement Improvement: Use Rapid Set Concrete In lieu of Precast slabs | \$ 78,485,000 | \$ 654,000 | \$ 71,044 | \$ 582,956 |

| | | | | | |
|----|---|-----------------------|----------------------|-------------------|----------------------|
| 9 | SR-99 Union Avenue to White Lane 2R Pavement Rehabilitation Improvement: Reconstruct two entire loop ramps in lieu of partial reconstruction | \$ 66,740,000 | \$ (221,000) | \$ 82,100 | \$ (303,100) |
| 10 | SR 62 CAPM Improvement: Eliminate the HMA | \$ 46,920,000 | \$ 4,296,000 | \$ 78,260 | \$ 4,217,740 |
| 11 | Consumnes Bridge Replacement Improvement: Use precast bridge members and ABC methods | \$ 73,767,000 | \$ 19,314,000 | \$ 100,214 | \$ 19,213,786 |
| 12 | SR 99 Selma to Fowler Improvement: Eliminate stage 4 construction by slightly extending the project limit | \$ 99,925,000 | \$ 3,041,000 | \$ 82,384 | \$ 2,958,616 |
| | Totals | \$ 747,365,000 | \$ 54,310,000 | \$ 965,156 | \$ 53,344,844 |

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.

Streamlining Environmental Review – NEPA

Projects that utilized NEPA assignment and completed the Project Approval and Environmental Document phase during fiscal year 2020-21 were identified. Categorical exclusions are estimated to save one month in time savings and environmental assessments achieve 15.2 months in time savings. The time savings were multiplied by the approved capital cost escalation rate (3.2%) 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 109 environmental documents completed utilizing NEPA Assignment achieving \$49.2 million in savings.

| NEPA ASSIGNMENT CATEGORIES | No of Projects | Savings: | Associated Costs: | Total Savings |
|--|-----------------------|---------------------|--------------------------|----------------------|
| Categorical Exclusions – 1 month | 96 | \$2,826,400 | | |
| Environmental Assessments – 15.2 months | 13 | \$47,250,031 | | |
| Legal Expenses | | | \$137,679 | |
| Program Staff Support | | | \$325,540 | |
| Consultant Costs | | | \$392,047 | |
| Totals | 109 | \$50,076,431 | \$855,266 | \$49,221,165 |

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.

Partnering

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

Data is collected from the project teams at the conclusion of the project from the Caltrans Excellence in Partnering award applications and tabulated on a spreadsheet (available on next page).

| | | Actual Contract Savings | | | | VECPs on Partnered Projects | | | Estimated ROI due to Partnering | | |
|----|-----------------|-------------------------|--------------------------|--------------------------|-------------------------|-----------------------------|------------------------|------------|---|----------------------|-----------------|
| # | Contract # | Came in under Budget | Original Allotment | Final Payment | Delta | VECP's Accepted | \$ Savings | Days Saved | Estimated Savings due to Partnering Decisions | Partnering Cost | ROI |
| 1 | 01-262034 | 0 | \$ 4,029,800.00 | \$ 6,246,154.44 | \$ (2,216,354.44) | 0 | | | \$ 1,550,000.00 | \$ - | |
| 2 | 03-0G9904 | 1 | \$ 5,809,000.00 | \$ 4,968,675.00 | \$ 840,325.00 | 0 | | | \$ 840,325.00 | \$ 13,363.92 | \$ 62.88 |
| 3 | 07-292304 | 1 | \$ 3,115,400.00 | \$ 2,812,454.58 | \$ 302,945.42 | 0 | | | \$ 302,945.00 | \$ 16,889.00 | \$ 17.94 |
| 4 | 07-305204 | 0 | \$ 6,048,200.00 | \$ 9,053,934.29 | \$ (3,005,734.29) | 0 | | | \$ 1,500,000.00 | \$ 21,199.69 | \$ 70.76 |
| 5 | 01-262054 | 1 | \$ 19,349,790.00 | \$ 18,122,862.45 | \$ 1,226,927.55 | 0 | | | \$ 3,200,000.00 | \$ 25,800.00 | \$ 124.03 |
| 6 | 06-0S4904 | 1 | \$ 20,387,500.00 | \$ 18,232,852.66 | \$ 2,154,647.34 | 1 | \$ 111,111.00 | 40 | \$ 2,154,647.34 | \$ 36,543.00 | \$ 58.96 |
| 7 | 06-394604 | 1 | \$ 18,091,300.00 | \$ 15,242,672.70 | \$ 2,848,627.30 | 2 | \$ 250,000.00 | | \$ 800,000.00 | \$ 26,286.33 | \$ 30.43 |
| 8 | 07-306404 | 1 | \$ 13,529,400.00 | \$ 13,484,506.51 | \$ 44,893.49 | 0 | | | \$ - | \$ 37,325.00 | \$ - |
| 9 | 08-0G7704 | 1 | \$ 17,196,900.00 | \$ 15,807,972.02 | \$ 1,388,927.98 | 0 | | | \$ 1,388,927.98 | \$ 20,508.19 | \$ 67.73 |
| 10 | 08-0N9714 | 1 | \$ 20,978,800.00 | \$ 19,182,854.71 | \$ 1,795,945.29 | 1 | \$ 55,000.00 | | \$ 400,000.00 | \$ 25,042.86 | \$ 15.97 |
| 11 | 08-1G6204 | 1 | \$ 14,871,000.00 | \$ 12,954,769.86 | \$ 1,916,230.14 | 0 | | | \$ 692,647.31 | \$ 18,162.66 | \$ 38.14 |
| 12 | 10-1C1804 | 1 | \$ 12,092,900.00 | \$ 11,849,983.00 | \$ 242,917.00 | 1 | \$ 20,000.00 | | \$ 750,000.00 | \$ 16,569.00 | \$ 45.27 |
| 13 | 10-3A7304 | 1 | \$ 23,313,700.00 | \$ 21,931,156.15 | \$ 1,382,543.85 | 0 | | | \$ 1,685,759.76 | \$ 21,585.96 | \$ 78.10 |
| 14 | 11-408704 | 0 | \$ 17,905,900.00 | \$ 17,919,041.00 | \$ (13,141.00) | 1 | \$ 600,000.00 | | \$ 1,000,000.00 | \$ 20,852.00 | \$ 47.96 |
| 15 | 11-409304 | 1 | \$ 20,613,100.00 | \$ 20,359,969.14 | \$ 253,130.86 | 0 | | | \$ 36,227.00 | \$ 63,773.00 | \$ 0.57 |
| 16 | 03-0H26U4 | 1 | \$ 37,480,600.00 | \$ 36,406,453.53 | \$ 1,074,146.47 | 0 | | | \$ 287,000.00 | \$ 47,349.32 | \$ 6.06 |
| 17 | 04-4J3404 | 1 | \$ 37,155,100.00 | \$ 33,890,051.37 | \$ 3,265,048.63 | 0 | | | \$ 780,000.00 | \$ 9,585.11 | \$ 81.38 |
| 18 | 06-471504 | 1 | \$ 36,488,000.00 | \$ 31,035,683.10 | \$ 5,452,316.90 | 3 | \$ 389,000.00 | | \$ 1,475,000.00 | \$ 16,900.00 | \$ 87.28 |
| 19 | 07-1952U4 | 0 | \$ 27,282,000.00 | \$ 31,582,793.30 | \$ (4,300,793.30) | 0 | | | \$ 5,000,000.00 | \$ 44,099.57 | \$ 113.38 |
| 20 | 08-368514 | 1 | \$ 37,800,000.00 | \$ 37,505,981.55 | \$ 294,018.45 | 2 | \$ 271,000.00 | | \$ - | \$ - | #DIV/0! |
| 21 | 11-418524 | 1 | \$ 45,063,400.00 | \$ 40,656,519.96 | \$ 4,406,880.04 | 1 | \$ 9,000.00 | | \$ 750,000.00 | \$ 10,000.00 | \$ 75.00 |
| 22 | 04-2I0704 | 1 | \$ 60,514,500.00 | \$ 56,461,430.63 | \$ 4,053,069.37 | 0 | | | \$ 409,100.00 | \$ 12,400.00 | \$ 32.99 |
| 23 | 04-235844 | 1 | \$ 51,224,000.00 | \$ 50,680,440.25 | \$ 543,559.75 | 0 | | | \$ 290,088.18 | \$ 25,024.87 | \$ 11.59 |
| 24 | 06-2HT104 | 1 | \$ 139,200,000.00 | \$ 134,950,000.00 | \$ 4,250,000.00 | 0 | | | \$ 2,800,000.00 | \$ 78,000.00 | \$ 35.90 |
| 25 | 07-215934 | 0 | \$ 89,447,000.00 | \$ 94,634,906.09 | \$ (5,187,906.09) | 0 | | | \$ 2,643,589.09 | \$ 13,901.05 | \$ 190.17 |
| 26 | 07-294704 | 1 | \$ 62,615,000.00 | \$ 54,723,754.46 | \$ 7,891,245.54 | 1 | \$ 610,000.00 | | \$ 1,500,000.00 | \$ 15,740.50 | \$ 95.30 |
| | Totals = | 21 | \$ 841,602,290.00 | \$ 810,697,872.75 | \$ 30,904,417.25 | 13 | \$ 2,315,111.00 | 40 | \$ 32,236,256.66 | \$ 636,901.03 | \$ 50.61 |

Savings are calculated by the peach columns, savings due to partnering decisions, \$32,236,256, minus the cost of partnering, \$636,901, total savings of \$31,600,000.

Reclaimed Asphalt Pavement

| RAP Efficiency Savings Summary | | |
|--------------------------------|---|--------------------|
| 1 | Total Amount of Type A HMA in tons | 1,979,113 tons |
| 2 | Total Amount of Type A HMA with RAP in tons (75% of step 1) | 1,484,335 tons |
| 3 | Total Amount of RAP in tons (15% of step 2) | 222,650 tons |
| 4 | Savings in using 1 ton of RAP instead of 1 ton of virgin mix (\$/ton) | \$37.26 |
| 5 | Cost Savings (Step 3 multiplied by Step 4) | \$8,295,939 |

Assumptions

- The following percentages were based on industry practice and actual use from surveying couple of districts and a southern lab in FY 2019-20.
 - 15 percent of RAP replacement in Type A HMA. Although up to 25 percent of RAP is allowed, 15 percent was selected for conservatism.
 - 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 FY 2019-20 from three district offices.

Savings Available for Reinvestment in the State Highway System

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.

The \$8.3 million in savings from reclaimed asphalt pavement are considered a cost avoidance.

Partial Depth Recycling

The use of PDR, instead of "Mill and Fill" with 20 percent digouts, saved the Department approximately \$6.8 million in 2020-21.

The efficiency savings calculation compares the bid item cost for PDR 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. Partial Depth Recycling was used in nine projects in FY 2020-21. The Pavement Program reviewed PDR data for projects with awarded bid dates in FY 2020-21 and found the following:

| Project Location and Description | PDR+Capping Layer Total Cost | Mill and Fill + Digouts (\$) | Cost Savings (\$) |
|---|-------------------------------------|-------------------------------------|--------------------------|
| 1. District 6 - Kern County, State Route 43 | \$2,461,157 | \$1,614,357 | -\$846,800 |
| 2. District 2 - In Lassen and Modoc County, State Route 139 | \$2,315,592 | \$2,952,756 | \$637,164 |
| 3. District 8 - In San Bernardino County, State Route 62 and 95 | \$9,500,137 | \$12,450,112 | \$2,949,975 |
| 4. District 4 – In San Mateo County, State Route 1 | \$4,450,270 | \$7,232,200 | \$2,781,930 |
| 5. District 9 – In Inyo County, State Route 136 and 190 | \$2,004,963 | \$2,442,609 | \$437,646 |
| 6. District 10 – In Merced County, State Route 140 | \$1,613,350 | \$2,044,510 | \$431,160 |
| 7. District 3 – In Glenn County, State Route 162 | \$2,817,210 | \$3,481,020 | \$663,810 |
| 8. District 8 – In San Bernardino County, State Route 138 | \$1,079,060 | \$824,685 | -\$254,375 |
| 9. District 5 – In Santa Barbara County, State Route 135 | \$2,503,715 | \$2,548,673 | \$44,958 |
| | | Total Savings | 6,845,468 |

Smart Water Controllers

The savings are calculated utilizing 2013 water use and payment data that was made available by HQ Accounting and AMS Advantage. Water utilities that were paid in 2013 showed a total cost of \$22,126,165. The total water cost in 2020 was \$18,482,634. When you subtract the 2020 amount from the 2013 amount, the answer is \$3,643,531 or a savings of \$3.6 million dollars. Tables are on the next page...

| Type of Water Use | Irrigation Water Use (Gallons) and Irrigation Water Expenditures (\$ Millions) | | | | | | | | |
|---|--|---------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|
| | by Calendar Year (January 1 – December 31) | | | | | | | | |
| | 2013** | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Total |
| Overall Irrigation Water (Cost) | \$ 22,126,165 | \$ 17,773,151 | \$ 15,021,347 | \$ 15,525,793 | \$ 18,024,987 | \$ 22,083,209 | \$ 14,192,707 | \$ 18,482,634 | \$ 143,229,993 |
| Potable* Irrigation Water (Cost) | NA | NA | \$13,821,959 | \$14,460,817 | \$16,767,086 | \$20,495,533 | \$13,148,523 | \$17,008,505 | \$ 95,702,423 |
| Total Potable Irrigation Efficiency Savings (Cost) compared to baseline year 2013 | | | \$ 8,304,206 | \$ 7,665,348 | \$ 5,359,079 | \$ 1,630,632 | \$ 8,977,642 | \$ 5,117,660 | \$ 37,054,567 |
| Overall Irrigation Water (Gallons) | 7,420,000,000 | NA | 2,736,137,392 | 2,620,685,591 | 3,081,010,069 | 3,871,035,084 | 3,010,754,106 | 3,069,132,281 | 18,388,754,522 |
| Potable Irrigation Water Use (Gallons) | | NA | 2,369,082,663 | 2,304,093,906 | 2,681,821,346 | 3,441,476,913 | 2,641,543,082 | 2,710,022,462 | 16,148,040,372 |
| Total Potable Irrigation Efficiency Savings (Gallons) compared to baseline year 2013 | | | 5,050,917,337 | 5,115,906,094 | 4,738,178,654 | 3,978,523,087 | 4,778,456,918 | 4,709,977,538 | 28,371,959,628 |

Potable Water:

"The 2019 California Plumbing Code defines potable water as "water that is satisfactory for drinking, culinary, and domestic purposes and that meets the requirements of the Health Authority Having Jurisdiction." The Environmental Health Division has established minimum requirements for individual water systems and state small water systems based on California Plumbing Code, California Health and Safety Code, California Code of Regulations (Title 22), Ventura County Building Code, and Ventura County Ordinance Code."

**Note: 2013 data was provided by HQ Landscape Architecture Department. This data did not segregate recycled water costs from potable water costs. The Total Irrigation Efficiency Savings costs for each calendar year are calculated by subtracting the potable water cost from the overall water cost of 2013. Total Irrigation Efficiency Savings (gallons) for each calendar year is calculated by subtracting the potable irrigation water use from the overall irrigation water use of 2013.

Documented information was obtained from HQ Accounting, AMS Accounting, and Datalink. The data from the Smart Controllers is uploaded into the cloud is for daily management of the system. It is not used to extract consumption data due to the fact that districts are NOT 100% converted to Smart controllers. For consistency, all data is extracted from Datalink, which obtains its data from AMS Advantage utility billing information that HQ Accounting inputs into the system.

Electronic Plans and Quantities Submittal Process

The savings are largely due to savings in staff time. Structure Office Engineer receives approximately 150 P&Q submittals each year. Before this electronic submittal process was implemented, engineers had to print out two copies of the plans, quantities, foundation reports, hydraulic reports, etc. and submit these hard copies to Structure Office Engineer. For this efficiency calculation, it was conservatively assumed that each project took about 1 hour to print, assemble, and submit the hard copy P&Q submittal.

Caltrans used \$150/hour as the loaded rate for a TE (Civil).
\$150/hour was used as the loaded rate for a Transportation Engineer (Civil).

150 projects x 1-hour x \$150/hour = \$22,500

\$1,000 in material savings were added for a total of \$23,500.

| | Old Process | New Process | Savings |
|---------------|--------------------|--------------------|-----------------|
| Labor Cost | 22,500 | 0 | 22,500 |
| Material Cost | 1,000 | 0 | 1,000 |
| Total | \$23,500 | \$0 | \$23,500 |