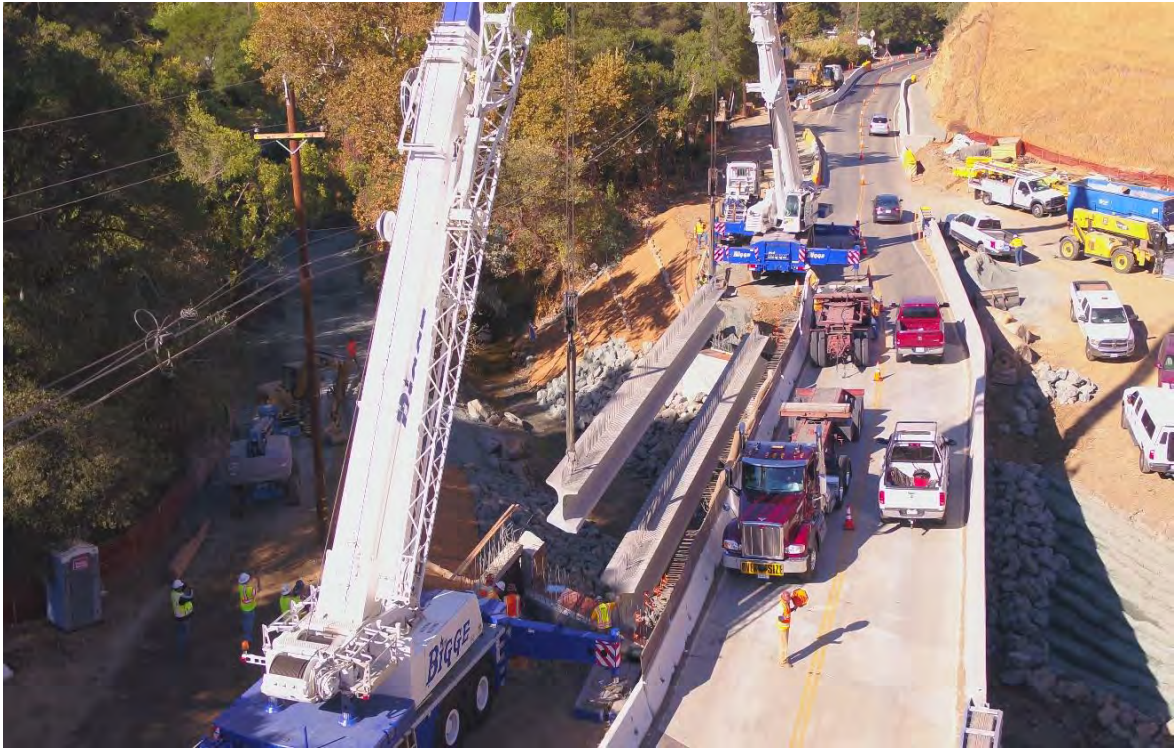


# **Marsh Creek Road Bridge Replacement Project**



**Contra Costa County**



**Public Works Department**

**January 11, 2019**



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## EXECUTIVE SUMMARY

Nestled in the mountainous valley on the east side of Mount Diablo State Park near Clayton, CA where a rich wetland ecosystem is thriving, the Marsh Creek Road Bridge serves as a part of a vital connection (with an average daily vehicle trips of 6000) for the local residents and communities to the neighboring metropolitan centers in the Bay Area.

The goal of the **Marsh Creek Road Bridge Replacement Project** is to replace the existing structurally deficient and geometrically obsolete steel girder bridge with a new, low-maintenance, single-span California “bulb-tee” wide flange concrete girder bridge that is 100 year flood compliant and built to current safety standards, while accommodating current two-lane two-way 6000 average daily vehicle traffic and minimizing impact to the local stakeholders and ecosystem.

The replacement bridge, which spans 90-feet long by 47-feet wide, with two 12-feet lanes and two 8-feet shoulders, overlaps the northern portion of the existing bridge over steep creek bank slopes. The project required the construction of a new, wider roadway alignment and associated soldier pile retaining wall to provide additional roadbed width, 22-feet-tall temporary soil-nail shoring walls to stabilize the existing bridge during the multi-staged construction, temporary waterline bypass and permanent 8” water main that is attached to the bridge, bridge approach pavement and new residential driveways, as well as rock slope protection under bridge in creek, coir block mechanically stabilized embankment wall for bank stabilization, and the removal of the existing steel girder bridge.

Given the above factors, the project was presented with the following key challenges and constraints: **(1) Maintaining two-way traffic** during construction and continuous **access** to the local resident who resides next to the bridge; **(2) fast paced construction schedule** including completing all work within the creek by the October 31, 2018 regulatory permit deadline and all project related work within one season/155 days instead of the traditional two season/215 days; **(3) limited construction laydown area** in the valley corridor and narrow equipment delivery time windows that created logistical and staging challenges; **(4) minimizing impact to a host of protected species** in the area, including California Red-Legged Frog, San Joaquin Kit Fox, Vernal Pool Fairy Shrimp, Longhorn Fairy Shrimp, Western Burrowing Owl, and Golden Eagle, and American Badger, whose presence on site would interrupt the continuity of construction; **(5) construction safety management and worker protection** during this complex and highly coordinated construction involving multiple players and subcontractors; and **(6) multi-stakeholder coordination and community relations** including coordinating with multiple agencies such as Caltrans, Federal Highway Administration, Contra Costa County Water District, United States Army Corps of Engineers (USACE), California Department of Fish and Wildlife, East Contra Costa Habitat Conservancy, US Mail, Cal Fire, and local utility companies and residents to balance different funding, permitting, and design requirements and resolving conflicting issues and concerns.

Addressing these challenges and delivering the \$4.9 million Marsh Creek Road Bridge Replacement Project on-time, within budget, and safely required a creative and methodical approach. The project management/design/construction team, consisting of **Contra Costa County Public Works Department, Substrate, Inc., Mark Thomas & Company, Inc., LSA Associates, Inc., and Bridgeway Civil Constructors, Inc.**, developed an intricate and comprehensive work plan that was carefully monitored and closely tailored to include the following innovations:



- To maintain traffic and to stage the dual cranes and trucks needed for girder installation, the County developed a convenience-focused staging plan that used short, staggered road closures lasting no longer than 15 minutes each; a girder was lifted, placed, and inspected, traffic would resume, and then the process was repeated.
- To shorten construction time, the team utilized precast concrete girders delivered from a local plant, adopted the use of high early strength concrete with accelerants, used soil-cement in lieu of traditional backfill with geogrid to eliminate a stage of shoring, eliminated a major stage of construction through work realignment, reduced bridge deck closure pure settlement time from 60 days to 15 days permissible by Caltrans latest criteria, and worked premium time and Saturdays throughout the project.
- To limit exposure to wildlife within the jobsite, the team installed Temporary Wildlife Exclusion Fencing (TWEF) to provide a buffer at the edges of the jobsite, and dripline fencing around trees to ensure their roots were not damaged by heavy equipment.
- To ensure wildlife in the creek was not affected by construction activities, the team installed a man-made temporary water stream diversion closed system consisting of a water-tight upstream cofferdam, 52" diameter high-density polyethylene (HDPE) pipes, and a downstream cofferdam.
- To construct the stage 1 bridge directly adjacent to live traffic lane, the contractor and resident engineer team collaborated to design and construct 22-foot tall temporary soil-nail shoring walls instead of the traditional shoring.

Ultimately, the project team was able to overcome all of the challenges and finished the in-creek work before the October 31, 2018 regulatory agency deadline, with all major bridge components completed on-time in one construction season. By avoiding a costly site winterization process, the project also maintained budget and kept costs under control. Also, the project has experienced zero incidents and achieved zero man-hours lost to safety or injury to date.

## **SIGNIFICANCE/RESULTS**

The project delivered a structurally sound bridge that improves driver, bicycle, and pedestrian safety and maintenance requirements. It enhanced the neighboring creek embankment and environment. It achieved the bridge replacement while protecting both the traveling public and the creek ecosystem.

## **TIMEFRAME**

Construction Start: April 30, 2018

Project Closeout Date: January 11, 2019



# 1. SCHEDULE PERFORMANCE

Originally, the County anticipated a schedule of 155 working days. The **most important aspect of this project** was to finish the in-creek work by **October 31, 2018** and complete the major components of this project in **one construction season** to avoid costly winterization. In order to be successful, the Contractor had to hit the ground running on the first working day of April 30, 2018. **Shortly after the award of the project, Substrate and BCCI discussed various strategies to help deliver this project in one season.** The entire project team, which consisted of Substrate, BCCI, Mark Thomas, and the County, sat together and brainstormed ideas to streamline the project. Based on that preliminary meeting and later meetings, the team was able to shave valuable days off the project schedule. Despite the fact that there were several project challenges and setbacks, the team was able to deliver the project in one season. **According to the approved baseline schedule the contract would be “substantially complete” December 27, 2018. The actual “substantial complete” is projected as January 8<sup>th</sup>, 2018.**

**The following changes and accommodations were made to meet the schedule and save time:**

- Deleted the entire Stage 3 Construction (10 days).
- Used High Early Strength Concrete & Concrete Accelerants (several days).
- Worked Premium Time and Saturdays.
- Used Soil-Cement Backfill with Geogrid to eliminate a stage of shoring (1 week).
- Deferred final driveway construction to the end of the project (a few days).
- Reduced Closure Pour Settlement time from 60 days to 15 days (45 days)

These innovative methods saved us critical weeks off the schedule, which were all required to help the team account for **various setbacks** on the project. These setbacks included:

- **Late start** (first working day April 30, 2018).
- **Inefficiencies (May 8<sup>th</sup> to May 23<sup>rd</sup>)** - Early on in the project, the Contractor was unsure on how proceed with the staged construction work. The contractor’s shoring sub-consultant AVAR came up with complex, though innovative shoring. The shoring ambitiously proposed to support the existing Transite Water Line behind it, but this proved to be beyond the comfort factor of CCWD (pipe agency-owner). This back and forth between the agency (CCWD) and the County and Contractor was a **2 week delay**.
- **Oil Lines (6/12/18)** - Unknown and unforeseen, abandoned and quit-claimed Shell Oil Lines were discovered just slightly prior to construction activities and the Contractor was able work around these lines through a multiple coordination effort – between the Contractor, Construction Manager, and the Design Team **(no measurable delay)**.
- **Shoring Construction (June 13<sup>th</sup> to July 13<sup>th</sup>)** - As mentioned previously, the shoring for this project was complex due to the unique construction of the existing Marsh Creek Bridge. The existing bridge had a non-standard abutment, which contained very little bar reinforcing. For this reason, additional measures had to be taken, such as creating a steel strut frame installed inside the existing bridge portal to ensure stability, as the bridge was still a lifeline structure. The impact of this is estimated to be a **1 week delay**, as it took 4 weeks to build the shoring, where 3 weeks was anticipated.



- **Nesting Bird (from June 4<sup>th</sup> to July 6<sup>th</sup>)** a Black Phoebe nested and laid eggs on the existing Marsh Creek Bridge, causing a few days of construction impact as the Contractor was not able to work at full efficiency. The Contractor was allowed to continue to work within a protective buffer, and under the supervision of full-time Biological Monitoring (provided by Gallaway Enterprises), a procedure that was approved by the California Department of Fish and Wildlife (CDFW). Estimated impact **(4-5 working days)**.
- **Marsh Fire** – On **July 25, 2018** a brush fire occur near the jobsite burned 250 acres of the surrounding area. Fortunately, the fire was just outside project limits and did not impact the jobsite. However, one working day impact occurred as Marsh Creek Road was completely shut down on July 26, 2018. **(1 day impact)**.
- **Coir Block Mechanically Stabilized Embankment (MSE) Wall (10/12/18 – 10/19/18 and 10/24/18 - 10/26/18)** – Additional Work: In order to construct the deep bridge abutment foundations, temporary excavations extended beyond the planned creek disturbance area into private property. This disturbance required an extension of the creek bank stabilization work. In coordination with the property owner, the agreement reached on the method of bank stabilization was to install Coir Block MSE walls, rather than Rock Slope Protection. **(This additional work was approximately 6 working days)**.
- **Arundo-Donax (Bamboo) Stalk and Root Removal (October 24, 2018)** - As part of an agreement with CDFW and the property owner in order to remediate the area, Arundo-Donax mitigation was required to be performed on the North-Western creek bank – This work impacted the Contractor **1 working day**.
- **Rain Days** – Although the weather was generally cooperative for the duration of the project, **2 rain days** were given to the Contractor in November around Thanksgiving.

In the end, considering the late, almost May 2018 start and a **Jan 8, 2018 “substantial complete,”** this is considered a successful project, as the **Contractor met the deadline for in-creek work and completion in one construction season.**





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## 2. CONSTRUCTION MANAGEMENT

The Marsh Creek Road Bridge Replacement Project required a construction management team that was extremely technical, had relevant experience working on complicated bridge projects within environmentally sensitive areas, and was able to coordinate with various stakeholders. As such, The Substrate/Hill team was selected to administer this project on the behalf of Contra Costa County.

The Construction Management team applied basic partnering philosophy as an element of the successful delivery of this project with the Contractor. As a result, The CM staff took part in delivering a successful project for the Contra Costa County. Throughout the construction of the project, it was the intent to be open with the Contractor and work alongside with them helping to minimize any unforeseen tribulations. The overall goal was to avoid unnecessary costs and delays in order to assure forward progress is always maintained. With the various challenges and obstacles faced throughout the duration of the project, the project team managed to overcome all issues and delivered the project on schedule.

Project elements of included: precast bulb-tee girder construction, cast-in-drilled-hole (CIDH) soldier pile wall construction, bridge demolition, complex temporary shoring, utility relocation, stream diversion, detailed traffic handling, stormwater pollution prevention plan (SWPPP) implementation and monitoring, multiple agency coordination, and coordination with the local residents.

Due to the unique features of this bridge replacement project, specialized construction expertise was necessary to successfully deliver this project. The project required expertise in particular construction methods such as CIDH, in creek work, dewatering operations, familiarity with bridge deck widening, and experience with technical construction stages and extensive coordination with various permitting agencies and stakeholders. One of the main challenges for the project was environmental protection and environmental agency coordination. Had these challenges not been handled properly, the likelihood of delays, additional costs, and schedule disruption would have increased significantly.

Another significant challenge was to ensure the safety of the travelling public. Approximately 6,000 vehicle per day that travel along Marsh Creek Road were safely maneuvered around 4 stages of traffic control, which required extensive coordination with California Highway Patrol for Construction Zone Enhanced Enforcement Program (COZEED), public notification via numerous press releases, and the use of the four portable changeable message boards that would communicate project changes to the commuters on a daily basis. Significant enhancements were made to safety on a regular basis to ensure line of sight, adequate stopping sight distance, visibility and general traffic safety, including adding traffic devices and signs.

Finally, since this project was schedule-driven, Accelerated Bridge Construction (ABC) techniques were applied throughout the duration of the project. This project was primarily paid for by Federal Highway Bridge Replacement funding, Local Road funds, and SB-1 funds.

**Construction Cost:     \$4,560,410 (no claims)**



### 3. SAFETY PERFORMANCE

The Contractor, Bridgeway Civil Constructors, Inc. and the Construction Manager, Substrate, Inc emphasized safety through communication, responsibility, accountability, safety procedures, training and education. Additionally, the teams continually strive to improve the quality of existing safety programs, such as using hazard analyses, work plans and risk assessments, including mandatory subcontractor safety orientation.

**Public Safety** – As mentioned previously, safety of the travelling public was of the utmost importance to the project team, especially related to the 4 stages of traffic control, which required ensuring traffic safety devices were installed per plan and per manufacturer’s recommendations. Additional safety measures included: site security fencing, fall protection, and requiring additional shoring measures to ensure the existing bridge was safely shored during Stage 2 construction.

**Worker Safety – Construction Safety and Illness Prevention Programs** The project team established measurable goals for safety programs and safety training for this project. Health and Safety standards and initiatives in the overall Construction Safety Plan included:

- Providing a workplace free from serious recognized hazards and compliant with standards, rules and regulations issued under the Occupational Safety and Health Act.
- Examine workplace conditions to make sure they conform to applicable OSHA standards
- Make sure employees have and use safe tools and equipment and properly maintain equipment.
- Use color codes, posters, labels or signs to warn employees of potential hazards.
- Enforce operating procedures and communicate them so that employees follow safety and health requirements through tailgate safety meetings.

<i>TOTAL HOURS WORKED – CONTRACTOR (INCLUDING SUBS) + CM + OWNER</i>	<i>17,500</i>
<i>NUMBER OF RECORDABLE ACCIDENTS</i>	<i>0</i>
<i>TRIR – TOTAL RECORDABLE INCIDENT RATE (# OF RECORDABLE *</i>	<i>0%</i>
<i>DART – DAYS AWAY FROM WORK, DAY OF RESTRICTED WORK ACTIVITY, OR JOB</i>	<i>0</i>
<i>NEAR MISSES RECORDED ON SITE</i>	<i>0</i>



## 4. ENVIRONMENTAL CONSIDERATIONS

With the in-creek activities, regulated species protection, nesting birds, and storm water quality, full consideration was given to this environmentally sensitive work area during construction, while at the same time maintaining project progress. Defining timelines for work being performed (working days) and implementation of pertinent requirements (exclusion fences, jobsite surveys, and employee training, etc.) had to be considered prior to the execution of the work.

### Part A - Environmental Protection/Compliance

With extensive environmental requirements, extensive work went into complying with permit requirements and coordinating with permitting agencies, such as USACE, CDFW, United States Fish and Wildlife Service, State Regional Water Quality Control Board, National Marine Fisheries Service, East Contra Costa Habitat Conservancy, Federal Highway Administration, and Caltrans.

### Species Protection

The following endangered or special-status species were located in the area: California Red-Legged Frog, California Tiger Salamander, Alameda Whipsnake, Giant Garter Snake, San Joaquin Kit Fox, Vernal Pool Fairy Shrimp, Longhorn Fairy Shrimp, Vernal Pool Tadpole Shrimp, Western Pond Turtle, Townsend Big-eared Bat, Western Burrowing Owl, and Golden Eagle. This includes the following local special status species which include: Coast Horned Lizard, Pallid Bat, White-tailed kite, Ringtail, and American Badger.



To limit exposure to wildlife within the jobsite, the Contract essentially called for TWEF to provide a buffer at the edges of the jobsite. The TWEF called for in this project was the standard Caltrans TWEF, which consisted of silt fence and orange ESA fencing. In addition to TWEF fence, dripline fencing was provided around tree driplines to ensure their roots were not damaged by heavy equipment.







Starting in February, the County removed a number of trees to remove within the project limits that could have been a deterrent to bridge construction because they could have become habitat for nesting birds. This contract called for a Contractor Supplied Biologist (CSB), which was provided by Gallaway Enterprises. As a precautionary measure, the County, under Contract Change Order, requested Nest Management Services through LSA Associates to prevent any possibilities for nesting birds.



However, despite our efforts with Nest Management, on June 4<sup>th</sup>, 2018 two Black Phoebes successfully nested on the existing Marsh Creek Bridge and laid eggs. Through an innovative compromise between the CSB, Gallaway Enterprise, and the CDFW the Contractor was allowed to continue working with a 25'0" protective buffer and full-time Biological Monitoring (provided by Gallaway Enterprises), a procedure that was approved by the CDFW. The Contractor was constructing temporary shoring at that time. The full-time Biologist monitored the birds to ensure they were not showing signs of distress from the nearby construction operations. This involved frequent shutdowns to ensure the safety of birds.

The Black Phoebes and their offspring successfully fledged their nest on July 6<sup>th</sup>, 2018. Nest Management operations continued till August 31, 2018, the official end of nesting season.





## **Part B – Alternative Practices - Temporary Stream Diversion and Dewatering**

A major feature of this project involved a temporary stream diversion to ensure the wildlife in the creek was not affected by construction activities. The contract and the CDFW permit required the stream diversion to be a closed system of two 52" diameter pipes that were sized for a 250 CFS water flow. The Temporary Stream Diversion work started on May 25, 2018 and ended on October 27, 2018.



The work entailed installing a water-tight upstream cofferdam, installing the 52" diameter HDPE pipes and a downstream cofferdam. After the cofferdams were complete, the TWEF was installed over it to create a fully closed system. All this work was performed with a full-time biologist who ensured that no fish, amphibians, or other wildlife was harmed. Over 500 fish, several California Red Legged Frogs, and a couple of Western Pond Turtles were relocated outside the area between the cofferdams.



The cofferdams were essentially water tight, and the contractor utilized clean river run gravel (which was allowed by the CDFW permit) to fill a few low spots in the creek to create a nice, clean, and dry working surface. Plastic was placed under the gravel and this gravel was later removed from the creek bed. The creek was restored to its pre-existing condition on October 31, 2018.

The final component of the stream diversion work was the dewatering plan. This involved two separate holding tanks – one for “clean water”, and one for “dirty water”. The clean water was creek/ground water that was pumped out of footing excavations, which were pumped to a small settling tank and then returned into the creek via a turbidity curtain. The dirty water was any water that came in contact with fresh concrete. This water was pumped into a large baker tank and was treated by an active treatment system. The treated water was then used as dust control via a water truck.





### Water Pollution Control

The Construction Management team was assisted by a sub-consultant, Thunder Mountain Enterprises, to employ their intricate working knowledge of the annual permit and the various requirements and time frames with which the requirements needed to be addressed. The Contractor's SWPPP Quality Control Inspector, Verux, performed timely and detailed inspections and were critical to the success of this Risk Level 2 project. Since the project is located over Marsh Creek, SWPPP monitoring during rain events was paramount for the CM team. If not managed properly, the project could have been shut down and both the County and the Contractor could have faced fines. Through the CM team's extensive training and experience on reviewing SWPPP's, inspecting BMPs, preparing required reports, and coordinating with Caltrans Storm Water Task Force and the Regional Quality Control Board, the project was effectively managed.

This project had one small numerical action level exceedance, despite having excellent BMPs. During a large storm event (1-1/4" rain in one day), a small amount of turbid water left the project site and pooled in a paved parking area adjacent to the site. It did not discharge into the creek; however, since it left the jobsite, it is technically considered an exceedance. It was tested by the QC Inspector Verux, and determined to exceed the NTU threshold. Immediately after this report, the project team installed additional BMPs to correct and prevent another exceedance, as a storm event was on the horizon. These measures were reported to the Water Board promptly via a NAL Exceedance Report that was uploaded to SMARTs, as was the follow-up corrective action. This did not qualify as a Notice of Discharge as the water did not enter the creek.



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## 5. COMMUNITY RELATIONS

The County and Substrate introduced themselves to the local residents and community members and provided contact for project inquiry. The team performed set up, and the County implemented and maintained a public outreach program for the project key stakeholders, which included:

- Residents and property owners adjacent to the project area
- Fire, Police, Garbage, and US Mail (Postal)
- Commuters

The project team help developed content to be hosted on the County's website, which displayed accurate and timely updates to inform users of important project information and events throughout the duration of the project. Users were able to access project information, such as fact sheets, project maps, and schedules, as well as notifications of upcoming delays, detours and/or road closures.

Critical outreach was performed by the County Public Information Officer, Steve Padilla, who sent out information leaflets and updated the County website and various other social media outlets. The following milestone events were relayed by the County PIO:

- Stage 2 – Girder Placement (Aug 1, 2018)
- Stage 2 to 4 Traffic Switch (Sept 11, 2018)
- Stage 4 – Girder Placement (Nov 2, 2018)
- Final Traffic Switch (est. Dec 21, 2018)

In addition to the outreach, the project had four Portable Changeable Message Signs relaying project information, two near the project site, and two several miles away, to give advanced warning to commuters from Brentwood and Concord. Finally, the County utilized the use of COZEEP to alert and warn drivers of the changed conditions on the jobsite during those milestone days, especially during traffic switches. Through the Project team and County's public outreach efforts, their website continually provided updates as to the status of the project and the nature of the Contractor's work which was well received by both the local and the commuters.

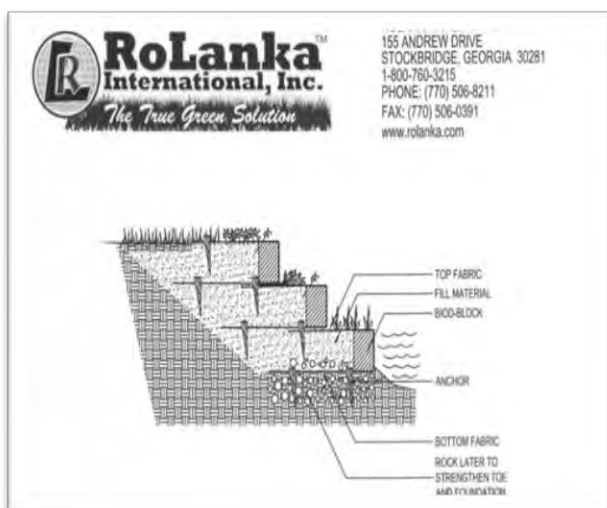
### Driveway #3 Access

The new Marsh Creek Bridge was situated directly adjacent to the resident on the Northeast Abutment of the bridge, making this resident the focal point for construction related impacts and coordination. A critical component of the project was to maintain clear, concise, and routine coordination with the resident. The Resident Engineer engaged the resident early and timely, and provided the resident with almost a daily synopsis of the work. As the Stage construction drawings could not accurately depict the entire scope of work in the area, coordination and adjustments of the driveway were made to ensure the resident had safe access at all times, and that fire and emergency vehicles had access. The team also ensured the resident had safe access to mail and garbage. Coordination with Cal-Fire occurred and fine adjustments to the temporary driveway had to be made to ensure that the residents could access the residence.



### Coir Block MSE Wall

During construction, as a result of the deep foundation excavations required for Abutment Construction, the work led to disturbances of creek bank outside planned limits and into private property. Therefore, an agreed-upon method for bank stabilization, which was also approved by CDFW, was the Coir Block MSE Wall discussed earlier. The method was preferred by the property owner over the standard Rock Slope Protection that was used within project limits. The project team engaged with the owner in a pre-construction meeting to go over means and methods, as well as inspection procedures. Through negotiations, the County was able to develop permanent easement agreements with the owner for future maintenance of the Coir Block.







## 6. PROJECT CHALLENGES



*Figure 1 - Constraints and Site Features*

### Challenge #1 - Schedule

As mentioned previously, this project was originally intended to be a two-season project. With that assumption, the designer did not figure the 60 Day closure pour settlement period into the working days for this project. Therefore, this 155 Working Day project was actually a 215 Working Day project from Day one. Coupling this with a late start of April 30, 2018, this left the project team only 129 working days to finish all the work in the creek by October 31, 2018.

Starting late and experiencing several aforementioned set-backs (starting inefficiencies, nesting bird, etc.), the Contractor found himself 3 weeks behind schedule come June 15th.

### Innovative Solutions

Utilizing principles and ideas discussed during the pre-job acceleration meeting, the Contractor and project team responded to the delay with the following measures:

**High-Early Strength Mix Designs** - The project team approved two special concrete mix designs, one with higher cement content and water reducers (Delvo), and another with concrete accelerant BASF MasterSet AC 534, which is pre-approved through Caltrans. By using one of these mixes in the abutment pours, retaining walls and approach slabs, the contractor was able to cut off several days from the project. They were able to backfill sooner in the case of abutments and retaining walls, and were also able to drive on the approach slabs sooner, as strength came up in 3 days, rather than 7 days. That's over 4,200 psi concrete in 3 days!





**BASF**  
We create chemistry

03 30 00 **Cast-in-Place Concrete**  
03 40 50 **Precast Concrete**

## MasterSet® AC 534

Accelerating Admixture  
Formerly Pozzolith NC 534®

**Description**  
MasterSet AC 534 patented, ready-to-use, liquid admixture is formulated to accelerate time of setting and to increase early concrete strengths. MasterSet AC 534 admixture does not contain calcium chloride and is formulated to comply with ASTM C-494/C-494M Type C accelerating admixture requirements.

**Applications**  
Recommended for use in:

**Features**

- Accelerated setting time across a wide range of temperatures
- Increased early compressive and flexural strengths

**Benefits**

- Earlier finishing of slabs — reduced labor costs
- Reduced in-place concrete costs
- Reduced or eliminated heating and protection time in cold weather
- Earlier stripping and reuse of forms
- Superior finishing characteristics for flatwork and cast surfaces

**Performance Characteristics**  
**Mixture Data:** 453 lb/cyd (269 kg/m³) of Type I cement; 3-4 in. (75-100 mm) slump; concrete temperature 74 °F (23 °C); ambient temperature 50 and 75 °F (10 and 24 °C); non-air-

Project Address: 12801 Marsh Creek Rd  
City, State: Clayton, CA  
Structure: Abutment #2  
Date of Pour: 7/23/2018  
Area of Pour: Abutment #2  
Specified Strength (psi): 5,000

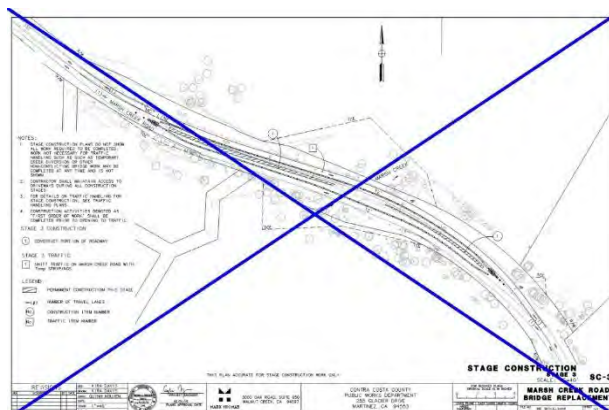
Sample	Date Tested	Age (days)	Tested By	Dimensions (in)	Area (in²)	Break Type	Maximum Load (lbs)	Compressive Strength (psi)
1	07/26/18	3	B. Loeb	6.00	28.27	3	120,870	4,280
2	07/26/18	3	B. Loeb	6.00	28.27	3	118,285	4,180
3	07/30/18	7	J. Mizutani	6.00	28.27	3	155,435	5,500
4	07/30/18	7	J. Mizutani	6.00	28.27	3	148,935	5,270
5	08/20/18	28						
6	08/20/18	28						
<b>28 Day Average</b>								

Time Sampled: 7:20AM  
Sampled by: S. Orr  
Date Delivered: 07/24/18  
Delivered by: J. Mizutani

Mix No: H40H15P2  
Cement Content: 7.3  
Supplier: Central  
Ticket/Truck No: 18671505  
Max Agg. Size: 1"  
Admixture: Delvo

Slump (C143): 4.75"  
Air Content: ☐ C231 ☐ C173  
Mix Temp (C1064): 78F  
Air Temp: 69F  
Weather: Clear  
Unit weight (C138): --

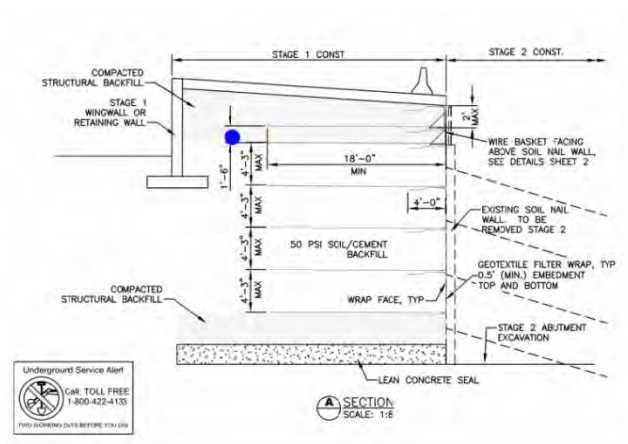
**Deleting Stage 3** - By slightly over-paving Stage 2, the project team deleted the entire Stage 3 Construction which saved 10 working days. Stage 3 was a sliver-pave widening in the center of the roadway and it would be prove to be inefficient and dangerous as the Contractor would have to work in a tight K-rail configuration.



In addition, local residents would be impacted as they would have to drive past the k-rail and perform an unsafe U-turn to get back to their driveways, as access would be cut off. We successfully deleted Stage 3, and the Contractor was able to go from Stage 2 directly to Stage 4, saving 10 working days.

**Soil-Cement MSE Shoring** - The Contractor proposed an innovative shoring solution in Stage 2 that would eventually facilitate Stage 4 bridge construction. This was utilizing soil-cement backfill behind the abutment with Tensar Geogrid, which would serve as a Temporary Mechanically Stabilized Embankment (MSE) wall. This led to a shoring solution that saved several days in traditional backfill and at least a week in the installation of an additional shoring.





**Reduced Closure Pour Settlement Time** – As was mentioned previously, the designer intended this job to be completed in two seasons, and therefore, did not include a settlement period. The standard settlement period from bridge closure pours is 60 calendar days. The project team collaborated and were able to use the criteria in the new recently published Caltrans Memos to Designers 8-3 “Deck Closure Pour and Waiting Period for Bridge Widening or Staged Construction”.

The designer accepted the recommendation and was able to reduce the closure pour wait period from 60 days to 15 days, saving 45 calendar days from the contract.

#### WAITING PERIOD CRITERIA

For cast-in-place (CIP) prestressed concrete, CIP reinforced concrete, precast concrete and steel girder bridges, a deck closure pour waiting period must be selected from Figures 8.3-1 to 8.3-8 when it satisfies all of the following requirements:

- The deck thickness for the closure pour bay is 8 inches or greater.
- The deck thickness and bar reinforcing specified in MTD 10-20 are used for the closure pour bay.

A 60-day waiting period is required when either of above requirements is not satisfied.

For concrete slab bridges, a deck closure pour waiting period must be selected from Figures 8.3-1 to 8.3-8 using a bay width equal to 3 ft.

Figures 8.3-1 to 8.3-8 must be supplemented with the following requirements and limitations:

- The closure pour waiting period needs not exceed 60 days.
- The minimum waiting period for cast-in-place (CIP) prestressed concrete construction is 10 days.
- The minimum waiting period for steel, CIP reinforced concrete, and precast concrete construction is 15 days.



**Premium Time Work** - Finally, from June 15<sup>th</sup> to October 27<sup>th</sup>, the Contractor began working premium time and Saturdays, including sometimes on Sundays to get the project back on schedule.

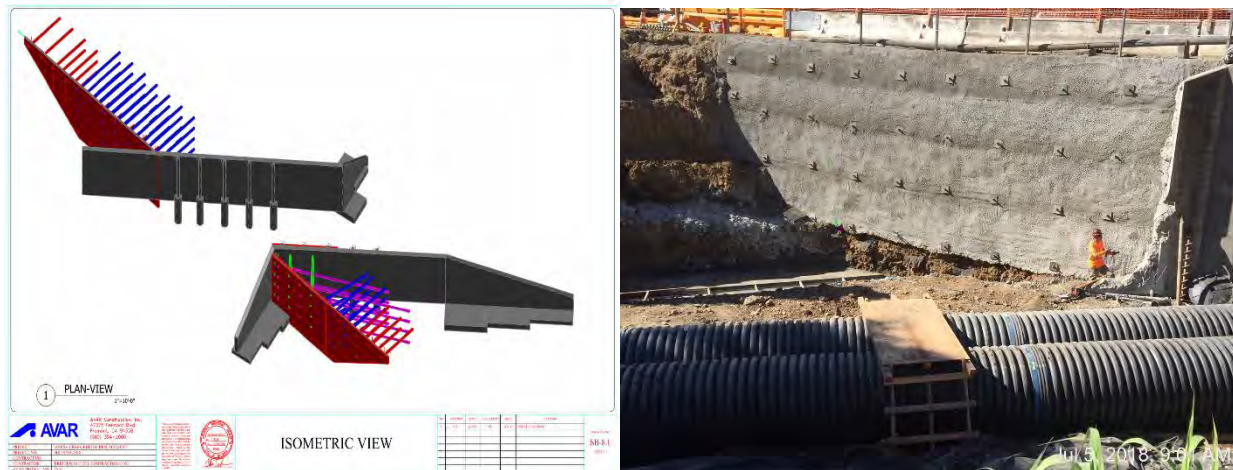
By utilizing all these methods, the Contractor was able to restore the creek and remove the stream diversion prior to October 31, 2018, our environmental permit deadline.

#### Challenge #2 – Shoring To Construct Two-Stage Bridge

One of the most critical requirements for project success was for the contractor to figure out a shoring solution that would allow for stage construction. The existing Marsh Creek Bridge abutment was unique in that it is served more as a bulkhead, rather than as an abutment. As such it was very nominally reinforced. Through a repeated review process, the Construction Manager, the County, and the Contractor were satisfied with the solution.



### Innovative Solution



The final solution was a partial soil nail wall, and partial sub-horizontal ground anchor, part of which engaged the existing bridge through a waler system that spread the load to the vertical pile/columns. This solution allow the Contractor to perform a partial demo, protect the 6" bypass water line and build the Stage 2 – Bridge Substructure and Superstructure all while stabilizing the directly adjacent roadway serving 6,000 vehicles a day. Finally, it served as a form for the Soil-Cement MSE wall that was construction in Stage 2, which facilitated Stage 4 Bridge Construction.

### Challenge #3 – Heavy Precast Girder Erection

The girders for our project were 4'0" deep by 4'0" wide wide-flange California Bulb Tee girders, and although they were only 88'3" long, they weighed about 44 tons. As such, they required a Special P-9 truck route and a double-crane pick to successfully place these girders.

### Innovative Solution

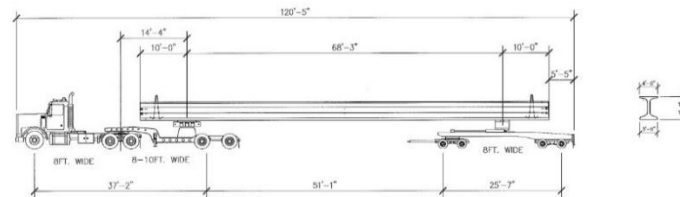
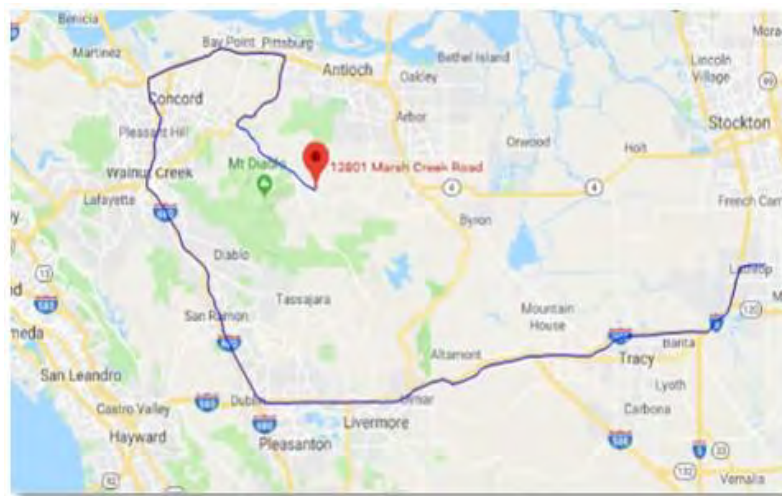
The six 88'3" long girders were fabricated in Lathrop, California at Confab LLC. The fabrication was Source Inspected and the Quality Assurance was performed by BSK Associates, who was part of the CM team.







The RE and the Contractor and his subs (including his truckers) had an early logistics meeting part of the submittal requirements. The RE asked to provide information about the truck route to ensure safe delivery on a P-9 truck route. The following truck route was used:



GIRDER HAULING RIG ELEVATION  
SCALE: 1/8" = 1'-0"

**Stage 2 Girder Erection:** Once delivered to the site, the girders were erected at two difference Stages. Stage 2 Girders were placed on August 2<sup>nd</sup>, 2018.



The precast girder erection operation was a critical aspect of delivering this Accelerated Bridge Construction (ABC) project in one construction season. The four 44-ton California Bulb-Tee girders were placed in only 3 hours by utilizing two 265-ton telescoping cranes, limiting exposure and delays to the traveling public.





**Stage 4 Girder Erection:** On November 2, 2018, the previous operation was repeated for the remaining two girders, again with the two 265-ton telescoping cranes. Work was again completed in less than 3 hours, limiting exposure and delays to the traveling public.



All six girders have been determined to have been placed within  $\frac{1}{4}$ " of theoretical values and no safety issues have occurred as a result of the placement activities. Significant coordination was required to ensure this success of these activities, which included: pre-erection logistics meetings (total 2), pre-erection safety meetings (total 2), precast girder erection plan with haul route, precast shop drawing review, precast quality control plan, source inspection and quality assurance. Source Inspection and Quality Assurance was provided by BSK following the Quality Assurance Program developed by Substrate, Inc.