

Shotcrete versus Fire and Water

Replacement of Flume 4/5/6 and 30

By Jason Myers



Fig. 1: Before shotcreting of the flume

On August 14, 2021, the Caldor Fire started in Northern California near Pollock Pines, CA. The fire ended up consuming almost 222,000 acres (90,000 hectares) and seriously threatened South Lake Tahoe. Besides the over 1000 structures that were lost, the fire also burned along a major portion of the El Dorado Irrigation District's Canal (EID) which provides drinking and irrigation water to numerous communities throughout the area. EID found that four of their flumes were destroyed and lost in the fire. Once the area was designated as safe, EID brought Syblon Reid (SRCO) onto the site to determine what repairs were needed to get the water flowing again. Syblon Reid and

Dees Hennessey Inc. (DHI) have worked on many different projects in the area in partnership with the EID, and we were put on notice before the fire was even out that shotcrete was going to be needed on the project.

The first set of challenges were these: how to get to a canal that you have no direct access to; how to get the nearest supply of concrete when it is three hours away; and how to complete the work over the winter. In the end, shotcrete was able to answer all of these questions in concert with our fellow partners working together. Three of the sites required pumping over 1000 ft (305 m) just to get to the work location, with an elevation drop of up to 500 ft (152 m) from the



Fig. 2: Streambed



Fig. 3: Canal before shotcrete



Fig. 4: Canal transition



Fig. 5: Look at Flume

pump to the jobsite. The fourth location required a new access road to get to the site, and once the access road was completed, it turned into a relatively normal project of pumping over 500 ft (150 m) to get to the end of the canal. Concrete was also properly dosed to retard the concrete for up to four hours in order to reach a high enough slump to pump the distance, but it was also accelerated so that it would be able to be stacked vertically on the canal walls. The nearest highway was visually only about a ¼ mile (.04 km) from the jobsite, but a canyon and river laid in between. It was always good to see or hear your concrete truck drive by, knowing that it would take at least another hour because of the time it took to cross the nearest undamaged bridge and to drive up and over the mountain above you, all the while hoping the driver did not get lost on the remaining 9 miles (14.5 km) of mountain roads to the jobsite.

The total scope resulted in over 1100 ft (335 m) of canal replacement, over four locations, with almost 1000 yd³ (760 m³) installed on the project. Shotcrete was integral to the project because it was able to adapt to any of the

work situations. SRCO only had to form the outside of the canal walls which, once heavy plastic was placed over the top, created its own shelter for everyone to work in and allowed shotcrete to be installed as long as the weather permitted truck delivery to the site. Additionally, shotcrete could easily be adapted to either the horizontal or vertical positions because adjustments made were in shotcrete procedures and not in the material. Since there was minimal formwork, the location of joints, waterstops, and sequencing was changed several times without rework of the forms. Shotcrete placement easily adapted to varying conditions like the waterstops and warped wing walls. Since shotcrete placement always has an exposed face, it is easy to verify proper consolidation, workmanship, and finishes immediately after shooting.

A challenge at the first site exemplified a key advantage of shotcrete on the project — the ability to place shotcrete wherever we could get the hose to reach. A road to the site was required for access before any of the canal reconstruction could begin. However, while this access work was in progress, a retaining wall was required at the canal site for access to the other side of a stream, so a bridge could be constructed and the demolition and removal of the old canal could continue. The question arose of how to install shotcrete in a location you had virtually no access to. The versatility of shotcrete allowed us to switch to a premixed bag mixture which we batched on site. This allowed us to shotcrete the wall, permitting the project to continue until we were needed for the main canal work a couple of months later.

Shotcrete's versatility continued to shine throughout this project. DHI's crews were familiar with many different applications of shotcrete and had the opportunity to utilize their skills including concrete lining in a new stream bed with hand-stacked rocks; providing a rat slab for the coming rain



Fig. 6: Shotcrete walls

2022 OUTSTANDING REPAIR & REHABILITATION PROJECT

Project Name

**Replacement of Flume 4/5/6 and 30
Pollock Pines, CA**

Shotcrete Contractor
Dees Hennessey Inc.

Architect/Engineer
GHD Inc.

Materials Supplier
Folsom Ready Mix & The Quikrete Company

Equipment Manufacturer
REED Concrete Pumps

General Contractor
Syblon Reid

Project Owner
El Dorado Irrigation District

and snow; shotcreting the invert and walls of the new canal; and armoring a hillside against erosion — sometimes from the same truck! SRCO tried to pump a couple of times with a local pumper but then got frustrated cleaning out clogged and broken hoses along the hillside. Meanwhile, having an experienced shotcrete crew and team, we were able to work around the same issues with no difficulties and made improvements along the way. After we proved what our team was capable of doing, we ended up providing most of the pumping and concrete services for the difficult sections of the project. In the end, we were able to continuously pump through over 1000 ft of line pump, with over 500 ft of drop, without any major difficulties; we did this just to get material to the different work locations.

Each of the sites had its own challenges, but we were able to devise a successful game plan around each situation. For example, on three of the sites, we needed to shotcrete the invert of the canal and then the sides of the canal monolithically without getting the rebound from the walls into the freshly shot invert. We also worked with SRCO to forge a plan to work through concrete placement during winter temperatures, keeping within ACI guidelines and moving the project forward. This included sometimes working for only a couple of days between rain and snow storms in order to shotcrete sections to protect against saturation of the soil that would require replacement of all the invert excavations. There is nothing better, or worse, than getting the call that the bladder dams on a section did not hold and the section of shotcrete that you placed a couple of days before is under numerous feet of water — at least it would get a good water cure.

This was a very complex project, which required us to work under emergency conditions. Shotcrete was critical to its success. The combination of shotcrete's flexibility and DHI's experienced crews allowed shotcrete to be utilized for all the concrete needs on this project. Unlike conventional projects with a footing crew, slab crew, and wall crew, a shotcrete crew was able to bounce between all of these items, sometimes doing all three at once. By preplanning and appropriately using available admixtures, concrete mixes were able to be adapted for these applications as well. Shotcrete was indeed the success factor on this project!



Jason Myers graduated from California Polytechnic University at San Luis Obispo in 1995 with a bachelor's degree in civil engineering and from Golden Gate University in 2015 with a master's in business administration with an emphasis in Project Management. Jason started out his professional career working for an earth retention subcontractor where he learned the importance of budgeting, scheduling, and client relationships. Also, during this time, he was introduced to the use of shotcrete and its applications. After working for a General Contractor for a couple of years, he realized that he enjoyed the tighter knit of working for a subcontractor and the ability to construct projects on a tighter time frame with several going at once. Jason also enjoys the process of handling most of the procedures that go into constructing a project rather than seeing only a small portion of the process. Jason joined Dees Hennessey Inc. in 2004 and has been a part owner of the company since 2007. Jason became President of Dees Hennessey Inc. at the beginning of 2023.