

2020 Outstanding Underground Project

Poe Tunnel

By Jason Myers



When you are faced with a project with limited access, material delivery by helicopter, the nearest personnel access is 5 miles (8 km) away, and the closest outside access to the shotcrete placement location is a half mile away, the only solution to handle all of these issues is shotcrete. The Poe Tunnel is a 15 mile (24 km) long tunnel in the foothills of the Sierra Nevada Mountains and is in an area of steep canyons. The tunnel transports water from a forebay on the North Fork of the American River to the Poe Powerhouse where electrical power is generated. The tunnel is almost 20 ft (6 m) in diameter and was constructed in the 1950's.

The owner, Pacific Gas & Electric (PG&E) regularly inspects their tunnel and during the 2016 inspection found several cracks in the tunnel shotcrete that was cause for concern. In 2016, the General Contractor performed some emergency repairs while a permanent fix was designed and approved. Dees Hennessey, Inc (DHI) was contracted by the General Contractor, Syblon Reid (SRCO) to perform the shotcrete placement for the final repair work. The scope consisted of a new tunnel lining for a length of 90 ft (28 m). Once the SRCO was able to mobilize on the project for the 2019 season it was decided to increase the scope and perform a shotcrete tunnel lining for 180 ft (55 m) of tunnel. This decision was made two weeks before the shotcrete was



scheduled to begin. The tunnel design thickness was 10 in. (250 mm) thick, not including overbreak and other repair work. The final shotcrete volume installed was over 500 yd³ (380 m³).

The difficulties to overcome on the project revolved around access to the site. The location of shotcrete work was 2,300 ft (700 m) from the nearest adit into the tunnel. Also, there was no access to that adit by vehicles or pedestrians due to the canyon, a large river at the bottom of the canyon, and a very active railroad in between. The nearest concrete plant is also two hours away.

We devised a plan for the shotcrete pumps and shotcrete material to be flown in by helicopter, across the canyon. Then the fresh shotcrete material would be pumped 2,300 ft (700 m) to the work location. One of the scheduling challenges to work with on the project was the weight limit for the helicopter. The most economical and functional way to transport the shotcrete was to use a helicopter that could carry around 0.5 yd³ (0.4 m³) per flight across the canyon. This proved to be the right balance to provide enough shotcrete to the shotcrete pump, without overloading it, while also allowing the truck to be emptied within an acceptable duration. This also allowed the helicopter to land and refuel after every other truck was emptied. The crew would take a 5 mi buggy ride from the nearest vehicle access point to and from the work location each day.

We used a highly retarded shotcrete mix to allow for the batching and delivery time, the transportation time of the helicopter, and the pumping of the shotcrete mixture. We also used a high slump on the mixture so that the shotcrete could be pumped 2,300 ft (700 m) from outside the adit to the work location. Once we got to the overhead portion of

the shotcrete installation, we used MAPEI Mapequick AFK 888 shotcrete accelerator to provide rapid set and allow placement of the shotcrete.

The greatest advantage of shotcrete for the project was its flexibility. It provided flexibility in the work sequence, flexibility in the scope of the work, and flexibility to stop and start as needed in response to external factors. By using shotcrete, all formwork was eliminated, and the work sequence could be modified anytime the circumstances changed. This project was done during the winter months, so keeping an eye on the weather was always essential and at times the helicopter would fly up to the point that the rain or wind would start. By using shotcrete, the location of construction joints could be adjusted easily and restarted the next day or whenever the conditions changed.

This flexibility also allowed for last minute adjustments to the shooting sequence. The drawings did not show the engineer wanted the invert of the tunnel to be shot in horizontal strips along the tunnel up to the spring line and from the spring line from one side through the overhead portion of shotcrete to the other side - remember this is a 20 ft (6 m) diameter tunnel. Because of the flexibility of shotcrete, we were able to modify our placement sequences to match the engineer's needs with no additional costs or schedule constraints. Only the flexibility of shotcrete, needing no formwork, allowed us to double the scope, and meet the weather challenges and project resequencing, while still completing before the original completion deadline for the original scope of only 90 ft.!

The Poe Tunnel Project was a unique project with unique problems. Shotcrete was able to provide unique solutions. There were many challenges to overcome but with proper planning and execution, shotcrete provided the answer to each of the challenges that occurred.

2020 OUTSTANDING UNDERGROUND PROJECT

Project Name
Poe Tunnel

Location
Parkhill, CA

Shotcrete Contractor
Dees Hennessey, Inc*

Architect/Engineer
Sage Engineers

Material Supplier
A&A Concrete

Equipment Manufacturer
REED Concrete Pumps & Shotcrete Equipment*

General Contractor
Syblon Reid

Project Owner
PG&E

*ASA Sustaining Corporate or Corporate Member



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 in 2004 and has been a part owner of the company since 2007. Jason currently serves as the Vice President of Operations as well as the Safety Director.