

## 2024 Outstanding Underground Project

# Anderson Dam Tunnel



*Two-boom jumbo installing pre-support spiles over steel set arches and shotcrete tunnel lining*



*Smoothing shotcrete interior surface complete looking out of tunnel toward the portal*

*By Brian Harris, PE, and Alex Folchi, PE*

Drill Tech Drilling & Shoring, Inc. performed Sequential Excavation Method (SEM) tunnel construction with geometric cross sections consisting of 19 ft to 24 ft (5.6 to 7.3 m) diameter tunnels (including wide span intersections) for the Anderson Dam Tunnel Project. This Project is the first phase of the dam's seismic retrofit that establishes new water supply tunnels, drop shafts, and lake intake structures required prior to rebuilding the dam itself in subsequent phases. Nestled in the foothills of Morgan Hill, California, work was completed in highly unstable and variable Santa Clara and Franciscan formations, which included regional faults notorious for seismic activity and varied significantly in rock quality. The tunnel alignment traversed through these native formations and around the existing dam abutment to ultimately provide future water supply around the reconstruction of Anderson Dam. Drill Tech safely overcame the challenges of difficult mixed-faced ground conditions (soil and rock intermixed with heavily faulted zones) and



*Tunnel excavation progressing ahead of steel arch set and shotcrete liner*



**LEFT:** Looking up into the 9 in. thick shotcrete lined 105 ft deep variable shaped shaft

**BELOW:** Looking down into the 9 in. (230 mm) thick shotcrete lined 105 ft (32 m) deep variable shaped shaft



successfully completed the critical underground excavation and support required for the infrastructure upgrades.

As an integral component to the geostuctural support mechanisms applied on this project, Drill Tech used shotcrete placement for excavation shoring on features including tunnel portal slopes, underground tunnel structural linings, and vertical shaft liners. Shotcrete primarily provided ground support immediately after excavation, thus stabilizing the open ground mined for the tunnel alignment. Following this initial application, shotcrete thickness was gradually built up to the full design thickness required by the engineer of record and acted as a portion of the composite

liner that also included steel beam arch sets. The project required tight tolerances of shotcrete applications and stringent interior smoothness criteria for the finish of interior surfaces.

Over the course of 18 months, Drill Tech performed reinforced slope shoring and tunnel lining that consisted of 1800 yd<sup>3</sup> (1400 m<sup>3</sup>) for slope stability and 5100 yd<sup>3</sup> (3900 m<sup>3</sup>) for tunnel / shaft linings. Drill Tech set a company record for most single shift shotcrete volume placement at the tunnel portal with 220 yd<sup>3</sup> (168 m<sup>3</sup>) sprayed in just 9 hours of work through a single nozzle. The applications of shotcrete at the project are included in the following table:

Project Element	Length / Depth / Area	Shotcrete Section Thickness	Shotcrete Type	Shotcrete Volume Placed
Tunnel Portal Shoring	48,000 ft <sup>2</sup>	12 in.	Double Mat Rebar Reinforced Shotcrete	1,800 yd <sup>3</sup>
Tunnel Underground Structural Liner	1,600 ft long of 19 ft – 24 ft diameter tunnel	8 in. – 14 in.	Steel Fiber Reinforced Shotcrete	4,450 yd <sup>3</sup>
Shaft Underground Structural Liner	105 ft depth of minimum 23 ft-diameter shaft (variable cross sections for pipe elbows)	9 in. – 11 in.	Welded Wire Fabric Reinforced Plain Shotcrete with Lattice Girders	300 yd <sup>3</sup>
Tunnel Interior Surface Waterproofing Membrane Preparation	1600 ft long tunnel	2 in.	Plain Sanded Shotcrete for Smoothing Purposes	350 yd <sup>3</sup>



24/7 underground excavation operations required custom onsite batching and transportation logistics to utilize Quikrete Wet Process Shotcrete. Drill Tech designed the onsite batching and loading facilities to fill specialty, low profile, underground mining remixer trucks for transfer of shotcrete from the outside plant to application points nearly 1600 ft (490 m) into the tunnel. Using prepackaged concrete material ensured the safety and reliability of excavation

activities for advancing the underground components of the project. This high quality pre-blended shotcrete product excelled in high-early strength development for rapid ground support while achieving specified compressive strength values for long-term strength. The combination of this quality concrete mixture design and its inherent performance qualities paved the way for project success.



Photo taken viewing tunnel bifurcation/intersection area, shotcrete liner visible in both tunnels



Tunnel Shotcrete placement via manlift and hand nozzle in 24 ft diameter tunnel

## 2024 OUTSTANDING UNDERGROUND PROJECT

*Project*  
**Anderson Dam Tunnel**

*Project Location*  
**Morgan Hill, CA**

*Shotcrete Contractor*  
**Drill Tech Drilling & Shoring, Inc.\***

*Architect/Engineer*  
**AECOM**

*Equipment Manufacturer*  
**Schwing Concrete Pumping**

*Materials Supplier*  
**The Quikrete Companies\***  
**Bekaert Corporation (Fibers)\***

*General Contractor*  
**Flatiron West Inc.**

*Owner*  
**Santa Clara Valley Water District**

*Tunnel Ground Support Supplier*  
**Jenmar Civil**

\*ASA Sustaining Corporate or Corporate Member



Looking into the Transition Zone bifurcation/intersection; comparison of complete smoothing shotcrete on left side and the in-progress right side which had yet to be completed



Aerial view of the 48,000 ft<sup>2</sup> (4500 m<sup>2</sup>) soil nail & reinforced shotcrete portal and the beginning of tunnel excavation



---

**Brian Harris, PE** (Drill Tech Project Sponsor for Anderson Dam) has 15 years of SEM tunneling experience, leading and overseeing operations on complex, high-profile projects. His expertise spans new construction and rehabilitation, open-face tunnel excavation, and the use of various ground support techniques such as shotcrete, steel elements, rock bolts, face support, and excavation sequencing.



---

**Alex Folchi, PE** (Drill Tech Project Manager for Anderson Dam) has 12 years of experience in the heavy civil construction industry, with field management encompassing scheduling, quality control, and coordination for projects including foundation piles, shoring systems, and tunneling operations.