



Ecuador- The San Francisco Hydro Plant Tunnel

Locations: Banos, Ecuador –the Avenue of the Volcanoes

Timeline: Construtora Norberto Odebrecht Contacted

Shotcrete Technologies in September of 2010 and the project was complete by March of 2011.

Project Background: The 11 Km. San Francisco Tunnel is used to feed water to a hydroelectric plant that is an important part of the national power generation network. The Ecuadorean government had shut down the power plant due to damage from substandard shotcrete work done by previous contractors.

Shotcrete Technologies, Inc. was called in to provide equipment, materials and shotcrete applicators. It was a massive undertaking with a short fuse to repair the nine meter diameter high and eleven kilometer long tunnels.

Provided: Four self-contained Robotic Shotcrete Units (see photos) Shotset 250 liquid Accelerator, Technical Expertise with application and mix design and four Shotcrete Crews (36 men) working around the clock. Management of the Shotcrete project was also provided by STI. Our management and several of the crew members spoke fluent Spanish, a necessity on this project. (A unique note: prior to the application of shotcrete, the Shot-Tech Robotic arms were used as high pressure washers for cleaning the tunnel.)

Because of the technical nature of the mix, even with mix experts on site, it was a challenge to find the right materials. The local materials we had hoped to use did not provide a quality mix, and our cement supply was sporadic—oftentimes “hot” cement was delivered. The mix had 8% silica fume, air entraining, super plasticizer, and Shotset 250 Accelerator used at a dosage of 3% by weight of cement.

Logistics were a real challenge, and the contractor hired hundreds of locals to prepare surfaces, set up equipment, supply materials, general back up and clean-up 24/7 for the shotcrete crews. The only access points were at the bulkhead and the intake making it necessary for the shotcrete mix to be pumped more than 900 m and then transferred to 8 cubic meter concrete trucks for final transport to the work area. Transportation took longer than the actual spraying and trucks often had to back up as far as six kilometers to the application site. An Eight cubic meter truck was emptied in only 40 minutes the average thickness of the applied shotcrete was 7 cm. When water control and/or spot repair was involved it took longer to empty a truck, and a slightly higher dosage of accelerator.

In spite of the remote location, and all of the logistical problems, approximately 7000 cubic meters of high quality shotcrete was placed in less than 3 months.