

Technical Tip

Making Dry-Mix Shotcrete Go the Distance Underground

Dry-mix shotcrete as a means of ground support for tunnels and mining drifts is fast, efficient, and very safe when properly applied. Its effectiveness is unmatched: I can remember lining unstable clay mining tunnels (drifts) using a layer of shotcrete, wire mesh, and another layer of shotcrete. The arrival of steel fiber shotcrete made life even easier, taking care of severe ground conditions.

by Joe Duro

Nevertheless, dry-mix shotcrete is still regarded by some in the mining industry as the dirty job that people do not want to do underground. In my opinion that is because people don't know how to do it properly. The mindset is that "anybody can do it and everybody knows how" when the truth is that "anybody can do it and everybody can be TAUGHT how."

One of the best methods to an efficient shotcrete operation is moving the shotcrete machine as little as possible. I have witnessed cases where mine captains and foremen decide to "jam" a shotcrete machine with a pre-dampener built in through a tight drift where only a scoop could go through. By the time the machine gets moved, the entire setup has been destroyed, the electric box needs to be rebuilt, and mechanics and electricians have to be called in. The result: wasted time and money lost. Then to add insult to injury, the same thing happens when the machine is moved back out!

To overcome this problem, using dry premixed shotcrete, I have shot at distances of over 550 m (1800 ft), by adding more hose sections and without ever moving the machine.* Given the procedures, shotcrete travels suspended in an air cushion without any problems. One time we used this technique to shoot 15 m (50 ft) up and 300 m (1000 ft) along. This is how I do it:

- Use premixed dry-mix shotcrete;
- Lay out 460 m (1500 ft) or so of 50 or 62 mm (2 or 2.5 in.) hose, and connect them;
- Start the air to read 480 to 550 kPa (70 to 80 psi) of pressure without any shotcrete running;
- Start the water (communication can be done using a bell: once for air, twice for water, three times for shotcrete, etc.—radio or lights can work, too);
- Start shotcrete — the shotcrete machine should never work "choaked" at the hopper. Instead, the shotcrete should fall from the pre-dampener into the pot going directly into the rotor chambers without overfilling them. This will create the air cushion needed to convey shotcrete for long distances;
- After the shooting is done, before shutting down the air, the gun operator should make sure that all shotcrete has left the hose;
- While shutting down, the nozzleman should always leave the water on to prevent cement dust from blowing into the water injection holes, which can cause blockages and time delays for the next crew.

*Accomplished at both Cogema Resources' Cluff Lake Mine and Cominco's Sullivan Mine (in Saskatchewan, Canada, and British Columbia, Canada, respectively.)



Another problem that I often find is how much unnecessary dust is created by inexperienced crews. Here are a few tips on how to minimize dust when using pre-mixed dry shotcrete:

- When in a tunnel or drift, always position the machine behind the vent tube; otherwise the dust coming from the exhaust of the machine will get trapped at the face where the nozzle man is working—again, move the machine as little as you can!
- Never overfeed the pot: the idea is to never give the machine more than it can efficiently handle. If the machine is unable to blow through all the shotcrete in its chambers, the left-over shotcrete will blow off the exhaust or “bubble” up the pot, again causing dust;
- When using a pre-dampener, never overwet the shotcrete, or else cement will deposit along the hose, causing shotcrete to bubble up the pot;
- When using dry shotcrete, the nozzle man should add as much water as possible while maintaining a stable consistency (without shotcrete falling out). Contrary to common belief, this water will not cause a loss in com-

pressive strength. It will, in fact, lead to maximum compaction and optimum strength with minimum dust.

- Always have a dust bag on the shotcrete machine’s exhaust pipe;
- If shotcrete bubbles up in the pot, here are some possible causes that can be corrected: a) a plug in the line; b) the machine is being overfed; c) the machine’s exhaust is plugged; and d) the wear pads need to be replaced.
- Get as much ventilation as you can.

See you next time, when we’ll talk about training your pot man!

Joe “the Professor” Duro has been working underground lining tunnels with concrete and shotcrete since 1965 with projects such as the Bennet Hydro Project, Revelstoke Dam, Mica Creek, and Roger’s Pass, a 17 km (11 mi) tunnel. In addition, Joe has been taking his expertise in shotcrete application around the world training and supervising on projects in the Indian Himalayas and lately in Chile and Peru with Target Products of Canada.



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