

Slope Reinforcement using Shotcrete in Arizona

7,000 cubic yards of shotcrete applied onto mountainsides

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With more than 7,000 cubic yards (5,350 m³) of shotcrete to be used for slope reinforcement in the Mesa-Payson Highway expansion in Arizona, it may be the biggest shotcrete application in the country. The project consists of shotcreting thirteen freshly-cut mountainsides in the Kitty Joe Canyon of the Matazel Mountain Range on Highway 87 between the cities of Mesa and Payson. The total cost of the 17-mile (27 km) road expansion is \$55 million.

"The entire project will take more than seven months to complete," said Mickey Garner, president of Shotcrete Specialties, the sub-contractor. "And we'd be done if it hadn't been for a freak snow last spring," she continued. The area had about 3 feet (1 m) of snow just as the company was starting the project.

She said another reason the project is taking so long is that they have to follow other contractors who are doing the blasting and dirt removal. "The terrain in that area is a mixture of loose rock and dirt, which can cause unstable conditions for the construction crews." She said they have had some dirt and rockslides already, and although no one was injured, it has slowed down the project.

After a mountainside is cut away, Shotcrete Specialties' crews place a drainage fabric against the rock wall to prevent water pressure build-up. Then wire mesh is placed over the surface which is held in place by anchor plates secured by soil nails. The soil nails are usually bolts that can go into the soil or rock up to a depth of 3 feet (1 m). A 12-inch (300 mm) coat of shotcrete is then placed onto the wire mesh at the rate of 60 to 70 cubic yards (46 to 54 m³) a day. The shotcrete mix used is 4,000 psi (28 MPa) strength, specified by the Arizona Department of Transportation (ADOT), but there are no special additives required.

Garner said they primarily use a Putzmeister Katt-Kreter[®] pump, but they occasionally switch to the smaller Putzmeister Thom-Katt[®] TS 2040 trailer pump. "It depends on how long the run is," she said. "If we're pumping shotcrete for a distance of 200 to 300 feet (60 to 90 m) we'll use the Katt-Kreter because of its greater pumping power. In areas where the run is less than 200 feet (60 m) we'll probably go with the Thom-Katt."

The Putzmeister Katt-Kreter is powered by a 101-horsepower engine and can pump up to 50 cubic yards (38 m³) an hour. Garner said the crews also like the Katt-Kreter because of its twin-shifting cylinders, which allow the pump to cycle smoothly. "A smooth operation makes a long day shorter for the nozzleman."

Even though the shotcrete is precolored a reddish brown to match the rock, ADOT wanted it to look authentic. "We carve it using knives and trowels to give it the appearance of a natural rock surface," she said.

While it only takes a crew of six to apply the shotcrete, it takes 12 people to carve it. "They have to do it when it's still moist and workable," said Garner, "and then still work fairly fast before the mixture sets." Shotcrete Specialties aimed to complete the enormous shotcrete job in November, 1999. ADOT said the entire divided four-lane highway project would be completed in the spring of 2001.

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