Shotcrete Remediation of Natural Historic Sites

by Daniel Journeaux

There is no reason why structural shotcrete should look like a scratchy gray glob after it has been applied. Some wonderful things have been done with shotcrete over the past few decades to make the end product much more visually appealing.

That was the approach that Janod Inc. of Champlain, New York, took when they were called in to submit a price for slope remediation above the Maid of the Mist and the Cave of the Winds at Niagara Falls. The initial contract documents called for removal of the unstable rock and bolting of structures that could potentially could become unstable. The contract was put out at as an emergency contract and they only had limited funds to stabilize the slopes in these two highly popular sites. Golder Associates had initially suggested using shotcrete to support the structures but the client decided to have the unstable rock removed because they were afraid of the visual impact that shotcrete would have on a site that receives over 12 million visitors a year.

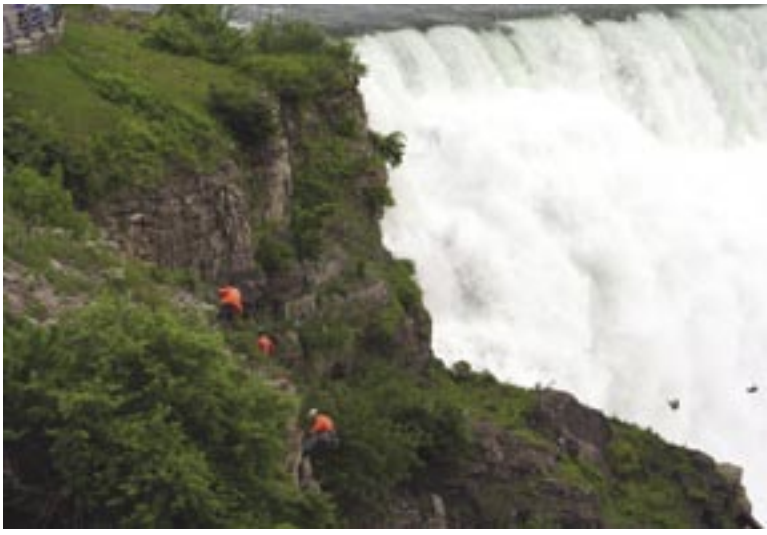
After Janod was awarded the contract for the stabilization of the walls, they moved quickly to show the Niagara Parks personnel examples of how shotcrete can be textured and sculpted to blend in with the natural surroundings. Golder and the Parks reviewed the recommendations and decided to allow Janod to use the sculpted shotcrete. During the kick off meeting, Janod and Golder explained to the Park that due to the budget restraints, shotcrete would be the only way to complete the work. Because of the limited budget, Janod could not do the extensive sculpting and coloring that was used on the New Jersey Rail project in Weehawken, but they felt comfortable that they would be able to color and sculpt enough to make it blend in to the natural rock without attracting attention.

The project was started in July of 2005 and the first phase was to install a temporary barrier above the base of the slope to protect the structures below (ticketing booth, elevator structure, restrooms, etc.) from falling rock. The slope was then scaled to

Noel Phillipon, Brian Blais, and David Marcoux ready to work on the slope

See how the loose column of rock is tied back into the slope using shotcrete

Coloring was added and a little bit of work with a trowel and the shotcrete blends into the natural surroundings



Crew scaling rock from the slope

Close up of the finished product

remove any rock that was too unstable to be safely remediated in place. On the Maid of the Mist slope there was a very large detached structure that would have been extremely dangerous and costly to remove, so that is where the shotcrete was used to effectively stabilize the block in place. The first step of that procedure was to apply shotcrete to tie the structure into the rock face to allow rock bolts to be safely installed. After the rock bolts were installed, shotcrete was applied to cover up the plates and nuts of the rock bolts and also to create an uneven surface. A coloring additive was added right at the pump so the coloring would be inconsistent and therefore blend in, because as we all know, Mother Nature is full of inconsistencies.

The end product was that, although it was not a perfect match, the shotcrete itself became almost invisible when looking at the whole slope, and that was the result that all the parties concerned were looking for, given the time frame and limited budget. Niagara Park and the New York State Office of General Services were extremely happy with the end result with a project that could have easily become a problem if it had been put into the wrong hands.

The work done in Niagara Falls has led to work in Letchworth State Park, which McMahon and Mann designed using the same techniques that were used in Niagara to solve some of their stabilization concerns.

Daniel Journeaux *has over 25 years of field experience on rock stabilization projects across North America. He has been President of Janod Inc. since 1993. Journeaux has been an invited speaker by the University of Laval, Queen's University, The Federal Highway Administration (Northwest and Southwest), quarry and mining associations, departments of transportation, and railways. He has been published in quarry and mining magazines.*