

Shotcrete: Old Specifications and Misconceptions

By Ted W. Sofis

One of the greatest advantages of using shotcrete is that shotcrete can be placed on vertical and overhead surfaces without the need for forming. In the 1980s, we performed large quantities of spall repair on several bridges where the repairs were specified for cast-in-place concrete. The additional costs of forming cost us approximately 30% more than a shotcrete repair. Unfortunately, the perception (at the time) was that a shotcrete repair was inferior to a cast-in-place repair. Today, we have better shotcrete materials and equipment; an association—ASA—that promotes good practices and education; and a growing acceptance, appreciation, and understanding of shotcrete's advantages.

Many of the old shotcrete specifications called for the material to be placed with multiple layers of 2 x 2 in. (50 x 50 mm) welded-wire reinforcement. Again, the specification was based on inaccurate information. Shotcrete was being treated

as merely a cosmetic surface repair and crews were not aware that the material could and should be gunned to the full depth of the repair. The specification itself presented a problem. By specifying multiple layers of 2 x 2 in. (50 x 50 mm) mesh, a situation was created that would cause honeycombing when attempting to gun to the full depth. Such a specification was based on the misconception that shotcrete should be placed in 3 in. (75 mm) lifts, as would be done with hand-troweled repair mortar.

That brings us to the essence of the issue: shotcrete is concrete. It's just placed in different methods—pneumatically in the dry process with water added at the nozzle and by pumping in the wet process with air added at the nozzle. In pouring a cast-in-place repair, no one would require it to be done in layers. Shotcrete is no different. Make sure your specifications are up to date and remember to treat shotcrete as you would treat a conventional cast-in-place concrete repair. Get behind the first layer of reinforcing bar whenever possible, avoid laminations, and gun the repair to full depth, if at all possible. In deep repairs, use reinforcing bars with appropriate spacing and avoid multiple layers of mesh. A monolithic repair will provide a better result. This is especially important in refractory installations, where laminations create points of failure in heatups and cooldowns. The same can be said about infrastructure projects where laminations create the same issues with freezing-and-thawing cycles. In short, a repair gunned to the full depth is desirable whenever possible.

Shotcrete provides many varied solutions to installation problems. We need to take advantage of this placement method and the technology involved to reduce costs, increase productivity, and improve the quality and durability of the installations. The world is rapidly changing and the construction industry is becoming more and more competitive. Therefore, it is imperative that we continue to look for and take advantage of better and more cost-effective ways to perform our work in both repair applications and new construction.



On this slope protection project, the dry-process shotcrete material is gunned to the full necessary depth in one pass

Shotcrete Corner



The deteriorated concrete on this bridge pier is removed to behind the first layer of reinforcing bar to allow the shotcrete to fully encapsulate the reinforcing bar



The shotcrete placement on this bridge pier is gunned to the full depth in one continuous pass. It is better to avoid gunning in layers whenever possible



The dry-process shotcrete in this tunnel reline is gunned overhead to the full desired depth without layers



In this power plant ash hopper, the refractory, on the left, is gunned to the full 9 in. (229 mm) depth in one application. The ungunned area with the "V"-type refractory anchors is to the right



Ted W. Sofis and his brother, William J. Sofis Jr., are the Principal Owners of Sofis Company, Inc. After graduating from Muskingum College, New Concord, OH, with a BA in 1975, Ted began working full time as a shotcrete nozzleman and operator servicing the steel industry. He began managing Sofis Company, Inc., in 1984 and has over 34 years of experience in the shotcrete industry. He is the Treasurer for ASA, Chair of the ASA Publications Committee, and a member of multiple ASA committees. Over the years, Sofis Company, Inc., has been involved in bridge, dam, and slope projects using shotcrete and refractory installations in power plants and steel mills. Sofis Company, Inc., is a member of the Pittsburgh Section of the American Society of Highway Engineers (ASHE) and ASA.