Repair of the Baltimore Harbor Tunnel

by Ted W. Sofis

The original construction of the Baltimore Harbor Tunnel began in 1955 and was completed in 1957. Tunnel sections measuring 300 ft (91 m) long were built in shipyards, towed by tug boats, and then submerged and placed into open trenches dredged in the harbor bottom. At the time of its completion, it was the longest twin tube of its type in the world. Ole Singstaud, one of the principle designers, also worked on the Holland and Lincoln Tunnels in New York.

In 1986 and 1987, the Sofis Company, Inc., was a subcontractor for Dick Corporation during the rehabilitation of the Baltimore Harbor Tunnel. Because of the enormous volume of traffic that the tunnel handled, the work schedule was extremely aggressive. The Harbor Tunnel was a project that initially presented several challenges. The Sofis Company had been contracted by Dick Corporation to perform the concrete repairs, which included spall repair in the tunnel invert below the roadway and overhead work on the tunnel roof. The general contractor's work scope called for the complete removal and replacement of the road slabs for the entire length of the tunnel. This could have provided access to the invert areas under the roadway where repairs needed be made. Due to scheduling constraints, however, nothing could interfere with the removal of the roadway floor slabs and the traveling form system for the pouring of the new roadway. The road slab demolition and replacement work were critical path items and all other work had to be scheduled around them.

Current entrance to the Baltimore Harbor Tunnel

Entrance to the Baltimore Harbor Tunnel from the 1950s

The Sofis Company was able to follow the demolition contractor as they saw cut and removed the floor slabs with the tear-out crew that chipped out the deteriorated areas of the invert. The crew, in turn, was closely followed by the general contractor who was replacing the tunnel floor. After the new road surface was poured in place, the only access to the invert areas were from manholes 600 ft (183 m) apart. Lowering buckets of repair mortar through the manholes and transporting the material effectively for those distances did not appear to be viable option. There would have to be a better way to get repair material to the scattered areas in the invert. The most efficient solution to the problem was to use shotcrete. The new roadway was used to transport the vehicles, materials, forklift for material handling, compressors, and shotcrete equipment to each manhole location along the new roadway and to run the hoses to the repair areas.

Because of the size and number of the repairs, it would be necessary to move constantly and it was determined that the dry shotcrete (gunite) process would provide the best option. On a tunnel repair project of this nature, each operation must

maintain its schedule because space and access is limited and each operation must follow the other to maintain the necessary pace. The tear-out crew followed the demolition contractor's slab removal operation. The general contractor's rail-mounted traveling form placing the new roadway followed the removal crew. After the new roadway was in place, the gunite crew followed the general contractor, shooting the premixed shotcrete material in the prepared areas.

The tunnel roof repairs were done in same manner with a constantly moving operation. A prebagged material was also used for the overhead work. Using prepackaged materials eliminated the step of batching or mixing on site, which gave us two advantages. It required less space, which was extremely important in an operation restricted to one lane, as the other lane had to kept open for vehicle access. It also eliminated the extra labor and equipment necessary for mixing on site. Other advantages of using prepackaged material included quality control issues and greater mobility. It was much easier, after completing a section, to breakdown the setup and move to another location by using a forklift to move the palletized material than it would have been dealing with piles of sand.

Tile replacement work and the installation of track anchored roof panels followed the shotcrete operations. Each operation remained on schedule, and the project was finished on time. Shotcrete provided an effective solution to accessing and placing the repair mortar in the tunnel invert and roof areas where any other method would have taken more time and been less cost effective. The versatility of the shotcrete process was well demonstrated on this project.

Ted W. Sofis *is a Principal Owner, along with his brother William J. Sofis, Jr., of Sofis Company, Inc. After graduating from Muskingum College with a BA in 1975, Sofis began working full time as a shotcrete nozzleman and operator in the steel industry and began managing Sofis Company in 1984. He resides in Pittsburgh, PA, and has over 30 years of experience in the shotcrete industry.*

Over the years, Sofis Company has been involved in bridge, dam, and slope projects using shotcrete, as well as refractory installations in power plants and steel mills. Sofis Company is a member of the Pittsburgh Section of the American Society of Highway Engineers (ASHE) and the American Shotcrete Association (ASA).