

Underground Parking Garage Rehabilitation Using Dry-Mix Shotcrete

by Randle Emmrich

The Department of Justice (DOJ) Headquarters, 951 Constitution Ave. N.W., Washington, DC, has been undergoing major rehabilitation and renovation. Work started in 2001 and continued into 2002. Gilbane Building Co. is the prime contractor on the site, but there are many subcontractors involved in restoring the DOJ building. Coastal Gunite Construction Co.,

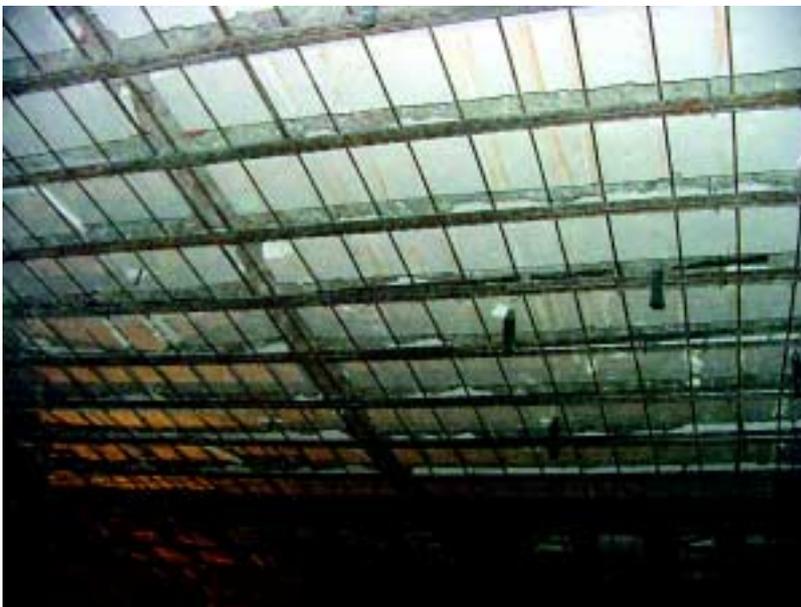
Cambridge, MD, is one of those subcontractors. In July 2001, Coastal Gunite was called on by Oncore Construction, a subcontractor to Gilbane, to assist them in rehabilitating the lower-level garage in the DOJ building. A meeting was held on-site between Oncore and Coastal Gunite to assess the situation and to determine what methodology would be best to rehabilitate the structure so that it would be aesthetically pleasing as well as structurally sound. Those present at the meeting were ASA members Curt White, President, Coastal Gunite; and Randle Emmrich, Project Manager, Coastal Gunite; along with Oncore's Bob MacDaniels, President; Bob Petrie, Vice President; and Frank Salzano, Project Manager. Also in attendance were Heiko Osterchrist (ASA member), U.S. Concrete Products, and Mike Hutchison, Metro Sealants.

The parking garage ceiling was composed of structural clay tiles, which formed the floor of the courtyard overhead. The clay tiles of the waffle slab were beginning to fail and the government wanted a new, flat concrete slab in its place. To accomplish this, the skeleton of the existing slab had to be used as the formwork for the new concrete slab. However, the dimensions of the waffle slab were such that the channels, or voids, were 10 in. (250 mm) deep. This posed the question of what material to use to fill the voids to a level surface while maintaining the structural integrity of the slab. Tolerances of no more than a 1/2-in. deviation in 10 ft (12 mm in 3 m) were required.

Many proposals were considered, including filling all of the voids in the waffle slab with gunite. Since 10 in. (250 mm) of gunite would result in too much dead load, Oncore proposed to Gilbane to use Styrofoam® blocks to minimize the depth of shotcrete required and yet maintain the structural qualities of the existing slab. The failing tile would be removed, and pieces of Styrofoam® would be inserted in the channels of the slab until the Styrofoam® was flush with the ribbing. Then only 3-1/2 in. (90 mm) of polypropylene fiber-reinforced, silica fume-modified gunite would be applied. This method would provide a new concrete slab that would be light in weight, as well as meet the structural requirements. Everyone agreed that this plan could



Original parking garage ceiling.



Styrofoam blocks inserted into channels of ceiling slab.

work, and the proposal was submitted to the government for review.

A few weeks later, the government approved the proposal and the work began. Gilbane's Project Manager, Tracy Sholbolton, oversaw the entire operation and worked willingly with Roland Ayers, Coastal Gunitite's Project Superintendent, and Pat Weir, Oncore's Project Superintendent, to keep the job safe, clean, and productive. Before Coastal mobilized, Oncore hydro-demolished the tile ribs. Then they installed 25-psi (170-kPa) Styrofoam® to fill all voids. Next, they installed 3 x 3 x 10 (75 x 75 MW 9.1 x MW 9.1) welded wire mesh and No. 3 (10 M) bars at 16 in. (400 mm) on center each way. Finally, the ceiling was prepared and made ready for the gunitite operation.

ASTM C 33 concrete sand was delivered to the site as well as Type I/II portland cement. U.S. Concrete Products supplied Gunitite 7001 SC, which is a shotcrete enhancer with silica fume and polypropylene fibers, that was batched into the mixture on-site. Coastal Gunitite's crew started placing 3-1/2 in. (90 mm) of gunitite overhead. The compressive strength was required to be 4000 psi (28 MPa) at 28 days, and the electrical resistivity needed to be 30,000 ohm-cm or less. Using the Gunitite 7001 SC shotcrete enhancer, the specification was easily met.

The government officials working at the DOJ were not familiar with the shotcreting process, so during a job site inspection, they were invited to watch the process firsthand. They were very intrigued and impressed by the small amount of

rebound and the final finish of the gunitite. This was in part due to the silica fume in the shotcrete enhancer supplied by U.S. Concrete Products and Metro Sealant. Since the overhead work was being completed to their liking, the government requested that additional work be done on the supporting vertical columns. Oncore chipped out the deteriorated concrete and installed reinforcing,



Application of gunitite.



Rehabilitated column using gunitite.



Close-up of rehabilitated column.

*Finished
gunitite ceiling
next to
original
ceiling.*



and Coastal Gunitite shot the columns back to their original form. The government could not believe that one could “shoot” a column so smoothly and kept insisting to Roland Ayers, Coastal Gunitite Superintendent, that he must have formed and poured the columns. Roland shook his head “no” and told them to “stick around for awhile and see for yourselves” and they did. This made them believers in the ability of gunitite to produce aesthetically attractive repairs.

The project’s only complication during construction was that the nation came under attack on September 11, and the heightened security measures that were put into place subsequent to the attacks made it very difficult to get any deliveries of equipment, materials, and so forth to the job site. Not to mention the fact that all employees had to have extensive background checks. Despite this issue, the gunitite portion of the job was finished within 5 weeks after the start date, and the government continued to work in their offices the entire time that their parking garage was receiving an essential structural and aesthetic rehabilitation.



Randle Emmrich is Vice President and Project Manager for the Coastal Gunitite Construction Co., Bethesda, MD. She graduated cum laude from Bucknell University

with a Bachelor of Science degree in Civil Engineering in May 1996, and received her E.I.T. in June of 1996. Following graduation, she began working for Coastal Gunitite in Atlanta, GA. In her 6 years in the gunitite business, she has overseen many projects, including the rehabilitation of bridges, piers, manholes, aqueducts, and sewers. Her projects have served various clients including the U.S. Army Corps of Engineers, ESSO Inter-America, Maryland Transportation Authority, Virginia Department of Transportation, City of Atlanta, and City of Indianapolis. Mrs. Emmrich is a member of ASCE, an associate member of ACI Committee 506, Shotcreting, and a member of the Board of Directors of the American Shotcrete Association.