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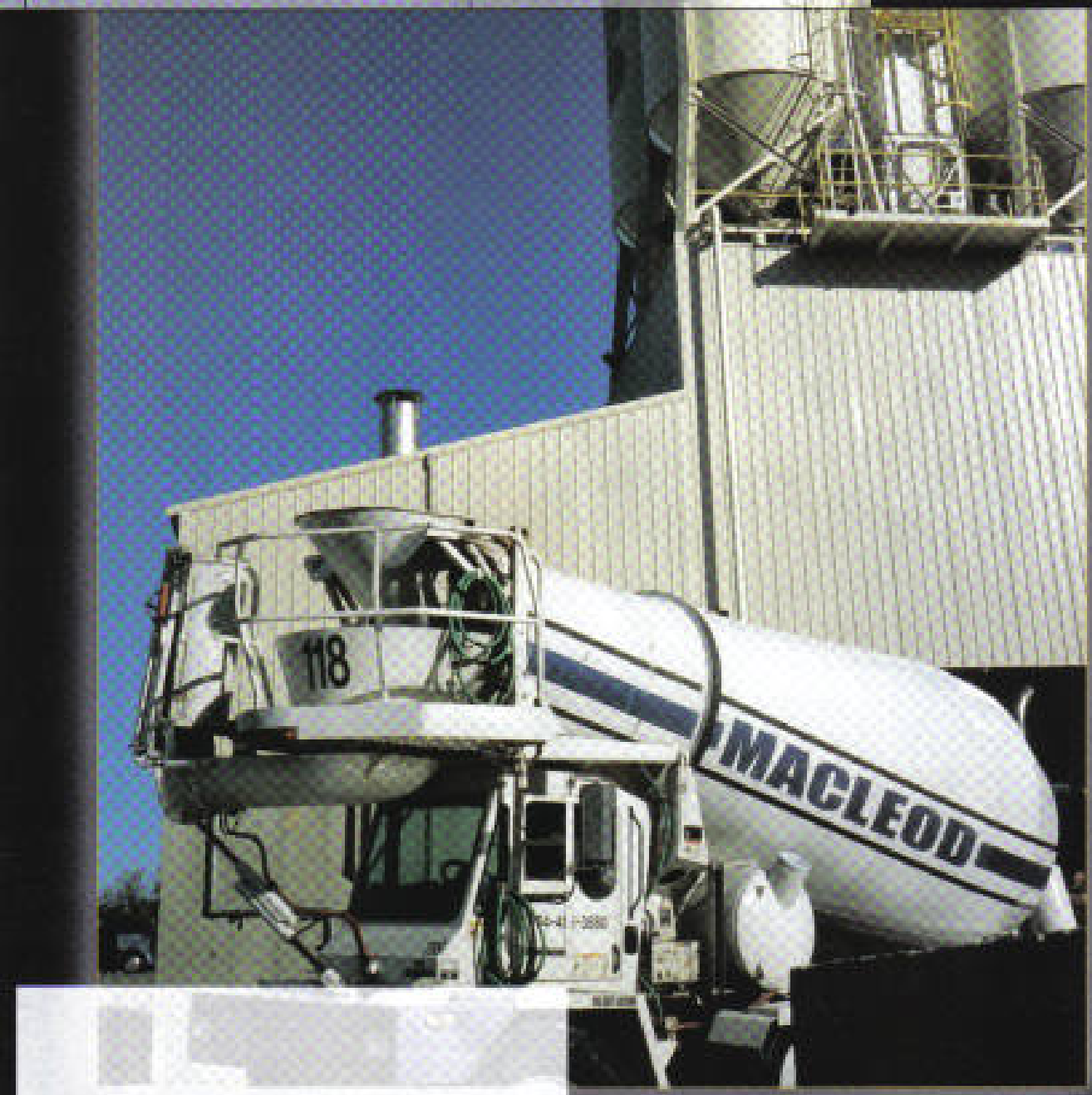
JANUARY 2006



North Carolina builder banks on upstream opportunities

A PRISM BUSINESS MEDIA PUBLICATION

Carbon fiber rights wall's wrongs

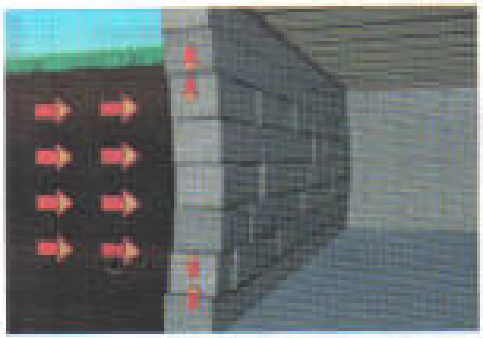
As construction neared completion in East Goshen Township, Pa., on Wellington at Hershey's Mill—a 370,000-sq.-ft., $21 million, multistory retirement facility comprising 195 independent-living senior apartments—building code inspectors uncovered a structural deficiency. Reinforcing steel in below-grade walls was positioned centrally at mid-depth instead of near the walls' interior face per the engineering design. The structural integrity of the facility's 90,000-sq.-ft. underground parking garage was thus compromised, jeopardizing the sale of units above the garage.

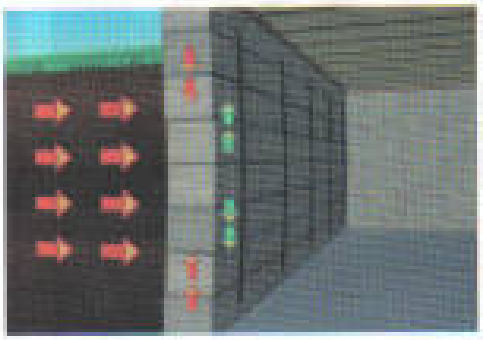
Since many residents had already moved in, solutions had to be investigated and implemented immediately. General contractor Caldwell, Heckles and Egan, Inc., of Lancaster, Pa., and the East Goshen Township Engineering Group responsible for licensing and inspection explored alternative options to steel I-beams or costly, time-consuming demolition and reconstruction of the garage's foundation walls.

When John Ferguson of Erdenheim, Pa.-based Premier Building Restoration was contacted regarding retro-fit options, a recently patented carbon-fiber strengthening system—the Reinforcer—was proposed on the basis of successful residential and commercial installations that Ferguson's firm had completed. The product's manufacturer, Nationwide Reinforcing Ltd. of Columbus, Ohio, was then consulted to determine the Reinforcer's viability as a solution for Wellington at Hershey's Mill.

Project principals discovered that the externally bonded Reinforcer is essentially a 4-in.-wide and .045-in.-thick strip or strap of carbon fiber reinforced polymer (CFRP). The material is lightweight, noncorrosive and virtually impossible to stretch. A tensile strength of more than 350,000 psi makes it 10 times stronger than steel at 36,000 psi. Accordingly, the Reinforcer provides an alternative to such intrusive methods as installing steel beams with heavy equipment to brace and shore up foundation walls: no digging, jack hammering, moving utilities and duct work are required.

A foundation's structural integrity becomes jeopardized when hydrostatic and lateral earth pressures exceed the strength of a concrete or masonry wall.





As lateral pressures are exerted upon the foundation, walls bow inward. The Reinforcer's effectiveness in counteracting such tendencies is based on standard engineering principles following Hookes law and a linear stress/strain relationship. Professional civil engineer and Nationwide Reinforcing co-founder Bob Thompson explains, "For every increase in pressure, the Reinforcer provides an equal and opposite resistant force, making the wall stronger to help eliminate shifting, cracking and bowing."

Thompson also emphasizes the ease-of-use and aesthetic benefits of the carbon fiber system: "Being lightweight and thin as a dime, the Reinforcer is easier and faster to install—a particular advantage around complex plumbing and electrical systems that otherwise might have to be removed and reinstalled. Also a significantly more attractive solution, the Reinforcer is virtually concealed once the block wall has been painted over."

To conduct a detailed engineering analysis of the Wellington project, which required approximately 20 hours, Thompson brought in his team of independent structural engineers. Included in the analysis was verification of lateral loads, height of

the walls and properties of the masonry and grout, i.e., all factors needed to determine spacing for the Reinforcer. According to team member Bill Shelley, president of Columbus-based Shelley Metz Baumann Hawk, Inc., "These variables were used in considering ultimate design strength versus working stress to derive a representation of the existing wall's integrity while assuming certain failure mechanisms to assure adequate safety." Overall, Ferguson reports, the inspection provided calculations proving to the township engineer that the Reinforcer was the optimal solution for the application.

Nationwide Reinforcing's engineers prepared design charts of the 400-ft. area of overstressed below-grade walls. Certified installers used these charts to determine the number of high-strength carbon strips needed and the optimal spacing required on the 11- to 15-ft.-tall foundation. Supplied on 250-ft. continuous rolls and cut to length, the strips were then placed along interior surfaces as indicated, after the walls were cleaned of all paint and debris. Approximately 100 precut, 8-ft. Reinforcer strips were applied with a structural epoxy paste (ECS 104) to the foundation walls. Removing excess epoxy off the strips and filling remaining cracks with ECS 104 completed the installation.

As Wellington at Hershey's Mill's underground garage was occupied by residents at the time, installation had to occur with the least amount of interruption to their daily activity. Nationwide's certified installer, therefore, worked in sections to minimize any disruption. Additionally, Thompson notes, "Because of the pending occupancy licensing deadline, the project had to be fast-tracked. Since the Reinforcer takes approximately half the installation time of other methods, we were able to complete the project in just two days, which satisfied the township as well."

In addition to the Reinforcer, manufactured and distributed since 1998, Nationwide Reinforcing produces the Reinforcer Shield, a unidirectional sheet/fabric made with high-strength carbon or glass fibers. Because the product readily conforms to irregular shapes such as circular or square columns, the manufacturer affirms, it especially suits flexural and shear strengthening applications and can provide a waterproofing membrane as well for foundation walls. —814/848-0377, www.thereinforcer.com