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We Will Never Forget...

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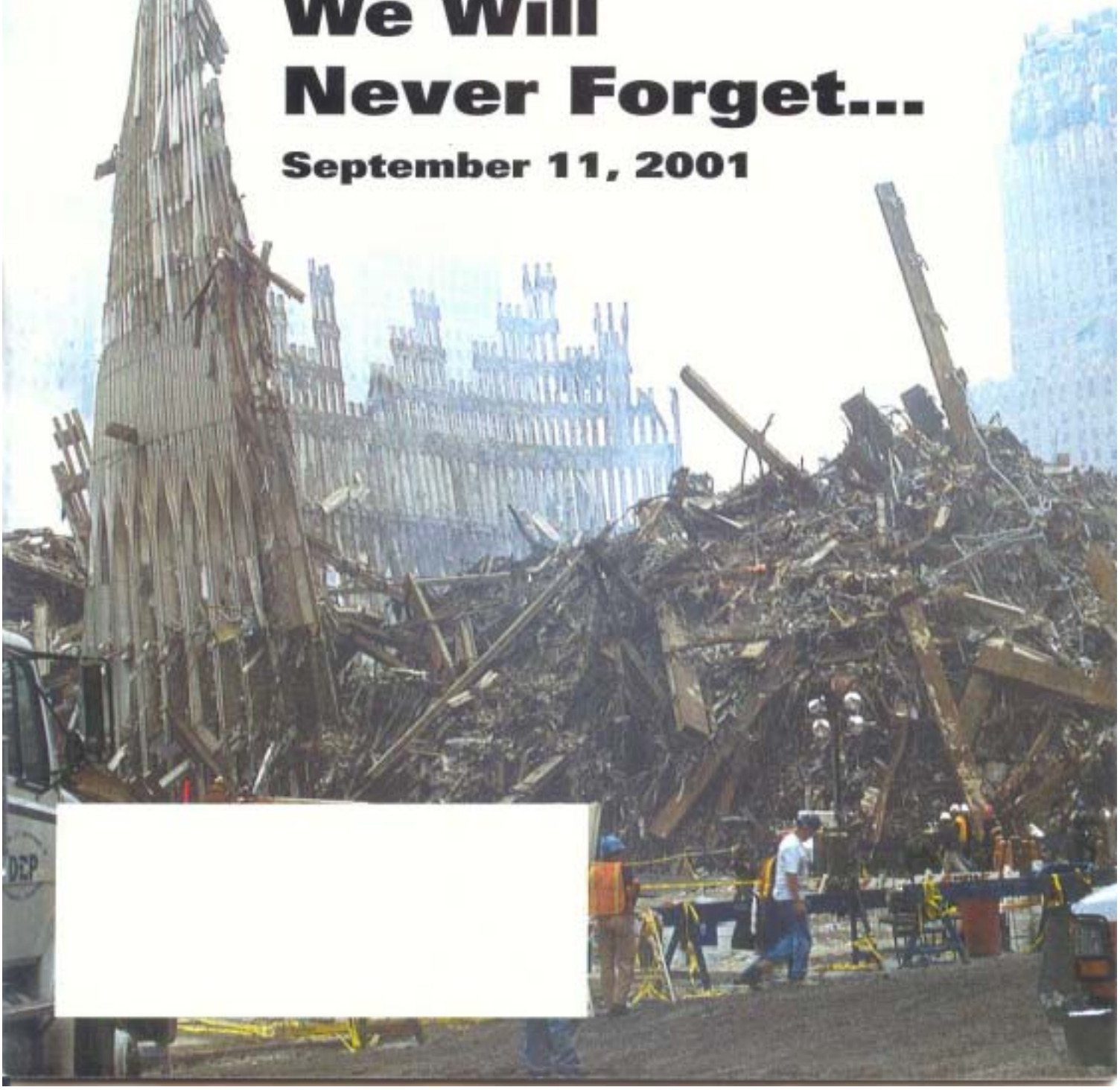

PCI Installs **Geopier Elements**

story by Carol Carder, courtesy of Geopier Foundation Co.
photos by Curt Grandia

A Lo-Dril attached to a Caterpillar 315 excavator plays an important part in PCI's installation of Geopier elements, drilling holes up to 20 feet deep.

With more than 80 years in heavy construction, Peterson Contractors, Inc. (PCI), has moved a lot of dirt. In recent years, though, the Iowa contractor has become a specialist in stopping soil movement.

Based in Reinbeck, PCI installs Geopier foundation systems in 25 states, including Iowa, Kansas, Missouri and Nebraska. As a licensee of Geopier Foundation Company (GFC) of Scottsdale, Ariz., PCI mobilizes its Geopier crews to jobs from North Dakota through the Midwest and south to Florida.

According to Dr. Nathaniel Fox, who designed and patented the Rammed Aggregate Pier System and is president of GFC, PCI will complete 40 percent of all Geopier installations in the country this year.

Geopier elements are constructed by building successive layers of densely compacted aggregate in a drilled or excavated cavity. Typical Geopier diameters are 24 inches, 30 inches and 36 inches. Undulating Geopier shafts consist of 12-inch thick layers of well-graded aggregate compacted with high-energy impact ramming action. Using special tamping equipment, the system compacts the aggregate and pre-stresses the surrounding soil. The result is improved strength and stiffness of the combined pier-soil system.

To build Geopier elements, PCI operators use a Lo-Dril attached to a Caterpillar 315 excavator to drill a 30-inch diameter hole to the design depth, generally from 8-20 feet deep. An operator using a Takeuchi TL126 skid loader with a custom bucket brings the aggregate to the hole where the bottom bulb is built with a 30-inch thick lift of clean stone without fines. Another operator uses a CAT 315 excavator with an NPK 8X hydraulic demolition hammer to ram the aggregate. The NPK hammer is modified with a downhole extension and a short tamper shaft and foot.

Each layer of aggregate dumped into the hole is rammed with 1.7-million foot-pounds of energy per minute. Then, 12-inch lifts of highway grade roadbase with some fines are built in layers up the shaft, and each lift is tamped with the same

With the hole drilled, a PCI operator uses a Takeuchi TL126 skid steer loader to carry the aggregate and dump it, in layers, into the hole.

energy. The aggregate bulging out laterally into the surrounding soil increases the load-bearing capacity. Depending on the soil stiffness, from 25 to 100 percent more compacted rock than the volume of the shaft is used. A footing, mat, or concrete cap seals the tops of many piers and others are topped with earthfill.

Geopier elements offer builders an intermediate foundation system between shallow footings and mats and deep foundations such as drilled caissons and driven steel piles. The system also makes over-excavation and replacement unnecessary. GFC is so confident of the performance of its design/build foundation, the company warranties total settlement to be no more than 1 inch for typical buildings and no more than 1-1/2 inches for parking structures. Differential settlements are designed to be less than one half of total settlement magnitudes.

PCI has installed Geopier solutions designed by The Pro Firm, of Des Moines, to support highway retaining walls, to stop settlement of a highway slab, to halt landslides, and to support a box culvert on a silty clay creekbed on a recent Iowa job.

Working as a subcontractor to Godbersen-Smith Construction Company of Ida Grove, Iowa, PCI installed 276 piers to support a 48-meter long poured-in-place box culvert rehabilitating a bridge on Route 191 near Neola, Iowa. According to Mark Freier of Godbersen-Smith, the Iowa Department of Transportation chose the culvert installation to keep the highway open during most of the repair and also so curbs could be removed later to widen the section of roadway.

"This job had some challenging aspects such as the tight working space with just 20 feet of headroom under the bridge and the need to case some of the holes until the aggregate could be rammed because of the high water table," Peterson said.

The performance expected from the Geopier elements, according to Steve Megivern, P.E., of The Pro Firm, is

After the aggregate is dumped into the hole, PCI uses an NPK tamping attachment to ram the aggregate, stabilizing and strengthening the pier-soil system.

reduction of the predicted total settlements from 55 centimeters without any reinforcement to only 10 centimeters with the piers. Professor David White, civil engineering associate at Iowa State University in Ames, is monitoring the inclinometers ISU installed to measure any future movements.

One member or another of the Peterson family has been pushing dirt around in Iowa since 1918. That's the year Cork Peterson's grandfather Martin Peterson started grading roads in Laurens, Iowa. His father Gale and uncle Dale (twins) followed in the family footsteps as roadwork contractors, also in Laurens. Cordell Peterson – no relation – founded Peterson Contractors Inc. (PCI) in Reinbeck, Iowa, in 1963. Cork joined him part-time while in college in 1965 and became a full-time partner in 1968 after returning from the U.S. Army Corps of Engineers.

"We've been really low profile for years doing grading, earthwork, heavy demolition, structures and underground utilities," Peterson said. "We've always turned down requests from publications and you wouldn't be hearing about us now if it wasn't for the Geopier foundation systems we're installing."

As more designers and owners discover cost savings up to 70 percent over conventional deep foundations and as more contractors discover the smooth sequencing of Geopier installation into construction activities, Peterson expects his foundation business will continue to grow.

Since its inception in 1990, the Geopier organization has designed/built more than 350 major projects in 35 states and now has Geopier licensees in 7 countries worldwide.

For additional information, visit Geopier Foundation Co., Inc., on the web at www.geopiers.com. ❑

Earlier this year, PCI's installation of Geopier elements also helped solve a problem in Iowa's Dallas County on a reoccurring landslide mid-slope on a steep, curved grade where County Road P-48 descends to the Raccoon River. The slide had plagued the Iowa Engineering Department for 32 years.

Before paving could begin, a landslide developed in the weathered shale and glacial till soils underlying a filled portion of the roadway. Filling and leveling the upper portion of the displaced soil mass proved only a temporary repair. At least 10 times, county contractors had performed significant work on the road and slide area, including the removal of a 450-foot section of the undermined pavement and installation of 300 linear feet of sheet pile in an unsuccessful attempt to cut off the slope movement.

Solutions such as retaining walls were deemed too expensive as was the million-dollar fix of partial replacement of the

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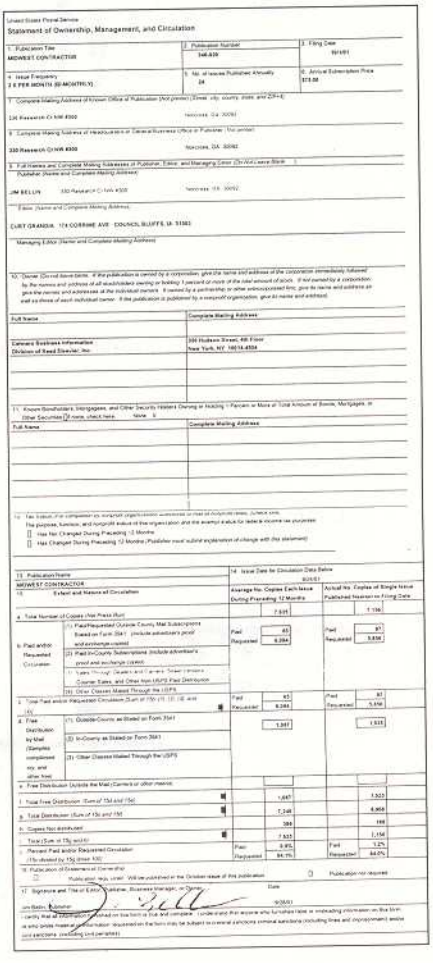
Statement of Ownership, Management, and Circulation

—Continued from page 18

road embankment with Styrofoam blocks. Jim George, the Dallas County engineer, contacted Dr. Richard Handy at Iowa State University and Henry D. Feeken of The Pro Firm. The Geopier solution installed by PCI this spring consists of nine rows of pier elements installed through the till and moist weathered shale zone to dry shale about 22-feet deep, paralleling 450 feet of roadway at the slide's mid-slope.

"The Geopier elements should keep the roadway slope inactive for decades to come, if not forever, and permit the long awaited paving," Feeken said. "Additionally, the $200,000 cost was only 20 percent of the million-dollar embankment replacement solution."

In addition to stabilizing soil, Geopier elements can also support heavy loadings. At Nucor Steel in Norfolk, Neb., as production increased and the company overloaded two storage bays, 15- to 30-foot tall stacks of steel billets were pressing into the floor and soil beneath them at contact pressures reaching 17,000 to 18,000 pounds per square foot. The soil, unable to support the loading, was rotating from the inside out "nearing global rotational failure," according to Dr. Ken Hall of Hall Blake & Associates of Memphis, Tenn. "The building's load-bearing columns were twisting and distorting and interfering with the operation of the overhead cranes," he noted. "In fact, movement was so great, the columns had to be rehabilitated by saw cutting and splicing."

Hall considered alternatives such as transferring the billet loads to a better stratum via deep foundations, but expected excessive costs, the eventual need for massive pile caps and downtime in this busy plant were not options. Hall recommended soil reinforcement with Geopier elements.

GFC's offices in Blacksburg, Va., and Memphis, Tenn., jointly designed and serviced the retrofit for the two 8,000-square-foot billet areas. PCI worked around business as usual in the plant as its crew drilled through the existing slag floor and old foundations to install 600 Geopier elements 30-inches in diameter and 30 feet deep on 6-foot-centers. A significant benefit to Nucor was eliminating the need for a concrete slab over the installed Geopier elements. K. Porter Construction Co. Inc, of Norfolk, Neb., reinstalled the slag floor by compacting lifts on top of the strengthened subgrade.

The third phase will be installed when conditions allow, strengthening the soil beneath a 20,000-square-foot area at a separate billet storage bay at Nucor. At that time, PCI will recycle the plant's slag waste product by using it, instead of the crushed limestone gravel, to build the Geopier elements.

"We have doubled our load capacity and can now safely stack billets up to 29 feet tall without damaging our foundation," said Larry Votruba, Nucor Steel construction manager. ❑