

## Slope Stabilization

# A DOSE OF GEOPIERS MAY SOLVE THE CASE OF THE SINKING ROAD



**STIFF** Pounded aggregate prestresses surrounding soil and forms stiff column.

IOWA ENGINEERS ARE BEGINNING A ONE-year observation period to determine if a low-cost soil stabilization technique has ended 33 years of recurring landslides that have crippled the use of an important county road. They hope that rammed aggregate geopiers will provide a permanent fix where other systems have failed.

Workers for Peterson Contractors Inc., Reinbeck, recently finished drilling 379 geopiers in a nine-row grid pattern on the downward slope of County Route P 48. The 30-in.-dia soil reinforcing piers were placed about 30 ft deep, paralleling 450 ft of unstable road at mid-slope of the 80-ft downward side. The hill is about 120 ft high.

The piers should increase the friction angle of the slope and stop future sliding of the shale bedrock. "They first took off 10 ft of top soil in two banks, each about 25 ft wide," says Henry D. Feeken, co-founder of The Pro-Firm, Clive, Iowa, a five-year old consulting engineering firm that designed the fix. "Then they drilled down 20 ft and created the bottom bulb with limestone aggregate, then compacted the rest of the aggregate pier, capping it with a 5-ft clay plug. The top soil was replaced and now it looks like nothing ever happened there."

According to Feeken, county officials originally routed the two-lane road to cut into the hillside. The road changed the flow of water from the 50-ft upward slope by putting in a bench that destabilized the downward slope. He says the road-

bed has dropped about 5 ft over the years, making repaving impossible. The road, located near Dexter, about 30 miles west of Des Moines, is used primarily by trucks hauling produce.

Geopiers were invented in 1988 by Nathaniel Fox, founder of Geopier Foundation Co., Scottsdale, Ariz. They are used to support structures and vertically reinforce soil. As aggregate stone is rammed into a hole, it creates a bulb of stone at the bottom, which prestresses the surrounding soil. Once the bulb is in place, layers of aggregate are compacted on top creating a dense, stiff shaft that strengthens the soil.

Over the years, Dallas County engineers have tried many remedies, including removing a 450-ft section of undermined pavement and replacing it with gravel, and the installation of a 300-ft-long sheet-pile retaining wall on the shoulder, which is shifting downward.

For the latest fix, engineers considered quick-time stabilization to dry out the soil and a \$1-million, 25-ft-deep excavation of the roadbed, followed by installation of styrofoam blocks to reduce bed weight. The blocks would have been covered with soil and repaved. But they opted for a \$170,000 geopier solution.

"We've lost three pavements in slides and have had a difficult time stabilizing the roadbed," says Bruce D. Logemann, project manager of the Dallas County Road Dept. "We're optimistic and feel geopiers is our best shot at stabilizing the road." If all goes well, the road could be repaved next year for the first time in nine years. □

*By William J. Angelo*

## New Millennium Woodstock PERFORMING ARTS COMPLEX EYED

It will still be open to the air. Otherwise the \$40-million, Richard Meier-designed concert pavilion, proposed to open in 2004 at the Bethel, N.Y., site of the 1969 music festival, will bear little resemblance to its predecessor stage. The 200-ft-wide, curved glass-and-steel structure will seat 3,500 people stadium-style with room for 14,000 more on a lawn. It may eventually anchor a 634-acre campus. A contractor has not yet been named.

