

Unique Foundation Support at St. Louis Mills Nov.-Dec. 2002 MR22

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NEWS AND REVIEW

Structural Engineering and Art

Unique foundation support at St. Louis Mills

by Carol Carder

When St. Louis area residents visit the new St. Louis Mills at State Highway 370 and Missouri Bottom Road next November, they will find a brightly colored entertainment destination and shopping mecca with at least 12 anchor stores and up to 200 specialty retailers, theme restaurants and a multi-screen movie theater. What they won't see is the fast track construction that is enabling The Beck Group to finish this 1.3-million-square-foot \$150-million mall in a record time of 16 months — two months faster than the completion time for other Mills centers of comparable size.

They also won't notice the work of Tarlton Corporation: the 800,000-square-foot concrete floor slab and the 600 concrete footings. And no one will see the unique Geopier soil reinforcement underlying the third of the footings that support the heavier column loads.

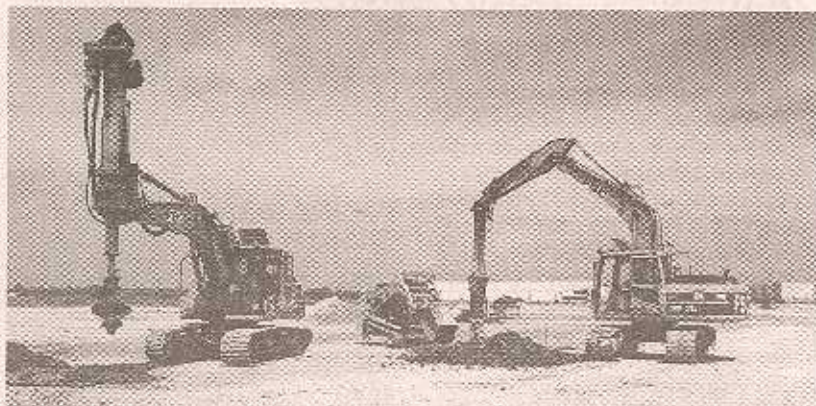
Soil reinforcement is necessary because the soils on the floodplain site are extremely soft, said geotechnical engineer Kevin Miller of PSI. Geotechnical borings revealed layers of clay, fine sands and silt

down to depths of 30 to 40 feet below grade. The top 10 feet of soils above the water table are the stiffest soils in the profile.

Miller recommended Geopier elements instead of deep foundations. Geopier elements are an intermediate foundation support system spread the load in the upper 10 feet of stiff soil. With this solution, the contractor could build with the spread foundations normally used to support single-story Mills' malls.

So what's a Geopier element?

Geopier elements resemble drilled shafts of aggregate, but the patented design/build system is a precise engineered product custom designed to the site conditions and desired load-bearing capacity. To build each of the Geopier elements, Foundation Service Corporation (FSC) of Renbeck, IA, the licensed installer, drilled a 30-in. shaft to the design depth ranging from 9 to 13 feet below the footing level. Then a modified hydraulic pavement tamper rammed in 12-inch lifts of clean fractured aggregate into the ground with 1.3 million foot pounds of force per minute. The undulating layers of aggregate reinforce the surrounding



Excavator with LoDril auger attachment drills 30-inch diameter shafts for Geopier elements at St. Louis Mills. Skid loader with custom bucket brings aggregate to the shaft where a hydraulic hammer rams it into the ground at 1.3 million foot pounds energy per minute.

Photo by Matt Caskey, Geopier Foundation Co.

soil allowing conventional spread foundations and floor slabs to support the structural loads.

The single-story structure rests on 822 columns, according to Design Associate Matt Caskey of Geopier Foundation Company—MidSouth LLC, Memphis, TN. Structural engineer McNamara Salvia Inc., Boston, MA calculated the bearing load on each foundation from the columns. Miller set a threshold for footing

loads that required soil reinforcement at 70,000, so only a third of the columns have Geopier elements installed under the spread foundations.

"Kevin [Miller] is using Geopier elements in the right dose," Caskey said.

The heaviest loads, up to 300,000 pounds, are on columns supporting large spans over open areas. These columns required 6 Geopier elements for support.

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FSC installed nearly 400 Geopier elements in the first phase in 8 days from August 15 through 28. In October FSC returned to install more than 200 additional piers to accommodate changes in design for new tenants.

"The speed was phenomenal... with 70 to 80 piers drilled and compacted a day," said Bill Pfeffer, senior project manager, The Beck Group. "We could never have drilled piers, set cages and poured them at the rate we installed the Geopier elements."

Steve Cronin, Tarlton Corporation said, "The Geopier installation sequenced well with foundations. We started foundations that didn't need the piers ahead, then followed right behind their work."

In its first phase on the foundations Tarlton excavated and placed approximately 600 footings in ten weeks, requiring 1200 cubic yards of concrete and 83 30-inch-by-30-inch concrete columns. Five Star Concrete supplied the concrete. Tarlton subcontracted the second phase flatwork to Ahal Contracting, who is using Breckenridge Materials for its supplier. The flatwork that began mid-October and is scheduled for completion in 10 weeks includes the 800,000-square-foot floor slab flatwork and 3300 linear feet of perimeter turn-down slab. **CMR**