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Geopier At Jordan Creek



FOCUS:
Annual Buyers'
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Wayne Curtis Publisher

Curt Grandia Editor
1217 32nd Street
West Des Moines, IA 50266
Phone/FAX: (515) 226-0273
Mobile: (515) 201-3907
E-mail: cgrandia@reedbusiness.com

Greg Sitek Editorial Director
Ph: (203) 633-1789
E-mail: gsitek@reedbusiness.com

John Ziegler Advertising Director
Ph: (440) 729-0270 • Fax: (440) 729-0215
E-Mail: jziegle@reedbusiness.com

Tammy Hardersen Advertising Sales
(515) 987-5378 • Fax: (515) 987-5379
Mobile: (800) 567-2143
E-mail: thardersen@reedbusiness.com

John Weatherhead
Custom Publishing Director
Ph: (800) 486-0014
E-mail: jweatherhead@reedbusiness.com

Jessica Brooks Group Circulation Manager
E-mail: jbrooks@reedbusiness.com

Ken Fetting Production Manager
E-mail: kfetting@reedbusiness.com

David Soltis Assistant Production Manager
E-mail: dsoltis@reedbusiness.com

Maria J. Villamarzo Graphic Designer

Corporate Office
30 Technology Parkway South, Suite 100
Norcross, GA 30092
Ph: (800) 486-0014 • Fax: (770) 417-4138

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Jim Casella
CEO, Reed Business Information
Curtis Allen
President, Reed Construction Data

For information on editorial or advertising reprints, please contact reprint services at (770) 417-4147.

Subscription Inquiries • Customer Service
Reed Business Information
8778 S. Barrons Blvd.
Highlands Ranch, CO 80129
Ph: (800) 446-6551 • Fax: (303) 470-4280
E-mail: subsmail@reedbusiness.com

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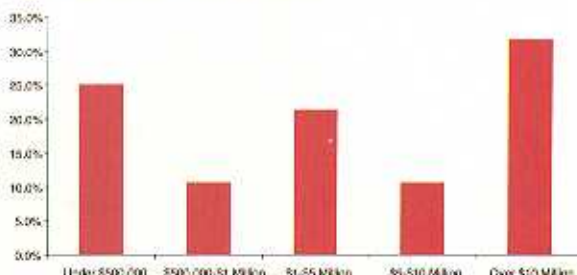
The theme of this year's Kubota Tractor Co. dealer meeting is "Expand the Vision."



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NI Annual Buyers' Intentions Survey

86 percent of this year's respondents expect the construction market to stabilize or grow in 2004.

On The Cover: Work continues at the \$200-million Jordan Creek Town Center where contractors are trying to get inside for the winter.

Geopier At Jordan Creek

Soil Stabilization System Supports Elements Of \$200-Million Complex In West Des Moines

By Carol Carder

John Bucksbaum, chairman of General Growth Properties, Inc. of Chicago, Ill., is celebrating his company's homecoming to the Des Moines area by building a unique entertainment and shopping complex on a 200-acre site in West Des Moines.

For the Jordan Creek Town Center, Callison Architecture Inc. of Seattle, Wash., designed a 3.5-acre manmade lake, a 1.3-million-square-foot two-level mall and entertainment complex located on the north side of the lake and a 500,000-square-foot open village style retail center on the southern section of the property. The lifestyle complex will feature waterfront dining and a lake district surrounded by pedestrian walkways and a lakefront boardwalk to create a park-like ambiance for shoppers.

Supporting the two-level mall under the spread foundations is an unseen, but unique, Geopier® soil reinforcement system composed of 1,132 Rammed Aggregate Piers. According to Andy Fry, project manager for the structural engineering firm Magnusson Klemencic Associates, of Seattle, this intermediate foundation system was selected to avoid costly over-excavation below the spread footings. The piers enhanced the native soil providing allowable bearing



Geopier elements are installed for a retaining wall at Jordan Creek Town Center in West Des Moines.

capacity of 4,000 pounds per square foot design load while limiting total settlement to less than 1 inch and differential settlements to less than 1/2-inch. The footings of the Jordan Creek Town Center support column loads of 65 kips to 580 kips.

In its soil investigation the geotechnical consultant, Allender Butzke Engineers (ABE) of Urbandale, Iowa, completed 113 borings 10 feet to 55 feet deep making sure borings ran 15 feet to 20 feet below the lower level elevations. The majority of the borings concentrate in the mall area and a few scatter across the rest of the site. According to Stacy Brocka, P.E., ABE, this site is at the end of a prehistoric glacier where silty clay loess soils vary from 3 feet to 27 feet deep and possess compressive strengths ranging from 440 to 2,400 pounds per square foot. The glacial till also varies in depth from 3 feet to 20 feet or 30 feet thick.

"Part of the mall will be sitting on wind blown loess soils while the other portion will be sitting on glacial till

soils," Brocka noted. "So we have a mixed bag of soft and stiff soils underneath this entire mall." Even where the mall sits on stiff glacial till, a cut 25 feet to 30 feet deep for a basement could go back into the loess soils. ABE presented three options to the developer, General Growth Properties Inc.: a deep foundation of caissons or augur cast piles, over-excavation and replacement of unsuitable soils, or Geopier soil reinforcement.

"Typically we use caissons for deep foundations here in central Iowa and/or over-excavation and replacement for moderate structural loads, but with timing being an issue we suggested investigating the Geopier option," Brocka explained.

The General Contractor, VCC of Little Rock, Ark., elected to proceed with the Geopier soil reinforcement system. Compared to over-excavation, installing the



Above: Two of the key attachments in Geopier installation are the drill and the rammer on a Caterpillar 315B and 320, respectively.

Right: In addition to Caterpillar excavators outfitted with drills, FSC also drilled pier shafts for two anchor stores at Jordan Creek with a Soil Mec R208.



Rammed Aggregate Piers avoided moving 75,000 to 80,000 cubic yards of soil and saved \$400,000 in construction costs and a month on the schedule, according to Don Davis, VCC vice president.

The Geopier system is a patented design-build system of multiple Rammed Aggregate Piers, precisely engineered. Richard Gernant, P.E., Geopier Foundation Company – Midwest of West Des Moines, custom designs each project to the site conditions and desired load-bearing capacity per pier.

To construct each pier, Foundation Service Corp. (FSC) of Reinbeck, Iowa, the licensed installer, drilled a 30-inch-diameter shaft to the 12-foot to 14-foot design depth below the spread footings. Then, a modified hydraulic hammer rammed 12-inch lifts of 3/4-inch class 2 aggregate base rock into the ground at 1 to 1.5 million-foot pounds of energy per minute. The hammer's beveled tamper compacts the gravel vertically and horizontally into the ground increasing lateral stresses and reinforcing the surrounding soil.

General Growth's site work contractor McAninch, of West Des Moines, is mov-

ing approximately 2 million cubic yards for the lake, the enclosed mall, the village center, and the parking areas. Instead of using the traditional chrome shovels, in September 2002 McAninch broke ground dramatically with five D6 CATs for the groundbreaking ceremony.

"We mobilized 75 pieces of earth moving equipment last fall and finished half the excavating, then started in again in the spring," said Tom Holtz, McAninch marketing director. To maintain the aggressive schedule in the wet April weather, McAninch chemically treated 150,000 cubic yards of soil with lime to dry it out. McAninch also surcharged 11 acres of the building pads with 120,000 cubic yards of soil. The surcharging achieved settlement of 4 inches.

McAninch also installed utilities for the owner. According to Chad Pohlmeier, McAninch utility estimator/project

manager, the work crews installed in excess of 65,000 linear feet of pipe ranging from 2-inch to 60-inch diameter with over 230 structures, sanitary sewer, storm sewer, water main, and approximately 100,000 linear feet of subdrain pipe.

Steve Moyna, McAninch estimator/project manager for earthmoving and paving, added, "The site plan specifies approximately 500,000 square yards of paving with numerous intersections with West Des Moines public streets. Coordination of scheduling, site work and construction of structures is crucial because we'll have up to 10 different general contractors working on-site when the anchor stores, theater complex, village area, restaurants, and hotel are under construction."

FSC sent a crew on-site in April and May for the majority of the pier installations and averaged 45 to 60 piers a



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day. Then FSC returned in July to install some piers next to the basement level of the Scheels All Sport anchor store.

"In spite of site flooding from the early spring rains, FSC successfully mobilized within a few days and kept the project on schedule," Gernant observed.

"The Geopier installer moved through the site at a good clip followed closely by our concrete foundation subcontractor Ahrens Concrete Construction (of Iowa City, Iowa) who never had to wait on the pier installation," said Davis. "For us it was critical to maintain schedule so the structural steel is up and the mall is enclosed before winter weather sets in."

Typically we use caissons for deep foundations here in central Iowa and/or over-excavation and replacement for moderate structural loads, but with timing being an issue we suggested investigating the Geopier option.

Stacy Brocka, P.E., Allender Butzke Engineers

The equipment used to install Geopier elements is compact and allows for smooth sequencing of adjacent site work. FSC uses CAT 315 B excavators, one with a Lo-Drill attachment and the other with a CAT 120 breaking hammer modified with a down hole extension for tamping the aggregate. FSC also drilled pier shafts using a Soil Mec R208 for two anchor stores.

Based on the successful Geopier installation for the mall, General Growth encouraged its four anchors to consider Geopier soil reinforcement for their structures. Gernant designed a 513-pier system for JESCO Inc. of Fulton, Miss., general contractor for Younkers; a 332-pier system for Henry Carlson Company of Sioux Falls, Iowa, general contractor for the 20-screen Century Theatre complex; and a 262-pier system for CDI Contractors LLC of Little Rock, general contractor for Dillard's.

FSC returned with two crews near the end of September to install more than 1,100 piers in five weeks while the foundation crews followed close behind. Due to the late start on the anchor stores and the need to accelerate the construction schedule, FSC sent two crews who worked a number of 14- to 16-hour days, according to Chuck Pitzen, FSC site superintendent. Pitzen also noted that FSC installed several piers in some really tight site constraints. In particular, several piers were installed next to the main mall, which was already well under construction with the second-floor level and steel roof up.

To confirm that the design parameters were correct, FSC conducted modulus tests to measure the deflection of loaded

piers. FSC installs a test pier in the center and two uplift resisting anchors positioned at each end. Three or four days later, the technician places a beam across the test pier and the uplift anchors and hydraulically loads an individual pier

to 150 percent of the maximum design load capacity. At the Younkers location, the test pier deflected the theoretical design value of 1/2-inch at 11,500 pounds per square foot, instead of at the assumed 13,585 pounds per square foot. Additional soil sampling and testing confirmed a layer of soil possessing higher moisture contents and related lower strength parameters that had not been reflected in earlier borings on the west side of the site. Gernant reviewed the



FSC conducts modulus tests to confirm that the Geopier design parameters are correct. Test piers are installed in the center and uplift resisting anchors are positioned at each end.

design and added a total of 30 Geopier elements to accommodate the lower load carrying capacity of piers at appropriate locations. The testing, design changes and shop drawings for additional piers were completed in about three working days which still kept the project moving forward with minimal delays, according to Gernant.

General Growth Properties plans a grand opening August 4, 2004, to



introduce the 1.3-million-square-foot, \$200-million center of four anchors and 120 in-line retailers to the greater Des Moines area. ■