Clay foundation making Fargo a 'city on stilts'

By Mike Nowatzki
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A 45-foot-high Ferris wheel will eventually tower over customers inside the new Scheels All Sports store being built along Fargo's 45th Street South.

But the massive structure already stretches more than twice that length underground.

More than 100 concrete supports, known as caissons, plunge from the building's foundation through 105 feet of unstable clay before hitting firm glacial deposits, said Jeff Pfingsten, the project's construction manager for R.L. Engebretson of Fargo.

It's a common construction method for big buildings in the Red River Valley, plagued with some of the nation's worst ground for construction.

"Every major load-bearing structure here in the Red River Valley must be supported," said Donald Schwert, a North Dakota State University geology professor who has done extensive research on Fargo's earthen foundation.

Schwert will explain how Fargo is "a city on stilts" during NDSU's 47th Faculty Lectureship at 7 p.m. Tuesday in the Memorial Union's Century Theater. The presentation is free and open to the public.

A map produced by the North Dakota Geological Survey in 1974 showed the state's largest city located in a sea of red, denoting poor construction conditions.

STILTS: Back Page

First of two parts

LOSING GROUND

▶ **Monday:** Counties and cities are looking at riverfront setback regulations.

If you go

▶ **What:** NDSU's 47th Faculty Lectureship, "A City on Stilts: The Geology Under Fargo," by geology professor Donald Schwert. Free and open to the public

▶ **When:** 7 p.m. Tuesday

▶ **Where:** Century Theater, NDSU Memorial Union

STILTS: Severe water conditions bring on shifts

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When the southern tip of glacial Lake Agassiz retreated from North Dakota 9,000 years ago, it left behind a Red River Valley covered in a thick blanket of expansive, highly problematic clay, Schwert said.

The clay was deposited by the Sheyenne River as it cut through shale and formed the valley that now embraces Valley City, he said.

The shale was broken down into a clay called Smectite.

"These are clays that love to take in water, and when they take in water they swell," Schwert said. "And they also love to give off water, so during times of drought, they contract."

Going for a ride

As a result, the city of Fargo goes for a ride during times of severe high or low water, Schwert said. Walls and foundations shift in houses. Water mains break. Sections of street may tilt or bulge.

Fargo's jelly underbelly forces the city to take extra measures when building roads and bridges, City Engineer Mark Bittner said.

For example, a typical street in Bismarck uses 2 to 4 inches of asphalt. Fargo, on the other hand, must lay 8 to 10 inches of gravel before topping it with 6 to 10 inches of asphalt, Bittner said.

"And they probably still have better streets than we do," he said.

Fargo also must truck in all of its gravel from the edges of glacial Lake Agassiz.

"Pretty soon we'll have most of Minnesota in town here, one truck at a time," Bittner quipped.

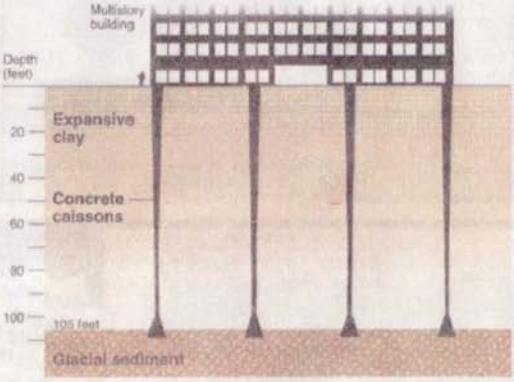
Long, hollow tubes of steel called piles are used to support structures where caissons are impractical. For example, the new Main Avenue bridge connecting Fargo and Moorhead used 45,300 feet of steel piles.

Piles and caissons can add significantly to the cost of building projects, Schwert said. Fargo's water treatment plant along Fifth Street South required 351 caissons at a cost of $2 million. The Fargodome required 200 caissons, while the Bison Sports Arena needed 64. The new 265,000-square-foot Scheels store used 103 caissons.

Soft ground

A 1974 North Dakota Geological Survey map showed that Fargo-Moorhead sits on land considered poor for general construction.

Expansive clay left over from glacial Lake Agassiz requires major building projects, such as the Radisson Hotel in Fargo and the Scheels All Sports store under construction on 45th Street South, to be supported with concrete caissons that extend 105 feet underground until they hit firmer glacial sediment.



Source: Donald Schwert, NDSU geology professor

The Forum

Mount Fargo's legacy

Fargo has learned some tough lessons about its geology during the city's 134-year history.

In June 1955, the Fargo Grain Terminal Elevator collapsed when the subsurface clay shifted under its tremendous weight.

The elevator's designers figured a broad slab of concrete would be adequate to support it, Schwert said.

What they didn't understand, he said, is the expansive underground clays behave like a bowl full of Jell-O pudding: push down in one spot, and the pudding simply rises in another.

That's what happened when Fargo created its first and only ski hill in the mid-1980s, facetiously dubbed "Mount Fargo."

Land excavated for the Bluemont Lakes development in south Fargo was donated to the city to build a ski hill on undeveloped land about 500 yards northeast of the intersection of Interstate 29 and 32nd Avenue South.

The hill began to slowly sink into the soft, wet clay, and in 1984, its weight pushed up a baby Mount Fargo.

The original Mount Fargo stood in an uneasy equilibrium as development continued around it. Then, in June 1991, it became active. The hill started moving in spots, making nearby homeowners uneasy, Schwert said. He climbed to the top of the hill to check it out.

"I was scared," he said. "It was moving here and moving there, and the police were down there with bullhorns saying, 'Get off of Mount Fargo!' " he recalled.

The city eventually trimmed off the top of Mount Fargo and used the clay to build dikes, he said.

Schwert said it's not his intent to cause alarm. He simply wants residents to be conscious of the earth beneath their feet and the innovative engineering required to build North Dakota's largest city.

"We can live compatibly in this type of vulnerable setting," he said.

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