Andersons build first prestressed concrete structure in the United States

In the early 1950s, prestressed concrete was still an untested idea in the United States. Engineers across Europe had been using it in designs for several years, but in the United States, few designers had heard of the material and none of the building codes mentioned it.

That did not bother Eivind Anderson, a Tacoma, Wash., contractor and Art and Thomas Anderson's father. The three cofounded Concrete Technology Corp. in Tacoma and are now considered the pioneers of the precast/prestressed concrete industry in the United States. They were intrigued by the versatility and performance of prestressed concrete and wanted to start producing it for a local market, but the real catalyst was when Eivind Anderson invited his son Art Anderson, who was living in Springdale, Conn., to return to Tacoma and help take over his contracting business.

At the time, Art Anderson was working in a partnership with John Fluke, a fellow Tacoma native and classmate at the Massachusetts Institute of Technology. He protested that he a doctorate in engineering from and didn't want to be a contractor. He did, however, offer to return if his father would help him establish a prestressed concrete manufacturing business.

Eivind Anderson knew nothing about prestressed concrete, so he and his sons spent six weeks touring prestressed concrete manufacturing operations across Europe. After seeing the prestressed concrete manufacturing operations there, Eivind Anderson agreed to help establish a plant in Washington.

To kick off the expansion, the Andersons decided to build a facility entirely out of prestressed concrete to showcase the material's strength and durability. It would be the first prestressed concrete building anywhere in the United States, as well as the first indoor precast concrete manufacturing facility featuring a controlled-temperature environment for curing concrete.

When the Andersons went to get a Small Business Administration loan, their advisor suggest that they build the plant in Seattle, Wash., the economic hub of the Pacific Northwest. But the Seattle building department refused to issue a permit for a prestressed concrete building.

"He said that there was nothing in the code book about prestressed concrete, so he couldn't let us build it," says Karl Anderson, Art Anderson's son.

Disappointed, they returned to Tacoma and showed the same plans to the building superintendent there. "He looked at our designs and said, 'Well there's nothing in the code book that says you can't build with prestressed concrete, so good luck!'"

After returning from a trip to Europe to tour prestressed concrete plants, Concrete Technology Corp. constructed the first prestressed concrete building anywhere in the United States. This aerial shot shows the building, which is used for manufacturing precast concrete panels. Courtesy of Concrete Technology Corp.

That was all they needed. In 1951, Concrete Technology Corp. started construction on the building. It was a fairly simple design, mimicking the buildings they saw in Europe. The building featured clear-span rigid frames with precast concrete wall and roof panels. Window frames were cast on the floor slab and were prestressed in both directions simultaneously.

"The key element was the roof girders," says Karl Anderson, who started working at the family business as an adult in 1969. "They are trapezoidal in shape, which gave the right slope to the roof." The roof panels were only 2 in. (50 mm) thick and 25 ft (7.6 m) long, so they were relatively lightweight "but very strong," he says.

To ensure that the plant structure could handle the heavy loads that would come with producing prestressed concrete panels indoors, Art Anderson figured out a way to produce zero-slump concrete with compressive strengths up to 10,000 psi (69 MPa), far greater than the 3000 psi (21 MPa) strengths that were typical of the time. His secret was to use powerful high-frequency vibrators attached to forms to consolidate the fresh concrete. Art later patented the technology as the Anderson Vibrator for External Consolidation.

Despite the skeptics who questioned the longevity of this untested material, the building has stood the test of time. It has weathered nearly 65 years of long, wet Tacoma winters and survived at least four earthquakes without sustaining any damage, Karl Anderson says. And although prestressed concrete building designs have gotten a lot fancier and more sophisticated since that building was erected, it continues to stand as a tribute to the beginning of this industry and the innovative risk takers who built it. "We are pretty proud of that," Karl Anderson says.

—Sarah Fister Gale

Precast concrete tepees a piece of Americana in South Dakota

One of the many advantages of precast concrete is its durability, and one of the most impressive examples of this durability can be seen along two interstate highways in South Dakota.

Rest stops along Interstate 90 (I-90) opened about 50 years ago in the state. As a way to attract motorists to the rest stops, the U.S. Department of Transportation commissioned Ward Whitwam, an architect, to design a number of precast concrete tepees for the rest stops. These tepees eventually came to be known as "Whitwam's wigwams."

Four of the tepees were built in the mid-1960s, and five more were built from 1973 to 1979. Seven of the nine are located along I-90, and the remaining two are located along Interstate 29.

Whitwam arranged for Gage Brothers, a Sioux Falls, S.Dak., precast concrete company founded in 1915, to build the structures. Whitwam, who is in his 90s now and is still active in architecture, credits Gage Brothers with making his architectural conception a reality.

"I didn't start here until 1980, so this was before my time," admits says Tom Kelley, president of Gage Brothers. "Our company had a good relationship with Mr. Whitwam on a number of projects over the past several decades, including some schools and a bank, so he contacted us when he came up with the idea for the tepees to see if we could make them out of precast."

Will Schroeder, who was the operations engineer for Gage Brothers at the time, was given the task. "Will was a very innovative thinker and worked out a way to do it," Kelley says.

Each tepee was composed of eight prestressed concrete lodgepoles, weighing 6.5 tons (58 kN) each. The design used an interlocking spiral construction. Each lodgepole was notched and inlaid with a steel plate where it intersects with another pole. At this point, the poles were welded together. Each tepee is 35 ft (10.7 m) in diameter at the bottom with a 3 ft (0.9 m) diameter opening at the top.

"It really was a simplistic design, but it worked well," Kelley says. "There is a steel ring at the top where all of the prestressed, four-strand cross sections meet, and they are all welded to the steel ring and also welded at the base."

Not only do the tepees feature an innovative design, but they were built so well that there has been no need for repair or even maintenance on them over the past four and five decades. "I took my grandkids there recently to show the tepees to them, and they are still in great shape," Kelley says. "That is pretty good when you realize that when they were built, we didn't have air entrainment or any admixtures."

The Interstates 90 and 29 tepees at rest areas in South Dakota have been around as long as 50 years without need of repair or maintenance. Gage Brothers constructed the tepees that architect Ward Whitwam designed. Courtesy of Gage Brothers Concrete Inc.

This detail shows the interior, looking upward, of one of the rest area tepees in South Dakota. Courtesy of Gage Brothers Concrete Inc.

These days, the tepees really are a part of history. In fact, they have been admitted onto the National Register of Historic Places. And it is likely that they will remain part of history. "When the rest areas were updated in recent years, there were no plans to build any new tepees," Kelley says.

That has not limited the relationship between Gage Brothers and Whitwam, though. "Mr. Whitwam was executive director of the American Institute of Architects in South Dakota into his late 80s," Kelley says. "He is still around, and he is still designing houses. In fact, I saw him the other day, and he said he was going to come in to talk with me because he had an idea for another project."

—William Atkinson