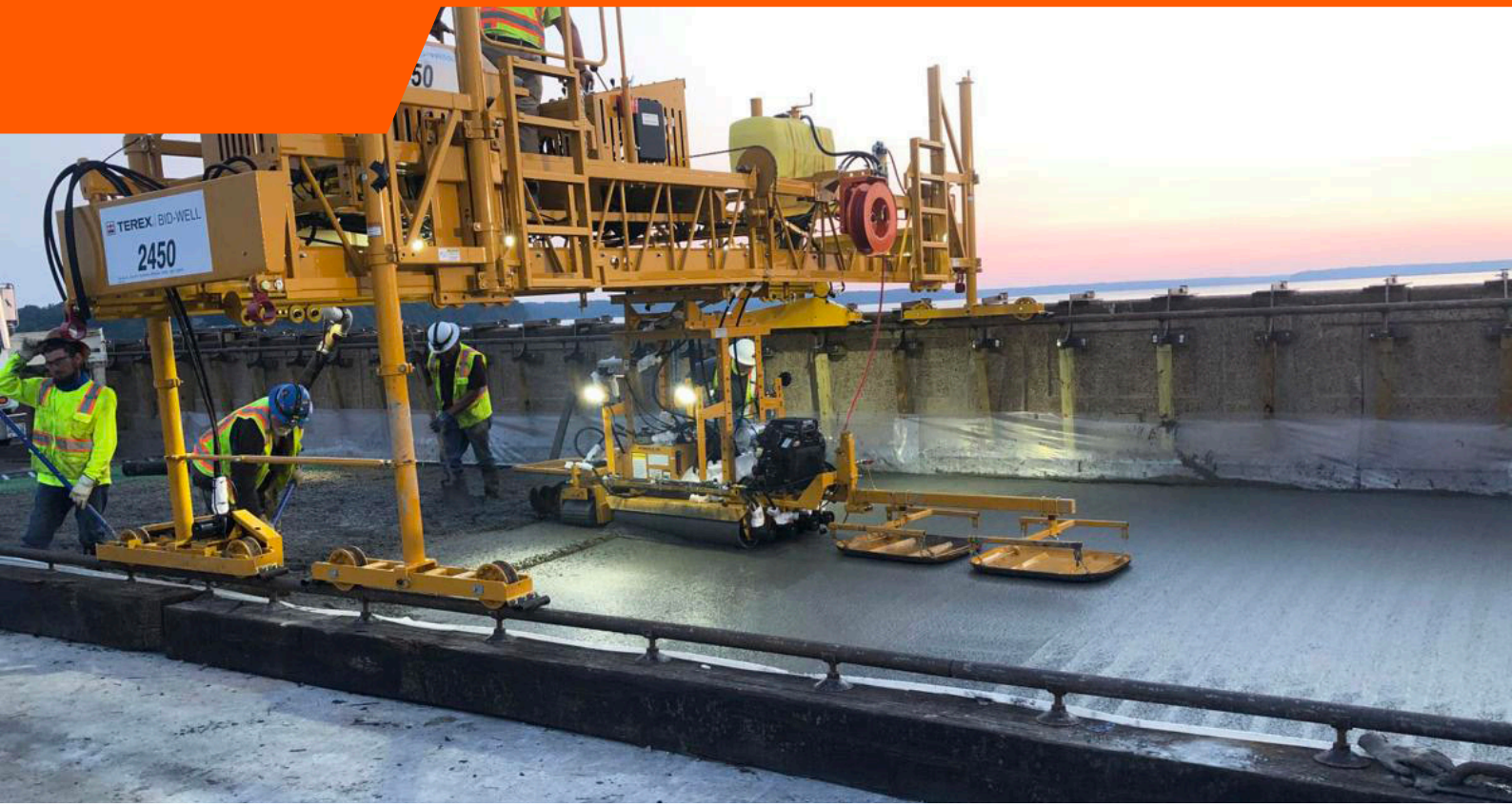


CASE STUDY:

WILSON DAM RENOVATION

Material from Arcosa Lightweight is being used in extensive bridge deck repairs for Wilson Dam, a 100-year-old hydroelectric dam located along the Tennessee River at Muscle Shoals, Alabama. Operated by the Tennessee Valley Authority (TVA), renovation of the historic landmark is the agency's first use of internally cured concrete.

The expert behind the project, TVA's Ben Byard, is the agency's Bridge Program Director and Facilities Asset Manager. Byard, who has a PhD from Auburn University, taught internal curing as a professor and saw the Wilson Dam project as a golden opportunity to take advantage of a key benefit of internal curing: longevity. "Our goal was to provide a 100-year bridge deck and internal curing is a great way to achieve that," he says.

Byard explains other benefits of the process. "Because you keep the internal relative humidity high much longer, you get increased strength before [the concrete] starts to desiccate," Byard says. "The combination of better strength and delayed drying shrinkage gives you a denser, better concrete. The decrease in cracking and increase in mechanical performance are the values of internal curing."

Renovation Overview

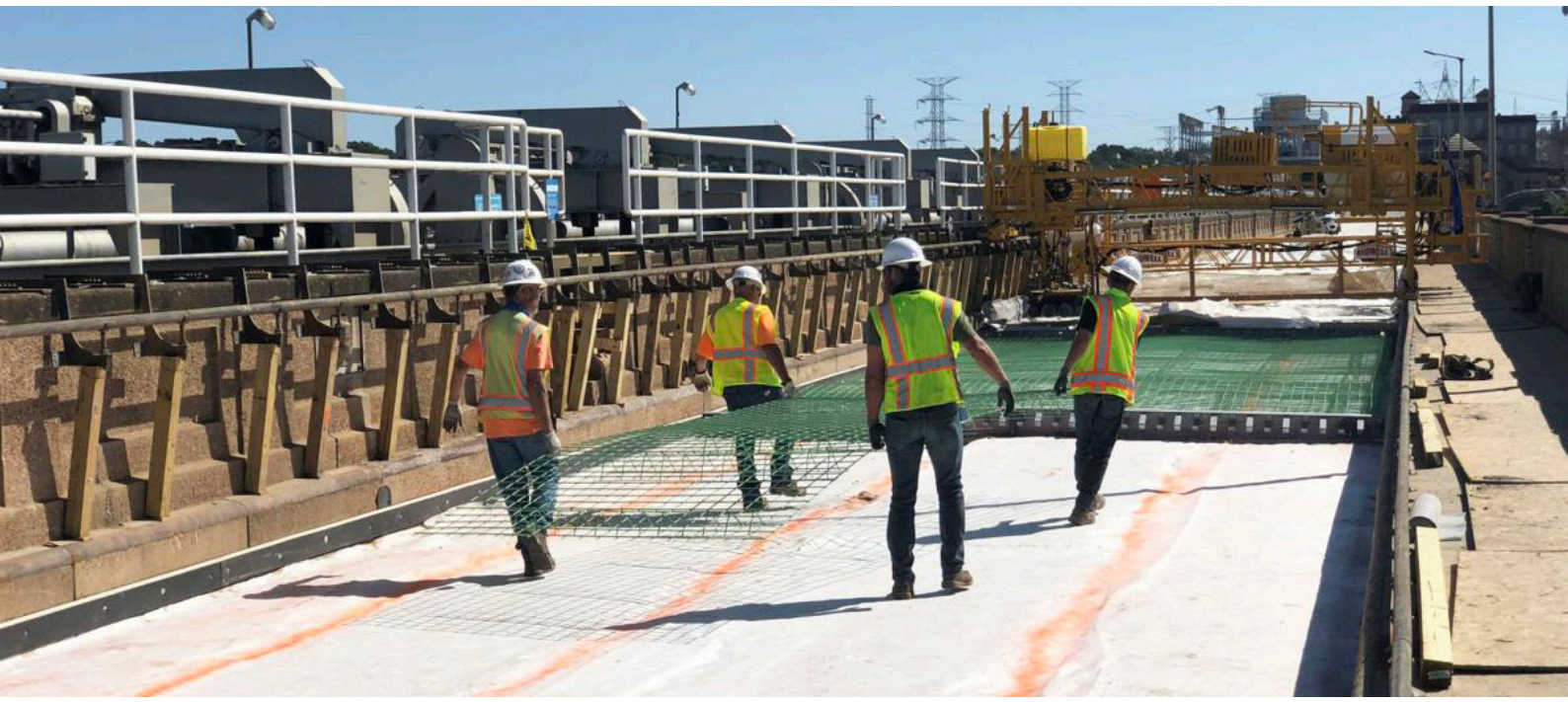
Arcosa's Jeff Speck briefly describes the Wilson Dam project: "The entire project includes some renovations to the dam and to some of the power-generating equipment," he explains. "They also replaced the concrete pavement and resurfaced the wall and sidewalks. There's a concrete road that runs across the spillway of the dam which connects two counties in northwestern Alabama."

The roadway atop the dam was constructed between 1918 and 1924 and for years, served as a well-traveled and essential route between Colbert and Lauderdale Counties. Use of the dam to cross the river slowed once the nearby Patton Island Bridge opened in

CASE STUDY: INTERNALLY CURED CONCRETE

WILSON DAM RENOVATION

ARCOSA LIGHTWEIGHT



2008, but TVA officials were eager to replace pavement on the road dating back to the 1950s.

"The dam originally had brick pavers as the wearing surface," Byard explains. "In the 1950s, they did an overhaul of the dam and bridge system. They pulled up all of the brick pavers and replaced them with unreinforced concrete decks. To level the concrete segments, they used a mortar-like material as a leveling agent," he says.

But when the driving surface of the roadway was being removed in 2019, extensive damage was revealed. "Because the concrete was unreinforced, cracks formed and increased exponentially. Water got in, hit that mortar layer and caused deterioration and settlement. Nasty dips," Byard says.

When TVA embarked on giving the Wilson Dam bridge a modern upgrade, Byard was thrilled. "If I'm doing a bridge deck, by golly, it's going to be internally cured. So, I specified that for the concrete. I went to the ready-mix supplier, Ready Mix USA, and they suggested Arcosa. I really wanted to use a lightweight aggregate with a regional and local presence."

Local Supplier

Matthew Moore with Cemex's Ready Mix USA North Alabama Region says the concrete used in the renovation project was batched from their nearby plant at the Florence Industrial Park. "For this job that was our main facility, which is on the north side of the river," says Moore. "We also have a plant in Tuscumbia on the south side of the river which acted as a backup facility."

At the plant, the only special handling was keeping the stockpile of lightweight material saturated by sprinklers. "The material does require some additional handling, storage, keeping it wet," says Moore. "When we batch it, we really have to pay attention to the moisture content. While normal weight aggregates only have about a one percent absorption rate, this material can have over 20%. It can be difficult with all that water in the lightweight, so we have to watch how it impacts the mix."

Moore says Ready Mix USA has extensive experience batching concrete with lightweight aggregate, most recently on a major new hospital which opened very near the Wilson Dam. But this project was somewhat unique.

"We've used a lot of lightweight aggregate through the years and this project was a little different," says Moore. "Basically, the internally cured concrete is designed to a weight and to an air spec and like I said, we have to take a little more care with the lightweight and make sure it's kept wet at the plant."

Like all commercial pours, Ready Mix USA's quality control team kept a close eye on material batched at the plant and delivered to the job site. "We had a dedicated quality control person monitor what we're producing and personnel on site to help with contractor communication," says Moore. "This project went really smooth. The contractor, TVA, the testing company, I have to say it went well. The things that I thought would be issues, we just didn't have them."

CASE STUDY: INTERNALLY CURED CONCRETE

WILSON DAM RENOVATION

ARCOSA LIGHTWEIGHT

Specifying Internal Curing

Speck and Arcosa Sales Rep David Annestedt were more than happy to help Byard with the project's lightweight needs. If you're new to Arcosa Lightweight's product, Speck describes the material Byard specified.

"It's lightweight fine aggregate, which is like sand, that's been pre-soaked before batching the concrete," Speck explains. "It replaces just a portion of the concrete sand. There's probably 250 pounds or so of the lightweight aggregate in a yard of concrete, and that relatively small replacement of concrete sand with pre-wet lightweight aggregate provides internal moisture to keep the hydration process going longer as the concrete cures."

He reinforces Byard's assertion on internal curing's value saying, "It reduces early age shrinkage, which will help reduce cracking in the pavement helping it to last longer. We've been promoting internal curing for a long time now," Speck says.

"The industry spent a lot of money and time on research of internal curing and the benefits that it provides to the service life of concrete structures. Actually, Ben was involved in some internal curing research when he was getting his PhD at Auburn."

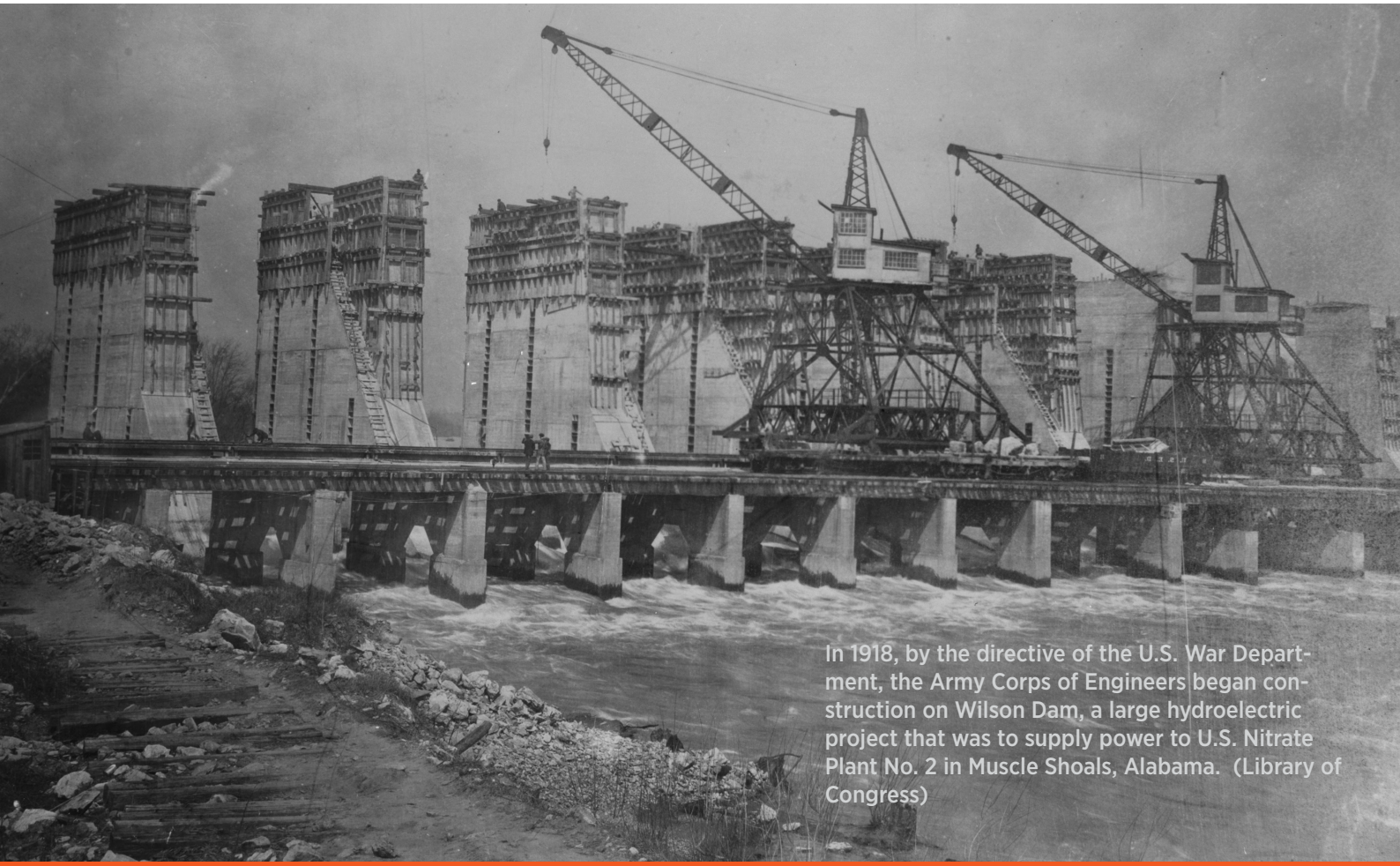
Byard says his research was funded by the Expanded Shale, Clay, and Slate Institute (ESCSI). "It was on lightweight concrete in bridge decks," Byard says. It's during the course of his advanced studies that Byard first crossed paths with Speck.

A Special Landmark

The region of Muscle Shoals is special to Byard and the team because, as he points out, the area is the original seat of the TVA when it was formed back in 1933. He says helping restore the only neoclassical-style dam built by the U.S. Army Corp of Engineers in the TVA system has been the highlight of his career. "It's a big deal because Wilson Dam is on the National Historic Register and it's a National Historic Landmark as well," he says.

Renovation of such a landmark is not a quick process. For one, all potential changes and updates had to be approved by the Department of the Interior because Wilson Dam is part of the U.S. National Park system. Byard says it was worth it. "It's still a really loved, relevant structure."

When asked if he would use Arcosa Lightweight again Byard says: "In a heartbeat. For a relatively minor increase in cost, you get a lot more bang for your buck in the performance."



In 1918, by the directive of the U.S. War Department, the Army Corps of Engineers began construction on Wilson Dam, a large hydroelectric project that was to supply power to U.S. Nitrate Plant No. 2 in Muscle Shoals, Alabama. (Library of Congress)