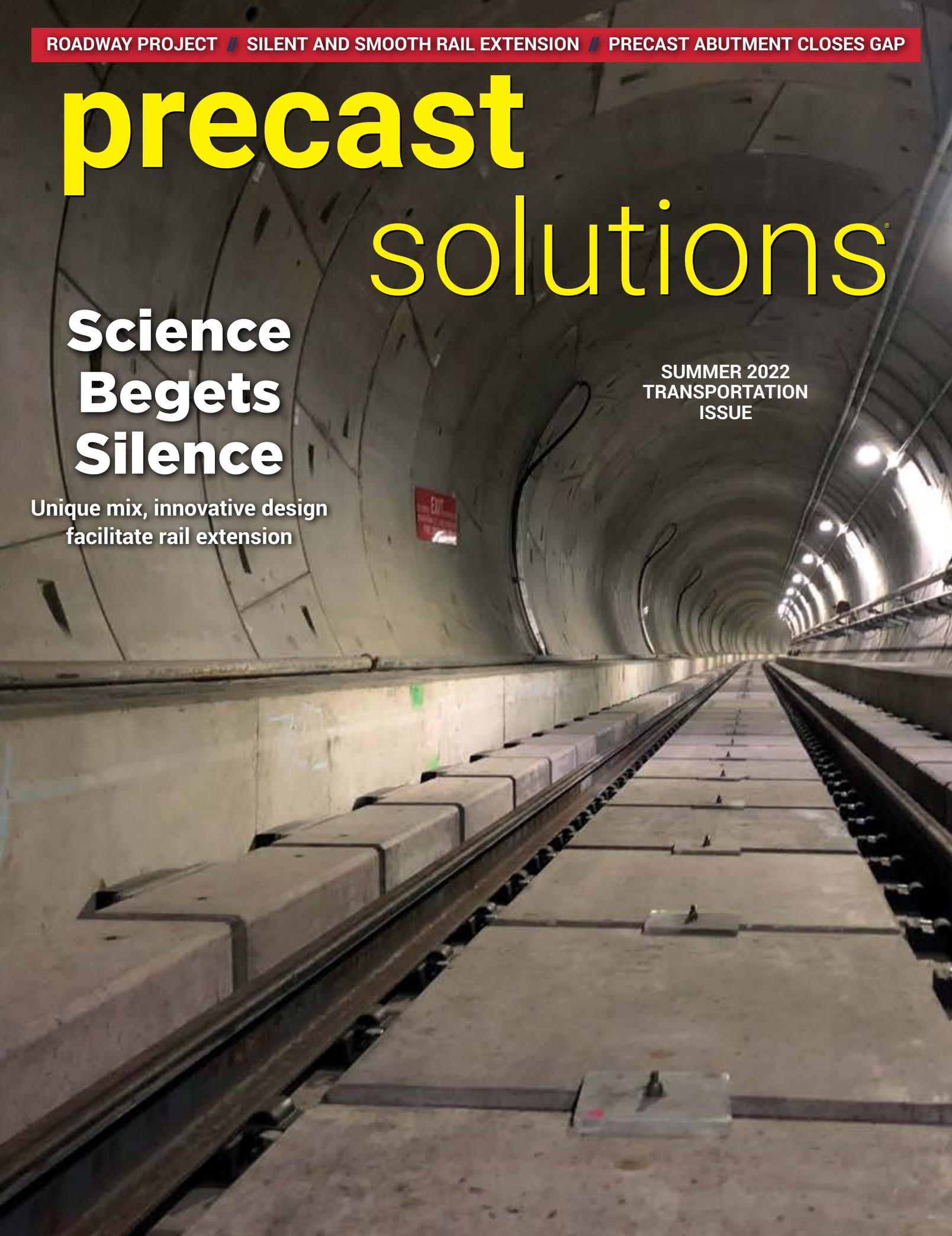


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# precast solutions

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### ON THE COVER:

Roughly three quarters of a mile of the 4.3-mile Northgate extension was slated to include work in tunnels passing under research facilities at the University of Washington, requiring a unique solution to reduce vibrations.

Photo courtesy of Columbia Precast Products

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# Specifier Q&A

Oscar R. Antommattei, MS, PE, FACI  
Kiewit Engineering Group Inc.

Photos courtesy of Kiewit Engineering Group Inc.



Oscar R. Antommattei

## What is your background and area of expertise?

My background is mainly concrete materials with experience in inspection, design, production and construction of concrete structures. My main areas of concrete expertise are mixture proportioning, thermal control planning, service life and durability, constructability, troubleshooting and forensic investigations.

## How did you become interested in doing what you do?

My interest for concrete started during my undergraduate years while studying at the University of Puerto Rico-Mayaguez, where I had the opportunity to join the ASCE student competitions and participate in the Concrete Canoe competitions. At that time, I had a lot of interest in the structural design and construction

aspects of civil engineering, but I found concrete materials to be a combination of both technical areas. Concrete as a structural material with very technical properties used for design and concrete as a construction material for different construction applications and field operations became my main focus of interest. Concrete also was present in my initial professional opportunities within the industry. I started my career in concrete production then worked on concrete structural inspection and construction, so I pursued graduate studies at Clemson University to further enhance my knowledge and opportunities in the concrete industry. Once I completed my master's degree at Clemson, I worked for an engineering consulting firm with an emphasis on forensics of concrete materials, design and construction projects, where I was able to gain expertise in numerous technical aspects of concrete. In 2012, Kiewit was looking to develop a concrete engineering department, so I joined Kiewit in the role as the in-house concrete expert. After 10 years at Kiewit, I lead a group of concrete engineers supporting Kiewit projects.



The SR520 Floating Bridge between Seattle and other communities on Lake Washington was the world's longest floating bridge when it opened in 2016, replacing a 1963 structure, and was built to withstand a 100-year storm.

## What types of projects do you typically oversee?

At Kiewit, we get to see a wide variety of projects, such as buildings, bridges, highways, ports, dams, power plants and tunnels, among others, but most typically it is large, heavy civil type infrastructure projects. We provide concrete technical services to support the design and construction teams for numerous projects as well as facilitating training on concrete quality and best practices within Kiewit and the industry. In our role as concrete engineering professionals, we get involved from the early stages of estimating and prebid design to the preconstruction, design, construction and postconstruction stages, depending on project needs. Every week, we typically get involved with five to 10 different projects, so that keeps the work interesting with sufficient level of difficulty and variety, so it is never boring.

## What are some unique or noteworthy projects on which you specified precast concrete?

I believe some of the most noteworthy projects where we have used precast concrete are the State Road 520 Floating Bridge, the Bayonne Bridge and, most recently, Sofi Stadium. These three projects certainly are on the top of my most favorite projects in Kiewit. The SR520 Floating Bridge was fascinating given all the complexities and unique features in the design of a floating bridge. The Bayonne Bridge was very interesting since both the substructure and superstructure are precast, post-tensioned concrete, which makes it one of a kind. SoFi Stadium was fascinating given it had massive concrete structures that needed to be constructed with stringent performance requirements for seismic conditions and included very large posttensioned precast segmental architectural columns that require use of self-consolidated concrete. In all these projects, our technical focus was supporting the design and construction operations with the concrete materials and thermal controls expertise to ensure the performance goals met the required quality expectations.



The substructure and superstructure of the Bayonne Bridge are both precast, post-tensioned concrete, making it a one-of-a-kind structure.

## What benefits does precast concrete offer your projects?

The most important benefits of precast concrete are the versatility of design, better control of quality in construction and improved schedule while maintaining the design performance in service. In essence, precast concrete allows many projects to become feasible alternatives that can be made a reality when cast-in-place is not possible or not justified given the local project conditions or access limitations.

## How do you see the role of precast concrete as a building material changing in the future?

The future of concrete and precast concrete should be expected to be mainly affected by new code standards, development of new materials technologies, the need for improved service life and durability, use of alternative cementitious materials, implementation of performance requirements and use of sustainable strategies in design and construction to improve resiliency of structures and reduce carbon footprint of concrete. Precast concrete will have a major role in the industry's future given its ability to be versatile and efficient with improved control in design, production and construction in a manufacturing facility. I believe that we will continue to see more use of precast concrete structures in future projects. **PS**



SoFi Stadium in Inglewood, Calif.



Photo courtesy of Euclid Chemical Co.




Photo courtesy of Euclid Chemical Co.



Photo courtesy of Euclid Chemical Co.

Concrete structures used in SoFi Stadium in Inglewood, Calif., had to meet stringent performance requirements for seismic conditions.



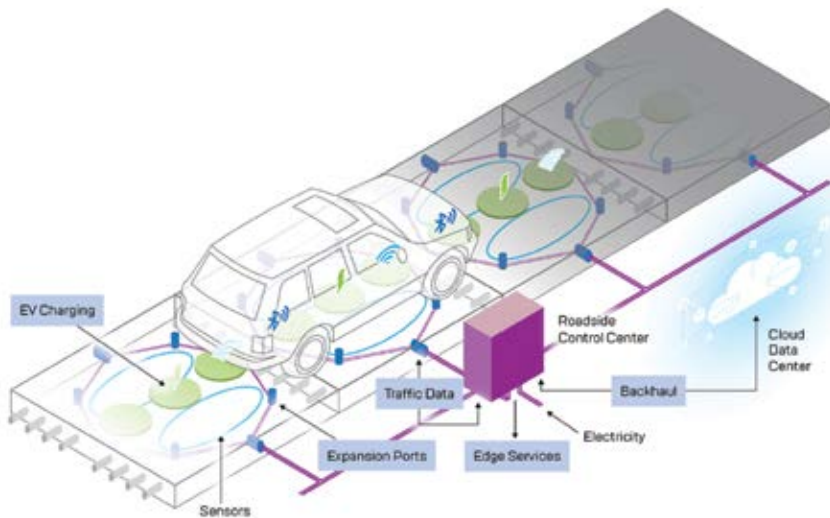
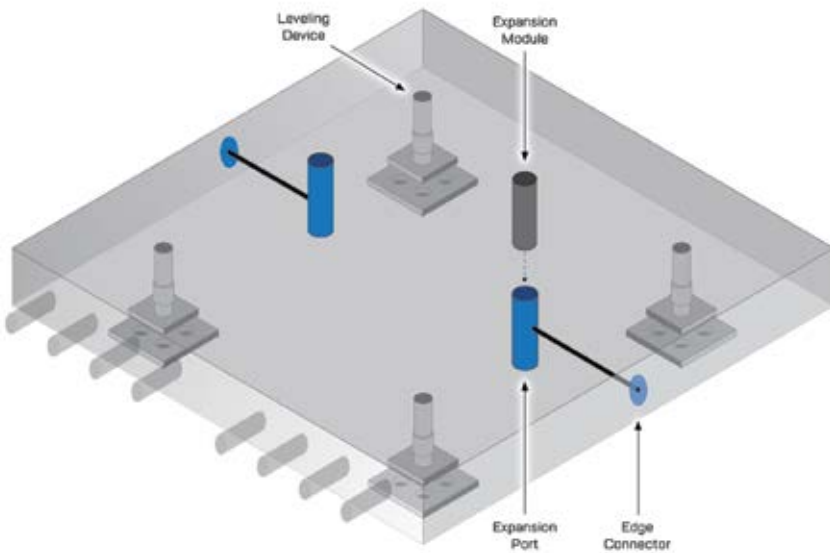
# Smart Pavement for Smart Cities





**Precast plays a starring role in Integrated Roadways' remedy to the financial burden of rebuilding aging roadways.**

By Shari Held  
Photos courtesy Integrated Roadways Inc.



- Networking/wireless communications (Wi-Fi, 5G, etc.) through antennas in the expansion ports.
- Wireless EV charging and assisted autonomy.

Technologically enhanced roadways alerting drivers to real-time traffic and road conditions, providing Wi-Fi and networking capabilities, charging electric cars, and communicating with autonomous vehicles may sound like something out of “Star Trek.” But Tim Sylvester, founder and CEO of Kansas City, Mo.-based Integrated Roadways, is on a mission to make it happen now.

Integrated Roadways’ patented Smart Pavement system embeds advanced technology in interlocking precast concrete pavement slabs for quick and easy installation.

Some services are still on the drawing board, but eventually Sylvester envisions the Smart Pavement service menu will include:

- Traffic data collection through in-road sensors.
- Sensor packages — weather sensors, black ice detectors, pollution detectors, water leak detectors, etc.
- Edge services and cloud technology.

This summer, Integrated Roadways begins production and installation of Smart Pavement in a Lenexa, Kan., intersection, bringing Sylvester one step closer to realizing his dream. This intersection is one of five scheduled for the new Lenexa City Center project.

With this project, Sylvester intends to prove how beneficial Smart Pavement can be for municipalities, commercial businesses and drivers so other cities will be motivated to install Smart Pavement.

“Let’s get things moving,” Sylvester said, “so America can rebuild its infrastructure.”

Lenexa shares Sylvester’s enthusiasm.

“Lenexa doesn’t want to be bleeding edge,” said Tim Green, city engineer/deputy director for the



city of Lenexa, “but doing something to get out in front of other cities is always a goal of ours.”

Sylvester first approached the city in 2019. Even though Lenexa was receptive, there were roadblocks.

For one, Integrated Roadways needed an agreement that it, as a private entity, could use the public right of way to conduct testing and data retrieval.

“We had to think outside the box to figure out how to do this,” Green said. “Who maintains what? Who owns what portion of the infrastructure? Those kinds of things. It’s been a learning experience for us, but we’ve got a good process in place moving forward.”

The city also applied for and received an Integrated Technology grant from the state of Kansas and the Kansas Department of Transportation. Determining what was eligible to be paid for by the grant was a challenge since this was new territory for everyone involved.

“It took longer than we had hoped, but now we’ll be able to move pretty quickly,” Green said.

## ONGOING PREP WORK

The development of Smart Pavement doesn’t wait for a project to be approved. Charting new technology territory requires trial and error, testing and retesting. Brad Werth, vice president of Precast Group and Business Development for McPherson Concrete Companies, said they’re learning as they go.

“From our perspective, it’s exciting to be involved with a cutting-edge technology product,” Werth said. “Concrete has been around since the Roman Empire, so people don’t think of it as a new technology. This gives us an opportunity for precast to become a more prominent product within the pavement industry.”

Currently, McPherson, Kan.-based McPherson Concrete is testing cellular antennas to determine what type of antenna will produce the best results by measuring the reception received at various distances.

“The challenge with casting the antenna into the concrete pavement is to determine if Integrated Roadways can get the reception needed to make it practical,” Werth said.

The company also built a demo pad for Integrated Roadways to test how much, if any, of its charging capabilities an electric car charger will lose when encased in precast. For this test project,

McPherson Concrete created a non-metallic environment for the charging apparatus, requiring a reinforcement design alteration of the slabs. Gator bar, a non-metallic basalt fiber reinforced with polymer, is lighter and stronger than the originally used steel rebar and doesn't interfere with the charger.

As of yet, no decision had been made on the type of technology that will be included in the Smart Pavement for the City Center.

"When we fabricate the pavement panels for the City Center, it's going to be a different animal altogether," Werth said.

## BUILDING ON SUCCESS

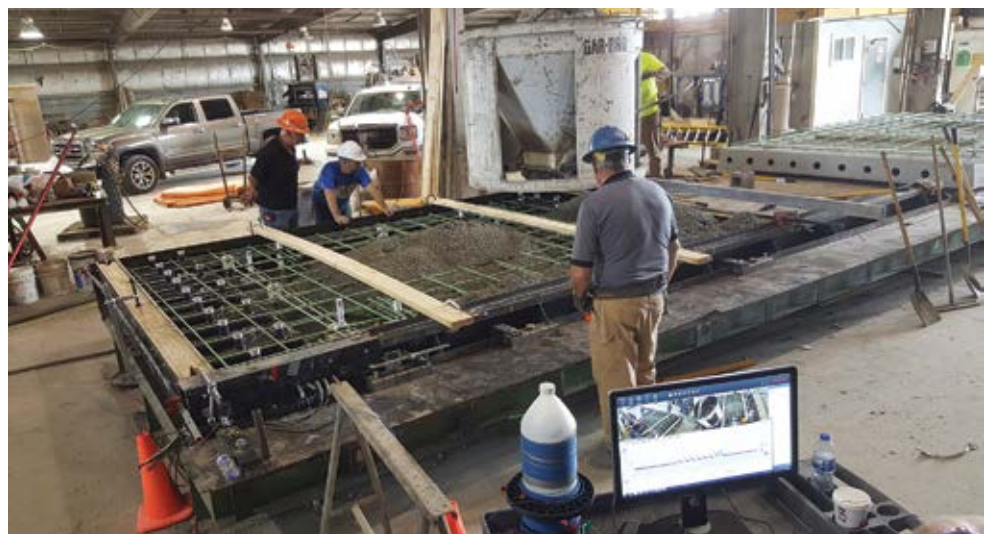
Denver, Colo., was the first city to showcase Smart Pavement when it chose Integrated Roadways to install four slabs at its busy Brighton Boulevard intersection. The 32 sensors and 16 expansion ports embedded in the pavement collect traffic data — the number of vehicles on the road at different times of day, the speed they travel and even the vehicle makes and models.

The panels were wet cast by McPherson Concrete. Werth said the only production process challenge was casting the delicate fiber optic cables in the concrete without damaging them. Installation was a breeze.

"The Colorado project was a construction proof to show that it could be built without any trouble," Sylvester said. "We also needed to prove the technology would work, which we did."

## PRECAST: THE PERFECT HOUSING MATERIAL

Sylvester champions the use of precast concrete for Smart Pavement slabs for many reasons. It is factory-



Precast concrete pavement slabs are cast with technology — such as traffic sensors — incorporated into the framework.

built, which allows Integrated Roadways to take advantage of production-line economies of scale. The technology is installed in the factory so it's ready to be laid at the job site. And the interlocking precast slabs are modular, so they can be easily and quickly installed and, if needed, a section removed and replaced with no disruption to the rest of the roadway.

Sylvester anticipates 80% of the slabs for a continuous roadway will be a uniform size and shape, while 20% will need to be modified to accommodate road curvature and other issues.

"Eventually, I think we'll have a catalogue of all our different designs and people can order them to fit their needs," Sylvester said.

Another big plus to using precast is the time factor.

"The amount of time it takes to build a road is one of the biggest issues with road building," Sylvester said. "You've always got traffic waiting. Putting the technology in place on-site would slow down the road building process. With precast, you can build the road twice as fast."

In Kansas, cast-in-place concrete is simply not a viable option.

"We've got only a couple months of good concrete weather," Green said. "We're always dealing with hot and cold temperatures, windy conditions and high humidity. One benefit of precast is you can make the panels under more controlled



conditions. Almost all our parking garages are precast, and they hold up very well. We anticipate we will have a long life from our Smart Pavement.”

## KANSAS, HERE WE COME

When complete, Lenexa City Center, a new urbanist development, will include City Hall, a recreation center and mixed-use, multi-story buildings featuring ground-level retail shops and upper-level offices and residences.

“It’s such a growing area. The benefit to the city will be to know what type of traffic we are getting, where it’s going and if there are congestion issues we need to deal with,” Green said. “It’s a great location for cutting-

edge technology that we can use in our new development.”

With the Lenexa City Center project, Sylvester’s goal is to prove the validity of Integrated Roadways’ business model. The company obtains private sector financing for each individual project. These private investors finance the building of public roadways and will be repaid from the revenue collected from Integrated Roadways’ sale of services and information to commercial entities.

“What we’re trying to do is show that roads can pay for their own existence from the data collection, wireless communications, wireless charging and all the other capabilities that digital

infrastructure can provide,” Sylvester said.

Green sees big advantages for cities with this business model.

“If they could take the money they now have to spend for new roadways and use it toward infrastructure maintenance, it would be a huge boost to cities,” Green said.

Green said the automated traffic data collecting capability of Smart Pavement also will save the city money. The manual process of sending workers out with counters or laying tubes over the road is a labor-intensive, time-consuming and expensive process.

“With the Integrated Roadways infrastructure in place, the hope is we can just pull up a website, look at a dashboard and see the amount of traffic during a certain time period,” Green said.

## MOVING FORWARD

During the next decade, Sylvester’s goal is to upgrade 10 to 20% of Lenexa’s roadways, intersections and continuous pavement, adding more and more intersections.

“Eventually we’ll start to build out the entire region and link it together, so large portions of the city can access our menu of services,” Sylvester said.

In the meantime, Lenexa benefits from the digital collection of traffic data and partnering with companies such as Integrated Roadways that are advancing this new technology. The city also hopes companies visiting Lenexa to see how Smart Pavement works for the city will decide to put down roots there.

“There’s just a lot of benefits to us,” Green said. “And the potential drawbacks are minimal to nil.” **PS**

*Shari Held is an Indianapolis-based freelance writer who has covered the construction industry for more than 10 years.*



# Silent a

A unique mix design and tight  
a light-rail extension underne

By Mason Nichols

Photos courtesy of Stacy and Witbeck  
Precast concrete slabs line the floor of a light-rail tunnel running underneath the University of Washington.

# and Smooth

t quality control power  
ath the University of Washington.

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## SUPPORT AND PROTECT

Sound Transit, the public transit agency serving the metropolitan area in Seattle, designated precast as the building material of choice for the Northgate Light-Rail Extension project, which expanded service to customers in north Seattle.

Along with the build-out of tunnels and new stations, roughly three quarters of a mile of the 4.3-mile extension was slated to include work in tunnels passing under research facilities at the University of Washington. Because of the highly sensitive nature of the equipment in these facilities and the type of work being performed above, vibration and electromagnetic interference generated from the trains had to be kept to a minimum. This requirement meant the Sound Transit team had to determine the best means of mitigating vibration while also designing a solution that supports the trains.

Sound Transit turned to Stacy and Witbeck, a construction firm specializing in transit infrastructure, to lead the trackwork portion of the project. In performing its research for the extension together with a variety of other organizations, the Sound Transit team, led by Rail Vehicle Engineering Manager Shankar Rajaram, concluded that precast concrete – manufactured with a unique mix design and installed with specialized rubber pads – was the best solution.

After determining its approach, Stacy and Witbeck teamed with Columbia Precast Products (CPP) of Woodland, Wash., to manufacture the 2,500 precast slabs needed for the work. According to Matt Johnson, project manager at Stacy and Witbeck, extensive planning was needed to meet the project’s technically complex requirements.

“We spent an entire year performing preconstruction work with Columbia Precast and Sound Transit,” he said. “It wasn’t just that the slabs needed to be a very specific, heavy weight to get the density of the concrete right. These pieces also had to be magnetically shielding.”

## IN THE MIX

Meeting the precise needs of the extension work meant generating a concrete mix suitable for the application. Although CPP typically manufactures its products with self-consolidating concrete – a special mix exhibiting high flowability, reduced segregation and a slew of other benefits –



Photos courtesy of Columbia Precast Products

Top: Columbia Precast Products experimented with its mix design to meet the weight parameters as well as make sure it would flow around the rebar and complex geometry of the forms.

Bottom: CPP partnered with Helser Industries, a forms manufacturer, to meet the tolerances for each of the panels.

additional components were needed to achieve the heavy weight and magnetic characteristics required for the slabs.

Jason Miles, plant manager at CPP, said his team ultimately decided on two unique elements in the hybrid mix design – hematite and iron ore slag. The hematite, which consisted of heavy, round balls approximately three eighths of an inch in diameter, played the role of coarse aggregate and was used to achieve the high density and magnetic properties specified. The iron ore slag functioned as the fine aggregate. Fiber also was part of the mix.

“This mix design was one of those where we kind of threw everything at it that would stick to get that weight up there,” Miles said. “And with those parameters, we also had to make it flow around all the rebar and the complex geometry of the form, which is why SCC was the most appropriate.”

According to Johnson, a limited set of options was available to the project team. Hematite was the mineral of choice because it typically is used in applications where magnetic shielding is needed, such as within hospital walls.





Photo courtesy of Stacy and Witbeck

The “floating” slabs for the Sound Transit extension project required a unique mix design to meet weight requirements and special forms for their unique shape.

While it can be particularly difficult to procure, the team was able to locate a solid source in Duluth, Minn. After performing the required due diligence and finding a reliable source for the hematite, CPP began developing prototype slabs. The company eventually finalized the mix design, which would be used on 16hz panels as well as two different sizes of 5hz panels. The panels ranged in weight from 11,000 to 22,000 pounds.

## **QUALITY, QUALITY, QUALITY**

Several factors presented challenges to the project team throughout the manufacturing process. When CPP secured the work with Stacy and Witbeck, they were in the process of building a new plant.

“We had to accelerate the schedule of our build-out to satisfy the Northgate extension timeline,” Miles said. “We were actually doing test batches in the plant before the roof was complete. That’s how tight the schedule was.”

Additionally, because of the magnetic properties of the materials used in the mix design, the CPP team encountered issues with some of its equipment during production.

“We had microwave probes for moisture in our aggregate bins and mixer,” Miles said. “So, microwaves and all that metal – the hematite and iron ore slag – didn’t cooperate very well. We were getting some strange numbers and had to change out those probes.”

With the high weight of each panel and the massive number of products that needed to be made, the work also caused significant wear and tear at the CPP production facility. This eventually necessitated the construction of new roadways at the plant to make the manufacturing process more efficient.

During the entire process, quality control was of particular concern, as officials from Sound Transit sought to ensure that all the panels produced for the work met the tight tolerances of

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the project. This resulted in four QC teams collaborating on the work – one from CPP, one third-party agency hired by CPP, one from Stacy and Witbeck and one from Sound Transit.

“Having all the third-party inspectors was actually an asset, because they could help us achieve the tolerances,” Miles said. “We’re used to dealing with 1/4-inch to 1/8-inch tolerances, but on the 16hz panels, we had to build them to within 1/32 inch. We really had to trust in our formwork.”

To help achieve this, CPP partnered with Helser Industries, a forms manufacturer based in Tualatin, Ore. According to Miles, Helser’s work was exemplary, with the forms being so well made that they did most of the work in helping meet the tolerances for the CPP team.

## IT ALL COMES TOGETHER

For the system to work as intended, each slab was installed in concert with a series of custom-built rubber pads that were approximately 12 inches in diameter by 7 1/2 inches tall.

“The rubber is really where you get your vibration mitigation, but you need to have the massive weight of the slab on it,” Johnson said. “Each slab sits on four support pads, and there’s additional compression achieved via rubber pads installed on the sides.”

Because of the way they were installed on top of the rubber system, the precast pieces are referred to as “floating” slabs. In addition to the pads and precast, the track also benefitted from the use of ultra-straight rails, which Sound Transit, Stacy and Witbeck, and the rest of the team sourced from Europe due to the material’s limited usage in the U.S. at the time. The ultra-straight rail, which was just as crucial to the job as the precast floating slabs, also aids with vibrations and potential interference as trains pass through the 3/4-mile section of the extension.

According to Johnson, this was the first 5hz precast concrete floating slab system in the United States. Beyond simply meeting the needs of the project, Johnson said precast brought significant advantages to the work.

“By going with a precast solution, we could perform all the complex design work, sourcing and production planning – even how to handle our quality control – ahead of time,” he said. “If we were trying to do this on the fly as we were building the job, it just wouldn’t have been possible.”

Miles pointed to other scheduling advantages brought about by using precast.



Photo courtesy of Columbia Precast Products

Each slab was installed in concert with a series of custom-built rubber pads that were approximately 12 inches in diameter by 7 1/2 inches tall.

“We could manufacture all the pieces for this project while other aspects of the work were still taking place,” he said. “This sped up the schedule at an immense rate.”

## QUIET, PLEASE

Public transportation systems generally are not known for their lack of noise and vibration. However, thanks to a bit of ingenuity and the use of precast concrete, Sound Transit developed a system capable of getting Seattle travelers where they need to be while simultaneously keeping complex research equipment safe at the University of Washington.

To date, extensive testing performed by 40 monitors positioned at 300-foot intervals in the project area shows that the precast rail system is meeting all criteria for quiet operations specified, making the Northgate extension a success for all involved.

“Columbia Precast was prepared and committed to making sure this project went well for us and the owner,” Johnson said. “This wasn’t simple, but everyone did their job and it worked out well for everyone.” **PS**

*Mason Nichols is a Grand Rapids, Mich.-based writer and editor who has covered the precast concrete industry for nearly a decade.*



Prestressed beams are set on the south abutment above the precast abutment system.

# Bridge System Closes the Gap

**Innovative precast abutment system saves time and money, putting a solution for aging bridges within communities' reach.**

By Heather Bremer

Photos provided by Delta Specialty Precast Concrete Engineers

**T**he best innovations are born of need.

In 2010, the town of Steuben, N.Y., desperately needed to replace its sole bridge. But the town did not have the \$700,000 to \$1 million required for such a project.

That's when David Husted of Husted Concrete Products approached his project manager, Tamer Osman, P.E., with a question: Can we come up with an idea to help the town be able to build the bridge in a cost-effective manner using its own crew?

Osman accepted the challenge and designed the precast abutment system (PAS), an innovative, fast-track bridge replacement solution pieced together as simply as LEGO blocks. Husted Concrete manufactured the system, and the rest was left to the town.

"The town built it with an excavator," said Osman, the director of specialty precast services with Delta. "They did it so quickly over a weekend, and that's how it started. It was the need of a town that didn't have the money to get big equipment."



Workers install six footing sections to begin work on the precast abutment system.

## HOW IT WORKS

The PAS is intended to provide a simple, economic and fast solutions for short-span or low-volume bridge replacements. Its main components include precast concrete caps, precast concrete laggings, precast concrete footings and H-piles bolted to the footings. The design must take into account earth lateral pressure, loads from the superstructure and soil parameters.

The precast lagging, or panels, are designed to retain the soil and resist lateral forces from the soil. The PAS panels measure just 8 inches thick.

The H-piles carry the precast cap beam, which in turn carries the superstructure. Osman designed the system to use widely available 12-by-53 H-piles, the same used for bridges.

“Most contractors have tons of this section,” Osman said. “It’s a good section that can take the loads.”

The precast footings distribute the load to the bearing stratum. The size of the footing is flexible depending on the bridge environment.

“The footing changes from one side to another,” Osman said. “If there was a rock on that side, then the footings are going to be small. If the soil is not good, the footing is going to get bigger.”

Mechanical couplers connect the units together.

Prior to construction, local crews prep the area, clearing the hole the bridge will be placed in and laying down a bed of gravel. The footer segments are set, then the H-piles are installed, bolted to each footer.

“The spacing between them I can play with, between 6 and 8 feet,” Osman said. “That’s a lot of savings.”

Next, abutment panels are lowered into place in between the piles. Once the panels are all in place and the abutments have been backfilled, the caps are positioned and prestressed beams are set on the caps. The bridge can then be paved and finished.

Osman did a cost-benefit analysis between the PAS system and other similar bridge solutions. He found PAS comes out as the most cost effective option, especially if the counties do some of the work themselves. And though steel may offer a cheaper solution in the short term, it doesn’t endure like precast.

“You’re going to save more money than any other system that I’m aware of,” Osman said. “(Steel) doesn’t work in all soils, and steel doesn’t have the longevity of (precast) concrete.”

## FACTORS IN DESIGN

Cost was the most influential factor in designing the system, but it was a multi-level challenge. Conventional abutments use a massive amount of concrete. Those projects require large forms for cast-in-place concrete as well as 28 days for curing of site-cast concrete. Even conventional precast systems need large trucks to transport the pieces, skilled labor for installation and cranes to lift them into place.

PAS panels use less concrete and are far lighter. Medium-sized excavators and smaller delivery trucks can be used on the project. And existing county or municipal crews can handle placement. All for about \$30,000 for a typical two-lane, 30-foot span bridge replacement.

“The system saves on time, saves on money in the ease of constructability that you need just an excavator to put those units together,” Osman said.

## SPREADING THE WORD

Upon the success of the Steuben project, Osman realized the opportunity the system provides for municipalities and counties in similar situations. He began making presentations across the region, sharing with officials the many attributes of the PAS, emphasizing its simple and flexible design, fast construction and affordable price tag.

The system has been used in about a half dozen projects since then. It’s been an easy conversation with communities looking to save money on major projects.

The system is used in smaller bridge projects over creeks and brooks, meaning most residents drive over the bridge without a second thought to the underside. But, if counties or municipalities desire, at a cost the precast supplier can use form liners to produce a custom look for the abutment panels.

One issue the system can not get around is federal funding. In New York, a county that receives federal funding must use an approved type of bridge from the state’s bridge manual. Since the



The adjacent wing wall abutment panels are in place for the South Creek Road Bridge.

PAS does not appear in the manual, it's not available to counties or towns utilizing federal funds.

“That’s the challenge when you try to do something innovative or outside the norm,” Osman said.

The system also has seen several iterations. Osman utilizes animation and 3-D printed models to develop these improvements. He made the columns bolted instead of embedded.

Osman also focused on improving transportation of the system. Originally, the footings and columns were standing up, taking up space on the trailers. He changed the design to take the columns out with a connection, allowing the footers to be stacked.

“You make one trip instead of four,” Osman said. “You keep looking for ways to make it more cost effective.”

## A SOLUTION FOR LINCOLN

Officials in Madison County, N.Y., attended one of Osman’s PAS presentations and loved the idea. They said they had the perfect project for it – a single span bridge in Lincoln, N.Y., in need of replacement.

During the design phase of the South Creek Road over Clockville Creek bridge replacement, Osman told officials they could save additional money by casting the pieces themselves.

“They preferred a precaster do it, and they didn’t want to do it themselves,” Osman said. “They hired a contractor, and it went really quick.”

The new bridge, with a larger hydraulic opening, used Osman’s abutment system with precast footing segments, H-piles, precast



A crew member looks over a finished half of the north abutment of the South Creek Road over Clockville Creek bridge replacement in Lincoln, N.Y.

panels and precast cap beams. The superstructure consisted of precast/prestressed adjacent box beams with an asphalt wearing surface.

These precast elements allowed crews to immediately backfill the abutments, effectively eliminating the curing time required for cast-in-place construction. This shortened the duration of construction and limited the impact on the public use of the roadway.

## AWARD-WINNING PROJECT

The work in Lincoln was recognized by the New York Chapter of the American Concrete Institute with the Silver Award for Design and Installation in the concrete category during its 2017 awards program. The project also was awarded the American

Council of Engineering Companies of New York Engineering Excellence Silver Award.

The recognition was nice, Osman said, but he found validation elsewhere.

“I’m not gonna lie and say it didn’t feel good and I did not want the recognition,” Osman said. “But it felt good when I was one site, and I saw them getting those big pieces that I drew on paper and putting them out. I felt good about that.” **PS**

*Heather Bremer is communications manager for NPCA.*

# Teamwork Makes Precast Dream Work

Open lines of communication between the project owner, engineer, precaster and contractor drove the success of a \$75 million DelDOT roadway reconstruction project.

By Bridget McCrea

Photos provided by R.E. Pierson Construction Co.



The contractor was able to complete one bridge span per night, which entailed setting four pieces, positioning them with a crane and then setting them in place across the roadway.



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It's not often that a \$75 million roadway reconstruction project spanning many months and involving dozens of different organizations goes smoothly and comes in both under budget and faster than expected, but that's exactly what happened with the rebuilding of Delaware's State Road 141/Interstate 95 interchange.

There were some hiccups along the way, of course, but when you get the project owner, engineer, designer and precaster in the same room (albeit a virtual one), it is clear that for this particular project, having everyone synced up and operating from the same playbook produced a positive outcome.

The project started in August 2019 and involved the complete roadway reconstruction and widening of SR 141, a major Delaware route. Owned and managed by the Delaware Department of Transportation (DelDOT), this route includes a major intersection and interchange with southbound I-95 just south of Wilmington. At that junction, three different interstates (Interstate 295, Interstate 495 and I-95) merge into one and are reduced to five traffic lanes.

"The area had a significant accident and congestion rate," said Nick Hetrick, P.E., the Delaware/Maryland region general manager for Pilesgrove, N.J.-based R.E. Pierson Construction Co Inc., the construction firm that managed the project. "The goal was to help relieve those issues while also improving the function of the interchange and replacing the bridges."

DelDOT project engineer Nicholas Dean, P.E., said the average daily traffic (ADT) numbers for the interchange are projected to hit nearly 110,000 by 2040, up from 85,200 in 2015. The highway bridges were "structurally deficient," he added, and not quite wide enough to handle the increase in traffic and DelDOT's target traffic pattern adjustments.

"This project was a good opportunity for us to get in and make the necessary adjustments," Dean said.



## MINIMAL DISRUPTION

According to Hetrick, the bridge crossings for SR 141 northbound and southbound from I-95 consisted of two structures, each of which included three different spans that were about 85 feet long and just more than 80 feet wide. These spans allow I-295's merge point to extend past the interchange via a slip lane. Interstate 95 runs beneath the center span, with a slip lane for the on and off movements for northbound and southbound SR 141 traffic (over the third span).

At the start of the project, the existing bridges were demolished while a phased construction strategy allowed DelDOT to maintain SR 141 traffic flow. The new bridge was constructed in halves, with precast concrete comprising both pier columns and caps. Upon delivery to the jobsite, the precast columns were set on the cast-in-place footings. The caps were set up on top of the columns and then connected into place.

The bridge deck superstructure, designed by Exmore, Va.-based Precast Systems Engineering encompasses a hybrid assembly of steel girders with precast concrete deck panels. The girders were shipped to the precast manufacturer, Precast Systems Inc. of Allentown, N.J., where the panels were cast on the girders and the entire assemblies shipped to the site.

The 85-foot-by-9-foot precast pieces spanned pier-to-pier and pier-to-abutment. The project required a total of seven modules per span (for a total of 21 per bridge) that were installed across the complete width of the bridge. R.E. Pierson also had precast concrete parapets cast for the exterior deck modules.

"That eliminated a lot of the field work that we originally anticipated having to do," Hetrick said.

The contractor was able to complete one bridge span per night, which entailed setting four pieces (as they were trucked in), positioning them with a crane and then setting them in place across the roadway.

For the size and scope of the project, the actual impact on traffic and the surrounding area was fairly minimal.

"DelDOT did have to shut I-95 down for one night using detours and slip lanes, but we were able to get everything installed in just three nights by setting half the bridge during the first phase and then another three nights for the rest of it," Hetrick said. "We also did some form work and UHPC closure pours to link all of the slabs together, put a PPC wearing surface on top of it, and then opened the road up to traffic."

## DESIGNING FOR SUCCESS

From the design perspective, Dean said DelDOT wanted to avoid conflict with any existing footers within the piles that were already in place. To achieve that goal, he and Scott Walls, P.E., a DelDOT project engineer, designed it so that all of the piles could be moved one foot in any direction without the need for a review process.

"If the contractor realized that a pile it was about to drive was in conflict with something, it could slide that pile over a foot without having to stop and call us about it," Dean said. "That really helped to speed up the process for this accelerated bridge construction project."

Walls said this also was the first project where DelDOT used modular superstructure units, which allowed it to create a functional module that was also practical from an installation perspective.

"We wanted the contractor to be able to pick the structure up and handle it using efficient cranes, versus needing a specialty contractor to handle that aspect of the project," Walls said. "We paid close attention to those types of details."

He said much attention was paid to the stresses that would be placed on the huge precast pieces and any negative impacts of movement on those structures during transport.

"In design, we put in a lot of time detailing the efforts to prevent those issues," Walls said. "We worked very closely with the precast team and their shop, going through their procedures and methods of picking up, carrying and transporting the pieces. It ended up working out phenomenally."

## PRECAST MAKES THE CUT

After considering the different concrete options for the highway improvement project, DelDOT chose precast for its fast installation times.

"It allowed us to take the bridge work off the critical path and accelerate the schedule," Dean said. "To the contractor's credit, they actually accelerated the schedule much farther than we would have anticipated (by a full six months, in fact) them being able to do. That was a feather in their cap."

Walls said DelDOT already had used precast elements in different ways on previous projects, including both precast abutments and precast beams. With the interchange improvement project, he said the agency wanted to build upon its existing knowledge of and experience with precast.

"We felt really comfortable with the material and the system," Walls said. "We pushed the limits a bit with the modules and pier caps, but based on our previous experience — where we didn't run into any issues — we wanted to use precast with this project as well."

Precast Systems Engineering answered that call after completing the Christina River Bridge project for DelDOT in Wilmington. The precaster had produced similar modules in the past, only using double T units versus steel beams (and on a smaller scale).

"For the SR 141 interchange project, we basically took some different approaches we'd used on past projects and married them together," said Chad Saunders, vice president at Precast Systems.



The specifics of the project required detailed and clear communication between all parties involved.

One innovative precast feature was the barrier with the form liner finish, which included both recesses and picture framing, versus just a standard barrier. From the precast perspective, Saunders said the unit weight of the exterior pieces made the project challenging and required excellent coordination between all the parties.

“That took a lot of good engineering on the part of Precast Systems Engineering,” Saunders said, “which had to figure out how everything was going to be lifted and handled.”

JP Binard, P.E., owner and manager at Precast Systems Engineering, concurs, and says the construction engineering and fine details took time to develop, but the end result was well worth the effort.

“We designed lifting to validate that DelDOT’s desired approach was acceptable, and to factor in some of the unique considerations the precaster used to handle and ship the pieces,” said Binard, who also developed the integrated shop drawings for the project. Those drawings were unique in that they incorporated the precast, steel fabrication and barriers. “We used 3D detailing methods to ensure that there were no clashes.”

## ALL ON THE SAME PAGE

Substantially completed in December 2021, the interchange project went smoothly overall thanks to the coordinated effort of everyone involved. Dean and Walls both liked the open lines of communication between DelDOT and all three vendors (contractor, precaster and precast engineer) throughout the process.

In a few instances, this high level of collaboration led to project simplifications. With the precast barrier, for example, the precaster and contractor worked together to make a few modifications that simplified the closure pour process.

“It was great to have that back-and-forth with the precaster and contractor, which really helped align with design and construction sides of the project,” Dean said. “The communication between all parties made this project a success, quite honestly. That was the biggest thing that we noticed on this one – that open lines of communication really drove the success of the project.” **PS**

*Bridget McCrea is a freelance writer who covers manufacturing, industry and technology. She is a winner of the Florida Magazine Association’s Gold Award for best trade-technical feature statewide.*



**Kayla Hanson, P.E.,  
Concrete Sealants**

A graduate of Purdue University, Hanson is experienced with durability and watertightness of precast concrete structures.



**Tyler Ley, Ph.D., P.E.**

Highly recognized for teaching excellence, Dr. Ley is a Professor of Structural Engineering at Oklahoma State University with over 20 years' experience in structural and concrete materials engineering.



**Claude Goguen, P.E.,  
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