The New Information Su

Precast concrete pavement slabs and integrated technology are a winning combination for the future of roadways.

By Shari Held All photos courtesy of Integrated Roadways.

The term "information superhighway" was introduced in the 1990s. Back then, it was used to describe a worldwide communications network. Today, Kansas City, Mo.-based Integrated Roadways is putting a different spin on the term. The company's innovative Smart Pavement system, which integrates advanced technology with precast concrete pavement slabs, has the potential to revolutionize the way our roads are built and financed.

"We look at Smart Pavement as a computer in a concrete case," said Tim Sylvester, founder and CEO of Integrated Roadways. "What we deliver is a sensing system that turns the pavement into a touchpad, but instead of fingertips, the sensing system is looking for tire positions."

Smart Pavement technology can potentially alert drivers to real-time traffic and road conditions, inform authorities of accidents and melt ice on the roadway. It could also provide Wi-Fi, automatically charge electric vehicles, and communicate directly with autonomous and self-driving vehicles and smart cities. And Sylvester, who has been awarded one U.S. patent and received publication notices for two others, has only begun to tap into the possibilities.

And, it's affordable. Sylvester's banking on the fact that Smart Pavement will be virtually self-funding in the future, generating income from the sale of data or network space to third parties.

PRECAST: THE FUTURE OF ROAD BUILDING

While serving as a project manager for a construction company, Sylvester observed two things. First, the rate of completing a project significantly impacted profitability. Second, the biggest factor out of the construction company's control was how quickly the infrastructure could be built.

"Because of that, I became interested in the process of how to build roads better, faster, cheaper," Sylvester said.

At the same time, public agencies were beginning to field requests for advanced technology capable of supporting smart cities and connected electric, autonomous and self-driving vehicles.

Integrated Roadways worked with the University of Missouri-Kansas City on a pilot project that was completed in just five hours.

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Sylvester soon discovered using precast slabs lowered the total cost of ownership, extended the road's service life and shaved time off the construction process. Plus, technology could be incorporated in precast more economically than with cast-in-place concrete or asphalt.

"That's when I decided precast was going to be the future of road building," Sylvester said.

In 2006, Sylvester founded Integrated Roadways and was prepared to set the world on fire, turning his concept into reality. But he quickly discovered he didn't have the credentials to sell his product. Undaunted, he returned to the University of Missouri and earned a combined electrical and computer engineering degree.

SMALL INROADS

Sylvester's biggest challenge was getting public agencies to recognize there were new options available for building roads. His first goal when he came back to Integrated Roadways full time was twofold: prove the superiority of precast pavement versus cast-in-place concrete or asphalt, and demonstrate that Integrated Roadways had the know-how to build a "standard" precast roadway.

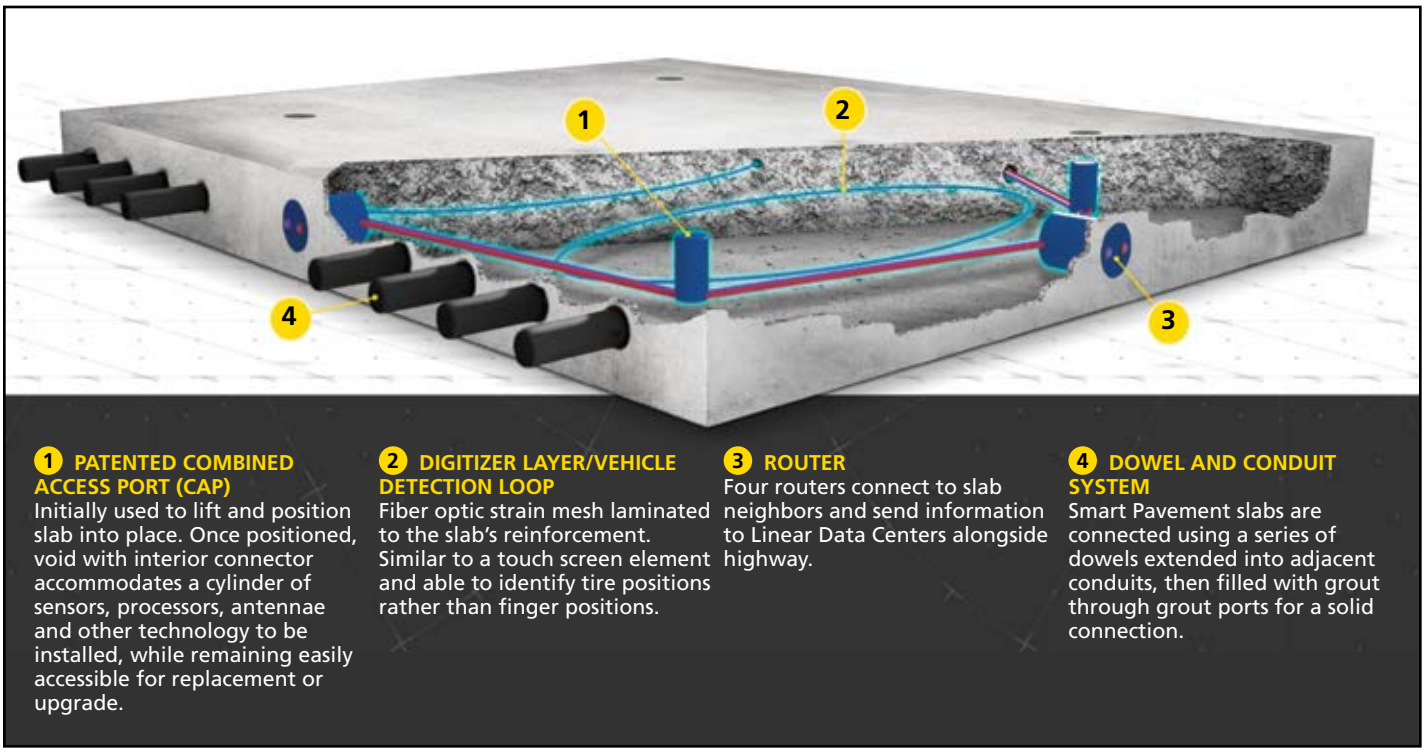
"We figured we wouldn't be able to establish the credibility we needed for the advanced technology until we had demonstrated that the means and methods of constructing the pavement system were valid, economical and repeatable," Sylvester said.

The company's first opportunity was to provide two precast jointed slabs on an Interstate 35 repair project for the Missouri Department of Transportation.

"Our finished joint repair actually ended up being smoother than the cast-in-place joint repairs that preceded it," Sylvester said.

In 2013, Sylvester's alma mater hired Integrated Roadways to provide a 22-foot-by-200-foot continuous precast pavement section as part of the new Bloch Executive Hall project.

Instead of the estimated two-day completion time, the crew completed installation in just five hours – proving how quickly a precast road could be built.



This rendering depicts the various technology which can be incorporated into an Integrated Roadways precast panel.

A BUMP IN THE ROAD

Riding high on the success of the Bloch Executive Hall project, Sylvester started working with Kansas City and the states of Missouri and Kansas to identify additional work.

Although public agencies recognized the advantages of precast Smart Pavement, they were hamstrung by a lack of funds and outdated procurement processes, which require them to select a low bidder.

At the same time, they were beginning to field requests for advanced technology capable of supporting smart cities and connected electric, autonomous and self-driving vehicles, but Sylvester found advanced technology was typically limited to 1% to 3% of the value of a total project.

A new financial model was needed. So, Sylvester went back to the drawing board and looked to internet giants Facebook and Google for inspiration.

"Advanced technology enables an abstraction of the financial model to where the person receiving the benefit isn't necessarily the person paying for the service," Sylvester said.

From there, it wasn't a huge leap to theorize that Integrated Roadways could finance the construction of the roads by selling the data it would collect and space on the networks it would build. Potential customers include data and sensor companies, wireless carriers, wired network providers, advertisers, insurance companies and real estate firms. Using this model, it's possible that neither public agencies nor the general public will have to pay for our roadways in the future.

"Now we approach DOTs and departments of public works with a much different offer that isn't in competition with the way they do things now," Sylvester said.

Integrated Roadways currently has two potential pilot projects lined up – one in Colorado and one at an undisclosed location in the Midwest.

PRODUCING SMART PAVEMENT

While selling public agencies on the concept of Smart Pavement, Integrated Roadways was simultaneously developing a manufacturing process for the product.

The company designs the pavement system, the network and the electronics. But everything else – from the engineering firm to the installer – is local to ensure compliance with local codes and regulations.

"Qualified, certified precast manufacturing facilities exist throughout the nation," Sylvester said. "That makes it very easy for us to show up in a new region and begin providing product."

Although the contract for the Colorado pilot project hasn't been signed, Wichita Concrete Pipe, the precast provider, is getting geared up to produce the prototype elements.

Workers will use a wet-cast process to fabricate 250 test panels. First, the panel is formed using steel molds. The electronic components, fiber-optic elements and steel rebar are then placed in the locations specified by the shop drawings. Then, concrete is cast around the elements.

Although the dimensions haven't yet been finalized, Brad Werth, vice president of Kansas-based Wichita Concrete Pipe,

Early pilot projects have proven the speed with which precast pavement systems can be installed. Future endeavors will focus on the inclusion of integrated technology.

anticipates each slab will measure 10 feet by 12 feet and weigh approximately 6 tons.

Only the passive elements – the power distribution, communications networks and sensing components that make the road touch-sensitive – are physically embedded in the precast. These are unlikely to wear out or become outdated. Active components that operate the passive systems will be placed in accessible modules for easy upgrading.

Werth anticipates making 10 slabs per day for the pilot project.

Sylvester estimates most projects will follow an 80/20 model, with 80% of the slabs falling into a small, standard set of slab types and 20% being custom-produced to accommodate specific variations in the grade and road path.

Werth has high hopes the pilot will be a success.

"If the concept proves out, we think it will be used all over the United States," he said. "We think there's real opportunity with this product."

PUTTING THE RUBBER TO THE ROAD

Colorado will showcase the first national deployment of Smart Pavement. The pilot project is a quasi-public/private partnership between Integrated Roadways and RoadX, a Colorado Department of Transportation Program.

"RoadX is all about finding new opportunities and demonstrating – often on a smaller scale – that they work or bring value, so other DOTs have a higher level of confidence that they're making a solid investment," said Peter Kozinski, P.E., director of the RoadX Program.

One of the state's priorities is getting its roads ready to communicate with connected and autonomous vehicles.

"In the early stages, that's going to require our roads and our infrastructure to provide information to vehicles," Kozinski said. "That data will also allow us to utilize our roads to a higher level of efficiency."

For this pilot project, Kozinski wants to ascertain how well Smart Pavement technology can detect when a vehicle leaves the road at an unsafe speed and trajectory, and have the pavement notify emergency responders when it detects such an event. The test location is a treacherous, one-mile stretch of state Highway 285.

"The pavement has a lot of other potential capabilities, so we want to understand all the features," Kozinski said. "But if this technology can inform us of potentially unsafe conditions or accidents, that fulfills our mission of keeping our citizens safer – it's a good investment now."

Construction is anticipated to begin in the spring and to be completed by late summer/early fall 2018. A successful project will provide Integrated Roadways with the proof of concept Sylvester needs to gain acceptance for Smart Pavement.

DRIVING TOWARD THE FUTURE

Despite its unproven status, Sylvester is optimistic about Smart Pavement's potential to revolutionize our roadways, much like the internet revolutionized the way we communicate.

"Although treating the road as a network for advanced mobility might seem like a mind-bending leap forward, we can't hold ourselves back by doing things the way we've always done them," Sylvester said. "We need to look forward and plan for the future because infrastructure lasts for decades." **PS**

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