Quarter 4 | 2016

CONCRETE PAVEMENT PROGRESS

ACPA

Restoration Extends Life of Concrete Pavements

ALSO IN THIS ISSUE:

High- and Low-Tech Strategies Help Protect Wetlands

Premature Joint Distress: West Des Moines Tests Possible Solutions

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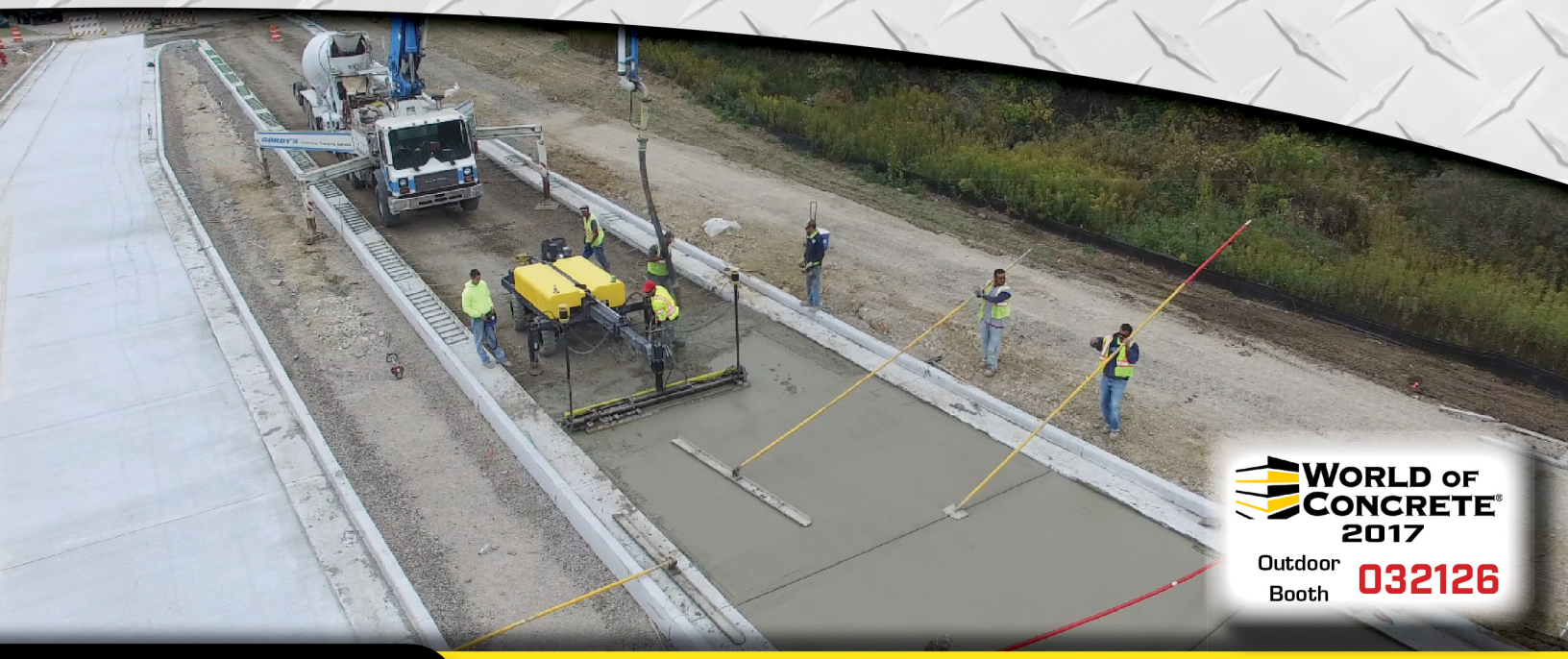

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Concrete Pavement Progress is the official magazine of the American Concrete Pavement Association (ACPA). ACPA is the national trade association for the concrete pavement industry. The primary mission of ACPA is to create and maintain a strong national presence through dynamic, strategic leadership, effective technical expertise and resources, and persuasive advocacy on behalf of the concrete pavement industry.

An Eye on the Future

ONE OF THE REMARKABLE FEATURES OF CONCRETE is its durability, and so, when a concrete pavement meets or exceeds its design life, it's hard not to think of the people responsible for that milestone. One question that comes to mind is whether at the outset of a project, the people who specify, design, and place the pavement stop to think it might last a generation … or longer?

Regardless of the answer, the reality is that many agencies/owners and contractors are doing just that—building something that will last a generation or possibly many generations, and increasingly, are restoring/preserving the pavement to last even longer. The common theme of this issue of *CONCRETE PAVEMENT PROGRESS* is construction with an eye on the future, weighing the decisions and factoring in sustainability, performance, and other factors to produce pavements that meet current and future needs of people, communities, and the world around us.

One example of constructing with an eye on the future is our story, "High- and Low-Tech Strategies Help Protect Wetlands." In this story, we take a look at a trafficway construction project in Lawrence, Kans., where the owner and contractor not only worked together to deliver this much-needed facility, but also worked to protect some natural wetlands and habitat. To get things done, the contractor used some of the latest technology in paving, combined with … well, a low-tech way of getting things done!

Our second story, "Premature Joint Distress: West Des Moines Tests Possible Solutions," tells the story of a road construction project in West Des Moines, Iowa, built to support a Microsoft data center. This is another example of constructing with an eye on the future, because this project may also hold the key to unlocking a problem with joint damage caused by de-icing chemicals.

Finally, in our cover story, "Restoration Extends Life of Concrete Pavements," we turn our attention to Highlands Ranch, Colo., where planners had the perfect response of what to do with a 35-year-old pavement that was experiencing some age-related issues.

ACPA is pleased to present these stories, and is eager to hear details about your projects, too! Please let us hear how you're building with an eye on the future!

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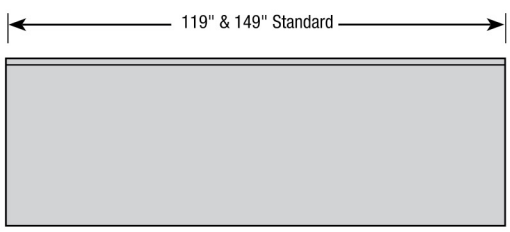

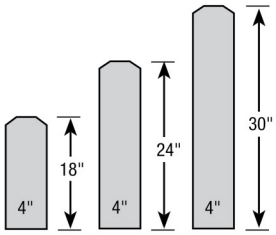

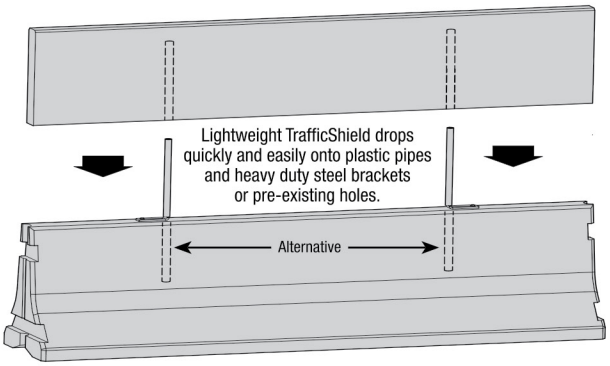

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- Cost: $130M
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- Sidewalk pavement: Over 28,000 sq. yards
- Other structures: 21 bridges, 22 concrete box culverts, 102,000 Sq. ft. of noise wall
- Project contractor: Emery Sapp & Sons

High- and Low-Tech Strategies Help Protect Wetlands

By Sheryl S. Jackson

LENGTHY PLANNING, DESIGN, and construction timelines for major roadway projects are not uncommon, but when wetlands are involved, the timeline can grow even longer.

Construction of 6.3 mile, four-lane, $130 million project trafficway in Lawrence, Kans., required the contractor to construct approximately 300 acres of manmade wetlands to replace 56 acres of wetlands needed for the road and to serve as a buffer to existing wetlands and habitat.

Although construction began in November 2013 and was completed in the fall of 2016, the preliminary design for the project was done 25 years ago, said Michelle Anschutz, P.E., field engineering administrator for the Kansas Department of Transportation (KDOT). The first design for a perimeter road to relieve traffic in the City of Lawrence was completed in 1991, but construction of the eastern segment was delayed to resolve issues with wetlands managed by Baker University and Haskell Indian Nations University.

The Kansas DOT, Missouri/Kansas Chapter-ACPA, and Emery Sapp and Sons (ESS), an ACPA member company, employed different technologies and techniques to minimize disruption to existing wetlands.

"Geotextile fabric around clean rock did add to the cost of the project, but it was important that the road not affect water flow and drainage," Anschutz said. The use of concrete pavement was another way to ensure minimal impact on the wetlands, she added. "We won't have to reconstruct or conduct major repairs for a long time."

Delivering the granular material for the subgrade required careful planning in order to minimize the pounds per square inch (PSI) exerted as the road was constructed, according to Chip Jones, branch manager of the heavy highway operations branch of ESS. "We used crane mats to distribute the weight of small tractor trailers that would dump, and then small bulldozers pushed the material forward," he says. "Procurement of the rock materials as well as finding and scheduling the number of trucks required was a full-time job," he said.

"We also used Cat 740s with scraper pans for grading because we were able to move dirt faster," Jones said. "This was helpful because we've had a lot of rain in the past 1.5 years, and we were able to stay ahead of schedule."

A construction technique unique to working in wetlands was the use of machetes to hand clear the area. "One lesson we learned was not to have the subcontractor's crews work too far ahead of the grading operation," Jones said. "There were a lot of cattails in the area, which grows fast, and if the crew did not stay just in front of the grading operations, they'd have to come back to clear an area they cleared a couple of weeks before."

Another technique used in the South Lawrence project that is not new to road construction but was new to KDOT was stringless paving, Jones said. There was some apprehension within the DOT because inspectors don't have the typical reference points they use when paving pins and strings are used to guide the paver. "We developed a way to share the data with them so they could verify slope and elevation throughout the project, he adds.

"We recommended stringless technology because it provides a better product—a smoother ride," Jones said. "Not only did we eliminate the risk of human error when setting strings, but we also used the GOMACO Smoothness Indicator® (GSI),

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which provides real-time data. This allows us to tweak settings if necessary while we are paving."

"The pavement rides wonderfully," says Anschutz. "This is only the second stringless project in the state, and it is the largest. This project definitely proves that it works."

Because the project involved KDOT, the City of Lawrence—which had a number of city streets that had to be tied into the new trafficway—and wetlands managers, Barker and Haskell Indian Nations Universities, coordination was essential to completing the project, Anschutz said. "There was a strong partnership approach between contractors and all parties, which resulted in a proactive approach to communication and resolving issues," she explains.

What about the wetlands? Anschutz points out, "Before this project, no one considered that you could bring wetlands back after construction, but we are already seeing some species—such as cranes—return." ✧

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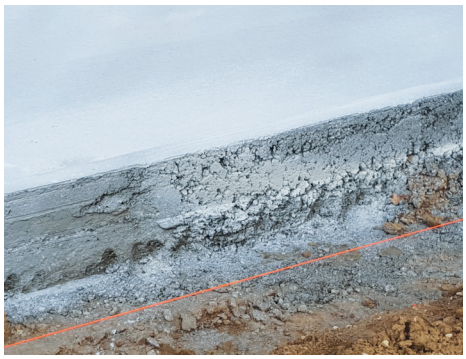

WEST DES MOINES

PROJECT SNAPSHOT

- Length of pavement: 3 miles
- Class C fly ash: Replaced cement at a rate of 30 to 35 percent
- 12-inch subgrade and 6-inch subbase
- Other project components: 3.3 miles of water main; 26.5 miles fiber optic conduit
- Cost of project: $60 million

Premature Joint Distress: West Des Moines Tests Possible Solutions

Change in specs increases fly ash to minimize damage by de-icing chemicals

By Sheryl S. Jackson

WHEN MICROSOFT ANNOUNCED the construction of a data center in West Des Moines, Iowa in 2014, the city committed to building new roads to serve the new facility.

City Engineer Duane Wittstock saw the 3.5 mile road leading to the data center as an opportunity to test recent research on new concrete mixtures. "We were seeing joint failures in concrete pavements that were no more than 10 years old throughout our city," he said. "We have a lot of concrete pavement in our city, but as we looked at the Microsoft project along with other future projects, we knew we had to figure out why the pavement was failing."

Wittstock attended a workshop at which Peter Taylor, Ph.D., P.E., director of the National Concrete Pavement Technology Center at Iowa State University, discussed the issue of premature joint distress in some areas. "Our issues were similar to other cities' problems, but ours were magnified by the number of concrete roads in our city," he said. "Older pavements did not have the same problems, just newer pavements."

"We have been studying premature joint deterioration in nine states for about eight years," Taylor said. "Most of the states are in the Midwest, but we also see the problem in parts of New York and Washington."

Research has identified two main causes of the early deterioration:

- Freeze-thaw damage in saturated concrete
- Salt-related chemical reactions in pavements treated with anti- or de-icing agents

While many areas of the United States routinely treat roads to prevent icing in winter months, pavements in areas that freeze and thaw repeatedly throughout the season—such as Midwest states—are more likely to see early deterioration compared to areas in which water trapped in air voids in the pavement stays frozen for most of the winter.

De-icing chemicals exacerbate damage as the chemicals collect in the joints. Wittstock also points to development of improved techniques for salting roads as one reason newer pavements exhibit damage earlier than older pavements. "We used to treat roads with rock salt, much of which was blown off the road by traffic," he explains. "Today, the liquid chemicals are uniformly placed on the road and stay there."

Although test sections of different concrete mixtures were constructed for research, Taylor points to West Des Moines willingness to commit to test the findings in a real-life setting as a significant step to evaluating solutions to the problem.

Specifications for the mix were based on research conducted by Oregon State University professor Jason Weiss, Ph.D. and specifications used in Minnesota due to that state's experience paving in cold weather, according to Jeremy Huntsman, P.E., project manager at H.R. Green.

Based on a recommendation from Weiss, cement was replaced with Class C fly ash at a rate of 30 to 35 percent, which differs from the standard Iowa DOT mix of 20 percent. Increased fly ash content reduces the risk of damage from de-icing salts by converting calcium hydroxide (CH) into calcium silicate hydrate (C-S-H), which results in a more durable concrete with lower saturation rates and greater long-term strength. Lower fly ash rates enable the creation of calcium oxychloride, an expansive compound that damages the cement paste and reduces durability.

Other modifications to the mix included:

- Minimum of 6 percent air behind the paver and a target water-to-cementitious-materials (w/cm) ratio of 0.40 to a maximum 0.42 (the standard Iowa DOT mix is about 0.45)—both strategies contribute to reduced permeability, which reduces saturation rates and the potential for freeze-thaw damage.

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- 400 pounds minimum cement per cubic yard of concrete was specified to address challenges presented by cold weather paving, such as delayed set times that increase risk of early-age cracking.
- Well-graded, durable aggregates as well as admixtures such as air-entraining admixtures, all specified in accordance with special provisions developed from the Iowa DOT, Minnesota DOT, and Iowa's Standard Urban Design and Specifications guidelines, as well as with advice from local contractors and the Iowa Concrete Paving Association.

Construction techniques that were used to further ensure the durability of the pavement included providing good drainage and protecting the concrete from water and de-icing chemicals. A 12-inch subgrade was installed throughout the project and 6-inch subbase along with a subdrain was installed in certain sections to evaluate the use of rock. The paving contractor, Concrete Technologies, Inc. (CTI), an ACPA member company, also used a surface sealer in and around the joints before applying joint filler.

Because this was the first time the mixture had been used, CTI occasionally had to adjust the water content to improve the workability of the mixture.

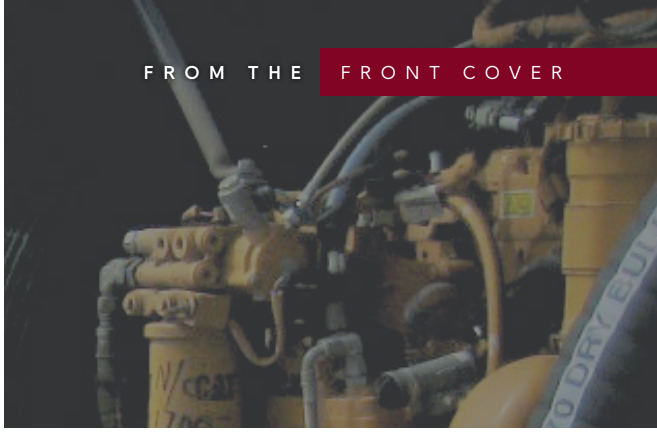
While the pavements associated with the Microsoft project handle light traffic, with only about 1,000 workers traveling the roads, West Des Moines has a higher traffic volume project underway—widening of South 50th Street, which handles over 12,000 vehicles per day.

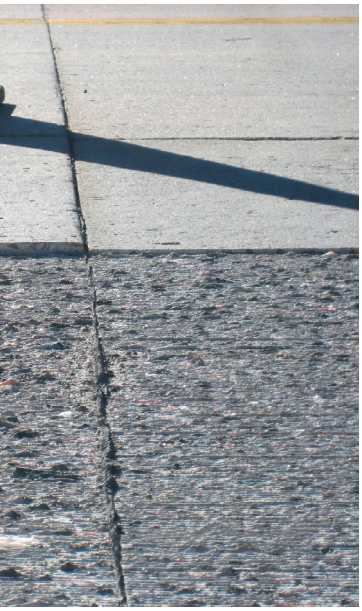
"It will be nine to 10 years before we know the results of the new mixture, but we are positive," Wittstock said. ✧

HIGHLANDS RANCH, CO

PROJECT SNAPSHOT

- 160 lane miles—largest concrete pavement grinding project in state
- Project awarded as multiple contracts with several different contractors performing work on one or more contract, including: Chato's Concrete, Interstate Improvement(2), Multiple Concrete Enterprises(1,2) and Villalobos Concrete Company(1)
- Cost of grinding and sawing/ sealing joints: $6,148,029
- Benefits: Smoother road, skid resistance re-established, road noise reduced
- Impact on pavement life: 10 to 20 additional years anticipated





Restoration Extends Life of Concrete Pavements

How Officials Added 10 to 20 Years to 35-Year-Old Pavements

By Sheryl S. Jackson

WHAT DO YOU DO with a 35-year-old pavement that has broken and shifted panels, joint separation, transverse joint faulting, and cracking? If you're the forward thinking officials of Highlands Ranch, Colo., you look for the best, most cost-effective solution available.

When the 22,000-acre, master-planned community of Highlands Ranch, Colo., was founded in 1981, roads throughout the community were paved with concrete. As the problems with the roads began to occur in this community of 96,000 people, Douglas County officials opted for a pavement restoration and preservation strategy, along with some repair and replacement. Jamie Johnson, P.E., pavement engineer for the Colorado/Wyoming Chapter-ACPA, had worked with other counties on grinding and other types of pavement restoration, so he was able to share six to eight years of data with county representatives.

"There are a number of benefits provided by grinding over other options," he said. "Not only do we expect the grinding to extend the life of the pavement from 10 to 20 years, but you don't lose curbs and gutters as you do with overlays."

After an assessment of the roads, county engineers determined several factors contributed to the movement that was causing the panels to break, separate, and crack. "The 7.5-inch thick pavement was originally built 35 years ago when the volume of traffic and speeds were lower," said Darrell E. Roberts, PLS, manager of engineering permits, inspections and utilities for Douglas County Department of Public Works Engineering. He noted the panels were not constructed using dowel bars for load transfer as they would be if built today.

Douglas County engineers consulted with ACPA and the International Grooving & Grinding Association to develop the contractual criteria used throughout the four-year project, says Brian Schultz, CPII, an engineering inspector with the county.

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Pavement before (top) and after grinding.

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"The contractual grinding specs were to meet a Half-car Roughness Index (HRI) of less than or equal to 150 in. per mile at a maximum grind depth of 0.5 in.," he explains. "If the concrete pavement smoothness couldn't meet this specification, then the contractor had to meet a HRI percent improvement of 50 percent or greater per segment per travel lane. If the pavement already had an HRI of less than or equal to 150 inches per mile then the contractor had to meet an HRI of less than or equal to 80 inches per mile without exceeding the one-half inch maximum grind depth."

To determine the extent and depth of grinding, the contractor, Multiple Concrete Enterprises (MCE), conducted a preliminary profile with a high speed profiler to calculate the roughness index, explains Jim McGee, general manager of MCE. "If the road segment was outside the specifications, that segment was repaired."

In addition to the grinding, some panels had to be replaced or repaired. Some of the original 35-year-old panels also required joint resealing.

As most of the roads in Highlands Ranch are residential, traffic and noise concerns had to be addressed. Lessons learned in the first year of the four-year project were applied to subsequent years to address resident concerns, including:

» Project phasing

Lane closures were required for the duration of the project. In the first phase, closures were extended to allow for three to four weeks of work and remained in place during construction. This generated many traffic flow issues through the length of the work zone. Traffic backups were resolved in the second phase with lane closures that reflected one to two days of work and daily removal of traffic control devices.

» Noise management

Although some of the project was on commercial roads, the majority were arterial and collector roads leading out of residential areas. Nighttime work hours were not always practical near these residential areas but even daytime work hours were disruptive if they went late into the day. Work hours were restricted to between 8:30 a.m. and 3:30 p.m., which extended the time it took to complete the contract, but significantly reduced complaints," adds Keith Burke, an engineering inspector with the county.

» Dust and runoff control

"With the proper equipment and management, grinding is generally a clean process," says Daniel R. Roberts, P.E., capital projects engineer for pavement management. "People are living next to the construction area, so it is important for the contractor to minimize runoff and minimize dust."

» Personal communication

There are also many small businesses located in Highlands Ranch so it was important to let owners and managers know what to expect during the process because it could potentially impact their customers' access to the business. "We made a point to visit stores in shopping centers adjacent to construction to let them know what was happening and when it would happen," says Schultz.

One of the reasons the Highlands Ranch project was successful also provides a lesson for other major concrete restoration projects, Johnson says. "Be realistic about expectations for the final product. Douglas County set up specifications but understood that the conditions for some areas might not fall within those parameters. Adding the 50 percent improvement requirement if specifications could not be met, made it possible for the project to succeed." ✧

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ACPA Takes the Stage at World of Concrete

ACPA WILL HAVE A STRONG PRESENCE at World of Concrete 2017, scheduled for January 16–20 at the Las Vegas Convention Center, Las Vegas.

The exhibits are open January 17–20; seminars and industry-sponsored training will be held January 16–20. Exhibits (show) hours are 9:30 AM to 5:00 PM (Tues.–Thurs.); 9:00 AM to 12:00 PM (Friday).

ACPA's will exhibit booth is C4322 in the Central Hall (best access point is the main entrance between the North and Central Halls). ACPA shares a booth space with IGGA (whose booth number is C4324).

In addition to exhibiting in the south hall, ACPA also will be involved in industry training and seminars. At this writing, all of the following events are expected to be held in the North Hall. Specific rooms will be announced later and will be displayed during the show.

Monday, January 16 8:30 AM–12:00 PM
Industry Training Course
Achieving High Quality Roller Compacted Concrete

Monday, January 16 1:00–4:30 PM
Industry Training Course
Constructing Smooth Concrete Pavements: Tips, Techniques and State of the Art Equipment

Wednesday, January 18 9:00 AM–12:00 PM
Industry Training Event
FuturePave: Update and Outlook for the Concrete Pavement Industry

Wednesday, January 18 1:00–2:00 PM
Press Conference
(Open to members of the media)

Thursday, January 19 8:30–10:00 AM
90 Minute Seminar
Locating Joints Properly in Pavements and Slabs on Grade

Thursday, January 19 1:00–5:00 PM
Industry Training Event
Pavement Jointing: Hands-On Workshop ✧

Going to World of Concrete? *Use this link to save money!*

ACPA encourages readers of *CONCRETE PAVEMENT PROGRESS* to use this unique link, https://www.compusystems.com/servlet/ar?evt_uid=747&PromoCode=A14, to save on exhibits, seminars, and more. By using this special link, you not only save money, you also support ACPA programs through a special incentive program. Here's a snapshot of those savings:

Exhibits-only rates:
» $20 online only, through 1/12/17; $70 onsite with printed Buyer Invite or $85 without

90-minute seminar rates:
» $95 before Dec. 1; $135 after Dec. 1 (and onsite)

3-hour seminars:
» $135 before Dec. 1; $175 after Dec. 1 (and onsite)

4-hour certification rates:
» $190 before Dec. 1; $225 after Dec. 1 (and onsite)

Super Pass packages:
» SP1 & SP2 rates = $405 before Dec. 1; $550 after Dec. 1 (and onsite)

» SP3 rates = $505 before Dec. 1; $650 after Dec. 1 (and onsite) ✧

**Some restrictions may apply*

Make Plans to Attend ConExpo-Con/Agg

See us in booth S60323

ACPA IS ENCOURAGING MEMBERS and affiliates to attend ConExpo-Con/Agg 2017, scheduled for Tuesday, March 7, through Saturday, March 11 at the Las Vegas Convention Center, Las Vegas. Held every three years, the show focuses on construction, aggregates, and ready mixed concrete.

The event is expected to include more than 2,500 exhibitors and more than 140 education sessions on a wide range of construction and materials topics. ACPA will be exhibiting at the show in booth S60323 (South Hall).

Several new features are planned for 2017, including a 7,500 sq ft exhibit called the "Tech Experience," which will focus on emerging technologies, innovative wearables, new materials, new safety and productivity technology and more.

Also planned for 2017 are 700 new exhibitors and education tracks; new technology to help visitors keep track of and follow-up with exhibitors; a "ConExpo-Con/Agg"radio broadcast; and a NASCAR weekend ticket offer. The event also will feature a new badge-pack that includes free transportation options, access to exhibits, discounts at local bars and restaurants, and entry to the "Tech Experience."

Visit http://conexpoconagg.com/ to learn more or to register for the show. ✧

Group Aims to Replicate First Concrete Test Strip

THE CITY OF BELLEFONTAINE, Ohio, the Ohio Chapter–ACPA, and the Task Force on Preservation of Artifacts from Historical Concrete Pavements* have developed a plan to place an 11-foot section to replicate the first concrete pavement constructed in America.

Expected to begin in the spring of 2017, the new section will incorporate the surface features of the original 7 foot wide concrete pavement.

A fundraising effort is underway with the aim of offsetting construction costs for the project and commemorating the new section. This latest effort follows the success of the 125th anniversary celebration of the original concrete pavement in Bellefontaine, Ohio, in April.

"We are now working to preserve, in concrete, one of the key components of this historic site," says Shiraz Tayabji, Ph.D., P.E., of Advanced Concrete Pavement Consultancy. Working with a small group of volunteers and public officials in Bellefontaine, we are working to re-create the original test strip that will provide service for another 100+ years, linking the past, present, and future of the concrete pavement industry."

The City of Bellefontaine is planning to generously support the re-creation effort by removing the asphalt pavement and providing maintenance of traffic and safety devices. To make the vision a reality, the group is asking for sponsorship gifts that will bring this project to life and preserve the historic site in concrete.

Please visit the Ohio Concrete association's fundraising website today, www.ohioconcrete.org/product/the-future-is-in-your-hands/. ✧

** The task force is represented by Shiraz Tayabji, Ph.D., P.E., Advanced Concrete Pavement Consultancy, LLC; Kurt Smith, ARA; Larry Scofield, P.E., IGGA/ACPA; Mark Pardi, P.E., ACPA Ohio Chapter; and Bill Davenport, American Concrete Pavement Association.*

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