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FALL 2012

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Dual Realities
New Research Update

volume 19 number 4

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American Institute of Architects (AIA) building, Raleigh, NC

the contents

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PUBLISHING DIRECTOR:
Jessica Chase, CAE

MANAGING EDITOR:
David R. Smith

CONTRIBUTING EDITOR:
Robert Bowers, P.Eng.

EDITOR:
Brad Causey

ART DIRECTOR:
Kathleen Wilson

ICPI
INTERLOCKING CONCRETE PAVEMENT INSTITUTE ®

13921 Park Center Road,
Suite 270, Herndon, VA 20171
Tel **703.657.6900**
Fax **703.657.6901**
Email ***icpi@icpi.org***

ICPI Canada
P.O. Box 1150
Uxbridge, ON L9P 1N4 Canada

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Amanda Daniel
Mohanna Sales Representatives
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interlockutor

David Smith

DUAL REALITIES EXIST IN THE MATRIX OF STORMWATER MANAGEMENT

Red Pill or Blue Pill

For some, the 1999 sci-fi movie *The Matrix* accurately characterizes a world with two realities. The story is about a giant matrix of interrelated computer programs that creates a machine-based manipulated world; the other world, the real world of humans, is tormented by the machines and forced underground to survive. Their means of entering and leaving the Matrix is via airships that travel through the underground utility chambers packed with sewer pipes. At times the humans disrupt and reprogram Matrix computer codes to survive. Eventually a savior, Neo, emerges to tame out-of-control machines disguised as humans. His biggest revelation is that the Matrix is a fabricated, digital reality. He learns how to operate above and outside it, so that he can eventually defeat the wayward machines.

This dual reality seems to exist in the stormwater management world. The Matrix exhibits itself as soul-numbing impervious pavements like sidewalks, plazas, parking lots and streets, mostly supporting petroleum-fueled transportation, mostly computer generated. This reality is that big institutions support such pavement. The reality of the stormwater community, the smaller and less influential folks who try to reduce stormwater runoff, seems to be slowly nibbling away at the programmed path of the Matrix. This begins with permeable pavement, often energized by runoff regulations, and when deployed, the Matrix programming seems to yield.

This magazine issue demonstrates some evidence. The feature article on permeable interlocking concrete pavement sidewalks and a parking lot in downtown Raleigh, NC, could have gone conventional under the influence of the Matrix. However, a human intervened and redefined the surface, reduced runoff, and increased the possibilities for friendlier urban places. Another Raleigh space is shown in the photo, a green alley between two buildings just blocks from the Governor's house. Again, someone intervened and reprogrammed this part of the Matrix.

Evidence of the Matrix losing its grip on conventional impervious pavements is demonstrated by this permeable interlocking concrete pavement alley in downtown Raleigh, NC.

Two other things might reprogram the Matrix: research and specifications. These can point it toward the humanizing reality of permeable pavement. An article in this issue notes the ICPI Foundation is supporting permeable pavement research. While research results support the stormwater community, the transportation folks (i.e., local and state DOTs) will only confidently embrace permeable pavements for applications beyond low-speed residential roads when structural testing and design charts for base thicknesses become available. The article notes that research on this is about to start at the University of California at Davis, and this effort is supported by the California concrete paver and cement industries.

Another reprogramming of the Matrix lies with dissemination of experience-tested specifications placed into state transportation agency manuals and municipal construction guidelines. The challenge is that each specification is written in the language of each agency with references to their materials and test methods. Each specification requires technical review to minimize transportation agency risks. That's a lot of specs taking a lot of time to change.

However, the Matrix at its core is a multiplicity of interconnected networks. And like the conclusion of *The Matrix* trilogy, the ultimate transformation of transportation agencies to permeable pavements will be viral. For now, the stormwater management world and the concrete paver industry are building the programming to make that happen.

Tech Spec Updates

SIGNIFICANT REVISIONS MADE TO POPULAR GUIDES

The Interlocking Concrete Pavement Institute (ICPI) announced updates to two of its popular Tech Spec technical bulletin series. "Tech Spec 10 Application Guide for Interlocking Concrete Pavements" and "Tech Spec 15 A Guide for the Specification of Mechanically Installed Interlocking Concrete Pavements" received significant edits.

Tech Spec 10 is completely revised to be the "starter piece" for design professionals and contractors. Organized in a manner similar to the Construction Specifications Institute (CSI) SpecData™ sheets, the revised Tech Spec demonstrates the range of applications suitable for interlocking concrete pavements and provides essential information on each. The reader is directed to specific ICPI design, installation and maintenance resources for these applications. The bulletin treats interlocking concrete pavement as a pavement system and gives direction on how to adapt that system to specific applications. For that reason, Tech Spec 10 should be the first read among the series of 17 ICPI Tech Spec technical bulletins as free downloads on ***www.icpi.org***.

The title for Tech Spec 15 was modified to more clearly indicate that the bulletin is about considerations when writing specifications for machine-installed concrete pavers. This method of installation accelerates construction time compared to manual methods, while managing costs and maintaining crew energy. It has been used on countless street, industrial, port and airport projects in North America and overseas. Specifications using this installation method are framed around a method statement where the paver manufacturer, paver installation contractor and testing laboratories provide specific information on the paving and bedding materials, test methods and frequencies, installation methods and measures for documenting project quality control/quality assurance.

The original Tech Spec version was framed from lessons learned on large port paving projects, including the Port of Oakland, CA, built in the early 2000s with approximately 4.7 million sf (470,000 m²) of interlocking concrete pavement for container handling facilities. The updated version provides additional information on placing and stitching paver clusters, i.e., the individual paver layers typically cover a square yard (m²) and consis of 35 to 45 concrete pavers manufactured in the final (or near final) laying pattern. The selection of paver layers and the decision to stitch them together primarily affect installation costs and secondarily, pavement performance. Criteria are provided for when and how to stitch together selected paver layers or clusters.

New versions of ICPI's Tech Specs 10 and 15 are now available.

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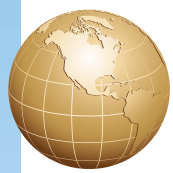
A new design approach: LEDs in precast concrete steps

Even the drawers at exhibitor booths are full of ideas.

GaLaBau 2012 Snapshot

THE WORLD SHOW FOR SEGMENTAL PAVING CONSTRUCTION



With 1,156 exhibitors and almost 62,000 attendees, the biennial GaLaBau 2012 offered a view into new trends for the segmental paving industry. GaLaBau is Europe's leading trade fair for the design of gardens, landscapes, sports fields, golf courses and playgrounds. Abounding in product and design ideas, the show returned to Nuremberg, Germany, Sept. 12-15, 2012, for its 20th show.

The show featured 12 halls with a comprehensive range of products and applications for design, construction and maintenance of urban green and open spaces. About half of the exhibitors presented construction and maintenance machinery. Some 30 percent offered building materials and the remaining 20 percent displayed specialty products like playground equipment, street furniture, or golf course construction and maintenance equipment. The show included indoor and outdoor exhibits and demonstrations. The show feels like a larger, international version of the Green Industries Expo and Hardscape North America held annually in Louisville, KY, at the end of October.

The show featured 12 two-man teams of technical school landscape/hardscape installer trainees that competed for the title of "German Champion Team." The dedicated students entered the Germany-wide competition for the "Landscape Gardener Cup 2012" (see photo below). Each team constructed the same hardscape/landscape design, which was judged based on installation principles.

GALABAU For more information on the show and exhibitors visit *www.galabau.info-web.de/en*.

The 20th GaLaBau was held Sept. 12-15, 2012 in Nuremberg, Germany.

Students compete for the Landscape Gardener Cup at GaLaBau 2012.

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- Nov. 15, 2012
- 1:00 p.m. EST
- no fee

REGISTRATION: **www.icpi.org/webinar2012nov**
PRESENTER: **Robert Bowers**
MODERATOR: **David Smith**

Lessons Learned: Retro-fitting PICP
- Dec. 5, 2012
- 3:00 p.m. EST
- $35 ICPI members/$70 non-members

REGISTRATION: **www.icpi.org/webinar2012dec**
PRESENTER: **Andrew Vear**

Using PICP Design Pro Software
- March 12, 2013
- 1:00 p.m. EST
- $45 ICPI members/$90 non-members (includes software)

REGISTRATION: **www.icpi.org/webinar2013mar**
PRESENTER: **David Smith**
MODERATOR: **Rob Bowers**

Selling Skills
- May 16, 2013
- 2:00 p.m. EST
- $35 ICPI members/$70 non-members

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PRESENTER: **Ed Fioroni**

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By MEREDITH LANDRY

NORTH CAROLINA STANDS AT THE VANGUARD OF PERMEABLE PAVEMENT POSSIBILITIES

The parking lot for the North Carolina chapter of the American Institute of Architects (AIA) building in downtown Raleigh had to be more than a place to park. The organization's impeccable 12,000 sf (1,200 m²) headquarters was completed late last year and earned Platinum-level LEED credits. The post-modern building was designed by renowned architect Frank Harmon, FAIA, whose firm won a professional competition for the project in 2008 because it promoted "healthy urbanism." This is evident inside the building and in the exterior landscaping and parking lot, which together provide exemplary integration of modern design with sustainable practices.

The American Institute of Architects (AIA), North Carolina Chapter building in downtown Raleigh, NC, designed by Frank Harmon, FAIA.

Photo Credit: Tom Edwards, New Image Studio

On a site smaller than an acre (0.4 ha), the remaining area around the building needed to accommodate landscaping and a parking lot for 36 cars. This immediately presented a challenge, says Harmon, who turned it into an asset. "We decided to turn this problem into a virtue by making a parking area that could be used for many purposes in addition to parking," he says. "We called this area the Parking Garden, so it could be used for sculpture exhibits, outdoor movies, street parties, a farmers market and other events connected to the building's large multi-purpose room."

This meant the lot not only had to be attractive, it also had to be useable immediately after inclement weather. So, naturally, Harmon selected permeable pavement. And when he envisioned a herringbone pattern using interlocking concrete pavers, the ICPI member contractor delivered.

Over four weeks in December 2011, the contractor installed the 8,200 sf (760 m²) parking lot using permeable interlocking concrete pavers that incorporated some of the building's blue tones. His crew installed most of the pavers with mechanical equipment to reduce construction time and costs. According to the contractor, mechanical installation of the concrete pavers saved at least a week's worth of labor costs.

Mechanical installation requires one person operating the machine and one person helping to set and align the pavers on the permeable bedding material. Once the paver joints are filled with permeable aggregates and compacted, the owner has immediate use of the surface. In contrast, pervious concrete requires about a week to cure and porous asphalt at least 24 hours before receiving vehicular traffic.

Continued on page 12

azers

CROSS SECTION:

—3 ⅛ in. (80 mm) concrete pavers
—2 in. (50 mm) #78 open graded aggregate stone
—4 in. (100 mm) #57 open graded aggregate stone
—Variable depth drainable subbase material

Different colored pavers delineate parking stalls, thereby eliminating the maintenance cost of periodic repainting.

NOT JUST A PAVEMENT

Although the mechanical installation saved significant time and money, some of the detail work had to be done by hand to achieve Harmon's standards for appearance.

To achieve Harmon's desire for a continuous herringbone pattern, the installation crew stitched the mechanically placed paving layers together. Each square yard (m^2) layer has a few half pavers on the layer sides. These half pavers are removed during layer placement, replaced by whole units to continue the herringbone pattern from one layer to its neighbors. This creates a consistent pattern across the surface and suggests a customized appearance.

Adding customization, the contractor gave the lot permanent parking stall stripes by creating them with a different color paver. As a result, the building owner eliminated time and money spent maintaining painted stripes on the lot's surface. Other permeable surfaces don't provide this option.

Because of its adaptability, sustainability and increased affordability, permeable pavement has seen a rise in demand every year for the last five years in the region. Frank Harmon hopes that the AIA project will inspire more developers to follow suit and increase that demand even more. "We like to think that our building and landscape raises the standard of sustainable design," Harmon says. "Being in the capital city and located a few hundred feet from the state legislature, it will, we hope, become a role model."

LEADING BY EXAMPLE

Permeable interlocking concrete pavers have already found their way into other parts of Raleigh, a city where excessive stormwater runoff is one of the most pressing environmental challenges, according to Harmon. Completed in the fall of 2011, the North Carolina Department of Environment and Natural Resources (NCDENR) in downtown Raleigh included a permeable interlocking concrete pavement sidewalk as part of its Green Square Complex, a two-block, multi-use, sustainable urban development that houses the NCDENR headquarters, the North Carolina Museum of Natural Sciences' Nature Research Center and underground parking for 426 cars.

"This is one of the first installations of a permeable paver system within a public streetscape in North Carolina," says Jonathan Parsons, a project landscape architect for O'Brien/Atkins, the Durham-based firm responsible for the design of the complex's sustainable systems. The NCDENR permeable paver project consists of 7,100 sf (660 m^2) of sidewalk placed in phases over three months.

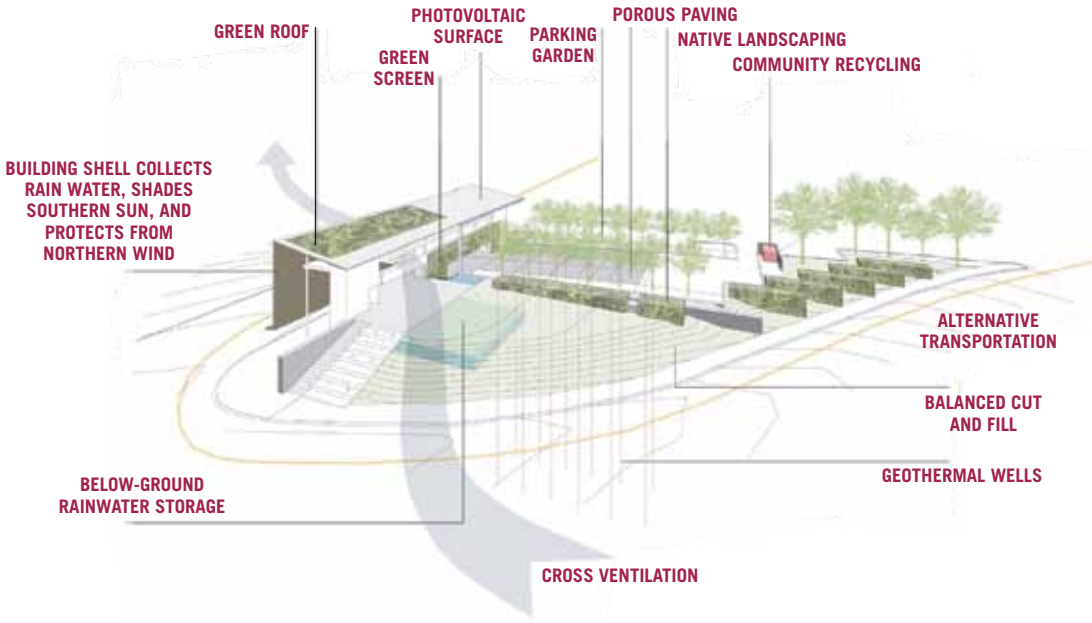
"This state agency project clearly sets the example for the rest of the state. They're incorporating green building principles in a downtown area with far too many hard surfaces," Parsons says. "Hopefully other urban settings across the state will realize the benefits from these principles."

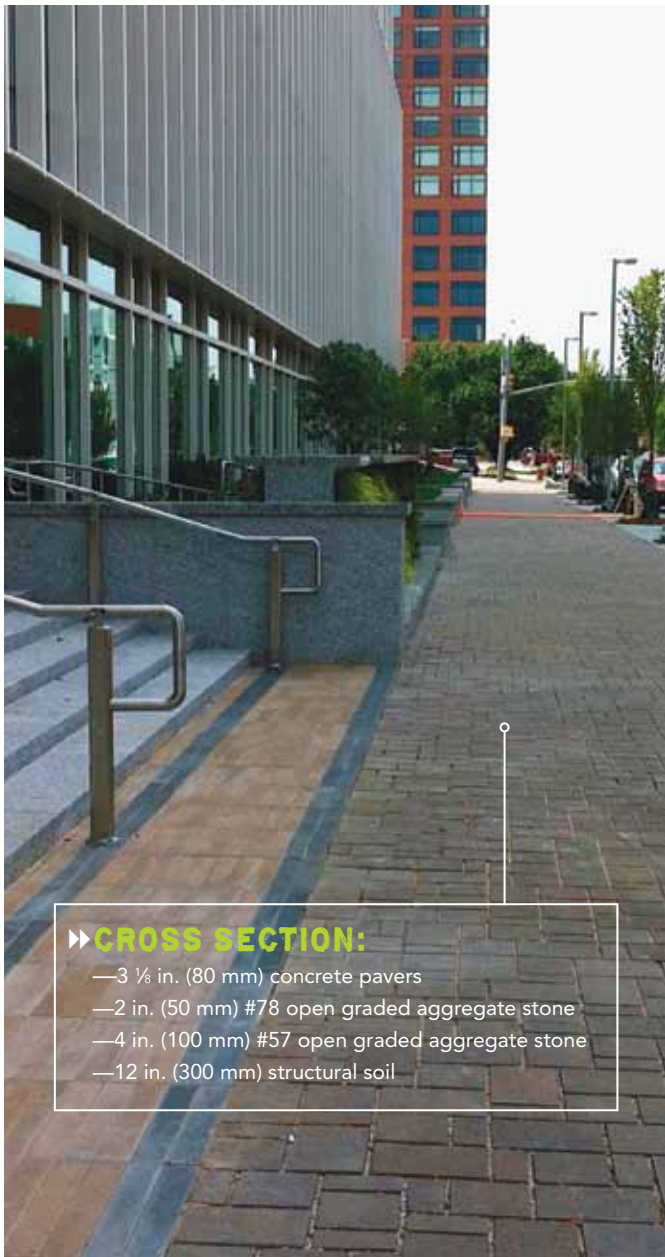
A BALANCED ENVIRONMENT

Raleigh is typical of most urban areas with expansive suburban development surrounding an urban core. Over the

> "This is one of the first installations of a permeable paver system within a public streetscape in North Carolina."
>
> —Jonathan Parsons, Project Landscape Architect, O'Brien/Atkins

AIA Building—Demonstrating Sustainability





CROSS SECTION:
—3 ⅛ in. (80 mm) concrete pavers
—2 in. (50 mm) #78 open graded aggregate stone
—4 in. (100 mm) #57 open graded aggregate stone
—12 in. (300 mm) structural soil

years, development impacted multiple streams within the drainage basin, according to Parsons. "Impacts include sudden changes in flow volume and intensity during rainstorms, plus temperature spikes caused by runoff flowing into the streams from paved areas," he says.

Raleigh in particular has been slow to accept permeable pavers since the clay soils in this part of the state infiltrate slowly, Parsons says. However, the state as a whole has made significant progress in expanding acceptance of permeable pavement as part of a site's stormwater management plan.

Between 1999 and 2005, North Carolina State University conducted several studies on permeable pavement for infiltrating stormwater runoff, all of which showed positive performance for runoff reduction. Two of these studies were co-funded by the Interlocking Concrete Pavement Institute. As a result, North Carolina State University faculty convinced NCDENR regulators to accept permeable pavement as a stormwater best management practice in 2006. NCDENR recently released revised design guidelines on permeable pavements. The 40-page document provides pollutant credits and site coverage credits to builders and homeowners for using permeable pavements across the entire state. The 2006 edition only provided such credits to the eastern counties with sandy soils.

Permeable pavement enables larger buildings and more efficient site use because the pavement manages the water on the site. The municipal storm drainage systems see less runoff and that reduces public expenses. For Frank Harmon's project, the permeable interlocking concrete pavement collects all roof runoff and 90 percent of rainwater stays on the site. "If you stand in a mature mountainside forest as it rains, you'll notice that 90 percent stays in the forest," he says. "That's how nature intends it to be in a balanced environment."

Photo Credit: O'Brien/Atkins in association with Fentress Architects.

The permeable pavement sidewalk adjacent to the North Carolina Department of Environment and Natural Resources (NCDENR).

PERMEABLE PAVEMENTS AND STORMWATER POLLUTANT REDUCTION

Sure, permeable pavement is better for the environment, but does it also help remove pollutants?

According to research conducted by North Carolina State University's Dr. Bill Hunt and his colleagues at the North Carolina Department of Environment and Natural Resources (NCDENR), permeable pavements usually improve stormwater runoff quality. Many states, including North Carolina, do not assign pollutant removal credits to these pavement systems. But NC State research investigating how well permeable pavements remove certain pollutants when compared to asphalt runoff has changed NCDENR's position. Revised permeable pavement design guidelines recently released by NCDENR give such credits to designers and project owners. The credits affirm the role of permeable pavement in decreasing stormwater pollutants such as heavy metals, motor oil, sediment and some nutrients.

the project winners

1 BROWN HALL, COLORADO SCHOOL OF MINES

- PROJECT LOCATION: Golden, CO
- SQUARE FEET OF PROJECT: 35,000
- CONTRACTOR: Rocky Mountain Hardscapes, LLP
- PRODUCT MANUFACTURER: Pavestone Company

With the construction of Brown Hall, the intent of the design created a beautiful and compelling pedestrian environment in newly vacated streets in the heart of the Colorado School of Mines campus. This solution also accommodated emergency and service vehicle loads and avoided exceeding historic off-site storm flows, while meeting the campus maintenance requirements for a long-lasting, durable pavement surface. The pavement profile captures water on slopes in places which exceeded 8 percent. This required site specific detailing, including subsurface check dams and subdrains, since the typical design is for under 5 percent slopes. The pavement system was designed for partial and full infiltration and in places adjacent to the building a liner was included at the bottom of the profile to protect the building foundation from surface water infiltration. An electric snowmelt system was incorporated into the paver design at building entrances.

Paver colors were selected to meet the solar reflectance values allowing the project to achieve the LEED credit SSc7.1 - Heat Island Effect/ Non-roof. Other LEED credits toward which the paver system contributed were: Stormwater Management Quantity Control Credit 6.1; Stormwater Management Quality Control Credit 6.2; Regional Materials Credit 5. In order to maintain continuity, designer and contractor collaborated on careful detailing of edge conditions around utility manholes and valve covers to accommodate the paver geometry and layout. Specific layout rules helped the contractor minimize redos and avoid a poor result. Team commitment meant spending time in the field to review the paver installation layout to ensure a quality installation and realize the design intent in a non-modular world. While the goal was LEED Silver, with the contribution of a permeable paver system, Brown Hall achieved LEED Gold certification.

Continued on page 16

1

CATEGORY:
CONCRETE PAVERS—PERMEABLE COMMERCIAL/ INDUSTRIAL

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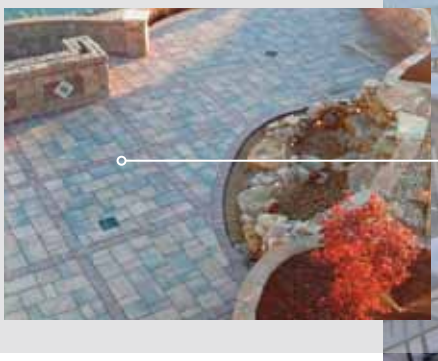


2

CATEGORY:
CONCRETE PAVERS—COMMERCIAL/INDUSTRIAL
1,000 TO 15,000 SQUARE FEET

2 LAKE FOREST COUNTRY CLUB

- PROJECT LOCATION: Hudson, OH
- SQUARE FEET OF PROJECT: 3,000
- CONTRACTOR: Rock Bottom Lawn & Landscaping
- PRODUCT MANUFACTURER: Belgard; Unilock

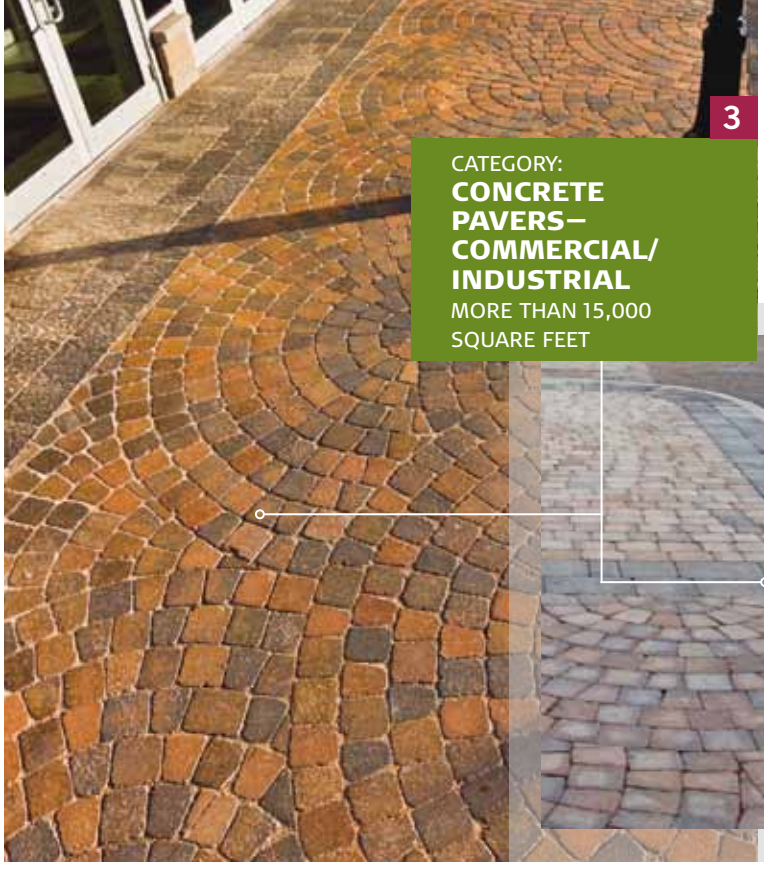
This project consisted of creating an outdoor event venue accommodating all types of gatherings from weddings to informal lunches. The design creates a functional meeting space that highlights and utilizes the picturesque lakefront setting. While the lake served as a beautiful backdrop to the project, it also created challenges in planning and construction. Excess water and slope down to the lake were resolved by engineered retaining walls and extensive drainage under the patio. A professionally diverse staff planned every aspect of the project, including the water feature, the custom bar and grill, and the carefully selected landscaping. To help reduce the scale of the 3,000 sf (279 m²) patio, it was constructed over a grid pattern, accentuated by key vertical elements such as the fireplace, bar, grill and water feature. An inlay of deep red creates the grid that draws your eye down straight lines toward these focal points. Sinuous walls provide a contrast to the rectilinear pavers. A swimming pool, water slides and lounging deck were completed by a separate contractor. The canopy system requested by the association was uniquely designed to conform to the project layout.

APPLICANTS To learn more about submitting a project for award consideration, go to *www.hardscapena.com*.

3 DARTMOUTH CROSSING SIDEWALKS

- PROJECT LOCATION: Dartmouth, NS
- SQUARE FEET OF PROJECT: 132,000
- CONTRACTOR: Cornerstone Interlocking Brick Ltd.
- PRODUCT MANUFACTURER: Permacon

The Dartmouth Crossing is a large retail development in Dartmouth, Nova Scotia. Among the typical big box stores are numerous upscale boutiques. When the architects and developers wanted to give these 'lifestyle' stores an inviting and appealing feel, they turned to 132,000 sf (12,263 m²) concrete paver sidewalks. Three challenges separated this project from other jobs. The first challenge was the complexity of the circular patterns and accent layouts. The cobblestone look was achieved by nesting half circles with a fan pattern between them. The amount of cutting involved was substantial as none of the factory-supplied circle kits were designed for this method of installation. The second challenge was the different thickness of the banding and soldier coursing.



3

CATEGORY:
CONCRETE PAVERS—COMMERCIAL/INDUSTRIAL
MORE THAN 15,000 SQUARE FEET

At 80 mm thick (as compared to 60 mm for the field), the banding pavers and border details had to be graded, laid, and cut before repeating the same process for the thinner field pavers. The third challenge was a tight timeline. Although the work was spread over three years (2007-09), there was always pressure to complete paving for individual stores for grand openings. The unit paving was always left until the very end for over 50 store openings. The pictures for this entry were taken August 2012, four years after installation. The installation has performed flawlessly and looks great with the "main street" storefront designs.

Continued on page 18

HNA HARDSCAPE 5TH ANNUAL PROJECT AWARDS
2012 HARDSCAPE North America

winners

4

CATEGORY:
CONCRETE PAVERS—TRANSPORTATION/ MUNICIPAL STREET

4 GLEN COVE FERRY TERMINAL

- PROJECT LOCATION: Glen Cove, NY
- SQUARE FEET OF PROJECT: 9,000
- CONTRACTOR: KJB Industries, Inc.
- PRODUCT MANUFACTURER: Nicolock Paving Stones

As part of the waterfront revitalization in the City of Glen Cove, NY, a terminal dock was added for a ferry to take passengers from Glen Cove into New York City. The site was a contaminated superfund site and this clean up was a major part of the contract. The project consisted of a concrete bulkhead more than 600 ft (183 m) along the waterfront from which floating docks extend for ferries to unload passengers. The ramps from the dock to the top of the bulkhead are handicap accessible. Between the bulkhead and the parking lot, a landscaped, paver walkway and seating area was constructed. The walkway and parking area has area lighting for night use.

HNA AND ICPI The Hardscape North America trade show is produced by ICPI. To learn more about ICPI, visit *icpi.org*.

5 VIRGINIA STREET RESIDENCE

- PROJECT LOCATION: Omaha, NE
- SQUARE FEET OF PROJECT: 2,500
- CONTRACTOR: Paver Designs
- PRODUCT MANUFACTURER: Belgard

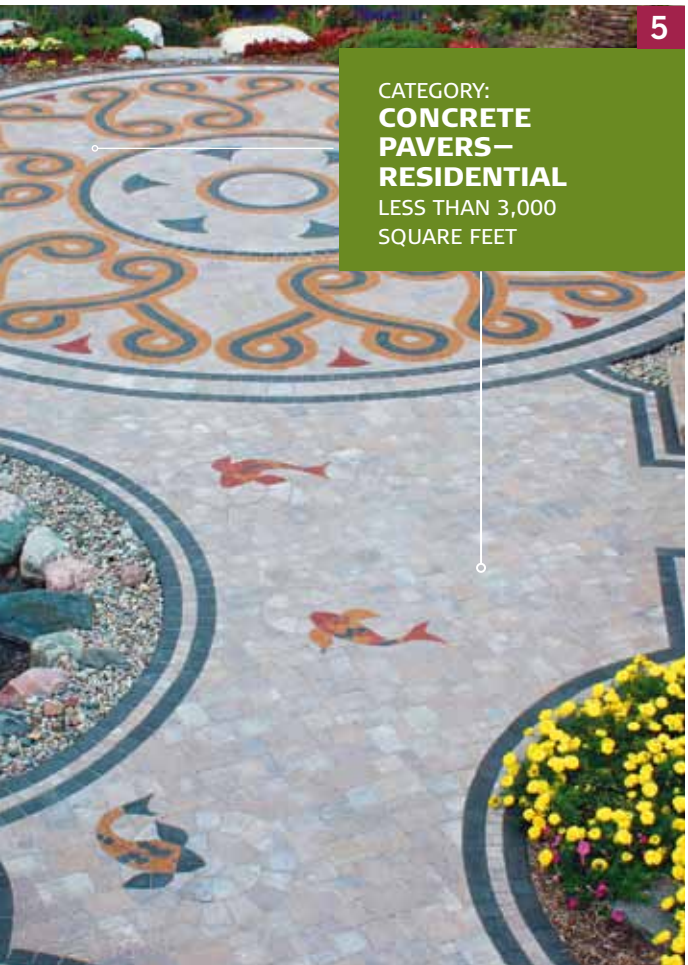
This two-stage project included a front patio area finished for a family wedding, and a driveway added after the wedding. The driveway was excavated to a depth of 16-18 in. (400-450 mm) and the patio is 12 in. (300 mm) deep. Crushed recycled concrete was used for the base with one inch of bedding sand. After the Mega-Arbel Stone pavers were placed, another inch (25 mm) of base was added for the Dublin Cobble paver areas. Holland stone pavers are usually used for the inlays. Three round seats were built next to the water feature and pebble designs were created in the center of each. Columns for the freestanding wall were designed with recessed areas for lights and for use as planters. Three-by-six inch (75 x 150 mm) Dublin cobble pavers were cut in half for the triple border in the narrower areas of the patio. The front paver entrance is gently ramped with no step for handicapped accessibility. The most difficult stage of this project was drawing over 20 diverse designs over the winter months and then making a final selection. Using the basement floor as a drawing board, the "Y" shaped designs were drawn on Masonite at appropriate

angles and distances so that the mirrored pairs nearly touched, and a template was made from this. After laying the field of pavers, the mosaic areas were marked with the template. These pavers were cut out one at a time. All of the colored Holland stone pavers were cut into thirds, and then angles were cut to follow curves. The template was moved and traced 12 times; each triple-row design took eight hours to complete, an approximate total time of 96 hours just for the mosaic patterns. Many additional hours were spent cutting and installing the fish and triple borders. Pavers in the mosaic, as well as the koi and borders, were coated with Techniseal NuLOOK. These colors are rich and bright, well worth the extra effort. Techniseal Color Boost matte finish was applied to the Mega-Arbel Stone on the driveway. No finish was applied on the Dublin Cobble Pavers.

6 LOPEZ OUTDOOR LIVING

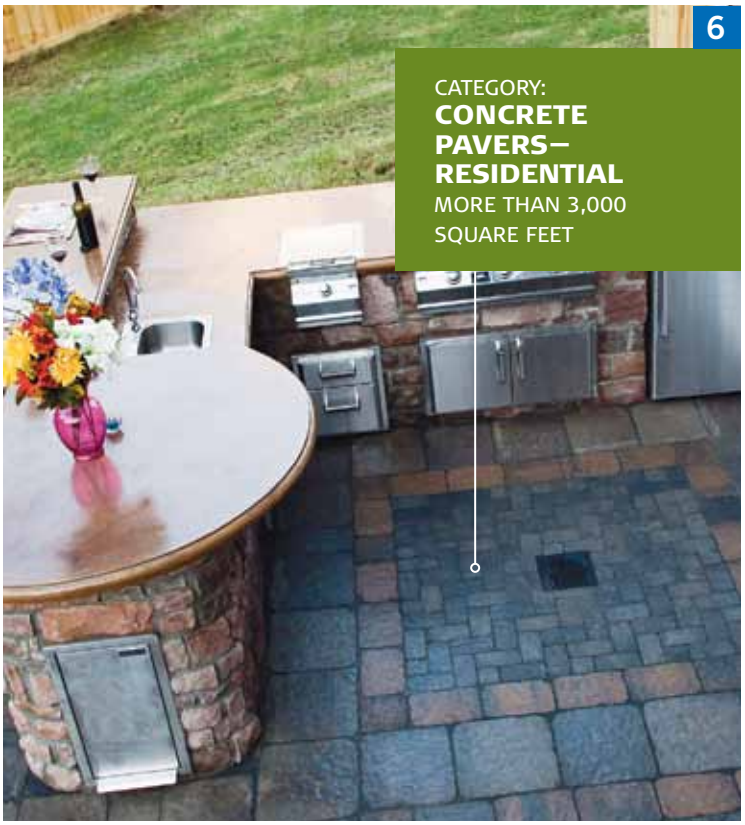
- PROJECT LOCATION: Williamsburg, VA
- SQUARE FEET OF PROJECT: 3,500
- CONTRACTOR: Mid Atlantic Enterprise, Inc.
- PRODUCT MANUFACTURER: Hanson Hardscapes & Rediscapes

The main objective for this project was to turn a disabled American veteran's unused, hilly backyard into a complete outdoor living destination. This meant creating a functional place for the client's needs while being an exciting place for his young family to play and entertain. A major challenge in this project was altering the terrain to suit the design plan. The entire backyard had to be clear cut and over 3,000 cubic yards (2,300 m²) of earth removed. Poor drainage was corrected before installing the hardscape. To accommodate the elevation changes of the property and to support an ADA compliant ramp, two walls were constructed using Rediscapes Wall Block. One wall serves as a freestanding retaining wall specially constructed on a large concrete footer and reinforced with rebar and concrete. Everything was custom built including a new deck and pergola to blend the home and hardscape. This included a fully functional outdoor kitchen, a gunite pool and spa large enough to accommodate the client's ever-growing family, two fire bowls and a fire pit to add the "wow" factor. In addition, a shed was built to complement the home while providing much needed storage space. A full landscape was installed, which included five 25 ft Magnolia trees to provide instant privacy in place of the overgrown woody area. To provide safety at night, the project was completed with strategically placed landscape lighting.



5

CATEGORY:
CONCRETE PAVERS—RESIDENTIAL
LESS THAN 3,000 SQUARE FEET



6

CATEGORY:
CONCRETE PAVERS—RESIDENTIAL
MORE THAN 3,000 SQUARE FEET

ENGINEER'S view

ICPI FOUNDATION SUPPORTS

New Research Projects

Sidewalk smoothness is part of accessibility, especially for those using canes, crutches, walkers and wheelchairs.

SIDEWALK SMOOTHNESS

The U.S. Access Board is currently researching smoothness criteria with the help of the University of Pittsburgh's Human Environmental Research Laboratories. The criteria are being developed by the University from wheelchair user surveys, extensive data on wheelchair use patterns and roughness measurements. The intent is to develop smoothness criteria that eventually may be included in national Americans with Disabilities Act (ADA) Design Guidelines or in an ASTM standard. These eventual criteria rationalize wheelchair user comfort and sidewalk accessibility.

As a parallel project, ICPI Foundation for Education and Research joined with the Brick Industry Association (BIA) to fund development of a sidewalk smoothness measurement device by the University of Pittsburgh. This University is the same one that conducted wheelchair-pavement interaction studies for ICPI and BIA in 2002 and 2004. The University is completing laboratory and in-situ pavement surface measurements, data analysis and recommended smoothness thresholds. They have begun development of a portable technology for smooth measurement capable of being operated by technician level personnel. The measurement device should be prototyped and tested by summer 2013.

PICP STRUCTURAL TESTING

As a pressing need for PICP market development, structural testing and validated design charts rank high. To address this need, the ICPI Foundation, the California Nevada Cement Association, and the Concrete Masonry Association of California and Nevada co-funded full-scale structural testing and development of design charts for PICP. Modeling, plus laboratory and full-scale load testing of PICP will be done by the University of California Pavement Research Center (UCPRC) in Davis. The ICPI Foundation support includes some of the project costs, a construction test area and project administration. Additional Foundation support includes review of the test program deliverables and review of the data for application to freeze-thaw areas by an outside consultant. About 2,800 sf (280 m²) of permeable pavers are being donated by an ICPI member for the test area. The photo below shows the specialized equipment that repeatedly applies wheel loads while measuring stresses and strains within various pavement structures. The project is expected to start in November 2012.

PICP COLD CLIMATE RESEARCH

The ICPI Foundation recently co-founded a permeable interlocking concrete pavement (PICP) parking lot being monitored by the Toronto and Region Conservation Authority (TRCA). This is a continuation of monitoring porous asphalt, pervious concrete and PICP at the offices near Toronto. The funds leverage other contributors who, along with ICPI, helped launch monitoring over two years. The additional funds extend monitoring another two years.

The two PICP parking lot installations at TRCA offices utilize pavers from ICPI Foundation donors.

As previously reported in this magazine, TRCA published very useful PICP reports on monitoring a heavily used PICP parking lot, asphalt parking lot and bioswale at a community college between 2005 and 2008. The reports demonstrated the ability of PICP to reduce runoff and pollutants in a cold climate while confirming lower use of deicing materials than with conventional pavements. A reason for this second monitoring project at TRCA facilities is that the permeable pavement cross sections being tested are those typically recommended by each industry. This side-by-side performance evaluation of PICP, pervious concrete and porous asphalt will be important to furthering PICP in Ontario, wider Canada, and in cold climate regions in the U.S.

PICP NUTRIENT REDUCTION RESEARCH

The ICPI Foundation is supporting a proposal from North Carolina State University (NCSU) to monitor a small PICP parking lot on low infiltration soils owned by the City of Durham, NC. The US EPA, the City of Durham and an ICPI member are also supporting this project. These research results may likely provide data on nutrient reductions through detention/de-nitrification via a raised subbase underdrain. A raised drain means that runoff can pond within the open-graded base reservoir, and through anaerobic processes, experience greater nutrient reduction than if simply exiting a pipe along the bottom of the base. The project deliverables will help answer questions from stormwater agencies about nutrient reduction on low infiltration clay soils. The research project also has a high impervious surface to receiving PICP surface ratio (6.5:1). The research will examine the rate of sediment accumulation and potential effects on surface infiltration. In the past, ICPI supported NCSU for PICP surface infiltration and water quality/quantity research. This new project starts in fall 2012, and monitoring will continue for two years.

The TRCA monitoring project near Toronto involves side-by-side comparisons of runoff volumes and pollutants from PICP and other permeable pavements, as well as from impervious pavement for comparison purposes.

Called a heavy vehicle simulator or HVS, this device will apply repeated wheel loads to instrumented PICP to help validate structural design and performance models at the University of California Pavement Research Center.

the MAIN events

2012

Nov. 23-26	Shanghai, China	*10th International Conference for Concrete Block Pavements*
Nov. 28-30	Toronto, ON	*Construct Canada*
Dec. 3-7	Washington, DC	*Ecobuild*

ECOBUILD To register for Ecobuild, visit *www.aececobuild.com*.

2013

Jan. 8-10	Toronto, ON	*Landscape Ontario Congress*
Jan. 11-13	Indianapolis, IN	*ICON Expo (w/ Precast Show)*
Jan. 13-15	Indianapolis, IN	*ICPI Annual Meeting*
Jan. 22-24	Las Vegas, NV	*International Builder Show (NAHB)*
Feb. 5-8	Las Vegas, NV	*World of Concrete*
Aug. 18-22	Myrtle Beach, SC	*Stormcon*
Aug. 25-28	Chicago, IL	*APWA Public Works Congress & Expo*
Sept. 10-14	Pittsburgh, PA	*ICPI 2013 Summer Meeting*
Oct. 24-26	Louisville, KY	*Hardscape North America*
Nov. 15-18	Boston, MA	*ALSA Annual Conference & Expo*
Nov. 20-22	Philadelphia, PA	*Greenbuild (USGBC)*
Dec. 9-13	Washington, DC	*Ecobuild*

ADVERTISERS IN THIS ISSUE

paving the way

WOULDN'T THAT BE A GREEN ALLEY?

PIWP?

By Kim Alters

This historic alley in Chicago's Gold Coast neighborhood has been restored using pavers made from wood.

To maintain its original character, one of only two remaining segmental wood-paved areas in Chicago saw restoration of its original construction. Dating from 1909 and located in the city's Gold Coast neighborhood along Lake Michigan, the alley is enshrined on the National Register of Historic Places and designated a City of Chicago Historic Preservation Landmark. While not officially one of Chicago Department of Transportation's 100-plus green alleys designed to reduce stormwater runoff, the alley has some sustainable aspects without official certification from the Forest Stewardship Council.

It took 10 years for the CDOT and the community to undertake the venture, says Michael Lev, vice president of TranSystems, the major consultant for the project. "The traditional thing to do would be to cut everything out and put in a concrete alley, but the community felt strongly that concrete was not the right solution," Lev says. Instead, CDOT decided to replace the original wood pavers with new ones. The construction team vetted various wood species for the new blocks, first considering used railroad ties but finally deciding on black locust wood due to its durability, density, resistance to insects and rotting, visual appeal and lack of odor.

The base of the alley was another issue. "We thought it was pretty unusual to have poured a concrete base under a wood paver street at that time," Lev says. Although using the existing base reduced costs and construction waste, he says, it also presented drainage complications. "We actually had to create a permeable paver design, but there was this solid concrete base underneath," Lev says. "We ended up detailing a pattern of weep holes, which the contractor drilled into the base, to allow water to percolate through the bedding sand and the sand in between the pavers, through some filter fabric, and then through the weep holes," he says. Obviously, open-graded, highly permeable jointing and bedding aggregates used in today's permeable interlocking concrete pavements aren't compatible with wood pavers. While sand isn't as permeable as open-graded aggregates, the passage of any water through sand joints and bedding certainly contributes a bit to stormwater runoff reduction.

Most importantly, the renovated alley retained its cultural value. The renovation of the century-old alley further confirms Chicago as the birthplace of green alleys before naming them as such. As a testament to the alley's history and durability, a small portion of its west end remains paved with the original 1909 paver blocks. The project won the 2012 American Public Works Association Project of the Year Historical Preservation category award for projects less than $5 million. A glance back to the past suggests that permeable interlocking concrete pavement assumed a role begun by permeable interlocking wood pavement alleys.

The construction team vetted various wood species for the new blocks, first considering used railroad ties but finally deciding on black locust wood due to its durability, density, resistance to insects and rotting, visual appeal and lack of odor.

Photos courtesy of TranSystems and Mark Freeze, Knight E/A, Inc.

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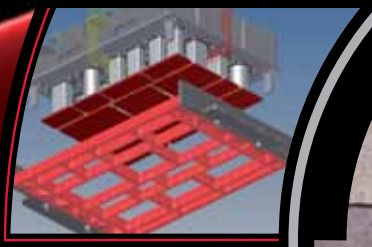

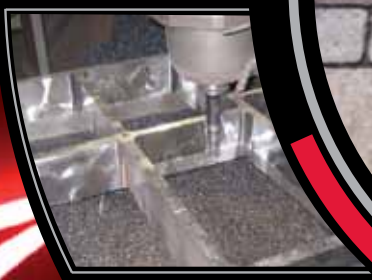

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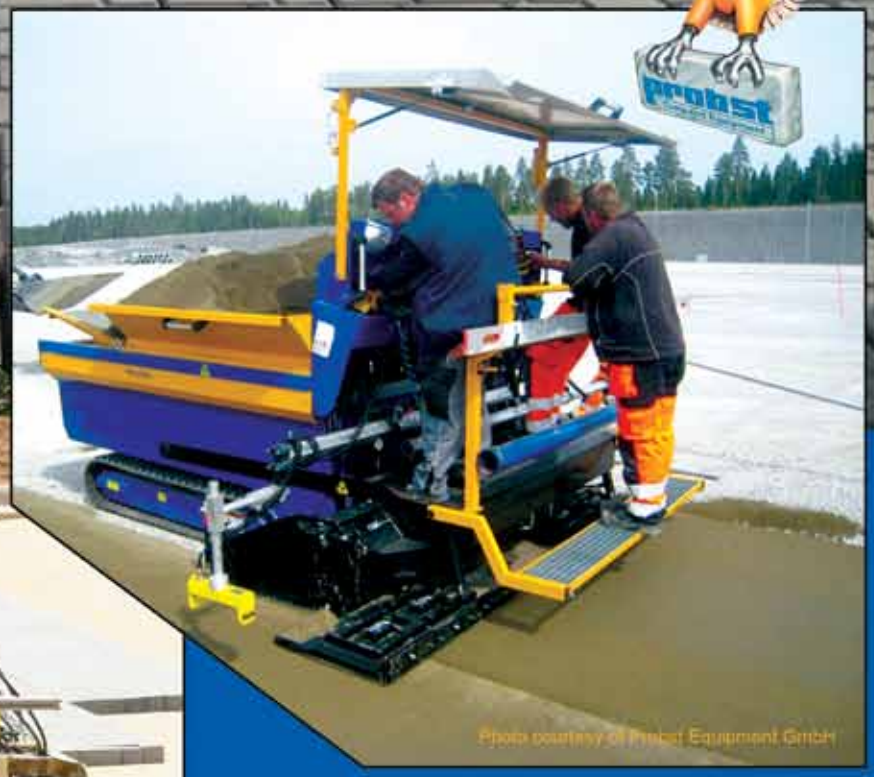
Photo courtesy of Southwest Specialties, Inc.



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