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PAVEMENT INSTITUTE

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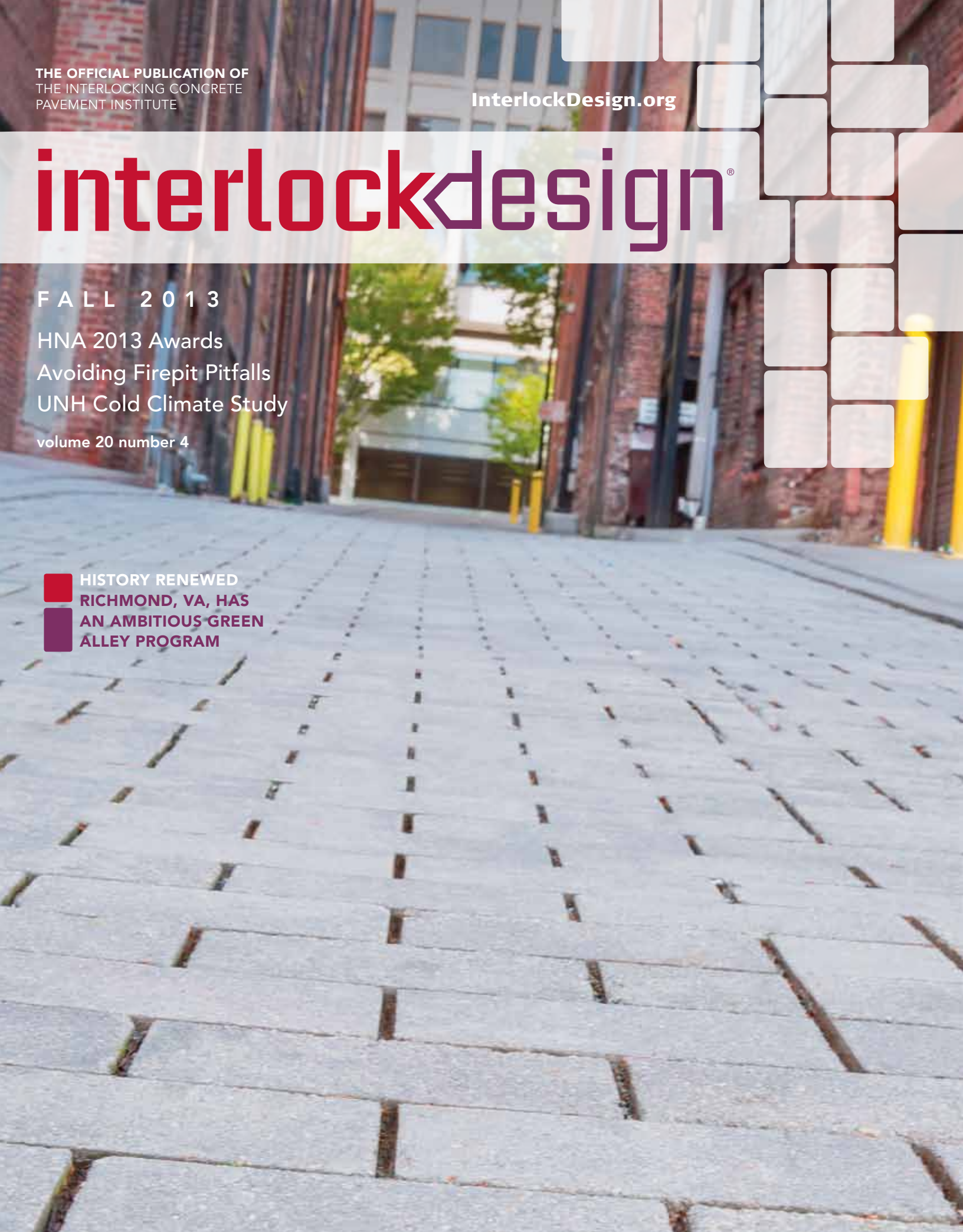
FALL 2013

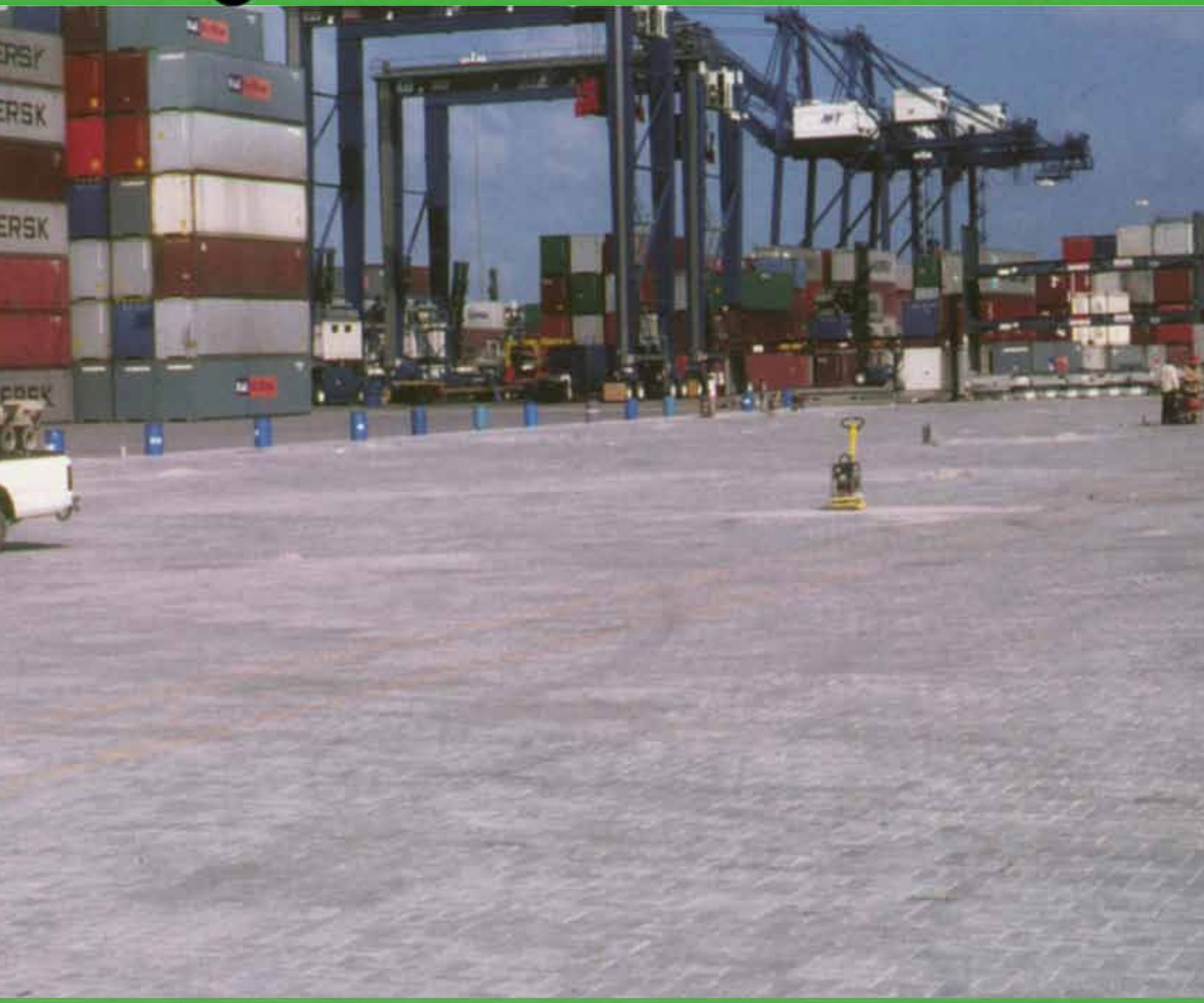
HNA 2013 Awards
Avoiding Firepit Pitfalls
UNH Cold Climate Study

volume 20 number 4



HISTORY RENEWED
RICHMOND, VA, HAS AN AMBITIOUS GREEN ALLEY PROGRAM

Long-Term Chemical Cure.



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Richmond's Green Alley Program (5th Street shown here, 12th Street on the cover)

Photo Credit: Sean DeWitt

the contents

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David R. Smith

The Structure of Green Infrastructure

With growing reference by designers, city officials and informed citizens, the term "green infrastructure" is rising into the national vocabulary. Infrastructure is something we experience daily, every time we walk, bike, drive or drink a glass of water. We really can't survive without it. 'Green infrastructure' sometimes comes across as more tangible than 'sustainable' technologies. And to paraphrase Kermit the Frog, making infrastructure green isn't easy. Fortunately, creating green infrastructure is worth the effort.

A common deployment of green infrastructure is through the use of vegetation and soil to manage rainfall where it lands, rather than stuffing it in pipes for disposal elsewhere (and to others' chagrin). Installing green infrastructure has been the basis for resolving years of U.S. EPA litigation with some 770 cities to reduce combined storm and sanitary sewers spilling untreated filth into waterways in violation of the Clean Water Act. Beyond using vegetation, bioswales and roof gardens, permeable pavement is emerging as a very effective tool for decreasing the volume of stormwater entering combined sewer systems that overload and then bypass the local sanitary waste treatment plant.

Today, many cities are using green infrastructure programs to renovate existing urban infrastructure supporting blocks or entire neighborhoods. The best projects achieve multiple goals. These can be reached with help from permeable interlocking concrete pavement (PICP). A multiplier effect is embedded within the structure of green infrastructure. Here are some multipliers when PICP is used:

Stormwater Management – Many studies have demonstrated that PICP reduces runoff and pollutants by meeting water quality goals through volume reduction, thereby reducing damage to lakes, rivers and beaches. A key PICP use is reducing combined sewer overflows (CSO) in older urban areas and in turn meeting NPDES permit requirements including total maximum daily loads (TMDLs). Any doubts about the effectiveness of PICP in achieving these goals should diminish by reading this issue's coverage of PICP research at the University of New Hampshire Stormwater Center on page 18.

Efficient Water Use – PICP recharges aquifers for water supplies and reduces the need for water importation that has plagued regions and states like California. At the site scale, PICP stores water for urban irrigation and vegetation around buildings while supporting shade tree watering and tree longevity.

Transportation and Safety – The texture of PICP can be used to calm traffic in residential neighborhoods, support wayfinding with colored units that mark parking areas while increasing neighborhood identity and urban design contexts. Other permeable pavements cannot do this.

Energy Efficiency – PICP has been used experimentally with horizontal ground-source heat pumps for building cooling/heating in residential and commercial structures. Light-colored paving units can reduce lighting use with reflective surfaces on sidewalks, parking lots and roadways.

Recycling/Reuse – Unlike regular interlocking concrete pavers, permeable pavers can be reinstated after utility repairs. The newly released LEED v4 provides credits for concrete pavers specified with a minimum 10 percent recycled content, e.g., flyash, silica fume, glass, etc., and materials in the pavement sourced within a 100-mile radius of a project site.

Urban Heat Island – Light-colored concrete paving units can reduce ambient summer temperatures on streets and sidewalks through reflective pavers on roadways. White titanium dioxide coatings can also help reduce the impacts of ozone and photochemical smog.

Education – Signs at PICP projects can educate the public on PICP design and benefits while creating new public expectations from the performance of parking lots, green alleys and streets. Infrastructure projects must now return multiple benefits to the community.

Economic Development – The scale of some infrastructure projects using PICP are such that homeowners or commercial property owners are motivated to reinvest in their properties. The signal from public sector spending on this is "we want you to stay here, invest and grow families and businesses." Investment begets investment: This cycle maintains or creates new jobs, a centerpiece of community stability and progress.

No other piece of the infrastructure holds as much potential to contribute to green infrastructure as PICP. Fortunately, cities are recognizing this contribution at an unprecedented pace, and ICPI is pleased to respond with the technical resources needed to make each project's design, construction and maintenance successful. Visit **www.icpi.org/permeable**. You'll be surprised at what's there.

2013 HARDSCAPE North America℠

HNA 2013 Recap

HIGHLIGHTS AND NEWS FROM THIS YEAR'S EVENT

More than 1,500 hardscape contractors and distributors attended the 7th annual Hardscape North America (HNA) Tradeshow held October 23-25 at the Kentucky Exposition Center in Louisville, KY. HNA also attracted 44 new exhibiting companies for 2013.

Fred Adams Jr., chair of the HNA Steering Special Committee and president of Fred Adams Paving Company, commented, "I am excited about the new events at the show, which included a new Hardscape Installer Championship, a Distributor/Dealer Reception and a new HNA Humanitarian Project Award."

Hardscape contractors, as well as landscape contractors who participated in GIE+EXPO (Green Industry & Equipment Expo), which was co-located with HNA, attended live HNA demonstrations, educational sessions and workshops to learn how to add hardscape construction or improve their skills and profitability.

A new feature this year — the HNA Installer Championship — attracted much attention in the tradeshow's 19-acre Outdoor Demonstration Area. Eight teams competed in three rounds, with Decorative Paving Company of Loveland, OH, emerging as the champion. The Decorative Paving team received $1,000, an iQ360 14-in. masonry saw with fully integrated dust collection plus accessories, a trophy and bragging rights for a year. The runner-up, Cooper Pavers of Mannington, NJ, took home $400, an accessorized iQ360 and a trophy.

HNA attendees, ICPI members and some friends dropped by the ICPI booth for a toast to celebrate the Institute's 20th year.

2013 HNA Installer Champions: Team Deco Dogs (Troy Love and Jake Taylor) of Decorative Paving Company, Loveland, OH, receive their trophy from event emcee Pat Taylor of Aqua Paving Construction.

HNA HUMANITARIAN PROJECT AWARD

The HNA Hardscape Project Awards, which were celebrated during a breakfast on Oct. 25, drew a record 115 entries. Sponsored by Belgard and Ewing Hardscape Products, there were 20 awards presented and 18 honorable mentions. A highlight of this year's ceremony was the presentation of the first-ever HNA Humanitarian Project Award. Heart of Texas Landscape and Irrigation, owned by Ben Pamplin in Belton, TX, won the award for its backyard makeover for the Considine family of Nolanville, TX. John Considine is serving his third deployment in Afghanistan while his wife, Marily, has been battling breast cancer, raising their two children and dealing with the results of a backyard fire. The makeover was featured for Mother's Day on NBC's *Today Show*.

HNA Humanitarian Project Award winners: Heart of Texas Landscape and Irrigation's Brian Bush, owner Ben Pamplin and Chris Armour.

PROGRAMS AND WORKSHOPS

This year the Distributor Program — themed "What's the Big Idea?" — was geared towards helping dealers and distributors jumpstart their businesses through a fast-paced program featuring industry experts. Following the program, participants were invited onto the show floor for the Dealer/Distributor Day, during which exhibitors and dealers had one-on-one networking time to discuss products and sales techniques.

Other features of the 2013 HNA included courses for installers and technicians; workshops; education; and the Executive Workshop where leading contractors shared best-practice advice on construction and business topics and participated in round table discussions with fellow business owners from all over North America.

"HNA is the No. 1 forum to share best practices and enhance the products and services they offer to their customers," said Adams. "HNA is *the* show for hardscape contractors and distributors."

The show has co-located since 2010 with GIE+EXPO (the Green Industry & Equipment Expo), which draws thousands of lawn and landscape professionals and outdoor power equipment dealers. Representatives of both shows announced an extension of the co-location through 2016.

"The ICPI is excited about extending our partnership between GIE+EXPO and Hardscape North America through 2016," noted Charles McGrath, CAE, executive director of the Interlocking Concrete Pavement Institute. "Co-locating with GIE+EXPO brings together landscape and hardscape. It's a natural fit. This partnership has resulted in positive growth for the show and greater return on investment for exhibitors as well as attendees."

The 2013 platinum sponsors were Belgard Hardscapes, National Concrete Masonry Association, Pavestone Company and Pine Hall Brick. Gold sponsors were iQ Power Tools, Pathfinder Systems and Techniseal, Inc., and silver sponsors were Ewing Hardscape Products and King of Hearths by Borgert.

HNA is endorsed by the Brick Industry Association and the National Concrete Masonry Association.

"How to Turn Cleaning and Sealing into a Profit Center" was one of many round table discussion topics at the Contractor Executive Forum.

In our next issue (coming out in February 2014), we will feature a two-decade retrospective to celebrate ICPI's 20th anniversary.

Future HNA dates are October 22–24, 2014; October 21–23, 2015; and October 19–21, 2016. Details are available online at www.HardscapeNA.com and through Sellers Expositions, 812-949-9200.


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By Alicia Lasek

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INTERLOCKING CONCRETE PAVERS COVER ALL THE BASES IN HISTORIC RICHMOND, VA'S, GREEN ALLEY PROGRAM

As major U.S. cities scramble to find ways to lessen the impact of stormwater on aging, overtaxed sewer infrastructure and local waterways, an unlikely hero has emerged in the form of "green" alleys — alleys retrofitted with stormwater-capturing, permeable surfaces and underground infiltration/ underdrain systems. As more cities adopt them, these alleys are creating increased opportunities for innovative surface design.

CROSS SECTION:

—3 1/8 in. (8 cm) gray- or granite-blend, tumbled texture concrete pavers
—running bond pattern
—2 in. (5 cm) No. 8 aggregate bedding course
—6 in. (15 cm) minimum No. 2 or No. 3 aggregate subbase

The 12th Street green alley section is a 5,200-sf (4,830-m²) passage that slopes down to the flood-prone Shockoe Bottom neighborhood.

Photo Credit: Sean DeWitt

The City of Richmond, VA, a recent green alley convert with five demonstration alleys and five planned for 2014, uses interlocking concrete pavers on its alley surfaces to meet three important design requirements: historical aesthetics, stormwater management and utilities access, says Michelle Virts, P.E., Deputy Director of Stormwater Utility in the city's Department of Public Utilities (DPU).

Richmond is one of some 770 U.S. cities that funnel sanitary sewage and rainwater into a combined sewer system (CSS). Like many cities with an aging CSS, they are routinely forced to release untreated stormwater into local waterways during storm events. In order to comply with EPA pollutant and volume allocations that protect the nearby Chesapeake Bay watershed, the city must invest in costly grey infrastructure, such as larger pipes and additional underground storage tanks, and/or in less costly sustainable green infrastructure that slows the flow of stormwater into the CSS and filters pollutants naturally.

To demonstrate the benefits of green stormwater capture and filtration technologies to local stakeholders, Richmond's Department of Public Works and DPU in 2009 kicked off a series of showcase projects, and a green alley program was of particular interest, says Virts. "We own and maintain 209 miles (336 km) of alleys so if we can get them to be a cost-effective solution [for pollution reduction], they are definitely one of our favorites, long-term," she says. "With the alleys we really get the triple bottom-line: the environmental benefit, the economic benefit because it improves neighborhood [property values] and the social benefit of converting what was a grungy-looking alley into a nice amenity."

APPEARANCE MATTERS

Over the years, Richmond's original Belgian block granite road and alley pavers, commonly referred to as cobblestones, have often been removed or simply paved over. But in 2009, a downtown master plan officially recognized the economic value of making the city's early history more evident in daily life, by, for instance, removing the asphalt from streets to unveil the cobblestone underneath. So when the city and Richmond-based Timmons Group engineers looked at permeable pavement options that could mirror the look of those original stone pavers, interlocking concrete pavers were the obvious choice. "The aesthetic is very important," says Virts.

"We want to preserve that historic character when we go in and modernize the surfaces, and the pavers give us this opportunity."

But looks aren't everything. Most of Richmond's utilities infrastructure runs along or underneath alleyways, and the city and designers foresaw repeated excavation for maintenance. Planners did not want inevitable utility repairs to interfere with the permeable water-capturing systems. "We wanted a surface that could easily be removed and put back, and we didn't want utility contractors forgetting that this is a pervious surface and putting in a patchwork of standard asphalt or concrete," Virts says. "[Interlocking concrete pavers are] a reminder and a safeguard to make sure the alley remains permeable even when repairs are needed."

> "Everybody loves the look of the alleys and is amazed by how the rainwater infiltrates immediately, so much so that we've received requests for them.
>
> —Michelle Virts, P.E., Deputy Director of Stormwater Utility, Richmond Department of Public Utilities (DPU)

GETTING STARTED

Richmond's pilot alley design specified a strip of permeable interlocking concrete pavers flanked by heavy-duty concrete edge restraints and a stone reservoir separated from the clay subgrade with PVC liners and geotextiles to protect surrounding basements. The city's Urban Design Committee specified gray- and granite-blend, tumbled-texture pavers in running bond patterns (see sidebar). With some of the alley sections as narrow as 8 ft. (2.4 m) wide, installation was done by hand.

The goal was to install permeable systems using stone reservoirs and perforated piping with check dams that contain volumes from two-year and 10-year storms, says Amelia Wehunt, P.E., project manager at Timmons Group. Proposed future goals specify a minimum 20 percent peak flow rate reduction; a pilot alley behind historic Monument Avenue achieved a 25 percent peak flow reduction. "We're proud of the results," she says. "It's a robust standard." The mini watershed in each permeable alley reaps instant benefits, Virts adds. "We know that some of our sewersheds only have a five-year storm capacity, so there is an immediate benefit to the capacity in our sewers."

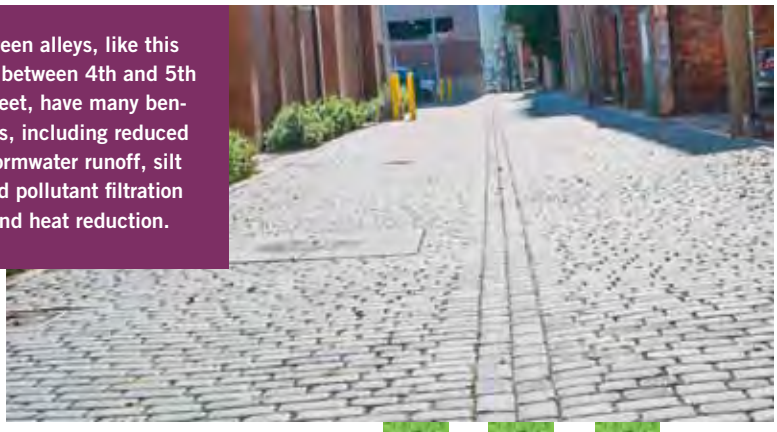
The pilot alley program was funded with a $211,000 grant from the National Fish and Wildlife Foundation and $213,000 in city matching funds. To take some of the burden off of the city's general fund, Richmond's Department of Public Works shares oversight of the official Green Alley Program with the DPU, which has

Continued on page 10

RICHMOND'S PAVER SYSTEM DRAFT SPECS

- **Design:** pavers flanked by heavy-duty concrete edge restraint
- **Pavers:** heavy-duty concrete, 3 1/8 in. (8 cm)
- **Paver color/texture:** gray-blend or granite-blend; tumbled texture (chose two types available in two and three size choices to create the cobblestone look)
- **Pattern:** running bond
- **Cross slope:** between 0.5% and 5%
- **Bedding course and joint filler:** 2 in. (5 cm) No. 8 aggregate
- **Choker course:** 4 in. (10 cm) layer of No. 57 stone
- **Subbase:** 6 in. (15 cm) minimum No. 2 or No. 3 aggregate
- **Stone reservoir depth:** 12 in. (30 cm) minimum; varies per water volume storage and flow requirements
- **Liners:** non-woven geotextile over 30 mil. thick PVC geomembrane
- **Underdrain detail:** perforated pipe, 4 in. to 12 in. (10 cm to 30 cm), including check dams, centered in trench, wrapped in geotextile, surrounded with No. 57 stone. Spaced and sloped to drain all stored water into storm sewer. (Design based on how much water needs to be handled, determined by design engineers.)
- **Monitoring system:** concrete monitoring weirs with steel markers or concrete joints

***Draft of specs courtesy of the City of Richmond**



Green alleys, like this one between 4th and 5th Street, have many benefits, including reduced stormwater runoff, silt and pollutant filtration and heat reduction.

Photo Credit: Sean DeWitt

a dedicated enterprise fund for stormwater management, says Virts. The five completed alleys are located in the city center, city residential areas and on the downtown campus of Virginia Commonwealth University. Five more are planned for the city's fiscal year 2014.

LEARNING CURVE

The alleys chosen for the pilot program were problem alleys, with surfaces in need of repair and utilities in need of attention. The 12th Street green alley section, for instance, a 5,200-sf (4,830-m²) passage that slopes down to the flood-prone Shockoe Bottom neighborhood, is the conduit for six public and private utilities. Prior to installing the permeable system at 12th Street, the DPU coordinated upgrades to water, gas, sanitary sewer and storm sewer lines; power lines for city streetlights; and privately owned fiberoptic cable, resulting in a two-year delay, says Shawn MacIntosh, City of Richmond engineer and project manager. While alleyways with utilities are not disqualified for future green system installations, this experience prompted the DPU to choose alleys with no or limited utilities for its next set of demo projects, says MacIntosh.

That said, the permeable interlocking concrete paver system soon demonstrated its expected benefits. In the fall of 2013, about 17 months after completion, the Virginia Commonwealth University green alley section required excavation so that crews could install bollards to protect alley streetlights. The work crew stockpiled the removed concrete pavers and each layer of stone, and then cut through the PVC trench liner. Once bollard installation was complete, a patch was glued onto the cut PVC and the entire section was restored using the original materials with no surface patching required, just as planned.

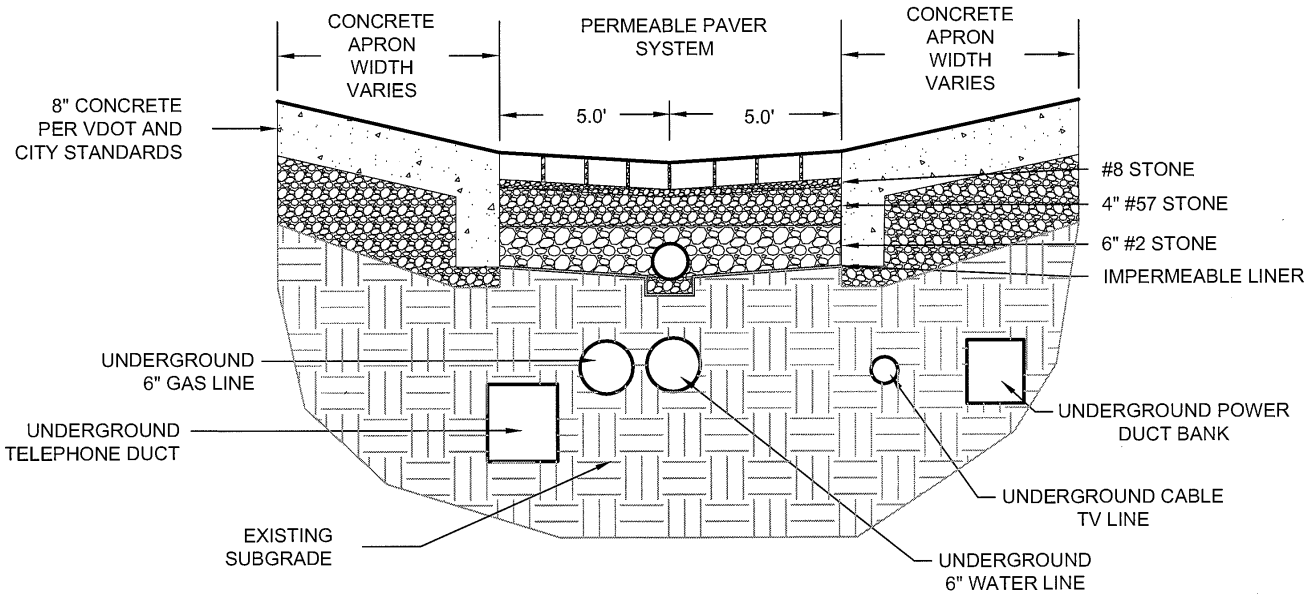
MOVING FORWARD

Response to the pilot alleys from local residents and business owners has been very positive, says Virts. "The feedback we've received is that everybody loves the look of the alleys and is amazed by how the rainwater infiltrates immediately, so much so that we've received requests for them." To encourage private landowners to install their own on-site stormwater management technology, the DPU offers a 50 percent credit on annual stormwater fees. Some area business owners have retrofitted their impervious surfaces with the permeable concrete paver system, she says.

"We are very happy with the success of the pilot project," says Virts. "If we can get more of a cost efficiency, we can incorporate the alleys into our formal capital improvement program; so that as utility work is done in the alleys, the surfaces become permeable, rather than just going back to the standard surface."

LEARN MORE For additional project details and information about Richmond's Green Alley Program, visit *www.interlockdesign.org*.

12TH STREET EXISTING UTILITIES



Prior to installing the permeable system at 12th Street downtown, the Richmond DPU had to coordinate with all of the utilities running beneath the alley — water, gas, sanitary and storm sewer lines, power lines for city streetlights, and privately owned fiber-optic cable — resulting in a two-year delay.

HNA 2013 award winners

ICPI announces concrete paver award recipients

1 MANATEE BRIDGE

- PROJECT LOCATION: Stuart, FL
- AREA: 2,500 SF
- CONTRACTOR: Sunshine Land Design
- MAIN PRODUCT MANUFACTURER: Belgard
- PROJECT DESIGNER: Kimley-Horn and Associates

PROJECT DESCRIPTION:
The City of Stuart revitalized a waterfront dining area using designer Keith Pelan's choice of vibrant colors and paver fan patterns that suggest ripples in the water. The contractor, Sunshine Land Design, solved many challenges, including the installation of a decorative concrete ribbon right through the middle of the paver fan pattern. Construction precautions were taken to prevent pollution of the nearby waterway.

1 COMMERCIAL/INDUSTRIAL: 1,000–15,000 SF

2 COMMERCIAL/INDUSTRIAL: MORE THAN 15,000 SF

2 FISH POND & LABYRINTH COMBINATION

- PROJECT LOCATION: Dubai, United Arab Emirates
- AREA: 15,000 SF
- CONTRACTOR: DUCON Industries, FZCO Installation Division
- MAIN PRODUCT MANUFACTURER: DUCON Industries, FZCO
- PROJECT DESIGNER: DUCON Design Division

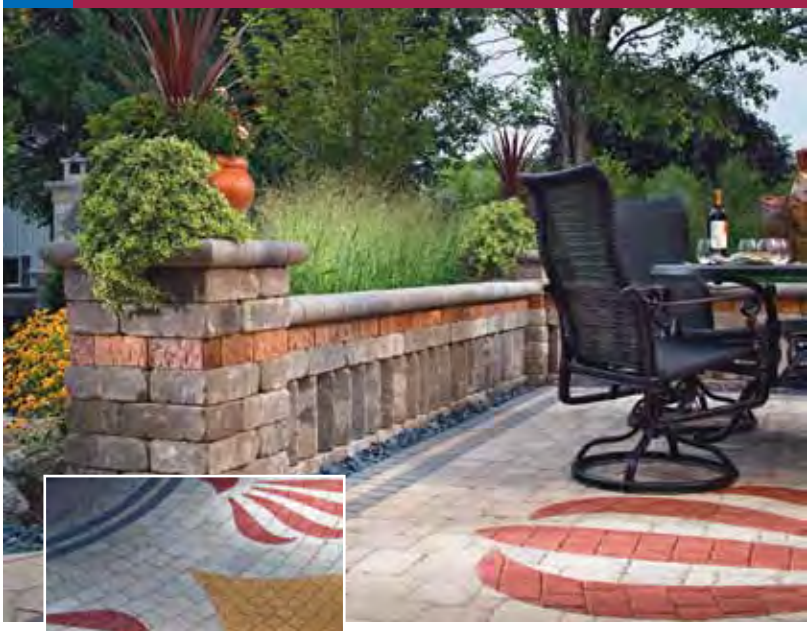
PROJECT DESCRIPTION:
DUCON Industries was commissioned to install a sophisticated and complex paver fish pond next to a paver labyrinth at a private villa. The turnkey project included a pond and water feature with 900 mini-koi fish. Execution of the project required a dedicated staff with 42 years of field experience to initiate this successful design, manufacture the concrete pavers, cut them perfectly and install the project. Over 22,000 Holland cut pavers were used, requiring approximately 40,000 man-hours to install. Each unique piece allows for a multidimensional perspective of water turbulence and of the fish.

3 CARTER RESIDENCE

- **PROJECT LOCATION:** Council Bluffs, IA
- **AREA:** 2,200 SF
- **CONTRACTOR:** Paver Designs, LLC
- **MAIN PRODUCT MANUFACTURER:** Belgard
- **PROJECT DESIGNER:** Justin Hampton

PROJECT DESCRIPTION:
This project was built by Jim and Justin Hampton of Paver Designs, LLC, a father and son company with no other employees. The two-level patio/entertainment area is approximately 2,200 sf (200 m²). Pavers were placed over 1 in. (2.5 cm) of bedding sand and 9 in. (23 cm) of crushed, recycled concrete base. Belgard Dublin Cobble and Mega Arbel pavers filled the primary field. Designs were laid out on the pavers, all cut individually, then filled in with Belgard red and gold Hollandstone pavers. NuLook, a Techniseal product, was applied to the paver surface to enrich its colors. Techniseal's HG Plus polymeric joint stabilizer was used during the final compaction. A Harmony fireplace, wood boxes, and grill island were installed in the lower patio area. The two-level backyard patio is connected by sidewalks to a nearly duplicated front courtyard.

3 RESIDENTIAL: LESS THAN 3,000 SF



MORE TO SEE Check out all of the award-winning projects online at *www.hardscapena.com/hna/2013awards*.

4 MAHAZ PROJECT

- **PROJECT LOCATION:** Sand Point, MI
- **AREA:** 3,240 SF
- **CONTRACTOR:** Esch Landscaping LLC
- **MAIN PRODUCT MANUFACTURER:** Unilock
- **PROJECT DESIGNER:** Matt Esch

PROJECT DESCRIPTION:
This hardscape project was constructed on the beach of Lake Huron at "the top of the thumb area" in Michigan. The house and landscape began on an empty lot between two existing homes. The designer addressed elevations, proximity regulations with neighboring homes, construction deadlines and clients living in another state. The clients required an outdoor kitchen, firepit, shower area, adequate sun bathing area, shade for comfort when entertaining guests and easy access to the beach. The hardscape team successfully shared space with the home construction crews. With the project beginning in March, wind and weather caused difficult working conditions because the site faced open water.

4 RESIDENTIAL: MORE THAN 3,000 SF

5 TRANSPORTATION/MUNICIPAL STREET

DON'T MISS OUT **HNA is not just about awards; visit *www.interlockdesign.org* for more great coverage of this year's event.**

5 TEXAS DEPARTMENT OF TRANSPORTATION PROJECT

- **PROJECT LOCATION:** Canyon, TX
- **AREA:** 10,300 SF
- **CONTRACTOR:** Concrete Paver Systems
- **MAIN PRODUCT MANUFACTURER:** Pavestone
- **PROJECT DESIGNER:** Pat Brinkman and Texas Department of Transportation

PROJECT DESCRIPTION:

This Texas Department of Transportation Project in Randall County is unique because of its three-color blend with 3 and 6 in. (7.5 and 15 cm) Highland Stone Retaining Wall blocks plus the 8 in. (20 cm) Diamond Pro Stone Cut Retaining Wall blocks. This was the first time that all three of these blocks were used together. The pavers on the embankment create a mural of the surrounding canyon. The landscape architect, Pat Brinkman, used a variety of products to give depth and visualization to the project. The products included in the mural were 2.3 in. and 3.2 in. (6 cm and 8 cm) Holland Stone and 3.2 in. (8 cm) split face Carriage Stone. A beautiful mural results with great color, texture and depth.

6 OHIO EXPO CENTER CARDINAL CORRIDOR

- **PROJECT LOCATION:** Columbus, OH
- **AREA:** 25,000 SF
- **CONTRACTOR:** The Decorative Paving Company
- **MAIN PRODUCT MANUFACTURER:** Oberfields, LLC
- **PROJECT DESIGNER:** Ohio Department of Natural Resources

PROJECT DESCRIPTION:

Welcome to the 160th Ohio State Fair! A 300-ft (90 m) long boulevard known as the Cardinal Corridor welcomes visitors. This project began a multi-year initiative to beautify the Ohio Expo Center by transforming acres of pavement into grass and trees that provide shade and reduce stormwater runoff. Nine trees were planted in runoff-reducing cells along the center of the newly created corridor. Surrounding the cells, grass pavers with sod create green space desired by the designers. The crowning feature of the boulevard is 25,000 sf (2,300 m^2) of permeable pavers. Underdrains below the paver fields connect to the cells and provide filtered water to the tree roots. The system can store approximately 20,000 gal. (75,700 L) of water, or the equivalent of a 1 in. per hour rainfall on three-quarters of an acre. The red, buff and charcoal colors create the autumn blend to compliment the Cardinal Corridor entry feature. The pavers were laid in a ninety-degree herringbone pattern to accommodate vehicular traffic. A charcoal-colored soldier course around the center grass area provides a visual frame that ties the entire space together.

6 PERMEABLE: COMMERCIAL/INDUSTRIAL

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honorable mention awards

1 COMMERCIAL/ INDUSTRIAL: 1,000–15,000 SF

TEMECULA CIVIC CENTER

- PROJECT LOCATION: Temecula, CA
- AREA: 11,150 SF
- CONTRACTOR: Western Pavers, Inc.
- MAIN PRODUCT MANUFACTURER: Acker-Stone

2 COMMERCIAL/ INDUSTRIAL: MORE THAN 15,000 SF

FLORIDA INTERNATIONAL UNIVERSITY, PARKVIEW HOUSING

- PROJECT LOCATION: Miami, FL
- AREA: 95,430 SF
- CONTRACTOR: US Brick & Block Systems
- MAIN PRODUCT MANUFACTURER: Coastal, an Oldcastle company

3 RESIDENTIAL: LESS THAN 3,000 SF

OUTDOOR PATIOS, BAR, GRILL AND FIREPIT

- PROJECT LOCATION: Palos Hills, IL
- AREA: 1,500 SF
- CONTRACTOR: Prairie Path Pavers
- MAIN PRODUCT MANUFACTURER: Unilock

URBAN MASTERPIECE

- PROJECT LOCATION: Brooklyn, NY
- AREA: 2,500 SF
- CONTRACTOR: Platinum Site Development
- MAIN PRODUCT MANUFACTURER: Unilock

MOUNTAIN MODERN

- PROJECT LOCATION: Cedar Hills, UT
- AREA: 1,100 SF
- CONTRACTOR: Platinum Landscape, LLC
- MAIN PRODUCT MANUFACTURER: Belgard

4 RESIDENTIAL: MORE THAN 3,000 SF

HYBRID DRIVE

- PROJECT LOCATION: Williamsburg, VA
- AREA: 5,000 SF
- CONTRACTOR: Mid Atlantic Enterprise, Inc.
- MAIN PRODUCT MANUFACTURER: Unilock

5 TRANSPORTATION/ MUNICIPAL STREET

DALLAS AREA RAPID TRANSIT ORANGE LINE

- PROJECT LOCATION: Dallas, TX
- AREA: 500,000 SF
- CONTRACTOR: Classic Tejas Construction
- MAIN PRODUCT MANUFACTURER: Belgard Hardscapes

6 PERMEABLE: COMMERCIAL/ INDUSTRIAL

HUNTINGTON TRAIN STATION PROJECT

- PROJECT LOCATION: Huntington Station, NY
- AREA: 600 SF
- CONTRACTOR: Deck and Patio Company
- MAIN PRODUCT MANUFACTURER: Techo-Bloc

7 ENGINEERED ICP

BATTLE COMMAND TRAINING CENTER TEST PAD

- PROJECT LOCATION: Carson, CO
- AREA: 4,000 SF
- CONTRACTOR: Continental Hardscape Systems, LLC
- MAIN PRODUCT MANUFACTURER: Pavestone Company
- PROJECT DESIGNER: Applied Research Associates, Inc., U.S. Army Corps of Engineers

By David R. Smith

University of New Hampshire Gives PICP High Marks

TWO-YEAR COLD CLIMATE STUDY YIELDS SUBSTANTIAL FINDINGS

The University of New Hampshire Stormwater Center (UNHSC) released a two-year study on the performance of a permeable interlocking concrete pavement (PICP) site built on the university campus. The 13,500 sf (1,350 m²) Hood House Drive and parking lot in Durham, NH, reduced runoff volume and pollutant mass removals some 95 percent. Water infiltrating from about half of the PICP area was monitored for pollutants such as sediments, zinc, petroleum hydrocarbons, and nutrients (i.e., phosphorous and nitrogen forms). Built over a mix of moderate and low infiltration soil, the pavement saw significant volume reductions such that no single rain event generated more than 5 gal. (20 L) of discharge to underdrains in the base. Additionally, the study confirmed that open-graded bases and soil subgrades do not heave from winter freezing and thawing.

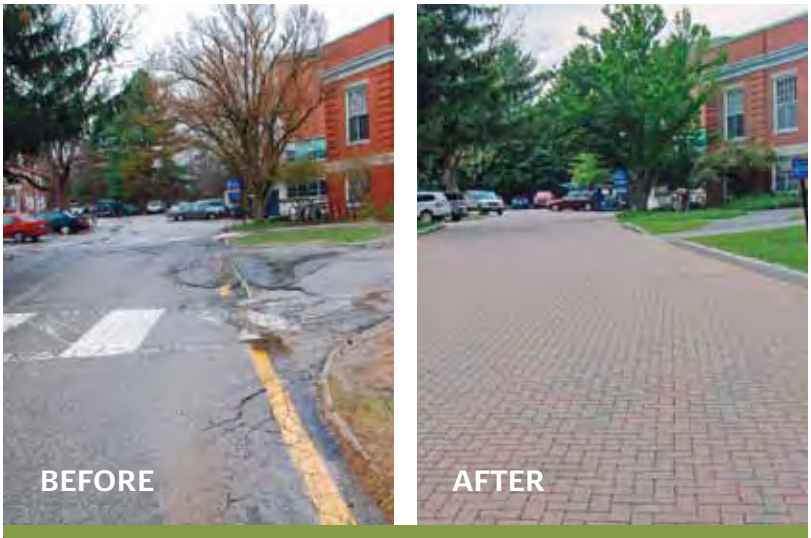
METHODOLOGY

Surface infiltration testing was conducted using a test method similar to ASTM C1781 *Standard Test Method for Surface Infiltration Rate of Permeable Unit Pavement Systems.* Testing showed a decline in surface infiltration for PICP areas subject to run-on from adjacent impervious or grassed areas. Surface infiltration rates declined 69 percent over 21 months, yet retained greater than 1,000 in./hr (2,540 cm/hr). Surface maintenance included vacuuming twice annually with regenerative air equipment typically used on the UNH campus. Figure 1 illustrates infiltration rates measured from September 2010 to May 2012.

Summertime thermal analyses compared four pavement surface types at three different times of the day. Surfaces included pervious concrete and porous asphalt sites on the campus. PICP surface temperatures were observed to be lower than that for porous asphalt, pervious concrete, and standard asphalt. Figure 2 provides data for measurements in June 2012.

EXCEPTIONAL PERFORMANCE

Hood House Drive and an adjoining parking lot were retrofitted from a standard asphalt surface to a PICP system in the summer of 2010. The existing condition included no stormwater control measures and conveyed surface runoff directly into the municipal storm sewer. The PICP was designed by Appledore Engineering, Inc. with input from UNHSC and the Interlocking Concrete Pavement Institute (ICPI). The lower end of the drive receives rainfall and run-on from three pedestrian walkways and an adjoining road. Pavers and the surrounding grass landscaping are separated by new granite curbing. Rainfall enters the PICP surface and passes into the reservoir consisting of an open-graded, crushed stone base and subbase. Excess stormwater not infiltrated into the soil subgrade drains through internal perforated pipes along the bottom that discharge into the municipal storm sewer system.



With its construction completion first reported in November 2010, the PICP drive and parking lot monitored by the University of New Hampshire Stormwater Center captured almost all rainfall without outflows from the base.

Figure 1. Surface infiltration rate monitoring over time of three separate locations representing different loading and usage characteristics.

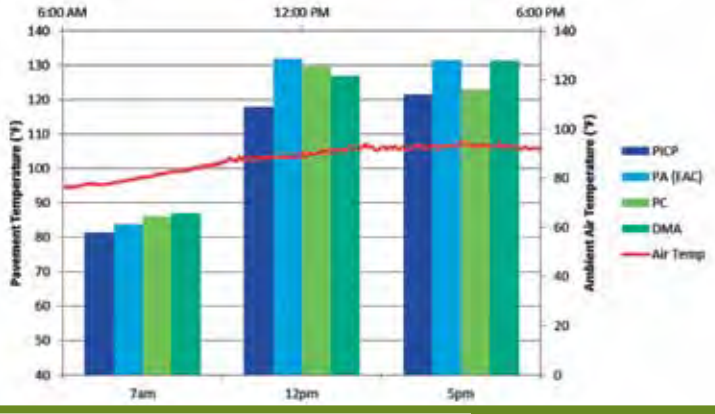


Figure 2. Thermal performance comparison of PICP, porous asphalt, pervious concrete and conventional asphalt with measurements taken on June 21, 2012.

Pollutant loads from conventional pavement were estimated by monitoring runoff from an adjacent road and parking lot similar in size, usage and location. The following two years consisted of monitoring the PICP, which received 26 storms with 18 water-sampling events. The PICP performance for volume reduction and pollutant load reduction was exceptional for an installation on a sandy clay soil. Some parts of the site are very rocky, with fine, sandy loam. Soil subgrade infiltration tests done prior to construction were about 3 in./hr (7.5 cm/hr) in one area, which appears to be the major reason for such little water leaving the base/subbase via perforated pipes.

PARTNERS AND PARTICULARS

The PICP cross section consists of 3 1/8 in. (80 mm) thick concrete pavers with ASTM No. 8 stone, bedded on about 2 in. (5 cm) of the same material. The 4 in. (10 cm) thick base was compacted over a crushed stone subbase of No. 2 stone with a thickness of 24 in. (6 cm) in the parking area and 16 in. (40 cm) in the drive area. Since the soil subgrade in the drive area slopes three percent, geotextile wrapped berms about 4 in. (10 cm) high were used to delay water and allow it to infiltrate into the soil subgrade rather than continue into perforated pipes to drain into a nearby storm sewer.

UNHSC analyses and procedures for this study comply with the Technology Acceptance and Reciprocity Partnership (TARP), and the Technology Acceptance Protocol – Ecology (TAPE) guidelines. The research project was funded by ICPI and the ICPI Foundation for Education & Research. The removal of the existing asphalt pavement and old granite curbs, new curbs, pipes and base installation were provided by the UNH Facilities Department. Pavers, bedding materials and installation were co-funded by eight ICPI members, the New England Concrete Masonry Association and the Northeastern Cement Shippers Association. Machine-assisted installation by an ICPI contractor member holding an ICPI PICP certification enabled timely installation of the bedding layer and pavers for about $4/sf ($43/m²).

COLD CASE

Since the early 1980s, there have been at least 18 studies lasting one year or longer on in-situ permeable interlocking and concrete grid pavements performed by stormwater agencies, universities and consultants world-wide. Of these, only three have been conducted in cold latitudes, including the UNH study. The takeaways from this study underscore past findings while presenting new ones that further demonstrate PICPs performance in cold climates:

- PICP eliminated practically all of the stormwater runoff from the storms at UNH;
- PICP effectively removes sediment, nutrients and metals through infiltration even during winter months;
- The surface was vacuumed twice annually over the two-year monitoring period with regenerative air equipment;
- Surface infiltration rates decline over time due to sediment and other debris, but rates can be increased with vacuum maintenance;
- The PICP surface is cooler compared to porous asphalt and pervious concrete;
- Winter snow plowing was done with no problems and there was no deicer damage;
- PICP does not heave from winter freezing and thawing; and
- The PICP surface provides opportunities for brining of deicing materials to prevent ice buildup, a feature not offered by other permeable pavement surfaces.

Project cost: approximately $9.90/sf including removal of the existing asphalt pavement, excavation, drainage, aggregates, new granite curbs and machine-installed concrete pavers. Costs do not include engineering and site soil testing or monitoring.

REPORTS AVAILABLE **A full report is available on *www.icpi.org* for downloading or on *www.unh.edu/unhsc/pubs-specs-info*. The latter site includes a one-page fact sheet on PICP. Also, a two-page project summary can be found on pages 16 and 17 in the UNH Stormwater Center 2012 Biennial Report. The report can be found at *www.unh.edu/unhsc/sites/unh.edu.unhsc/files/docs/UNHSC.2012Report.10.10.12.pdf*.**

By Chuck Green

Playing with Fire

AVOID THE PITFALLS OF FIRE PIT AND FIREPLACE INSTALLATION

However precisely contractors construct outdoor fire features like fire pits and barbecues using interlocking concrete pavers, experts say that sturdiness and longevity will be compromised unless the top soil and sod are thoroughly excavated. "Ignore [base preparation] and everything done after that is a waste of time," says Ross Yantzi, owner of Pavestone Plus Limited in Tavistock, Ontario.

HNA 2013 attendees Jamel Taylor (left) and Wes Maggard discuss fireplace installation after the "Construction of Fire Features for Outdoor Living Areas" demo on Oct. 24.

BONUS CONTENT
The online version of this article at *www.interlockdesign.org* will feature a link to photos from the HNA 2013 demo: "Construction of Fire Features for Outdoor Living Areas."

Yet that part of the job often is neglected or short-changed, especially among first-time landscapers. The base work is probably the most difficult, but most important phase of construction, Yantzi says. "That's where people cut corners, by just building on top of soil. They're saving money at the beginning, but keep spending more because [the structure] moves and eventually has to be repaired. We've done quite a few repairs, and whether it's retaining walls or pavers, the reason behind most repairs is inadequate base preparation."

Not one who takes chances, Jason Goodnight, Vice President of The Brick Doctor, Inc., usually adds a concrete footer when constructing fire pits and fireplaces for an even firmer foundation. The thickness of the footer depends on the application, he says. He recommends 4 in. (10 cm) for a standard fire pit under 3 ft. (1 m) tall and 6 in. (15 cm) for larger ones.

Placement of the fire feature is another key consideration. Some regulations require the fireplace or fire pit on a non-combustible surface that extends beyond its sides to a length equal to its height, according to Section 6 of ICPI's Advanced Residential Paver Technician Manual. Several codes, including fire, plumbing and electrical, could apply to the construction of outdoor fireplaces, fire pits, grills and kitchens. Local bylaws, municipal ordinances and homeowner association covenants also may include regulations for outdoor living spaces, while some building departments require permits for the construction of outdoor kitchens and elements like outdoor fireplaces.

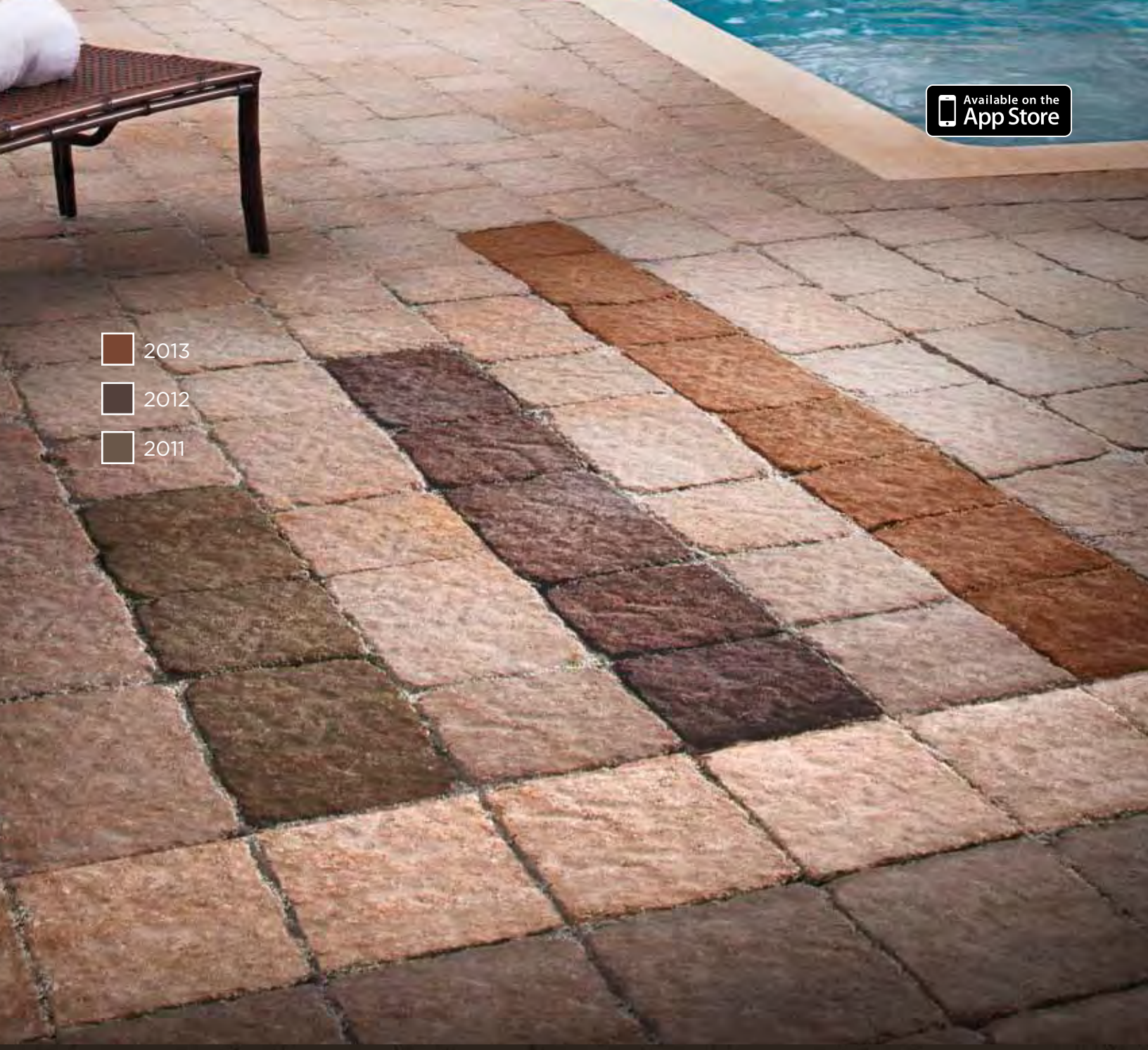
Another important requirement for the construction of fire pits and fireplaces is the use of specialized heat-resistant materials because of the extreme temperature differences these structures endure, the manual states. Fire pits sometimes are constructed without regard to heat dissipation. Concrete pavers and segmental retaining wall units aren't made to withstand extreme heat. Fire-resistant, ceramic blocks should line the inside of fire pits.

To be more efficient and not burn money, measure and establish an average excavation time for one yard of soil, installation of one ton of base material, and build time for 10 sf (1 m^2) of pavers. "You're developing a database and making jobs more predictable," says Yantzi. Professional landscapers and hardscapers also should be aware of things like access to back properties, where fire pits and barbecues typically are located, he advises. "Access impacts whether [a job] takes three days, five, 20 or 30."

Another way to manage the bottom line is by establishing a realistic time budget for each design and a timeline for completing each project, Goodnight says. Otherwise, expenses can spiral rapidly, especially when customers want expensive features like stainless steel inserts and granite tops, he adds.

According to the 2013 Residential Landscape Architecture Trends Survey, across all categories, 97 percent of respondents rated fire pits and fireplaces as somewhat or very in-demand for 2013, followed by grills at 96.3 percent.

With concrete pavers available in a range of colors, shapes and sizes, these options enhance their popularity over other kinds of paving materials, says Goodnight.



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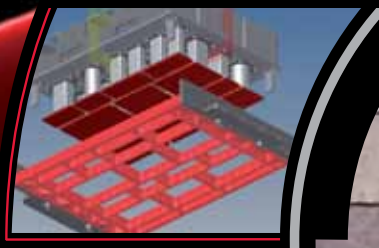

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