August 2011
Volume 18 Number 3

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Contents

August 2011 • Volume 18 Number 3

Editorial

6 Care and Feeding
Pricing and economics can transform municipal paving to interlocking concrete pavements. Design, financial analysis, and management tools need to be delivered to help save money.

Features

8 Corner Store and Neighborhood Cornerstone Resurrected with Concrete Pavers
A Washington, DC neighborhood anchor is resurrected next to an interlocking concrete pavement street.

12 Sustainable Paving Project Addresses Municipal Social, Economic and Environmental Needs
Osseo, Minnesota, aims for sustainable street design using a combination of street and pedestrian interlocking concrete pavement and permeable interlocking concrete pavement.

Engineer's View

16 Maximizing LEED® Points with Segmental Concrete Pavement

Contractor's Corner

19 Salt Water Pools and Concrete Pavers

Industry News

20 Hardscape North America Supports Industry Contractors
Meat-and-potatoes education sessions and outdoor demos are generously served at the industry trade show October 27-29, 2011 in Louisville, Kentucky.

24 University of Georgia Develops Segmental Concrete Pavement Systems Curriculum for Landscape Architecture Schools

26 ICPI Releases Updated Structural Design Technical Bulletin

Departments

28 Concrete Paver Industry Calendar of Events

28 Advertisers in this Issue

Interlocking CONCRETE PAVEMENT MAGAZINE

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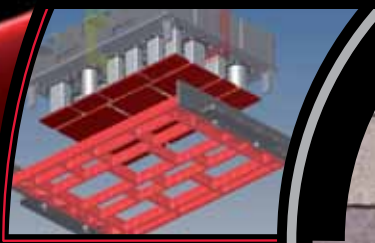

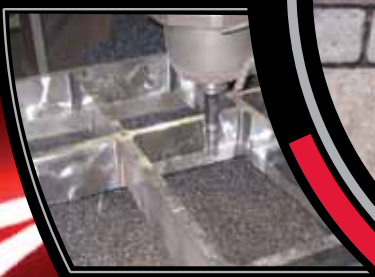

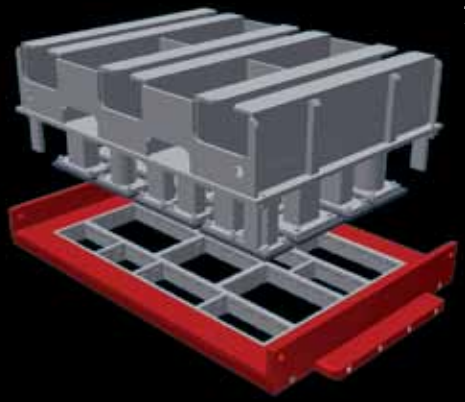

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David R. Smith

Care and Feeding

The advent of the internal combustion engine brought cities concrete and asphalt streets in the early part of the 20th century. Prior to that, streets were usually mud, or in more urbanized places, clay brick. The earliest segmental pavement streets were made with stones. In some cases, the stones were ballast removed from the holds of ships crossing the Atlantic. The weight enabled better handling of the ship. In the New World, the ship traded stones for agricultural goods and in later years, manufactured goods and sailed back to Europe.

Traveling around most U.S. and Canadian cities reveals an obvious reality. Conventional pavement dominates; asphalt in most roads, concrete in most sidewalks. Segmental pavement is reserved for special areas like historic districts to preserve their character. That might suggest that conventional pavements in the rest of the city contribute less character. They provide none.

The first project in which interlocking concrete pavement (ICP) was introduced in the U.S. was a municipal street application, Roosevelt Island in New York City. About 1 million square feet (100,000 m^2) placed in 1969 and the pavement is still there. ICP since expanded from there to many cities across the U.S. and Canada. They are almost *de rigueur* for historic districts and for economic development projects. This issue covers two projects set in those contexts; one in Washington, DC and the other in Osseo, Minnesota. Many cities have adopted ICP in urban design guidelines for such areas. A few places, like Ripon, California, have even made them standard for all residential streets because the future replacement cost of asphalt was found unaffordable.

There are very few cities where ICPs dominate streets and sidewalks. Downtown San Antonio, Texas might qualify or Seaside, Florida where Jim Carey's *The Truman Show* was filmed. That was a story about an insurance salesman/adjuster who discovers his entire life is actually a TV show. Practically every exterior shot in the 1998 movie includes concrete pavers.

Cities are faced with a tight financial picture for the foreseeable future. Less revenue and rising asphalt prices from demand for oil is forcing reduced street maintenance budgets. Will cities be able to afford replacement of square miles (hectares) of asphalt streets 10 or 20 years from now? When will they turn to interlocking concrete pavements as a *standard* street pavement? When will such pavement move out of TV show status to reality?

The reaction observed from talking with a few city officials over the years on this point is their resistance to ICP boils down to taking on a third pavement after asphalt and concrete. What's the care and feeding required? ICP will be one more pavement to maintain. We don't have people or skills to maintain it. How is it designed? It's not state DOT approved, etc.

Fortunately the Interlocking Concrete Pavement Institute has responded with tools to address these concerns. They include ASCE 58-10 standard on structural design, software to do design, ASTM and CSA product standards, an emerging ASTM standard on pavement management to compare performance to other types, maintenance guidelines, guide construction specifications and detail drawings, contractor certification, and life-cycle cost software to compare/forecast economic performance.

The tools and people exist for care and feeding of municipal interlocking concrete pavements. Similar tools and people have been in place for decades for asphalt and concrete pavements. An additional tool under development for ICP is a life cycle assessment to compare its environmental performance to other pavements. We expect to report on this in the future.

The challenge now is deployment of these tools by the industry to thousand of cities and county transportation agencies, and some state or provincial DOTs. The times are quickly approaching where prices are making ICP competitive on an initial cost basis with asphalt. And interlocking concrete pavement is substantially less expensive to maintain than asphalt. No periodic resurfacing and reinstatement of existing units after repairs means less care and feeding. Such an economic analysis challenges cities to migrate to ICP. ❖

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Corner Store and Neighborhood Cornerstone Resurrected with Concrete Pavers

Located at the heart of the historic Capitol Hill neighborhood since 1873, the Eastern Market building operates the oldest continually operated fresh food public market in Washington, DC. *Washington Post* staff writer Philip Kennicott described the store's character: "There were no aisles, no chutes to feed the crowd through a phalanx of cash registers, no carefully calculated funneling of customers for the maximum economic squeeze. There was, instead, a vibrant mob crowded into a single, bustling, wonderfully disorganized space. It was a brick box that forced you into proximity with strangers, a drug powerful enough to attract suburbanites in number."

Owned by the District of Columbia, the historic brick building is an architectural, social and economic anchor for the neighborhood by housing a grocery store and a hall for cultural events, while attracting a farmer's market and arts and crafts stands on the street and in adjacent blocks. Tragedy struck in 2007 when the market building burned. Fortunately the gutted shell was renovated soon thereafter. As part of the $22 million, two-year renovation, Washington, DC District Department of Transportation (DDOT) renovated the street and sidewalks in front of the building with pavers. DDOT reached out to residents by asking their preferences for paving materials. The residents voted for a cobblestone appearance using 6 x 9 in. (150 x 225 mm) tumbled, colored concrete pavers for the street, and rectangular clay paving bricks for the sidewalks. The street pavement—open to vehicular traffic only on weekdays—offers an old world feel for patrons who peruse the farmer's market, other outdoor vendors, and dine outside at nearby restaurants.

Built on 7th Street between North Carolina Avenue and C Street by Anchor Construction of Washington, DC, the pavement consists of about 20,000 sf (2,000 m^2) of $3^1/_8$ in. (80 mm) thick pavers in a herringbone pattern. The pavers were supplied by an ICPI member. The units are bitumen-set on a $^3/_4$ in. (20 mm) layer of sand-asphalt and adhesive over $5^1/_2$ in. (140 mm) of asphalt. This rests on an 8 in. (200 mm) thick compacted aggregate base. Completed in fall 2009, the pavement also includes sub-grade drainage.

Slightly raised crosswalks of cast-in-place concrete provide modest speed humps to slow vehicular traffic. Flush with the pavement surface, granite curbs mark the crosswalks, and raised granite curbs lines the sides of the street.

Continued on p. 10

On weekdays, the street looks historic and continues working like any other in the city by receiving vehicular traffic and parking.

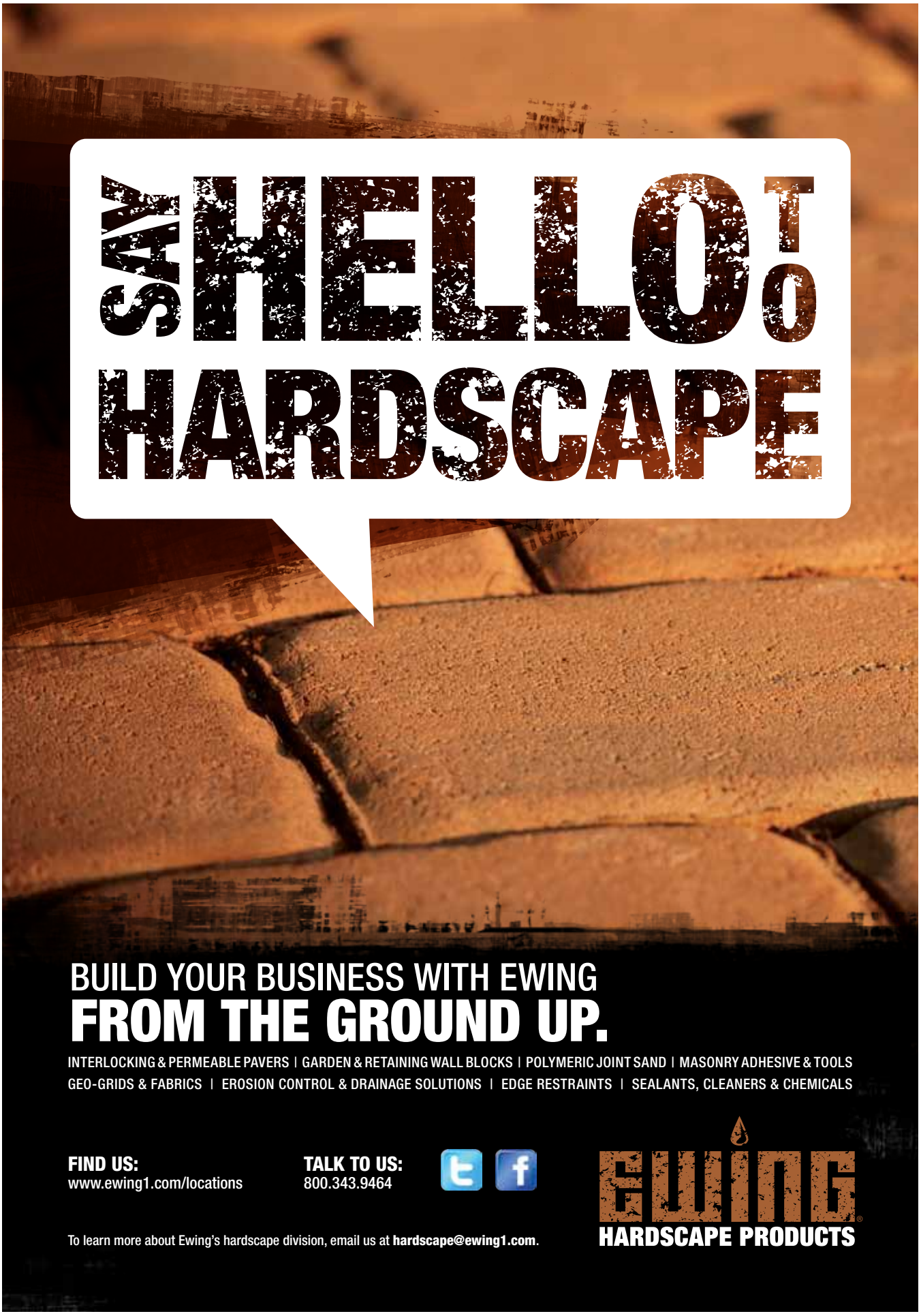
Neighborhood Cornerstone Resurrected with Concrete Pavers *Continued from p. 8*

The gutters are made of mortar-set clay pavers on concrete, a DDOT standard detail used throughout the city. The tumbled concrete pavers utilize two blended pigments to create natural stone with adobe and golden brown colors. Non-pigmented pavers mark 45° parking stripes.

The total budget for the streetscape portion of the renovation was $2.7 million, and included street and sidewalk paving, lighting, curbs, gutters, crosswalks, curb ramps, street trees, and bike racks. The return on the District's investment is evident from a thriving residential neighborhood supporting the market, not to mention hundreds of locals and tourists that stop by via a nearby Metro subway station. Whether buyers or vendors, all continue a 138-year tradition of shopping in a long-lasting building surrounded by a long-lasting pavement. ❖

Energetic vendors and patrons shop in the linear market interior.

Gray pavers in the herringbone paving pattern mark parking stalls in front of the Eastern Market building. No paint or repainting required.



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Sustainable Paving Project Addresses Municipal Social, Economic and Environmental Needs

Osseo, Minnesota, extends their downtown civic living room into the street with interlocking concrete pavements.

Osseo, Minnesota, (pop. 2,500) some 15 miles (24 km) northwest of Minneapolis, focused on sustainable street design through a $4.7 million renovation of Central Avenue, the main street through an historic downtown business district. Segmental concrete pavement played a major role in achieving "complete street" design principles and elements that satisfies social, economic and environmental needs of this growing hamlet. Technologies include bike corrals, pedestrian furniture, a one-block plaza-like street with interlocking concrete pavement (ICP), energy-efficient LED street lighting (with poles supporting banners and flower baskets), permeable interlocking concrete pavement (PICP), and structural soil to support street trees. The combined area of ICP and PICP in streets and sidewalks is 65,000 sf (6,500 m²).

The design helps satisfy the social needs of the town with a one-block ICP street across from City Hall that is closed to vehicular traffic for community events. Closure extends the City Hall plaza and adjacent veteran's park into the street, thereby expanding the town living room. The 3 1/8 in. (80 mm) thick pavers are bitumen-set on a concrete base.

Economic needs are supported with ICP that visually unifies the downtown, as well as energy-efficient lighting, and street trees, making it more attractive and comfortable for shoppers. Environmental needs, specifically reduction of stormwater runoff and pollution reduction, are accomplished with PICP sidewalks and along curbside parking. About 20,000 sf (2,000 m²) of PICP is on the sidewalks providing water and soil to the trees via structural soil, a mix of soil and open-graded aggregates.

The streetscape is designed as a "kit of parts" to accommodate future redevelopment. The modular nature of interlocking pavers supports this design approach. The kit includes four designs for the public right-of-way. They are a café module to extend street front restaurants into an outside sidewalk dining area, a corral for bicycle parking, pedestrian benches, and planter units. Each can be

Sidewalks combine PICP along to allow water to soak into the structural soil under the trees while regular ICP is built with a 8 in. (200 mm) thick compacted aggregate base.

Granite chips are used under the PICP and bedding sand under the ICP in the sidewalks.

Sidewalk pavement under these bike racks combines permeable units with regular pavers to feed the street trees.

Cast iron detectable warnings set in concrete accent curb ramps.

installed or existing ones exchanged for others as development occurs.

Central Avenue once served as a major north-south corridor through downtown until Trunk Highway 169 was rerouted around Osseo and Central Avenue was returned to the City as a local roadway. However, many regional commuters still use Central Avenue as a convenient thoroughfare making average daily traffic over 11,000 vehicles per day, all of which passes over the bitumen-set ICP and concrete base. Even with this traffic volume, the designers maintained the two-lane wide main street when rebuilding it because widening would have damaged the character (and economy) of the small town, thereby reducing the downtown's role as a destination.

Besides ICP and PICP supplied by an ICPI member, the project included rehabilitation of the storm sewers to mitigate local flooding problems as well as enlarging the water lines to increase service and fire protection. The scope and goodwill of the project earned the City of Osseo the Project of the Year award from the City Engineers Association of Minnesota in early 2011. Winning projects are rated highly on public benefits and service, innovative design characteristics, construction management and control techniques, environmental design considerations, community relations and involvement during construction, safety performance, and quality of the finished project.

The Central Avenue project was a collaborate effort by landscape architecture and planning firm Hoisington Koegler Group, Inc. of Minneapolis and Bolton & Menk, Inc., Engineers and Surveyors based in Mankato, Minnesota. The project was built by Structures Hardscapes, a civil engineering design/build firm based in Chaska, Minnesota. ❖

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Robert Bowers, P.Eng.

Maximizing LEED® Credits with Segmental Concrete Pavement

Within the North American design and construction community, a means for addressing sustainability or 'green building' is through LEED® or Leadership in Energy and Environmental Design. Developed by the U.S. Green Building Council (USGBC) in 1998, LEED® provides voluntary guidelines for reducing energy and wasted resources from building and site design. The Canadian Green Building Council (CaGBC) formed in 2003 published similar LEED® guidelines tailored to Canadian climates. U.S. and Canadian guidelines were developed by a range of representatives from the building industry and environmental science.

LEED® establishes a consensus-based means for measuring building and site performance. It promotes designs that integrate energy and resource conservation. LEED® is being applied to many publicly funded projects and a growing number of private ones, with or without official registration and certification. A primary objective of LEED® is to help facility owners reduce maintenance and life-cycle costs. This is accomplished by including all players in an integrated development process during the design stages of a project.

Purpose

LEED® rating systems have been developed or are under development for:

- New Commercial Construction and Major Renovation projects (NC)
- Commercial and Retail Interiors
- Core and Shell
- Homes
- Neighborhood Development
- Schools, Healthcare and Retail
- Existing Building Operations and Maintenance

This article demonstrates the potential for the family of segmental concrete paving systems in assisting achievement of LEED® points for New Commercial Construction and Major Renovation projects or LEED®-NC. This family includes interlocking concrete pavements, permeable interlocking concrete pavements, concrete grid pavements and precast concrete paving slabs. The products can also be used to satisfy the requirements in the other rating systems listed above.

LEED®-NC version 3 is promulgated by the USGBC and the 2009 NC and CS (Core & Shell Development version) by the CaGBC. Each version has similar evaluation criteria for sustainable design and some minor differences. Readers should check with www.usgbc.org and www.cagbc.org for the most current versions including the LEED® Reference Guide (USGBC 2009).

The LEED® Process

The decision to apply for LEED® certification must occur early in the design process. The project owner and designers evaluate categories and associated criteria explained in the rating categories below for compatibility with the project, architectural program, budget and resulting environmental impact. This enables energy and cost-saving synergies for site and building design decisions.

To start the LEED® certification process, the project is registered on the USGBC or CaGBC web site with payment of a fee based on the total area of the project plus a registration fee. The web site specifies materials to be submitted such as project plans and documentation. The person seeking LEED® certification is sent a project checklist to evaluate aspects of the project might be eligible for LEED® credits. A letter template is also provided to help standardize documentation of credits. The registration fee enables access to the member-only parts of the web site and to access to the history of credit interpretations.

LEED® documentation can come from all involved on the project team including product manufacturers, contractors, cost estimators, specification writers and designers. Responsibility for managing this process will vary with each project. However, this effort is often coordinated by a LEED® Accredited Professional, one who has taken a course sponsored by USGBC or CaGBC and an exam on the credits and their requirements.

Once documentation is submitted with the LEED® application, they are reviewed for acceptance for LEED® credits. Additional documentation can be requested from the USGBC (or CaGBC) as needed and the project team has a specified amount of time to provide this. Final certification is granted within 30 days of receipt of all necessary documentation. LEED® certificates and a plaque are issued to the project design team.

LEED® Credits

For new commercial construction or LEED®-NC, the US and Canadian Green Building Councils grant certification based on the same number of points earned from each rating system. The minimum number of required points is 40. Higher ratings are shown below.

Level	Points
Certification	40-49
Silver	50-59
Gold	60-79
Platinum	80 or more

New projects and major renovations earn points from six broad rating categories with specific subcategories. The major categories include:

- Sustainable Sites
- Water Use Efficiency (for building)
- Energy and Atmospheric Pollutants
- Materials and Resources
- Indoor Air Quality
- Innovative Ideas and Designs

The two primary categories that pertain to segmental concrete paving are Sustainable Sites and Materials and Resources. Within these categories, there are several subcategories for rating various aspects of the building and site for LEED® points. These are listed in the table on page 18.

The LEED® in Specifications and Project Management

Upon registering a project for LEED® certification, a project checklist is provided by the USGBC or CaGBC that lists all of the LEED® credits in a table. The project is compared to the applicable LEED® credits thereby identifying which credits will require the appropriate documentation or tests. This evaluation helps scope the level of certification to be attained by the project. Generally, the higher the certification, the more effort is placed into documentation and into building and site systems that comply with LEED® requirements. The LEED® project checklist can also be used to identify responsibility among the architect, contractor or owner for complying with applicable credits.

Besides identifying which parts of the building or site could comply with LEED® requirements, the project checklist identifies which sections of the specification will need to be written to include LEED® requirements, and into

Continued on p. 18

 Continued from p. 17

Part 1, 2 or 3 of each Section in the project specifications. Division 01, General Conditions should include the owner's goals for achieving LEED® credits, substitution procedures for green building products that contribute to LEED® points, submittal procedures (which may be covered in greater detail for each product in the relevant specifications sections), and a waste management plan. Submittals should occur before construction begins and substitutions should be conducted at the bid stage rather than during construction.

The latest specification formats include sections for specifying sustainable building products. Specific requirements and procedures for compliance to LEED® credits for segmental concrete paving products for sustainable sites and materials and resources should be included in the specifications. Examples include a letter from the manufacturer stating the recycled content of the paving units could be a required submittal, waste management goals, or drainage calculations showing the required reduction of stormwater runoff contributed by permeable interlocking concrete pavement or grid pavements.

If segmental paving is indoors and sealed, or the joint sand stabilized with a liquid, such materials should comply with indoor air quality construction requirements in LEED®. Many projects have a pre-bid conference where the scope of the project is presented with details on the bid documents. The person running the conference should be familiar with LEED® goals for the project and also review submittal requirements and substitution request procedures with prospective bidders. During construction, the owner's representative or contractor should appoint someone responsible for enforcing the contract provisions pertaining to achieving LEED® requirements and documentation. The importance and role of this person should be presented at the pre-bid conference.

This person could be responsible fulfilling contractor related items on the project checklist.

The additional project cost for compliance to LEED® certification is small and segmental concrete paving products used in the normal course of project design (roads, plazas, sidewalks, roof decks, etc.) can earn LEED® credits. Higher levels of certification (Silver, Gold, etc.) will likely increase project costs. However, the initial investment in sustainable design and construction should be returned to the owner in lower maintenance costs during the life of the building and site. When properly designed and installed, segmental concrete pavement has very low maintenance.

LEED® v3 Segmental Concrete Pavement Checklist

Using segmental concrete pavers can help projects earn up to 37 LEED® points as shown in the table below. See *ICPI Tech Spec 16–Achieving LEED® Credits with Segmental Concrete Pavement* for details on how to earn points. The 24-page bulletin can be downloaded from www.icpi.org.

Categories

Sustainable Sites		**Points**
Credit 6.1	Stormwater Design: Quantity Control	1
Credit 6.2	Stormwater Design: Quality Control	1
Credit 7.1	Heat Island Effect: Non-Roof	1
Credit 7.2	Heat Island Effect: Roof	1
Water Efficiency		**Points**
Credit 1	Water Efficient Landscaping: Reduce by 50%	2
	No Potable Water Use or Irrigation	4
Energy and Atmosphere		**Points**
Credit 2	On-site Renewable Energy (PICP w/ ground source heat pumps)	1–7
Materials and Resources		**Points**
Credit 2	Construction Waste Management–Recycled or Salvaged: 50%	1
	Construction Waste Management–Recycled or Salvaged: 75%	2
Credit 3	Materials Reuse: 5%	1
	Materials Reuse: 10%	2
Credit 4	Recycled content: 10%	1
	Recycled content: 20%	2
Credit 5	Regional materials: 10%	1
	Regional materials: 20%	2
Innovation and Design		**Points**
Credit 1	Path 1–Innovation in Design	1–5
	Path 2–Exemplary Performance	1–3
Total Possible Points		**25–37**

David R. Smith

Salt Water Pools and Concrete Pavers

Salt water pools are seeing growth due to their comfort to human skin and while controlling harmful bacteria. Salt content in pool water is about 0.5% which is well under that in the oceans. That's probably why water in salt pools doesn't stick to the skin like ocean water.

Salt water pools have been reported to erode stone copings made with soft limestone in Texas and Arizona, places where rain is absent much of the summer. Florida may have fewer problems with regular afternoon showers that can wash off salt on copings and decks during the summer. Of course, salt combined with freeze-thaw conditions can make erosion worse.

Salt stains have been reported on pools with concrete paver decks and paver copings. These whitish stains look similar to efflorescence. While stains can be unsightly, the author has not heard of salt water eroding and damaging concrete paver pool copings. This may likely be due to better material properties of concrete pavers compared to soft limestone or other soft stones.

One solution to avoiding salt stains is to seal pavers around salt water pools. *ICPI Tech Spec 10–Application Guide for Interlocking Concrete Pavements* recommends sealing pool decks for other reasons, namely to eliminate joint sand erosion and maintain a clean surface. Sealing can also help prevent staining from salt water pools. *ICPI Tech Spec 5–Cleaning, Sealing and Joint Sand Stabilization of Interlocking Concrete Pavement* gives general guidance on sealer types, longevity and application techniques. Sealer companies may have specific recommendations for pool decks. Sealing around pools should be applied in a thickness that does not create slipping hazards after the sealer dries.

Another way to reduce or avoid stains is regular monitoring of salt water concentrations and pH levels by the owner. Salt concentrations should be kept below 5,000 parts per million, closer to 3,000, suggested in a February 26, 2007 article on the subject in *Pool & Spa News*. Obviously, washing and rinsing the coping and pool deck with fresh water at the end of the season can help reduce build up.

Concrete pavers typically have higher densities and lower absorption than soft limestone. ASTM C568 *Standard Specification for Limestone Dimension Stone* places limestone in three categories based on its bulk density. Class I has the lowest densities between 110 and 130 lbs/ft^3 (1760 to 2160 kg/m^3) and maximum allowable absorptions of 12%. Concrete pavers typically have higher densities, 135 to 145 lbs/ft^3 (2162 to 2322 kg/m^3), and average absorptions lower than 5% as required by ASTM C936 *Standard Specification for Solid Concrete Interlocking Paving Units*. With higher densities, lower absorption plus sealing, concrete pavers are better positioned than soft limestone or other soft stone to resist staining and damaging erosion from salt water pools. The author welcomes comments and experiences in dealing with salt water pools, stains, and concrete pavers. Please send them to dsmith@icpi.org. ❖

Salt water pools are growing in popularity due to increased swimmer comfort. Concrete pavers can be compatible with them when industry guidelines are followed.

Photo: www.salt-water-pools.com

Hardscape North America Supports Industry Contractors

Now in its fourth year, Hardscape North America (HNA) continues to attract thousands of contractors and distributors of segmental concrete wall and paving systems to see the latest on residential and commercial construction. Joined for the second year with GIE+Expo at the Kentucky Exposition Center in Louisville, HNA brings national level educators presenting certification courses plus how-to construction, marketing and sales seminars for increased contractor and distributor profits. HNA features indoor and outdoor exhibits displaying time-and-money saving tools, machines and accessories to build beautiful concrete paving and walls.

With HNA located with GIE+Expo, the complete show features 750 exhibits covering some 478,000 sf (47,800 m²).

Outdoor Exhibits and the HNA Arena

Over two days participants can kick the tires and test drive machinery from more than 100 suppliers in the 19 acre (7.7 ha) outdoor demo park next to the same exhibitors' indoor displays. Registration for the HNA show pre-show education courses and the conference program includes access to two days of installation demonstrations in the HNA Outdoor Arena as listed below.

Hundreds gather to view a hardscaping product and system construction at the HNA outdoor area.

Outdoor Arena Education Courses

Segmental Retaining Wall Installation Fundamentals

Thursday, October 27: 10:00–11:15 a.m.

Presenter: Ronnie Birdwell, Sims Stone

Interlocking Concrete Paver Installation and Specialty Tools for Hardscape Installations

Thursday, October 27: 12:00 noon–1:15 p.m.

Presenter: Pat McCrindle, MLPS Paver Systems, Inc.

Low-Voltage Lighting for Hardscape Installations

Thursday, October 27: 1:30–2:45 p.m..

Presenter: Jeff Hesser, Cast Lighting LLC

Construction Best Practices for Permeable Interlocking Concrete Pavement

Thursday, October 27: 3:00–4:15 p.m.

Presenter: Chuck Taylor, Oldcastle Architectural, Inc.

Enhancing Hardscape Projects with Water Features

Friday, October 28: 10:00–11:15 a.m.

Presenter: James Chubb, Atlantic Water Gardens

Top Hats and Tuxedos: Steps, Columns and Seat Walls for Residential Hardscapes

Friday, October 28: 12:00 noon–1:15 p.m.

Presenter: Pat McCrindle, MLPS Paver Systems, Inc.

Building the Outdoor Room

Friday, October 28: 1:30–2:45 p.m.

Pat McCrindle, MLPS Paver Systems, Inc.

Cleaning and Sealing Concrete Pavers

Friday, October 28: 3:00–4:15 p.m.

Presenter: Russ Heitman, Seal 'n Lock System Corp.

Machine-assisted installation demonstrations

Thursday and Friday, October 27 and 28: 10:00 a.m. and 1:30 p.m

In addition to these sessions at the HNA Outdoor Arena, mechanized installation demonstrations are featured in the outdoor demonstration area. Watch, listen and learn how mechanized installation of permeable interlocking concrete pavements can increase crew efficiency and improve your bottom line for commercial and larger residential projects. Placement and screeding equipment is demonstrated as well.

Presenter: Chuck Taylor, Oldcastle Architectural, Inc.

HNA outdoor area features mechanized installation equipment for increased efficiency and crew energy.

Indoor HNA Seminars Provide Business Growth Opportunities

The seminar following provides marketing and sales ideas presented by industry experts to help increase your bottom line.

Grow Your Business through Paver Installation

Thursday, October 27: 10:00–11:15 a.m.

New to hardscaping? Efficiency counts in today's market. Improve your landscaping business and be more competitive by learning best practices for concrete paver installation. Learn how selection of materials and installation efficiency can improve your bottom line.

Bill Gardocki, President, Interstate Landscape Company, Inc.

Access, Bid and Build Commercial Hardscape Projects

Thursday, October 27: 10:00–11:15 a.m.

Learn how to get involved in the commercial market by establishing and building relationships with general contractors and developers. This session takes you through the commercial sales process and provides an overview of the bidding and estimating tools that will help you expand your hardscape business into this market.

Fred Adams, President, Fred Adams Paving Company, Inc.

Creative Consultations to Improve Profitability

Thursday, October 27: 1:30–2:45 p.m.

Don't miss out on value-added sales and profits by not asking the right questions! Hardscape features like seating walls, columns and decorative accents that can be added to a landscape plan by first understanding the needs of the homeowner and offering the right solutions. The session features actual projects in which contractors were successful in adding profitable hardscape features and phased installation plans.

Tim Huinker, Construction Specialist, Anchor Wall Systems

Low-Impact Landscape Design Using Permeable Interlocking Concrete Pavement

Thursday, October 27: 1:30–2:45 p.m.

Permeable pavement systems infiltrate stormwater through the pavement, eliminating runoff and reducing pollutants. Learn about the design and construction of permeable interlocking concrete pavement through several case studies. Review maintenance, ADA compliance, durability, incentives for LID paving solutions and potential LEED® credits.

Kevin Earley, Director of Commercial Sales, Nicolock Paving Stones

Contracting for Profit: Planning & Estimating Hardscapes

Thursday, October 27: 3:00–4:15 p.m.

Never underestimate the true cost of designing and installing a hardscape project again. Learn what should be considered when estimating a job, such as materials and labor costs, customer needs, the complexity of the project and other competing projects on the schedule.

Terry Morrill, Owner, Pacific Outdoor Living

Creative Brick Walls in Landscape Design

Thursday, October 27: 3:00–4:15 p.m.

Enhance landscape designs with clay brick masonry, including retaining walls and free-standing walls. Details and sources of information are covered, as well as the process of incorporating sculpture into the brick.

Eric Johnson, Vice President of Engineering, Brick Industry Association Southeast Region

Engineering Secrets Every Contractor Should Know about Segmental Retaining Walls

Friday October 28: 10:00–11:15 a.m.

Learn basic engineering principles behind successful segmental retaining walls. The session covers how landscape contractors can identify and address common site conditions. Topics include learning how different soils affect walls and what to do, learning about the impact of water and irrigation on walls and the importance of compaction.

Don Armstrong, P.E., Chief Engineer, Anchor Wall Systems

Continued on p. 22

Hardscape North America Supports Industry Contractors *Continued from p. 21*

Designing and Selling Outdoor Living Spaces

Friday October 28: 10:00–11:15 a.m.

A patio is just a patio, but a patio with a fire feature or outdoor kitchen creates an outdoor room. This session offers solid ideas to leave your customers with that "I have to have it" feeling. Before, during and after photographs are shared, showing the creative installation details of noteworthy landscape projects.

Joe Palimeno, Landscape Designer, Vander Kooi & Associates

Maintaining a Profitable Business through Customer Relationships

Friday October 28: 1:30–2:45 p.m.

How can you better manage customer relationships and still maintain profitability during tough times? During this session, the presenter shows how to increase customer retention by understanding customer needs and how to satisfy them.

Ed Fioroni, Ph.D., Vice President of Distributor Sales and Marketing, Pavestone, and Immediate Past Chairman of the ICPI

Peak Performance for Pavers: Offering New Services to Existing Customers

Friday October 28: 1:30–2:45 p.m.

Learn how to increase profits by offering paver sealing, joint-stabilization products and maintenance services. Paver sealing and joint-stabilization products provide customers with an enhanced, rejuvenated and superior paver system. The benefit to you? Diversifying your business and increasing your bottom line.

Phil Graves, Regional Sales Manager, Techni-Seal, Inc. and Mike Riehm, President and CEO, Envirobond

A Designer's Viewpoint for Hardscape Contractors

Friday October 28: 3:00–4:15 p.m.

Great budget. Great concept. Great idea on paper. It all means nothing if the designer and contractor aren't working together. This session follows the stories of three case studies that utilized segmental retaining wall and concrete unit paving products. Explore the design and construction process, and get the designer's perspective on how to execute great projects as a team.

Chad Watkins, ASLA, President/Principal, Watkins Acy Strunk Design, Inc.

Increase Hardscape Project Performance Using Geosynthetics

Friday October 28: 3:00–4:15 p.m.

Reduce callbacks by brushing up on geosynthetic types, polymers and uses in hardscape construction. The session illustrates installation best practices and pitfalls to avoid in the field, with an emphasis on selecting the right geogrid and geotextile for the right application.

Janice Reid, Southeastern Regional Sales Manager Strata Systems, Inc.

Pre-Show Construction Courses Offer Value for Contractors

HNA offers contractors two full days of pre-show installation courses. These will be held Tuesday and Wednesday, October 25 and 26 at the Hyatt Regency Hotel in downtown Louisville, Kentucky, minutes from the HNA show location. Courses conclude with an exam and participants receive certificates recording their achievement.

ICPI Concrete Paver Installer Course

October 25 and 26: 8:00 a.m. to 5:00 p.m.

This two day course is designed for contractors involved—or who would like to build—residential interlocking concrete pavements. Course content includes fundamentals of job planning and documentation, job layout, soil characteristics, compaction, base materials, edge restraints, bedding and joint sands, selection and installation of concrete pavers, maintenance and management, specialty applications and construction tips, safety, estimating, job costing and contract basics. Participant also meeting the minimum installation requirements are eligible for certification.

ICPI Commercial Paver Technician Course

October 25 and 26: 8:00 a.m. to 5:00 p.m.

This advanced two day course covers best practices for installation of interlocking concrete pavements in commercial, municipal and industrial applications. The curriculum is designed for foremen and higher personnel. Topics covered include stabilized bases, bedding sand hardness, durability, overlays, inlays, rigid applications, roof plaza decks, crosswalks, concrete grid pavements, commercial and mechanical installation, contracts, MasterFormat specifications, liens, construction details, plan reading, submittals, retainage, estimating software, on-screen takeoffs and company marketing. The course is for contractors who would like to expand services to non-residential markets or who are already servicing them. While not a firm perquisite, completion of the ICPI Concrete Paver Installer Course prior to taking this course is extremely helpful.

Permeable Interlocking Concrete Pavement (PICP) Specialist Course

October 25: 1:00 p.m.–5:00 p.m.
October 26: 8:00 a.m.–5:00 p.m.

Thanks to national, state/provincial and local stormwater run-off regulations, PICP sales are growing at over 20% annually. Capture this market by building according to industry best practices for residential and commercial PICP construction. This course is for experienced contractors presently doing residential and/or commercial concrete pavement installations and would like to build permeable pavements. Course content includes job planning, documentation and job layout, flow and estimating quantities, soil and site characteristics, subbase and base materials, edge restraints, bedding and jointing materials, and paver selection, installation and maintenance. While a not a firm perquisite, completion of the ICPI Concrete Paver Installer Course prior to taking this course is extremely helpful.

Segmental Retaining Wall (SRW) Installer Course and Certified SRW Installer (CSRWI) Exam

October 25: 8:00 a.m.–5:00 p.m.

Sponsored by the National Concrete Masonry Association (NCMA), this one-day program teaches design, construction and performance of SRWs. This course provides basic knowledge needed on industry best practices to install quality walls that meet customer expectations and ensure long-term contractor success. A highly experienced NCMA SRW instructor delivers SRW installation guidelines, materials (including SRW units and geosynthetics), soils, compaction and water, planning and equipment selection.

Advanced SRW Installer Course and Certified SRW Installer-Advanced (CSRWI-A) Exam

October 26: 8:00 a.m.–5:00 p.m.

This NCMA sponsored, one-day course teached advanced SRW applications and installation techniques enabling contractors to increase their value to customers. The course is open to NCMA-CSRWIs engaged in construction of SRWs. The program is focused on advanced residential applications and small commercial jobs the incorporate stairs, corners, pillars, etc.

Registration for all courses includes classroom training, student manuals, exams, and coffee breaks. As an added bonus, registration includes free admission to HNA and GIE+Expo Trade shows. Register by September 19 to receive early-bird discounts. For more information on the pre-show installation courses or to register, visit www.HardscapeNA.com.

The Best Projects Recognized

HNA Awards Breakfast

Friday, October 28: 7:30 a.m.–8:45 a.m.

Outstanding hardscape projects are recognized at an awards breakfast in the Kentucky Exposition Center including the best walkways, patios, driveways, plazas, parking lots and roadways. Winning projects include those made with concrete pavers, permeable interlocking concrete pavers, brick pavers, segmental concrete retaining walls and combinations of these materials. HNA exhibitors displaying the best booth and most valuable promoter will also be recognized. Shuttle buses transport attendees from the Hyatt Regency Hotel to the Kentucky Exposition Center. Tickets for this awards breakfast can be purchased at www.HardscapeNA.com/registration. Project entries can be submitted no later than September 15 at www.HardscapeNA.com.

Entertainment Options

HNA registration also includes entry to two country music venues playing on concrete pavers on 4th Street in downtown Louisville. Stealing Angels gets the crowd on their feet on Thursday, October 27, at 9:00 p.m. Their new album, Paper Heart, features songs personal to the trio. Their lead single reflecting the album name can be heard on radio stations across the country. The Monarchs open for Stealing Angels at 8:00 p.m.

Stealing Angels ready to entertain HNA and GIE+Expo attendees

Master fiddler and musical story teller Charlie Daniels

Charlie Daniels Band takes the stage on Friday, October 28, at 9:00 p.m. Charlie Daniels is a Grammy-award winning country music and southern rock legend best known for his No. 1 country hit, "The Devil Went Down to Georgia." Special guests, The Davisson Brothers open for Daniels taking the stage at 8:00 p.m. ❖

University of Georgia Develops Segmental Concrete Pavement Systems Curriculum for Landscape Architecture Schools

As a first of its kind, the University of Georgia, College of Environmental Design, Department of Landscape Architecture has released a new web site, http://ced-icpi.ced.uga.edu/ that provides landscape architecture students and educators with a flexible and evolving curriculum on segmental concrete pavements. The site structure links self-guided presentations with interactive animations and a studio project library that spans concept to construction. Faculty are encouraged to use this site as a supplement to their existing curriculum and to encourage their students to add to this living library by uploading their completed projects to the site. Students are encouraged to explore and interact with the site's materials to become familiar with design and structural principles related to segmental concrete pavement.

The site is composed of presentations, animations, and studio projects, each supplemented with additional resources and materials. The presentations are self-guided and provide students with resources to explore beyond the scope of this site. The animations engage students to explore key ideas and principles related to sustainable design, structural design, and design theory. The studio projects provide a set of exercises that link research, conceptual design, and implementation. The site's materials are tagged and searchable, and available to view online or download for later viewing. Most importantly, the site is open, and students are encouraged to expand the site through uploading completed studio projects.

The site emphasizes the following subject areas:

- Loading and Utility: segmental concrete pavers provide flexible, easily installed, and incredibly durable loading capacities to the surfaces that landscape architects frequently design, including streets, parking, sidewalks, plazas and roofs. Concrete pavers are easy to install, and they are also easy to remove and store for repairs to infrastructure. The variety of loading options that they provide, combined with their sustainable, place-making, and wayfinding potentials, make concrete pavers a valuable addition to the material repertoire that landscape architects bring to their deigns.
- Sustainability: segmental concrete pavers are well-suited for addressing environmental and stormwater concerns. Segmental pavers are typically sourced near project sites, and the industry's manufacturing processes are becoming more efficient with less impact to the environment. Segmental pavers also provide long-term durability, which reduces the energy and costs associated with continual repairs. And permeable segmental concrete pavement, through its capacity to mimic the porosity of softscapes, detain large volumes of stormwater, and allow stormwater infiltration into the soil below, helps to prevent surface runoff associated with impervious pavements.
- Orientation and Wayfinding: segmental concrete pavers can provide integral, effective, and highly creative complements to wayfinding needs. Segmental pavers can suggest direction, location, center and boundaries. And, critically, they can also provide visible and tactile safe routes and cues to nearby or oncoming dangers such as transit and elevation drops. Achieved creatively and thoughtfully, the integration of wayfinding needs into pavement systems can contribute to the identity, variety, and materiality of built environments.
- Place-Making: segmental concrete pavers offer unique and powerful means to employ and reinforce key concepts of place including space, edges, foci, and thresholds. Segmental pavers can abstract and reveal cultural and environmental patterns, forms, and processes. Given their modular and inter-

changeable nature, segmental pavers offer an incredibly variable media to landscape architects. They can expand and shrink space, create and strengthen identity, add emotion, meaning, movement and play to highly functional surfaces.

This site employs a wide range of pedagogical approaches to teach the design and application of segmental concrete pavers. Critical to these approaches is the site's ability to upload and augment materials through student submissions. In this fashion, the materials stay relevant, diverse and connected to student interests. There are several ways to contribute to this site. Each of the studio projects has a downloadable template that students can use to complete the project and then submit to the site to be added to the growing library of projects.

The studio projects work independently and also collectively; a student may complete and submit one project or a combination of projects. The studio sections build on one another: research projects explore places, site character and processes; design projects apply conceptual design approaches to the researched places; and implementation projects develop and mock up the conceptual designs. Instructors and students may choose to explore a single project by using generated or already posted materials, or they may choose to combine projects to create linkages between stages of design. Which approach the student employs should depend on instructional goals and interests.

Once completed, the project can be uploaded to the site by clicking the "submit" link beneath the project description. This link will ask the student to name the project, write a short description of the project location and significance, and attach the completed template. The project will be evaluated, and if it meets the goals and requirements of the site, it will be posted on the site. ❖

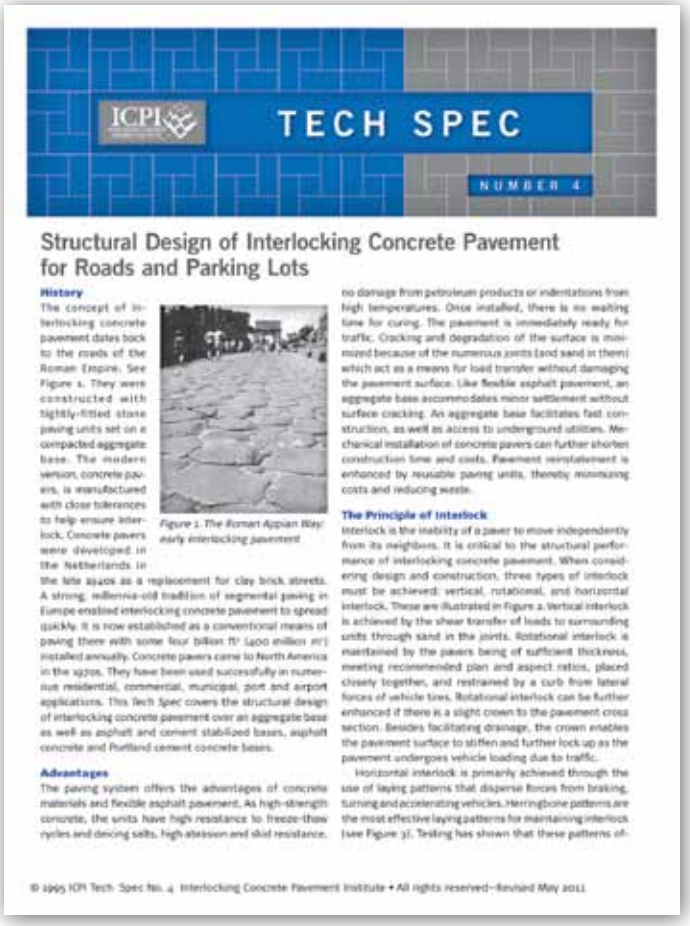
ICPI Releases Updated Structural Design Technical Bulletin

The Interlocking Concrete Pavement Institute (ICPI) recently released *Tech Spec 4–Structural Design of Interlocking Concrete Pavements*. This comprehensive 28-page bulletin for civil engineers provides flexible and rigid pavement design procedures for interlocking concrete pavement subject to vehicular traffic. The flexible design procedures cover interlocking concrete pavements on granular, asphalt stabilized, cement stabilized and asphalt bases. The rigid design method is for concrete bases under interlocking concrete pavement surfaces.

The design guide uses design methods developed by the American Association of State Highway Officials (AASHTO) and those found in that organization's 1993 book, *Guide for Design of Pavement Structures*. While AASHTO has yet to include segmental concrete pavement in their design guides, the AASHTO design procedures provide the technical basis for *Tech Spec 4* since interlocking concrete pavements behave structurally in a manner similar to conventional pavements.

The bulletin defines interlock and how it applies to structural design. The reader follows a design flow chart, text and tables to determine flexible base and subbase thicknesses. A detailed description of ESALs or 18-kip (80 kN) equivalent single axle loads is provided for readers to better understand a core concept in pavement design, and its relationship to the Caltrans Traffic Index. In addition, various correlations among soil types and soil characteristics are given as different regions and engineers use various tests to characterize soil such as the California Bearing Ratio, R-value, and resilient modulus.

The *Tech Spec* includes design tables for designs up to 10 million ESALs for flexible and rigid pavement construction. An extensive portion is dedicated to rigid pavement design, following AASHTO and industry guidelines for concrete bases. Design examples for flexible and rigid pavements are provided. The flexible pavement design method follows the American Society of Civil Engineers ASCE 58-10 national design guide, *Structural Design of Interlocking Concrete Pavement for Municipal Streets and Roadways* which is based on AASHTO design methods. ❖


ICPI TECH SPEC
NUMBER 4

Structural Design of Interlocking Concrete Pavement for Roads and Parking Lots

History

The concept of interlocking concrete pavement dates back to the roads of the Roman Empire. See Figure 1. They were constructed with tightly-fitted stone paving units set on a compacted aggregate base. The modern version, concrete pavers, is manufactured with close tolerances to help ensure interlock. Concrete pavers were developed in the Netherlands in the late 1940s as a replacement for clay brick streets. A strong, millennia-old tradition of segmental paving in Europe enabled interlocking concrete pavement to spread quickly. It is now established as a conventional means of paving there with some four billion ft² (400 million m²) installed annually. Concrete pavers came to North America in the 1970s. They have been used successfully in numerous residential, commercial, municipal, port and airport applications. This Tech Spec covers the structural design of interlocking concrete pavement over an aggregate base as well as asphalt and cement stabilized bases, asphalt concrete and Portland cement concrete bases.

Figure 1. The Roman Appian Way: early interlocking pavement

Advantages

The paving system offers the advantages of concrete materials and flexible asphalt pavement. As high-strength concrete, the units have high resistance to freeze-thaw cycles and deicing salts, high abrasion and skid resistance, no damage from petroleum products or indentations from high temperatures. Once installed, there is no waiting time for curing. The pavement is immediately ready for traffic. Cracking and degradation of the surface is minimized because of the numerous joints (and sand in them) which act as a means for load transfer without damaging the pavement surface. Like flexible asphalt pavement, an aggregate base accommodates minor settlement without surface cracking. An aggregate base facilitates fast construction, as well as access to underground utilities. Mechanical installation of concrete pavers can further shorten construction time and costs. Pavement reinstatement is enhanced by reusable paving units, thereby minimizing costs and reducing waste.

The Principle of Interlock

Interlock is the inability of a paver to move independently from its neighbors. It is critical to the structural performance of interlocking concrete pavement. When considering design and construction, three types of interlock must be achieved: vertical, rotational, and horizontal interlock. These are illustrated in Figure 2. Vertical interlock is achieved by the shear transfer of loads to surrounding units through sand in the joints. Rotational interlock is maintained by the pavers being of sufficient thickness, meeting recommended plan and aspect ratios, placed closely together, and restrained by a curb from lateral forces of vehicle tires. Rotational interlock can be further enhanced if there is a slight crown to the pavement cross section. Besides facilitating drainage, the crown enables the pavement surface to stiffen and further lock up as the pavement undergoes vehicle loading due to traffic.

Horizontal interlock is primarily achieved through the use of laying patterns that disperse forces from braking, turning and accelerating vehicles. Herringbone patterns are the most effective laying patterns for maintaining interlock (see Figure 3). Testing has shown that these patterns of-

***ICPI Tech Spec 4* is available for free download from www.icpi.org. ICPI members can purchase copies in packs of 10 at www.icpi.org for $12 plus shipping and handling.**

Concrete Paver Industry Calendar of Events

October 25-26, 2011
ICPI Concrete Paver Installer Certification Course
Hyatt Regency Hotel
Louisville, Kentucky
www.icpi.org

October 25-26, 2011
PICP Installer Certificate Course
Hyatt Regency Hotel
Louisville, Kentucky
www.icpi.org

October 25-26, 2011
ICPI Commercial Installer Certificate Course
Hyatt Regency Hotel
Louisville, Kentucky
www.icpi.org

October 27-29, 2011
Hardscape North America
Kentucky Exposition Center, Louisville
www.hardscapeNA.com

December 5-8, 2011
ASTM Meetings
Tampa Marriott Waterside Hotel
Tampa, Florida
www.astm.org

December 5-8, 2011
PICP Workshop
University of New Hampshire Stormwater Center
Durham, New Hampshire
www.unhsc.com

ICPI Webinars for Design Professionals, Contractors and Suppliers
For registration details or more information, visit www.icpi.org or call ICPI at 703-657-6900.

See www.icpi.org for a listing of 2011–2012 ICPI installer courses.

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