PICP Stormwater Benefits

- Helps meet local, state, provincial stormwater drainage design criteria and provides compliance with the U.S. National Pollutant Discharge Elimination System (NPDES) regulations
- Outdoor demonstration lab for classes focused on environment and energy
- Pilot projects offer research opportunities for faculty and students.
- LEED® point eligible for Sustainable Sites, Water Efficiency, Materials & Resources and/or Innovative Design; Earns Green Globe points
- Meets U.S. Environmental Protection Agency stormwater performance criteria as a structural best management practice (BMP) while providing parking, road and pedestrian surfaces
- No curing is required. The paver surface may be used when installed and may be designed to display an array of patterns.
- PICP typically reduces or eliminates the need for conventional stormwater management ponds.
- Snow plowed with typical removal equipment; reduced winter ice hazards, de-icing salt use and snow removal costs
- Reduces runoff temperatures thereby preserving aquatic habitats
- Infiltrates, filters and treats stormwater runoff from conventional impervious pavements and roofs

Design Software Available

New software from ICPI for permeable pavement called Permeable Design Pro incorporates research from a range of university research studies.

Contact ICPI for further information.

Application Opportunities

- New construction
- Parking spaces
- Low-speed roads
- Plazas
- Sidewalks
- Walkways
- Bike paths
- Courtyards
- Parking lot retrofits

Permeable Interlocking Concrete Pavement (PICP) with open-graded base and subbase for infiltration and storage.
PICP Meets LID Goals

- Conserves on-site space: roads, parking, stormwater infiltration and retention all combined into the same space creating more green space or building opportunities
- Preserves wooded areas that would otherwise be cleared for stormwater detention or retention ponds
- Increases site infiltration that helps maintain pre-development runoff volumes, peak flows and time of concentration
- Promotes tree survival and growth
- Contributes to urban heat island reduction through evaporation and reflective, light colored pavers
- Highly visible, cost-effective exemplary demonstration of a cornerstone LID technique for public and private development

PERMEABLE INTERLOCKING CONCRETE PAVEMENT: A LOW IMPACT DEVELOPMENT TOOL

PICP Supports LID Principles

1. Conserve vital ecological and natural resources: trees, streams, wetlands and drainage courses
2. Minimize hydrologic impacts by reducing imperviousness, conserving natural drainage courses, reducing clearing, grading and pipes
3. Maintain pre-development time of concentration for runoff by routing flows to maintain travel times and discharge control
4. Provide runoff storage and infiltration uniformly throughout the landscape with small, on-site decentralized infiltration, detention and retention practices such as permeable pavement, bioretention, rain gardens, open swales and roof gardens
5. Educate the public and property owners on runoff and pollution prevention measures and benefits

Permeable joint material consisting of small aggregates allows infiltration of stormwater.
Integrate Permeable Pavement into the Curriculum!

PICP makes a useful instructional tool for engineering, architecture, landscape architecture and construction students. The outdoor classroom provides a demonstration site to monitor performance and maintenance aspects and can have a lasting impact on students as they move into their careers.

Base construction uses locally available materials. Pavers are delivered ready to place, joints filed, compacted and ready for traffic.

Mechanical installation equipment accelerates construction; typical 5,000 sf (500 m²)/machine/day. After placement, joints and/or openings filled with small aggregate and pavers are compacted.

ICPI Civil Engineering University Curriculum Available
(www.icpi.org/university/)

Instructional Modules include:
Module 1: Introduction
Module 2: Materials and Standards
Module 3: Road Design
Module 4: Construction Methods
Module 5: Maintenance and Management
Module 6: Life-Cycle Cost Analysis
Module 7: Airpot Pavement Design
Module 8: Port and Industrial Pavement
Module 9: Permeable Pavement Design

Multiple permeable pavement materials monitored by university students in Kinston, NC.

PICP functions as a retention pond and parking lot at the Elmhurst College, LEED® project in Elmhurst, IL, part of an LID sustainable site.

PICP under bleachers at the U.S. Naval Academy in Annapolis, MD provides structural support and on-site infiltration.
Peak Flow Reduction

- Permeable pavers can reduce the peak flow by as much as 100%, bringing runoff volumes nearer to pre-development levels. (Bean, Eban Z., William F. Hunt, David A. Bidelspach, “Evaluation of Four Permeable Pavement Sites in Eastern North Carolina for Runoff Reduction and Water Quality Impacts, Journal of Irrigation and Drainage Engineering 133 no. 6 (2007): 583-592).
- Reduced peak flows can relieve campus storm sewers and distressed streams. Increased flows (volume per time) of stormwater runoff, as a result of impermeable surfaces, cause stream channel erosion and loss of aquatic habitat.

Volume Reduction

- PICP reduces runoff for ALL rainstorms.
- May be designed to store and slowly release runoff from larger storms thereby reducing flooding potential.

Additional Benefits

- Cooler than conventional pavements
- ADA compliant
- Concrete pavers available in various shapes and colors from local ICPI members; colored pavers mark lanes and parking spaces.
- Simplified surface and subsurface repairs by reinstating the same paving units; no ugly patches or weakened pavement from utility cuts

FAQs

Can PICP be used on clay soils?
Yes. Even in clay soils, PICP reduces runoff and helps to capture “first flush” runoff and reduce pollution.

Can PICP be combined with other LID tools?
Yes. University studies have demonstrated a treatment train that starts with PICP in the parking lot and continues with the outlet from the PICP feeding an adjacent bioretention cell or grassy swale.

Is Maintaining PICP difficult?
No. PICP can be maintained through street sweeping and vacuuming based on periodic inspections. Fewer deicing salts are needed in the winter and small aggregate is used to enhance traction rather than sand.

Hydrologic performance for 12 rainfall events in 2006: Asphalt compared to LID tools PICP and a bioswale adjacent to an asphalt lot at Seneca College, Ontario by the Toronto & Region Conservation Authority (www.trca.on.ca)

<table>
<thead>
<tr>
<th>Hydrologic Characteristic</th>
<th>Asphalt</th>
<th>PICP</th>
<th>Bioretention Swale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Flow Volume (m³)</td>
<td>37.0</td>
<td>33.5</td>
<td>16.7</td>
</tr>
<tr>
<td>Avg. Peak Flow (L/s)</td>
<td>2.2</td>
<td>0.05</td>
<td>0.40</td>
</tr>
<tr>
<td>Avg. Flow Duration (hrs)</td>
<td>2.0</td>
<td>73.50</td>
<td>0.04</td>
</tr>
<tr>
<td>Avg. Rainfall-runoff Lag (hrs)</td>
<td>Negligible</td>
<td>5.5</td>
<td>2.5</td>
</tr>
</tbody>
</table>

References


For more information pertaining to permeable interlocking concrete pavement, please visit the Interlocking Concrete Pavement Institute (icpi.org) or the Low Impact Development Center (lowimpactdevelopment.org).

Other Fact Sheets available for Developers, Municipal Officials and Design Professionals

Disclaimer: The content of this brochure is intended for use only as a guideline. It is not intended for use or reliance upon as an industry standard, certification or specification. ICPI & LIDC make no promises, representations or warranties of any kind, expressed or implied, as to the content of this brochure. Professional assistance should be sought with respect to the design, specifications and construction of each permeable interlocking concrete pavement project.