

Interlocking Concrete Pavement Institute (ICPI)
Model Stormwater Ordinance for Permeable Interlocking Concrete Pavements
August 2010

Background

What are permeable interlocking concrete pavements (PICP)?

PICP consists of solid concrete units molded with joints and/or openings that create an open area across the pavement surface. The openings allow water from storm events to flow freely through the surface into an open-graded base where it is collected and stored before it infiltrates into the underlying soils. For low-infiltration rate soils, drain pipes are often placed in the subbase to drain excess water, thereby functioning as a detention facility with some infiltration. The entire pavement system can support vehicular or pedestrian traffic while minimizing stormwater runoff and recharging groundwater supplies. Research has demonstrated that PICP is an effective method for reducing stormwater runoff and pollutants from urbanized areas. Initial surface infiltration rates exceed 500 in./hour. Properly design, installed and maintained PICP can have design life surface infiltration rates exceeding 100 in./hour.

What are the benefits PICP?

PICP is suitable for parking lots, streets, plazas and walkways and its use minimizes or eliminates stormwater runoff destined for receiving waters by providing infiltration. This helps maintain dry-weather stream flows, lake levels and related aquatic life, as well as recharge groundwater supplies. PICP was first used in Europe in the mid-1980s and was introduced to North America in 1992. The U.S. EPA recognizes permeable pavements as a best management practice (BMP) for stormwater and many state BMP manuals include PICP.

This technology has increased use throughout North America and supports national, state and local sustainable design and construction initiatives such as low impact development (LID) and Cool Communities as well as earning credits in the LEED® green building rating system and other rating systems. PICP reduce or eliminate expensive stormwater drainage, temporary detention and retention ponds thereby reducing land development costs. PICP provides an extremely durable surface in freeze-thaw and deicing salt conditions.

ICPI urges communities to adopt a stormwater management ordinance that include PICP.

The following model stormwater ordinance gives local governments a start in the development of a stormwater ordinance that includes PICP. The ordinance should be adjusted to accommodate local conditions.

About ICPI

Founded in 1993, ICPI represents producers, suppliers, contractors, design professionals and consultants. ICPI promotes the highest product standards through ICPI product certification and installation guidelines through a PICP certificate program for contractors. ICPI publishes the *Interlocking Concrete Pavement Magazine*, along with marketing and technical resources for design professionals, contractors and homeowners. PICP Applications for pavers include driveways, patios, plazas, walkways, parking lots and roads. To learn more about ICPI, visit icpi.org.

Disclaimer

This model ordinance is intended for use only as a guideline. It is NOT intended for use or reliance upon as an industry standard, certification or as a specification. ICPI makes no promises, representations or warranties of any kind, express or implied, as to its content and disclaims any liability for damages resulting from its use or modification. Professional assistance should be sought with respect to the ordinance writing as well as design, specifications, construction, inspection and maintenance of each PICP project.

Stormwater Management Using PICP

(Community)

Ordinance No. _____

(a) Purpose.

The purpose of this Ordinance is to promote health, safety, and welfare within (community) and its watershed by minimizing the harms and maximizing the benefits, through provisions designed for allowance of permeable interlocking concrete pavement (PICP) as part of a stormwater management planning and implementation of stormwater goals for (Community).

(Community) recognizes that stormwater runoff has been traditionally treated as a by-product of development and mainly from impervious surfaces (roofs and paving) to be disposed of quickly and efficiently. The result is typically increased flooding, degradation of surface and subsurface water quality, soil erosion and sedimentation, reduced groundwater resources, as well as reduced recreational and economic opportunities. These conditions engender the need to implement site-specific technologies and practices to filter and infiltrate stormwater and thereby reduce impacts from development. This Ordinance encourages the use such technologies called Best Management Practices (BMPs) which are structural, vegetative, or managerial practices designed to treat, prevent, or reduce degradation of water quality due to stormwater runoff. All development projects subject to review under the requirements of this Ordinance shall be designed, constructed, and maintained using BMPs to prevent flooding, protect water quality, reduce soil erosion, maintain and contribute to the aesthetic values of the project. (Community) recognizes that PICP is one of several BMPs for achieving stormwater goals.

(b) General Requirements for PICP

(1) The surfacing materials for pedestrian and vehicular uses shall consist of concrete paving units that conform to ASTM C936 including an average 8,000 psi compressive strength.

(2) Whenever possible, PICP shall be used to reduce post-development peak flows and total water volumes to pre-development conditions. Pre-development is defined as the conditions on the existing site prior to the proposed development project.

(3) Development plans shall be provided that include post-construction BMPs. PICP shall be designed to manage stormwater to help reduce local minor flooding, degradation of water quality related to stormwater runoff, and increase groundwater recharge and opportunities for water harvesting for irrigation where possible.

(3) PICP shall be designed by a registered professional engineer or landscape architect and installed by a contractor who has successfully completed the requirement of the Interlocking Concrete Pavement Institute (ICPI) PICP Installer Technical Certificate course;

- (4) PICP shall include maintenance instructions to the property owner including a maintenance inspection schedule;
- (5) At a minimum, PICP surface, base/subbase shall be designed to adequately accommodate the rainfall depth of [insert local storm event requirements]. The base/subbase layers shall be designed to have sufficient detention capacity that stormwater will infiltrate into the soil below and can accommodate a second [insert local storm event requirements] depth within 5 days of the previous storm;
- (6) PICP shall be designed in accordance with guidelines in the ICPI manual, Permeable Interlocking Concrete Pavements, on guide specifications on www.icpi.org.
- (7) PICP shall be installed by a person holding an ICPI PICP Installer Technician Certificate who shall be onsite to oversee each installation crew during all PICP construction.

(c) Development of New Properties

- (1) Property is considered new property if the property proposed for development has no existing construction.
- (3) Impervious cover (total roof area, pedestrian and vehicular paving) shall not exceed a maximum of ___% of the total property according to the specific land use and zoning designation. See (reference section/pages) for specific land uses and maximum allowable impervious cover for each land use.
- (2) One-hundred (100) percent of the total area covered by PICP shall be considered a pervious or permeable surface.

(d) Re-development of Existing Properties

- (1) Property is considered existing property if the property proposed for re-development has existing construction.
- (2) Existing properties that do not exceed the maximum allowed impervious surface for new properties shall meet the requirements under (c) Development of New Properties.
- (3) Existing properties that exceed the maximum allowed impervious surface as stated in (c) Development of New Properties may construct new impervious surfaces if the proposed new impervious surface meets all setback and other regulations of this ordinance and if the following conditions are met:
 - i. The applicant removes existing impervious surfaces exceeding the maximum allowed impervious surface under (c) Development of New Properties and restores those areas to a PICP surface at a 1 to 1 ratio.
 - ii. Applicant shall submit a comprehensive stormwater management plan that emphasizes infiltration and onsite retention of stormwater for at the [insert design storm event(s)]. This shall be achieved through a combination of structural BMPs such as PICP and buffer strips, swales, rainwater gardens, bioswales, and other low impact development methods. The stormwater management plan must be designed by a registered professional engineer or landscape architect and installed as designed by a qualified contractor.
- (4) One-hundred (100) percent of the total area covered by PICP designed to allow for infiltration of water into the soil subgrade may be considered pervious;
- (5) A survey shall be submitted showing calculations of the exact dimensions of all existing impervious surfaces and of the lot before and after completion of the project;
- (6) In replacing existing impervious surfaces with surfaces designed to be PICP, the applicant must give priority to replacing those surfaces closest to natural bodies of water (lakes, ponds,

rivers, streams or ocean) or those surfaces where the replacement is most likely to improve stormwater management;

(e) Streets and Access

- (1) PICP shall be considered a viable option for paving residential streets.
- (2) Street right-of-way widths shall be designed to reflect the minimum PICP required to accommodate the travel-way, parking lanes, sidewalks, and vegetated open channels.
- (3) PICP shall be considered a viable option for parking lanes on collector and thoroughfares.

(f) Parking Lots

- (1) Parking requirements shall be based on requirements described in (reference parking lot ordinance).
- (2) Parking lot designs shall reduce the overall impervious area by providing compact car spaces, minimizing stall dimensions, incorporating efficient parking lanes, and using PICP.

(g) Site Design

- (1) Direct rooftop runoff to PICP, open channels, or vegetated areas and avoid routing rooftop runoff to the roadway and to the stormwater conveyance system.
- (2) Create a variable width, naturally vegetated or permeable buffer system along all drainage ways that also encompasses critical environmental features such as the 100-year floodplain, steep slopes, and wetlands.
- (3) Minimize clearing and grading of woodlands and native vegetation to the minimum amount needed to build lots, allow access, and provide fire protection.
- (4) Conserve trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native plants.
- (5) Use PICP for paved areas and schedule installation to protect PICP from construction borne sediment.
- (6) Newly constructed stormwater outfalls to public waters must provide for filtering or settling of suspended solids and skimming of surface debris before discharge. PICP may be used as one method to achieve this requirement.

(h) Inspection and Maintenance Reporting

- (1) (Community) shall ensure that preventative maintenance is performed by inspecting PICP and all stormwater management systems draining into and from it.
- (2) Applicant shall provide an inspection plan and maintenance plan for PICP and other BMPs on the project site. Inspection reports shall be maintained by (community) for all stormwater management systems. Section(s) (___) provides inspection plans and maintenance requirements for other BMPs.
- (3) PICP inspection and maintenance shall include the items and intervals listed in the table below:

PICP Inspection and Maintenance Checklist	
Vacuum/sweep surface	Annually, based on sediment loading Power washing is not recommended.
Replenish aggregate in joints	As needed
Inspect vegetation and/or filter media around PICP perimeter for cover & soil stability	Annually, repair/replant as needed
Repair all surface deformations exceeding 1/2 in. (13 mm)	Annually, repair as needed
Repair pavers offset by more than 1/4 in. (6 mm) above/below adjacent units	Annually, repair as needed
Replace broken units impairing surface structural integrity	Annually, repair as needed
Check drainage inlets and outfalls for free flow of water & outflow and/or from observation well	Annually, after a major storm

- (4) Inspection reports for PICP and stormwater management systems shall include the following:
- i. The date of inspection;
 - ii. Name of inspector;
 - iii. The condition of PICP and systems draining into and from PICP as listed in the above table.

(h) Notification and Inspection

After notification is provided to the owner of any deficiencies discovered from an inspection of PICP, the owner shall have 30 days or other time frame mutually agreed to between (community) and the owner to correct the deficiencies. (Community) shall then conduct a subsequent inspection to ensure completion of the repairs.

(i) Applicability

(1) All development located within the jurisdiction of (community) must meet the minimum standards of this ordinance for PICP stormwater design.

(2) Any project in this jurisdiction which has obtained building permits on or before (date) shall be exempt from the requirements of this ordinance.

(k) This ordinance shall take effect and be in force from and after (date).