

The Eco-Stone® Family of Permeable Pavers Sales Training

Selling the Eco-Stone Family of
Permeable Pavements

What Do You Need to Know to Sell Eco-Stone?

- Reasons why permeable pavements are used
- Terms used in stormwater/green industry
- Types of projects suitable for using permeable interlocking concrete pavements
- Infiltration rate guidance
- Basic construction guidelines and materials
- Features and benefits of Eco-Stone
- Maintenance
- Research, references and referrals
- Frequently asked questions

Reasons Why Permeable Pavements are Used

- Permeable pavements are used for specific reasons
 - To meet stormwater objectives – examples include
 - Capture & infiltrate entire stormwater volume - zero runoff
 - Infiltrate the increased runoff generated by development & impervious surfaces
 - Infiltrate a fixed volume of runoff from storms – capture “first flush” – typically .75 in. to 1.5 in. (18-40mm)
 - Infiltrate sufficient volume of water to control peak rate of discharge to storm sewers

Reasons Why Permeable Pavements are Used

- Permeable pavements are used for specific reasons
 - To meet stormwater objectives – examples include
 - Treat runoff to remove a given percentage of pollutants – total suspended solids (TSS) & phosphorous
 - Reduce stream bank erosion and over-bank flooding
 - Maintain groundwater recharge rates
 - Get to know your local and state requirements for stormwater runoff management – these vary across the United States

Reasons Why Permeable Pavements are Used

- Permeable pavements are used for specific reasons
 - As part of LEED (Leadership in Energy & Environmental Design by the U.S. Green Building Council)
 - Is LEED point eligible under Sustainable Sites, Material & Resources, Water Efficiency and Innovation and Design Process credits
 - See UNI-GROUP U.S.A. Eco-Stone Guide & Research Manual, Eco-Stone Brochure and ICPI Tech-Spec 16

Reasons Why Permeable Pavements are Used

- Permeable pavements are used for specific reasons
 - As part of LID (Low Impact Development) and EPA Smart Growth Guidelines
 - Permeable pavements are recommended practices under these programs, which seek to control stormwater on site and promote infiltration
 - The Low Impact Development Center has issued four permeable paver fact sheets for municipalities, designers, developers and educational institutions
 - See UNI-GROUP U.S.A. Eco-Stone Guide and Eco-Stone Brochure

Reasons Why Permeable Pavements are Used

- Permeable pavements are used for specific reasons
 - As part of Green Building programs
 - Green Building is finally becoming more mainstream – NAHB has instituted a green building program nationwide and FHB has instituted a Green Building Initiative
 - Green Building research has demonstrated cost-effective benefits – saving energy and resources
 - Green Building is appealing to consumers

Terms Used in the Stormwater/Green Industries

- Familiarize yourself with terminology
 - **NPDES** – National Pollutant Discharge Elimination System by the EPA
 - This permit requires the control nonpoint source runoff through the use of a comprehensive stormwater management plan
 - Governing authorities (federal, state, or local level) must develop and implement strategies that include a combination of structural and non-structural **best management practices** (BMPs)
 - Eco-Stone is considered a structural BMP under infiltration practices

Terms Used in the Stormwater/Green Industries

- Familiarize yourself with terminology
 - **Nonpoint Source Pollution** – Caused by rainfall washing over impervious surfaces and carrying with it pollutants that end up in streams, lakes, and rivers
 - **TMDL (Total Maximum Daily Load)** – A new EPA standard that governing agencies must develop regarding maximum pollutant levels that are allowed in runoff
 - States will be developing new TMDL manuals
 - This will serve to further encourage the use of BMP practices to manage stormwater runoff

Terms Used in the Stormwater/Green Industries

- Familiarize yourself with terminology
 - LID – Low Impact Development
 - An approach to land development that uses various land planning & design practices for conserving natural resources, as well as reducing infrastructure costs
 - Major focus is on infiltration – keeping stormwater on site – and recharging groundwater
 - Permeable and porous pavements are recommended practices as they reduce impervious cover
 - Target – Developers, builders, architects/landscape architects, environmental engineering would all be involved in these types of projects

Terms Used in the Stormwater/Green Industries

- Familiarize yourself with terminology
 - LEED – Leadership in Energy & Environmental Design
 - Becoming increasingly popular
 - Commercial and institutional new and renovation construction
 - New standards for homes and “neighborhoods”
 - Many states and cities are adopting this green building assessment system, requiring new public construction meet LEED criteria
 - Target - Architects & Landscape Architects would be the major design professionals responsible for specifying products to meet LEED standards

Terms Used in the Stormwater/Green Industries

- Familiarize yourself with terminology
 - **Sustainable Design** – Meeting the needs of the present without compromising the needs of the future
 - Encompasses all types of construction – residential, commercial, municipal and even industrial
 - Uses practices that promote energy and resource conservation such as water-saving technologies (permeable pavements can recharge groundwater)

Terms Used in the Stormwater/Green Industries

- Familiarize yourself with terminology
 - **Impervious Cover** – Any surface in the built environment that prohibits infiltration of rainwater into the ground
 - Includes roofs and pavements, which take up a substantial portion of a property
 - Most “green” practices and stormwater management goals seek to reduce the amount of impervious cover in development projects of all types
 - The Eco-Stone Family of Permeable Pavers pavement surface is 100% pervious through the joints and/or openings and can infiltrate up to 100% of the rainfall depending on design storms

Types of Projects Suitable for Eco-Stone

- The Eco-Stone Family of Permeable Pavers can be used for a wide variety of projects
 - Commercial, Municipal, Institutional and Cultural Buildings and Parks – walks, parking lots, service areas, plazas, entry ways
 - Residential Buildings – walkways and driveways
 - Industrial sites that do not store hazardous materials – Ecoloc & Eco-Optiloc
 - Boat ramps and non-commercial boat landings

Types of Projects Suitable for Eco-Stone

- The Eco-Stone Family of Permeable Pavers can be used for a wide variety of projects
 - Storage areas for containers with non-hazardous contents
 - Impervious area that does not exceed five times the area of the permeable pavement
 - Sites where space limitations, high land prices, and/or runoff from additional development make permeable pavements a cost-effective solution

Types of Projects Suitable for Eco-Stone

- The Eco-Stone Family of Permeable Pavers can be used for a wide variety of projects
 - Design considerations for pedestrian & disabled persons
 - Currently the ADA requires pavements that are firm, stable & slip-resistant, which Eco-Stone and all other pavers meet
 - Studies have shown wheelchair-dependent persons may be sensitive to vibration and recommendations may be forthcoming to reduce both traditional and permeable paver chamfer widths
 - If concerned about permeable pavements in handicap areas or where pedestrians wear a lot of high heels – use regular pavers in these areas or use a paver such as Eco-Priora – designed with smaller joints to meet proposed ADA standards – however, there is some question whether the “filled” voids constitute an “opening” so they all may comply regardless

Types of Projects Not Suitable for Eco-Stone

- Eco-Stone should not be used for certain types of projects
 - Vehicle salvage yards, recycling & fueling facilities, equipment maintenance areas
 - Industrial facilities that produce or store hazardous materials
 - Storage areas for containers with contents that could damage groundwater or soil
 - Land uses that drain pesticides or fertilizers into permeable pavement

Infiltration Rate Guidance

- Most common error in designing permeable pavements
 - Assuming the amount or percentage of open surface area is equal to the percentage of perviousness
 - For example, an 18% open surface area is incorrectly assumed to be 18% pervious, or 82% impervious – this is often the case with municipalities
 - The amount of perviousness and amount of infiltration are not dependent on the percentage of open area, but on the infiltration rates of the joint and opening fill material, the bedding layer and base materials, and ultimately the subgrade
 - PICP is 100% pervious and can infiltrate up to 100% of runoff
 - Compared to existing soils, permeable pavements have much higher rates of infiltration – from 500 in./hr to 2,000 in./hr – these should be stressed not the open area

Infiltration Rate Guidance

- Despite high infiltration rates of the materials, a life-time, long-term design infiltration of the entire pavement system must be considered, including the subgrade
 - Research has shown infiltration rates level off as the pavements age, depending on level of intensity and use
 - A conservative design rate of 3 in./hr can be used as the basis for the design surface over a 20-year life given the variance in subgrade soil infiltration rates – this will accommodate most storms
 - With optimal construction and maintenance, longer-term infiltration rates of 50 in./hr (1270mm/hr) are possible
 - Research by Borgwardt has shown that even after 10 years without maintenance, PICP pavements infiltrated 16 in./hr

Construction Guidelines & Materials

- Current construction guidelines
 - Current standards are “nationwide” and were implemented for uniformity and also for ease of construction by contractors
 - These guidelines will vary depending on climate, design storms, amount of runoff entering system from adjacent impervious surfaces, and traffic load as well as local availability of aggregate materials used in the system

Construction Guidelines & Materials

- Current construction guidelines
 - Design of system changes depending on following:
 - Full Exfiltration – All water entering the system exfiltrates into the permeable subgrade
 - Partial Exfiltration – Where soils may not be able to accept full design storm, perforated pipe would be added
 - No Exfiltration – Where soils have low or no permeability and low strength, impermeable liners may be added and perforated pipe is used

Construction Guidelines & Materials

- Current construction guidelines
 - There are 4 situations where permeable pavements should not exfiltrate:
 - When depth from the bottom of the base to the high level of the water table is less than 2 ft or where there is not sufficient depth of soil to provide adequate filtering of pollutants
 - Directly over solid rock
 - Over aquifers with insufficient soil depth to filter pollutants
 - Over fill soils – when exposed to water may cause unacceptable performance

Construction Guidelines & Materials

- Current construction guidelines
 - ICPI recommends a subbase of ASTM No. 2 stone (open-graded aggregate 2.5 to $\frac{3}{4}$ in.) – thickness varies with design – minimum 6 in. for pedestrian traffic and 8 in. for vehicular – provides a stable platform for placing No. 57 base
 - 4 in. thick base of ASTM No. 57 (experienced contractors may choose to use No. 57 for the entire base/subbase)
 - 1 1/2-2 in. thick bedding layer of ASTM No. 8 which is also used for smaller openings and joints – Also can use No. 87, 89, 9 or 10 for smaller joints – though infiltration rates will be lower
 - Geotextiles may be required
 - These are guidelines – thicknesses and materials may be adjusted depending on climate, storms, traffic loads, and material availability

Construction Guidelines & Materials

- Current construction guidelines
 - If possible, subgrades should not be compacted, as compaction reduces infiltration
 - Base thicknesses can be increased to compensate for poorer site soils, and geotextiles can be used as well to increase structural stability
 - If soils are compacted, the reduced infiltration must be taken into consideration

Construction Guidelines & Materials

- Current construction guidelines
 - Interlocking permeable concrete pavements should be designed by engineers with experience in hydrology and hydraulics
 - Requires more initial design consideration – existing soil testing, rainfall and traffic data and more construction oversight

Features & Benefits of Eco-Stone

- Permeable interlocking concrete pavements function as an infiltration and retention area that allows for pedestrian and vehicular traffic
 - Allows for conservation of space and reduces impervious cover
 - Can reduce runoff by up to 100% from majority of most common design storms in the U.S.
 - Preserves natural open space otherwise used for retention & detention
 - Reduces water pollutants & improves water quality
 - Reduces runoff temperatures

Features & Benefits of Eco-Stone

- Permeable interlocking concrete pavements function as an infiltration and retention area that allows pedestrian & vehicular traffic
 - Reduces peak discharges and stress on storm sewers
 - Increases groundwater recharge
 - Reduces downstream flows and stream bank erosion
 - Reduces overall project development costs due to reduction in sewers and drainage appurtenances
 - Eliminates ponding and flooding in parking lots

Features & Benefits of Eco-Stone

- Permeable interlocking concrete pavements function as an infiltration and retention area that allows pedestrian & vehicular traffic
 - Reduces snow plow costs due to snow & ice melting and draining through surface
 - High-strength, low-absorption pavers resist freeze-thaw and heaving
 - Eligible for LEED credits
 - Ready for traffic immediately
 - May be placed over underground stormwater storage systems for rainwater harvesting for re-use

Features & Benefits of Eco-Stone

- Permeable interlocking concrete pavements function as an infiltration and retention area that allows pedestrian & vehicular traffic
 - Like traditional pavers, they allow for underground repairs
 - Can meet wide variety of stormwater management objectives
 - Recommended practice under EPA, LID, Smart Growth and Green Building

Maintenance of Eco-Stone

- Permeable interlocking concrete pavements can become clogged with sediment over time, slowing infiltration rates and decreasing storage capacity
 - Rate of sedimentation depends on level of traffic
 - Research has shown that periodic removal of sediment in the openings will increase surface infiltration rates
 - Vacuum-type street cleaning equipment without water spray are the most effective at removing sediment from the openings – suction adjustments can be made to prevent uptake of aggregate in the opening and joints
 - Frequency of cleaning depends on level of usage – usually once or twice a year – determine by inspection of ponding

Research, References & Referrals

- Permeable interlocking concrete pavement research is ongoing
 - Uni-Group U.S.A. has extensive research information on the Eco-Stone Family of Permeable Pavers
 - Many papers and articles are being written about all types of porous pavements and have contributed to the increasing interest in their use
 - Bruce Ferguson's Porous Pavement book may likely be used as a text book and provides detailed information on all types of porous pavements
 - If a customer asks a question you don't know the answer to, either contact us, or refer them to us

Available Tools for Selling Eco-Stone

- Uni-Group U.S.A. offers a number of tools for sales representatives
 - UNI-GROUP U.S.A. website
 - Updated with over 60 downloadable files
 - New products such as Eco-Optiloc and Eco-Priora
 - New Members-Only portion of site being updated
 - Eco-Stone Design Guide and Research Summary
 - Updated Eco-Stone Brochure
 - Eco Case Studies
 - Updated Eco PowerPoint Presentation
 - Staff at UNI-GROUP and F. von Langsdorff offices to answer questions from you or your design professionals and municipal officials

Frequently Asked Questions

- What type of questions can you expect from design professionals on Eco-Stone?
 - Can these pavers be snow-plowed?
 - Yes, as with traditional pavers, if properly installed, snow removal does not present a problem. Some municipalities set blow blades slightly higher when plowing pavers.
 - What is the percentage of open area?
 - Many municipalities use a “percentage of open area” to apply credits in meeting stormwater requirements. This is not an accurate indication of the perviousness of the system. For example Eco-Stone has a little over 12% open area. However, in many cases, it can infiltrate 100% of the runoff. Typical permeable pavements are designed to handle 75-80% of the storms common in the U.S., though they can be designed to handle larger storms. Infiltration ability is the key factor.

Frequently Asked Questions

- What type of questions can you expect from design professionals on Eco-Stone?
 - What type of base material should be used in permeable pavements?
 - Typically, open-graded aggregates are used in Eco-Stone pavements because they have a void space (for water storage) of 30-40%. Current guidelines call for a subbase of ASTM No. 2 or 3 aggregate, and a base of ASTM No. 57 aggregate, though No. 57 may be used for the entire base/subbase by experienced contractors.
 - In some areas, dense-graded aggregates have been used for added structural support and if design storms will support its use. Gradation of materials do vary widely and they may be applicable depending design storms for an area. This must be factored into the infiltration rate design however.

Frequently Asked Questions

- What type of questions can you expect from design professionals on Eco-Stone?
 - What type of drainage void material should be used in permeable pavements?
 - Typically, a coarse aggregate material meeting the grading requirements of ASTM No. 8, (approx. 2 to 6-7 mm gradation) is used in PICP for the bedding and joints/openings. This is much coarser than traditional joint and bedding sands. For PICP with smaller joints, aggregate material meeting the grading requirements of No. 87, 89, 9 or 10 may be used, though the finer gradations in these materials will reduce infiltration rates. See Borgwardt infiltration test rates for some of these materials in our Eco-Stone Guide and Research Summary.
 - Tests of the new Eco-Priora with No. 9 in the joints were just over 100 in./hr. This may vary, as Eco-Priora can be made with varying joint widths.

Frequently Asked Questions

- What type of questions can you expect from design professionals on Eco-Stone?
 - Can I get LEED credits for Eco-Stone?
 - Yes. Typically at least 5 LEED credits can be attained using Eco-Stone and more credits are possible. Refer to the Eco-Stone Guide and Research Summary, the UNI-GROUP website, or ICPI Tech Spec on LEED for more information.
 - Can permeable pavements be used in cold climates?
 - Yes. Ice and snow melting on the surface can drain into the base, reducing re-freezing and resultant slipping hazards. Bases are typically designed to drain within 24 hours, so it is unlikely ice will form in that time. If it does, the aggregate base materials will accommodate water expansion during freezing and minimize risk of heaving. Sand shouldn't be used on PICP surfaces, though a small aggregate (such as that used in the joints) may be used. Research has shown less deicing salt is needed as well.

Frequently Asked Questions

- What type of questions can you expect from design professionals on Eco-Stone?
 - Does Eco-Stone meet ADA requirements?
 - Yes. Currently ADA Design Guidelines only require that pavements be firm, stable and slip-resistant. If there is concern about the openings, solid pavers or ADA-compliant permeable pavers such as Eco-Priora may be used in areas used by disabled persons.
 - Wider walkways could include an area of solid pavers in the center, with permeable pavers along the sides to capture runoff.
 - What about high-heeled shoes?
 - The same advice above applies to high-heeled shoes. It is important to note that in both cases, the pavement should be monitored to ensure that the aggregate material completely fills the drainage openings. Some settling has been observed in PICPs after initial installation – check back to see if additional fill material is needed.

Frequently Asked Questions

- What type of questions can you expect from design professionals on Eco-Stone?
 - My area has a lot of clay soils. Can I still use Eco-Stone?
 - Yes. Infiltration rates of clay soil is usually low, however, perforated pipe can be incorporated to remove excess water. The pavement still provides filtering action to reduce pollutants and slows the rate of runoff entering into drainage systems.
 - Have there been any approvals of Eco-Stone by government agencies?
 - In many instances, they do not specifically approve proprietary products. However, a number of states and cities do list Eco-Stone specifically and porous or permeable pavements in general – see our website. If you know of a municipality or state that has approved PICP, please let us know.

Frequently Asked Questions

- What type of questions can you expect from design professionals on Eco-Stone?
 - How often does Eco-Stone pavements need to be cleaned?
 - Cleaning is usually done at least once per year, and is determined by the level of usage of the pavement. Vacuum cleaning equipment is recommended for best results and pavers should be swept/vacuumed dry. Particle size should be adjusted to prevent uptake of aggregate in the openings and joints.
 - Should an engineer be consulted on permeable paver projects?
 - Yes. It is recommended that engineers, design these types of systems to ensure that all project design parameters are met.

Frequently Asked Questions

- What type of questions can you expect from design professionals on Eco-Stone?
 - Will Eco-Stone qualify for credits in stormwater programs?
 - In most cases, yes. The amount of credit will vary, depending on how the governing agency classifies it. This should NOT be based on the Eco-Stone open area – but on the ability to infiltrate runoff. PCIP is typically designed to infiltrate 75-80% of the design storms in the U.S. However, depending on the design storm and construction of the system, PICP can infiltrate up to 100%.
 - The Rational Method coefficient of runoff (C value) is 0.00-0.30 – this number is significantly lower than impervious surfaces
 - The NRCS “curve number,” ranges from 45-80 depending on soil classification. By comparison, impervious asphalt is 95-98 for all soils.

Frequently Asked Questions

- What type of questions can you expect from design professionals on Eco-Stone?
 - Can the pavement be designed for use with water harvesting technologies or to collect and treat stormwater runoff?
 - Yes, the design of PICP is flexible and it can be designed in a number of ways – including incorporating water harvesting technologies for non-potable reuse of stormwater and using impermeable liners to capture infiltrated water and pipe it out for disposal or treatment. See the Eco-Stone Design Guide and Research Summary or the Eco-Stone Powerpoint presentation.

Frequently Asked Questions

- What type of questions can you expect from design professionals on Eco-Stone?
 - Are pavements that use sand between the joints, such as solid pavers, brick and stone permeable?
 - Not really. While a very small amount of water might infiltrate through the sand joints initially, they will quickly lock up. The Eco-Stone Family of Permeable Pavers uses much coarser aggregate in the drainage openings and joints to allow rapid infiltration of water.

Need Additional Help?

- Contact Harald von Langsdorff for sales training
 - Harald is available for sales training and other seminar presentations, as well as for design assistance on permeable and traditional paver projects. Contact him at 905-838-1980 or at harald@langsdorff.com.
- Contact Donna DeNinno for design assistance
 - Contact her at the UNI-GROUP U.S.A. office at 1-800-872-1864 or info@uni-groupusa.org.