Master Specification for
Aqua-Bric®, Eco-Stone® and Andover 5511
Permeable Interlocking Concrete Pavements
Section 32 14 13.19

Note: This guide specification describes construction of permeable interlocking concrete pavements. Permeable Design Pro software as well as the Interlocking Concrete Pavement Institute (ICPI) Permeable Pavement Manual-Fourth Edition and ICPI “Tech Spec” series are recommended for technical guidance. Notes are given on the use of a compacted aggregate base under the bedding stone and pavers. Permeable pavements involve analysis of the hydrological design requirements with regards to storm frequency, duration and intensity. This guide specification should be edited to fit specific project conditions and requirements. Pavements subject to vehicular traffic should be designed in consultation with a qualified civil or geotechnical engineer or landscape architect, in accordance with established flexible pavement design procedures.

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Concrete paver units.
B. Bedding/aperture/joint stone.

1.02 RELATED SECTIONS
A. Section: [   ] – Curbs and Drains.
B. Section: [   ] – Aggregate Base.
C. Section: [   ] – Pavements, Asphalt and Concrete.

1.03 REFERENCES
A. American Society of Testing and Materials (ASTM):
   3. C 140 - Sampling and Testing Concrete Masonry Units.
   4. C 936 - Specification for Solid Interlocking Concrete Paving Units.
   5. C 979 - Specification for Pigments for Integrally Colored Concrete.
   8. D 2940 - Graded Aggregate Material for Bases or Sub bases for Highways or Airports.

1.04 QUALITY ASSURANCE
A. Paver manufacturer shall be an ICPI Producer.
B. Installation shall be by a contractor and crew with at least five years’ experience in placing interlocking concrete pavers on projects of similar size and scope.
C. Contractor shall conform to all local, state/provincial licensing and bonding requirements and shall have attended the Pavers by Ideal Advanced Level Course on the Construction of Permeable Interlocking Concrete Pavements or be an ICPI Certified Contractor.

1.05 SUBMITTALS
A. Concrete paver manufacturer’s literature, product data and color chart.
B. Five full size samples to indicate color and texture.
C. Test results from an independent testing laboratory for compliance of paving unit requirements to ASTM C 936 and CSA A231.2-95 for resistance to freeze-thaw and or other applicable requirements.
D. Sieve analysis for grading of bedding/aperture/joint stone.

1.06 MOCK-UPS
A. Prior to starting the work, a 10 ft. x 10 ft. area shall be installed as described in Article 3.02.
B. This area will be used to determine surcharge of the bedding layer, joint sizes, lines, laying pattern(s), and the color(s), and texture of the pavers to be used on the project.
C. This area shall be the standard from which the work will be judged and shall be left undisturbed until the work is completed. Whenever possible, it shall be incorporated as part of the work.

1.07 STORAGE AND HANDLING
A. Protect concrete pavers and accessory materials during shipment, storage, and construction against staining and damage.
B. Cover aggregates with waterproof covering to prevent exposure to rainfall or removal by wind.
C. Coordinate delivery and paving schedule with other trades.

Pavers by Ideal® is a registered trademark of Ideal Concrete Block Company, Inc.
1.08 ENVIRONMENTAL CONDITIONS
A. Do not install bedding layer or pavers during heavy rain or snowfall.
B. Do not install bedding layer or pavers over frozen base materials.
C. Do not place pavers over frozen bedding aggregate.

PART 2 PRODUCTS

2.01 CONCRETE PAVERS
A. The pavers shall be manufactured by Ideal Concrete Block Company, Inc. PO Box 747, Westford, MA 01886 Phone: 781-894-3200 - Fax: 978-692-0817 - E-mail: info@IdealConcreteBlock.com or approved Interlocking Concrete Pavement Institute (ICPI) Producer.

B. The unit pavers for the field shall be:
1. Aqua-Bric® permeable pavers.
   a. The thickness shall be 6 cm.
   b. Overall dimension 4" x 8".
   c. The units shall possess 2mm chamfers around the top surface.
   d. The spacer bars shall be 4.5 mm.
   e. The units shall be molded with a notch in each corner to provide an overall void space not less than 9.5% per square foot.
   f. Color shall be ________________________________.

2. Aqua-Bric® IV permeable pavers.
   a. The thickness shall be 8 cm.
   b. The overall dimension of 4½" x 9".
   c. The units shall possess 2mm chamfers around the top surface.
   d. The spacer bars shall be 5 mm.
   e. The units shall be molded with a notch in each corner to provide an overall void space not less than 10.4% per square foot.
   f. Color shall be ________________________________.

3. Eco-Stone® permeable pavers.
   a. The thickness shall be 8 cm.
   b. The overall dimension of 4½" x 9".
   c. The apertures shall possess a void space not less than 12% per square foot.
   d. Color shall be ________________________________.

4. Andover 5511® permeable pavers.
   a. The thickness shall be 7 cm.
   b. The overall dimension of 5½" x 11".
   c. The apertures shall possess a void space not less than 7½ per square foot.
   Color shall be ________________________________.

C. Color shall match, within the sole discretion of the architect and/or owner, the samples selected for the project.

D. Pavers shall meet the following requirements set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units.
1. Minimum compressive strength of 8,000 psi with no individual unit less than 7,200 psi.
2. Maximum water absorption of 5% with no unit greater than 7% when tested in accordance with ASTM C140.
3. Freeze-thaw resistance according to ASTM C-936 section 5.5.

2.02 BEDDING/APERTURE/ JOINT AGGREGATE
A. EcoGrade Filtration Stone conforming to ASTM #9 clean graded stone shall be used to fill the apertures and joints.
B. ¾" stone conforming to ASTM #8 shall be used as the bedding course.
C. Stone shall be clean, washed crushed aggregate. It shall be non-plastic and free from deleterious or foreign matter. In no case shall the use of sand or limestone screenings be permitted.

2.03 EDGE RESTRAINTS
Note: See ICPI Tech Spec 3, “Edge Restraints for Interlocking Concrete Pavements,” for guidance with selecting edge restraints for various applications.

A. Edge restraints for Aqua-Bric shall be PaveEDGE®, SnapEdge®, granite, pre-cast concrete or existing structures.
B. Edge restraints for Aqua-Bric IV and Ecostone and pavements subject to heavy loads similar to AASHTO H20 loading shall be PaveEDGE® Industrial, granite or concrete curbing or existing structures.
2.04 BASE AGGREGATE

Note: Permeable interlocking concrete pavements require site specific design as determined by the structural and hydrological requirements of the pavement. In many cases, 1½” processed gravel aggregate conforming to ASTM D 2940 for highway flexible pavements is sufficient to accommodate the first flush and rainfall of a 2 year – 24 hour storm. Where greater infiltration capacity and storage is desired due to higher rainfall intensity, a 1½” open-graded aggregate similar to ASTM #467 is more appropriate. If ASTM #467 stone is not available, ASTM #57 stone may be used when the thickness of the base is not greater than 6”. For base thicknesses exceeding 6”, #57 stone should be used in combination with ASTM #2 stone where the #2 stone comprises the majority of the base thickness. (See Table Appendix for gradations and sizes.)

2.05 WOVEN GEOTEXTILE

A. Geotextile for use a soil separator shall be SRW Permeable 350 woven polypropylene fabric with a minimum Open Area of 6% to provide a Water Flow rate no less than 60 gpm/ft² in accordance with ASTM D 4491. Other geotextile shall be SRW SS5 woven polypropylene fabric with a minimum CBR puncture no less than 700 lbs per ASTM D 6241.

PART 3 EXECUTION

3.01 EXAMINATION

A. SUBGRADE

1. Verify that subgrade preparation, surface tolerances and compacted density conform to the specifications.

Note: The elevations and surface tolerances of the soil subgrade determine the final surface elevations of concrete pavers. The paver installation contractor cannot correct deficiencies excavation and grading of the soil subgrade with additional bedding materials. Therefore, the surface elevations of the soil subgrade should be checked and accepted by the General Contractor or designated party, with written certification presented to the paver installation subcontractor prior to starting work.

2. Verify that woven geotextile fabric has been placed according to specifications and drawings.

C. BASE

Thickness: For structural design the minimum thickness, over well-draining sub grade soils, is typically 6” to 8” for pedestrian use, 12” for vehicular traffic subject to passenger type vehicles and up to 18” for street and industrial pavements. Pavements subject to vehicular traffic should be designed in consultation with a qualified civil engineer, in accordance with established flexible pavement design procedures. Use of ICPI Permeable Design Pro or Lockpave Pro design software as well as the Interlocking Concrete Pavement Institute (ICPI) “Tech Spec” series are recommended for technical guidance.

The final thickness of the base also may be influenced by the hydrological requirements for the site. How much water will flow into the pavement system and what will be done with it once it enters the base layer must be determined. Factors such as: type of sub grade soil and its infiltration capacity, depth to bedrock and the depth of the seasonable high of the water table, must be considered to determine if the water can be allowed to soak into the sub grade soil or is it necessary to divert it to another location. In the case of the latter, it is necessary to install perforated drainage pipe. The condition of the site, such as the terrain, the area of impervious surfaces including structures, and location to wetland areas, are some other aspects that also must be evaluated.

1. Verify that aggregate base materials, thickness, compaction, surface tolerances, and elevations conform to specifications.
2. Recommended base surface tolerance should be +/- 3/8 in. (10 mm) over a 10 ft. (3 m) straight edge.
3. The base shall extend 6” beyond the area to be paved when using PVC edging or directly against curbing or suitable established structures.
4. Verify that base is dry, uniform, even, and ready to support stone, pavers, and imposed loads.
5. See ICPI Tech Spec 2, “Construction of Interlocking Concrete Pavements” for further guidance on construction practices.

D. EDGE RESTRAINTS

1. Verify location, type, installation and elevations of edge restraints around the perimeter area to be paved.

3.02 INSTALLATION

A. SUBGRADE: All organic or unsuitable material shall be removed. The soil shall be graded uniform and flat and, if required, compacted to the designated density. Geotextile fabric shall be extended up the sides of the excavated area. If used to stabilize the subgrade, geotextile fabric shall be rolled over the entire area overlapping all seams by no less than 24".
Pavers by Ideal® Master Specification for Permeable Interlocking Concrete Pavements

(Note: Except where the CBR is <5 avoid compacting subgrade with PICP installations whenever possible as compaction will reduce the permeability of soils. Consult engineer to determine if compaction is required. If deemed necessary, compact to a minimum of 95% standard Proctor density per ASTM D 698 or a 98% Modified Proctor density per ASTM D 1557 for areas subject to continual vehicular traffic. Reduced infiltration may require drain pipes within the open-graded base to conform to local storm drainage requirements.)

Note: When PICP pavement abuts an inhabited structure, install an impermeable liner against the building foundation.

B. BASE:
1. Compaction shall not be less than 95% Standard Proctor Density in accordance with ASTM D 698 for areas subject to pedestrian use only. All pavement subject to vehicular traffic shall be compacted to not less than 98% Modified Proctor density according to ASTM D 1557.
2. The base shall be placed in layers uniformly spread and compacted. For vehicular areas, the material shall be placed in 4" to 6" thick lifts and compacted using a plate rammer or smooth dual or single smooth drum, minimum 10 ton (10 T) vibratory roller or a minimum 13,500 lb. (60 kN) centrifugal force, reversible vibratory plate compactor that provides maximum compaction force without crushing the aggregate base.
3. Base material for pedestrian areas may be placed in 4" thick lifts and compacted using a plate compactor capable of exerting no less than a 10,000 lbs. force.
4. Areas not accessible to roller compaction equipment, compact to specified density with hand operated equipment.
5. Surface tolerance of the compacted #57 stone shall be +/- 3/4 in. (19 mm) over a 10 ft. (3 m) straightedge.

C. SETTING BED
1. Spread the bedding aggregate evenly over the base course and screed to a nominal 2 in. thickness.
2. Once screeded, the bedding material should not be disturbed or pre-compact.
3. Do not use the bedding aggregate to fill depressions in the base surface.

E. PAVERS
1. Insure that pavers are free of foreign material before installation.
2. Set concrete pavers in accordance with patterns shown on the drawings. Units shall be installed straight and true to the required lines with uniform joint spacing through-out. Maintain straight pattern lines.
3. Cut as necessary to accommodate field conditions and to achieve an accurate and consistent fit to pattern as indicated on plans and details. Concrete pavers shall be free from stain, dirt, or dust after cutting.
4. Install "soldier/sailor" course as shown on the Plans or fill gaps at the edges of the paved area with cut pavers indicated on plans and details. Concrete pavers shall be free from stain, dirt, or dust after cutting.
5. Work shall proceed by moving forward on top of the previously installed units. On sloped areas, work shall proceed uphill.
6. Pavers shall be taken from 3 or more pallets at the same time by working vertically through the cubes to blend color evenly. If necessary, redistribute units to achieve uniform color blending.
7. Care shall be taken when transporting material over uncompacted pavement in order to prevent damage or pre-compaction.
8. Fill the openings and joints with EcoGrade Filtration or ASTM #9 Stone into the joints and apertures.

Note: Units cut no smaller than one-third of a whole paver are recommended along edges subject to vehicular traffic

F. COMPACTION
1. Remove excess aggregate on the surface by sweeping pavers clean.
2. Compact and seat the pavers into the bedding material using a low-amplitude, 75-90 Hz plate compactor capable of at least 5,000 lb. (22 kN) centrifugal compaction force. This will require at least two passes with the plate compactor.
3. Replace broken or cracked pavers with new units to match adjoining pavers.
4. Compact the entire pavement in overlapping passes to insure the pavement surface is true to grade. Do not vibrate within 3 ft. of the unrestrained edges of the paving units.
5. Sweep additional EcoGrade Filtration Stone over the pavement surface and compact until the joints and apertures are completely full.
6. All work to within 3 ft. of the laying face must be left fully compacted with stone-filled joints at the end of each day.

G. COMPLETION
1. Sweep off excess filtration stone when the job is complete.
2. The final surface elevations shall not deviate more than 3/8 in. under a 10 ft. long straightedge.
3. The surface elevation of pavers shall be 1/8 in. to ¼ in. above adjacent drainage inlets, concrete collars or channels.

Note: The top surface of the pavers may be 1/8 in. to 1/4 in. (3 to 6 mm) above the final elevations after compaction. This difference in initial and final elevation is to compensate for minor settling during the initial lock-up period.
3.03 QUALITY CONTROL
A. After removal of excess stone, check final elevations for conformance to the drawings.
B. Replace pavers that are chipped, broken, stained, or otherwise damaged.
C. Clean exposed surfaces to remove asphalt, dirt and stains.
   i. If using a commercial cleaner, follow procedures recommended by chemical company and paver manufacturer.
   ii. Test small sample areas for acceptance of cleaning procedures.
   iii. Protect adjacent surfaces from damage during cleaning and operations.
   iv. After cleaning, examine work and repair unacceptable conditions and correct as required.

3.04 PROTECTION
A. After work in this section is complete, the General Contractor shall be responsible for protecting work from sediment deposition and damage due to subsequent construction activity on the site.
B. Keep the pavement free of construction debris and run-on from adjacent areas of exposed soil.
C. As included in the original bid price and with no additional compensation, PICP installation contractor shall return to site after 6 months from the completion of the work and provide the following as required:
   a. fill paver joints with stones
   b. replace broken or cracked pavers
   c. re-set units that have settled to initial elevations.

4. MAINTENANCE
Note: Proper design and installation, including the use of the correct aggregates to fill the voids, coupled with a scheduled maintenance program can prevent the loss of porosity over time. The frequency of cleaning is determined by rate of sedimentation which depends on the amount and type of traffic the pavement receives as well as the residue collected in the run-off. Periodic sweeping with street cleaning is recommended. Properly installed, Aqua-Bric, Eco-Stone and Andover 511 pavements can be plowed with conventional snow removal equipment. Blade height adjustment is not required. Use plow equipped with a polyurethane or rubber blade to avoid scratching the surface.
A. The pavement should be kept clean of leaves and debris. Use sand sparingly in the winter. When necessary to restore infiltration, sweep and clean the pavement with equipment similar to a Johnson 605 vacuum. Add additional Eco-Grade Filtration Stone as required to refill apertures in the pavement.
B. For commercial parking areas, the cleaning should be performed when porosity reaches a reduced level of ______%.
## Table Appendix

### Ideal Eco-Grade Filtration Stone: Joint/Void

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Nominal Opening in²</th>
<th>Percent Passing</th>
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<tbody>
<tr>
<td>No. 4</td>
<td>0.187</td>
<td>95 to 100</td>
</tr>
<tr>
<td>No. 8</td>
<td>0.0937</td>
<td>25 to 60</td>
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<tr>
<td>No. 16</td>
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<td>0 to 10</td>
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<tr>
<td>No. 100</td>
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### ASTM # 9 (1/4") Stone – Joint/Void

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<th>Sieve Size</th>
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<th>Percent Passing</th>
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<td>No. 4</td>
<td>0.187</td>
<td>85 to 100</td>
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<tr>
<td>No. 8</td>
<td>0.0937</td>
<td>10 to 30</td>
</tr>
<tr>
<td>No. 16</td>
<td>0.0469</td>
<td>0 to 10</td>
</tr>
<tr>
<td>No. 50</td>
<td>0.0117</td>
<td>0 to 5</td>
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### ASTM # 8 (3/8") Stone – Setting Bedding

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<td>0 to 10</td>
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<tr>
<td>No. 16</td>
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<td>0 to 5</td>
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### ASTM # 57 (3/4") Open Graded Stone – Base

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<td>0 to 10</td>
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<tr>
<td>No. 8</td>
<td>0.0937</td>
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### ASTM # 467 1½" Open Graded Stone – Base

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<td>¾&quot;</td>
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### ASTM # 2 (2½") Open Graded Stone – Base/Sub base

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<tr>
<td>¾&quot;</td>
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