



INTEPLAST GROUP
WORLD-PAK DIVISION

INSTALLATION SPECIFICATIONS FOR AQUAPERMTM PAVER

**Applicable to all AquaPermTM Permeable
Unit Paver Systems**

FOREWORD

These outline specifications have been prepared for the general guidance of architects, engineers, contractor and superintendents associated with the construction of permeable interlocking concrete pavements. A qualified engineer must determine the suitability of the design, confirm site conditions and monitor the installation in critical applications.

Introduction

AquaPerm Pavers are “Green” low environmental impact pavers designed and engineered to drain water, increase traction and enhance appearance. AquaPerm Pavers are manufactured from a proprietary process and are porous, extremely durable and have high strength. For use both indoors and outdoors, AquaPerm Pavers are water permeable, thereby preventing water from puddling. AquaPerm Pavers can be installed over most natural surfaces, such as compacted aggregates, asphalt, sand and cement.

Features

- Porous and water permeable, no “puddling”.
- Highly durable.
- High slip resistant, excellent traction under all conditions.
- No icy buildup. Typical pavement puddles when snow melts, the puddles then freeze again. With AquaPerm pavers, the melt water drains and does not refreeze on the surface.
- Qualifies for Credit 6-LEED: Limits disruption of natural water flows by minimizing storm water runoff.
- Qualifies for Credit 7-LEED: Reduces urban heat island effect by allowing water storage in the underneath soils and subsequent water evaporation to remove latent heat.
- Low heat conduction and accumulation. Walking barefoot on AquaPerm Pavers in the hot sunny days does not feel the scorching heat.

**SECTION 321443
POROUS UNIT PAVING**

PART 1 GENERAL

1.1. SECTION INCLUDES

- A. Porous Paver Unit
- B. Bedding aggregates
- C. Aggregate Base
- D. Edge Restraints

1.2. RELATED SECTIONS

Note: These related sections refer to standard specifications available from the local municipality or highway agency or from major specification writing agencies such as the Federal Highway Administration (FHWA), the National Stone Association (NSA), the American Concrete Pavement Association (ACPA), the National Asphalt Producers Association (NAPA), the National Institute of Building Sciences (NIBS), National Master Specifications (NMS), the American Society for Testing and Materials (ASTM), the Canadian Government Standards Board (CGSB), the Ontario Provincial Standard Specifications (OPSS), etc.

- A. Section: [-] - Curbs and Drains.
- B. Section: [-] - Aggregate Base.
- C. Section: [-] - Cement Treated Base.
- D. Section: [-] - Asphalt Treated Base.
- E. Section: [-] - Overlays of Asphalt and Concrete Pavements.
- F. Section: [-] - Roofing Materials.
- G. Section: [-] - Bitumen and Neoprene Setting Bed, Acrylic Fortified Mortar Setting Bed.
- H. Section: [-] - Geotextiles.
- I. Section: [-] - Unshrinkable Fill

1.3. REFERENCES

Note: Street, industrial, port and airport pavement thicknesses should be designed in consultation with a qualified civil engineer, in accordance with established flexible pavement design procedures. This specification may require modifications.

- A. American Society of Testing and Materials (ASTM) (latest edition):
 - 1. C 33 Specification for Concrete Aggregates.
 - 2. C 136 Method for Sieve Analysis for Fine and Coarse Aggregate.
 - 3. C 140 Sampling and Testing Concrete Masonry Units.
 - 4. C 144 Standard Specifications for Aggregate for Masonry Mortar.
 - 5. C 979 Specification for Pigments for Integrally Coloured Concrete.
 - 6. C1491 Standard Specifications for Concrete Roof Pavers.

7. D 698 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 5.5 lb (24.4 N) Rammer and 12 in. (305 mm) drop.
8. D 1557 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 10-lb (44.5 N) Rammer and 18 in. (457 mm) drop.
9. C 29 Bulk Density and Voids in Aggregate Materials.

Note: In order to determine the latest version of the listed specifications and standards, please consult the ASTM web page (www.astm.com)

1.4. QUALITY ASSURANCE

- A. Installation shall be by a contractor and crew with at least one year of experience in placing permeable concrete pavers on projects of similar size.
- B. The Contractor shall conform to all local, state/provincial licensing and bonding requirements.

1.5. SUBMITTALS

- A. Shop or product drawings and product data shall be submitted.
- B. Full size samples of permeable concrete paving units shall be submitted to indicate color and shape selections. Colours will be selected by Owner.
- C. Sieve analysis for grading of bedding and joint opening aggregates shall be submitted.
- D. The layout, pattern, and relationship of paving joints to fixtures and project formed details shall be indicated.

1.6. MOCK-UPS

- A. A 9 ft. x 9 ft. (2.5m x 2.5m) paver area shall be installed as described in Article 3.02.
- B. This area will be used to determine joint sizes, lines, laying pattern(s), color(s), and texture of the project.
- C. This area shall be the standard from which the work will be judged.

1.7. DELIVERY, STORAGE, AND HANDLING

- A. Concrete pavers shall be delivered to the site in steel banded, plastic banded, or plastic wrapped cubes capable of transfer by fork lift or clamp lift. The pavers shall be unloaded at the job site in such a manner that no damage occurs to the product.
- B. Delivery and paving schedules shall be coordinated in order to minimize interference with normal use of buildings adjacent to paving.

1.8. ENVIRONMENTAL CONDITIONS

- A. Do not install bedding aggregates or pavers during heavy rain or snowfall.
- B. Do not install bedding aggregates and pavers over frozen base materials.
- C. Do not install frozen bedding aggregates.

PART 2 MATERIALS

2.1. WATER PERMEABLE PAVERS

- A. Supplied by: Inteplast group, Ltd., which is located at: 9 Peach Tree Hill Road. Livingston, NJ07039; Toll Free 800-452-2117; Fax 800-889-8807; Email: AquaPerm@inteplast.com ; Web: www.inteplast.com
- B. Product name(s)/shape(s), color(s), overall dimensions, and thickness of the permeable paver(s) specified as follows:
- Product name: AquaPerm
- Product shape(s):
- Product color(s):
- C. Pavers shall meet the minimum material and physical properties set forth in the following.
1. Compressive strength with no individual unit under 5,000 psi (34.5 MPa).
 2. Absorption with no unit greater than 10% when tested according to ASTM C 140.
 3. Resistance to 50 freeze-thaw cycles, when tested according to ASTM C 67, with no breakage greater than 1.0% loss in dry weight of any individual unit. This test method shall be conducted not more than 12 months prior to delivery of units.
 4. Water permeability with no individual unit under 0.45 gallon/ ft²-min.
- D. Efflorescence shall not be a cause for rejection.
- E. Pigment in concrete pavers shall conform to ASTM C 979. ACI Report No. 212.3R provides guidance on the use of pigments.
- F. Maximum allows breakage of product is 5%.

2.2. GRANULAR SUBBASE

The granular subbase material shall consist of granular material graded in accordance with ASTM D 2940. The subbase thickness and specific aggregate gradation shall be determined by the Designing Engineer.

2.3. GRANULAR BASE

The granular base material shall be crushed stone conforming to ASTM C 33 No 57, as presented in Table 1. The granular base thickness and specific aggregate gradation shall be determined by the Designing Engineer.

**TABLE 1
GRANULAR BASE
GRADING REQUIREMENTS**

ASTM C 33 No 57	
Sieve Size	Percent Passing
1 ½ in (37.5 mm)	100
1 in (25 mm)	95 to 100
½ in (12.5 mm)	25 to 60
No. 4 (4.75 mm)	0 to 10
No. 8 (2.36 mm)	0 to 5

2.4. BEDDING AGGREGATES

A. The granular bedding material shall be graded in accordance with the requirements of ASTM D 33 No 8. The typical bedding thickness is between 1 ½ & 2 inches and the specific aggregate gradation shall be determined by the Designing Engineer.

Note: Aggregate materials used in the construction of permeable pavements shall be clean, have zero plasticity and contain no No. 200 sieve size materials. The aggregate materials must serve as the structural load bearing platform of the pavement as well as a temporary receptor for the infiltrated water that is collected through the openings in the pavement's surface.

B. The bedding aggregate shall conform to the grading requirements of ASTM C 33 No 8 as shown in Table 2.

**TABLE 2
BEDDING AGREGATE
GRADING REQUIREMENTS**

ASTM C 33 No 8	
Sieve Size	Percent Passing
½ in (12.5 mm)	100
3/8 in (9.5 mm)	85 to 100
No. 4 (4.75 mm)	10 to 30
No. 8 (2.36 mm)	0 to 10
No. 16 (1.18 mm)	0 to 5

2.5. EDGE RESTRAINTS

The provision of suitable edge restraints is critical to the satisfactory performance of interlocking concrete block pavement. The pavers must abut tightly against the restraints to prevent rotation under load and any consequent spreading of joints. The restraints must be sufficiently stable that, in addition to providing suitable edge support for the paver units, they are able to withstand the impact of temperature changes, vehicular traffic and/or snow removal equipment.

Curbs, gutters or curbed gutter, constructed to the dimensions of municipal standards (noting that these standards generally refer to cast-in-place concrete sections), are considered to be acceptable edge restraints for heavy duty installations.

Edge restraints shall be used along all unrestrained paver edges and supported on a minimum of 6 in. (150mm) of aggregate base.

PART 3 EXECUTIONS

3.1. EXAMINATION

A. Verify that subgrade preparation, compacted density and elevations conform to the specifications.

Note: For installation on a compacted aggregate base and soil subgrade, the designer should be aware that the top surface of the pavers may be 1/8 to 1/4 in. (3 to 6 mm) above the final elevation after compaction. This difference in initial and final elevation is to

compensate for possible minor settling.

Note: Compaction of the soil subgrade should be based on the recommendations of the Designing Engineer. The Architect/Engineer should inspect subgrade preparations, elevations and conduct density tests for conformance to specifications.

- B. Verify that geotextiles, if applicable, have been placed according to specifications and drawings.
- C. Verify that aggregate base materials, thickness, compaction, surface tolerances and elevations conform to the specifications.

Note: The aggregate base should be spread and compacted in uniform layers not exceeding 6 in. (150 mm) thickness. Recommended base surface tolerance should be plus or minus 3/8 in. (10 mm) over a 10 ft. (3 m) straight edge. The Architect/Engineer should inspect geotextile materials and placement (if applicable), base preparation, surface tolerances and elevations for conformance to specifications.

Note: Mechanical tampers (jumping jacks) are recommended for compaction of soil subgrade and aggregate base around lamp standards, utility structures, building edges, curbs, tree wells and other protrusions. Areas not accessible to roller compaction equipment should be compacted to the specified density with mechanical tampers. **CAUTION** - Care shall be taken around the perimeters of excavations, buildings, curbs, etc. These areas are especially prone to consolidation and settlement. Wedges of backfill should not be placed in these areas. If possible, backfilling and compacting in these areas particularly should proceed in shallow lifts, parallel to the finished surface.

- D. Verify the proper installation of the concrete curbing, in terms of location, elevation, and adherence to the specifications.
- E. Verify that the base is dry, uniform, even and ready to support bedding course aggregates, pavers and imposed loads.
- F. Beginning of bedding course aggregates and paver installation shall signify acceptance of the base and concrete curb edge restraints.

3.2. SITE PREPARATION

- A. The site must be stripped of all topsoil and other objectionable materials to the grades specified.
- B. All subdrainage of underground services within the pavement area must be completed in conjunction with subgrade preparation and before the commencement of subbase construction.
- C. After trimming to the grades specified, the pavement is to be proof rolled to a percentage of Standard Proctor Maximum Dry Density as specified by the Designing Engineering with soft spots or localized pockets of objectionable material excavated and properly replaced with approved granular material.
- D. The subgrade shall be trimmed to within 0 to 3/8 in. (0 to 10 mm) of the specified grades. The surface of the prepared subgrade shall not deviate by more than 3/8 in. (10 mm) from the bottom edge 39 in. (1 m) straight edge laid in any direction.
- E. The Contractor shall insure that the prepared subgrade is protected from damage from inundation by surface water. No traffic shall be allowed to cross the prepared subgrade. Repair of any damage resulting shall be the responsibility of the Contractor and shall be repaired.

- F. Under no circumstances shall further pavement construction proceed until the subgrade has been inspected by the Owner or the Consultant.

3.3. GRANULAR SUBBASE AND BASE INSTALLATION

- A. After proper construction of the concrete curb edge restraints for the water-permeable pavement as per Section 3.4, and upon approval by the Consultant, aggregate subbase (as specified in design) and base shall be placed in uniform lifts not exceeding 6 in (150 mm) loose thickness and roller compacted according to the AASHTO guidelines for installing open graded aggregates. Because the subbase and base are open graded aggregated materials, a method specification is appropriate for guidance in all aggregate compactive force.

Subbase thickness shall be: _____ in. (_____ mm).

Base thickness shall be: _____ in. (_____ mm).

- B. The granular base shall be trimmed to within to within 0 to 3/8 in. (0 to 10 mm) of the specified grade. The surface of the prepared base shall not deviate more than: (an example: 3/8 in. (10 mm) from the bottom edge of a 10 ft. (3 m) straight edge laid in any direction).

Note: The acceptable final base tolerances shall be determined by the Designing Engineer.

- C. Before commencing the placing of bedding aggregate course and the placement of the AquaPerm pavers, the base shall be inspected by the Owner or the Consultant.

3.4. EDGE RESTRAINTS

- A. Adequate concrete edge restraint shall be provided along the perimeter of all paving as specified. The face of the concrete edge restraint, where it abuts pavers, shall be vertical down to the subbase.
- B. All concrete edge restraints shall be constructed to dimensions and level specified and shall be supported on a compacted subbase not less than 6 in (150 mm) thick.
- C. Concrete used for the construction of the edge restraints shall be air-entrained and have a minimum compressive strength as specified. All concrete shall be in accordance with ASTM C 94 requirements.

3.5. PAVER INSTALLATION

- A. Spread the bedding aggregate evenly over the base course and screed to a nominal 1 ½ in. to 2 in. (28 mm to 51 mm) thickness. The bedding aggregate should not be disturbed. Place sufficient bedding aggregate to stay ahead of the laid pavers. Do not use the bedding aggregate to fill depressions in the base surface.
- B. Initiation of paver placement shall be deemed to represent acceptance of the pavers.
- C. Pavers shall be free of foreign material before installation.
- D. Pavers shall be inspected for color distribution and all chipped, damaged or discolored pavers shall be replaced. Maximum allow breakage as per 2.1, section F.
- E. The pavers shall be laid in pattern(s) as shown on the drawings.
- F. Joints between the pavers shall be maintained according to the spacer bars.

G. Gaps at the edges of the paved area shall be filled with cut pavers.

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

H. Pavers to be placed along the edge shall be cut with a masonry saw.

Note: The use of infill concrete or discontinuities in patterns will not be permitted except along the outer pavement boundaries, adjacent to drains and manholes.

I. Upon completion of cutting, the area must be swept clean of all debris to facilitate inspection and to ensure pavers are not damaged during compaction.

J. Low amplitude, high frequency plate compactor shall be used to compact the pavers.

Note: Use of a urethane plate compactor pad is recommended to minimise any scuffing of the paving stone surface.

K. The pavers shall be compacted and the bedding aggregates shall be swept into all joints until they are full. This will require at least two or three passes with the compactor. Do not compact within 3 ft. (1 m) of the unrestrained edges of the paving units.

L. All work to within 3 ft. (1 m) of the laying face must be left fully compacted at the completion of each day.

M. Excess surface bedding aggregates shall be swept off when the job is complete.

N. The final surface elevations shall not deviate, as an example, more than 3/8 in. (10 mm) under a 10 ft. (3 m) long straight edge. Acceptable surface elevation deviations shall be specified by the Designing Engineer.

O. The surface elevation of pavers shall be 1/8 to 1/4 in. (3 to 6 mm) above adjacent drainage inlets, concrete collars or channels.

3.6. FIELD QUALITY CONTROL

A. Final elevations shall be checked for conformance to the drawings after removal of excess jointing aggregate.

END OF SECTION