PERMEABLE ARTICULATING CONCRETE BLOCK/MAT (P-ACB/M) SPECIFICATION FOR PARKING LOTS, DRIVEWAYS, ALLEYS AND ROADWAYS

PART 1: GENERAL

A. Scope of Work

The contractor shall furnish all labor, materials, equipment, and incidentals required and perform all operations in connection with the installation of the Permeable Articulating Concrete Block/Mats (P-ACB/M) in accordance with the fines, grades, design and dimensions shown on the Contract Drawings and as specified herein.

B. Submittal

The contractor shall submit to the engineer all manufacturer's performance research results and calculations in support of the permeable articulating concrete block/mat (P-ACBM) system and geosynthetic proposed for use.

The contractor shall furnish manufacturer's certificates of compliance for the permeable articulating concrete blocks/mats, revetment cable, and any revetment cable fittings and connectors to the engineer prior to the start of mat fabrication.

The contractor shall furnish to the engineer all manufacturer's specifications, literature, shop drawings for the fabrication of the mats, and recommendations, if applicable, that are specifically related to this project, 14 days prior to assembly of the permeable articulating concrete block/mats.

PART 2: PRODUCTS

A. GENERAL

Permeable articulating concrete block/mats shall be premanufactured of individual concrete blocks with specific stormwater runoff capacities, bound into mats by the use of revetment cables. The mats shall arrive at the jobsite assembled according to lengths and widths as specified on the shop drawings.

Individual blocks in the articulating concrete mats shall be staggered, beveled, and interlocked for enhanced stability. The mats shall be constructed of closed cell blocks with an arched storage chamber for additional stormwater storage as shown on the contract drawings. Parallel strands of cable shall extend through two (2) ducts in each block in a manner which provides for longitudinal binding of the blocks within the mats. Each row of blocks shall be laterally offset by one-half block width from the adjacent row so that any given block is cabled to four other blocks (two in the row above and two in the row below). Six adjacent blocks shall also surround each block.

Each block shall incorporate interlocking surfaces that prevent lateral displacement of the blocks within the mats when they are lifted by the longitudinal revetment cables. The interlocking surfaces must not protrude beyond the perimeter of the blocks to such an extent that they reduce the flexibility or articulating capability of the articulating concrete mats or become damaged or broken when the mats are lifted during shipment or placement. Once the mats are in place, the interlocking surfaces shall prevent the lateral displacement of the blocks even if the cables should become damaged or removed. The mats must be able to flex a minimum of 10 degrees between any given row and column of blocks in the uplift direction.

The cables shall be inserted into the mats in such a manner to form lifting loops at one end of the mat with the corresponding cable ends spliced together to form a lifting loop at the other end of the mat with sleeves approved by the engineer.

Infiltration Performance: The P-ACB/M will only be accepted when accompanied by documented third party surface infiltration performance characteristics based on ASTM C1701/C1701M-09. The surface infiltration rate shall be no less than 4,000 inches per hour on an outdoor working surface, with typical base material utilized for the test.

Structural Performance: The design of the P-ACB/M shall be capable of supporting AASHTO HS-20 and H-20 truck loading. The blocks should be analyzed as unreinforced concrete arches supporting a uniform truck tire load with impact per AASHTO standards. *As with all vehicular traffic paving systems, the subgrade soil, geosynthetic and base preperation for the P-ACB/M must be properly designed and prepared. This is critical to the performance of the system.*

B. Cellular Concrete Blocks

1. Materials

1.1 Cementitious Materials – Materials shall conform to the following applicable ASTM specifications:

1.1.1 Portland Cements - Specification C 150, for Portland Cement.

1.1.2 Blended Cements - Specification C 595, for Blended Hydraulic Cements.

1.1.3 Hydrated Lime Types - Specification C 207, for Hydrated Lime Types.

1.1.4 Pozzolans - Specifications C 618, for Fly Ash and Raw or Calcinated Natural Pozzolans for use in Portland Cement Concrete.

1.2 Aggregates shall conform to the following ASTM specifications, except that grading requirements shall not necessarily apply:

1.2.1 Normal Weight - Specification C 33, for Concrete Aggregates.

2. Physical Requirements

2.1 At the time of delivery to the work site, the units shall conform to the physical requirements of ASTM D 6684-04 as prescribed below.

TABLE 1. PHYSICAL CHARACTERISTICS

Compressive Strength (average of 3 units)

- Min. psi = 4,000, mpa = 27.6

Water Absorption (average of 3 units)

- Max. lb/ft^3 = 10, kg/m^3 = 160

3. Visual Inspection

3.1 All units shall be sound and free of defects that would interfere with the proper placing of the unit or impair the strength or permanence of the construction. Surface cracks incidental to the usual methods of manufacture, or surface chipping resulting from customary methods of handling in shipment and delivery, shall not be deemed grounds for rejection.

3.2 Cracks exceeding 0.25 inches in width and/or 1.0 inch in depth shall be deemed grounds for rejection.

3.4 Blocks rejected prior to delivery from the point of manufacture shall be replaced at the manufacturer's expense. Blocks rejected at the job site shall be replaced at the expense of the contractor.

4. Sampling and Testing

4.1 The purchaser or his authorized representative shall be accorded proper access to the manufacturer to inspect and sample the permeable concrete blocks at the place of manufacture from lots ready for delivery.

5. Expense of Tests

Additional testing, other than that provided by the manufacturer, shall be borne by the purchaser.

6. **Manufacturer**

The permable articulating concrete block mat shall be PaveDrain® or pre-approved equal, as represented by:

NATIONALLY
PaveDrain, LLC
PMB 292 – 7245 S. 76th St.
Franklin, WI 53132-9041
PH. (414) 423-6531
info@pavedrain.com
www.pavedrain.com

The **PaveDrain^{R}** permeable articulating concrete mats shall have the following nominal characteristics as identified on the plans.

TABLE 2. STANDARD SIZES AND WEIGHTS OF *PaveDrain^{R}* PERMEABLE ARTICULATING CONCRETE BLOCK/MATS

CLASS	TYPE	BLOCK WEIGHT Lbs./Sq.Ft.	BLOCK SIZE (in.) Length	Width	Height	STORAGE CHAMBER Volume (in.)
S6-45	Closed	42-48	11.9	12.00	5.65	1.0

C. Revetment Cable and Fittings

Polyester Revetment Cable and fittings. Revetment cable shall be constructed of high tenacity, low elongating, continuous filament polyester fibers. Cable shall consist of a core construction comprised of parallel fibers contained within an outer jacket or cover. The weight of the parallel core shall be between 65% to 70% of the total weight of the cable. The revetment cable shall have the following physical characteristics listed below.

Nominal Cable Diam. - Circum.	Approx. Ave. Strength Lbs.	Weight/100 ft. Min. lbs.	Max Lbs.
1/4" - 20mm	3,700	2.47	2.74
5/16" - 27mm	7,000	3.99	4.42
3/8" - 30mm	10,000	4.75	5.26
1/2" - 40mm	15,000	8.93	9.90

NOTE: Polyester cable shall be determined by the supplier, based on the size of the mats to be placed.

Elongation requirements specified below are based upon stabilized new, dry, cable. Stabilization refers to a process in which the cable is cycled fifty (50) times between a load corresponding to $200D^2$ and a load equal to 10%, 20%, or 30% of the cables approximate average breaking strength. Relevant elongation values are as shown in the table below. The tolerance on the values is $\pm$ 5%.

	% Breaking Strength		
	10%	20%	30%
Permanent Elongation (while working)	0.7	1.8	2.6
Elastic Elongation	0.6	1.4	2.2
Total Stretch	1.3	3.2	4.8

The revetment cable shall exhibit good to excellent resistance to most concentrated acids, alkalis, and solvents. Cable shall be impervious to rot, mildew and degradation. The materials used in the construction of the cable shall not be affected by continuous immersion in stormwater runoff.

Selection of cable and fittings shall be made in a manner that insures a safe design factor for mats being lifted form both ends, thereby forming a catenary. Consideration shall be taken for the bending of the cables around hooks or pins during lifting. Revetment cable splicing fittings shall be selected so that the resultant splice shall provide a minimum of 60% of the minimum rated cable strength. Fittings such as sleeves and stops shall be aluminum and washers shall be galvanized steel unless otherwise shown on the Contract Drawings.

D. Size of Permeable Articulating Concrete Block/Mats

If the permeable articulating concrete blocks/mats cables and fittings are fabricated at the manufacturer or another approved location into mats with a width of up to eight (8) feet and a length of up to thirty-six (36) feet or approved by the Engineer.

PART 3: FOUNDATION PREPARATION AND MAT INSTALLATION

A. Foundation and Preparation

General. Areas on which permeable articulating concrete block/mats are to be placed shall be constructed to the lines and grades shown on the Contract Drawings and to the tolerances specified in the Contract Documents, and approved by the Engineer.

Grading. The aggregate bedding layer shall be graded to a smooth plane surface to ensure intimate contact is achieved between the legs of the permeable articulating concrete block/mats and the aggregate bedding layer. A small plate compactor is recommended.

Inspection. Immediately prior to placing the permeable articulating concrete block/ mats the prepared area shall be inspected by the Engineer, the owner's representative, and or by the manufacturer's representative. No blocks/mats shall be placed thereon until that area has been approved by one of these parties.

C. Placement of Permeable Articulating Concrete Blocks/Mats

General. Permeable articulating concrete block/mats, shall be constructed within the specified lines and grades shown on the contract drawings.

Placement. The permeable articulating concrete block/mats shall be placed on the aggregate bedding layer so as to produce a smooth plane surface. No individual block within the plane of placed articulating concrete mats shall protrude more than one-quarter inch of an inch or as otherwise specified by the Engineer.

If installed in mats the permeable articulating concrete block/mats shall be attached to a spreader bar or other conventional device to aid in the lifting and placing of the mats in their proper position by the use of a crane or other approved equipment. The equipment used should be adequate capacity to place the mats without bumping, dragging, or otherwise damaging the aggregate bedding layer. The mats shall be “zippered” together forming a seamless mat to mat connnection.

Consultation. The manufacturer or representative of the permeable articulating concrete blocks/mats shall provide design and construction advice during the design and installation phases of the project.

FINISHING. The joints between the P-ACB/M do not require backfilling with smaller aggregates or sand in order to function properly. The joints are meant to be left open.