

SPECIFICATIONS
FOR

CHANNEL LOCK II™
FLEXIBLE REVETMENT SYSTEM

WITH
POLYESTER REVETMENT CABLES

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FOR
EROSION CONTROL**

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PART 1 - GENERAL

1.1 SCOPE OF WORK:

This item consists of furnishing and installing an interlocking flexible revetment system (cellular concrete blocks) in accordance with the lines, grades, design and dimensions shown on the plan and drawings and specified herein.

1.2 REFERENCES:

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designations only.

American Society for Testing and Materials (ASTM) Publications.

<u>ASTM C 33-97</u>	Concrete Aggregates
<u>ASTM C 140-91</u>	Sampling and Testing Concrete Masonry Units
<u>ASTM D 4268-93</u>	Testing Fiber ropes

US Federal Highway Administration (FHWA) and US Bureau of Reclamation (USBR)

<u>FHWA RD-89-199</u>	Hydraulic Stability of Articulated Concrete Block Revetment Systems During Overtopping Flow.
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1.3 DELIVERY, STORAGE AND HANDLING OF MATERIALS:

Materials delivered to the site shall be inspected for damage, unloaded and stored with the minimum of handling. Contractor may designate a storage site at the project for materials to be delivered and stored prior to placement if needed. Storage site to be approved by the Contracting Officer, if necessary. Materials shall not be stored directly on the ground and shall be kept free of dirt and debris. Materials shall be so handled as to ensure delivery to the site in sound undamaged condition. Synthetic geotextiles that are not to be installed immediately shall be protected from the direct sunlight and in accordance with the applicable portions of the SECTION entitled GEOTEXTILES.

1.4 MEASUREMENT:

Unit of measurement for the cellular concrete blocks shall be by the square foot of surface area satisfactorily covered with the cellular concrete blocks.

1.5 PAYMENT:

Unit of payment for acceptable cellular concrete blocks placed will be made at the contract unit price per square foot for "cellular concrete blocks", which price shall include costs of furnishing, hauling and placing the cellular concrete blocks with cables.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA:

The interlocking flexible revetment system shall be as described herein known as Channel Lock II or an approved equal. Hydraulic test data and block performance according to FHWA-RD-89-199 will be required to be submitted for approval by the Contracting Officer. The concrete blocks shall be a minimum of 4.50” Thick, have a Net Weight/Area of 36 lbs. PSF for the open cell blocks and shall withstand water flow velocities of 26.1 FPS and critical shear stress (at horizontal) of 31.8 lbs. PSF on a 1V:2H slope in direction of flow.

2.2 CELLULAR CONCRETE BLOCKS:

The cellular concrete blocks shall be octagonal shaped with interlocking components four directional within a 15” module. Each component shall resist horizontal movement when interlocked into adjacent blocks. (Interlock is hereby defined as the inability to pull apart or separate when one component is placed in conjunction with another component). The assembled blocks shall be the open-cell type and have a void space of approximately 24% to allow for re-vegetation. Maximum water absorption shall be 7%.

2.21 Concrete Materials:

The compressive strength of the concrete shall be a minimum of 4000 PSI at 28 days. The core compressive strength shall not be less than the minimum and test cores shall be tested at the engineer’s option. Test procedures shall be in accordance with ASTM C 140-91. Cores failing to meet the minimum compressive strength requirements shall be cause for rejection of the represented lot by the engineer.

2.22 Aggregate:

The aggregate shall meet the requirements of ASTM C 33-97, except for grading. Aggregate grading shall be reasonably consistent and shall be well-graded from the maximum size which can be conveniently handled with available equipment

2.3 CELLULAR CONCRETE BLOCKS WITH CABLES:

The cellular concrete blocks shall have cables and shall be installed as an assembly of concrete blocks connected by the use of revetment cables. The cables will extend through 2 or more tunnels within the blocks to bind the mattresses in both the longitudinal and lateral directions. Cable shall conform to ASTM D 4268-93.

2.4 CABLE REQUIREMENTS:

Cable shall be constructed of high tenacity, low elongation and continuous filament polyester fibers. Cables 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 percent of the total weight of the cable. The revetment cable shall have the following minimum physical properties:

Nominal Cable Diameter:	20 mm
Approximate Strength Lbs.	3,700
Weight	Yield – 41.3 ft/lb.

2.41 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 associated with marine organisms. The materials used in the construction shall not be affected by continuous immersion in fresh or salt water.

2.42 Selection of cable and fittings shall ensure a safe design factor for mattresses being lifted from 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 result splice shall provide a minimum of 75 percent of the minimum rated cable strength. Fittings such as sleeves, stops and washers shall be in accordance with manufacturer's recommendations unless otherwise shown.

2.43 Elongation Requirements:

Requirements listed below are based upon stabilized new and dry cable. The tolerance of these values is plus or minus 5 percent.

	% Breaking Strength		
	<u>10%</u>	<u>20%</u>	<u>30%</u>
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

2.5 **FILTER FABRIC:**

The filter fabric used for cellular concrete blocks shall be in accordance with the SECTION entitled GEOTEXTILES.

PART 3 - EXECUTION

3.1 **FOUNDATION PREPARATION:**

Areas on which filter fabric and cellular concrete blocks are to be placed shall be constructed to the lines and grades shown. The subgrade for the cellular concrete blocks shall be free of voids, pits and depressions. Voids, pits and depressions shall be brought to grade by backfilling in accordance with the applicable portions of the SECTION entitled STRIPPING, EXCAVATION, FILLING AND BACKFILLING. Obstructions, such as roots and projecting stones larger than 1 inch remaining on the surface, shall be removed and the soft or low density pockets of material removed shall be filled with selected material and compacted to a minimum of 90% proctor density.

3.12 Perimeter:

Excavation and preparation for anchor trenches, side trenches, toe trenches and aprons shall be done in accordance to the lines, grades and dimensions shown on the plans.

3.13 Inspection:

Immediately prior to placing the filter fabric and cellular concrete blocks, the prepared area shall be inspected by the Contractor and approved before the fabric or blocks are placed thereon.

3.2 **INSTALLATION OF CELLULAR CONCRETE MATTRESSES:**

3.21 Filter Fabric:

Placement of filter fabric shall be installed in accordance with the SECTION entitled GEOTEXTILES USED AS FILTERS and as stated herein.

3.22 Placement of Cellular Concrete Mats:

Cellular concrete mats shall be placed within the limits shown. The blocks shall be interlocked in a manner which discourages any vertical displacement or horizontal movement. The cellular concrete mats shall be placed on the filter fabric in such a manner as to produce a level surface. Individual blocks which are hand installed and hand threaded cables shall be installed according to manufacturer's recommendations. No more than 200 linear feet of filter fabric shall be laid before covered with concrete blocks. Fabric installed more than two (2) days not covered by blocks shall be lifted and the surface of the slope inspected for slope defects. The Contracting Officer will require uncovered fabric to be lifted after heavy rainfall to inspect for slope damage. The manufacturer, Contractor and Client shall discuss subgrade preparation, geotextile and cellular block placement at the pre-construction meeting to ensure that all parties are aware of the issues regarding installation. The manufacturer of the cellular concrete mats shall be present during the first week of block placement to assist the Contractor. The Contractor shall furnish a certificate from the manufacturer or an authorized representative thereof stating that the blocks were installed correctly. Final acceptance and approval of the installation will be made by the Contracting officer.

3.23 Quality Control:

Equipment shall be minimized on the installed concrete blocks until backfill or topsoil is placed over the revetment system to refrain from breaking or damaging any blocks. Any blocks broken or damaged shall be repaired prior to final inspections.

3.24 Grouting:

Any areas where there are partial blocks (to avoid small blocks with reduced hydraulic stability) shall be grouted. Joints where block interlock is discontinuous shall be grouted. Field placed grout shall be non-shrink and have a compressive strength of 4,000 psi, the durability properties of the ACBM concrete, and shall meet the ACBM manufacturer's requirements. All cable ties and anchoring shall be completed prior to placing the grout.

3.3 **FINISHING:**

3.41 The voids of the cellular concrete blocks for the limits shown shall be filled with gravel or topsoil per the specifications. At no time shall more than 500 lineal feet of blocks be exposed not backfilled. Prior to backfill, the blocks surface shall be inspected for damage. Individual blocks which are cracked and reduce the individual block weight to 1/3 shall be replaced prior to the placement of backfill.

3.4 **CONTRACTOR QUALITY CONTROL:**

The Contractor shall inspect for compliance with contract requirements and record the inspection of operations including but not limited to the following as applicable:

- (1) Preparation of surface to receive cellular concrete blocks or mattresses
- (2) Individual concrete blocks and filter fabric soundness and free of defects
- (3) Cables and fittings - breaking strength
- (4) Assembly of cellular concrete blocks bound by cables to form cellular concrete mattresses
- (5) Placement of blocks or mattresses and filter fabric on the prepared subgrade