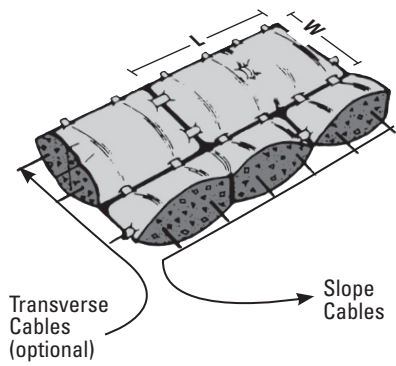




The FABRIFORM® Process utilizes a double-layer, 100% nylon fabric form, especially woven for optimum strength, stability, adhesion, and filtering characteristics, combined with a highly fluid fine aggregate concrete (grout) to provide an economical hard armor solution for erosion control. Fabriform revetments can be cast underwater as well as in-the-dry.

## Fabriform® Articulating Block Technical Data

DESIGNS BASED ON OVER 40 YEARS OF EXPERIENCE

	Designation Style	CAST-IN-PLACE							
		Block Size (LxW)*		Average Thickness**		Coverage Per		Dry Weight***	
		in.	mm	in.	mm	Y <sup>3</sup> Mortar	M <sup>3</sup> Mortar	lb / ft <sup>2</sup>	kg / m <sup>2</sup>
4" ABNN	20 x 12	500 x 300	4	100	75 ft <sup>2</sup>	9.11 m <sup>2</sup>	45	220	
6" ABNN	20 x 20	500 x 500	6	150	50 ft <sup>2</sup>	6.07 m <sup>2</sup>	68	330	
8" ABNN	40 x 24	1000 x 610	8	200	38 ft <sup>2</sup>	4.55 m <sup>2</sup>	90	440	
10" ABNN	40 x 30	1000 x 750	10	250	31 ft <sup>2</sup>	3.76 m <sup>2</sup>	113	550	
12" ABNN	40 x 40	1000 x 1000	12	300	25 ft <sup>2</sup>	3.03 m <sup>2</sup>	135	660	

\* Dimensions shown are nominal net cast-in-place block sizes, without articulating hinges. Articulating hinges are approximately 1.5" (37.5 mm) wide and provide relief for hydrostatic pressures.

\*\* Nominal; maximum thickness of blocks will be greater.

\*\*\* Dry Weight based on a specific weight of 2.1 or 135 lb/cf. Unit Weight may vary with material proportions and source.

Articulating Block (AB) revetment fabric is a form for casting in place heavy-duty, rectangular concrete blocks in a staggered joint pattern. AB revetments may be reinforced by cables inserted between the two layers of fabric prior to fine aggregate concrete (grout) injection. Reinforcing cables interlock the cast-in-place concrete blocks when the AB revetment articulates due to changing soil and water conditions. Un-reinforced AB revetments should only be used where minimal settlement is anticipated and a high coefficient of hydraulic friction is required.

AB revetment fabrics are a woven, double-layered fabric of 100% high-tenacity, multifilament nylon of which at least 50% by weight consists of textured fibers for optimum filtering characteristics and adhesion to the grout. Nylon yarns also provide a relatively high resistance to ultraviolet light and alkali degradation. Block thickness is controlled by spacer cords in the middle of each block. Lateral flow of grout is controlled by shop-installed bulk-heads (grout stops) located at predetermined intervals as required.

The AB revetment fabric is shop-assembled in predetermined panel sizes to fit site topography. The panels are convenient to handle and are joined together side-by-side at the job site by means of sewing or zipper closures attached to both the upper and lower layers of fabric. Reinforcing cables, which are installed perpendicular to block length, are referred to as "slope cables." Transverse cables, parallel to block length, may also be inserted if required. Final selection of cable(s) for each job is at the discretion of the Engineer (Designer).

The panels will contract when they are injected with grout. Allowance must be made for this contraction when preparing shop drawings of panel assemblies. Contraction will vary with site conditions. For budgetary estimates, a minimum contraction allowance should be made for approximately 23% additional fabric to cover the cast-in-place area.

### NOTE:

Information contained in this publication is offered in good faith as a guide to placement of Fabriform® erosion control revetments. It is based on experience obtained under a variety of conditions. However, information contained herein will not apply to every job and dimensions and quantities shown are approximate only and will vary as a result of site conditions and installation procedures. The user is cautioned to obtain from others such professional and technical services as may, in his own judgment, be necessary or desirable to insure effective and economical installations.

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# Guide Specifications: Fabriform® Articulating Block Fabric and Revetment Installation

PAGE 2 OF 4

## I. GENERAL

### A. Scope of Work

The work shall consist of furnishing all labor, materials, and equipment for installing fabric-formed concrete revetment as indicated in the contract drawings and specified herein.

### B. Description

The work shall consist of installing a reinforced (or un-reinforced) concrete revetment, as indicated in the contract drawings, by positioning a specially woven, dual wall, 100% nylon fabric form on the slope or surface to be protected and injecting it with fine aggregate concrete (grout). The surfaces to be protected shall be prepared and graded to such an extent that they are normally stable in the absence of erosive forces.

### C. Qualification of Contractor

The Contractor shall furnish records of past successful experience in performing this type of work. The Contractor shall save the Owner harmless from liability of any kind arising from the use of any patented or unpatented invention in the performance of this work.

## II. MATERIALS

### A. Fiber and Fabric Specifications

Fiber and fabric materials shall meet the minimum requirements, as listed and reported by an independent testing agency, shown below:

PROPERTY	TEST METHOD	UNIT	VALUE
<b>PHYSICAL</b>			
Composition			NYLON
Weight (both layers)	ASTM D-5261	oz/yd (g/m)	13 (440)
Thickness	ASTM D-5199	mils (mm)	30 (0.76)
<b>MECHANICAL</b>			
Grab Tensile Strength	ASTM D-4632	lbf (N)	WARP 400 (1780)
			FILL 350 (1550)
Grab Tensile Elongation	ASTM D-4632	%	WARP 30
			FILL 30
Wide Width Strip Tensile Strength	ASTM D-4595	lbf/in (kN/m)	WARP 300 (52.5)
			FILL 275 (48)
Elongation At Break	ASTM D-4595	%	WARP 15
			FILL 15
Trapezoidal Tear Strength	ASTM D-4533	lbf (N)	WARP 170 (750)
			FILL 170 (750)
<b>HYDRAULIC</b>			
Apparent Opening Size (AOS)	ASTM D 4751	U.S. Standard (mm)	40 (0.425)
Flow Rate	ASTM D-4491	gal/min/sf (l/min/m)	90 (3665)

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# Guide Specifications: Fabriform® Articulating Block Fabric and Revetment Installation

PAGE 3 OF 4

## B. Fabric Design

Fabric-forming material shall consist of double-layer, open-selvage fabric joined in a mat configuration. Fabric shall be woven of 100% high-tenacity, continuous multifilament nylon of which at least 50% by weight shall be textured fiber. Polyester, staple, and partially orientated yarn shall not be allowed. The tensile strength of spacer cords used to control block thickness shall total not less than 600 lbs (2.7kN) at each section of control.

Fabric, designated as \_\_\_\_\_ ABNN on the drawings, shall be woven in such a manner as to provide articulation joints, surrounding fine aggregate concrete-filled blocks measuring approximately \_\_\_\_\_" x \_\_\_\_\_" x \_\_\_\_\_". (See Note 1 below.) Block thickness shall be measured as described in Section III.D of this specification.

*NOTE 1: Designer will indicate here the fabric designation required from choice of fabric styles listed below. Fabric style designates approximate nominal thickness and size:*

*4" ABNN – 4" x 20" x 12" (100mm x 500mm x 300mm); 6" ABNN – 6" x 20" x 20" (150mm x 500mm x 500mm);*

*8" ABNN – 8" x 40" x 24" (200mm x 1,000mm x 610mm); 10" ABNN – 10" x 40" x 30" (250mm x 1,000mm x 750mm);*

*12" ABNN – 12" x 40" x 40" (300mm x 1,000mm x 1,000mm)*

The two layers of fabric shall be connected at the center of each block with spacer cords of such a length as to positively control thickness of the finished block and to produce a pronounced corrugation in the surface of the form, when filled, to serve as evidence of complete and uniform filling of the fabric block form. Articulation joints between adjacent blocks shall be staggered in such a manner as to avoid formation of a continuous channel from top to bottom of the slope.

Forms for individual blocks shall be interconnected with conduits, top, bottom, and sides to allow for passage of fluid grout between all adjacent blocks and to provide a sheath for protection of cables, if required, between adjacent blocks. Cast-in-place distance between conduits is approximately 10" (250mm) in the slope direction and 12" (300mm) in the transverse direction. The flat width of each conduit as woven shall be not less than 3" (75mm) or more than 5" (125mm).

## C. Fabric Porosity

Fabric porosity is essential for the successful execution of this work. At the direction of the Engineer, the Contractor shall demonstrate the suitability of fabric design by injecting the proposed grout into 5½" (140 mm) diameter sleeves. The sleeves shall be constructed of a single layer of the same basic fabric material. Test cylinders, 12" (300 mm) long, shall be cut from each specimen and tested in accordance with ASTM C-39. This test will be run once at the start of the project unless otherwise directed by the engineer. (See Item G below).

## D. Relief of Hydrostatic Uplift

Fabric, designated as \_\_\_\_\_ ABNN on the drawings, shall be woven in such a manner as to provide interwoven bands of attachments between blocks. These bands shall control the length and width block dimensions and also act as filter strips to provide relief of hydrostatic uplift beneath the completed revetment.

## E. Tensile Reinforcing Members (if required)

Tensile reinforcing members (cables), where required, shall be threaded through cable conduits between adjacent blocks. Cables, when used, are normally threaded through every conduit parallel to the slope. Transverse cables may also be threaded through conduits perpendicular to the slope, at the option of the designer. Slope cables shall consist of \_\_\_\_\_ dia. on approximately \_\_\_\_\_ in. ( \_\_\_\_\_ mm) centers cast-in-place. Transverse cables shall consist of \_\_\_\_\_ dia. on approximately \_\_\_\_\_ in. ( \_\_\_\_\_ mm) centers cast-in-place. (See Note 3 below).

Where necessary, cables shall be joined by means of copper connectors. Aluminum connectors in direct contact with cement grout will not be permitted. All cables shall be completely embedded in the hardened grout. Exposed cables between adjacent blocks will not be permitted.

*Note 3: Designer normally specifies 11/32" diameter (27mm circumference) nylon cable with 5,200 lb. breaking strength. Other types of cable may be specified such as 1/4" diameter (20mm circumference) polyester cable with 3,700 lb. breaking strength. Cable spacing must be a multiple of conduit spacing as called for in Section II. B.*

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# Guide Specifications: Fabriform® Articulating Block Fabric and Revetment Installation

PAGE 4 OF 4

## F. Fabric Assembly

AB Fabric shall be factory assembled into predetermined panel sizes. The AB fabric rolls are first cut into the lengths specified on the shop drawings. These fabric pieces are then joined together, top layer to top layer and bottom layer to bottom layer. This will allow for the finished revetment to have the full block thickness between the top and bottom seam. A single seam in which all four layers of fabric are joined at one point will not be permitted. All factory seams shall face downwards and shall be made using a double-needled machine utilizing the Standard Type 401 stitch. Zipper closures shall be attached to the sides of the AB panels as required for connection of adjacent panels at the site location. If required, bulkheads (grout stops) may be installed parallel to and in between individual mill widths at predetermined intervals to regulate the flow of fine aggregate concrete. Grout stops shall be designed as to produce full block thickness along the full length of the grout stop. Completed AB panels shall be inspected to verify that full block dimensions are maintained throughout the panel.

## G. Fine Aggregate Concrete (Grout)

Fine aggregate concrete (grout) shall consist of a mixture of portland cement, fine aggregate, and water so proportioned and mixed as to provide a readily flowable grout. Admixtures and/or a pozzolan may be used with the approval of the Engineer. Use of super plasticizers requires special precautions; silica fume is not recommended. The hardened fine aggregate concrete shall exhibit a compressive strength of 2,500 psi (17 MPa) at 28 days when specimens are made and tested according to the provisions of ASTM C-31 and C-39. The average compressive strength of fabric cast test cylinders, as described in Paragraph C above, shall be at least 20% higher at 7 days than that of companion test cylinders made in accordance with ASTM C-31, and not less than 3,000 psi (21 MPa) at 28 days.

## III. INSTALLATION

### A. Fabric Storage

Immediately following receipt of fabric on the job site, fabric shall be inspected and stored in a clean, dry area where it will not be subject to mechanical damage or exposure to moisture or direct sunlight. Fabric allowed to become wet and then dried before installation may be subject to shrinkage.

### B. Site Preparation

The surface to be protected shall be constructed to the line and dimensions as shown on the contract drawings. The area shall be free of all obstruction and organic material, such as rocks and roots. Areas below grade shall be brought to grade using engineered fill or a drainage stone as specified by the Engineer. Anchor and flank trench installation will be in accordance with project plans and specifications.

### C. Fabric Placement

The AB fabric panels shall be positioned over a geotextile filter fabric, as specified by the Engineer, and zipped together at their approximate design location, making the appropriate allowance for approximately 11% contraction of the fabric in each direction which will occur as a result of grout injection. Cables shall be securely attached to the ground anchor system at the crown of the slope to prevent slippage of the fabric as it is being filled with fine aggregate concrete. Cable length shall be approximately 10% less than fabric length and the ends of cables which protrude through the fabric shall be provided with clips and external washers so that the cable will be placed in tension when the fabric form is filled with grout. Cables shall each be fastened to separate points of attachment so that the point of anchorage is in a direct line with the cable itself.

If joining of panels as described above is impractical, adjacent panels may be overlapped a minimum of 3 feet (900 mm), subject to Engineer's approval. In no case will simple butt joints between panels be allowed. However, a modified butt joint where an underlayment of similar fabric is sewn to one panel and overlapped a minimum of 2 feet (600mm) by the adjacent panel is allowed subject to Engineer's approval.

### D. Fine Aggregate Concrete Injection

Following placement of AB fabric panels over the geotextile filter cloth, fine aggregate concrete shall be injected between the upper and lower layers of fabric through small slits cut in the upper layer of fabric. The injection pipe shall be wrapped tightly at the point of injection with a strip of burlap during pumping. First pump the upper edge of the mat which has been placed in the anchor trench followed by injection into the lower edge, working back up the slope. Avoid overpressuring of the fabric. After pumping, the burlap shall be pushed into the slit as the injection pipe is withdrawn in order to minimize spillage of fine aggregate concrete on the revetment surface. The burlap seal shall be removed prior to the final set of the fine aggregate concrete and the injection area hand finished. The sequence of fine aggregate concrete injection shall be such as to insure complete filling of the revetment forming fabric to the thickness specified by the fabric manufacturer.

Foot traffic will not be permitted on the freshly pumped mat when such traffic will cause permanent indentations in the mat surface. Walk boards shall be used where necessary.

Excessive fine aggregate concrete which has been inadvertently spilled on the mat surface shall be cleaned up with a broom and shovel. Use of a water hose to remove spilled grout from the surface of a freshly pumped mat will not be permitted.

During grout injection, the mat thickness may be measured by inserting a short piece of stiff wire through the mat at several locations from the crest to the toe of the slope. Any mat measuring less than 90% of the average of all thickness measurements shall be re-injected until desired average thickness has been attained.

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