

FlexGround SurFlex[®]

Articulating Concrete Block/Mat Safety Surfacing

Manufacturer's Specifications

This document provides the specifications for a non-porous poured in place surfacing system composed of Submar UltraFlex articulating concrete block covered with Flexground KoolFlex rubber layer membrane, an aliphatic thermoplastic composite grout filling layer that renders the pad non-porous, and an aliphatic water-based color seal.

There are variations in the final specifications as required by the Client.

PART 1 – GENERAL

1.01 Work Included

The contractor shall furnish all labor, materials, equipment, and incidentals required and perform all operations in connection with the installation of articulating concrete erosion control mats in accordance with the fines, grades, design and dimensions shown on the Contract Drawings and as specified herein.

- A. Provide all labor, materials, and tools necessary for the complete installation of a non-porous poured in place safety surfacing overlay on articulating concrete mats.
- B. Section includes: Articulating concrete block/mat and resilient non-porous safety surfacing poured in place system.

1.02 Submittals

- A. The contractor shall submit to the engineer all manufacturer's performance research results and calculations in support of the articulating concrete mat system and geotextile proposed for use. All calculations must be made in accordance with PART2.A. of this specification utilizing a windows based computer program developed specifically for the articulating concrete mat.
- B. The contractor shall furnish manufacturer's certificates of compliance for articulating concrete blocks/mats, revetment cable, and any revetment cable fittings and connectors to the engineer prior to the start of mat fabrication.
- C. 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 articulating concrete mats.
- D. The manufacturer must be experienced in the manufacturing of a non-porous poured in place surfacing system and provide references of five (5) specific installations in the last three (3) years.

ARIZONA

Lic #288687 & 283192
602.954.0000

CALIFORNIA

Lic #1003439
916.474.5431

NEVADA

Lic #0076764 & 0077757
702.303.8701

- E. The installer must provide competent workmen skilled in this specific type of poured in place surfacing system installation. The designated supervisory personnel on the project must be competent in the installation of this material, including mixing of the materials, and spreading and compacting the materials correctly.
- F. Manufacturer should provide written instructions for recommended maintenance practices.
- G. Performance Requirements: Provide products that have been manufactured, fabricated and installed to meet or exceed the criteria and methodology identified in PARTS 2, 3, 4 and 5 below.
- H. Quality Assurance:
 - i. Test reports: upon request, provide test reports from recognized, qualified, independent third party testing laboratories. Self-testing of products is not acceptable.

1.03 Maintenance and Warranty

The bidder and/or manufacturer must provide the following:

- A. The poured in place surfacing manufacturer should provide a warranty to the owner that covers defects in materials and workmanship of the rubber for a period of **THREE (3) years** from the date of Substantial Completion.
- B. The manufacturer's warranty should include general wear and tear. The warranty should specifically exclude vandalism, high heel punctures, acts of war or acts of nature beyond the control of the owner or the manufacturer.
- C. The bidder should provide a warranty to the owner that covers defects in the installation workmanship, and further warrant the installation was done in accordance with the manufacturer's recommendations.
- D. All poured in place warranties should be limited to repair or replacement of the affected areas and should include all necessary materials, labor, transportation costs, etc. to complete said repairs. All warranties are contingent on the full payment by the owner of all pertinent invoices.
- E. The owner also agrees to do routine maintenance as outlined in the FLEXGROUND Maintenance manual
- F. The installer should clean the jobsite and remove excess materials.
- G. The manufacturer should instruct the owner's personnel on proper maintenance and repair of the KOOLFLEX surface.
- H. A **ONE (1) year** warranty extension may be added if a FlexCoat Color Seal is applied two years after initial installation.
- I. FlexCoat will be installed at owners' expense and is not included in the original contract price.

ARIZONA

Lic #288687 & 283192
602.954.0000

CALIFORNIA

Lic #1003439
916.474.5431

NEVADA

Lic #0076764 & 0077757
702.303.8701

PART 2 – ARTICULATING CONCRETE BLOCK/MATS

2.01 General

- A. All articulating concrete mats shall be premanufactured of individual concrete blocks with specific hydraulic 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.
- B. 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 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.
- C. 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 25 degrees between any given row or column of blocks in the uplift direction and a minimum of 45 degrees in the downward direction.
- D. 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.

2.02 Cellular Concrete Blocks

- A. Scope – This specification covers concrete blocks for erosion control mats used in revetments, storm channels, etc. and for soil stabilization.
- B. Materials – Cementitious Materials – Materials shall conform to the following applicable ASTM specifications:
 - i. Portland Cements - Specification C 150, for Portland Cement.
 - ii. Blended Cements - Specification C 595, for Blended Hydraulic Cements.
 - iii. Hydrated Lime Types - Specification C 207, for Hydrated Lime Types.
 - iv. Pozzolans - Specifications C 618, for Fly Ash and Raw or Calcinated Natural Pozzolans for use in Portland Cement Concrete.

ARIZONA

Lic #288687 & 283192
602.954.0000

CALIFORNIA

Lic #1003439
916.474.5431

NEVADA

Lic #0076764 & 0077757
702.303.8701

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

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

D. Physical Requirements

- i. At the time of delivery to the work site, the units shall conform to the physical requirements prescribed in Table 1.

COMPRESSIVE STRENGTH		WATER ABSORPTION	
NET AREA		MAX lb/ft ³	
MIN PSI (mPA)		(kg/m ³)	
Average of 3 units	Individual Unit	Average of 3 units	Individual Unit
4,000	3,500	10	12
27.6	(24.1)	(160)	(192)

E. Visual Inspection

- i. 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.
- ii. Cracks exceeding 0.25 inches in width and/or 1.0 inch in depth shall be deemed grounds for rejection.
- iii. Chipping resulting in a weight loss exceeding 10% of the average weight of the blocks shall be deemed grounds for rejection.
- iv. 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 repaired with structural grout at the expense of the contractor.

F. Sampling and Testing

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

G. Expense of Tests

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

H. Manufacturer

The articulating concrete block mat shall be Submar UltraFlex[®], as represented by:

NATIONALLY

SUBMAR, INC. B

Jeff Webb

1711 Dunn Street

Houma, Louisiana 70360

Phone: (985)868-0001

Fax: (985) 851-0108

www.submar.com

The Submar **UltraFlex[®]** articulating concrete mats shall have ONE or MORE of the following nominal characteristics.

UltraFlex [®]		BLOCK WEIGHT		BLOCK SIZE			OPEN AREA
Class	Type	Lbs.	Lbs/SF	Length Inches	Width Inches	Height Inches	%
M4545	Closed	53-61	40-46	17.1	11.9	4.5	10
M6055	Closed	72-83	54-62	17.1	11.9	6.0	10
M9085	Closed	108-124	78-91	17.1	11.9	9.0*	10

NOTE:

* Block height may vary by approximately 0.5" based on local manufacturing capabilities. Weight of the units is more important.

2.03 REVETMENT CABLE & FITTINGS

- A. **Galvanized Steel Revetment Cable and Fittings.** Revetment cable shall be constructed of preformed galvanized aircraft cable. The cables shall be made from individual wires and strands that have been formed during the manufacture into the shape they have in finished cable.
- B. Cable shall consist of a core construction comprised of six (6) or seven (7) wires wrapped within seven (7) or nineteen (19) wire strands. The revetment cable shall have the following physical properties:

ARIZONA

Lic #288687 & 283192
602.954.0000

CALIFORNIA

Lic #1003439
916.474.5431

NEVADA

Lic #0076764 & 0077757
702.303.8701

NOMINAL CABLE DIAM.	APPROX LBS.	AVG STRENGTH (kN)	MIN LBS	LBS/100 FT (kg)	MAX LBS	(kg)
1/8"	1,700	(7.5)	2.8	(.04)	2.9	(.04)
3/16"	3,700	(16.4)	6.2	(.09)	6.5	(.10)
1/4"	6,100	(27.1)	10.6	(.16)	11.0	(.16)
3/8"	3,300	(59.2)	23.6	(.35)	24.3	(.36)

- C. The revetment cable shall exhibit resistance to mild concentrations of acids, alkalis, and solvents. Fittings such as sleeves and stops shall be aluminum, and the washers shall be galvanized steel.
- D. Selection of cable and fittings shall be made in a manner that insures a safe design factor for mats 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 resultant splice shall provide a minimum of 75% of the minimum rated cable strength.

2.04 ANCHORS

IF permanent anchoring is required, the cables shall be attached to the anchoring system as indicated on the contract drawings.

2.05 SIZE OF ARTICULATING CONCRETE MATS

The articulating concrete blocks, cables and fittings shall be 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 forty (40) feet or approved by the Engineer.

PART 3 – FOUNDATION PREPARATION AND MAT PLACEMENT

3.01 FOUNDATION & PREPERATION

- A. **General** – Areas on which articulating concrete 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.
- B. **Grading** – The slope shall be graded to a smooth plane surface to ensure that intimate contact is achieved between the slope face and the entire bottom surface of the articulating concrete mats. All slope deformities, roots, grade stakes, and stones which project normal to the local slope face must be regraded or removed. NO holes, "pockmarks", slope board teeth marks, footprints, or other voids greater than 1.0 inch in depth normal to the local slope face shall be permitted. NO grooves or

depressions greater than 0.5 inches in depth normal to the local slope face with a dimension exceeding 1.0 foot in any direction shall be permitted. Where such areas are evident, they shall be brought to grade by placing compacted homogenous material. The slope and slope face shall be uniformly graded, compacted, and the depth of layers, homogeneity of soil, and amount of compaction shall be as required by the Engineer.

- C. Excavation and preparation for anchor trenches, side trenches, and toe trenches or aprons shall be done in accordance to the lines, grades and dimensions shown in the Contract Drawings. The anchor trench hinge-point at the top of the slope shall be uniformly graded so that no dips or bumps greater than 0.5 inches over or under the local grade occur. The width of the anchor trench hinge-point shall also be graded uniformly to assure intimate contact between all articulating concrete block mats and the underlying grade at the hinge-point.
- D. **Inspection** – Immediately prior to placing articulating concrete mats the prepared area shall be inspected by the Engineer, the owner's representative, and or by the manufacturer's representative. No blocks shall be placed thereon until that area has been approved by one of these parties.

3.02 PLACEMENT OF FILTER FABRIC

- A. **General** – Filter fabric, as specified elsewhere, shall be placed within the limits shown on the Contract Drawings.
- B. **Placement** – The filter fabric shall be placed directly on the prepared area, in intimate contact with the subgrade, and free of folds or wrinkles. The filter fabric shall not be walked on or disturbed when the result is a loss of intimate contact between the articulating concrete mats and the filter fabric or between the filter fabric and the subgrade. The filter fabric shall be placed so that the upstream strip of fabric overlaps the downstream strip. The longitudinal and transverse joints shall be overlapped at least two (2) feet. The filter fabric shall extend at least one foot beyond the top and bottom revetment termination points. When the articulating concrete mats are placed as large mattress, the top lap edge of the filter fabric should not occur in the same location as a joint between articulating concrete mats unless the space is filled with concrete.

3.03 PLACEMENT OF ARTICULATING CONCRETE BLOCK/MATS

- A. **General** – Articulating concrete block/mats, shall be constructed within the specified lines and grades shown on the contract drawings.
- B. **Placement** – The articulating concrete mats shall be placed in such a manner as to produce a smooth plane surface. No individual block within the plane of placed articulating concrete block mats shall protrude more than one-half inch or as otherwise specified by the Engineer.
- C. The articulating concrete block mats shall be attached to a spreader bar or other approved 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. The mats shall be placed side by side, so that the mats abut each other. *Mat seams or openings between mats*

greater than two (2) inches shall be filled with concrete. Distinct changes in grade will result in a discontinuous revetment surface in the direction of flow shall require a concrete seam at the grade change location so as to produce a continuous surface. Anchor trenches and side trenches shall be back filled and compacted flush with the top of the blocks. The integrity of a soil trench back fill must be maintained so as to sure a surface that is flush with the top surface of the articulating concrete block mats for its entire service life. Toe trenches shall be back filled as shown on the Contract Drawings. Back filling and compaction of trenches shall be completed in a timely fashion.

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

PART 4 – KOOLFLEX SAFETY SURFACING MATERIAL

At completion of installation of Articulating Concrete Block/Mats, KOOLFLEX poured in place surfacing system shall be installed directly over the Block/Mats in accordance with the following:

- A. A dual durometer poured-in-place system with a base layer membrane and an aliphatic thermoplastic composite grout filling layer that renders the pad non porous and sealed with a color seal.
- B. FLEXGROUND primer is a 100% solids urethane primer/sealer. It is designed with a low viscosity and penetrating abilities making this an ideal priming urethane.
- C. The KOOLFLEX SURFACING base surface should be manufactured from .5-4mm SBR rubber coated with an elastomeric rubber compound and mixed with urethane binder (110 pounds of rubber to 22 pounds of binder).
- D. FlexGrout thermoplastic composite grout should be a thixotropic aliphatic thermoplastic paste applied at 1 gallon per 35 square feet over wear coarse layer rendering it non porous.
- E. FlexGrout thermoplastic composite grout was tested by QAI Laboratories for the following, and any requested substitution of product must meet or exceed these testing outcomes and provide ASTM testing data:
- i. *ASTM D 2047-11 Coefficient of Friction: Polish Flooring Surface.* (Test Report #QI1411123-4) FlexGrout has been tested and certified at a friction of .588 dry standard, and .817 wet standard.
 - ii. *ASTM D4 12-06ae2 ThermoPlastic Elastomers – Tension.* (Test Report #QI1305148-2) FlexGrout has been tested and certified at a Peak Tensile Strength of 163psi; chlorine soaked at 133psi; and a Tensile Elongation at Break of 132.2%; chlorine soaked at 112.2%.
 - iii. *ASTM D624-00(2012) Tear Strength.* (Test Report #QI1305148-2) FlexGrout has been tested and certified with a median Maximum Tear Strength of 75.74lbs; chlorine soaked at 70.03lbs.

- F. A water-based aliphatic composite color seal should be applied at 200 sq. ft. per gallon and spread evenly to cover entire surface. Acrylic and latex based coatings are not acceptable.

PART 5 – KOOLFLEX EXECUTION AND INSTALLATION

The poured in place surfacing installer should strictly adhere to the installations procedures outlined under these sections. Any variance from these requirements should be accepted in writing by the manufacturer's onsite representative, and submitted to the architect/owner, verifying that the changes do not in any way affect the warranty.

5.01 Perimeter

- A. A urethane primer should be applied to the Submar UltraFlex articulating concrete block mat at a rate of 200-250 square feet per gallon. The entire area does not need to be primed at once, instead, prime about 700 square feet at a time. This procedure should be continued until all areas are complete.
- B. The urethane primer should be applied to any equipment that will be surrounded by the poured in place safety surfacing system.

5.02 Cushion Layer (optional – as needed)

- A. The cushion layer comprised of SBR buffings shall be mixed with the MDI moisture cure polyurethane binder at a rate of 12% of the total weight of the material thoroughly so that the binder is evenly dispersed into the rubber base.
- B. The cushion layer mix should then be spread and troweled to the desired depth and allow to cure for 24 hours.

5.03 Base Course Rubber Layer

- A. The base course layer should be mixed with EPDM rubber granules and aromatic urethane binder at a rate of 20% of the total weight of the materials so the granules are covered thoroughly and evenly.
- B. The base course layer mix should be spread and trowelled to a depth of 3/8" immediately after the application of primer.

5.04 Grout Sealer

- A. The base course rubber layer should be sealed with an aliphatic thermoplastic composite grout. FlexGrout should be spread with a trowel at a rate of 1 gallon per 40 square feet. Pressure should be applied to the trowel with enough force to push the grout into the wear course layer, rendering it impermeable. The finished texture should be slip resistant, smooth and even.

- B. The poured in place surface should be allowed to cure for 24-72 hours or until dry to the touch.

Approved product: FlexGrout by FlexGround, LLC
Contact: Bill Stafford, bill@flexground.com
480-694-8320

5.05 Color Seal

- A. The color seal should consist of a water based aliphatic thermoplastic composite liquid. Acrylic and latex based coatings are not acceptable. Color seal should be roll applied to completely cover entire surface. The color seal should be allowed to cure for 24-72 hours or until dry to touch.
- B. The finished texture should be slip resistant, smooth and even.
- C. The poured in place surface should be allowed to cure for 24-72 hours or until dry to the touch.

Approved product: Color Seal by FlexGround, LLC
Contact: Bill Stafford, bill@flexground.com
480-694-8320

PART 6 – SURFLEX STANDARD SIZES (other drop specifications available per design and approval)

	BLOCK THICKNESS	LBS/SF	IMPACT DROP HEIGHT
M4545-CS-IAB	4.5"	45	Color seal only
M6055-CS-IAB	6"	55	Color seal only
M9085-CS-IAB	9"	85	Color seal only
M4545-0-IAB	4.5"	45	0 foot
M6055-0-IAB	6"	55	0 foot
M9085-0-IAB	9"	85	0 foot
M4545-5-IAB	4.5"	45	5 foot
M6055-5-IAB	6"	55	5 foot
M9085-5-IAB	9"	85	5 foot

PART 7 – SITE (GENERAL)

- A. Trailer/ Large truck access will be necessary for the installation. In the case that access for trailer/truck is not available the owner or general contractor will be responsible for transporting material to the job site.

- B. Crew is responsible for protecting the surface only while on site. General Contractor or owner shall be responsible for the security of the surfacing overnight during installation, as well as during the surfacing's curing period upon completion of the install.
- C. Crew will leave site clean and shall remove all trash and debris.
- D. Owner/General contractor shall provide a dumpster for all waste and trash.

ARIZONA

Lic #288687 & 283192
602.954.0000

CALIFORNIA

Lic #1003439
916.474.5431

NEVADA

Lic #0076764 & 0077757
702.303.8701