

LAKE MANAWA STATE PARK
BOAT RAMP EXTENSIONS
POTTAWATTAMIE COUNTY, IOWA
PROJECT NUMBER: 24-04-78-01

January 12, 2024

This Addendum is issued to modify, explain or correct the original Drawings and Specifications, and is hereby made a part of the Contract Documents. Please attach this Addendum to the Project Manual in your possession. Insert the number and issue date of this Addendum in the blank space provided on the Proposal Form.

Specifications:

- A. Specification section 02279 Articulated Concrete Block is missing from the specifications manual. Please include the attached section.

1 DIVISION 2 - SITE WORK

2
3 **STANDARD SPECIFICATION FOR**
4 **SECTION 02279**
5 **ARTICULATING CONCRETE BLOCK (ACB) REVETMENT SYSTEM**
6

7 **PART I GENERAL**

8
9 **SCOPE**

10 The work covered by this Section consists of furnishing all plant, labor, equipment, and materials, and performing all operations in
11 connection with the installation of cellular concrete erosion control block mattresses in accordance with the lines, grades, design,
12 and dimensions shown on the drawings and as specified herein.
13

14 **REFERENCES**

15 The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by
16 the basic designation only.
17

18 American Society for Testing and Materials (ASTM) Publications.

19 ASTM C 33-93 Concrete Aggregates

20 ASTM C 140-96B Sampling and Testing Concrete Masonry Units

21 ASTM C 476-95 Grout for Masonry

22 ASTM D 698-78 Moisture Density Relationship of Soils

23 ASTM D 6684 Materials and Manufacture of Articulating Concrete Block (ACB) Revetment Systems
24

25 U.S. Federal Highway Administration (FHWA) and U.S. Bureau of Reclamation (USBR) Report.
26

27 FHWA-RD-89-199 Hydraulic Stability of Articulated Concrete Block Revetment Systems During Over topping Flow.
28

29 **DELIVERY, STORAGE, AND HANDLING OF MATERIALS**

30
31 Delivery and Storage. Materials delivered to the site shall be inspected for damage, unloaded and stored with the minimum of
32 handling. Materials shall be kept free of dirt and debris.
33

34 Handling. Materials shall be handled in such a manner as to ensure delivery to the site in sound, undamaged condition. Synthetic
35 geotextiles that are not to be installed immediately shall be protected from the direct sunlight and in accordance with the
36 manufacturer's recommendations.
37

38 **SUBMITTALS**

39 The following shall be submitted in accordance with the Section entitled SUBMITTAL PROCEDURES.
40

41 Shop Drawings. At least 30 days prior to the start of any installation of the cellular concrete mats, the Contractor shall submit to the
42 owner shop drawings for the layout and details of the cellular concrete mats. The cellular concrete mats layout shall be to the lines
43 and grades shown on the drawings. The shop drawings shall include layout, layout sequence, anchor details, mat junction details,
44 anchor to mat connection details, and details for grade change.
45

46 Representative Samples. The sources from which the Contractor proposes to obtain materials shall be selected well in advance of
47 the time when the materials will be required in the work. Product literature and suitable samples of the cellular concrete mattresses,
48 cable, fittings, anchors and filter fabric shall be submitted to the owner for approval, prior to delivery of any such material to the site
49 of the work. All samples shall be obtained by the Contractor and delivered at his expense to a point designated by the owner at least
50 10 days in advance of the time when the placing of the concrete mattresses is expected to begin. The contractor shall submit the
51 cellular concrete block revetment system Manufacturer's certification that the revetment system and components meet the
52 requirements of this specification.
53

54 Documentation of Testing. The contractor shall provide to the owner test results documenting that the revetment system has been
55 tested under controlled flow conditions for hydraulic performance characteristics in accordance with FHWA-RD-89-199, utilizing a
56 2:1 slope in the direction of flow.
57

58 **MEASUREMENT OF CELLULAR CONCRETE MATTRESSES**

59 The unit of measurement for the cellular concrete mattresses shall be by the square foot of cellular concrete mattresses placed.
60

1 PAYMENT for acceptable cellular concrete mattresses placed will be made at the contract unit price per square foot for "Cellular
2 Concrete Mattresses," which prices shall include all costs for furnishing, hauling, and placing the cellular concrete mattresses as
3 specified herein and as shown on the drawings.

4 **PART II PRODUCTS**

5
6 **MATERIALS FOR CELLULAR CONCRETE MATTRESSES**

7 Cellular Concrete Mattresses shall be manufactured in conformance with the requirements of ASTM D 6684 "Materials and
8 Manufacture of Articulating Concrete Block (ACB) Revetment /Systems", except that, unless otherwise specified, freeze-thaw
9 requirements shall not apply.

10
11 Concrete shall conform to ACI requirements for normal weight concrete and shall have a minimum compressive strength of 4,000
12 psi at 28 days when tested in accordance with ASTM C 140-96B.

13
14 Aggregate shall meet the requirements of ASTM C 33 except for grading requirements. Aggregate grading shall be reasonably
15 consistent and shall be well graded from the maximum size, which can be conveniently handled with available equipment.

16
17 **CELLULAR CONCRETE BLOCKS**

18 Shall be formed by a vibratory block forming machine. Cellular concrete blocks shall be interlocking; and penetrations shall be
19 included for revetment cables as necessary to bind the individual blocks into mattresses in two perpendicular directions. Cable
20 penetrations shall prevent any exposure of cables to potential UV degradation within the dimensions of the individual blocks (i.e.,
21 cables shall not pass through open areas within the dimensions of individual blocks). The blocks shall be open or closed cell, as
22 shown in the plans, and capable of articulation when formed into mattresses.

23
24 **CELLULAR CONCRETE MATTRESSES**

25 Cellular concrete mattresses shall be pre-manufactured as an assembly of concrete blocks when connected into mattresses by the
26 use of revetment cables. Two (2) integral longitudinal cables per block are required, as well as one (1) integral transverse cable. No
27 partial or "half" blocks will be allowed without a transverse cable. The final revetment system must be tied continuously throughout
28 with cables in two perpendicular directions.

29
30 Refer to Part IV, Special Project Requirements, for approved systems. Proposed equals must be approved by the engineer a
31 minimum of thirty (30) days prior to bid date. The owner or his engineer reserves the right to accept or reject any proposed equal
32 cellular concrete mattress system for reasons including but not limited to previous performance record, appropriate and applicable
33 testing, hydraulic performance characteristics, and qualified technical support. The following information must be included in the
34 submittal to be considered for approval:

- 35
36 1. Test results documenting the critical shear stress and velocity of the specific revetment system (geometry and
37 thickness) being proposed as an equal. Hydraulic performance testing shall be in accordance with FHWA-RD-89-
38 199, utilizing a 2:1 slope in the direction of flow.
39 2. Manufacturer's certification that the revetment system design and components meet all of the requirements of this
40 specification.

41
42 Size of Cellular Concrete Mattresses. The Cellular concrete blocks and cables and fittings shall be fabricated at the manufacturer's
43 plant or another approved location into mattresses with a width of up to 8 feet and a length that is capable of being transported
44 without special permitting.

45
46 **REVETMENT CABLE**

47 The concrete blocks shall be bound into mats by the use of polyester revetment cable and fittings. Revetment cables shall be placed
48 in both the longitudinal and transverse directions. Individual blocks shall be interconnected in two (2) perpendicular directions.

49
50 Polyester Revetment Cable shall be constructed of high tenacity, low elongating, and continuous filament polyester fibers. Cable
51 shall consist of a core construction comprised of parallel fibers contained within an outer jacket or cover. The weight of the parallel
52 core shall be between 65 to 70 percent of the total weight of the cable. Longitudinal cables shall be sized to provide a minimum
53 cable strength to mat weight ratio of 5:1 for safe material lifting/handling. Additionally, all revetment cable shall have the following
54 minimum physical characteristics:

55

DIRECTION	NOMINAL CABLE DIAMETER	APPROXIMATE AVG. STRENGTH LB.	WEIGHT/100 FT. (LB.)
Longitudinal & Transverse	¼"	3,700	2.47

56

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

6 PART III EXECUTION

7 SUBGRADE PREPARATION

8 General. All subgrade preparation should be performed in accordance with ASTM D6884-03, Standard Practice for Installation of
9 Articulating Concrete Block (ACB) Revetment Systems.
10

11
12 Construction Methods. Areas on which filter fabric and cellular concrete mattresses are to be placed shall be constructed to the lines
13 and grades shown on the drawings. The subgrade for the cellular concrete mats shall be free of voids, pits, or depressions and
14 shall be proof-rolled to a minimum of 90% of the ASTM D 698 density. Voids, pits or depressions shall be brought to grade by
15 backfilling in accordance with the applicable portions of the project specifications. All obstructions, such as roots and projecting
16 stones larger than 1 inch remaining on the surface, shall be removed and all of the soft or low density pockets of material removed
17 must be filled with selected material and compacted to a minimum of 90% of the ASTM D 698 density. Special consideration for
18 buried obstructions (i.e. stumps, debris, etc.) will be as shown on the drawings.
19

20 Excavation and Preparation for anchor trenches, side trenches, and toe trenches or aprons shall be done in accordance to the lines,
21 grades and dimensions shown on the drawings.
22

23 Inspection and Approval. Immediately prior to placing the filter fabric and cellular concrete mattresses, the prepared area shall be
24 inspected by the owner's representative and approval obtained before any fabric or mattresses are placed thereon.
25

26 INSTALLATION OF CELLULAR CONCRETE MATTRESSES

27 General. All placement and preparation should be performed in accordance with ASTM D6884-03, Standard Practice for Installation
28 of Articulating Concrete Block (ACB) Revetment Systems. Cellular Concrete Mattresses shall be placed within the limits shown on
29 the drawings. The cellular concrete mats or blocks shall be placed on the filter fabric in such a manner as to produce a relatively
30 planar surface. No more than 200 linear feet of filter fabric shall be laid before being covered with concrete mattresses, and any
31 fabric installed more than 2 days shall be lifted and the surface of the slope inspected for any slope defects. The owner may require
32 any uncovered fabric to be lifted after heavy rainfall to inspect for slope damage. Final acceptance and approval of the installation
33 will be made by the owner. The Contractor shall hold the owner harmless from liability of any kind arising from the use of any
34 patented or non-patented invention used in the performance of this work.
35

36 Visual Inspection. All units shall be sound and free of defects that would interfere with either the proper placement of the unit or
37 impair the performance of the system. Surface cracks incidental to the usual methods of manufacture, or surface chipping resulting
38 from customary methods of handling in shipment and delivery, shall not be deemed grounds for rejection.
39

40 Cracks exceeding 0.25 inches (.635 cm) in width and/or 1.0 inch (2.54 cm) in depth shall be deemed grounds for rejection.
41

42 Chipping resulting in a weight loss exceeding 10% of the average weight of a concrete unit shall be deemed grounds for rejection.
43

44 Blocks rejected prior to delivery from the point of manufacture shall be replaced at the manufacturer's expense. Blocks rejected at
45 the job site shall be repaired with structural grout or replaced at the expense of the contractor.
46

47 Placement of Prefabricated Mattresses shall be done with mats attached to a spreader bar or other approved device to aid in the
48 lifting and placing of the mats in their proper position by the use of a crane or other approved equipment. The mats shall be placed
49 side-by-side and/or end-to-end so that the mats abut each other. The maximum space or gap between mattresses shall be 3
50 inches, except that local wider gaps may be accepted if the length of the gap is less than 3 feet and the entire gap is grouted. No
51 overlapping of mats will be accepted and no blocks shall project vertically more than 1 inch beyond the adjacent blocks. All
52 placements of mats shall be in accordance with the manufacturer's recommendations and the Contractor's approved shop drawings.
53 As adjacent mats are placed, they shall be secured to each other by fastening the protruding horizontal and vertical cable
54 connections and end cable loops together along each side of the mats. The fastening shall be done with approved sleeves.
55

56 Individual Concrete Blocks that are hand placed shall be subject to the spacing and level parameters specified in Subparagraph:
57 Placement of Prefabricated Mattresses above. Revetment cables shall be threaded into the blocks as the placement proceeds and
58 fastened with approved sleeves, fittings or fasteners.
59

60 FILTER FABRIC

61 Filter fabric used for embankment erosion control under riprap shall be a woven or nonwoven synthetic material formed into a stable
62 network such that the filaments or yarns retain their relative position to each other. The material shall be made of polypropylene, UV

1 stabilized, be mildew, rot, insect, and rodent resistant, and be inert to commonly encountered chemicals found in soil. During all
2 periods of shipment and storage, the fabric shall remain wrapped in a heavy-duty protective covering to protect the fabric from direct
3 sunlight, ultraviolet rays, mud, dirt, dust and debris. The fabric shall be free of defects, or flaws which significantly affect its physical
4 properties. A competent laboratory must be maintained by the producer of the fabric at the point of manufacture to insure quality
5 control. Each roll of fabric in the shipment shall be labeled with a number or symbol to identify that production run. The fabric shall
6 also meet the following requirements:
7

8 **Filter Fabric**

9	Grab strength, wet, lb	220 lb. minimum	ASTM D 1682
10	Elongation at failure, %	220 lb. minimum	ASTM D 1682
11	Mullen Burst Strength, lbs	430 lb. minimum	ASTM D 3786
12	Puncture Strength, lbs.	125 lb. minimum	ASTM D 751 (modified)
13	Equivalent Opening Size,	40-80 mesh	C.O.E. W-02215

14
15 **FINISHING**

16 Surface Treatment. If required on the plans, the voids of the cellular concrete mats for the limits shown on the drawings shall be
17 filled with topsoil. The soil should then be seeded in accordance with the Section entitled TURF.
18

19 **CONTRACTOR QUALITY CONTROL**

20 The Contractor shall inspect for compliance with contract requirements and record the inspection of all operations including but not
21 limited to the following, as applicable:
22

- 23 1. Preparation of surface to receive cellular concrete mattresses.
- 24 2. Individual concrete blocks and filter fabric soundness and free of defects.
- 25 3. Cables and fittings - breaking strength.
- 26 4. Assembly of cellular concrete blocks bound by cables to form cellular concrete mattresses.
- 27 5. Placement of mattresses and filter fabric on the prepared subgrade.
- 28 6. Embedment of cables in the anchor trenches, side trenches, and toe trenches.

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32 **SEE NEXT PAGE FOR SPECIAL PROJECT REQUIREMENTS**
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PART IV SPECIAL PROJECT REQUIREMENTS

Application: The requirements of this section shall govern the articulating concrete block (ACB) revetment system.

Approved System: Contractor shall provide one of the following ACB revetment systems or approved equivalent.

- ShoreBlock® BD Series BD-600CC as manufactured by Shoretec, LLC.
- Armorflex Class 55 as manufactured by Armortec, a Contech Company.

Cellular concrete mattress shall be fabricated in a single piece.

~~Anchors: ACB revetment systems shall be anchored with tipping plate soil anchors. Tipping plate soil anchors shall be MPS Civil Products Manta Ray Earth Anchor MR-4, or approved equivalent. Contractor shall ensure that all portions of anchor are installed below all portions of the ACB revetment mat, and that the anchors are installed in general conformance with manufacturer recommendations.~~

Proof rolling of the subgrade shall not be required.

*** END ***