

STRENGTHENED SOIL WALLS STANDARD SPECIFICATIONS

NOTE: Whenever this Special Provision conflicts with the Plans or Standard Specifications, this Special Provision shall govern.

STRENGTHENED SOIL RETAINING WALL

1.0 DESCRIPTION: This item covers the materials, fabrication, construction, measurement, and payment for furnishing and installing Strengthened Soil retaining wall. The scope of work for wall erection includes; excavation, grading, and compaction of the wall foundation, general and local dewatering, as required for proper execution of the work, construction of leveling pads, erection of precast wall panels, placement of soil reinforcing mesh, and placement and compaction of select backfill material within the reinforced soil volume. The scope of work also includes furnishing and placing cast-in-place concrete coping. For the purpose of this special provision, the wall foundation shall include all area underlying the leveling pad and the reinforced soil volume. All other items necessary for construction of the Strengthened Soil wall not specifically mentioned herein shall conform to the applicable sections of the Standard Specifications.

BID ITEM RETAINING WALL

2.0 MATERIALS: The Contractor shall make his own arrangements to purchase the face panels, reinforcing mesh and attachment device, joint filler, and all necessary accessories from Shaw Technologies, Inc., P.O. Box 654, Colleyville, Texas, 76034.

2.1 Concrete Face Panels. Cement shall conform to the requirements of Section 2001 of the 1990 Standard Specifications. Concrete shall be air entrained and have a minimum compressive strength at 28 days of 4,000 psi. Retarding admixtures may be used with prior approval of the Engineer. Accelerating agents or any admixture containing chlorides will not be permitted.

Connectors, reinforcing steel, PVC sleeves, and lifting devices shall be set in place to the dimensions and tolerances shown on the shop plans prior to casting.

2.1.1 Testing and Inspection. Acceptability of the precast units will be determined on the basis of compression tests and visual inspection. The precast units will be considered acceptable, regardless of curing age, when compression test results conform to 28-day strength specifications, and when the visual inspection is satisfactorily completed. The Contractor or his supplier shall furnish facilities and perform all necessary sampling and testing in an expeditious and satisfactory manner. A KDOT inspector shall be notified in advance so that he may be present during all sampling and testing.

2.1.2 Casting. The panels shall be cast in metal forms on a flat area, the front face at the bottom, the back face at the top. Connectors shall be set in the rear face. The concrete in each form shall be placed without interruption and shall be consolidated by the use of an approved vibrator, supplemented by such hand tamping as may be necessary to force the concrete into the corners of the forms and prevent the formation of stone pockets or cleavage planes. Clear form oil of the same manufacture shall be used throughout the casting operation.

2.1.3 Curing. The units shall be cured in accordance with Section 701 for the concrete to develop the specified compressive strength. Any production lot, which does not conform to the strength requirements of Section 2.1.7 - Compressive Strength, shall be rejected.

2.1.4 Removal of Forms. The forms shall remain in place until they can be removed without damage to the unit.

2.1.5 Concrete Finish and Tolerances. Front face of the panels shall have a formed finish in accordance with section 701 and approved by the Engineer. Rear face of the panel shall be screened to eliminate open pockets of aggregate and surface distortions in excess of 1/4 inch.

2.1.6 Tolerances. All units shall be manufactured within the following tolerances:
All dimensions within 3/19 inch.

Angular distortion with regard to the height of the panel shall not exceed 0.125 inch in 5 feet.

Surface defects on formed surfaces measured on a length of 5 feet: not more than 0.125 inch.

2.1.7 Compressive Strength. Acceptance of the concrete face panels with respect to compressive strength will be determined on a production lot basis. A lot shall consist of each 40-production panels or fraction thereof produced in one day. No less than six standard 6-inch by 12-inch cylinders shall be made from samples selected at random from concrete used in the production lot. The cylinders shall be prepared and tested in accordance with Kansas Test Methods.

At least three of the cylinders shall be cured in the same manner as the panels and tested at seven days or later. Other sets of three cylinders each may be tested at other dates. Three cylinders shall be cured in accordance with Kansas Test Methods and tested at 28 days. A test result will be the average compressive strength of three cylinders. Acceptance of the lot will be made if the average of any set of three is greater than 4,000 psi.

2.1.8 Rejection. Units shall be subject to rejection because of failure to meet any of the requirements specified above. In addition, any or all of the following type defects shall be sufficient cause for rejection:

Defects that indicate imperfect molding.

Honeycombed or open texture concrete surfaces.

Any damage that would prevent making a satisfactory joint.

Chipped face panel edges.

Discoloration of concrete.

2.1.9 Marking. The date of manufacture shall be clearly scribed on the rear face of each panel.

2.1.10 Handling, Storage, and Shipping. All units shall be handled, stored, and shipped in such a manner as to eliminate the danger of chipping, cracks, fractures, and excessive bending stresses. Panels in storage shall be supported on firm blocking located between panels to protect the exposed exterior finish.

2.2 Concrete for leveling pads shall be Commercial Grade (AE), in accordance with Section 717. Cast-In-Place copings shall be Class AAA (AE), meeting Section 402 requirements.

2.3 Soil Reinforcing Mesh. Reinforcing mesh shall be shop-fabricated of cold drawn steel wire conforming to the minimum requirements of ASTM A82 and shall be welded into a finished mesh fabric in accordance with ASTM A 185. Reinforcing mesh shall be galvanized in accordance with ASTM A123. The mesh will be accepted on the basis of a Type A Certification and visual inspection.

2.4 Reinforcing Steel. Reinforcing steel shall conform to the requirements of Section 1601 of the Standard Specifications, Grade 60.

2.5 Attachment Devices. Connectors: The connectors shall be fabricated of cold drawn steel wire conforming to the requirements of ASTM A82. Connectors shall be galvanized in accordance with ASTM A123, or approved equal. The connectors shall be placed within $\pm \frac{1}{2}$ inch from the dimensions shown on the plans or approved shop drawings.

Tie Bar: Tie Bars shall be fabricated of cold drawn steel wire conforming to the requirements of ASTM A82 and galvanized in accordance with ASTM A123.

Devices will be accepted on the basis of Type A Certification and visual inspection.

2.6 Joint Materials:

2.6.1.1 Vertical Joints. Where required, as shown on the plans, cover for horizontal and vertical joints between panels shall be a filter fabric. The adhesive used to temporarily attach the fabric material to the rear of the facing panels shall be Pliobond 5001 or equal. The filter fabric shall cover a minimum of 6 inches on each side of the joint.

2.6.1.2 Horizontal Joints. Filler for horizontal joints between panels shall be as shown on the plans and approved by the Engineer.

2.7 Select Granular Backfill Material. The granular backfill material used in the structure volume shall consist of sand, sand-gravel, or crushed stone, shall be reasonably free from organic or otherwise deleterious materials, and shall comply with the following requirements as determined by Kansas Test Methods.

2.7.1.1 Gradation:

Sieve Size Percent Retained

Sand 2 inches 0

No. 100 90 - 95

No. 200 95 - 100

Crushed Stone 2 inches 0

3/8 inch 50 - 100

No. 200 95 - 100

The frequency of sampling of select granular backfill, necessary to assure gradation control throughout construction, shall be one test per 500 tons.

2.7.1.2 Quality. Representative material samples for the following tests shall be submitted to the Engineer of Test (c/o Research and Materials Laboratory, 2300 Van Buren, Topeka, KS 66611) for acceptance prior to utilizing this material for the project.

a. The Plasticity Index (P.I), as determined by AASHTO T-90 shall not exceed 6.

b. Maximum laboratory dry density and optimum moisture content shall be determined by AASHTO T-99 methods C or D (with oversize correction, as outlined in Note 7).

c. The material shall exhibit an angle of internal friction of not less than 34 degrees, as determined by the standard direct shear test AASHTO T-236, utilizing a sample of the material compacted to 95 percent of maximum laboratory dry density at optimum moisture content.

d. Soundness. The materials shall be substantially free of shale or other soft, poor durability particles meeting the following requirements as determined in accordance with Section 1117.

Soundness, "Freeze and Thaw", minimum 0.90

Los Angeles, wear, maximum 40%

e. Electrochemical Requirements. The backfill materials shall meet the following criteria:

Requirements Test Methods

Resistivity > 5,000 ohm centimeters ASTM G-57-78 (Lab)

ph > 4.5 < 9.5 Soil Survey 8 Cla

If the resistivity is less than 5000 ohm/cm but greater than 2000 ohm/cm, the backfill material can be accepted if it meets the following additional electrochemical requirements:

Chlorides < 100 parts per million ASTM D-512

Sulfates < 200 parts per million ASTM D-516 (B)

3.0 CONSTRUCTION REQUIREMENTS:

3.1 Technical Representative. The Contractor shall provide a manufacturer technical representative to be on the project during initial erection and be available during the construction of all retaining walls at no additional cost to KDOT. Sufficient time shall be spent with both the contractor and KDOT inspectors to ensure they are familiar with the proper erection procedures.

3.2 Wall Excavation. The cost of all excavation necessary to construct the wall shall be considered incidental to the amount bid per square foot for the wall. All materials encountered shall be removed without regard to classification. Excavation for the wall shall be coordinated with underdrain construction so that drainage pipes and structures will be constructed as specified. The Contractor shall be responsible to maintain stable sides at all excavations by providing reasonable cut back slopes or shoring where necessary.

3.3 Foundation Preparation. The foundation for the Strengthened Soil volume shall be graded level for a width equal to or exceeding the length of reinforcing mesh plus 6 inches or to the limits shown on the plans. Prior to wall construction, the foundation shall be compacted with a minimum of three passes of an 8-ton, smooth wheel vibratory roller, or equal, as approved by the Engineer. Any foundation soils found to be unsatisfactory or incapable of sustaining the required compaction shall be removed and replaced.

At each panel foundation level, a concrete leveling pad shall be constructed as shown on the plans. The pad shall be cured a minimum of 12 hours before placement of wall panels.

3.4 Wall Erection. Precast panels shall be placed vertically with the aid of a light crane. For erection, panels shall be placed by means of a lifting insert precast into the upper edge of the panels. Panels should be placed in successive horizontal lifts in the sequence shown on the plans as backfill placement proceeds. As fill material is placed behind a panel; the panels shall be maintained in vertical position by means of temporary wooden wedges placed on the external side of the wall in the joint between adjacent panels. External bracing is required of the initial lift. Vertical tolerances (plumbness) and horizontal alignment tolerance shall not exceed 3/4 inch when measured along a 10-foot straight edge. The maximum allowable offset in any panel joint shall be 3/4 inch. The overall vertical tolerance of the wall (plumbness from top to bottom) shall not exceed 1/2 inch per 10 feet of wall height.

Horizontal and vertical joint openings between panels shall be uniform and no larger than 1 - 1/4 inch and no smaller than 1/2 inch.

The plumbness and tolerances of each panel row at the face shall be checked prior to erection of the next panel row. Should any panels be out of tolerance, the fill shall be removed and the panels reset to their proper tolerances.

3.5 Backfill Placement. Backfill placement shall closely follow the erection of each lift of panels. At each reinforcing mesh level, backfill shall be roughly leveled before placing the attaching mesh. Reinforcing mesh shall be placed normal to the face of the wall. The Contractor shall place backfill in maximum loose lift thickness of 10 inches or less as may be necessary to obtain the specified density.

The entire Strengthened Soil volume shall be compacted to 95 percent of maximum laboratory density. Compaction shall be. Compaction should proceed from the area nearest the wall face to the back of the reinforcing mesh, except for a strip 3 feet wide adjacent to the backside of the wall. This 3-foot strip shall be compacted with light mechanical tampers after compaction of the remainder of the layer and soil density tests will not be required within this area.

At the end of each day's operations, the Contractor shall shape the last level of backfill so as to permit runoff of rainwater away from the wall face.

Any wall materials that become damaged during backfill placement shall be removed and replaced at the Contractor's expense.

4.0 METHOD OF MEASUREMENT: The bid item for the wall will be measured in square feet. A datum will be set as shown on the plans, which will establish the Nominal Wall Area. Final payment will be based on a Nominal Wall Area. The wall design (Strengthened Soil) will stipulate the square footage of wall proposed to meet plan requirements, but payment will still be based on a Nominal Wall Area. The Nominal Wall Area will be adjusted, with the approval of the Engineer, due to any addition or deletion of the wall. This adjusted Nominal Wall Area will be computed as the ratio of the initial Nominal Wall Area to the initial design area proposed times the total square footage of the final wall, which includes the addition or deletion.

5.0 BASIS OF PAYMENT: The amount of completed and accepted work, measured as provided above, will be paid for at the contract bid price per square foot of "Retaining Wall". This bid price shall be full compensation for: materials; excavation; preparing the wall foundation; constructing underdrains (if shown on the plans); concrete leveling pad; furnishing and fabricating all materials for the walls, including concrete face panels; reinforcing mesh; connectors and tie bars; joint materials; filter cloth; constructing cast-in-place coping; placing reinforcing mesh; erecting panel elements to the lines and grades shown of the plans; furnishing and placing all select granular material; backfilling, and all labor, equipment, tools, and incidentals necessary to complete the work.