SECTION 1052

MECHANICALLY STABILIZED EARTH WALL SYSTEM COMPONENTS

1052.1 This specification covers material requirements for metallic soil reinforcement, non-metallic soil reinforcement, concrete facing panels for large block wall systems, and concrete blocks for small block wall systems that are supplied as part of mechanically stabilized earth wall systems. All precast items shall be in accordance with Sec 1001.

SECTION 1052.10 METALLIC SOIL REINFORCEMENT.

1052.10.1 Scope. This specification covers metallic soil reinforcement and the accompanying attachments utilized in mechanically stabilized earth wall systems.

1052.10.2 Reinforcement Strips. Metallic soil reinforcement strips shall be in accordance with the specifications of the manufacturer of the wall system and the contract documents. The minimum grade of steel for strips and connection devices shall be AASHTO M 270, Grade 36.

1052.10.3 Reinforcement Mesh. Metallic soil reinforcement mesh shall be in accordance with the specifications of the manufacturer of the wall system and the contract documents. The minimum grade of steel for strips and connection devices shall be either AASHTO M 270 Grade 36, ASTM A 1011 Grade 50 or ASTM A 463 Grade 50. Welding shall be in accordance with AASHTO M 55.

1052.10.4 Fasteners. Fasteners shall consist of either AASHTO M 164 hexagon head bolts or AASHTO M 164 hexagonal cap screws with nuts and washers.

1052.10.5 Galvanizing and Aluminizing. All soil reinforcement material shall be either galvanized or aluminized. Galvanized soil reinforcement shall be in accordance with AASHTO M 111. Aluminized soil reinforcement shall be in accordance with ASTM A 463 Aluminized Type 2-100, SS, Grade 50, Class 2. Fasteners, including bolts, nuts and washers, shall be galvanized in accordance with AASHTO M 232. All connection devices shall be galvanized in accordance with either AASHTO M 111 or M 232.

1052.10.6 Certification. The manufacturer of the wall system shall certify in writing that the soil reinforcement, connections and fasteners meet the minimum requirements directed by the design and this specification. The contractor shall provide this certification and any other supporting documentation to the engineer prior to the material being delivered to the construction site.

SECTION 1052.20 NON-METALLIC SOIL REINFORCEMENT.

1052.20.1 Scope. This specification covers non-metallic or geosynthetic soil reinforcement utilized in mechanically stabilized earth wall systems.

1052.20.2 Geogrids. Non-Metallic or geosynthetic soil reinforcement shall be of a polymeric nature and shall consist of a geogrid determined by the wall manufacturer or supplier.

1052.20.2.1 The geogrid shall be dimensionally stable and shall be able to maintain geometry during transport, handling and installation.

1052.20.2.2 The geogrid manufacturer shall maintain a quality control program to ensure that the manufactured material meets the requirements of the index tests shown below. Sampling and conformance testing for the index tests shown in the table shall be done in accordance with ASTM D 4354.

Geogrids	
Property	**Test Procedure**
Specific Gravity (HDPE only)	ASTM D 1505
Wide Width Tensile	ASTM D 4595, GRI GG1
Melt Flow (HDPE and PP only)	ASTM D 1238
Inherent Viscosity (PET only)	ASTM D 4603, GRI GG8
Hydrolysis Resistance (PET only)	GRI GG7
UV Oxidation Resistance	ASTM D 4355
Survivability	ASTM D 5261

1052.20.3 Certification. The manufacturer of geogrid shall certify in writing that the geogrid is in accordance with this specification. The certification shall include the roll numbers and identification, the sampling procedures, the results of the quality control tests along with the tests used, and the Minimum Average Roll Value (MARV) for each roll. This certification and any other supporting documentation shall be provided to the engineer prior to the material being delivered to the construction site.

SECTION 1052.30 MSE PANEL AND SOUND WALLS

1052.30.1 Scope. This specification covers the concrete facing panels used as part of mechanically stabilized earth wall systems and sound wall systems.

1052.30.2 Acceptance.

1052.30.2.1 Lot Definition. A production lot will be defined as a group of panels and precast posts that will be represented by a single compressive strength sample, and shall consist of either 40 panels and or precast posts or a single day's production, whichever is less.

1052.30.2.2 Quality Control. The QMP shall define QC testing and inspection frequencies including the following.

1052.30.2.3 Compressive strength of cylinders or cores shall be taken at least once a lot in accordance with AASHTO M199. Compressive strength testing may also be performed to control handling and curing operations. Cylinders shall be cured in accordance with AASHTO T23 field curing procedures. For field cure compressive strength samples sufficient cylinders shall be cured in the same manner as the panels and precast posts and tested in accordance with AASHTO T22, shall represent the initial strength of the concrete. In addition, a set of cylinders shall be cured in accordance with AASHTO T23 and tested at 28 days. The average compressive strength of these cylinders, when tested in accordance with AASHTO T22, shall represent the compressive strength of the production lot.

1052.30.2.4 Air content testing shall be performed in accordance with AASHTO T152 or AASHTO T196. Air content samples shall be taken at the beginning of each day's production and at the same time as compressive samples are taken to ensure compliance with this specification.

1052.30.2.5 Slump testing shall be performed in accordance with AASHTO T119. The slump shall be determined at the beginning of each day's production and at the same time as the compressive strength samples are taken.

1052.30.2.6 Aggregate gradation and quality shall be checked at least once a month per aggregate source to ensure compliance with the specifications.

1052.30.2.7 Steel placement shall be checked for each unit.

1052.30.2.8 All equipment used for testing shall be maintained and calibrated in accordance with AASHTO R18 or equivalent program.

1052.30.2.9 QC shall ensure the concrete plant is calibrated, monitored, and maintained in a manner sufficient to provide uniform compliant concrete.

1052.30.2.10 Quality Assurance. The QMP shall reference an industry organization or define independent QA testing frequencies including the following:

Tested Property[a]	Test Method	Independent QA
Air	T152	Twice a year
Slump	T119	Twice a year
Coarse Aggregate Deleterious	TM71	Twice a year
Coarse Aggregate Absorption	T85	Twice a year
Compressive Strength	T22	Twice a year
[a] All samples shall be taken at the precast plant		

1052.30.2.11 MoDOT QA and Auditing. The engineer may perform MoDOT QA testing or audit the producer's QMP, documentation and production at any time, which may include coring of the precast units at the producer's expense.

1052.30.2.12 Other Criteria. Concrete facing panels, coping and precast posts will not be accepted if any of the following defects in physical characteristics are found: imperfect molding, honeycombing or open texture concrete, cracked or severely chipped panels and precast posts, soil reinforcement attachment devices improperly installed/damaged, lifting inserts not useable, exposed reinforcing steel, and color variation on the front face of the panel due to excess form oil or other reasons.

1052.30.3 Material.

1052.30.3.1 Concrete. Concrete material, proportioning, air entraining, mixing, slump and transporting of concrete shall be in accordance with Sec 501, except as noted in this section.

1052.30.3.2 Aggregate. Fine and coarse aggregate for the concrete mixture shall be in accordance with Sec 1005, except that the requirements for gradation and percent passing the No. 200 sieve will not apply.

1052.30.3.3 Steel Reinforcement. Reinforcement shall be in accordance with Sec 1036.

1052.30.4 Design. Shop drawings shall be approved by the Bridge Division is the MSE wall is constructed in conjunction with a bridge abutment.

1052.30.4.1 The concrete shall be an approved MoDOT mix that is air-entrained, with a minimum compressive strength of 4,000 psi at 28 days. No additional admixtures will be permitted unless approved by the engineer.

1052.30.4 Casting. The panels shall be cast in such a manner that the acceptance criteria of this specification are met. Soil reinforcement connection devices shall not be in contact with or attached to the reinforcing steel in the concrete facing panels.

1052.30.5 Manufacturing.

1052.30.5.1 Casting. The panels and precast posts shall be cast in such a manner that the acceptance criteria of this specification are met. Soil reinforcement connection devices shall not be in contact with or attached to the reinforcing steel in the concrete facing panels.

1052.30.5.2 Curing. One of the following methods shall be used. Curing as recommended by the wall designer. Curing membrane, in accordance with Sec 1055, may be applied and if used shall be left intact until the strength requirements are met. Steam and moisture curing methods shall be in accordance with Sec 1029.

1052.30.5.3 Tolerances.

1052.30.5.3.1 Panel and Post Systems. Shall be in accordance with approved shop drawings. Any variations from the approved shop drawings such as dimensions, materials, or finish must be approved by the wall manufacturer. Post dimensions for sound walls shall be within 1/4 inch in width and depth and within one inch along the length dimension.

1052.30.5.3.2 Panel Dimensions. Panel connection devices shall be within one inch of the specified dimension. The panel face and thickness dimensions shall be within 1/8 inch of the specified dimension. All other dimensions or items shall be within 1/4 inch of the specified dimensions.

1052.30.5.3.3 Panel Squareness. Squareness, as determined by the difference between the two diagonals, shall not exceed 1/2 inch.

1052.30.5.3.4 Panel Surface Finish. Surface defects on smooth formed surfaces measured over a length of 5 feet shall not exceed 1/8 inch. Surface defects on the textured-finish surfaces, measured over a length of 5 feet, shall not exceed 3/8 inch.

1052.30.5.4 Other Criteria. Concrete facing panels, coping and precast posts will not be accepted if any of the following defects in physical characteristics are found: imperfect molding, honeycombing or open texture concrete, cracked or severely chipped panels and precast posts, soil reinforcement attachment devices improperly installed/damaged, lifting inserts not usable, exposed reinforcing steel, and color variation on the front face of the panel due to excess form oil or other reasons.

1052.30.6 Marking. The date of manufacture, production lot number and piece mark shall be clearly scribed on an unexposed face of each panel.

1052.30.7 MoDOT Identification Number. When the manufacturer contacts the engineer one business day, or earlier, in advance of shipping precast products the engineer will assign a specific MoDOT identification number for each size and type of product in the shipment.

1052.30.7.1 Prior to delivery to the jobsite, the source, intermediate agent, shipper or contractor's representative shall notify the inspecting District by fax or electronically a minimum of one business day, or earlier, prior to the impending shipment of precast material. This notification shall include a shipping form (Precast Shipping Form) and will include, at minimum, the following:

a) The specific contract number.

b) Receiving Purchaser/Contractor.

c) Line number for which the material will be used.

d) Type and quantity of material.

e) Date of expected delivery to the jobsite.

f) Manufacturer's name.

g) Stationing or structure number on precast unit, if applicable.

h) Panel type, quantity and wall number for MSE panels.

1052.30.7.2 Upon approval, the precaster will receive an identification number. The precast unit shall be clearly and permanently marked by the precaster with the ID number as required by appropriate 1000 specification prior to shipment. Requests for alternate precast labeling shall be submitted to the inspecting District for approval. Material without proper identification number(s) will not be permitted for use on a project.

1052.30.8 Handling, Storage and Shipping. All panels shall be free of chips, discoloration, cracks, fractures, and any other defects determined to be detrimental to the cosmetic value or to the performance characteristics of the panels. The panels shall not be subjected to excessive bending stresses and the panel connection devices and exposed exterior finish shall be protected from damage.

1052.30.9 Documentation. Copies of test results for all required tests, and any other supporting documentation shall be in accordance with Sec 1001.14.

1052.30.10 Delivery. A bill of lading or delivery receipt shall be furnished to the engineer at the destination point. The bill of lading shall contain an itemized statement of the sizes and lengths of precast units with the corresponding MoDOT identification number provided to the manufacturer for each size and type of precast unit for that shipment. The bill of lading shall contain a certified statement. The certified statement shall be signed by an authorized representative of the manufacturer and shall state the following:

"This certifies that the precast products in this shipment are in accordance with MoDOT specifications."

SECTION 1052.40 SMALL BLOCK WALL SYSTEMS - CONCRETE BLOCKS.

1052.40.1 Scope. This specification covers the concrete blocks used as part of small block mechanically stabilized earth wall systems. Wet cast blocks shall be produced in accordance with Sec 1052.30. Dry cast blocks shall be produced at stated below.

1052.40.2 Acceptance. Acceptance will be based upon manufacture test results compliant with the following requirements.

1052.40.2.1 Freeze Thaw Testing. The concrete blocks shall be tested for freeze-thaw durability in accordance with ASTM C1262. Freeze-thaw durability shall be based on tests from five specimens made with the same material, concrete mix design, manufacturing process and curing method conducted not more than 18 months prior to delivery. Test results will be required for each project.

1052.40.2.2 Units that are not exposed to deicing salts shall be in accordance with the following testing requirements. When tested in water, the weight loss of each of five test specimens at the conclusion of 100 cycles shall not exceed 1.0 percent of its initial weight; or the weight loss of each of four of the five test specimens at the conclusion of 150 cycles shall not exceed 1.5 percent of its initial weight.

1052.40.2.3 Test results for units that are exposed to deicing salts shall be tested in a 3 percent saline solution and shall be in accordance with the following:

a) When tested in 3 percent saline solution the weight loss of each of five test specimens at the conclusion of 40 cycles shall not exceed 1.0 percent of the initial weight; or the weight loss of each of four of the five test specimens at the conclusion of 50 cycles shall not exceed 1.5 percent of its initial weight.

1052.40.2.4 Compressive Strength. Acceptance of the compressive strength of the concrete blocks will be based on production lots in compliance with ASTM C140. Acceptance of the compressive strength of a production lot will occur if the compressive strength test results is equal to or greater than the design strength at 28 days. The engineer of record shall evaluate and approve acceptance of deviations below design strength.

1052.40.2.5 Absorption. The manufacturer shall sample and test units based on production lots for absorption in accordance with ASTM C140.

1052.40.2.6 Dimensional Tolerances. Concrete blocks shall be manufactured within the following tolerances:

a) The length and width of each concrete block shall be within 1/8 inch of the specified dimension.

b) The height of each concrete block shall be within 1/16 inch of the specified dimension.

c) When a broken face finish is used, the dimension of the front face shall be within one inch of the theoretical dimension of the concrete block.

1052.40.2.7 Other Criteria. All concrete blocks shall be sound and free of cracks or other defects that would interfere with the proper placement of the blocks or significantly impair the strength or permanence of the construction. At the time of the delivery to the work site the concrete blocks shall:

a) A maximum water absorption of 5 percent

b) Minor cracks incidental to the usual method of manufacture or minor chipping resulting from shipment and delivery will not be grounds for rejection. Minor cracks will be defined as cracks that are no wider than 1/64 inch and no longer than 25 percent of the block height.

c) Any exposed face of a concrete block shall be free of chips, cracks or other imperfections when viewed from a distance of 30 feet under diffused lighting. Up to 5 percent of a shipment may contain slight cracks or small chips no larger than one inch.

1052.40.2.8 Concrete blocks shall not be accepted if any of the requirements specified above or the following defects in physical characteristics are found:

a) Defects indicating imperfect molding.

b) Defects indicating honeycomb or open texture concrete.

c) Cracked or severely chipped blocks.

d) Color variation on front face of blocks.

1052.40.3 Material.

1052.40.3.1 Concrete. Concrete material, proportioning, air entraining, mixing, slump and transporting of concrete shall be in accordance with Sec 501, except as noted in this section. Coloring pigments, integral water repellants, finely ground silica and other constituents shall be previously directed as suitable for use and shall be in accordance with applicable ASTM standards, or evidence shall be provided to prove the product is not detrimental to the durability of the concrete blocks or any material customarily used in masonry construction.

1052.40.3.2 Aggregate. Fine and coarse aggregate for the concrete mixture shall be in accordance with Sec 1005, except that the requirements for gradation and percent passing the No. 200 sieve will not apply.

1052.40.4 Design. The concrete mixture shall have a minimum compressive strength of 4,000 psi at 28 days. The design including all contents of the mixture and curing method shall be submitted to the engineer for approval prior to use.

1052.40.5 Manufacturing

1052.40.5.1 Finish Color. Color and finish shall be as shown on the plans. If no color or finish is specified on the plans, the contractor shall provide a color and finish to the engineer for approval.

1052.40.6 Certification. The manufacturer of the concrete blocks shall certify that the concrete blocks are in accordance with this specification. This certification, copies of test results for all required tests, and any other supporting documentation shall be provided to the engineer prior to the material being shipped to the construction site.