



Designation: A1115/A1115M – 24

# Standard Practice for Construction of Mechanically Stabilized Earth Walls with Inextensible Soil Reinforcement<sup>1</sup>

This standard is issued under the fixed designation A1115/A1115M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 Mechanically stabilized earth walls (MSEW) covered in this standard practice are engineered earth retaining structures comprised of pre-fabricated wall facing elements and engineered backfill reinforced with inextensible steel elements. This practice covers procedures and components for the construction of MSEW including soil reinforcement, connections to facing, and selection and placement of granular backfill. Such walls may have a segmental precast concrete (SPC) facing or a flexible wire facing. This standard practice does not address the design of MSEW.

1.2 *Units*—The values stated in either SI units or Imperial units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

A36/A36M Specification for Carbon Structural Steel

A123/A123M Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A153/A153M Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A510/A510M Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel

A572/A572M Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

A780/A780M Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

A902 Terminology Relating to Metallic Coated Steel Products

A1011 Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

A1064/A1064M Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

C136/C136M Test Method for Sieve Analysis of Fine and Coarse Aggregates

D698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))

D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

D1505 Test Method for Density of Plastics by the Density-Gradient Technique

D2000 Classification System for Rubber Products in Automotive Applications

D3080/D3080M Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions

D4439 Terminology for Geosynthetics

F3125/F3125M Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee A05 on Metallic-Coated Iron and Steel Products and is the direct responsibility of Subcommittee A05.12 on Wire Specifications.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

## 2.2 Canadian Standard:<sup>3</sup>

**CAN/CSA G40.20/G40.21** General Requirements for Rolled or Welded Structural Quality Steel

## 2.3 AASHTO Standards:<sup>4</sup>

**AASHTO LRFD** Material Specifications

**AASHTO LRFD** Construction Specifications

**D698** Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))

**M 85** Standard Specification for Portland Cement

**T 90** Standard Method of Test for Determining the Plastic Limit and Plasticity Index of Soils

**T 99** Standard Method of Test for Moisture–Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

**T 104** Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

**T 236** Standard Method of Test for Direct Shear Test of Soils Under Consolidated Drained Conditions (ASTM Designation: D3080-72 (2003))

**T 267** Standard Method of Test for Determination of Organic Content in Soils by Loss on Ignition

**T 288** Standard Method of Test for Determining Minimum Laboratory Soil Resistivity

**T 289** Standard Method of Test for Determining pH of Soil for Use in Corrosion Testing

**T 290** Standard Method of Test for Determining Water-Soluble Sulfate Ion Content in Soil

**T 291** Standard Method of Test for Determining Water-Soluble Chloride Ion Content in Soil

## 2.4 FHWA Guidelines:<sup>5</sup>

**GEC 11** Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Slopes – Volume I (Publication No. FHWA-NHI-10-024)

## 3. Terminology

3.1 *Definitions*—For definitions of general terms used in this practice, refer to Terminology **A902**.

### 3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *backing mat, n*—an independent wire mat that is placed behind the rear face of wire faced walls to reduce the aperture size or opening between wires of the facing element.

3.2.2 *batter, n*—intentional deviation of the wall from true vertical or plumb position.

3.2.2.1 *Discussion*—A positive batter indicates the wall is tilted toward the backfill and a negative batter indicates the opposite.

3.2.3 *bearing pads, n*—material inserted between SPC panels to help provide proper spacing and keep the panels from having point contact and spalling.

3.2.3.1 *Discussion*—Typically an elastomeric or polymeric material.

3.2.4 *connection, n*—the connection between the wall facing and the soil reinforcement.

3.2.5 *connection elements, n*—the components used to attach the soil reinforcement to the wall.

3.2.6 *coping, n*—cast-in-place or prefabricated segments used at the top of SPC wall panels to provide the desired aesthetic finish to the wall top.

3.2.7 *Engineer of Record, n*—licensed professional responsible for sealing design drawings and specifications for the overall project.

3.2.8 *engineered backfill, n*—the soil that is compacted between layers of soil reinforcements.

3.2.9 *geotextile, n*—refer to committee D35, Terminology **D4439** for correct terminology.

3.2.10 *Geotechnical Engineer, n*—an engineer trained in the behavior of soil, rock, and slope stability.

3.2.11 *hog rings, n*—galvanized clips used to secure backing mats, hardware cloth, or facing of wire faced walls, or a combination thereof.

3.2.12 *leveling pad, n*—an unreinforced concrete pad used to provide a level, consistent surface at the proper grade to place the first row of panels.

3.2.13 *mechanically stabilized earth wall (MSEW), n*—engineering term for the stabilization of earth structures using soil reinforcements.

3.2.14 *prepared foundation, n*—excavated and proof-rolled area that the reinforced soil and leveling course bears on.

3.2.15 *reinforced soil, n*—a composite structure composed of alternating layers of compacted granular backfill and soil reinforcements.

3.2.16 *soil reinforcement, n*—a manufactured steel element that is placed between layers of engineered backfill.

3.2.17 *struts, n*—wire element used to secure support and maintain the vertical alignment of the wire facing during the backfilling operation.

3.2.18 *wall design engineer, n*—the Licensed Professional Engineer or Engineering Firm that designs the final details of the MSEW.

3.2.19 *wall facing panels, n*—discrete modular panels comprised of precast reinforced concrete, flexible welded wire, metal, wood, or other materials.

3.2.19.1 *Discussion*—The panels are placed vertically and used to contain or confine the soil in position at the face of the wall.

3.2.20 *wooden wedges, n*—hardwood wedges used to assist in maintaining the panels at the correct batter during placement and compaction of the backfill.

## 4. Significance and Use

4.1 Mechanically stabilized earth walls (MSEW) are engineered earth retaining structures comprised of pre-fabricated wall facing elements and engineered backfill that is reinforced

<sup>3</sup> Available from Canadian Standards Association (CSA), 178 Rexdale Blvd., Toronto, ON M9W 1R3, Canada, <http://www.csagroup.org>.

<sup>4</sup> Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, <http://www.transportation.org>.

<sup>5</sup> Available from Federal Highway Administration (FHWA), 1200 New Jersey Ave., SE, Washington, DC 20590, <http://www.fhwa.dot.gov>.