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SUPERSEDED BY EI 09-027 EFFECTIVE 5/6/10	*New York State Department of Transportation* **ENGINEERING INSTRUCTION**	**EI 08-038**	

Title: **SECTION 733 – EARTHWORK MATERIALS: MECHANICALLY STABILIZED EARTH SYSTEM BACKFILL MATERIAL GEOSYNTHETIC REINFORCED EARTH SYSTEM SLOPE BACKFILL MATERIAL**

Distribution:

- ☒ Manufacturers (18)
- ☒ Local Govt. (31)
- ☒ Agencies (32)
- ☐ Surveyors (33)
- ☒ Consultants (34)
- ☒ Contractors (39)
- ☐ _____( )

Approved:

Robert L. Sack, P.E.
Deputy Chief Engineer (Research)

6·OCT·08
Date

ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the letting of May 7, 2009.
- Superseded issuance(s): This EI does not supersede any previous issuances.
- The information transmitted by this issuance will be incorporated into a future revision to the Standard Specifications.

PURPOSE: The purpose of this EI is to issue the following additions to Section 733 *Earthwork Materials*:

§733-02 *Mechanically Stabilized Earth System Backfill Material.*
§733-03 *Geosynthetic Reinforced Earth System Slope Backfill Material.*

TECHNICAL INFORMATION:

- To embrace the future that is SiteManager, the Geotechnical Engineering Bureau is changing how some of its specifications are written to align them with most Standard Specifications, which separate materials from pay items. Standard Specification §733-02 is being assigned the material specifications related to the backfill material for a Mechanically Stabilized Earth System (MSES). Standard Specification §733-03 is being assigned the material specifications related to the backfill material for an over steepened slope constructed utilizing Geosynthetic Reinforced Earth System (GRES). These changes align the specifications with SiteManager's methodology in defining its Material Codes and Pay Items, with Items referring to one or many Materials.

- The materials section for the MSES backfill material was revised to include:
  1. An explanation of the provision for the Department to perform Quality Assurance (QA) testing on MSES material.
  2. Additional backfill materials that include recycled Portland Cement Concrete Aggregate (RCA) and crushed stone with a size designation 2.
  3. The requirements for acceptance of material on the contract site and acceptance of the material as part of the MSES.

- The materials section for the GRES backfill material was incorporated from the special specification Item 554.9610/20--17 Geosynthetic Reinforced Earth System (Permanent/Temporary).

- The Standard Specification Section 554 *Internally Stabilized Fill Structures* is being issued concurrently via EI 08-037.

- The revision to the Construction Inspection Manual (CIM) MURK Part 1B with the new title Section 554 *Internally Stabilized Fill Structures* will be issued separately at a later date.

IMPLEMENTATION:

- The Main Office Design Quality Assurance Bureau will insert these standard specification shelf notes beginning with projects submitted for the letting of May 7, 2009.

TRANSMITTED MATERIALS:

- Standard Specification shelf notes of *§733-02 Mechanically Stabilized Earth System Backfill Material.* Both metric and US Customary shelf notes are attached.

- Standard Specification shelf notes of *§733-03 Geosynthetic Reinforced Earth System Slope Backfill Material.* Both metric and US Customary shelf notes are attached.

BACKGROUND: The NYS Department of Transportation is implementing Trns·port SiteManager, including both Construction and Materials functionality. Implementation of standard AASHTO software enables SiteManager to allow revising business practices to be more consistent with industry-accepted best practices. The revisions to the Standard Specifications are to conform to SiteManager's methodology in defining its Material Codes and Pay Items.

CONTACT: Questions or comments regarding this issuance should be directed to Randall. J. Romer, P.E. of the Geotechnical Engineering Bureau at (518) 457-4714, rromer@dot.state.ny.us.

MECHANICALLY STABILIZED EARTH SYSTEM BACKFILL MATERIAL
GEOSYNTHETIC REINFORCED EARTH SYSTEM SLOPE BACKFILL MATERIAL

Make the following changes to the Standard Specifications dated May 4, 2006 as modified by EI 08-035:

Add the following subsections:

§733-02 – MECHANICALLY STABILIZED EARTH SYSTEM BACKFILL MATERIAL

QUALITY ASSURANCE PROGRAM. The Department maintains a Quality Assurance (QA) program instituted by the Geotechnical Engineering Bureau (GEB) for backfill material used in a Mechanically Stabilized Earth System (MSES). The Department will sample and test backfill taken from behind the newly-constructed wall and, if the material is determined to not meet specification requirements, reject said material.

The number of samples and their locations (plan and elevation) will be determined by the quantity of material to be used in each MSES structure. Results from chemical testing (i.e. resistivity, sulfates, sulfides, chlorides) can take several weeks to obtain.

SCOPE. This specification covers the material requirements and methods of testing backfill material generally used for the construction of a MSES.

SAMPLING. Perform material tests and assurance methods pertaining to the backfill requirements in conformance with the procedures contained in the geotechnical control procedure "*Procedure for the Control and Quality Assurance of Granular Materials*".

GENERAL. Provide backfill material for any MSES from a single source unless prior approval for use of designated multiple sources is obtained from the Director, GEB.

MATERIAL REQUIREMENTS.

A. STOCKPILE. Stockpile the backfill material in accordance with the geotechnical control procedure "*Procedure for the Control and Quality Assurance of Granular Materials*".

B. GRADATION. Provide backfill material of one of the following types:

1. Type A. Material consisting of any mineral (inorganic) soil, blasted or broken rock, or similar materials of natural origin, including mixtures thereof, and having a gradation in accordance with TABLE 733-02A *Backfill Gradation*.

TABLE 733-02A BACKFILL GRADATION	
Sieve Size Designation	**Percentage Passing by Weight**
100 mm	100
6.3 mm	30-100
425 μm	0-60
75 μm	0-15

2. Type B. Material consisting of crushed stone conforming to §703-02 *Coarse Aggregate*, Size Designation 2.

3. Type C. Material consisting of recycled Portland Cement Concrete Aggregate (RCA). Type C backfill consists of at least 95%, by weight, of RCA and is free from organic and other

deleterious material. Material may contain up to 5% by weight asphalt and/or brick. Gradation for Type C backfill conforms to Table 733-02A *Backfill Gradation.*

4. Type D. Material consisting of recycled Portland Cement Concrete Aggregate (RCA). Type D backfill consists of at least 95%, by weight, of RCA and is free from organic and other deleterious material. Material may contain up to 5% by weight asphalt and/or brick. Gradation for Type D backfill conforms to §703-02 *Coarse Aggregate*, Size Designation 2.

C. PLASTICITY INDEX. Provide material having a Plasticity Index not exceeding 5.

D. DURABILITY. Provide material having a Magnesium Sulfate Soundness loss less than 30 percent.

E. CORROSION POTENTIAL (METAL REINFORCING AND/OR CONNECTORS ONLY). The Department will test for the corrosion potential of any system with exposed metal in the backfill. Stockpiled materials will be tested for resistivity and pH, and may be tested for sulfides at the Department's discretion. Material failing to meet the following requirements of Table 733-02B *Resistivity, Soluble Salts and pH Requirements*, will be rejected except as specified below:

Material failing to meet the resistivity criterion may be tested for sulfate and chlorides. Material meeting the criteria for both sulfates and chlorides and having a resistivity greater than 10 ohm-m will be acceptable. Chemical testing is not required for Type B backfill or for Type D backfill.

TABLE 733-02B RESISTIVITY, SOLUBLE SALTS AND pH REQUIREMENTS

Property		Test Method	Acceptance Criteria
Resistivity		AASHTO T288	$\rho \geq 30$ ohm-m
Chlorides		AASHTO T291 Method A	$Cl^- \leq 100$ mg/kg
Sulfates		AASHTO T290 Method A, gravimetric	$SO_4^{2-} \leq 200$ mg/kg
		AASHTO T290 Method B, turbidmetric	
Sulfides		NYSDOT Test Method 711-12C	$S^{2-} \leq 300$ mg/kg
pH	Type A or C	NYSDOT GTM-24	$5 \leq pH \leq 10$
	Type B or D	NYSDOT GTM-24	$5 \leq pH \leq 12.5$

BASIS OF APPROVAL. Stockpiles of MSES backfill material will be approved in accordance with the geotechnical control procedure "*Procedure for the Control and Quality Assurance of Granular Materials*".

BASIS OF ACCEPTANCE. Backfill material from approved stockpiles will be accepted on the contract site by delivery ticket. Each delivery ticket shall identify the Suppliers name, date, NYSDOT contract number, stockpile number, item number and quantity.

Backfill material from approved stockpiles will be accepted as part of the MSES upon confirmation that the material gradation type provided by the Contractor, outlined in §733-02B *Gradation,* conforms to the MSES submittal provided by the wall system designer-supplier and upon successful completion of the QA program indicating that the material conforms to the specification.

§733-03 – GEOSYNTHETIC REINFORCED EARTH SYSTEM SLOPE BACKFILL MATERIAL

SCOPE. This specification covers the material requirements and methods of testing backfill material generally used for the construction of over steepened slopes utilizing Geosynthetic Reinforced Earth System (GRES).

SAMPLING. Obtain a representative sample of the source for the performance of a gradation analysis in accordance with the procedures contained in the geotechnical test method "*Test Method for the Grain-Size Analysis of Granular Soil Materials*".

MATERIAL REQUIREMENTS. Any mineral (inorganic) soil, blasted or broken rock, or similar materials of natural origin, including mixtures thereof, may be suitable materials subject to the following:

A. GRADATION. Provide backfill material conforming to the following:

1. Gradation Spread. Provide backfill material having a gradation in accordance with TABLE 733-03A *Backfill Gradation*.

TABLE 733-03A BACKFILL GRADATION	
Sieve Size Designation	**Percentage Passing by Weight**
150 mm	100
425 μm	0-60
75 μm	0-40

2. Gradation Ratio. Provide backfill material having a gradation ratio in accordance with the following formula:

$$\frac{Percent\ Pass.\ 75\mu m\ sieve}{Percent\ Pass.\ 425\mu m\ sieve} x100 \leq 70$$

The gradation is evaluated at the contract level.

BASIS OF APPROVAL. Sources will be approved upon successful completion of the gradation tests indicating that the material conforms to the specification.

BASIS OF ACCEPTANCE. Backfill material from a source not within the contract limits will be accepted on the contract site by delivery ticket. Each delivery ticket shall identify the Suppliers name, date, NYSDOT contract number, item number, and quantity.

Backfill material will be accepted based upon successful completion of the gradation tests indicating that the material conforms to the specification.

MECHANICALLY STABILIZED EARTH SYSTEM BACKFILL MATERIAL
GEOSYNTHETIC REINFORCED EARTH SYSTEM SLOPE BACKFILL MATERIAL

Make the following changes to the Standard Specifications dated May 1, 2008 as modified by EI 08-035:

Add the following subsections:

§733-02 – MECHANICALLY STABILIZED EARTH SYSTEM BACKFILL MATERIAL

QUALITY ASSURANCE PROGRAM. The Department maintains a Quality Assurance (QA) program instituted by the Geotechnical Engineering Bureau (GEB) for backfill material used in a Mechanically Stabilized Earth System (MSES). The Department will sample and test backfill taken from behind the newly-constructed wall and, if the material is determined to not meet specification requirements, reject said material.

The number of samples and their locations (plan and elevation) will be determined by the quantity of material to be used in each MSES structure. Results from chemical testing (i.e. resistivity, sulfates, sulfides, chlorides) can take several weeks to obtain.

SCOPE. This specification covers the material requirements and methods of testing backfill material generally used for the construction of a MSES.

SAMPLING. Perform material tests and assurance methods pertaining to the backfill requirements in conformance with the procedures contained in the geotechnical control procedure "*Procedure for the Control and Quality Assurance of Granular Materials*".

GENERAL. Provide backfill material for any MSES from a single source unless prior approval for use of designated multiple sources is obtained from the Director, GEB.

MATERIAL REQUIREMENTS.

A. STOCKPILE. Stockpile the backfill material in accordance with the geotechnical control procedure "*Procedure for the Control and Quality Assurance of Granular Materials*".

C. GRADATION. Provide backfill material of one of the following types:

1. Type A. Material consisting of any mineral (inorganic) soil, blasted or broken rock, or similar materials of natural origin, including mixtures thereof, and having a gradation in accordance with TABLE 733-02A *Backfill Gradation*.

TABLE 733-02A BACKFILL GRADATION	
Sieve Size Designation	**Percentage Passing by Weight**
4 in.	100
¼ in.	30-100
No. 40	0-60
No. 200	0-15

2. Type B. Material consisting of crushed stone conforming to §703-02 *Coarse Aggregate*, Size Designation 2.

3. Type C. Material consisting of recycled Portland Cement Concrete Aggregate (RCA). Type C backfill consists of at least 95%, by weight, of RCA and is free from organic and other deleterious material. Material may contain up to 5% by weight asphalt and/or brick. Gradation for

Type C backfill conforms to Table 733-02A *Backfill Gradation.*

4. Type D. Material consisting of recycled Portland Cement Concrete Aggregate (RCA). Type D backfill consists of at least 95%, by weight, of RCA and is free from organic and other deleterious material. Material may contain up to 5% by weight asphalt and/or brick. Gradation for Type D backfill conforms to §703-02 *Coarse Aggregate*, Size Designation 2.

C. PLASTICITY INDEX. Provide material having a Plasticity Index not exceeding 5.

D. DURABILITY. Provide material having a Magnesium Sulfate Soundness loss less than 30 percent.

E. CORROSION POTENTIAL (METAL REINFORCING AND/OR CONNECTORS ONLY). The Department will test for the corrosion potential of any system with exposed metal in the backfill. Stockpiled materials will be tested for resistivity and pH, and may be tested for sulfides at the Department's discretion. Material failing to meet the following requirements of Table 733-02B *Resistivity, Soluble Salts and pH Requirements*, will be rejected except as specified below:

Material failing to meet the resistivity criterion may be tested for sulfate and chlorides. Material meeting the criteria for both sulfates and chlorides and having a resistivity greater than 10 ohm-m will be acceptable. Chemical testing is not required for Type B backfill or for Type D backfill.

TABLE 733-02B RESISTIVITY, SOLUBLE SALTS AND pH REQUIREMENTS

Property		Test Method	Acceptance Criteria
Resistivity		AASHTO T288	$\rho \geq 30$ ohm-m
Chlorides		AASHTO T291 Method A	$Cl^- \leq 100$ mg/kg
Sulfates		AASHTO T290 Method A, gravimetric	$SO_4^{2-} \leq 200$ mg/kg
		AASHTO T290 Method B, turbidmetric	
Sulfides		NYSDOT Test Method 711-12C	$S^{2-} \leq 300$ mg/kg
pH	Type A or C	NYSDOT GTM-24	$5 \leq pH \leq 10$
	Type B or D	NYSDOT GTM-24	$5 \leq pH \leq 12.5$

BASIS OF APPROVAL. Stockpiles of MSES backfill material will be approved in accordance with the geotechnical control procedure "*Procedure for the Control and Quality Assurance of Granular Materials*".

BASIS OF ACCEPTANCE. Backfill material from approved stockpiles will be accepted on the contract site by delivery ticket. Each delivery ticket shall identify the Suppliers name, date, NYSDOT contract number, stockpile number, item number and quantity.

Backfill material from approved stockpiles will be accepted as part of the MSES upon confirmation that the material gradation type provided by the Contractor, outlined in §733-02B *Gradation,* conforms to the MSES submittal provided by the wall system designer-supplier and upon successful completion of the QA program indicating that the material conforms to the specification.

§733-03 – GEOSYNTHETIC REINFORCED EARTH SYSTEM SLOPE BACKFILL MATERIAL

SCOPE. This specification covers the material requirements and methods of testing backfill material generally used for the construction of over steepened slopes utilizing Geosynthetic Reinforced Earth System (GRES).

SAMPLING. Obtain a representative sample of the source for the performance of a gradation analysis in accordance with the procedures contained in the geotechnical test method "*Test Method for the Grain-Size Analysis of Granular Soil Materials*".

MATERIAL REQUIREMENTS. Any mineral (inorganic) soil, blasted or broken rock, or similar materials of natural origin, including mixtures thereof, may be suitable materials subject to the following:

A. GRADATION. Provide backfill material conforming to the following:

1. Gradation Spread. Provide backfill material having a gradation in accordance with TABLE 733-03A *Backfill Gradation.*

TABLE 733-03A BACKFILL GRADATION	
Sieve Size Designation	**Percentage Passing by Weight**
6 in.	100
No. 40	0-60
No. 200	0-40

2. Gradation Ratio. Provide backfill material having a gradation ratio in accordance with the following formula:

$$\frac{Percent\ Pass.\ No.200\ sieve}{Percent\ Pass.\ No.40\ sieve} x100 \leq 70$$

The gradation is evaluated at the contract level.

BASIS OF APPROVAL. Sources will be approved upon successful completion of the gradation tests indicating that the material conforms to the specification.

BASIS OF ACCEPTANCE. Backfill material from a source not within the contract limits will be accepted on the contract site by delivery ticket. Each delivery ticket shall identify the Suppliers name, date, NYSDOT contract number, item number, and quantity.

Backfill material will be accepted based upon successful completion of the gradation tests indicating that the material conforms to the specification.