

To: SUPERSEDED BY EI 10-02S EFFECTIVE <u>1/6/11</u>		New York State Department of Transportation ENGINEERING INSTRUCTION	EI 08-005
Title: STANDARD SPECIFICATIONS SECTION 737 – GEOSYNTHETICS			
Distribution: ☐ Manufacturers (18) ☐ Surveyors (33) ☒ Main Office (30) ☒ Consultants (34) ☒ Local Govt. (31) ☒ Contractors (39) ☒ Regional/Agencies (32) ☐ _____ ()		Approved:  Robert L. Sack, P.E. Deputy Chief Engineer (Research) 14 Feb 08 Date	

ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the letting of September 4, 2008.
- Superseded issuance(s): This EI does not supersede any previous issuances.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 a new section 737 Geosynthetics of the Standard Specifications.

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. Section 737 is being assigned the material specifications related to Geosynthetics. This change also will align the specifications with SiteManager methodology in defining its Material Codes and Pay Items, with Items referring to one or many Materials.

IMPLEMENTATION:

- The Main Office Design Quality Assurance Bureau will insert these standard specification shelf notes beginning with projects submitted for the letting of September 4, 2008.

TRANSMITTED MATERIALS:

- Standard Specification shelf notes of *Section 737 Geosynthetics*.

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. Questions or comments regarding the technical aspects of the revisions to the Standard Specification should be directed to John Remmers of the Geotechnical Engineering Bureau at (518) 457-4704, jremmers@dot.state.ny.us.

STANDARD SPECIFICATIONS SECTION 737 – GEOSYNTHETICS

Make the following changes to the Standard Specifications dated May 4, 2006:

add the following:

SECTION 737 – GEOSYNTHETICS

QUALITY ASSURANCE PROGRAM. The Department maintains a Quality Assurance (QA) program for geosynthetics. The Geotechnical Engineering Bureau will test a sample of the geosynthetic material delivered to the project site. The results of the QA testing will not effect the use of a material on the project for which it is supplied. It is for the purpose of monitoring any changes in manufacturing processes which may affect the original properties that were determined at the time of initial approval.

Several scenarios may develop as a result of the QA testing.

1. The properties are shown to be the same as originally determined within the statistical validity of the test. No action will be taken.
2. The properties are shown to be significantly different than originally determined.
 - a. If the results are within the acceptable minimum for approval, contact with the manufacturer will be made by the Geotechnical Engineering Bureau to determine what has changed.
 - b. If the results are below the minimum acceptable for approval, the product's status on the Approved List will be re-evaluated. The manufacturer will be notified of the review.

737-01 GEOTEXTILES

SCOPE. This specification covers the material requirements and methods of testing geosynthetic materials used in highway construction. The following Geotextile Structure Types are evaluated in this specification:

737.0101 – Needle-Punched - Non-Woven	(NP - NW)
737.0102 – Heatbonded - Non-Woven	(HB - NW)
737.0103 – Monofilament - Woven	(MF - W)
737.0104 – Multifilament – Woven	(MuF - W)
737.0105 – Slit Film – Woven	(SF – W)
737.0106 – Combination Monofilament/Fibrillated Yarn – Woven	(C – W)
737.0107 – Circular – Woven	(Cir – W)

GENERAL. The Department's evaluation of geotextiles submitted will be based on the following tests:

1. Soil Retention - The test to evaluate this characteristic will be performed in accordance with the Apparent Opening Size Test, ASTM D4751.
2. Flow Capacity - The test to evaluate this characteristic will be performed in accordance with the Permittivity Test, ASTM Method D4491.
3. Tensile Strength - The tests to evaluate this characteristic will be performed in accordance with the following:
 - a. Grab Test Method, ASTM D4632
 - b. Trapezoid Tear Test Method, ASTM D4533
 - c. Static Puncture Strength Using a 50-mm Probe, ASTM D6241

STANDARD SPECIFICATIONS SECTION 737 – GEOSYNTHETICS

Applications. Based on the above tests and criteria that follow, the Geotextiles may be accepted for the following:

- Geotextile Bedding
- Geotextile Separation
- Geotextile Drainage
- Geotextile Slope Protection
- Geotextile Stabilization
- Turbidity Curtains
- Silt Fence

MATERIAL REQUIREMENTS. Following is a table of the requirements for acceptance to the Approved List for the pay items established in the specifications. The pay items are identified by applications:

A. Geotextile Bedding. Geotextile bedding shall meet the requirements of Table 737-01A.

Table 737-01A Bedding Geotextile Requirements									
Application	Geotextile Structure	Minimum Strength Class Requirements					Bedding Class Requirements		
		Class	Percent Elongation (%)	Grab Strength (N)	Tear Strength (N)	Puncture Strength (N)	Class	Apparent Opening Size (maximum)	Minimum Permittivity (sec ⁻¹)
Geotextile Bedding	C - W	1	< 50%	1400	500	2750	A	Sieve Size (mm) 0.43	0.7
			≥ 50%	900	350	1925	B	Sieve Designation No. 60	0.2
	MF - W	2	< 50%	1100	250	2200	C	Sieve Designation No. 70	0.1
			≥ 50%	700	250	1375			

B. Geotextile Separation. Geotextile separation shall meet the requirements of Table 737-01B.

Table 737-01B Separation Geotextile Requirements									
Application	Geotextile Structure	Minimum Strength Class Requirements					Separation Class Requirements		
		Class	Percent Elongation (%)	Grab Strength (N)	Tear Strength (N)	Puncture Strength (N)	Class	Apparent Opening Size (maximum)	Minimum Permittivity (sec ⁻¹)
Geotextile Separation	Any type listed in §737-01 Scope	2	< 50%	1100	400 ¹	2200	NA (X)	Sieve Size (mm) 0.6	0.02
			≥ 50%	700	250	1375		Sieve Designation No. 30	

Table 737-01B Notes:

¹ For woven monofilament geotextiles the minimum average value is 250 N.

C. Geotextile Drainage. Geotextile drainage shall meet the requirements of Table 737-01C.

Table 737-01C Drainage Geotextile Requirements										
Application	Geotextile Structure	Minimum Strength Class Requirements					Drainage Class Requirements			
		Class	Percent Elongation (%)	Grab Strength (N)	Tear Strength (N)	Puncture Strength (N)	Class	Apparent Opening Size (maximum)		Minimum Permittivity (sec ⁻¹)
								Sieve Size (mm)	Sieve Designation	
Geotextile Drainage	Non-Woven	2	< 50%	1100	400	2200	A	0.43	No. 40	0.5
			≥ 50%	700	250	1375	B	0.25	No. 60	0.2
							C	0.22	No. 70	0.1

D. Geotextile Slope Protection. Geotextile slope protection shall meet the requirements of Table 737-01D.

Table 737-01D Slope Protection Geotextile Requirements										
Application	Geotextile Structure	Minimum Strength Class Requirements					Slope Protection Class Requirements			
		Class	Percent Elongation (%)	Grab Strength (N)	Tear Strength (N)	Puncture Strength (N)	Class	Apparent Opening Size (maximum)		Minimum Permittivity (sec ⁻¹)
								Sieve Size (mm)	Sieve Designation	
Geotextile Slope Protection	NP - NW	1	< 50%	1400	500	2750	A	0.43	No. 40	0.7
			≥ 50%	900	350	1925	B	0.25	No. 60	0.2
							C	0.22	No. 70	0.1

E. Geotextile Stabilization. Geotextile stabilization shall meet the requirements of Table 737-01E.

Table 737-01E Stabilization Geotextile Requirements										
Application	Geotextile Structure	Minimum Strength Class Requirements					Stabilization Class Requirements			
		Class	Percent Elongation (%)	Grab Strength (N)	Tear Strength (N)	Puncture Strength (N)	Class	Apparent Opening Size (maximum)		Minimum Permittivity (sec ⁻¹)
								Sieve Size (mm)	Sieve Designation	
Geotextile Stabilization	Any type listed in §737-01 Scope	1	< 50%	1400	500	2750	NA (X)	0.43	No. 40	0.05
			≥ 50%	900	350	1925				

F. Turbidity Curtain. Turbidity curtains shall meet the requirements of Table 737-01F.

Table 737-01F Turbidity Curtain Requirements										
Application	Geotextile Structure	Minimum Strength Class Requirements					Turbidity Curtain Class Requirements			
		Class	Percent Elongation (%)	Grab Strength (N)	Tear Strength (N)	Puncture Strength (N)	Class	Apparent Opening Size (maximum)		Minimum Permittivity (sec ⁻¹)
								Sieve Size (mm)	Sieve Designation	
Turbidity Curtain	Any type listed in §737-01 Scope	2	< 50%	1100	400 ¹	2200	NA (X)	0.3	No. 50	0.4
			≥ 50%	700	250	1375				

Table 737-01F Notes:

¹ For woven monofilament geotextiles the minimum average value is 250 N.

STANDARD SPECIFICATIONS SECTION 737 – GEOSYNTHETICS

G. Silt Fence. Silt fences shall meet the requirements of Table 737-01G.

Table 737-01G Silt Fence Requirements

Application		Geotextile Structure	Minimum Strength Class Requirements							Silt Fence Class Requirements			
										Apparent Opening Size (maximum)		Minimum Permittivity (sec ⁻¹)	
										Sieve Size (mm)	Sieve Desig.		Class
Silt Fence	Any type listed in §737-01 Scope	Any type listed in §737-01 Scope	1.2	NA	400	MD	Supported ¹	s	NA	0.6	No. 30	0.05	
						XD							
			1.2	≥ 50% ²	550	MD	Unsupported	us 1.2					
					450	XD							
			2.0	< 50% ²	550	MD	Unsupported	us 2					
					450	XD							

Table 737-01G Notes:

¹ Silt fence support shall consist of 14 gage steel wire with a mesh spacing of 150 mm x 150 mm or prefabricated polymeric mesh of equivalent strength.

² As measured in accordance with ASTM D4632.

³ MD = Machine Direction, XD = Cross-Machine Direction.

STANDARD SPECIFICATIONS SECTION 737 – GEOSYNTHETICS

BASIS OF APPROVAL. All geotextiles, including those sold under a private label agreement, being submitted for testing and approval must be submitted through the American Association of State Highway and Transportation Officials (AASHTO) National Transportation Product Evaluation Program (NTPEP). The program has four submittal periods per calendar year. Information regarding submittal is available at the address shown below:

AASHTO-NTPEP Coordinator
444 N. Capitol St., NW, Suite 249
Washington, DC 20001

The approval criterion for geotextiles is based on AASHTO M-288 Specification for Geotextiles.

The approval/rejection of geotextiles for use on NYSDOT projects is based on the NTPEP Report and shown on the Approved List.

BASIS OF ACCEPTANCE. Properly labeled geotextiles shall be accepted on the basis of manufacturer's certification along with the brand name and style appearing on the Department's Approved List for the intended application.

737-02 GEOMEMBRANES

A. Geomembranes. The Department's evaluation of geomembranes submitted will be based on the following tests:

1. Tensile Strength - Test in accordance with ASTM D4632, Grab Test Method.
2. Elongation - Test in accordance with ASTM D4632.
3. Trapezoidal Tear Resistance - Test in accordance with ASTM D4535, Trapezoid Tear Test Method.
4. Puncture - Test in accordance with ASTM D4833, Index Puncture Resistance.

Geomembranes shall meet the following requirements:

1. Ultimate Tensile Strength - 800 N⁽¹⁾
 2. Ultimate Elongation - 65%⁽¹⁾
 3. Trapezoid Tear Resistance - 265 N⁽¹⁾
 4. Puncture - 400 N⁽²⁾
- (1) Minimum value in weaker principal direction. The average of the test results in the weaker principal direction shall be equal to or greater than the stated values.
- (2) The average of the test results for puncture shall meet or exceed the stated value.

BASIS OF APPROVAL. Producers of geomembranes shall demonstrate the quality of their products before being placed on the Department's Approved List. The producer shall provide:

1. A completed New York State Department of Transportation Product Evaluation Form, Form Number SM 465.
2. A test data sheet identifying the geomembrane properties.
3. A 16 sq m sample of geomembrane to allow for testing by the Department.

BASIS OF ACCEPTANCE. Properly labeled geomembranes shall be accepted on the basis of manufacturer's certification along with the brand name and style appearing on the Department's Approved List for geomembranes.

STANDARD SPECIFICATIONS SECTION 737 – GEOSYNTHETICS

737-03 PREFABRICATED VERTICAL DRAINS

A. Prefabricated Vertical Drains. The Department's evaluation of prefabricated vertical drains submitted will be based on the following tests:

1. Prefabricated Vertical Drain:
 - a. Equivalent Sand Drain Diameter - Test in accordance with NYSDOT - GEB Large Diameter Consolidation Test.
2. Cover Geotextile
 - a. The requirements listed in Geotextile Drainage (Table 737-01C).

Prefabricated Vertical Drains shall meet the following requirements:

1. Prefabricated Vertical Drain
 - a. Equivalent Sand Drain Diameters - 40 mm minimum.⁽¹⁾
 2. Cover Geotextile Wrapping
 - a. The requirements listed in Geotextile Drainage (Table 737-01C).
- ⁽¹⁾ The average of the test results shall meet or exceed the stated values.

BASIS OF APPROVAL. Producers of prefabricated vertical drains shall demonstrate the quality of their products before being placed on the Department's Approved List. The producer shall provide:

1. A completed New York State Department of Transportation Product Evaluation Form, Form Number SM 465.
2. A test data sheet identifying the cover geotextile and core and their properties.
3. A 10 m long sample of the prefabricated vertical drain to allow for testing by the Department.

BASIS OF ACCEPTANCE. Properly labeled prefabricated vertical drains shall be accepted on the basis of manufacturer's certification along with the brand name and style appearing on the Department's Approved List for prefabricated vertical drains.

737-04 PREFABRICATED COMPOSITE STRUCTURAL DRAINS

A. Prefabricated Composite Structural Drain⁽¹⁾. The Department's evaluation of Prefabricated Composite Structural Drains (PCSD's) submitted will be based on the following tests:

1. PCSD: Flow Capacity Under Load - Test in accordance with ASTM D4716, Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
2. Geotextile: The requirements listed in Geotextile Drainage (Table 737-01C).

The PCSD shall meet the following requirements:

1. PCSD:
 - a. Hydraulic Transmissivity
 - i. For impermeable cores, where flow is allowed on both sides, the hydraulic transmissivity shall be 0.8 L/sec./m of width under 72 kPa and a hydraulic gradient of 0.1⁽²⁾.

STANDARD SPECIFICATIONS SECTION 737 – GEOSYNTHETICS

- ii. For permeable cores, or one sided flow impermeable cores, the hydraulic transmissivity shall be 0.4 L/sec./m of width under 72 kPa and a hydraulic gradient of 0.1⁽²⁾.
- (1) This includes prefabricated composite structural drains used as integral abutment drains.
- (2) The average of the test results shall meet or exceed the stated values.

2. Geotextile:

- a. The requirements listed in Geotextile Drainage (Table 737-01C) Class A.

BASIS OF APPROVAL. Producers of PCSD's shall demonstrate the quality of their products before being placed on the Department's Approved List. The producer shall provide:

- 1. A completed New York State Department of Transportation Product Evaluation Form, Form Number SM 465.
- 2. A test data sheet identifying the properties of the protective geotextile and the core.
- 3. A 1.5 sq m sample of the PCSD drain to allow for testing by the Department.

BASIS OF ACCEPTANCE. Properly labeled prefabricated composite structural drains shall be accepted on the basis of manufacturer's certification along with the brand name and style appearing on the Department's Approved List for the intended application.

737-05 PREFABRICATED COMPOSITE INTEGRAL ABUTMENT DRAINS

A. Prefabricated Composite Integral Abutment Drain. The criteria for acceptance of Prefabricated Composite Integral Abutment Drains (PCIAD's) shall be same as for PCSD except that the minimum thickness of the PCIAD shall be 10 mm as measured by ASTM D5199.

BASIS OF APPROVAL. Producers of PCIAD's shall demonstrate the quality of their products before being placed on the Department's Approved List. The approval procedure for PCIAD's follows the approval procedure for PCSD's.

BASIS OF ACCEPTANCE. Properly labeled prefabricated composite integral abutment drains shall be accepted on the basis of manufacturer's certification along with the brand name and style appearing on the Department's Approved List for the intended application.

737-06 PREFABRICATED COMPOSITE EDGE DRAINS

A. Prefabricated Composite Edge Drains. The Department's evaluation of Prefabricated Composite Edge Drains (PCED's) submitted will be based on the following tests:

- 1. PCED:
 - a. Flow Capacity - Test in accordance with ASTM D4716, Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
- 2. Cover Geotextile:
 - a. The requirements listed in Geotextile Drainage (Table 737-01C).

Prefabricated Composite Edge Drains shall meet the following requirements:

- 1. PCED:
 - a. Flow Capacity - 3 L/sec./m of width when tested at a 69 kPa load after 100 hours, at a hydraulic gradient of 0.1. If the flow channel is separated into two or more

STANDARD SPECIFICATIONS SECTION 737 – GEOSYNTHETICS

- parts, only the flow rate of the section facing the pavement will be considered.
2. Cover Geotextile:
 - a. The requirements listed in Geotextile Drainage (Table 737-01C).

BASIS OF APPROVAL. Producers of PCED's shall demonstrate the quality of their products before being placed on the Department's Approved List. The producer shall provide:

1. A completed New York State Department of Transportation Evaluation Form, Form Number SM 465.
2. A test data sheet identifying the cover geotextile and core and their properties.
3. A 1.5 sq m sample of the PCED.

BASIS OF ACCEPTANCE. Properly labeled prefabricated composite edge drains shall be accepted on the basis of manufacturer's certification along with the brand name and style appearing on the Department's Approved List for prefabricated composite edge drains.

737-07 GEOGRIDS. Geogrid reinforcing shall be tested and certified to meet the minimum requirements for geosynthetic products in accordance with AASHTO Specifications for Highway Bridges, Geosynthetic Reinforcement.

- A. T_D . Long Term Design Tensile Strength = T_{ULT}/RF .
- B. T_{ULT} . Ultimate Tensile Strength. Determined in the primary strength direction in accordance with ASTM D4595 or D6637, based on the Minimum Average Roll Value (MARV), per ASTM D4759, for the product.
- C. RF . Total Reduction Factor = $RF_{CR} \times RF_{ID} \times RF_{DU}$. The minimum RF value permitted is 3.0.
- D. RF_{CR} . Reduction Factor for Creep Deformation for 100 Year Design Life. Calculated in accordance with Geosynthetic Research Institute Standard Practice GRI-GG4 using ASTM D5262 to determine long term strength, T_{LT} , and ASTM D4595 to determine short term strength, T_{ST} .
- E. RF_{ID} . Reduction Factor For Installation Damage Calculated in Accordance with Geosynthetic Research Institute Standard Practice GRI-GG4. The minimum tested RF_{ID} value permitted is 1.1.
- F. RF_{DU} . Reduction Factor for Durability. Determined in Accordance with EPA9090 and ASTM D4595. The minimum tested RF_{DU} value permitted is 1.1.

Submit the geogrid manufacturer's certification with the material. Include in the certification the geogrid manufacturer's name, the geogrid name, the test lot number, the minimum average roll value for Ultimate Tensile Strength, the long-term design tensile strength, and the reduction factors used to calculate the long-term design tensile strength.

BASIS OF ACCEPTANCE. Properly labeled geogrids shall be accepted on the basis of the information on the manufacturer's certification meeting the minimum requirements for the geogrids stated in the contract documents.

737-08 GEOCELLS. Geocells shall be made of High Density Polyethylene (HDPE) of the size(s) and dimensions shown on the plans. Geocells shall be tested and certified to meet the minimum requirements listed in Table 737-08.

STANDARD SPECIFICATIONS SECTION 737 – GEOSYNTHETICS

TABLE 737-08		
Property	Test Method	Requirement
Thickness	ASTM D 5199	1.1 mm minimum
Cell Seam Peel Strength	Per U.S. Army Corps of Engineers Technical Report GL-86-19 Appendix A	10.0 N per mm of cell depth, minimum
Ultraviolet Stability	ASTM D 1603 or ASTM D 4218	1.5 % by weight carbon black minimum
Environmental Stress Crack Resistance	ASTM D 1693	2000 hrs minimum

Geocells will be perforated with the exception of the fascia, which will be solid and green in color.

Submit the geocell manufacturer's certification with the material. Include in the certification the geocell manufacturer's name, the geocell name, the test lot number, the minimum thickness, the cell seam peel strength, the ultraviolet stability, and the environmental stress crack resistance.

BASIS OF ACCEPTANCE. Properly labeled geocells shall be accepted on the basis of the information on the manufacturer's certification meeting the minimum requirements for the geocells stated in Table 737-08 and the contract documents.