

SUPERSEDED BY EB 15-031 EFFECTIVE 9/28/15		New York State Department of Transportation ENGINEERING INSTRUCTION	EI 14-003								
Title: STANDARD SPECIFICATION SECTION 737 – GEOSYNTHETICS											
Target Audience: <table border="0"> <tr> <td>☐ Manufacturers (18)</td> <td>☐ Surveyors (33)</td> </tr> <tr> <td>☒ Local Govt. (31)</td> <td>☒ Consultants (34)</td> </tr> <tr> <td>☒ Agencies (32)</td> <td>☒ Contractors (39)</td> </tr> <tr> <td></td> <td>☐ _____ ()</td> </tr> </table>		☐ Manufacturers (18)	☐ Surveyors (33)	☒ Local Govt. (31)	☒ Consultants (34)	☒ Agencies (32)	☒ Contractors (39)		☐ _____ ()	Approved:  Robert L. Sack, P.E. Deputy Chief Engineer (Research) 27 MAR 14 Date	
☐ Manufacturers (18)	☐ Surveyors (33)										
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ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the letting of September 4, 2014.
- This EI supersedes EI 13-015.
- The revisions issued with this EI will be incorporated into the next update of the Standard Specifications.

PURPOSE: The purpose of this EI is to issue revised Standard Specification Section 737 *Geosynthetics*.

TECHNICAL INFORMATION:

- Section 737 in the Standard Specifications is deleted and replaced with the revised Section 737 transmitted by this issuance.
- The revisions to the Standard Specification Section 737 *Geosynthetics* include the following:
 1. Section 737 Quality Assurance Program, revised the first paragraph to state "The Department maintains a Quality Assurance (QA) program for geosynthetics appearing on the Approved List. For monitoring purposes, the Geotechnical Engineering Bureau (GEB) will select and evaluate geosynthetic material delivered to project sites to compare its properties to those properties determined at the time of the product's initial approval, which may indicate a change has occurred in the manufacturing process or Quality Control (QC) process".
 2. Section 737 Quality Assurance Program, added the following as the second paragraph: "If selected, a QA sample of the following sizes of geosynthetic material will be obtained by a Departmental Geotechnical Engineer and will be submitted for testing:

§737-01 Geotextiles: 3 yd² QA sample.

§737-02 Geomembranes: 4 yd² QA sample.

§737-03 Prefabricated Vertical Drains: 10 ft. long QA sample.

§737-04 Prefabricated Composite Structural Drain: 3 yd² QA sample.

§737-05 Prefabricated Composite Integral Abutment Drain: 3 yd² QA sample.

§737-06 Prefabricated Composite Edge Drain: 6 ft. long QA sample."

3. §737-01, Basis of Approval, revised the second sentence to state "The program has a rolling submission cycle".
4. §737-01, Basis of Approval, revised the second paragraph to state "The approval criterion for geotextiles is based on AASHTO M-288 *Specification for Geotextiles* and material properties listed in NTPEP's DataMine".
5. §737-01 Basis of Acceptance, eliminated the requirement of a sample submittal to, and approval from, the Regional Geotechnical Engineer

6. §737-02, clarified that the material and testing requirements are for unreinforced geomembranes.
 7. §737-02, Basis of Approval, changed the size of the material submittal to 10 yd².
 8. Basis of Acceptance for §737-03, §737-04, §737-05, and §737-06, edited the sentence describing the 4th requirement to state "A letter identifying the Manufacturer and product name of the geotextile cover wrapping that states that the geotextile appears on the Approved List for Geotextile Drainage, and states that it is the same geotextile identified in the material certification".
 9. §737-04, Basis of Approval, changed the size of the material submittal to 4 yd².
 10. §737-06, Basis of Approval, changed the size of the material submittal to 10 ft. long.
- The cost impact of the specification change is expected to be negligible.

IMPLEMENTATION:

- The Main Office Design Quality Assurance Bureau will insert these standard specification revisions into contract proposals beginning with projects submitted for the letting of September 4, 2014.

TRANSMITTED MATERIALS:

- Revisions to Standard Specification Section 737 *Geosynthetics*. Both metric and US Customary revisions are attached.

BACKGROUND: The general term geosynthetics encompasses the subfamilies of geotextiles, geogrids, geocells, geocomposites, and geomembranes. Various construction practices incorporate geosynthetics to take advantage of their properties and ease of installation. Geosynthetics have six primary functions: filtration, drainage, separation, reinforcement, fluid barrier, and protection. The type of geosynthetic used on a particular project will depend on its intended primary function in the installation, and thus its critical properties.

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, or via e-mail at randy.romer@dot.ny.gov. Questions or comments regarding the technical aspects of the revision to the Standard Specification should be directed to Don Dwyer, P.E., of the Geotechnical Engineering Bureau at (518) 457-4724, don.dwyer@dot.ny.gov.

SECTION 737 – GEOSYNTHETICS

Make the following changes to the Standard Specifications dated May 1, 2008 as modified by EI 13-015:

Delete entirely Section 737 and **Replace** it with the following:

SECTION 737 – GEOSYNTHETICS

QUALITY ASSURANCE PROGRAM. The Department maintains a Quality Assurance (QA) program for geosynthetics appearing on the Approved List. For monitoring purposes, the Geotechnical Engineering Bureau (GEB) will select and evaluate geosynthetic material delivered to project sites to compare its properties to those properties determined at the time of the product's initial approval, which may indicate a change has occurred in the manufacturing process or Quality Control (QC) process.

If selected, a QA sample of the following sizes of geosynthetic material will be obtained by a Departmental Geotechnical Engineer and will be submitted for testing:

§737-01 Geotextiles: 3 yd² QA sample.

§737-02 Geomembranes: 4 yd² QA sample.

§737-03 Prefabricated Vertical Drains: 10 ft. long QA sample.

§737-04 Prefabricated Composite Structural Drain: 3 yd² QA sample.

§737-05 Prefabricated Composite Integral Abutment Drain: 3 yd² QA sample.

§737-06 Prefabricated Composite Edge Drain: 6 ft. long QA sample.

The following scenarios may develop as a result of the QA testing.

1. The properties are shown to be comparable to those 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 **NYSDOT TECHNICAL SERVICES APPROVED LIST OF GEOSYNTHETICS FOR HIGHWAY CONSTRUCTION - GEOTEXTILES (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 – Recycled/ Reinforced Needle-Punched – Non-Woven	(R/R NP – NW)
737.0108 – Circular – Woven	(Cir – W)

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GENERAL. The Department's evaluation of geotextiles submitted will be based on one or more of 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. Mass per Unit Area - Test to evaluate this characteristic will be performed in accordance with ASTM D5261.
3. Flow Capacity - The test to evaluate this characteristic will be performed in accordance with the Permittivity Test, ASTM Method D4491.
4. 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 2 in. Probe, ASTM D6241

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 by applications:

SECTION 737 – GEOSYNTHETICS

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 (lbf)	Tear Strength (lbf)	Puncture Strength (lbf)	Class	Apparent Opening Size (maximum)		Minimum Permittivity (sec ⁻¹)
								Sieve Size (in.)	Sieve Designation	
Geotextile Bedding	C - W	1	< 50%	315	112	618	A	0.0165	No. 40	0.7
			≥ 50%	202	79	433	B	0.0098	No. 60	0.2
	MF - W	2	< 50%	247	56	495	C	0.0083	No. 70	0.1
			≥ 50%	157	56	309				

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 (lbf)	Tear Strength (lbf)	Puncture Strength (lbf)	Class	Apparent Opening Size (maximum)		Minimum Permittivity (sec ⁻¹)
								Sieve Size (in.)	Sieve Designation	
Geotextile Separation	Any type listed in §737-01 Scope	2	< 50%	247	90 ¹	495	NA (X)	0.0234	No. 30	0.02
			≥ 50%	157	56	309				

Table 737-01B Notes:

1 For woven monofilament geotextiles the minimum average value is 56 lbf.

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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 (lbf)	Tear Strength (lbf)	Puncture Strength (lbf)	Class	Apparent Opening Size (maximum)	Minimum Permittivity (sec ⁻¹)
Geotextile Drainage	Non-Woven	2	< 50%	247	90	495	A	Sieve Size (in.) No. 40	0.5
			≥ 50%	157	56	309	B	No. 60	0.2
							C	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 (lbf)	Tear Strength (lbf)	Puncture Strength (lbf)	Class	Apparent Opening Size (maximum)	Minimum Permittivity (sec ⁻¹)
Geotextile Slope Protection	NP - NW	1	< 50%	315	112	618	A	Sieve Size (in.) No. 40	0.7
			≥ 50%	202	79	433	B	No. 60	0.2
							C	No. 70	0.1

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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 (lbf)	Tear Strength (lbf)	Puncture Strength (lbf)	Class	Apparent Opening Size (maximum) Sieve Size (in.)	Minimum Permittivity (sec ⁻¹)
Geotextile Stabilization	Any type listed in §737-01 Scope	1	< 50%	315	112	618	NA (X)	No. 40	0.05
			≥ 50%	202	79	433			

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 (lbf)	Tear Strength (lbf)	Puncture Strength (lbf)	Class	Apparent Opening Size (maximum) Sieve Size (in.)	Minimum Permittivity (sec ⁻¹)
Turbidity Curtain	Any type listed in §737-01 Scope	2	< 50%	247	90 ¹	495	NA (X)	No. 50	0.4
			≥ 50%	157	56	309		No. 17	

Table 737-01F Notes:

¹ For woven monofilament geotextiles the minimum average value is 56 lbf.

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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			
		Max. Post Spacing (ft.)	Percent Elongation (%)	Grab Strength (lbf)	Orientation ³	Fence Between Posts	Designation	Class	Apparent Opening Size (maximum)		Minimum Permittivity (sec ⁻¹)
									Sieve Size (in.)	Sieve Desig.	
Silt Fence	Any type listed in §737-01 Scope	4.0	NA	90	MD	Supported ¹	s	NA (X)	0.0234	No. 30	0.05
					XD						
		4.0	≥ 50% ²	123	MD	Unsupported	us 4.0				
				101	XD						
		6.5	< 50% ²	123	MD	Unsupported	us 6.5				
				101	XD						

Table 737-01G Notes:

- ¹ Silt fence support shall consist of either 14 gage steel wire with a mesh spacing of 6 in. x 6 in. or prefabricated polymeric mesh with a minimum ultimate tensile strength of 200 lb/ft in both machine and cross machine directions measured in accordance with ASTM D6637.
- ² As measured in accordance with ASTM D4632.
- ³ MD = Machine Direction, XD = Cross-Machine Direction.

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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 a rolling submission cycle. Information regarding submittal is available at the address shown below:

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

The approval criterion for geotextiles is based on AASHTO M-288 *Specification for Geotextiles* and material properties listed in NTPEP's DataMine.

Approved geotextiles will be added to the Approved List.

BASIS OF ACCEPTANCE. Geotextiles will be accepted based on the following:

1. The roll of material being properly identified by having labels affixed to:
 - a. the cover wrapping,
 - b. the geotextile, and
 - c. the core around which the geotextile is rolled,
2. The material brand name and style appearing on the Approved List for the intended application, and
3. A material certification submitted with the geotextile stating that the material conforms to the specification and that it is the same one appearing on the Approved List.

737-02 GEOMEMBRANES

SCOPE. This specification covers the material requirements and methods of testing unreinforced geomembranes used in highway construction. The following geomembrane types are evaluated in this specification:

737.0201 – Geomembrane, Unreinforced

GENERAL. The Department's evaluation of unreinforced 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 D4533, Trapezoid Tear Test Method.
4. Puncture - Test in accordance with ASTM D4833, Index Puncture Resistance.

MATERIAL REQUIREMENTS. Unreinforced geomembranes shall meet the following requirements:

1. Ultimate Tensile Strength – 180 lbf⁽¹⁾
 2. Ultimate Elongation - 65%⁽¹⁾
 3. Trapezoid Tear Resistance - 60 lbf⁽¹⁾
 4. Puncture - 90 lbf⁽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 Form Number GE-335 *Product Evaluation Form (PEF) for Geosynthetics*.
2. A test data sheet identifying the geomembrane properties.
3. A 10 sq yd sample of geomembrane to allow for testing by the Department.

Approved geomembranes will be added to the Approved List.

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BASIS OF ACCEPTANCE. Unreinforced geomembranes will be accepted on the basis of:

1. The roll of material being properly identified either by a label on the geomembrane or the container. The container may be either the cover wrapping or the core around which the geomembrane is rolled,
2. The material brand name and style appearing on the Approved List for the intended application, and
3. The material certification submitted with the geomembrane stating that the material conforms to the specification and that it is the same one appearing on the Approved List.

737-03 PREFABRICATED VERTICAL DRAINS

SCOPE. This specification covers the material requirements and methods of testing prefabricated vertical drains used in highway construction.

GENERAL. 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 Wrapping:
 - a. The requirements listed in Geotextile Drainage (Table 737-01C).

MATERIAL REQUIREMENTS. Prefabricated Vertical Drains shall meet the following requirements:

1. Prefabricated Vertical Drain:
 - a. Equivalent Sand Drain Diameters – 1 ½ in. minimum.⁽¹⁾
 2. Cover Geotextile Wrapping:
 - a. The requirements listed in Geotextile Drainage (Table 737-01C). The geotextile shall be tightly wrapped around the core.
- ⁽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 Form Number GE-335 *Product Evaluation Form (PEF) for Geosynthetics*.
2. A test data sheet identifying the cover geotextile and core and their properties.
3. A 30 ft. long sample of the prefabricated vertical drain to allow for testing by the Department.

Approved prefabricated vertical drains will be added to the Approved List.

BASIS OF ACCEPTANCE. Prefabricated vertical drains will be accepted on the basis of:

1. The roll of material being properly identified either by a label on the prefabricated vertical drain or the container. The container may be either the cover wrapping or the core around which the prefabricated vertical drain is rolled,
2. The material brand name and style appearing on the Approved List for the intended application,
3. The material certification submitted with the prefabricated vertical drain stating that the material conforms to the specification and that it is the same one appearing on the Approved List, and
4. A letter identifying the Manufacturer and product name of the geotextile cover wrapping that states that the geotextile appears on the Approved List for Geotextile Drainage, and states that it is the same geotextile identified in the material certification for the prefabricated vertical drain.

737-04 PREFABRICATED COMPOSITE STRUCTURAL DRAINS

SCOPE. This specification covers the material requirements and methods of testing prefabricated composite structural drains (PCSD's)⁽¹⁾ used in highway construction.

SECTION 737 – GEOSYNTHETICS

GENERAL. The Department's evaluation of 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. Cover Geotextile Wrapping: The requirements listed in Geotextile Drainage (Table 737-01C).

MATERIAL REQUIREMENTS. 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 4.0 gal./min./ft. of width under 1500 psf and a hydraulic gradient of 0.1⁽²⁾.
 - ii. For permeable cores, or one sided flow impermeable cores, the hydraulic transmissivity shall be 2.0 gal./min./ft. of width under 1500 psf and a hydraulic gradient of 0.1⁽²⁾.
 2. Cover Geotextile Wrapping:
 - a. The requirements listed in Geotextile Drainage (Table 737-01C) Class A. The geotextile shall be bonded to the core.
- (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.

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 Form Number GE-335 *Product Evaluation Form (PEF) for Geosynthetics*.
2. A test data sheet identifying the properties of the protective geotextile and the core.
3. A 4 sq. yd. sample of the PCSD drain to allow for testing by the Department.

Approved PCSD's will be added to the Approved List.

BASIS OF ACCEPTANCE. PCSD's will be accepted on the basis of:

1. The roll of material being properly identified either by a label on the PCSD or the container. The container may be either the cover wrapping or the core around which the PCSD is rolled,
2. The material brand name and style appearing on the Approved List for the intended application,
3. The material certification submitted with the PCSD stating that the material conforms to the specification and that it is the same one appearing on the Approved List, and
4. A letter identifying the Manufacturer and product name of the geotextile cover wrapping that states that the geotextile appears on the Approved List for Geotextile Drainage, and states that it is the same geotextile identified in the material certification for the PCSD.

737-05 PREFABRICATED COMPOSITE INTEGRAL ABUTMENT DRAINS

SCOPE. This specification covers the material requirements and methods of testing prefabricated composite integral abutment drains (PCIAD's) used in highway construction.

GENERAL. PCIAD's shall meet the requirements of PCSD except that the minimum thickness of the PCIAD shall be 0.4 in. 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.

Approved PCIAD's will be added to the Approved List.

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BASIS OF ACCEPTANCE. PCIAD's will be accepted on the basis of:

1. The roll of material being properly identified either by a label on the PCIAD or the container. The container may be either the cover wrapping or the core around which the PCIAD is rolled,
2. The material brand name and style appearing on the Approved List for the intended application,
3. The material certification submitted with the PCIAD stating that the material conforms to the specification and that it is the same one appearing on the Approved List, and
4. A letter identifying the Manufacturer and product name of the geotextile cover wrapping that states that the geotextile appears on the Approved List for Geotextile Drainage, and states that it is the same geotextile identified in the material certification for the PCIAD.

737-06 PREFABRICATED COMPOSITE EDGE DRAINS

SCOPE. This specification covers the material requirements and methods of testing prefabricated composite edge drains (PCED's) used in highway construction.

GENERAL. The Department's evaluation of 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 Wrapping:
 - a. The requirements listed in Geotextile Drainage (Table 737-01C).

MATERIAL REQUIREMENTS. PCED's shall meet the following requirements:

1. PCED:
 - a. Flow Capacity – 15 gal./min./ft. of width when tested at a 10 psi load after 100 hours, at a hydraulic gradient of 0.1. If the flow channel is separated into two or more parts, only the flow rate of the section facing the pavement will be considered.
2. Cover Geotextile Wrapping:
 - a. The requirements listed in Geotextile Drainage (Table 737-01C). The geotextile shall be bonded to the core or tightly wrapped around the core.

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 Form Number GE-335 *Product Evaluation Form (PEF) for Geosynthetics*.
2. A test data sheet identifying the cover geotextile and core and their properties.
3. A 10 ft. long sample of the PCED to allow for testing by the Department.

Approved PCED's will be added to the Approved List.

BASIS OF ACCEPTANCE. PCED's will be accepted on the basis of:

1. The roll of material being properly identified either by a label on the PCED or the container. The container may be either the cover wrapping or the core around which the PCED is rolled,
2. The material brand name and style appearing on the Approved List for the intended application,
3. The material certification submitted with the PCED stating that the material conforms to the specification and that it is the same one appearing on the Approved List, and
4. A letter identifying the Manufacturer and product name of the geotextile cover wrapping that states that the geotextile appears on the Approved List for Geotextile Drainage, and states that it is the same geotextile identified in the material certification for the PCED.

SECTION 737 – GEOSYNTHETICS

737-07 GEOGRIDS

SCOPE. This specification covers the material requirements and methods of testing geogrids used in highway construction.

GENERAL. Submit the geogrid material 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. The following definitions apply:

- 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 = $RF_{CR} \times RF_{ID} \times RF_{DU}$.
- 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.

MATERIAL REQUIREMENTS. 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*.

BASIS OF ACCEPTANCE. Geogrids will be accepted on the basis of:

1. A material certification identifying:
 - a. The geogrid manufacturer's name,
 - b. The geogrid name,
 - c. The test lot number,
 - d. The minimum average roll value for Ultimate Tensile Strength,
 - e. The long-term design tensile strength, and
 - f. The reduction factors used to calculate the long-term design tensile strength.
2. An evaluation to verify that the long-term tensile design strength of the geogrid meets or exceeds the required design value stated in the contract documents, based on appropriate reduction factors.

737-08 GEOCELLS

SCOPE. This specification covers the material requirements and methods of testing geocells used in highway construction.

GENERAL. Submit the geocell material 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.

MATERIAL REQUIREMENTS. Geocells shall be made of High Density Polyethylene (HDPE) of the size(s) and dimensions shown in the contract documents. Geocells shall be tested and certified to meet the minimum requirements listed in Table 737-08 *Geocell Requirements*.

SECTION 737 – GEOSYNTHETICS

TABLE 737-08 GEOCELL REQUIREMENTS		
Property	Test Method	Requirement
Thickness	ASTM D 5199	0.04 in. minimum
Cell Seam Peel Strength	Per U.S. Army Corps of Engineers Technical Report GL-86-19 Appendix A	56 lbf per inch 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.

BASIS OF ACCEPTANCE. Geocells will be accepted on the basis of

1. A material certification identifying:
 - a. The geocell manufacturer's name,
 - b. The geocell name,
 - c. The test lot number,
 - d. The minimum thickness,
 - e. The cell seam peel strength,
 - f. The ultraviolet stability, and
 - g. The environmental stress crack resistance.
2. An evaluation that the information on the material certification meets the minimum requirements for the geogrids stated in Table 737-08 and the contract documents.

737-09 GEOSYNTHETIC FIBERS

SCOPE. This specification covers the material requirements and methods of testing geosynthetic fibers used in highway construction.

GENERAL. Submit the geosynthetic fiber material certification with the material. Include in the certification the geosynthetic fiber manufacturer's name, the geosynthetic fiber name, the test lot number, the polypropylene percentage, fiber length, specific gravity, carbon black content, tensile strength, tensile elongation and Young's modulus.

MATERIAL REQUIREMENTS. Geosynthetic fibers shall consist of fibrillated polypropylene strands and shall be tested and certified to meet the minimum requirements listed in Table 737-09 *Geosynthetic Fiber Requirements*.

TABLE 737-09 GEOSYNTHETIC FIBER REQUIREMENTS		
Property	Test Method	Requirement
Polypropylene	ASTM D4101 Group 1/ Class 1/ Grade 2	99.4 % minimum
Fiber Length	Measured	1 inch
Specific Gravity	ASTM D792	0.033 lb/in ³
Carbon black Content	ASTM D1603	0.6 % minimum
Tensile Strength	ASTM D2256	45 ksi minimum
Tensile Elongation	ASTM D2256	15 % maximum
Young's Modulus	ASTM D2101	700 ksi minimum

SECTION 737 – GEOSYNTHETICS

BASIS OF ACCEPTANCE. Geosynthetic fibers will be accepted on the basis of

1. A material certification identifying:
 - a. The geosynthetic fiber manufacturer's name,
 - b. The geosynthetic fiber name,
 - c. The test lot number,
 - d. The polypropylene percentage,
 - e. The fiber length,
 - f. The specific gravity,
 - g. The carbon black content,
 - h. The tensile strength,
 - i. The tensile elongation, and
 - j. Young's modulus.
2. An evaluation that the information on the material certification meets the minimum requirements for the geosynthetic fiber stated in Table 737-09 *Geosynthetic Fiber Requirements* and the contract documents.

SECTIONS 738 THRU 799 (VACANT)

SECTION 737 – GEOSYNTHETICS

Make the following changes to the Standard Specifications dated May 4, 2006 as modified by EI 13-015:

Delete entirely Section 737 and **Replace** it with the following:

SECTION 737 – GEOSYNTHETICS

QUALITY ASSURANCE PROGRAM. The Department maintains a Quality Assurance (QA) program for geosynthetics appearing on the Approved List. For monitoring purposes, the Geotechnical Engineering Bureau (GEB) will select and evaluate geosynthetic material delivered to project sites to compare its properties to those properties determined at the time of the product's initial approval, which may indicate a change has occurred in the manufacturing process or Quality Control (QC) process.

If selected, a QA sample of the following sizes of geosynthetic material will be obtained by a Departmental Geotechnical Engineer and will be submitted for testing:

- §737-01 Geotextiles: 2.5 m² QA sample.
- §737-02 Geomembranes: 3 m² QA sample.
- §737-03 Prefabricated Vertical Drains: 3 m long QA sample.
- §737-04 Prefabricated Composite Structural Drain: 2.5 m² QA sample.
- §737-05 Prefabricated Composite Integral Abutment Drain: 2.5 m² QA sample.
- §737-06 Prefabricated Composite Edge Drain: 1.8 m long QA sample.

The following scenarios may develop as a result of the QA testing.

1. The properties are shown to be comparable to those 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 **NYSDOT TECHNICAL SERVICES APPROVED LIST OF GEOSYNTHETICS FOR HIGHWAY CONSTRUCTION - GEOTEXTILES (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 – Recycled/ Reinforced Needle-Punched – Non-Woven	(R/R NP – NW)
737.0108 – Circular – Woven	(Cir – W)

SECTION 737 – GEOSYNTHETICS

GENERAL. The Department's evaluation of geotextiles submitted will be based on one or more of 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. Mass per Unit Area - Test to evaluate this characteristic will be performed in accordance with ASTM D5261.
3. Flow Capacity - The test to evaluate this characteristic will be performed in accordance with the Permittivity Test, ASTM Method D4491.
4. 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

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 by applications:

SECTION 737 – GEOSYNTHETICS

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) Sieve Size (mm)	Minimum Permittivity (sec ⁻¹)
Geotextile Bedding	C - W	1	< 50%	1400	500	2750	A	0.43 No. 40	0.7
			≥ 50%	900	350	1925	B	0.25 No. 60	0.2
	MF - W	2	< 50%	1100	250	2200	C	0.22 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) Sieve Size (mm)	Minimum Permittivity (sec ⁻¹)
Geotextile Separation	Any type listed in §737-01 Scope	2	< 50%	1100	400 ¹	2200	NA (X)	0.6 No. 30	0.02
			≥ 50%	700	250	1375			

Table 737-01B Notes:

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

SECTION 737 – GEOSYNTHETICS

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) Sieve Size (mm)	Minimum Permittivity (sec ⁻¹) Sieve Designation
Geotextile Drainage	Non-Woven	2	< 50%	1100	400	2200	A	0.43	No. 40
			≥ 50%	700	250	1375	B	0.25	No. 60
							C	0.22	No. 70

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) Sieve Size (mm)	Minimum Permittivity (sec ⁻¹) Sieve Designation
Geotextile Slope Protection	NP - NW	1	< 50%	1400	500	2750	A	0.43	No. 40
			≥ 50%	900	350	1925	B	0.25	No. 60
							C	0.22	No. 70

SECTION 737 – GEOSYNTHETICS

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) Sieve Size (mm)	Minimum Permittivity (sec ⁻¹)
Geotextile Stabilization	Any type listed in §737-01 Scope	1	< 50%	1400	500	2750	NA	0.43	0.05
			≥ 50%	900	350	1925	(X)	No. 40	

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) Sieve Size (mm)	Minimum Permittivity (sec ⁻¹)
Turbidity Curtain	Any type listed in §737-01 Scope	2	< 50%	1100	400 ¹	2200	NA	0.3	0.4
			≥ 50%	700	250	1375	(X)	No. 50	

Table 737-01F Notes:

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