



Florida Department of Transportation

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MIKE DEW
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July 9, 2018

Khoa Nguyen
Director, Office of Technical Services
Federal Highway Administration
3500 Financial Plaza, Suite 400
Tallahassee, Florida 32312

Re: State Specifications Office
Section: **985**
Proposed Specification: **9850202 Geosynthetic Materials.**

Dear Mr. Nguyen:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.

The changes are proposed by Larry Jones of the State Structures Design Office to modify the language.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to dan.hurtado@dot.state.fl.us.

If you have any questions relating to this specification change, please call me at 414-4130.

Sincerely,

Signature on file

Dan Hurtado, P.E.
State Specifications Engineer

DH/dt

Attachment

cc: Florida Transportation Builders' Assoc.
State Construction Engineer

GEOSYNTHETIC MATERIALS.(REV ~~5-15-18~~ 7-9-18)

SUBARTICLE 985-2.2 is deleted and the following substituted:

985-2.2 Physical Requirements: Each geosynthetic material shall be tested by an independent third party in accordance with the following methods as they apply to the specific application type. All testing and reported values, except apparent opening size (AOS), are to be minimum average roll values in the weakest principal direction unless indicated otherwise in this Section. Values for AOS are maximum average roll values.

Geotextile Selection	
In-situ Soil Type or Drainage Application	Class for Type D1, D2, D3 Materials (see Table 1.1)
< 15% passing a No. 200 Sieve*	a
15% to 50% passing a No. 200 Sieve*	b
> 50% passing a No. 200 Sieve*	c
> 50% passing a No. 200 Sieve* with Plastic Index >7	d
MSE Joint Cover for Sand or Limerock Backfill	e
MSE Joint Cover for Coarse Aggregate or Limerock Backfill	f

*as per AASHTO T88.

Table 1.1 Drainage Geotextiles Test Methods and Requirements for Types D-1, D-2 and D-3			
Property/Test Method	D-1	D-2	D-3
Minimum Permittivity (Sec - 1) per ASTM D4491	D-1a = 0.7 D-1b = 0.2 D-1c = 0.1 D-1d = 0.1 D-1e = 0.7 <u>0.25</u> D-1f = 1.5	D-2a = 0.7 D-2b = 0.2 D-2c = 0.1 D-2d = 0.1 D-2e = 0.7 <u>0.25</u> D-2f = 1.5	D-3a = 0.5 D-3b = 0.2 D-3c = 0.1 D-3d = 0.1 D-3e = 0.7
Maximum AOS (mm, US Sieve No. 30) per ASTM D4751	D-1a = <u>0.425</u> (40) D-1b = <u>0.250</u> (60) D-1c = <u>0.212</u> (70) D-1d = <u>0.300</u> (50) D-1e = <u>0.212</u> (70) D-1f = <u>0.600</u> (30)	D-2a = <u>0.425</u> (40) D-2b = <u>0.250</u> (60) D-2c = <u>0.212</u> (70) D-2d = <u>0.300</u> (50) D-2e = <u>0.212</u> (70) D-2f = <u>0.600</u> (30)	D-3a = <u>0.425</u> (40) D-3b = <u>0.250</u> (60) D-3c = <u>0.212</u> (70) D-3d = <u>0.300</u> (50) D-3e = <u>0.212</u> (70)
Minimum Grab Tensile Strength (lbs)	315	Woven Monofilament = 248 Other Woven Geotextiles	Elongation <50% = 248 Elongation ≥50% = 158

Table 1.1 Drainage Geotextiles Test Methods and Requirements for Types D-1, D-2 and D-3			
Property/Test Method	D-1	D-2	D-3
per ASTM D4632		Elongation <50% = 315 Elongation ≥50% = 203	
Mass per Unit Area (oz/sy) per ASTM D5261	Provide Test Result	Provide Test Result	Provide Test Result
Minimum Puncture Strength (lbs) per ASTM D6241	618	Woven Monofilament = 495 Other Woven Geotextiles: Elongation <50% = 618 Elongation ≥50% = 433	Elongation <50% = 495 Elongation ≥50% = 309
Minimum Trapezoidal Tear (lbs) per ASTM D4533	113	Woven Monofilament = 57 Other Woven Geotextiles: Elongation <50% = 113 Elongation ≥50% = 79	Woven Monofilament = 57 Other Geotextiles: Elongation <50% = 90 Elongation ≥50% = 57
Minimum UV Resistance per ASTM D4355 (% Retained Strength)	50% @500 hours	50% @500 hours	50% @500 hours
Limitations	Woven Monofilament Geotextiles only	Woven Geotextiles only. No Slit Film Geotextiles allowed.	No Slit Film Geotextiles allowed.
* Equivalent opening sizes in millimeters per ASTM E11 are as follows: No. 30 sieve = 0.600, No. 40 sieve = 0.425, No. 50 sieve = 0.300, No. 60 sieve = 0.250, No. 70 sieve = 0.212			

Table 1.2 Test Methods and Requirements for Drainage Geotextiles Types D-4 and D-5		
Property/Test Method	D-4	D-5
Minimum Permittivity (Sec ⁻¹) per ASTM D4491	0.5	0.5
Maximum AOS (mm, US Sieve No.) per ASTM D4751	0.425 (40)	0.212 (70)
Minimum Grab Tensile Strength (lbs) per ASTM D4632	180	90
Mass per Unit Area (oz/sy) per ASTM D5261	Provide Test Result	Provide Test Result
Minimum Puncture Strength (lbs) per ASTM D6241	223	223
Minimum Trapezoidal Tear (lbs) per ASTM D4533	3570	40
Minimum UV Resistance per ASTM D4355 (% Retained Strength)	50% @500 hours	50% @500 hours

Table 2 Test Methods and Requirements for Erosion Control Materials					
Property/Test Method	E-1	E-2	E-3	E-4	E-5
Permittivity (Sec ⁻¹) per ASTM D4491	0.05	0.05			
Grab Tensile Strength (lbs) per ASTM D4632	90	90			
Minimum UV Resistance per ASTM D4355 (% Retained Strength)	80% @ 500 hours	80% @ 150 hours	80% @500 hours		
Tensile Strength **(lbs/ft) per ASTM D6818 or D5035			135x70	275x135	550x275
Filtration Efficiency (%) per ASTM D5141	75% and min. flow rate of 0.3 gal/sf/min				
Design Shear***			≥2.1 psf	≥3.6 psf	≥5.0 psf
** Wide Width Tensile Strength is expressed in units of measure of lbs/ in ft, in machine direction and cross direction as MD x CD. *** Design Shear limits for Erosion mats must be determined by 30 minutes sustained flow in an unvegetated state as determined by tests performed by Utah State University, Texas Transportation Institute or an independent testing laboratory approved by the State Drainage Engineer.					

Table 3 Test Methods and Requirements for Structural Geosynthetics			
Property/Test Method	Structural Application Type	Test Methods for Woven Geotextiles	Test Methods for Woven or Extruded Geogrids
Permittivity (sec ⁻¹)	R - 1, 2, 3, 4, 5	ASTM D4491	
UV Stability (Min Retained Strength @500 hr)	R - 3	ASTM D4355	ASTM D4355
Puncture Strength (lbs)	R - 5	ASTM D6241	
Grab Strength (lbs)	R - 5	ASTM D4632	
Opening Size	R - 1, 2, 3, 4, 5	AOS (US Sieve No.) ASTM D4751	Aperture Size (in x in)
Tensile Strength (lbs/ft)		ASTM D4595	ASTM D6637
Machine Direction Ultimate, (T _{ult})			
2% Strain	R - 1, 3		
5% Strain	R - 2, 3, 4, 5		
10% Strain	R - 1, 2, 3, 4, 5		
Cross Direction Ultimate			
2% Strain	R - 1, 3,		

Table 3 Test Methods and Requirements for Structural Geosynthetics			
Property/Test Method	Structural Application Type	Test Methods for Woven Geotextiles	Test Methods for Woven or Extruded Geogrids
5% Strain	R - 2, 3, 4, 5		
10% Strain	R - 1, 2, 3, 4, 5		
Strain @ Ultimate Tensile Strength	R - 1, 2, 3, 4, 5		
Tear Strength (lbs)		ASTM D4533	
Machine Direction	R - 5		
Cross Direction	R - 5		
Soil-Geosynthetic Friction	R - 1, 2, 3	ASTM D6706/D5321	ASTM D5321/D6706
<u>Pullout Resistance</u>	<u>R - 3</u>	<u>ASTM D6706</u>	<u>ASTM D6706</u>
Creep Resistance- T_{creep} (lbs/ft)	R - 2, 3	ASTM D5262	ASTM D5262
Creep Reduction Factor (T_{ult}/T_{creep})	R - 2, 3		
Installation Damage (RF_{ID})		AASHTO R69	AASHTO R69
Sand	R - 2, 3, 4		
Limestone	R - 2, 3, 4		
Durability (RF_D)			
Chemical	R - 2, 3, 4	AASHTO R69	AASHTO R69
Biological	R - 2, 3, 4	AASHTO R69	AASHTO R69
Joint Strength (RF_j)		GRI: GT7	GRI: GG4(a) & GG4(b)
Mechanical	R - 2, 3		
Sewn	R - 2, 3	ASTM D4884	

SUBARTICLE 985-3.1 is deleted and the following substituted:

985-3.1 Product Acceptance: All geosynthetic materials shall be one of the products listed on the Department's Approved Product List (APL).

Manufacturers seeking evaluation of structural and drainage products must submit an application in accordance with Section 6 and include independently certified test reports from the National Testing Product Evaluation Program (NTPEP) that document the material meets the physical requirements of this Section. Acceptance for structural geosynthetic materials requires the manufacturer's facility to be on NTPEP's list of compliant producers. These requests must also include the current NTPEP audit report.

Manufacturers seeking evaluation of erosion control products must submit an application in accordance with Section 6 and include independently certified test reports that the material meets the requirements of this Section.

Products will be listed on the APL according to geosynthetic application type. For products with limited APL approvals, installations and design alternatives must not rely on the limitation. Structural geosynthetics are listed with property values.

SUBARTICLE 985-4.1.1 is deleted and the following substituted:

985-4.1.1 Drainage: Select geotextile materials that meet the required permeability and AOS based on test results on the soil or fill adjacent to the geotextile for gradation. Materials for drainage applications must be tested in accordance with and meet the physical requirements in 985-2.2, Table 1.1.

Drainage Applications		
Geotextile Type	Description	Standard Plans Index
D-1	Revetment (Special)	
	Rock, Rubble without bedding stone	
	Ditch Pavement (Rubble Riprap) without bedding stone	524-001
D-2	Revetment (Standard)	
	Articulating Block	
	Gabions	524-001
	Rock, Rubble, and Broken Concrete with bedding stone	
	Ditch Pavement (Rubble Riprap) with bedding stone	524-001
	<u>Joint Cover for Mechanically Stabilized Retaining Wall with Coarse Aggregate Backfill</u>	
	Joint Cover for Mechanically Stabilized Retaining Wall Supporting Spread Footing Foundations	
D-3	Underdrain	440-001
	French Drain	443-001
	Sheet Piling Filter	
	Filter Fabric Jacket (Culvert)	430-001
	Concrete Pavement Subdrainage	446-001
	Joint Cover for Mechanically Stabilized Retaining Wall <u>with Sand or Limerock Backfill</u>	
D-4	Slope Pavement	
	Ditch Pavement (Sand-Cement Riprap or Concrete)	524-001
D-5	Separation Geotextile	
	Cast-In-Place Retaining Wall	

GEOSYNTHETIC MATERIALS.**(REV 7-9-18)**

SUBARTICLE 985-2.2 is deleted and the following substituted:

985-2.2 Physical Requirements: Each geosynthetic material shall be tested by an independent third party in accordance with the following methods as they apply to the specific application type. All testing and reported values, except apparent opening size (AOS), are to be minimum average roll values in the weakest principal direction unless indicated otherwise in this Section. Values for AOS are maximum average roll values.

Geotextile Selection	
In-situ Soil Type or Drainage Application	Class for Type D1, D2, D3 Materials (see Table 1.1)
< 15% passing a No. 200 Sieve*	a
15% to 50% passing a No. 200 Sieve*	b
> 50% passing a No. 200 Sieve*	c
> 50% passing a No. 200 Sieve* with Plastic Index >7	d
MSE Joint Cover for Sand or Limerock Backfill	e
MSE Joint Cover for Coarse Aggregate Backfill	f

*as per AASHTO T88.

Table 1.1 Drainage Geotextiles Test Methods and Requirements for Types D-1, D-2 and D-3			
Property/Test Method	D-1	D-2	D-3
Minimum Permittivity (Sec - 1) per ASTM D4491	D-1a = 0.7 D-1b = 0.2 D-1c = 0.1 D-1d = 0.1 D-1e = 0.25 D-1f = 1.5	D-2a = 0.7 D-2b = 0.2 D-2c = 0.1 D-2d = 0.1 D-2e = 0.25 D-2f = 1.5	D-3a = 0.5 D-3b = 0.2 D-3c = 0.1 D-3d = 0.1 D-3e = 0.7
Maximum AOS (mm, US Sieve No.) per ASTM D4751	D-1a = 0.425 (40) D-1b = 0.250 (60) D-1c = 0.212 (70) D-1d = 0.300 (50) D-1e = 0.212 (70) D-1f = 0.600 (30)	D-2a = 0.425 (40) D-2b = 0.250 (60) D-2c = 0.212 (70) D-2d = 0.300 (50) D-2e = 0.212 (70) D-2f = 0.600 (30)	D-3a = 0.425 (40) D-3b = 0.250 (60) D-3c = 0.212 (70) D-3d = 0.300 (50) D-3e = 0.212 (70)
Minimum Grab Tensile Strength (lbs) per ASTM D4632	315	Woven Monofilament = 248 Other Woven Geotextiles = 315	Elongation <50% = 248 Elongation ≥50% = 158

Table 1.1 Drainage Geotextiles Test Methods and Requirements for Types D-1, D-2 and D-3			
Property/Test Method	D-1	D-2	D-3
Mass per Unit Area (oz/sy) per ASTM D5261	Provide Test Result	Provide Test Result	Provide Test Result
Minimum Puncture Strength (lbs) per ASTM D6241	618	Woven Monofilament = 495 Other Woven Geotextiles = 618	Elongation <50% = 495 Elongation ≥50% = 309
Minimum Trapezoidal Tear (lbs) per ASTM D4533	113	Woven Monofilament = 57 Other Woven Geotextiles = 113	Woven Monofilament = 57 Other Geotextiles: Elongation <50% = 90 Elongation ≥50% = 57
Minimum UV Resistance per ASTM D4355 (% Retained Strength)	50% @500 hours	50% @500 hours	50% @500 hours
Limitations	Woven Monofilament Geotextiles only	Woven Geotextiles only. No Slit Film Geotextiles allowed.	No Slit Film Geotextiles allowed.

Table 1.2 Test Methods and Requirements for Drainage Geotextiles Types D-4 and D-5		
Property/Test Method	D-4	D-5
Minimum Permittivity (Sec ⁻¹) per ASTM D4491	0.5	0.5
Maximum AOS (mm, US Sieve No.) per ASTM D4751	0.425 (40)	0.212 (70)
Minimum Grab Tensile Strength (lbs) per ASTM D4632	180	90
Mass per Unit Area (oz/sy) per ASTM D5261	Provide Test Result	Provide Test Result
Minimum Puncture Strength (lbs) per ASTM D6241	223	223
Minimum Trapezoidal Tear (lbs) per ASTM D4533	70	40
Minimum UV Resistance per ASTM D4355 (% Retained Strength)	50% @500 hours	50% @500 hours

Table 2 Test Methods and Requirements for Erosion Control Materials					
Property/Test Method	E-1	E-2	E-3	E-4	E-5

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Property/Test Method	E-1	E-2	E-3	E-4	E-5
Permittivity (Sec ⁻¹) per ASTM D4491	0.05	0.05			
Grab Tensile Strength (lbs) per ASTM D4632	90	90			
Minimum UV Resistance per ASTM D4355 (% Retained Strength)	80% @ 500 hours	80% @ 150 hours	80% @500 hours		
Tensile Strength **(lbs/ft) per ASTM D6818 or D5035			135x70	275x135	550x275
Filtration Efficiency (%) per ASTM D5141	75% and min. flow rate of 0.3 gal/sf/min				
Design Shear***			≥2.1 psf	≥3.6 psf	≥5.0 psf
** Tensile Strength is expressed in units of measure of lbs/ft, in machine direction and cross direction as MD x CD. *** Design Shear limits for Erosion mats must be determined by 30 minutes sustained flow in an unvegetated state as determined by tests performed by Utah State University, Texas Transportation Institute or an independent testing laboratory approved by the State Drainage Engineer.					

Table 3 Test Methods and Requirements for Structural Geosynthetics			
Property/Test Method	Structural Application Type	Test Methods for Woven Geotextiles	Test Methods for Woven or Extruded Geogrids
Permittivity (sec ⁻¹)	R - 1, 2, 3, 4, 5	ASTM D4491	
UV Stability (Min Retained Strength @ 500 hr)	R - 3	ASTM D4355	ASTM D4355
Puncture Strength (lbs)	R - 5	ASTM D6241	
Grab Strength (lbs)	R - 5	ASTM D4632	
Opening Size	R - 1, 2, 3, 4, 5	AOS (US Sieve No.) ASTM D4751	Aperture Size (in x in)
Tensile Strength (lbs/ft)		ASTM D4595	ASTM D6637
Machine Direction Ultimate, (T _{ult})			
2% Strain	R - 1, 3		
5% Strain	R - 2, 3, 4, 5		
10% Strain	R - 1, 2, 3, 4, 5		
Cross Direction Ultimate			
2% Strain	R - 1, 3,		
5% Strain	R - 2, 3, 4, 5		

Table 3 Test Methods and Requirements for Structural Geosynthetics			
Property/Test Method	Structural Application Type	Test Methods for Woven Geotextiles	Test Methods for Woven or Extruded Geogrids
10% Strain	R - 1, 2, 3, 4, 5		
Strain @ Ultimate Tensile Strength	R - 1, 2, 3, 4, 5		
Tear Strength (lbs)		ASTM D4533	
Machine Direction	R - 5		
Cross Direction	R - 5		
Soil-Geosynthetic Friction	R - 1, 2, 3	ASTM D5321	ASTM D5321/D6706
Pullout Resistance	R - 3	ASTM D6706	ASTM D6706
Creep Resistance- T_{creep} (lbs/ft)	R - 2, 3	ASTM D5262	ASTM D5262
Creep Reduction Factor (T_{ult}/T_{creep})	R - 2, 3		
Installation Damage (RF_{ID})		AASHTO R69	AASHTO R69
Sand	R - 2, 3, 4		
Limestone	R - 2, 3, 4		
Durability (RF_D)			
Chemical	R - 2, 3, 4	AASHTO R69	AASHTO R69
Biological	R - 2, 3, 4	AASHTO R69	AASHTO R69
Joint Strength (RF_j)		GRI: GT7	GRI: GG4(a) & GG4(b)
Mechanical	R - 2, 3		
Sewn	R - 2, 3	ASTM D4884	

SUBARTICLE 985-3.1 is deleted and the following substituted:

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Drainage Applications		
Geotextile Type	Description	Standard Plans Index
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	Rock, Rubble without bedding stone	
	Ditch Pavement (Rubble Riprap) without bedding stone	524-001
D-2	Revetment (Standard)	
	Articulating Block	
	Gabions	524-001
	Rock, Rubble, and Broken Concrete with bedding stone	
	Ditch Pavement (Rubble Riprap) with bedding stone	524-001
	Joint Cover for Mechanically Stabilized Retaining Wall with Coarse Aggregate Backfill	
	Joint Cover for Mechanically Stabilized Retaining Wall Supporting Spread Footing Foundations	
D-3	Underdrain	440-001
	French Drain	443-001
	Sheet Piling Filter	
	Filter Fabric Jacket (Culvert)	430-001
	Concrete Pavement Subdrainage	446-001
	Joint Cover for Mechanically Stabilized Retaining Wall with Sand or Limerock Backfill	
D-4	Slope Pavement	
	Ditch Pavement (Sand-Cement Riprap or Concrete)	524-001
D-5	Separation Geotextile	
	Cast-In-Place Retaining Wall	