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Subsurface Drainage

Description: This specification is applicable to placing a geotextile against the soil to allow long-term passage of water into a subsurface drain system retaining the in-situ soil. The primary function of the geotextile in subsurface drainage applications is filtration. Geotextile filtration properties are a function of the in-situ soil gradation, plasticity, and hydraulic conditions.

Geotextile Requirements: Woven silt film geotextiles (i.e. geotextiles made from yarns of a flat, tape-like character) will not be allowed.

Test	**Test Method**	**Units**		**Class 2**[2]				**Class 3**			
				<50%		=50%		<50%		=50%	
Grab Strength	ASTM D 4632	N	lbs	1100	248	700	158	800	180	500	113
Sewn Seam Strength	ASTM D 4632	N	lbs	990	223	630	142	720	162	450	101
Tear Strength	ASTM D 4633	N	lbs	400	90*	250	56	300	68	180	41
Puncture Strength	ASTM D 4833	N	lbs	400	90	250	56	300	68	180	41
Burst Strength	ASTM D 3786	kPa	psi	2700	392	1300	189	2100	305	950	138
UV Resistance	ASTM D 4355	%		50% @ 500 hrs.		50% @ 500 hrs.		50% @ 500 hrs.		50% @ 500 hrs.	
% in-situ soil passing 0.075mm (#200 sieve)[1]				Course <15	Medium 15-50	Fine >50	Course <15	Medium 15-50	Fine >50	Course <15	Medium 15-50	Fine >50	Course <15	Medium 15-50	Fine >50
Permittivity[3,4]	ASTM D 4491	sec^{-1}		.5	.2	.1	.5	.2	.1	.5	.2	.1	.5	.2	.1
AOS**[3,4]	ASTM D 4751	mm		.43	.25	.22[5]	.43	.25	.22[5]	.43	.25	.22[5]	.43	.25	.22[5]

[1]Based on grain size analysis of in-situ soil in accordance with AASHTO T88.

[2] Default geotextile selection. The Engineer may specify a Class 3 geotextile for trench drain applications based on one or more of the following:

a) The Engineer has found Class 3 geotextiles to have sufficient survivability based on field experience.

b) The Engineer has found Class 3 geotextiles to have sufficient survivability based on laboratory testing and visual inspection of a geotextile sample removed from a field test section constructed under anticipated field conditions.

c) Subsurface drain depth is less than 2 m (6.56 ft), drain aggregate is less than 30 mm (1.18 in) and compaction requirement is equal to or less than 95% of AASHTO T-99.

[3] These default filtration property values are based on the predominate particle sizes of the in-situ soil. In addition to the default permittivity value, the Engineer may require geotextile permeability and/or performance testing based on engineering design for drainage systems in problematic soil environments.

[4] Site specific geotextile design should be performed especially if one or more of the following problematic soil environments are encountered: unstable or highly erodable soils such as non-cohesive silts; gap graded soils; alternating sand/silt laminated soils; dispersive clays; and/or rock flour.

[5] For cohesive soils with+ a plasticity index greater than 7, geotextile maximum average roll value for apparent opening size is 0.30 mm (#50 sieve).

* The required MARV tear strength for woven monofilament geotextiles is 250 N (56 lbs).

** Maximum Average Roll Value

All other values are Minimum Average Roll Values (MARV)

Products that meet class specification	**Class 2**		**Class 3**	
	<50%	**=50%**	**<50%**	**=50%**
Coarse Gradation (<15%)	None	150EX	GTF 400 EO	140EX
Medium Gradation (15-50%)	GTF 400E	150EX	GTF 400 EO	140EX
Fine Gradation (>50%)	GTF 400E	150EX	GTF 400 EO	140EX

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Separation

Description: This specification is applicable to the use of a geotextile to prevent mixing of a subgrade soil and an aggregate cover material (subbase, base, select embankment, etc.). This specification may also apply to situations other than beneath pavements where separation of two dissimilar materials is required but where water seepage through the geotextile is not a critical function.

The separation application is appropriate for pavement structures constructed over soils with a California Bearing Ratio greater than or equal to three (CBR = 3, shear strength greater than approximately 90 kPa (13.05 psi)). It is appropriate for unsaturated subgrade soils. The primary function of a geotextile in this application is separation.

Geotextile Requirements: The geotextile shall meet the requirements in this table.

Test	**Test Method**	**Units**		**Class 2**[2]				**Class 3**			
				<50%		=50%		<50%		=50%	
Grab Strength	ASTM D 4632	N	lbs	1100	248	700	158	800	180	500	113
Sewn Seam Strength	ASTM D 4632	N	lbs	990	223	630	142	720	162	450	101
Tear Strength	ASTM D 4633	N	lbs	400	90*	250	56	300	68	180	41
Puncture Strength	ASTM D 4833	N	lbs	400	90	250	56	300	68	180	41
Burst Strength	ASTM D 3786	kPa	psi	2700	392	1300	189	2100	305	950	138
UV Resistance	ASTM D 4355	%		50% @ 500 hrs.				50% @ 500 hrs.			
Permittivity	ASTM D 4491	sec^{-1}		02^2		02^2		02^2		02^2	
AOS**	ASTM D 4751	mm		.60		.60		.60		.60	

[1]Default geotextile selection. The Engineer may specify a Class 3 geotextile based on one or more of the following:

a) The Engineer has found Class 3 geotextiles to have sufficient survivability based on field experience.

b) The Engineer has found Class 3 geotextiles to have sufficient survivability based on laboratory testing and visual inspection of a geotextile sample removed from a field test section constructed under anticipated field conditions.

c) Aggregate cover thickness of the first lift over the geotextile exceeds 300 mm (11.81 in) and aggregate diameter is less than 50 mm (1.97 in).

d) Aggregate cover thickness of the first lift over the geotextile exceeds 150 mm (5.91 in) , aggregate diameter is less than 30 mm (1.18 in), and construction equipment contact pressure is less than 550 kPa (79.77 psi).

[2] Default value. Permittivity of the geotextile should be greater than that of the soil (? g > ? s). The Engineer may also require the permeability of the geotextile to be greater than that of the soil (kg > ks).

* The required MARV tear strength for woven monofilament geotextiles is 250 N (56 lbs).

** Maximum Average Roll Value

All other values are Minimum Average Roll Values (MARV)

Products that meet class specification:

Class 2		**Class 3**	
<50%	**=50%**	**<50%**	**=50%**
GTF 250	150EX	GTF 200S	140EX

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Stabilization

Description: This specification is applicable to the use of a geotextile in wet, saturated conditions to provide the coincident functions of separation and filtration. In some installations, the geotextile can also provide the function of reinforcement. Stabilization is applicable to pavement structures constructed over soils with a California Bearing Ratio between one and three (1<CBR<3), and shear strength between approximately 30 and 90 kPa (4.35-13.05 psi).
The stabilization application is appropriate for subgrade soils which are saturated due to a high groundwater table or due to prolonged periods of wet weather.
This specification is not appropriate for embankment reinforcement where stress conditions may cause global subgrade foundation or stability failure.
Reinforcement of the pavement section is a site-specific design issue.
Geotextile Requirements: The geotextile shall meet the requirements in this table.

Test	**Test Method**	**Units**		**Class 1[1]**				**Class 2**				**Class 3**			
				<50%		=50%		<50%		=50%		<50%		=50%	
Grab Strength	ASTM D 4632	N	lbs	1400	315	900	202	1100	248	700	158	800	180	500	113
Sewn Seam Strength	ASTM D 4632	N	lbs	1200	270	810	182	990	223	630	142	720	162	450	101
Tear Strength	ASTM D 4633	N	lbs	500	113	350	79	400	90*	250	56	300	68	180	41
Puncture Strength	ASTM D 4833	N	lbs	500	113	350	79	400	90	250	56	300	68	180	41
Burst Strength	ASTM D 3786	kPa	psi	3500	508	1700	247	2700	392	1300	189	2100	305	950	138
UV Resistance	ASTM D 4355	%		50% @ 500 hrs.				50% @ 500 hrs.				50% @ 500 hrs.			
Permittivity	ASTM D 4491	sec^{-1}		.05[2]		.05[2]		.05[2]		.05[2]		.05[2]		.05[2]	
AOS**	ASTM D 4751	mm		.43		.43		.43		.43		.43		.43	

[1]Default geotextile selection. The Engineer may specify a Class 2 or 3 geotextile based on one or more of the following:
a) The Engineer has found the class of geotextiles to have sufficient survivability based on field experience.
b) The Engineer has found the class of geotextiles to have sufficient survivability based on laboratory testing and visual inspection of a geotextile sample removed from a field
test section constructed under anticipated field conditions.
[2] Default value. Permittivity of the geotextile should be greater than that of the soil (? g > ? s). The Engineer may also require the permeability of the geotextile to be greater than that of the soil (kg > ks).
* The required MARV tear strength for woven monofilament geotextiles is 250 N (56 lbs).
** Maximum Average Roll Value
All other values are Minimum Average Roll Values (MARV)
Products that meet class specification:

Class 1[1]		**Class 2**		**Class 3**	
<50%	=50%	<50%	=50%	<50%	=50%
None	180EX	GTF 400E	150EX	GTF 400EO	140EX

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Permanent Erosion Control

Description: This specification is applicable to the use of a geotextile between energy absorbing armor systems and the in-situ soil to prevent soil loss resulting in excessive scour and to prevent hydraulic uplift pressures causing instability of the permanent erosion control system. This specification does not apply to other types of geosynthetic erosion control materials such as turf reinforcement mats.

The primary function the geotextile serves in permanent erosion control applications is filtration. Geotextile filtration properties are a function of site hydraulic conditions, and the in-situ soil gradation, density, and plasticity.

Geotextile Requirements: Woven silt film geotextiles (i.e. geotextiles made from yarns of a flat, tape-like character) will not be allowed.

Test	**Test Method**	**Units**		**Class 1[2,3] (All Others)**						**Class 2[2] (Woven Monofilament)**					
				<50%			=50%			<50%			=50%		
Grab Strength	ASTM D 4632	N	lbs	1400	315		900	202		1100	248				
Sewn Seam Strength	ASTM D 4632	N	lbs	1200	270		810	182		990	223				
Tear Strength	ASTM D 4633	N	lbs	500	113		350	79		400	90*				
Puncture Strength	ASTM D 4833	N	lbs	500	113		350	79		400	90				
Burst Strength	ASTM D 3786	kPa	psi	3500	508		1700	247		2700	392				
UV Resistance	ASTM D 4355	%		50% @ 500 hrs.			50% @ 500 hrs.			50% @ 500 hrs.					
% in-situ soil passing 0.075mm (#200 sieve)[1]				Course <15	Medium 15-50	Fine >50	Course <15	Medium 15-50	Fine >50	Course <15	Medium 15-50	Fine >50			
Permittivity[4]	ASTM D 4491	sec^{-1}		.7	.2	.1	.7	.2	.1	.7	.2	.1			
AOS**[3,4]	ASTM D 4751	mm		.43	.25	.22[5]	.43	.25	.22[5]	.43	.25	.22[5]			

[1] Based on grain size analysis of in-situ soil in accordance with AASHTO T88.

[2] As a general guideline, the default geotextile selection is appropriate for conditions of equal or less severity than either of the following:

a) Armor layer stone weights do not exceed 100 kg (220 lbs), stone drop height is less than 1 m (3.28 ft), and no aggregate bedding layer is required.

b) Armor layer stone weights exceed 100 kg (220 lbs), stone drop height is less than 1 m (3.28 ft), and the geotextile is protected by a 150 mm (5.91 in) thick aggregate bedding layer designed to be compatible with the armor layer.

[3] The Engineer may specify a Class 2 geotextile based on one or more of the following:

a) The Engineer has found Class 2 geotextiles to have sufficient survivability based on field experience.

b) The Engineer has found Class 2 geotextiles to have sufficient survivability based on laboratory testing and visual inspection of a geotextile sample removed from a field test section constructed under anticipated field conditions.

c) Armor layer stone weights less than 100 kg (220 lbs), stone drop height is less than 1 m (3.28 ft), and the geotextile is protected by a 150 mm (5.91 in) thick aggregate bedding layer designed to be compatible with the armor layer.

d) Armor layer stone weights do not exceed 100 kg (220 lbs), stone is placed with a zero drop height.

[4] These default filtration property values are based on the predominate particle sizes of the in-situ soil. In addition to the default permittivity value, the Engineer may require geotextile permeability and/or performance testing based on engineering design for drainage systems in problematic soil environments. Site specific geotextile design should be performed especially if one or more of the following problematic soil environments are encountered: unstable or highly erodable soils such as non-cohesive silts; gap graded soils; alternating sand/silt laminated soils; dispersive clays; and/or rock flour.

[5] For cohesive soils with a plasticity index greater than 7, geotextile maximum average roll value for apparent opening size is 0.30 mm (#50 sieve).

* The required MARV tear strength for woven monofilament geotextiles is 250 N (56 lbs).

** Maximum Average Roll Value

All other values are Minimum Average Roll Values (MARV)

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Temporary Silt Fence*

Description: This specification is applicable to the use of a geotextile as a vertical, permeable interceptor to remove suspended soil from overland water flow. The function of a temporary silt fence is to filter and allow settlement of soil particles from sediment laden water. The purpose is to prevent the eroded soil from being transported off the construction site by water runoff.

Geotextile Requirements: The geotextile used for temporary silt fence may or may not be supported between posts with a wire or polymeric mesh. The temporary silt fence geotextile shall meet the requirements of the table below. All numeric values except AOS represent MARV. Values for AOS represent maximum average roll values.

Field monitoring shall be performed to verify that armor system placement does not damage the geotextile. The minimum height above ground for all silt fence shall be 760 mm (29.92 in). Minimum embedment depth shall be 150 mm (5.91 in). Refer to Section XXXXX for more detailed installation requirements.

	Test Method	Units	Supported	Unsupported	Unsupported
Elongation	ASTM D-4632	%	N/A	=50	=50
Maximum Post Spacing		m/ft	1.2/3.9	1.2/3.9	2/6.56
Grab Strength					
Machine	ASTM D-4632	N/lbs	400/90	550/123	550/123
Cross Machine	ASTM D-4632	N/lbs	400/90	450/101	450/101
Permittivity1	ASTM D-4491	Sec-1	0.05	0.05	0.05
Water Flow Rate	ASTM D-4491	(liters/m^2/sec)(gpm/ft^2)	3 /4.43	3 /4.43	3 /4.43
Apparent Opening Size**1	ASTM D-4751	Mm	0.60	0.60	0.60
UV Stability	ASTM D-4355	% after 500 hr.	70	70	70

[1]These default filtration property values are based on empirical evidence with a variety of sediments. For environmental sensitive areas, a review of previous experience and/or site or regionally specific geotextile tests should be performed by the agency to conform suitability of these requirements.

* Silt fence support shall consist of 14 gage steel wire with a mesh spacing of 150 mm (5.91 in) by 150 mm (5.90 in) or prefabricated polymeric mesh of equivalent strength.

** Maximum Average Roll Value

All other values are Minimum Average Roll Values (MARV)

Products that meet class specification: GTF 190 for Unsupported =50%

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Paving Fabric

Description: This specification is applicable to the use of a paving fabric, saturated with asphalt cement between pavement layers. The function of the paving fabric is to act as a waterproofing membrane within the pavement structure. This specification is not intended to describe fabric membrane systems specifically designed for pavement joints and localized (spot) repairs.

Geotextile Requirements: The geotextile used for paving fabric must meet the requirements of the table below.

Test	Test Method	Units	Requirements
Grab Strength	ASTM D-4632	N/lbs	450/101
Mass Per Unit Area	ASTM D-3776	$(g/m^2)(oz/yd^2)$	140/4.2
Ultimate Elongation	ASTM D-4632	%	=50
Asphalt Retention[1]	Texas DOT Item 3099	$(l/m^2)(gal/yd^2)$	[1,2]
Melting Point	ASTM D-276	$^0C/^0F$	150/302

[1] Asphalt required to saturate paving fabric only. Asphalt retention must be provided in manufacturer certification (refer to section 4). Value does not indicate the asphalt application rate required for construction. Refer to Appendix titled Construction/Installation Guidelines for discussion of asphalt application rate.

[2] Product asphalt retention property must meet the MARV provided by the manufacture's certification (refer to section 4).

All values are Minimum Average Roll Values (MARV)