

GRI-GT13(a) Specification Geotextile Separation for Roadways (ASTM Test Method Based)

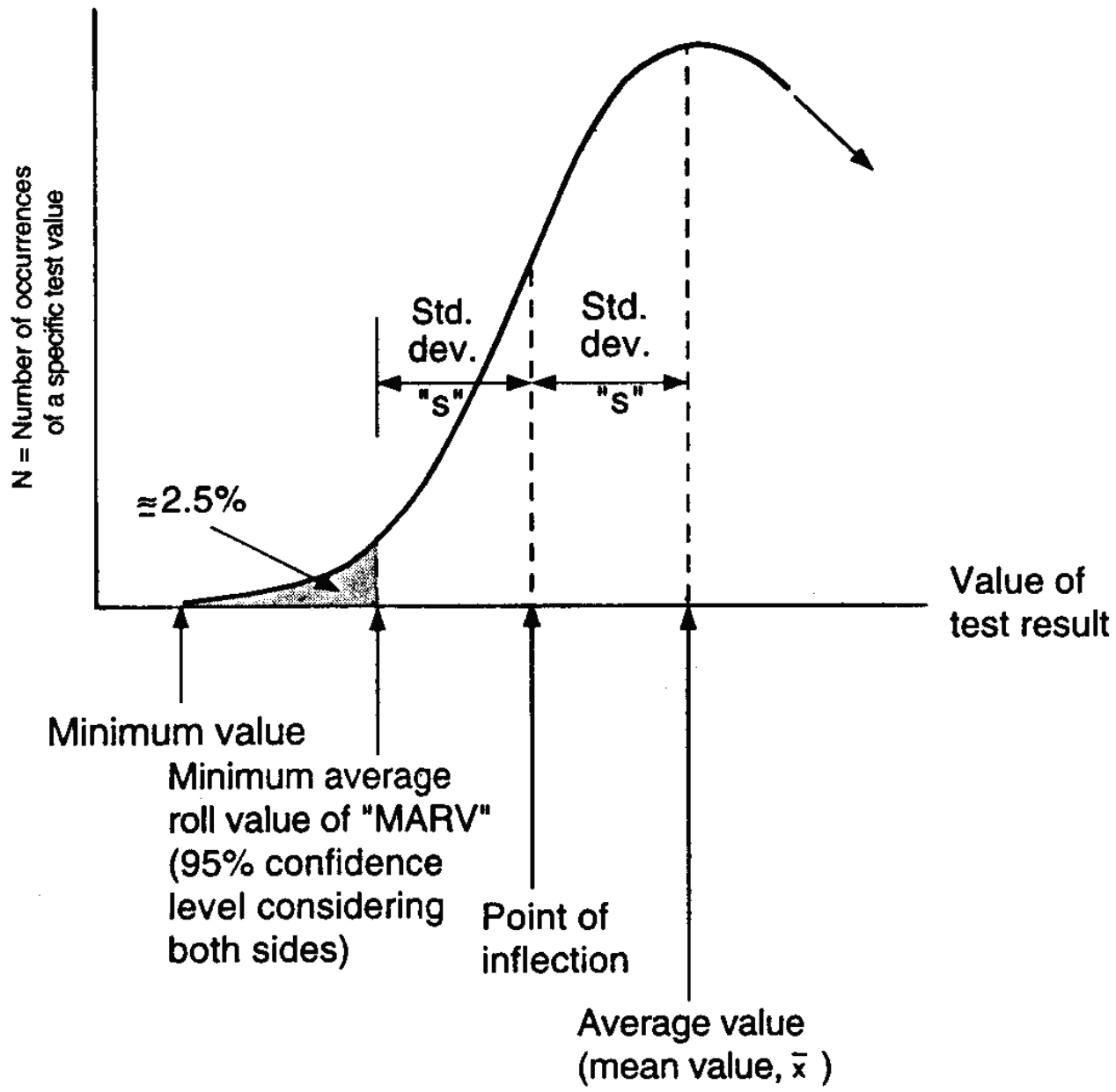
- **placed between subgrade soil and an overlying aggregate layer**
- **separation prevents mixing and intrusion**
- **meant for firm subgrades; e.g., paved roads**
- **three levels of installation survivability**
- **survivability guide is also included**
- **augments AASHTO M288 specification**

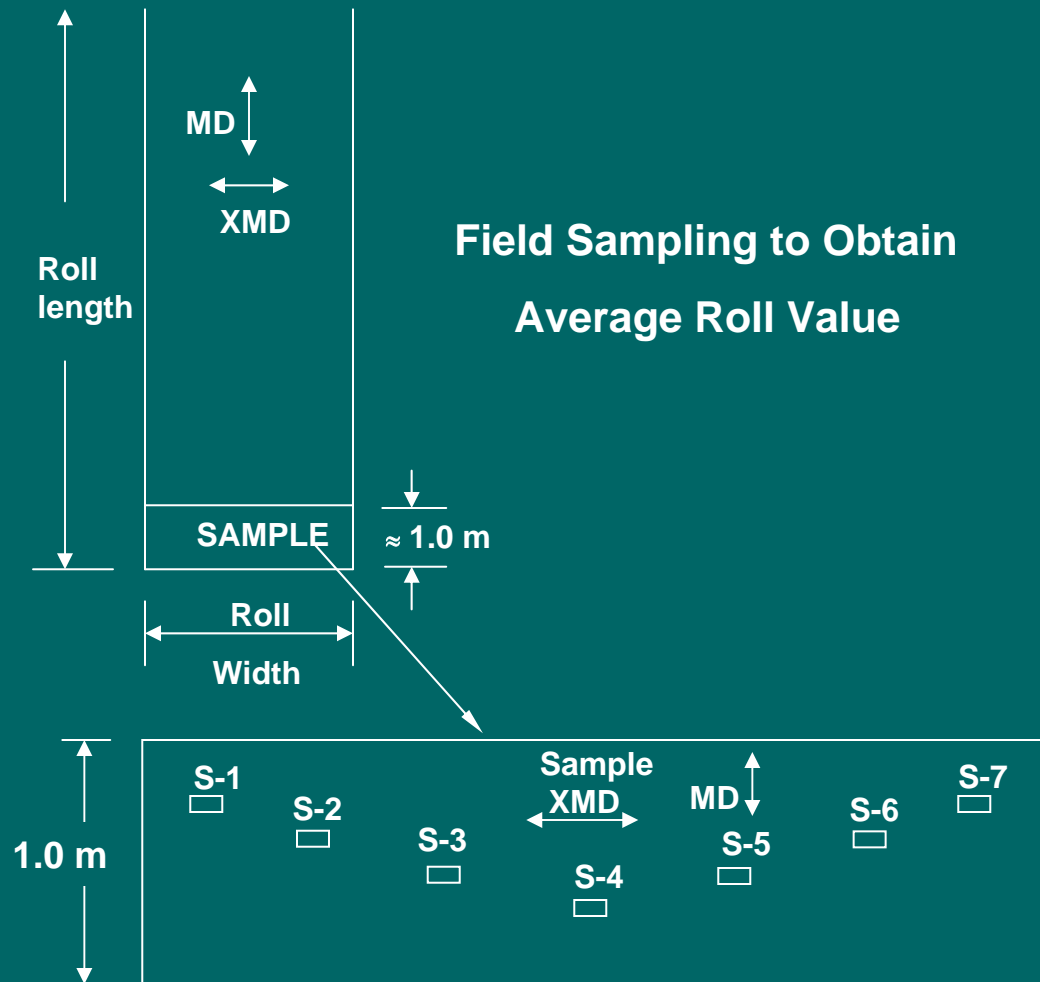
Preliminary Comments

- includes wovens and nonwovens
- silent on type of polymer
- subgrade evaluated using CBR-test value; i.e., CBR > 3.0 (soaked) or CBR > 8.0 (unsoaked)
- values are MARV; except AOS (its MaxARV) and UV (its min. ave.)

Regarding MARV

- minimum average roll value
- accommodates variation in GT manufacturing properties
- statistically it's the " $\mu-2\sigma$ " value
- MaxARV is the " $\mu+2\sigma$ " value
- procedure shown in next screens





Take Specimens from above Sample and Test as Required

Test Number	Roll Number					
	1	2	3	4	5	6
1	643N	627N	637N	642N	652N	637N
2	627	615	643	646	641	624
3	652	621	628	658	639	631
4	629	616	662	641	657	620
5	632	619	646	635	642	618
6	641	621	633	642	651	633
7	<u>662</u>	<u>622</u>	<u>619</u>	<u>658</u>	<u>641</u>	<u>641</u>
Average =	641	620	638	646	646	629

↑ This is MARV Value!

Test Properties Included

1. grab tensile strength
2. trapezoidal tear strength
3. CBR puncture strength
4. Permittivity (Flow Rate)
5. apparent opening size
6. UV stability by Xenon Arc

1. Grab Tensile Response

- follows ASTM D4632
- 10 specimens MD & XMD across width
- 100 mm wide; gripped in center 25 mm
- must avoid slippage or grip failure
- record maximum strength in kN (lb)
- elongation is not included
- develop MARV for strength and compare to spec



**D4632 - Grab Tensile Test
[Evaluates Strength (and Elongation) at Failure]**

2. Trapezoidal Tear Strength

- follows ASTM D4533
- tear propagates from an initial cut
- maximum value is recorded
- 10 specimens in MD and XMD across roll width
- take average value of lowest
- develop MARV and compare to specification value



**D4533 - Trapezoidal Tear Strength
(Evaluates the Maximum Value)**

3. CBR Puncture Strength

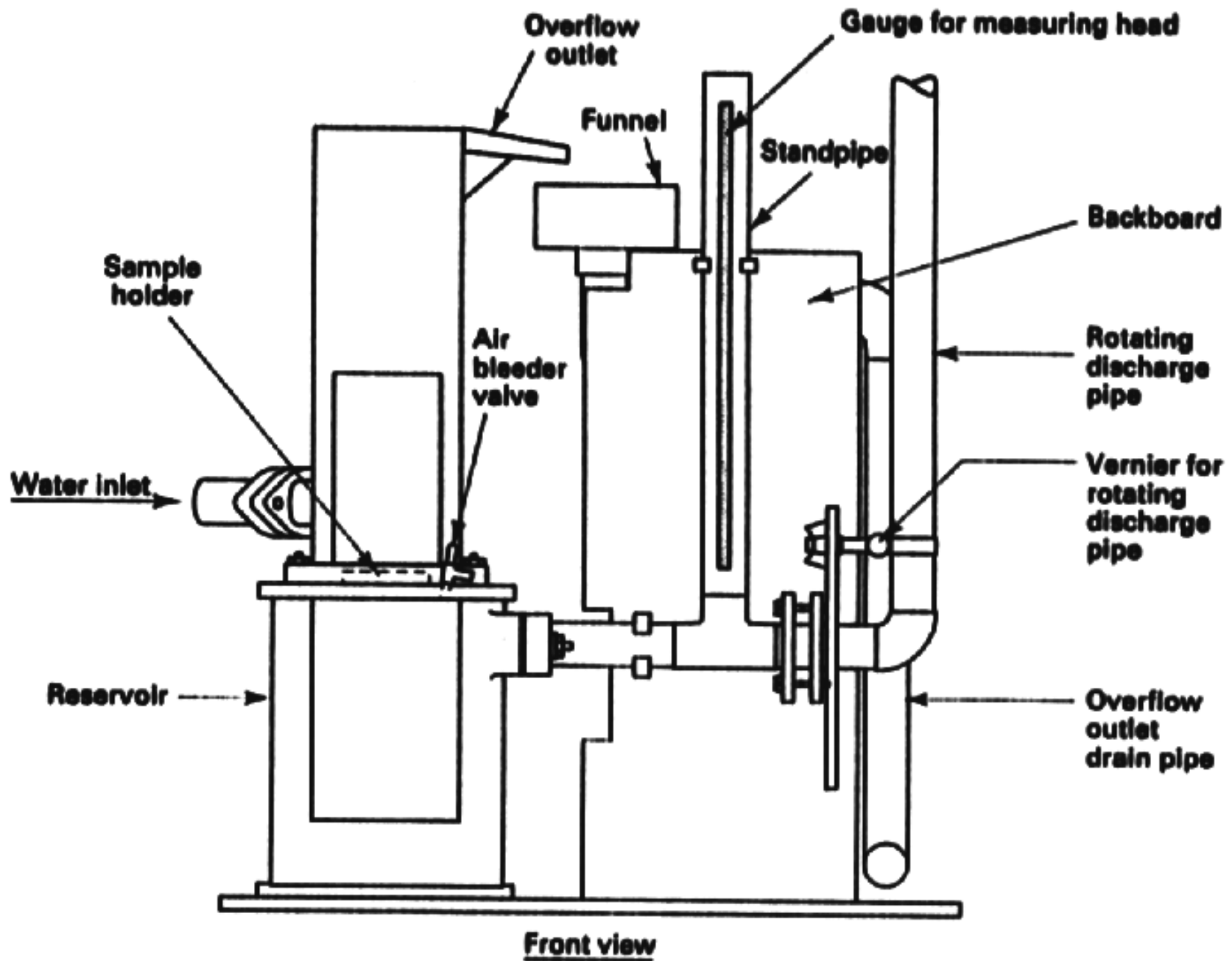
- California Bearing Ratio (CBR) is a soil strength test adopted for geosynthetics
- follows ASTM D6241 using the same device.... modified with flanges
- probe is 50 mm (2.0 in.) diameter
- container is 150 mm (6.0 in.) diameter
- 10 specimens across roll width
- puncture strength is obtained
- develop MARV and compare to spec



D6241 - Puncture (CBR) Strength
[Evaluates Strength at Rupture (and Accompanying Deformation)]

4. Permittivity (Water Flow Rate)

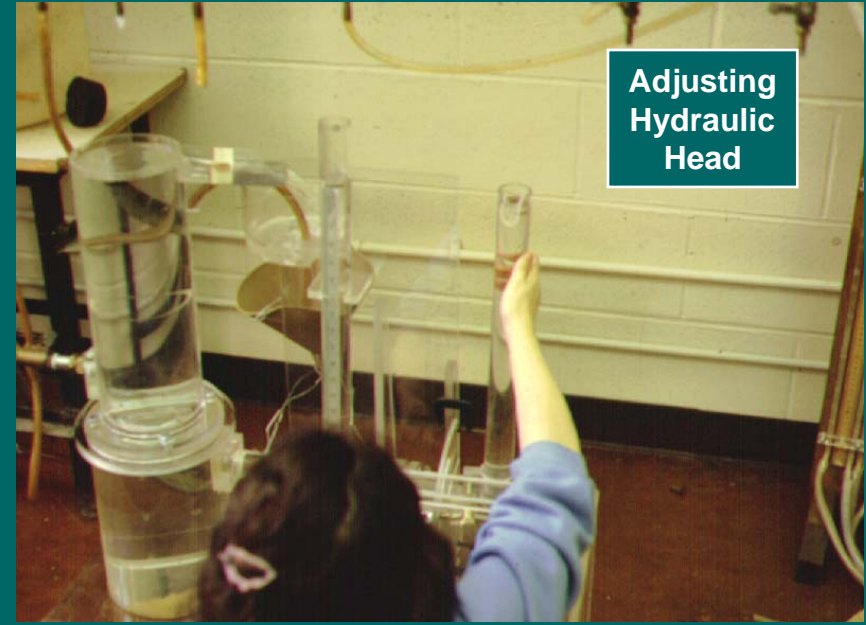
- follows ASTM D4491
- uses deaired water (≤ 6 ppm dissolved oxygen)
- measures flow rate/unit area
- constant head of 50 mm (2.0 in.)
- results in permittivity, $\psi = (k)(t)$
- value must be $\geq 0.02 \text{ sec}^{-1}$



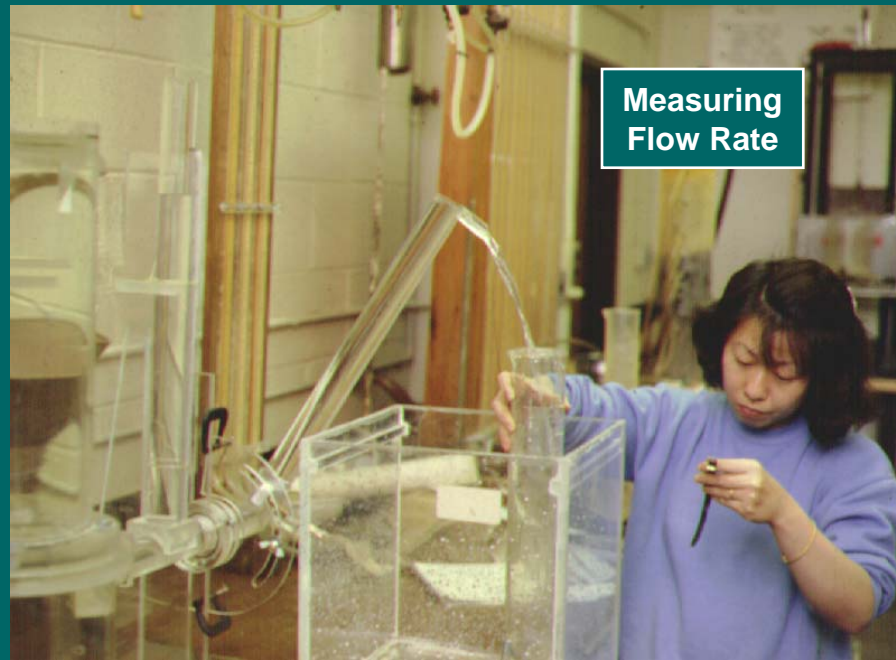
ASTM D4491 – Water Flow Rate (Permittivity) Device



Specimen Being Placed



Adjusting Hydraulic Head



Measuring Flow Rate

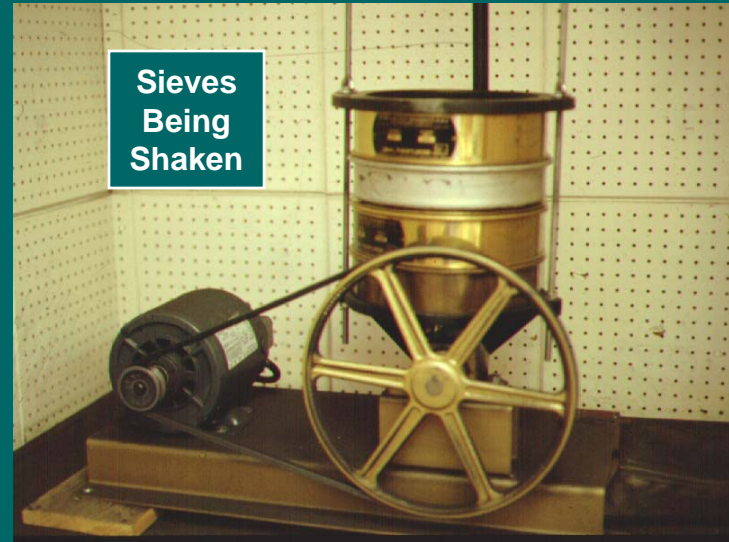
5. Apparent Opening Size

- its dry bead sieving, per ASTM D4751
- AOS is often called EOS
- it's a maximum value, i.e., “MaxARV”
- converted to either O_{95} in mm, or equivalent U. S. sieve size
- values must be ≤ 0.60 mm (0.024 in.)
- this is equivalent to #30 sieve size

**ASTM D4751
AOS Test**



**Sieves
Being
Shaken**



**Bottom
Pan With
Beads That
Passed Fabric**

6. Ultraviolet Resistance

- follows ASTM D4355 (Xenon Arc)
- 500 hours exposure
- cycled at 90 min. light; 30 min. light and water spray
- 50 mm strip tensile per D5035
- 5 MD and 5 XMD and values averaged together
- min. ave. $\geq 50\%$ strength retained



Typical
Xenon Arc
Weatherometer



Interior Chamber
of Xenon Arc
Weatherometer

ENGLISH UNITS

Table 1(a) - Geotextile Properties Class 1 (High Survivability)⁽¹⁾

Property	ASTM Test	Unit	Elongation n < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	lb	315	203
Trapezoid Tear Strength	D 4533	lb	112	79
CBR Puncture Strength	D 6241	lb	630	440
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	in.	0.024	0.024
Ultraviolet Stability ⁽²⁾	D 4355	% Ret. @ 500 hrs	50	50

Table 1(b) - Geotextile Properties Class 2 (Moderate Survivability)⁽¹⁾

Property	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	lb	248	158
Trapezoid Tear Strength	D 4533	lb	90	56
CBR Puncture Strength	D 6241	lb	500	320
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	in.	0.024	0.024
Ultraviolet Stability ⁽²⁾	D 4355	% Ret. @ 500 hrs	50	50

Table 1(c) - Geotextile Properties Class 3 (Low Survivability)⁽¹⁾

Property	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	lb	180	113
Trapezoid Tear Strength	D 4533	lb	68	41
CBR Puncture Strength	D 6241	lb	380	230
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	in.	0.024	0.024
Ultraviolet Stability ⁽²⁾	D 4355	% Ret. @ 500 hrs	50	50

Notes:

(1) All values are MARV except UV stability; it is a minimum value and AOS which is a maximum value.

(2) Evaluation to be on 2.0 inch strip tensile specimens after 500 hours exposure.

SI METRIC UNITS

Table 2(a) - Geotextile Properties Class 1 (High Survivability)⁽¹⁾

Property	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	N	1400	900
Trapezoid Tear Strength	D 4533	N	500	350
CBR Puncture Strength	D 6241	N	2800	2000
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	mm	0.60	0.60
Ultraviolet Stability ⁽²⁾	D 4355	% Ret. @ 500 hrs	50	50

Table 2(b) - Geotextile Properties Class 2 (Moderate Survivability)⁽¹⁾

Property	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	N	1100	700
Trapezoid Tear Strength	D 4533	N	400	250
CBR Puncture Strength	D 6241	N	2250	1400
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	mm	0.60	0.60
Ultraviolet Stability ⁽²⁾	D 4355	% Ret. @ 500 hrs	50	50

Table 2(c) - Geotextile Properties Class 3 (Low Survivability)⁽¹⁾

Property	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	N	800	500
Trapezoid Tear Strength	D 4533	N	300	180
CBR Puncture Strength	D 6241	N	1700	1000
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	mm	0.60	0.60
Ultraviolet Stability ⁽²⁾	D 4355	% Ret. @ 500 hrs	50	50

Notes:

(1) All values are MARV except UV stability; it is a minimum value and AOS which is a maximum value.

(2) Evaluation to be on 50 mm strip tensile specimens after 500 hours exposure.

**Table 3 - Required Degree of Survivability as a Function of Subgrade Conditions, Construction Equipment and Lift Thickness
(Class 1, 2 and 3 Properties are Given in Table 1 and 2; Class 1 + Properties are Higher than Class 1 but Not Defined at this Time)**

	Low ground-pressure equipment ≤ 25 kPa (3.6 psi)	Medium ground-pressure equipment > 25 to ≤ 50 kPa (>3.6 to ≤ 7.3 psi)	High ground-pressure equipment > 50 kPa (> 7.3 psi)
Subgrade has been cleared of all obstacles except grass, weeds, leaves, and fine wood debris. Surface is smooth and level so that any shallow depressions and humps do not exceed 450 mm (18 in.) in depth or height. All larger depressions are filled. Alternatively, a smooth working table may be placed.	Low (Class 3)	Moderate (Class 2)	High (Class 1)
Subgrade has been cleared of obstacles larger than small to moderate-sized tree limbs and rocks. Tree trunks and stumps should be removed or covered with a partial working table. Depressions and humps should not exceed 450 mm (18 in.) in depth or height. Larger depressions should be filled.	Moderate (Class 2)	High (Class 1)	Very High (Class 1+)
Minimal site preparation is required. Trees may be felled, delimited, and left in place. Stumps should be cut to project not more than ± 150 mm (6 in.) above subgrade. Fabric may be draped directly over the tree trunks, stumps, large depressions and humps, holes, stream channels, and large boulders. Items should be removed only if placing the fabric and cover material over them will distort the finished road surface.	High (Class 1)	Very high (Class 1+)	Not recommended

*Recommendations are for 150 to 300 mm (6 to 12 in.) initial lift thickness. For other initial lift thicknesses:

- 300 to 450 mm (12 to 18 in.): reduce survivability requirement one level;
- 450 to 600 mm (18 to 24 in.): reduce survivability requirement two levels;
- > 600 mm (24 in.): reduce survivability requirement three levels

Note 1: While separation occurs in every geotextile application, this pavement-related specification focuses on subgrade soils being "firm" as indicated by CBR values higher than 3.0 (soaked) or 8.0 (unsoaked).

Source: Modified after Christopher, Holtz, and DiMaggio