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Mechanical Properties of Geotextile Fabrics

Two fabrics were provided that are being considered as underlayments for Ultrabase panels. Fabrics were a gray Typar and black fabric from Tencate. Typar is a spunbonded nonwoven, an inherently isotropic material. The Tencate fabric is woven and therefore has a machine direction (warp) and cross machine direction (weft). Tensile and creep properties were evaluated in order to characterize the ability of fabrics to perform as supporting underlayments. Tensile characterization included ultimate strength, ultimate elongation and initial modulus. At least 5 measurements were made for each sample. Creep was measured by loading a sample in tension at 123 psi (more than the required 100 psi). This value was chosen as being representative of a 14,000 lb, 6 wheeled vehicle parked on top of panels. It is assumes that it is possible for at least 2 wheels to be parked on a single panel. Given the footprint area of a panel as 59.3 sq in this represents a load of 100 psi on the fabric. This weight applied to the fabric will press into the fabric deforming it in both compression and tension. Creep would result in a nonrecoverable deformation. This potential effect is evaluated by loading the fabrics in tension and measuring the amount of deformation, or strain at 1 hr and again at 24 hrs. It is assumed on this case that the strain is nonrecoverable.

The Tencate fabric is superior in all characteristics measured. It is stronger in tensile and stiffer as measured by initial modulus. In addition there is no creep detected after 24 hrs of loading in tension. The Typar fabric showed 0.2% strain after 24 hrs, a small but measurable difference.

The Tencate fabric is balanced is properties. Within measurement error, there was no difference between machine and cross machine directions.

While the Tencate fabric is superior it cannot be stated that the Typar fabric is not suitable for use as an underlayment. Typar may very well be suitable for use conditions. However, the Tencate fabric is expected to perform better under heavy loads.

Data and graphs are attached.

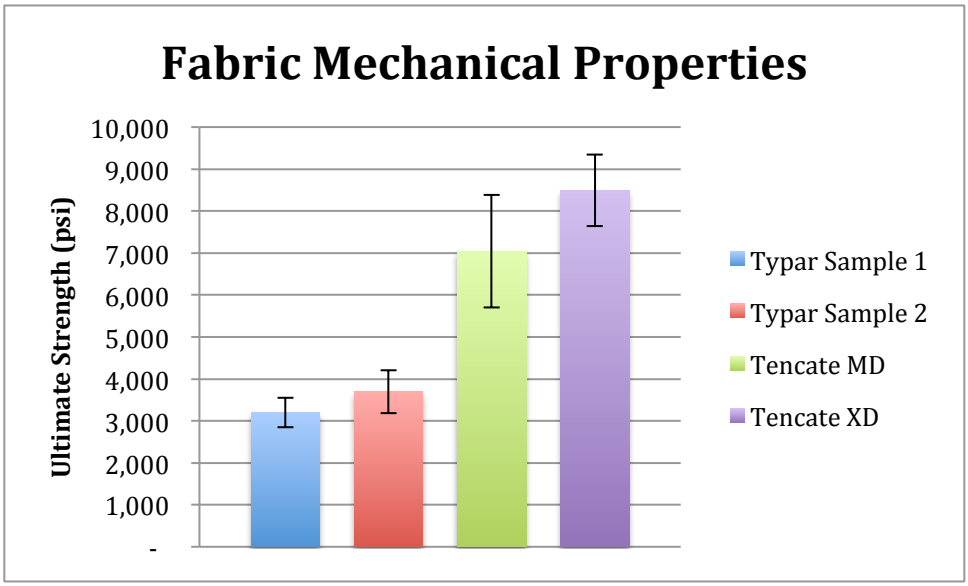
Please let me know if you have any questions or would like to discuss the data.

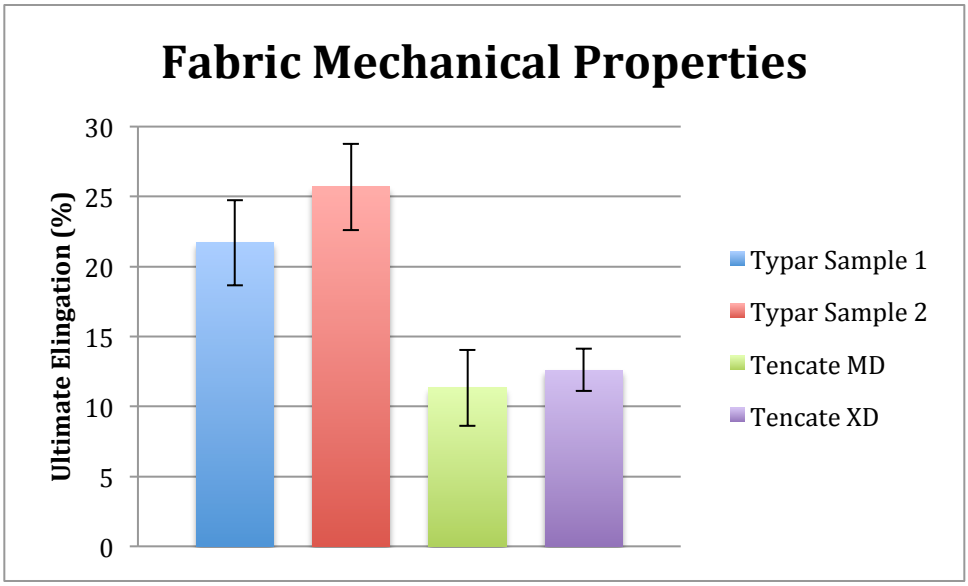
Best regards,

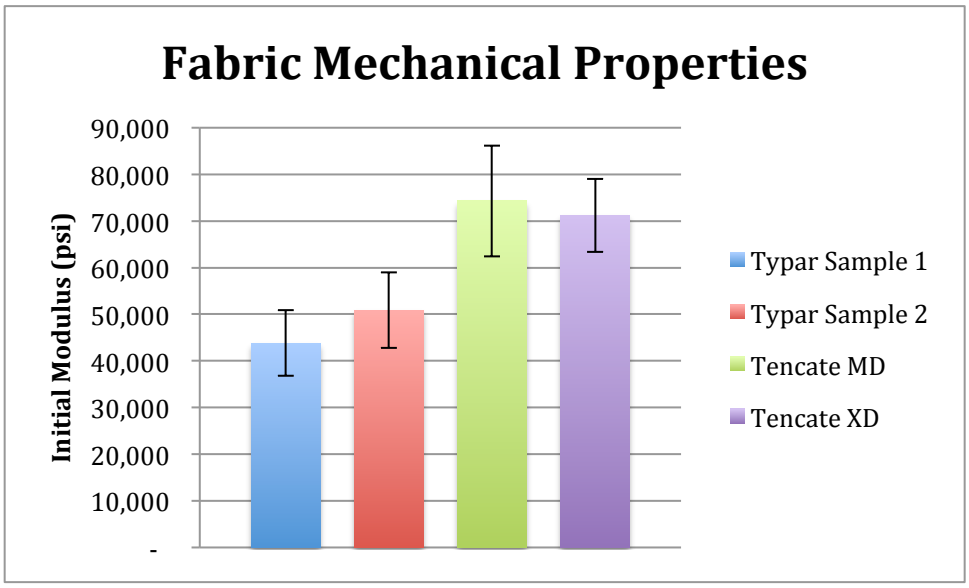
Davis Lee, PhD

IBT-001-2013- TENSILE TEST (As Received at Room Temperature)

Sample	Sample / Direction	Test Specimen ID	Ultimate Strength (psi)	Ultimate Elongation (%)	Initial Modulus (psi)	Creep Test % Strain at 123 psi I hr	Creep Test % Strain at 123 psi 24 hrs
Typar - (Gray)	Gray (1st Sheet)	**Average**	**3,201**	**21.7**	**43,832**	0	0.2
		SD	345	2.94	7,102		
		%CV	11%	14%	16%		
	Gray (2nd Sheet)	**Average**	**3,695**	**25.7**	**50,871**		
		SD	501	3.13	8,089		
		%CV	14%	12%	16%		
Tencate (Black)	Machine Direction	**Average**	**7,040**	**11.3**	**74,294**	0	0
		SD	1,373	2.74	12,231		
		%CV	19%	24%	16%		
	Cross Machine Direction	**Average**	**8,490**	**12.6**	**71,176**		
		SD	882	1.46	7,728		
		%CV	10%	12%	11%		




Fabric Mechanical Properties
Ultimate Elingation (%)
30
25
20
15
10
5
0
Typar Sample 1
Typar Sample 2
Tencate MD
Tencate XD


Fabric Mechanical Properties
Initial Modulus (psi)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
-
Typar Sample 1
Typar Sample 2
Tencate MD
Tencate XD