

A CLOSER LOOK AT TRIAXIAL GEOGRIDS

Unreported Comparisons of Triaxial Geogrids to Conventional Biaxial Geogrids

Decades of research and experience have gone into understanding the reinforcement mechanisms offered by geogrids and the physical properties critical to their performance. The Geosynthetic Materials Association (GMA), US Army Corps of Engineers (USACE)² and the Federal Highway Administration (FHWA)³ have published design reports commonly identifying tensile properties measured at 2% and 5% strain, as well as ultimate tensile strength and junction strength for survivability. All are well established industry standards. Excluded from the report is aperture stability as its relevance to performance has never been conclusively established.

With the introduction of TriAx, however, the manufacturer proposes a new property, “Radial Stiffness”, which they measure at 0.5% strain. With current biaxial geogrids reporting to industry recommended tensile properties at 2% and 5% strain, it is impossible to make a valid comparison of TriAx geogrids to biaxial geogrids without additional testing. This prevents the buyer or designer from easily comparing the strength of TriAx geogrid to more familiar biaxial geogrids.

Figure 1 illustrates the application of ASTM D 6637 on conventional biaxial geogrids. Figure 2 illustrates how the manufacturer may apply ASTM D 6637 to its new triaxial geogrid.

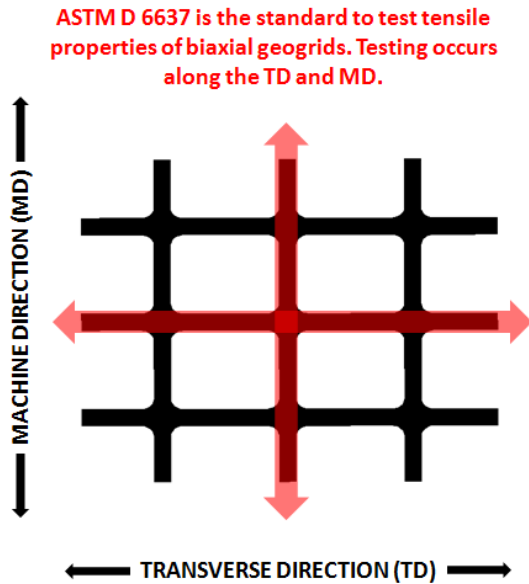


Figure 1

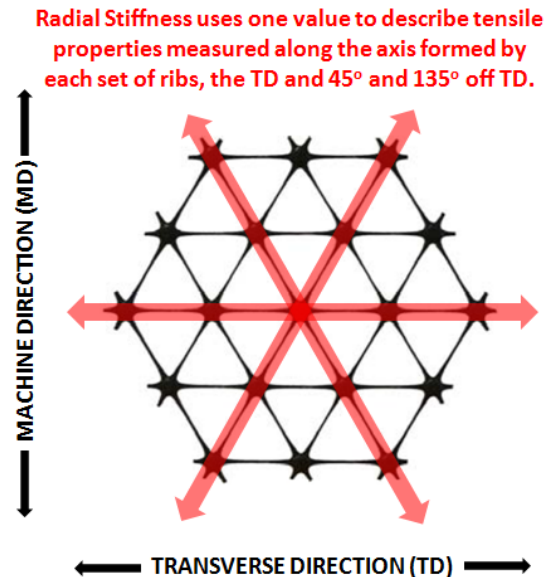


Figure 2

Integrally formed, stiff polypropylene, biaxial geogrids are available in different tensile strengths, classified by some manufactures and state DOT’s as Type 1 and Type 2 geogrids. Type 1 geogrids generally have a TD ultimate tensile strength of approximately 1,400 lbs/ft and TD tensile strengths @ 2% and 5% strain of approximately 450 lbs/ft and 920 lbs/ft respectively while Type 2 geogrids generally have a TD ultimate tensile strength of approximately 2,100 lbs/ft and TD tensile strengths @ 2% and 5% strain of approximately 600 lbs/ft and 1,340 lbs/ft. There is little published data on values between 0% and 2% strain.

TECHNICAL NOTE: SR7

In an effort to better classify the new triaxial geogrid, samples of a triaxial geogrid were tested and measured using the industry accepted and established parameters of 2% and 5% strain and ultimate strength. Table 1 summarizes the results of the test.

PER ASTM D 6637		LOAD @ 2% STRAIN		LOAD @ 5% STRAIN		LOAD @ PEAK (ULTIMATE)	
		kN/m	Lbs/ft	kN/m	Lbs/ft	kN/m	lbs/ft
TriAx 140 compared to Type 1 Biaxial Geogrids							
TriAx 140	TD	3.95	270	8.99	616	14.73	1,009
BX1100	TD	6.6	450	13.4	920	19	1,300
	MD	4.1	280	8.5	580	12.4	850
MS220	TD	6.6	450	13.4	920	20.5	1,400
	MD	4.4	301	9	616	13.5	925
LBO202	TD	6.6	450	13.4	925	20.5	1,400
	MD	4.1	280	8.5	580	13	890
TriAx 160 compared to Type 2 Biaxial Geogrids							
TriAx 160	TD	4.6	314	10.64	726	18.924	1,291
BX1200	TD	8.6	590	19.6	1,343	28.8	1,970
	MD	6.0	410	11.8	810	19.2	1,310
MS330	TD	9.0	620	19.6	1,343	30.7	2,100
	MD	6.1	418	13.5	925	20	1,370
LBO302	TD	10.5	710	21.0	1,435	31.5	1,970
	MD	6.5	443	13.0	890	17.5	1,195

Table 1 (TD=Transverse Direction, MD=Machine Direction. With no ribs oriented in the MD, TriAx geogrids can only be tested in the TD according to ASTM D 6637)

ASTM D 6637 is the industry standard for testing tensile properties of geogrids. Testing is done along the TD and MD axis, paralleling the ribs. For paved and unpaved roads, maximum deformations form transversely to the wheel paths. Geogrids used for these applications are generally manufactured to have the highest strength in the TD (across the width of the roll) to coincide with the direction from which the most repeated stress occurs. With no ribs oriented in the MD, TriAx geogrids can only be tested per industry standards, in the TD.

For geogrids made of extruded or punched polypropylene, (all shown in table 1) tensile properties are closely related to polymer mass per unit area. Type 2 geogrids gain their increased strength from the increased amount of polymer as compared to a Type 1 geogrids, in general, about 50% more. Type 1 geogrids typically weigh from 200-250 g/m², and Type 2 geogrids typically weigh about 300-350 g/m². With the sample of TriAx160 weighing 237g/m² and the sample of TriAx 140 only 190 g/m², neither triaxial geogrid tested demonstrated both adequate mass and tensile properties to fit Type 1 or Type 2 classification.

MS and LBO geogrids are manufactured by Tenax Corporation, 4800 East Monument Street, Baltimore, MD, 21205, USA

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