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### **Architectural Fabric Tear Propagation**

In general the tear resistance of Fiberglass is low compared to its tensile strength per inch ( 8% to 15% ) The tear resistance of Polyethylene is high compared to its tensile strength per inch, ( 40% to 50% ) and Polyester tear strength compared to tensile strength per inch falls somewhere in between the two ( 15% to 35% )

Tensile structures typically use factors of safety against tensile failure of four (4) for snow load, five (5) for wind load and eight (8) for prestress. Tensile ruptures of fabrics are rare. Actual failures occur at seams or are the result of tear propagation subsequent to a puncture or snag. In testing fabrics the Trapezoid Tear Method ASTM D4857 ( Old designation ASTM 5106 ) is typically conducted where a load is applied to a slit within the fabric plane at a test specified angle. A better test may be the mono-slit test in either a uni-axially loaded fabric or better - in a bi-axially loaded fabric. Comparing the mono-slit tests to the trap-tear tests may enable one to develop a formula for comparing fabrics when only given the strip tensile and trap-tear strengths of a fabric. This formula can be used to chart the factor of safety required so that a tear will not tend to propagate. Developing and using this formula should make for designing safer structures

Thru tests and formula a graph can be developed. Looking at the graph on the following page, to prevent a 5 slit from propagating in fabrics D and E would required a factor of safety with respect to tensile strength of at least 3. To prevent a 5 slit from propagating in fabric B a factor of safety of at least 6 should be used, and for fabric G a factor of safety of 7. For fabric A we could extrapolate and conclude that a factor of safety of at least 9 would have to be employed.

It is my opinion that it would be prudent to use a higher factor of safety in fabrics that have low tear strength as compared to their tensile strength ( fiberglass ) than would be used in a fabric that did not have such a disparity between the two ( polyethylene )

I believe that a program discussing some of the factors that increase or decrease actual field tear propagation would be of value to any attendees involved in tensile fabric structures.

# Lmax

Fabric	Sst/Rult	Factor of Safety			
		2	4	6	8
A	18.3	0.3	1.0	2.4	4.2
B	8.2	0.6	2.4	5.4	9.3
C	7.0	0.7	2.7	6.2	10.9
D	2.3	2.1	8.4	19.1	33.8
E	2.2	2.2	8.7	19.6	34.9
F	8.5	0.5	2.9	4.2	7.5
G	7.6	0.4	1.7	3.8	6.8

## Lmax vs Required Factor of Safety

