



Innovative Sports Technologies, Inc.

Strength of a Sports Surface Underlayment Panel

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Summary

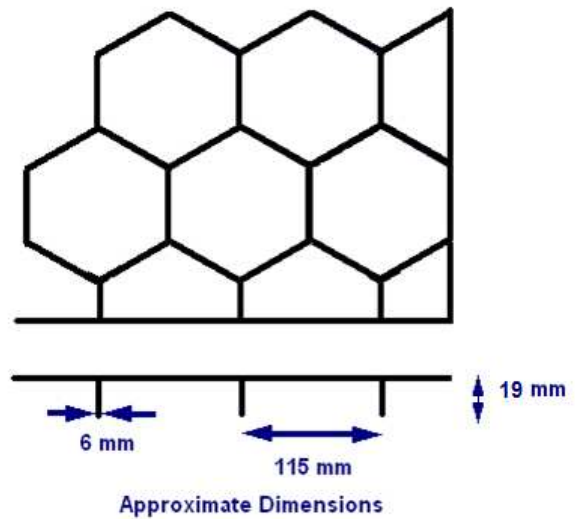
This report concerns the breaking strength of a molded surface panel. The panel is a semi rigid structure comprised of a flat surface plate and a substructure of vertical walls forming hexagon cells. A sketch of the structure and its approximate dimensions are shown at right.

For the purposes of strength testing, the structure is heterogeneous and non-linear – its responses to load depend strongly on how the structure is loaded and how loads are distributed.

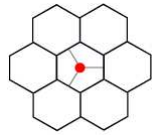
Compressive force-displacement tests were performed at two locations on sample sections of the panel – in the center of a hexagon (nominally the weakest part of the structure) and at the point where three hexagon walls abut to form a “post” (nominally the strongest part of the structure.)

Tests were performed using a Tinius Olsen H 10K UTM with a 50 mm diameter elliptically faced tup (15mm contact radius) at a compression rate of 1 mm s^{-1} and to a maximal load of 9000 N (4.6 MPa) (~ 2000 lb or 660 psi) Two examples of each location were tested.

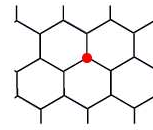
In all cases, the structure failed with permanent plastic deformation at less than the maximal load. Average failure loads for the “mid-hexagon” loading case were 1705 N / 2.6 MPa (382 lb / 374 psi). For the “post” load case, average failure loads were ~ 4545 N / 6.9 MPa (1019lb / 998 psi).



Force-Displacement & Stress-Strain Curves

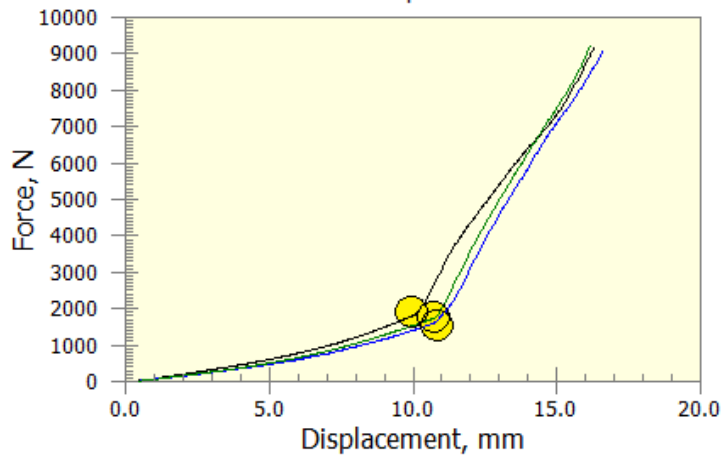


Mid-Hexagon

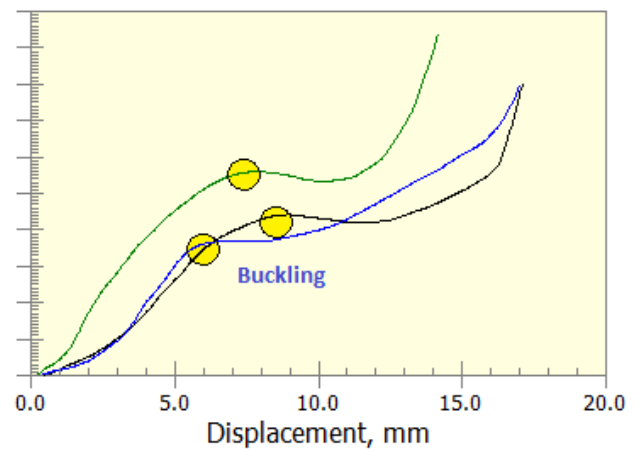


Post

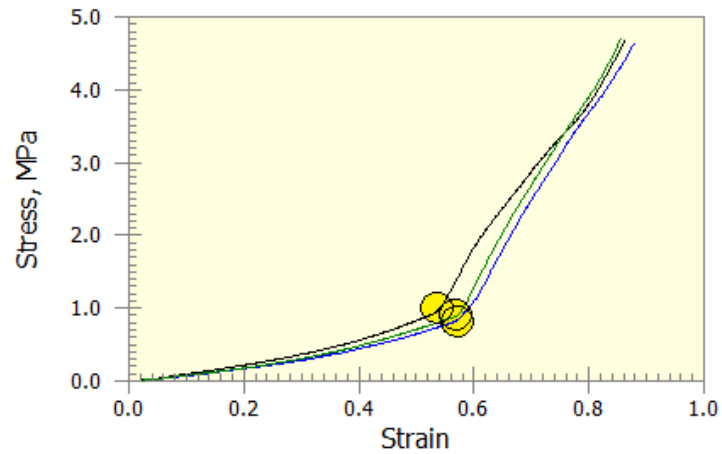
Force-Displacement



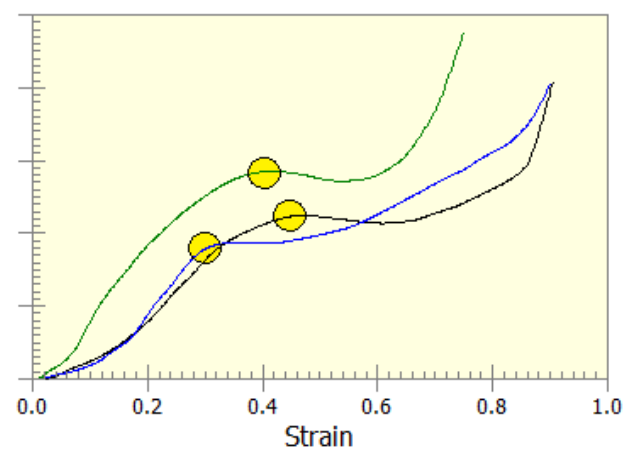
Force-Displacement



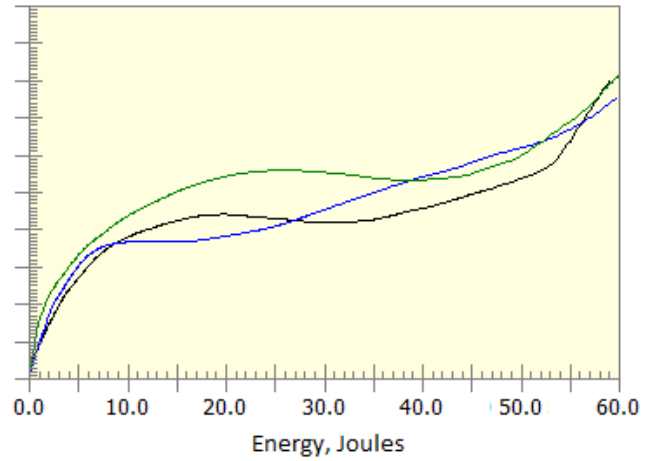
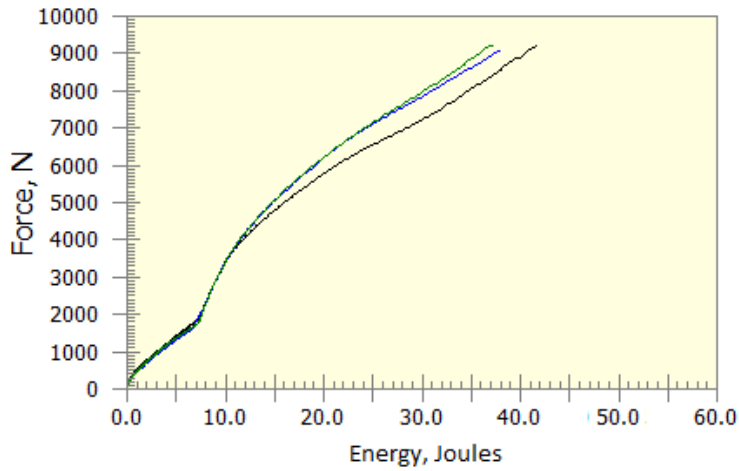
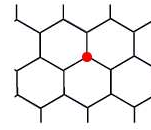
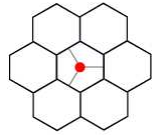
Stress-Strain



Stress-Strain

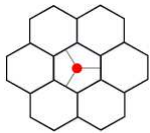


Energy Input & Force



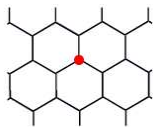
Buckling Loads

Site	Trial	Test #	Displacement		Force		Strain	Stress		Energy Input	
			mm	in	N	lb		MPa	psi	Joules	ft lb



Mid-Hex

1	6616	10.1	0.40	1828	410	0.53	2.77	401	6.9	5.1	
2	6617	10.6	0.42	1578	354	0.56	2.40	347	5.7	4.2	
3	6618	10.7	0.42	1708	383	0.57	2.59	375	6.1	4.5	
Mean			10.5	0.41	1705	382	0.55	2.59	374	6.2	4.6



Post

1	6620	8.7	0.34	4394	985	0.46	6.67	965	17.8	13.1	
2	6621	6.3	0.25	3673	824	0.33	5.58	807	10.1	7.5	
3	6622	7.6	0.30	5568	1249	0.40	8.45	1223	23.7	17.5	
Mean			7.5	0.30	4545	1019	0.40	6.90	998	17.2	12.7