PLTW | Engineering

Activity 2.1.8 Composite Sample Testing Report

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Activity 1 Preparing Workspace Description

To prepare the workplace for the Composite Sample Testing activity, we first got into groups of 4-6. The first group had unilateral and bilateral fiberglass, scissors, measuring tape, and two 2x2 and two 1x2 foam blocks which they arranged on their table. The second group worked on setting up the area for assembling the composite sample by placing a plastic sheet on the tabletop, cutting wax paper to be placed under the foam blocks, wearing gloves, and pouring resin and epoxy into small cups with tongue depressors. The last group worked on preparing the vacuum machine which would be used to compress the composites in sealed bags for curing.

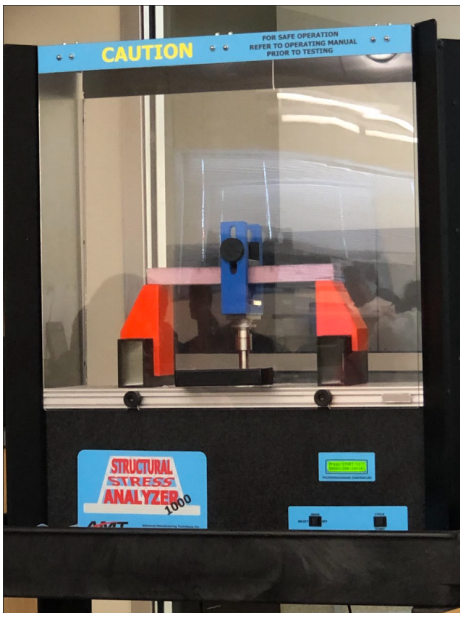
Activity 2 Preparing Samples Description

When preparing the samples, the first group first cut the unilateral and bilateral fiberglass into the appropriate dimensions to fit the foam blocks on the front and back. The second group then put them together by taking the cups of mixed epoxy and resin and pouring them on top of the fiberglass strips placed on either side of the foam blocks. Using a tongue depressor, the second group evened out the epoxy and resin on either side before going over to the third group and placing the sample into the bags. The

third group kept the bags open for the samples to easily be placed inside and then used the vacuum machine to remove all the air to allow the sample to cure before testing.

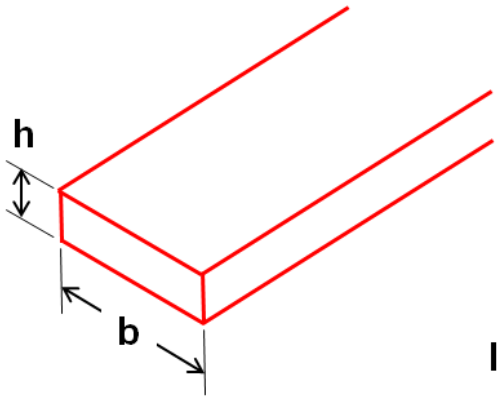
Activity 3 Testing Samples Description

To test the samples, after removing them from the sealed bags they were cured in, we placed them inside a structural stress analyzer machine. The samples were fit tightly using 3D printed brackets on either side to level it and a pin to keep it in place. When running the tests, the software we used displayed a graph of the displacement and force being exerted on the sample as it continuously pushed up. Once the sample broke or the machine could no longer feel resistance, we returned the machine to its original position, opened the cover of the machine, and removed the sample before repeating the process with a different sample.



Problems:

1. Calculate the moment of inertia for each beam (one sample calculation).

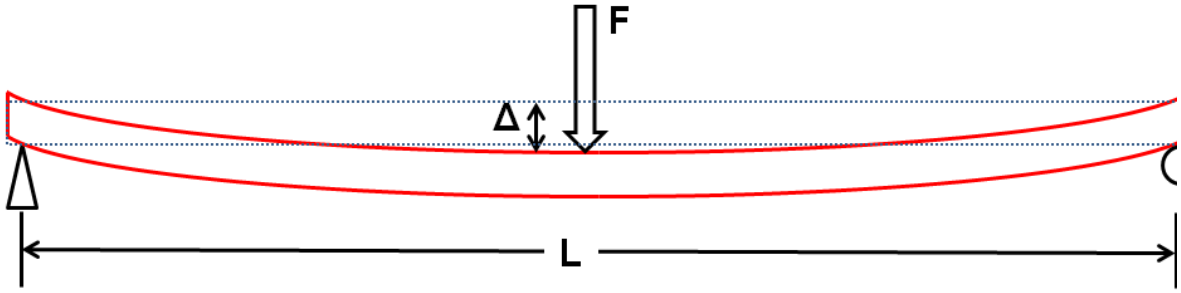


$$I = \frac{bh^3}{12}$$

I = Moment of inertia
b = Width of sample
h = Thickness of sample

Moment of Inertia Calculation (I)

2. Based on the experimental data, compute the Young's modulus for the material (one sample calculation).

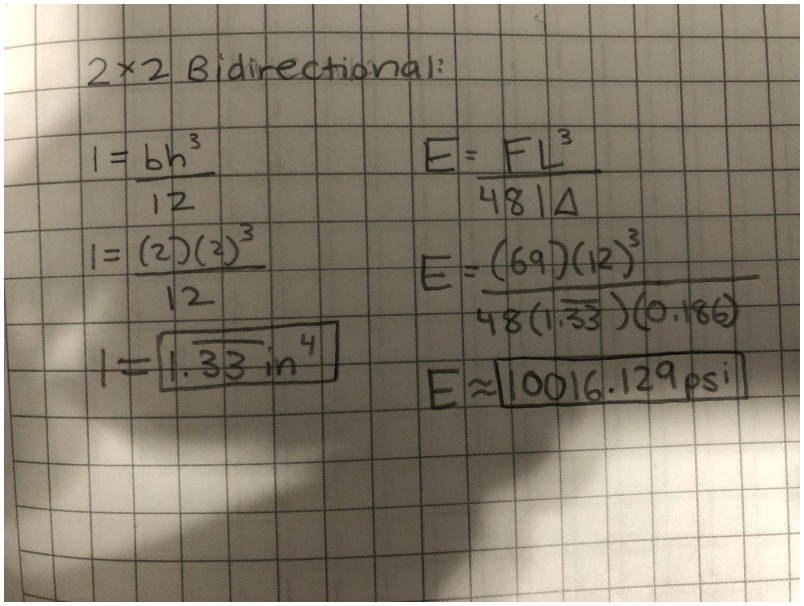


$$\Delta = \frac{F L^3}{48 E I} \qquad E = \frac{F L^3}{48 I \Delta}$$

F = Axial force (lb)
L = Length of span (in.)
Δ = Deflection (in.)
I = Moment of inertia ($in.^4$)
E = Modulus of Elasticity (psi)

	1 in x 2 in Bidirectional	1 in x 2 in Unidirectional	2 in x 2 in Bidirectional	2 in x 2 in Unidirectional
F(lb)	37	48	69	75
L (in)	12	12	12	12
y (in)	0.148	0.142	0.186	0.175
I_{xx} (in^4)	0.167	0.167	1.333	1.333
E (psi)	54000	73014.085	10016.129	11571.429

Sample Calculation:



Graph: 2x2 Bilateral