

LABORATORY REPORT**# 2020-01-FMSC**

Requested by: Mr. John J. Martin
Freeman Manufacturing and Supply Company (FMSC)

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August 6th, 2020

SUMMARY

A total of 32 samples (curved plywood panels) were received from Mr. John J. Martin, Freeman Manufacturing and Supply Company to test Flexure properties. The samples were identified as presented in Table 1.

Samples' identification	Number of samples received	Internal Identification (for analysis)	Dimensions (in) (Width, Thickness, base length)	Samples species**
12PSM	4	12 PSM 1, 12 PSM 2, 12 PSM 3, 12 PSM 4	2 x 0.5 x 19.75	12 layers / Soft Maple
PENTA IMPORT	4	PENTA IMPORT-1, PENTA IMPORT-2, PENTA IMPORT-3, PENTA IMPORT-4	2 x 0.5 x 20.70	11 layers / Birch***
AP	4	AP-1, AP-2, AP-3, AP-4	2 x 0.5 x 20.70*	7 layers / Soft Maple
AH	4	AH-1, AH-2, AH-3, AH-4	2 x 0.5 x 20.70	9 layers / Soft Maple
PLYFORM MIX	4	PLYFORM MIX-1, PLYFORM MIX-2, PLYFORM MIX-3, PLYFORM MIX-4,	2 x 0.5 x 21.00	7 layers / Soft & Hard Maple
PLY-SM	4	PLY-SM-1, PLY-SM-2, PLY-SM-3, PLY-SM-4	2 x 0.5 x 20.70	7 layers / Soft Maple
2,0	4	SERIES 2-1, SERIES 2-2, SERIES 2-3, SERIES 2-4	2 x 0.5 x 20.70	7 layers / Hard Maple
XP	4	XP-1, XP-2, XP-3, XP-4	2 x 0.5 x 21.00	7 layers / Soft & Hard Maple****
TOTAL	32			

*Sample with notches and/or openings

**Gross identification (by hand lens)

***The external layers (top and bottom) are in transversal direction and thinner than internal layers.

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Table 1. Identification of samples

The samples were storage in a controlled environment and tested using a modified 3-point bending test from ASTM Standard D3043 "Standard Test Methods for Structural Panels in Flexure". The equipment used corresponded to an Instron 5567 Universal testing machine, and the loads were applied at a constant speed of 0.2 in/min.

An example of the samples received are presented in Figure 1 and the set-up for a modified 3-point bending test is presented in Figure 2. Dimension of samples:

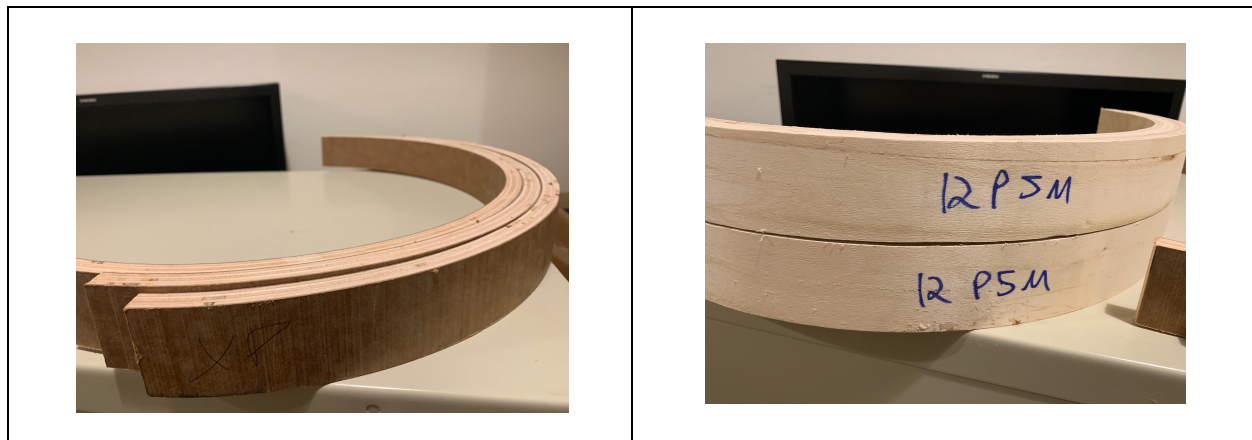


Figure 1. Samples XP and 12 PSM are presented here as examples.

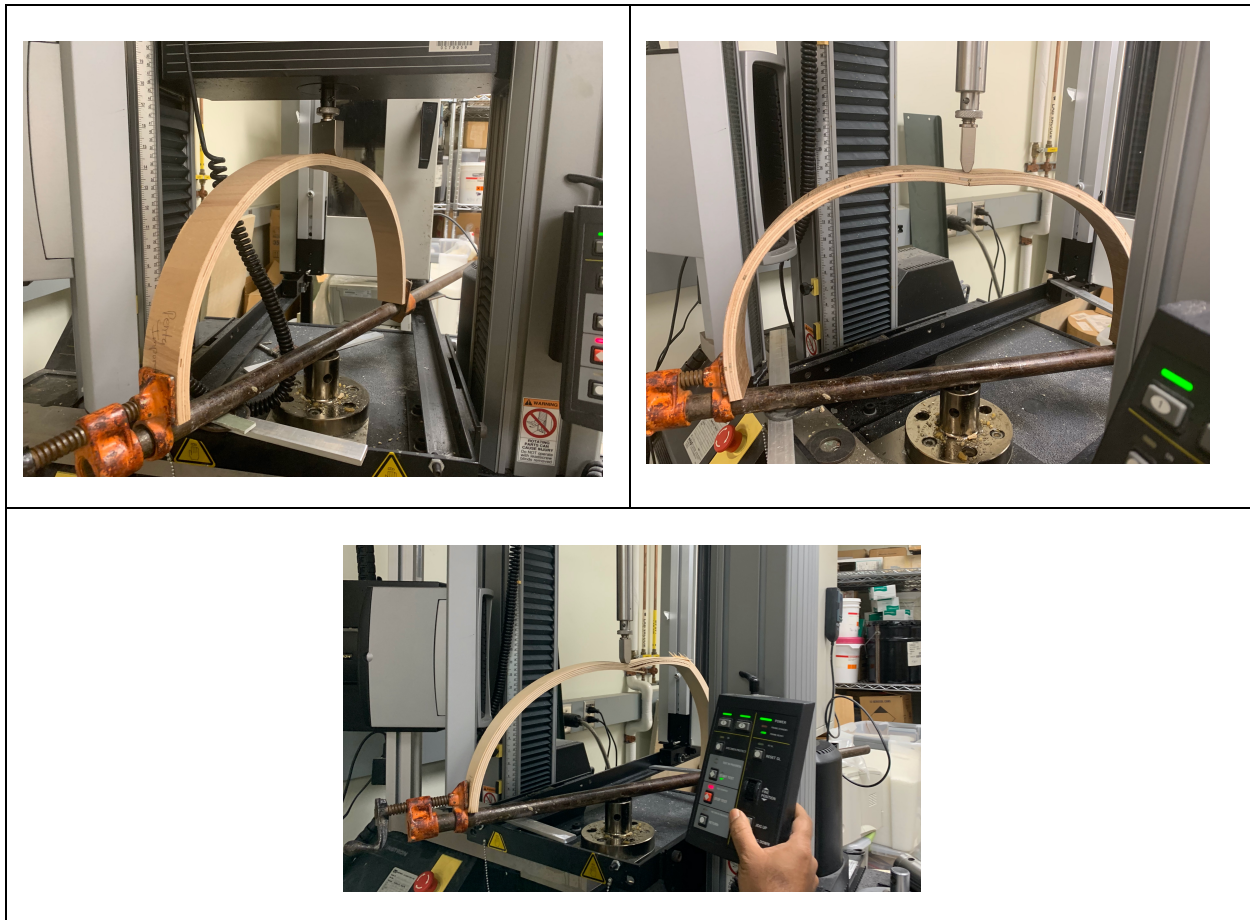


Figure 2. Set-up used for all experiments. The horizontal span was modified slightly depending on each specific sample.

RESULTS

In Table 2 are presented the maximum load reached for each of the 4 specimen per sample.

In Table 2 and Figure 3 are presented the average and the standard deviation (STD) of the Maximum loads (lbf) reached by the samples.

Table 2. Average of maximum loads (lbf)

Test	MAX LOAD (Lbf)							
	12PSM	PENTA IMPORT	AP	AH	PLYFORM MIX	PLYSM	SERIES 2	XP
1	491.7	587.7	279.7	623.6	711.2	491.7	528.8	260.6
2	572.9	515.9	520.3	595.5	795.5	572.9	537.9	280.3
3	593.8	580.4	573.2	674.9	827.4	593.8	527.6	264.8
4	569.1	656.3	551.0	623.6	792.9	569.1	515.7	256.8
AVG	556.8	585.1	481.1	629.4	781.7	556.8	527.5	265.6
STD	38.8	49.7	117.8	28.7	43.0	38.8	7.9	8.9

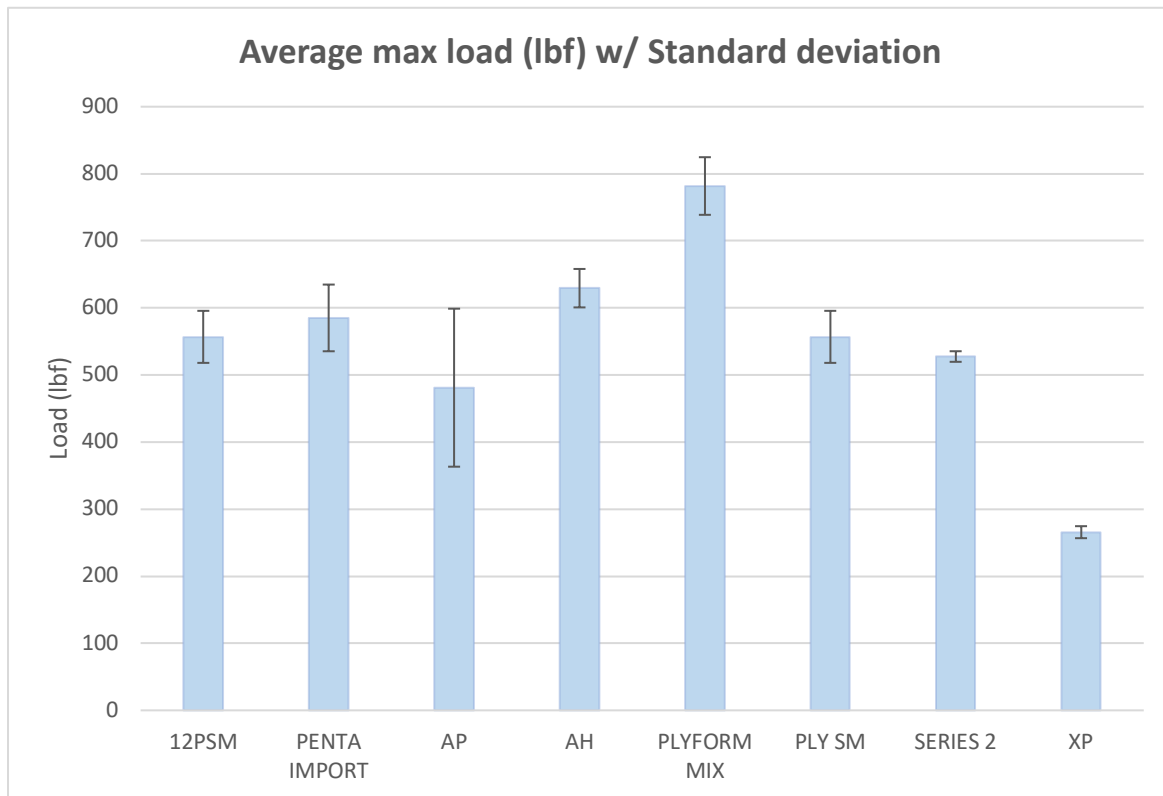


Figure 3. Average of and standard deviation or loads at rupture point.

According to these results, it is possible to infer that samples “PLYFORM MIX” and “XP” displayed the maximum and minimum resistance to break, respectively. Considering the standard deviation of all measurements, not apparent significant difference between all the other samples in terms of maximum load to break.

In terms of the Modulus of Elasticity in flexure (MOEf), and according to the results presented in Figure 4 the following trend is appreciated:

PLYFORM MIX = AH > PI > 12PSM = AP = PLY SM = SERIES 2 > XP

Remember that MOEf is determined considering the slope of the curve “load vs deflection” (Figure 4), in the linear part; i.e, lower load application. No calculations were performed this time, just based on the shape of the load-deflection curves.

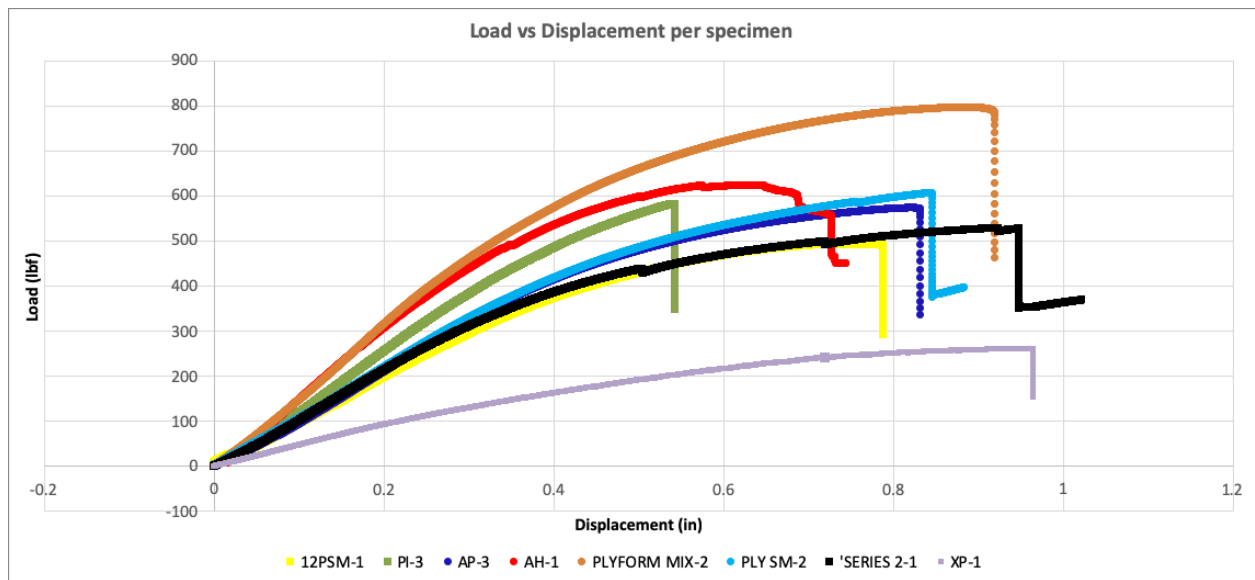


Figure 4. Representative Load versus Deflection curves for each sample (PI:PENTA IMPORT).

PRICE PER ANALYSIS

Not applicable this time.

The company will give a donation of \$1,500 (a thousand and five hundred) to the Forest Product Society Student Chapter (Dr. Gloria Oporto is the current advisor).

PAYMENT TERMS

Make a check payable to: WVU - Forest Product Society Student Chapter

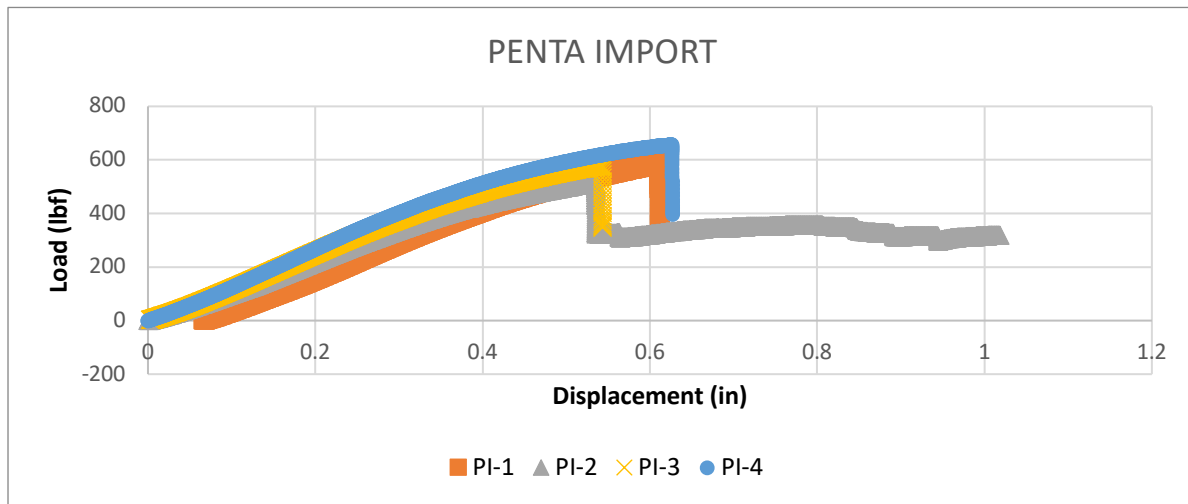
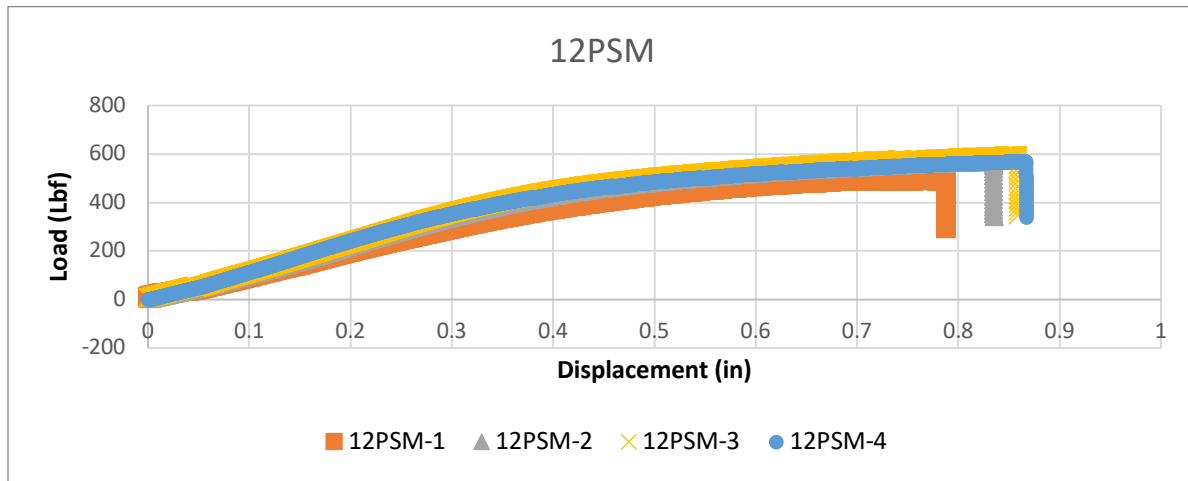
PROJECTED PRICE OF ANALYSIS

Future analyses and prices will be discussed accordingly.

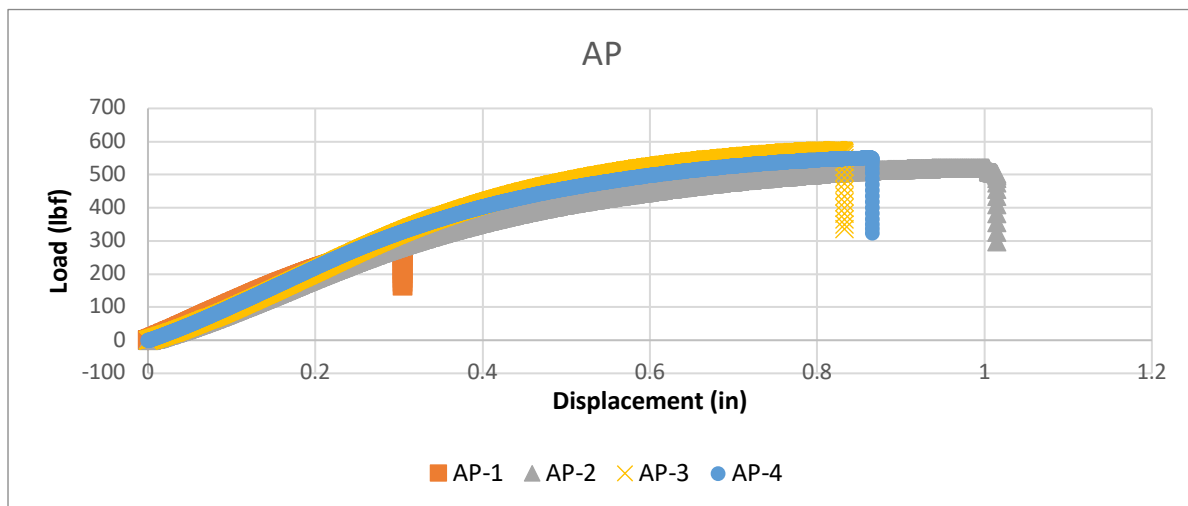
ANNEX

Part 1: All curves "Load vs Displacement" for each of the four specimens per sample
Part 2: Pictures of the samples after their rupture.

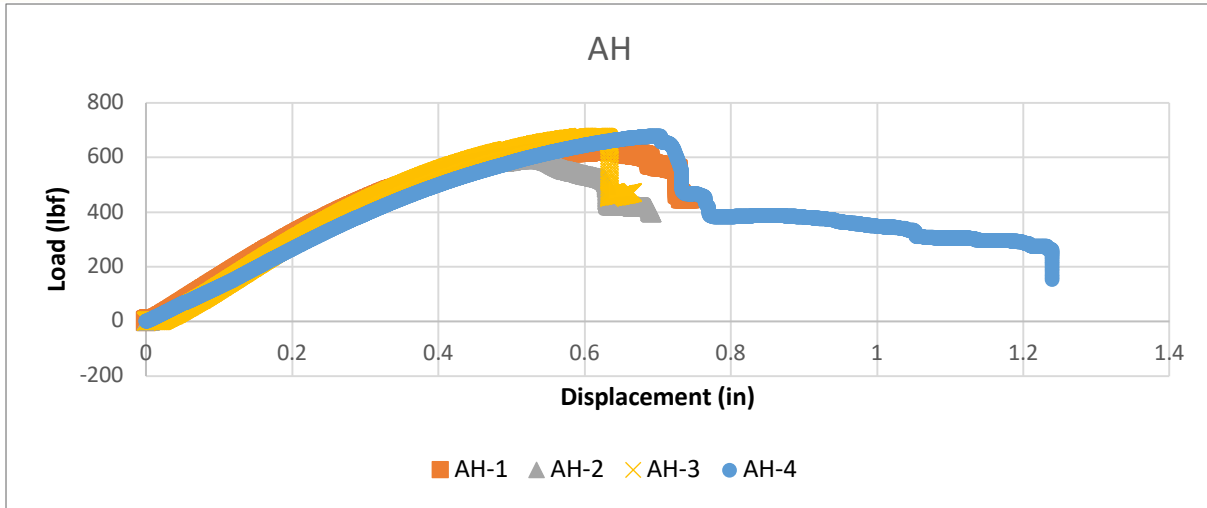
Part 1: All curves "Load vs Displacement" for each of the four specimens per sample



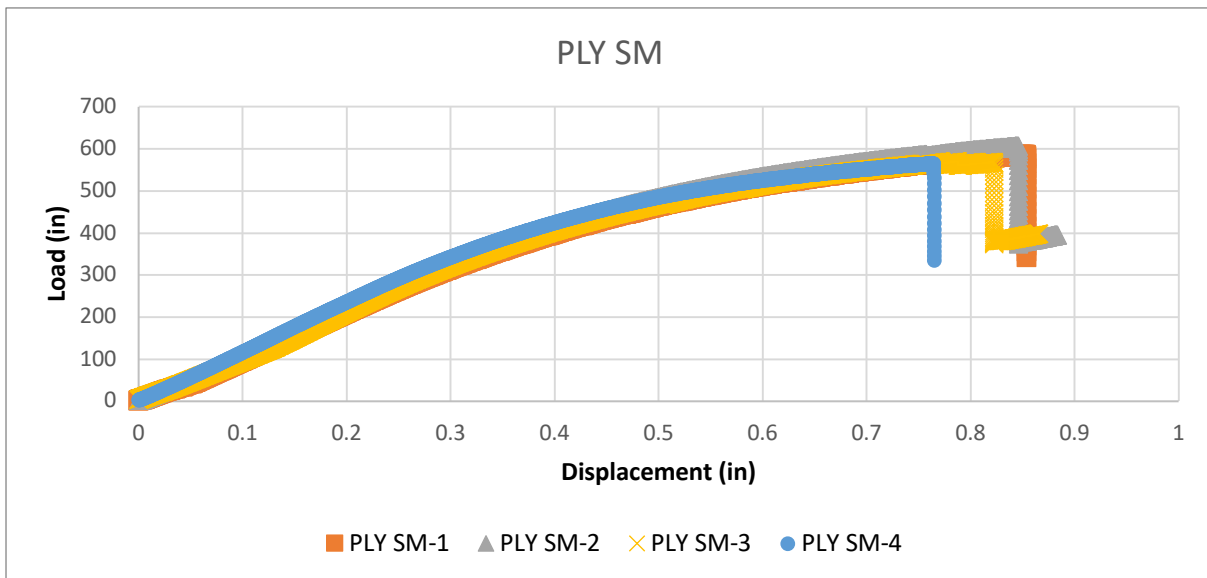
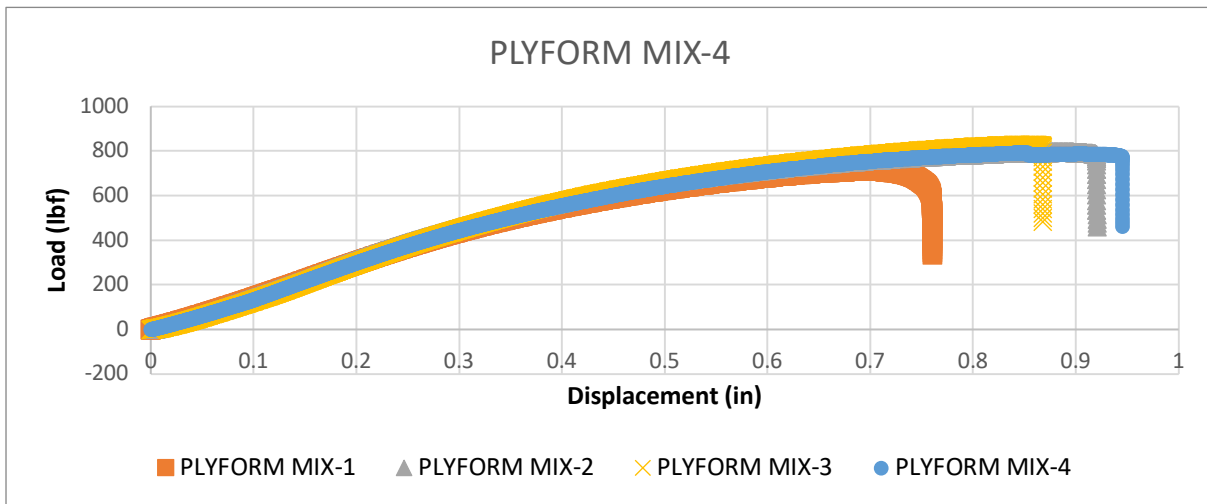
*We just keep the load a little bit longer to see the displacement behavior.

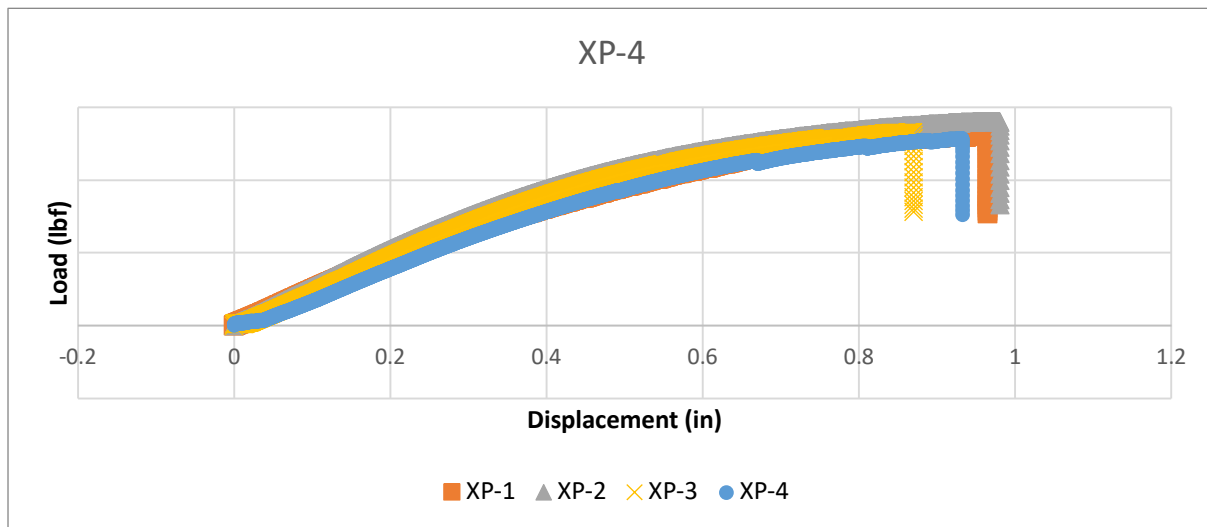
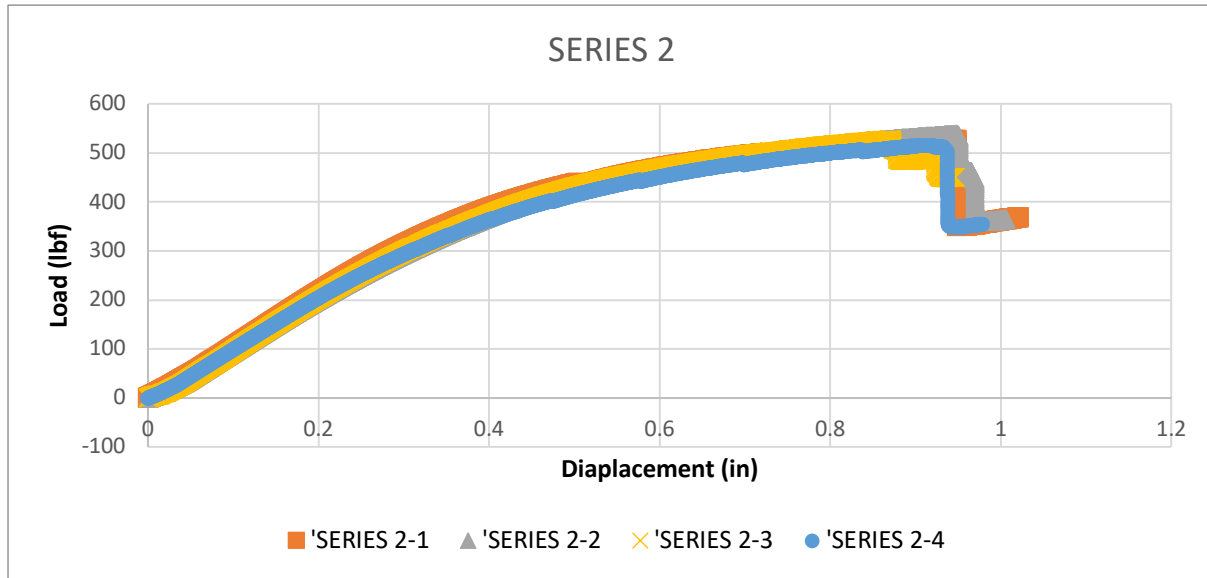


*One of the AP samples broke earlier because of the presence of a notch on the sample.

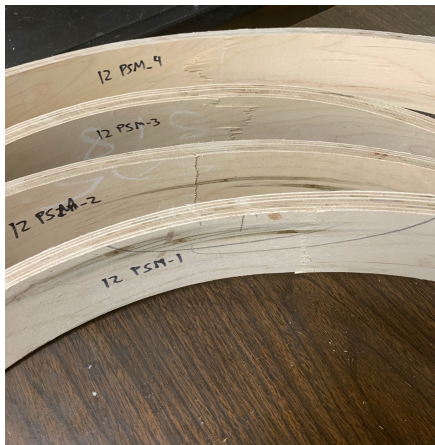


*We just keep the load a little bit longer to see the displacement behavior.





Part 2: Pictures of the samples after their rupture.



12 PSM



PI: PENTA IMPORT

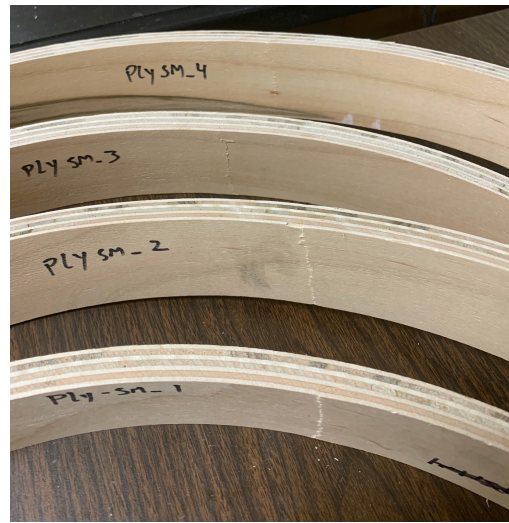


AP



AH

PLYFORM MIX (NOT AVAILABLE)
(IT WILL BE SENT LATER IF NEEDED)



PLY SM



SERIES 2.0



XP