Georgia-Pacific Chemicals

The Use of Internal Bond (IB) Testing in Plywood versus Standard Lap Shear

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bonds that last. | advancements that work.™

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Why are Test Methods Important

"Truth has nothing to do with the conclusion, and everything to do with the methodology."
— Stefan Molyneux

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Panel Testing

- In the Lab and mills, people often use panel test data from lap shear to determine how the process is doing
- If the values go down, they look to the line or to the resin to see what has changed
- But, what if it is neither of these, and the true cause for the decrease is inherent in the test method used to evaluate the panel?

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Lap Shear

- Factors that affect lap shear test
  - Fine fiber
  - Water temperature
  - Depth of kerf
  - Jaw position
  - Head speed
  - Direction of lathe checks

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Lap Shear

- Factors that affect lap shear, but are not controlled
  - Density/strength of the wood
  - Late wood vs. early wood
  - Is this the weak point in the panel

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Lap Shear vs IB

- Lap Shear
  - Accelerated aging test
  - Wood failure
  - Allows evaluation of mode of bond failure
  - Failure is on specific glue line determined by how the sample was kerfed
- IB
  - Accelerated aging test
  - Wood failure (larger test area)
  - Allows evaluation of mode of bond failure
  - Gives strength of bond
  - Failure is at weakest point in sample

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Mode of Failure

- Lap Shear
  - Failure in the lap shear test is from a shear mode
  - The failure in a lap shear occurs between the cell layer, not through the cells
- IB
  - Failure in IB is in tension mode
  - Failure still occurs between cell layers, not through the cells
- Thus, the focus of the failure in both tests is similar

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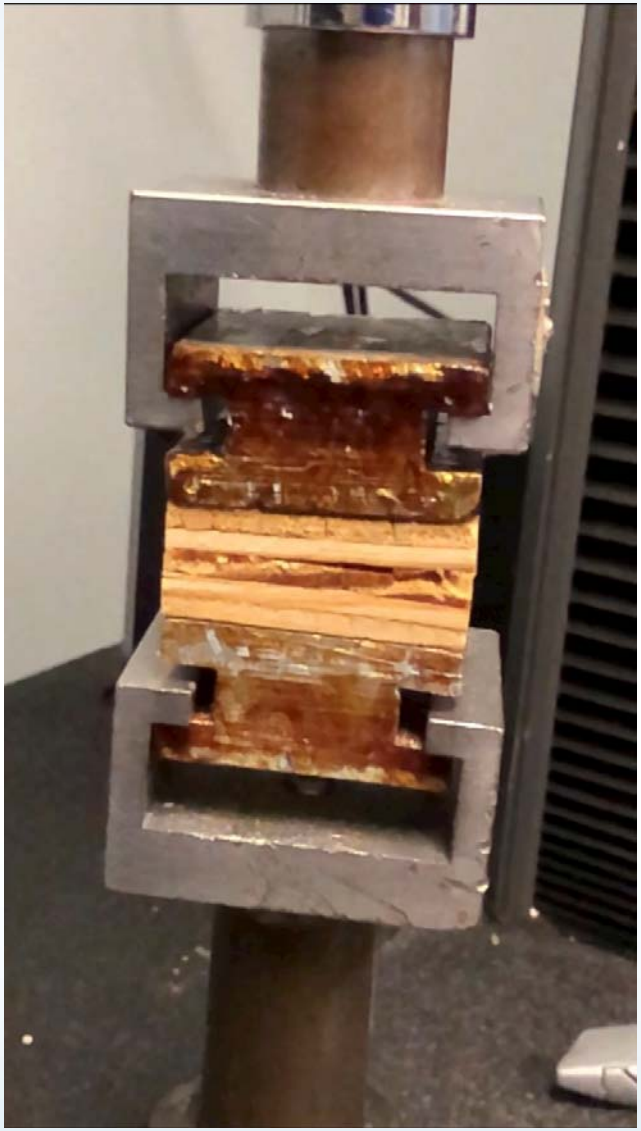
IB Breaking



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Reading Wood Failure

Lap Shear

IB

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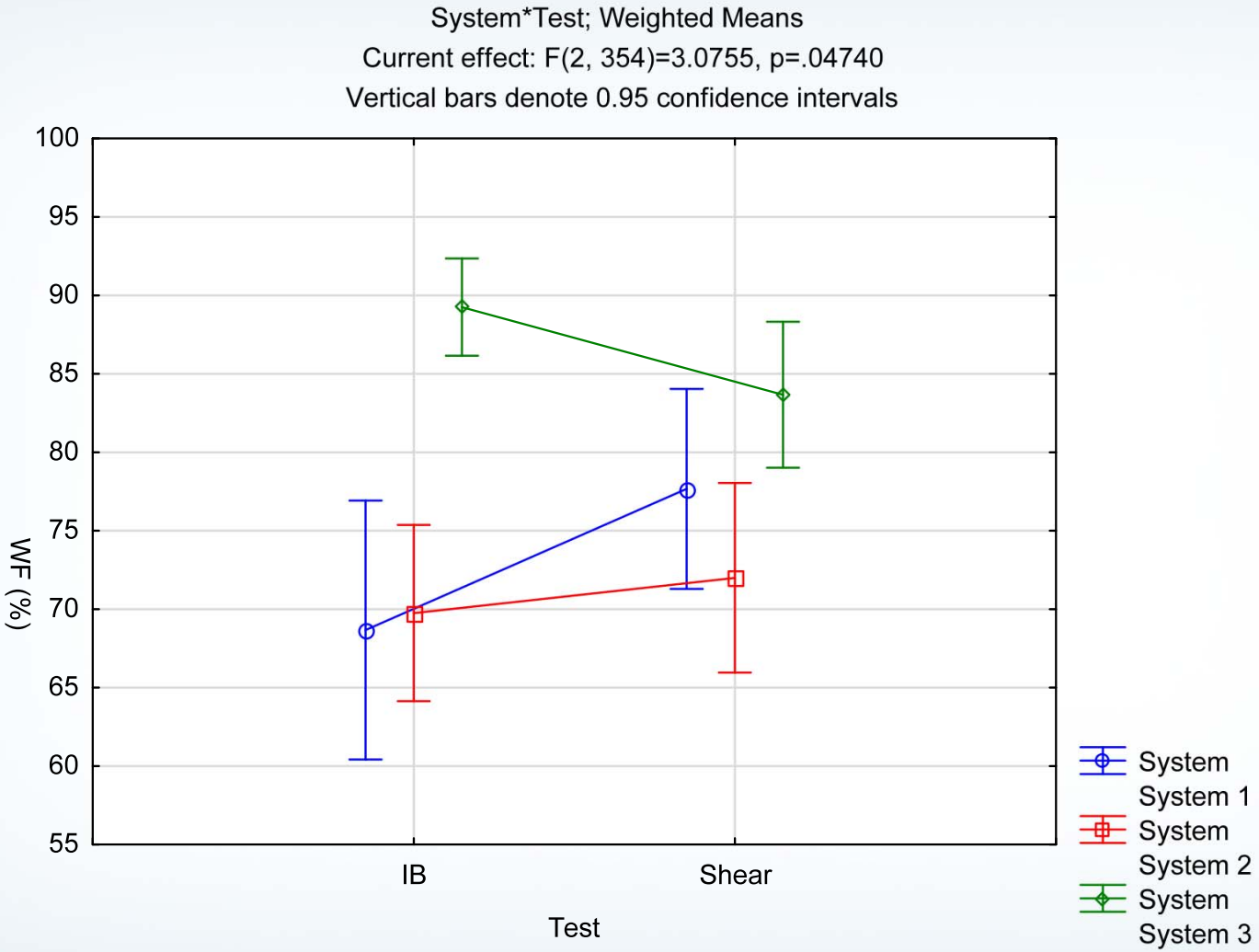
IB vs Lap Shear Wood Failure



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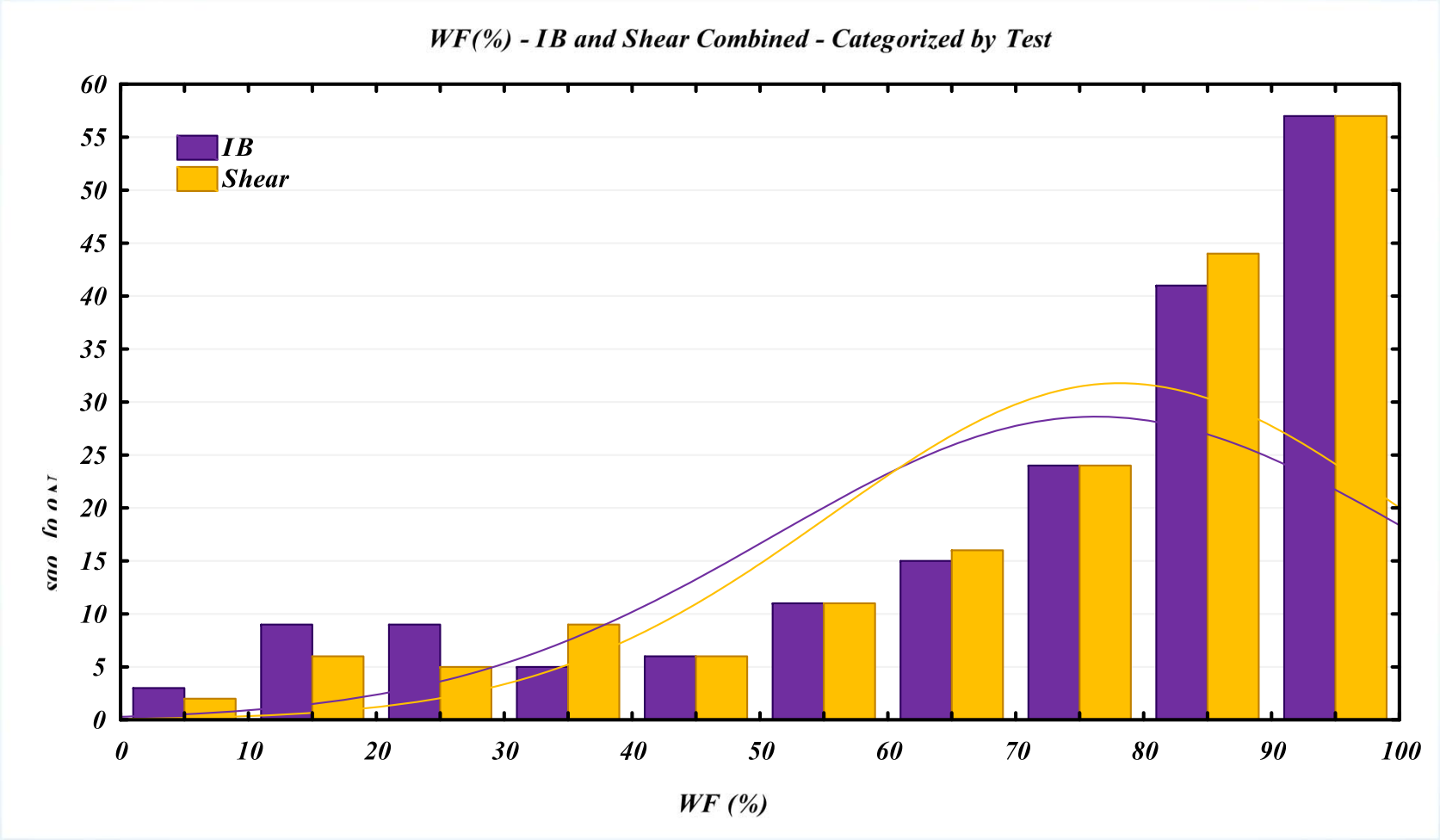
Wood Failure by Different Test



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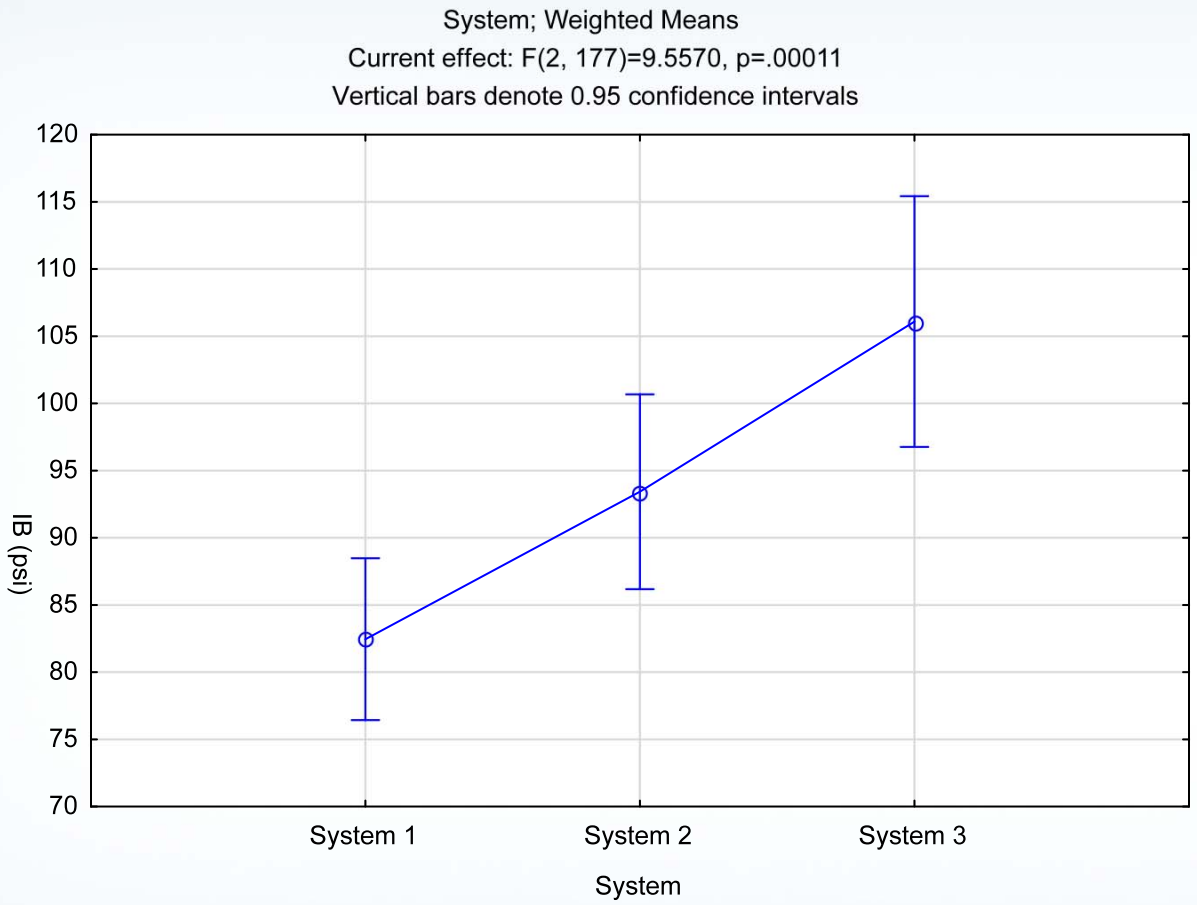
Strength by IB



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Wood Failure and Strength

- Wood Failure is highly dependent on the quality of the wood and the effect is often opposite to the strength of the bond
  - Low density wood will often give higher wood failure but very low strength
  - High density wood is harder to penetrate so may not have the depth and amount of fiber pull but will still have high strength
  - So, looking at the two in combination gives a better understanding of the quality of the bond

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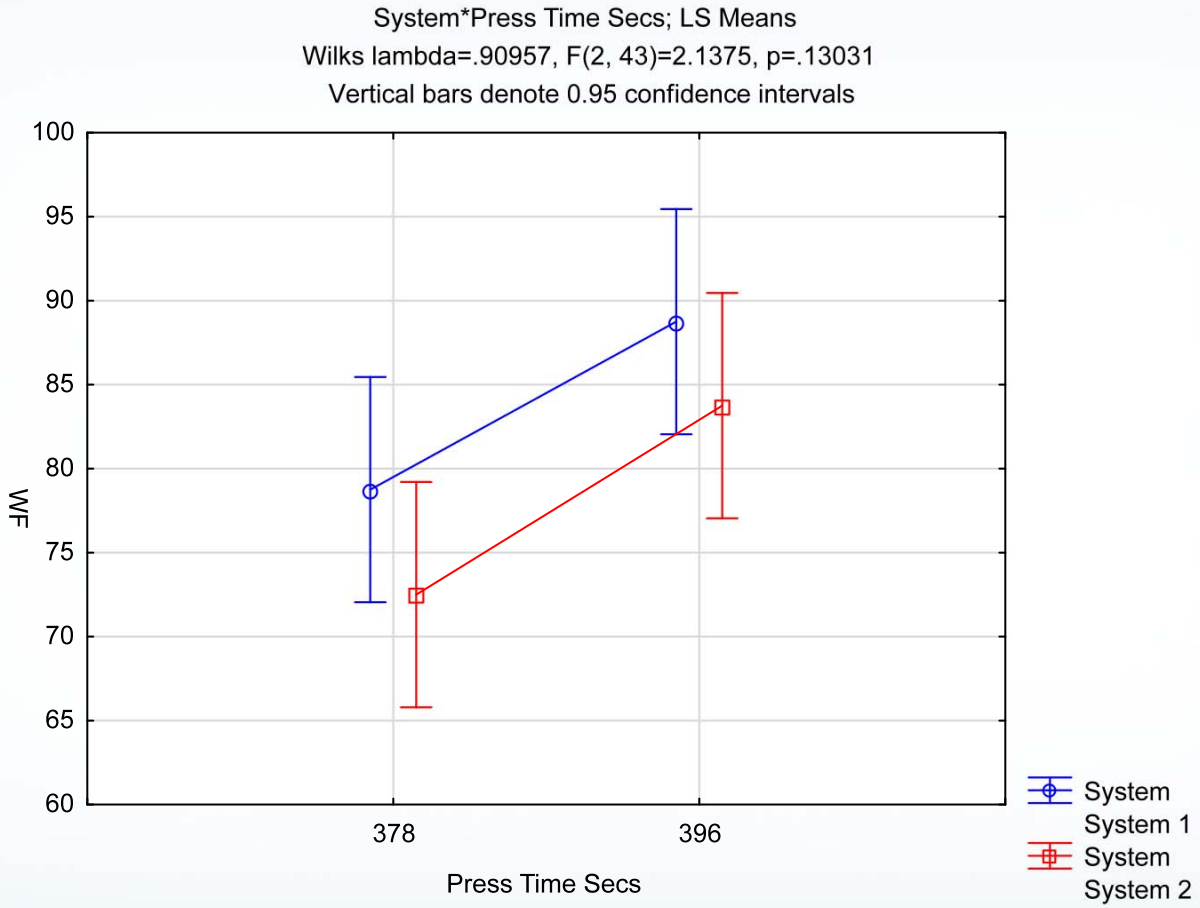
Advantage of IB Method



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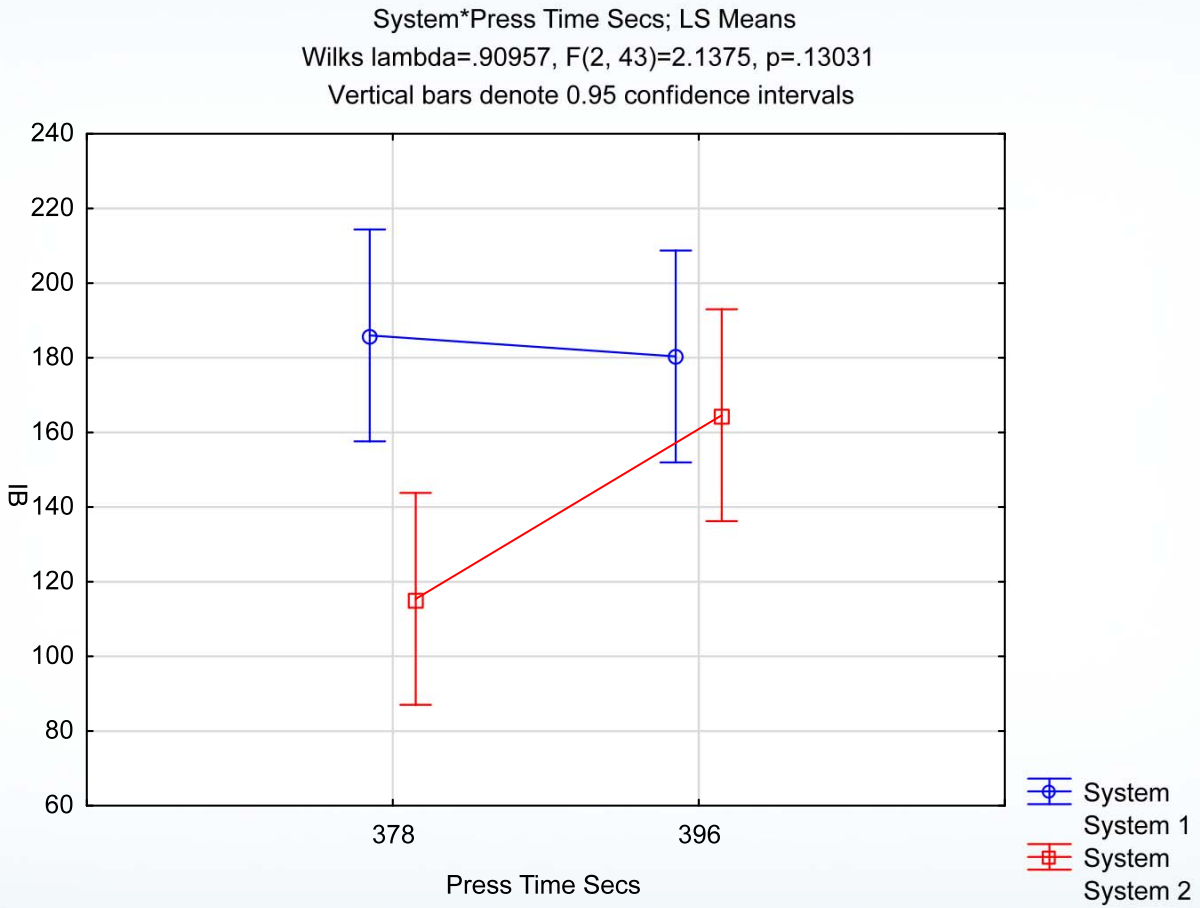
Advantage of IB Method



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Advantages of IB

- Bigger sample area - IB is traditionally a 2”x2” sample whereas lap shear is 1”x1”
  - Same number of samples provides 4 times the sample size
- Provides the strength of the bond
  - Was the failure due to high density wood sample?
  - Break is always at the weakest point

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Future Thoughts

- EN314.2 looks at shear strength and wood failure. In this test, as the strength decreases the amount of wood failure for an acceptable bond increases. Could IB be a better surrogate than the shear test?
- Could an algorithm be developed that uses both strength and wood failure to better define the quality of a bond?

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