

ADHESIVE BONDING OF PLANED AND SAWN JOINTED SUGAR MAPLE LUMBER: BENDING STRENGTH OF GLUED JOINTS

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Abstract

The sugar maple is one of the most important trees in the eastern United States and is the state tree of New York. Sugar maple is also known as hard maple and is the most frequently used species of maple for glue-jointed wood products. However, a surface quality suitable for the glue-jointing process is influenced by machining wood using circular table saw and jointer machines.

The main objective of this study was to evaluate the strength of the glue lines in glued-jointed planed and sawn hard maple lumber. The pieces of wood were prepared by using a circular table saw and a jointer machine. First, the difference between the interaction with the wood glue on both the saw-cut and jointed substrates was observed. For example, using microscopic techniques, the results showed that more than 60% adhesive penetrated into the planed surface of hard maple after 10 minutes as compared with sawn maple with the same range of the moisture content. Then, the bending strength of maple lumber with a sawn edge and jointed edge glue joint was evaluated in accordance with the standard procedures.

1. Methodology

1.1 To observe the difference between a saw-cut and a planed substrate and its interaction with adhesive during the bonding process.

1.1.1 Prepare maple pieces in accordance with standard procedures.

1.1.2 Dimension and measure the moisture content of the sawn and planed edges in three places; at the ends and in the middle.

1.1.3 Observe the sawn and planed surfaces of each type under a microscope and record the observations.

1.1.4 Apply wood glue to all pieces, observing each one under a microscope immediately after applying the glue. After observing the first one, set a timer for 5 minutes and observe and record each piece again. Continue observing and recording every 5 minutes for 30 minutes.

1.1.5 Use the data collected to create an overall observation of each wood type and compare.

2. Methodology

2.1 To observe the strength of the glue joints on planed and sawn joints.

2.1.1 Prepare maple samples in accordance with standard procedures, with the grain going parallel to the length.

2.1.2 Glue the two edges together.

2.1.3 Let them dry and cure for 24 hours.

2.1.4 Using the mechanical testing machine, set to the fulcrum setting, find the pounds of force it takes to break the piece perpendicular to the grain.

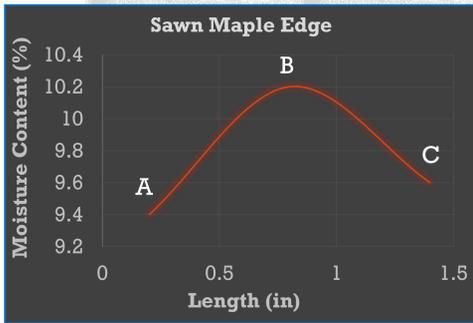
2.1.5 Record the psi it takes to break the piece and observe whether any part of the break is along the glue joint.



1. Experimental

1.1 Sawn Maple Edge:

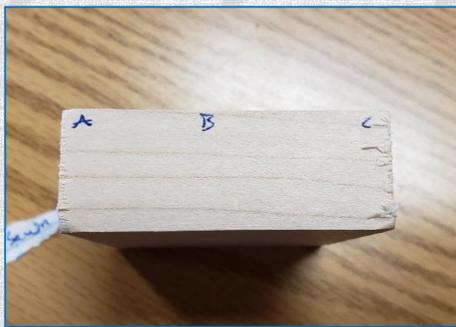
Moisture content



Sawn Maple Edge:

Magnification: 10.5

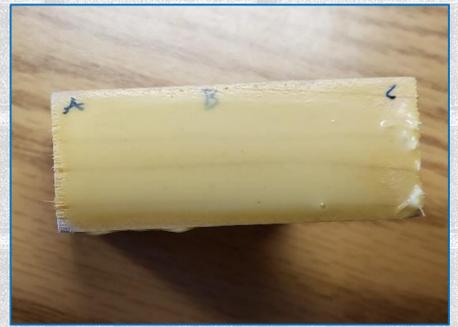
Before glue: Uniform grain; Minimal loose fibers



Sawn Maple Edge:

10 minutes: Still uniformly yellowish

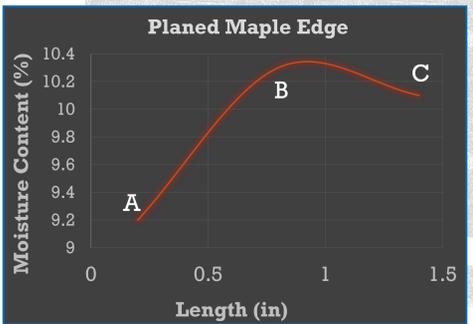
Edges starting to become translucent



1. Experimental

1.2 Planed Maple Surface:

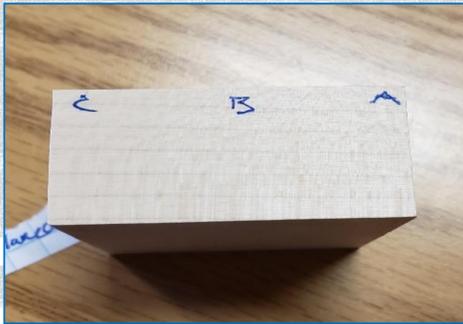
Moisture content



Planed Maple Edge:

Magnification: 10.5

Before glue: Uniform grain; Fiberglass look



Planed Maple Edge:

10 minutes: Approximately 60% adhesive penetration; Uniform, clear look along edges



2. Experimental

2.1 Planed-Edge Maple Joint:

Breaking point force: 40,000psi



2. Experimental

2.2 Sawn-Edge Maple Joint:

Breaking point force: 37,000psi



2. Experimental

2.3 Sawn-Edge/Planed-Edge Maple Joint. Breaking point force: 7,000psi



3. Conclusion

The breaking point of glue lines in the planed joints is considerably higher than sawn joints, indicating better adhesive bonding during the glue-jointing process.