TECHNICAL NOTE

RockBats
Technical Note
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(proprietary)

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Impact Bending Strength of Hard Maple

An in-house study was conducted to compare the effects of the following physical and mechanical characteristics on Impact Bending Strength:

- Tangential- vs. Radial-Face Impact Bending Strength (i.e. Face-grain vs. Edge-grain contact)
- Low Modulus of Elasticity vs. High Modulus of Elasticity (MOE)
- Straight-grained vs. Steep Slope of Grain

Procedures

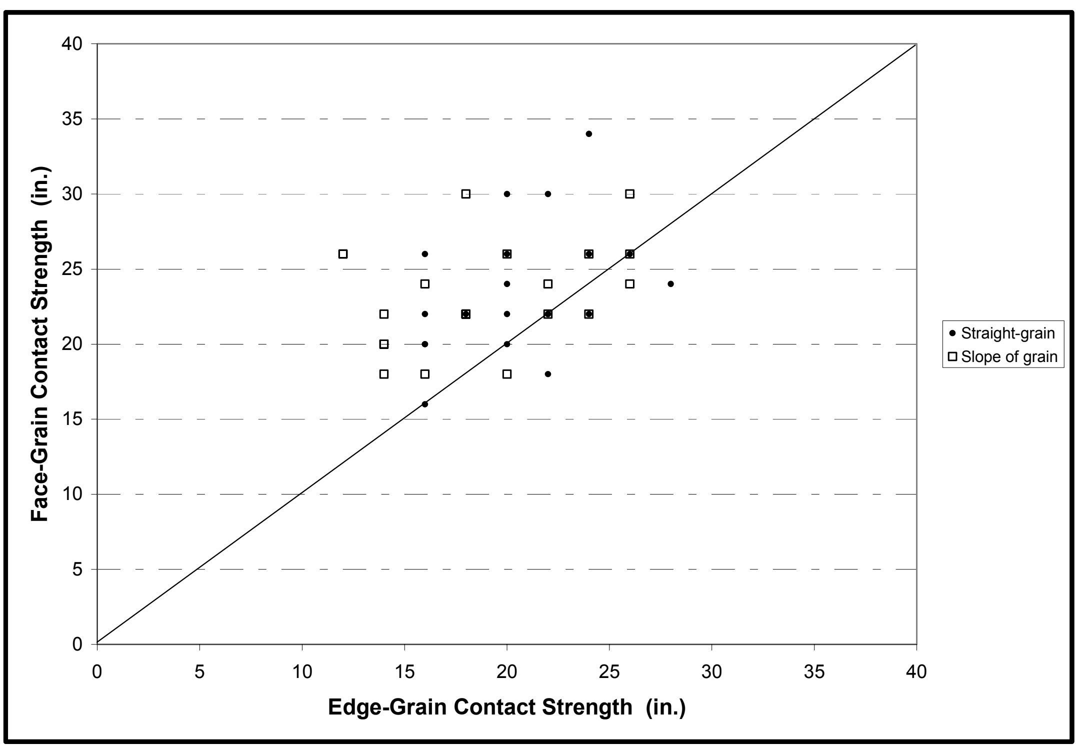
One-inch diameter by 30-inch long Hard Maple dowels were selected for this study, which represents the handle of a baseball bat. The round cross section allowed us to rotate the specimen to test in the radial and tangential orientations. A total of 40 dowels were selected, with 4 groups of 10 having the characteristics shown in the table below.

	Low MOE	High MOE
Straight-grained	10	10
Steep Slope of Grain	10	10

Non-destructive measurements were taken on each dowel: Weight, rings per inch, slope-of-grain, and deflection as a simple beam across a 27.75-inch span. After non-destructive measurements were taken, the 30-inch dowels were cut into two 15-inch dowels, and each half was designated for tangential- and radial-face impact bending tests, respectively. Testing the 15-inch diameter dowels that were cut from the same 30-inch dowel allows a direct comparison between tangential-face and radial-face contact. Impact bending tests involve dropping a weight onto a cantilever dowel, and recording the height that causes failure.

Results

Each 30-inch dowel had two impact bending strength results: face-grain contact and edge-grain contact. All 40 data pairs were plotted in the figure below, and overlaid with a 1:1 line. All data points above the 1:1 line are specimens that had a higher impact bending strength for face-grain contact, than edge-grain contact. (note: there are 5 data points that overlay exactly over another point; this is the reason less than 40 points are visible)

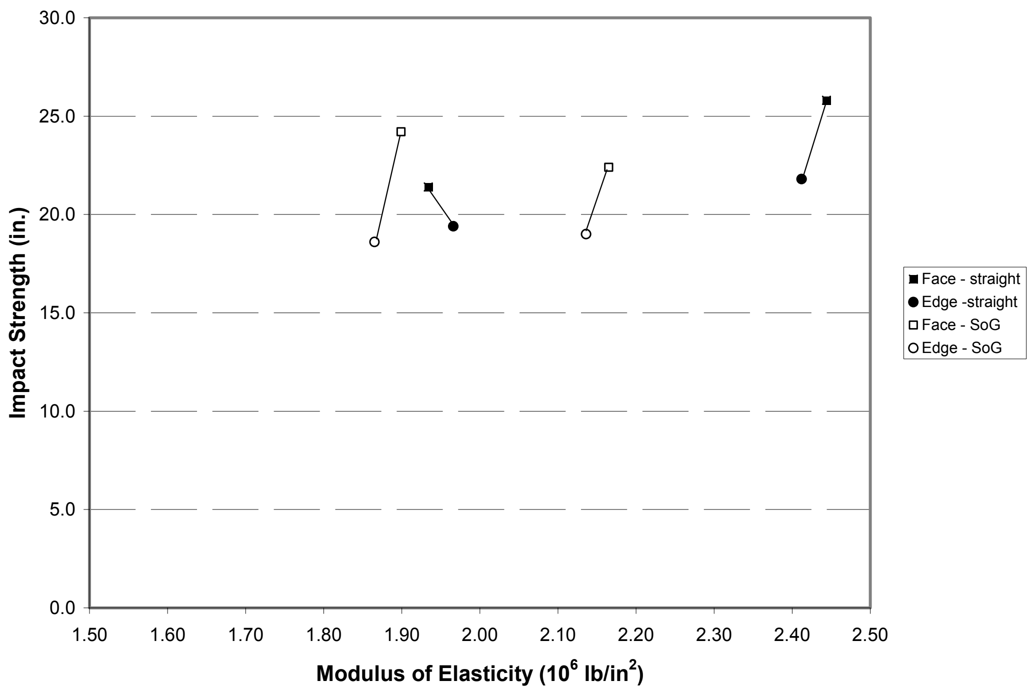


We observed that 85% of the tests showed that face-grain contact had equal or higher impact bending strength than edge-grain contact. In our evaluation of specimens having a wide range of physical and mechanical characteristics, we found face-grain impact bending strength was higher than edge-grain in all cases. The table below shows the calculated increase in impact bending strength for face-grain contact over edge-grain contact for each test group (each value is the average of 10 tests).

	Low MOE	High MOE
Straight-grained	1.10	1.18
Steep Slope of Grain	1.15	1.18

Values shown are the ratio between face-grain and edge-grain impact bending strength
(e.g. 1.18 means that face-grain is 18% higher than edge-grain)

Note that there seems to be a significant increase in face-grain strength performance for the higher MOE groups vs. the lower MOE groups. What the above values do not show is the relative strength values between Low MOE groups and High MOE groups. The figure below shows the average MOE and Impact Bending Strength of each of the 4 groups.



A comparison of the relative strength performance between High MOE specimens and Low MOE specimens within each group is tabulated below (each value is the average of 10 tests).

	Face-contact	Edge-contact
Straight-grained	1.21	1.12
Steep Slope of Grain	0.93	1.02

Values shown are the ratio between High MOE strength and Low MOE strength
(e.g. 1.21 means that high MOE specimens are 21% stronger in impact bending than low MOE specimens)

Summary

This data shows that impact bending strength is higher when contact is made on the tangential face (i.e. face-grain), compared to contact on the radial face (i.e. edge-grain). The highest increases were observed in the test group having the highest MOE and straightest slope-of-grain.