Technical Q & A

Ripping Lumber Will Likely Change the Grade

by Jim Vogt, P.E.

Why "ripping" lumber can negate grade and design values.

Cutting lumber for use in a truss is something that metal plate connected wood truss manufacturers are well accustomed to. Cross cutting and angle cutting are usually necessary to convert stocked lumber into pieces that fit the dimensional requirements of a truss. This type of cutting (i.e., across the width of the piece), seldom has any adverse affect on the grade of the lumber. Cutting or "ripping" lumber length-wise to create thinner or narrower lumber, however, almost always affects the grade, and typically requires the resulting pieces to be re-graded.

Question

I recently saw a picture in a construction magazine of a group of radius trusses in the roof of a building under construction. It appeared that the bottom chords in these trusses had been ripped to create the radius in the truss. I thought this type of cutting is not allowed. Am I mistaken?

Answer

As long as the grade, size and species of the ripped pieces of lumber used in these trusses meet or exceed the grade, size and species specified on the truss design drawing, what you have described is acceptable. It must be understood, however, that ripping lumber in this manner will very likely have an adverse affect on the grade, meaning that the resulting piece or pieces may no longer have the same grade and design values as the original piece.

Virtually all softwood lumber used for structural applications in the United States today is produced in accordance with U.S. Department of Commerce Voluntary Product Standard PS 20-05, American Softwood Lumber Standard. Section 7.3.7 of PS 20-05 states the following regarding ripped and resawn lumber:

> **7.3.7** Remanufacture (ripped, resawn or surfaced) of graded or grade marked lumber negates the grade or grade mark and the design values of the original product.

Resawn lumber is defined in Appendix B of PS 20-05 as:

> **Resawn lumber**–the product of sawing any thickness of lumber to develop thinner lumber.

Similarly, ripped lumber is defined as:

> **Ripped lumber**–the product of sawing any width of lumber to develop narrower lumber.

Grading rules for lumber consider the extent, location and number of various characteristics that determine the quality of piece of lumber. Two of the most common growth related characteristics found in lumber are knots and the grain deviation associated with them. Knots and grain deviation are considered "defects" because they tend to reduce the overall strength of a piece of lumber. The wood fibers in and around these natural growth characteristics are often oriented at radical angles to the fibers in the surrounding wood (Figure 1). Stresses resulting from loads applied to the lumber are generally transferred perpendicular to the fibers in and around the knot, instead of parallel to them. Since wood is considerably weaker across its grain than parallel to it, failure is often initiated in the knot or grain deviation at loads far below the capacity of straight-grained material (Figure 2). This is especially true when the knot and grain deviation are located in an area of high stress, such as near the edge of a joist or chord member subjected to bending stresses.

at a glance

- All softwood lumber used for structural applications in the United States today is produced in accordance with U.S. Department of Commerce Voluntary Product Standard PS 20-05.
- Grading rules for lumber consider the extent, location and number of various characteristics that determine the quality of piece of lumber.
- If it appears that ripping lumber is the only alternative, hire a certified lumber grader to re-grade the material.

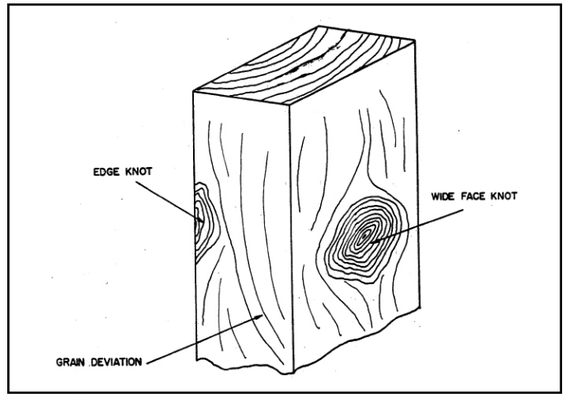

Figure 1. Sketch depicting knots and grain deviation in lumber.

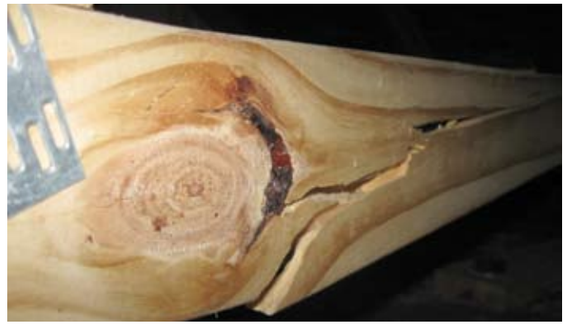

Figure 2. Failure in bottom chord of truss initiating in grain deviation around large wide face knot.

Ripping and resawing reduce the cross section of a piece of lumber. As a result, the extent (size) of any knots from the original piece that are now in the ripped or resawn piece(s) increases relative to the reduced section, and the location of these knots will also be typically closer to an edge or surface in the new piece. These changes are often significant enough to reduce the grade of the ripped or resawn piece(s) relative to the grade of the original piece.

Table 1 lists the maximum allowable knot size for four sizes and visual grades of sawn lumber. A review of this table indicates three important points. First, the maximum allowable size of a knot increases as the grade of the lumber decreases. Second, the maximum allowable size of a knot increases as the size of the lumber increases. Third, for a given grade and size of lumber, the maximum size of a knot located along the centerline of the wide face is greater than the maximum size of a knot located at the edge of the wide face. Stresses due to bending are greatest at the extremities (edges) of the lumber. Since knots and grain deviation tend to reduce the strength of a piece lumber, the size of a knot is more critical at or near the edge of the lumber than at or near its centerline. (See sidebar on page 12 for an example.)

Using the information in Table 1, we can quickly see how ripping a piece of lumber can reduce the grade of the remaining piece(s) relative to that of the original piece, based on knot size and location alone. Let's look at example.

Continued on page 12

	Select Structural		No. 1		No. 2		No. 3	
Lumber Size	Max. Knot at Edge of Wide Face	Max. Knot at Centerline of Wide Face	Max. Knot at Edge of Wide Face	Max. Knot at Centerline of Wide Face	Max. Knot at Edge of Wide Face	Max. Knot at Centerline of Wide Face	Max. Knot at Edge of Wide Face	Max. Knot at Centerline of Wide Face
2x4	3/4"	7/8"	1"	1-1/2"	1-1/4"	2"	1-3/4"	2-1/2"
2x6	1-1/8"	1-7/8"	1-1/2"	2-1/4"	1-7/8"	2-7/8"	2-3/4"	3-3/4"
2x8	1-1/2"	2-1/4"	2"	2-3/4"	2-1/2"	3-1/2"	3-1/2"	4-1/2"
2x10	1-7/8"	2-5/8"	2-1/2"	3-1/4"	3-1/4"	4-1/4"	4-1/2"	5-1/2"

Table 1. Maximum allowable knot sizes for selected grades and sizes of sawn lumber.

before

The joint of a truss in the Structural Building Components Research Institute (SCBRI) before the truss is tested. Note the knot on the edge of the bottom chord.

after

The truss fails at the spot of the knot, exposing a weakness in the lumber at that location.

Technical Q&A

Continued from page 11

Assume that a maximum of 3-3/4" is to be removed from a portion of a Select Structural 2x10 joist to create a desired architectural effect. The minimum depth of this piece after ripping will be 5-1/2". If the original 2x10 had the maximum allowable knot size of 2-5/8" at the centerline of the wide face and this knot happened to occur in the area where the ripped piece was now 5-1/2" deep, this 2-5/8" diameter knot would now be considered an edge knot in the ripped piece of lumber. A review of the table indicates that the highest grade of 2x6 lumber in which a 2-5/8" edge knot is allowed is No. 3—a considerable drop in grade. While this example is extreme, it illustrates the degrading effect that ripping lumber can have on the grade of the resulting piece(s) and why PS 20 requires that the pieces be re-graded.

If a component manufacturer is confronted with a situation in which ripping lumber may be required, what should he do? First, contact the truss design engineer to discuss the possible alternatives. Section 3.4.2 of ANSI/TPI 1-07 states:

3.4.2 Lumber Substitutions.
Truss lumber of a different grade shall be permitted if the substitute grade meets or exceeds the specified grade for each of the following engineering design properties:

(a) Reference design value for bending (F_b);
(b) Reference design value for tension (F_t);
(c) Reference design value for compression parallel to grain (F_c);
(d) Reference design value for compression perpendicular to grain ($Fc_\perp$);
(e) Reference design value for shear (F_v);
(f) Specific gravity (G);
(g) Reference modulus of elasticity (E); and
(h) Reference modulus of elasticity for stability calculations (E_{min}).

Any substitution of a specified Lumber grade not meeting the above requirements, or any substitution of a specified lumber grade to Structural Composite Lumber products shall require the review and approval of a Truss Designer.
(Underline added for effect)

If it appears that ripping lumber is the only alternative, hire a certified lumber grader to re-grade the material. SBC

To pose a question for this column, call the SBCA technical department at 608/274-4849 or email technicalqa@sbcmag.info.

New SBCA Members

REGULAR MEMBERS

Acadia Community Truss LTD
Box 1160 • Carberry, MB R0K 0H
204/834-3208 • Mr. Conrad Hofer

Listing as of 11/10/09. For more information about SBCA membership, contact Anna (608/310-6719 or astamm@qualtim.com) or visit www.sbcindustry.com.

STRUCTURAL BUILDING COMPONENTS™

THE FUTURE OF FRAMING

www.sbcmag.info

Dear Reader:

The mission of ***Structural Building Components Magazine (SBC)*** is to increase the knowledge of and to promote the common interests of those engaged in manufacturing and distributing of structural building components to ensure growth and continuity, and to be the information conduit by staying abreast of leading-edge issues. SBC will take a leadership role on behalf of the component industry in disseminating technical and marketplace information, and will maintain advisory committees consisting of the most knowledgeable professionals in the industry. The opinions expressed in SBC are those of the authors and those quoted solely, and are not necessarily the opinions of any affiliated association (SBCA) .

Truss Publications, Inc.

6300 Enterprise Lane • Suite 200 • Madison, WI 53719
608/310-6706 phone • 608/271-7006 fax
www.sbcmag.info • admgr@sbcmag.info