SOME PRINCIPLES IN LUMBER GRADING

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Report

No. 1963

November 1953

1Maintained at Madison, Wis., in cooperation with the University of Wisconsin.
Fifty-five percent of all wood that is removed from the forest nowadays goes into lumber of one sort or another. Four-fifths of this lumber is softwood and the rest hardwood. The great bulk of the softwood lumber is yard lumber consisting mainly of boards and dimension but including some higher grade items such as finish, flooring, and siding. Fuel, the second largest wood use, accounts for 18 percent of the total. Pulpwood accounts for 11 percent and veneer for 4 percent. Wood use in both these forms is increasing whereas the use of wood as lumber is decreasing. The miscellaneous item, 12 percent, includes posts, poles, piling, shingles, hewed ties, etc.
The wider the board in a given grade, the larger the allowable knot. No. 1 Douglas-fir boards are used here to illustrate this point. The size of the allowable knot increases from 1-3/4 inches in 4-inch widths to 3-1/2 inches in 12-inch widths. Sizes are not necessarily the same in all softwoods, but this same grading principle is generally observed. Remember that these are the maximum allowable knots and that such knots are not found in every board. In ripping wide boards into narrow ones considerable degrade necessarily results because of knots too large for narrow widths of the same grade.
In boards of any one width, the lower the grade the larger the allowable knot. This also applies to knotholes if any. The 8 inch width in Douglas-fir boards is used here to illustrate this principle. The solid black circles represent knots and the open circles the knotholes. The exact sizes allowed in the No. 3 grade are not specified, but they would certainly be larger than in No. 2. The above principle is generally applied in the grading of all softwood boards.
Yields of different qualities of ponderosa pine lumber are shown above. The proportions are only approximate. They illustrate one thing common to nearly all softwoods; that is, the small proportion of Selects and high Common grades. Selects comprise only one-eighth of the cut. They are usually sold as C and btr. and are used chiefly for finish, moldings, and siding. Shop grades which account for one-fourth of the cut will be dealt with in more detail later. Nos. 1 and 2 are usually combined and comprise one-eighth of the cut. The combination meets all needs for a strictly sound tight grade with small to medium knots. One-fourth of the production falls in the No. 3 grade. It allows knot-holes and moderately coarse defects and is used extensively in construction and containers. The remaining fourth of the cut consists of No. 4, a coarser and less sound grade.
Shop grades are based on the percentage of the piece that can be obtained in cuttings suitable for door manufacture. Each of the shop boards above is 12 inches wide by 8 feet long and contains 8 feet surface measure. The No. 1 shop piece at the left yields one stile and one muntin (dotted lines) that total 5 surface feet or 62.5 percent of its surface area. The minimum requirement for the grade is 50 percent. The board at the right yields one bottom rail and one top rail, or 3-1/4 surface feet or 40 percent. This places it in the No. 2 shop grade. The places where the cuttings go in the finished door are indicated.
A knot on the edge of a piece of dimension weakens it more than a knot of equal size that is away from the edge. Since dimension is graded for strength, the location of knots as well as their size must be taken into account. Three grades of southern pine 2 x 4's are used here to illustrate some of the factors involved. In No. 1 for instance, a knot at the edge may not exceed $1/4$ the cross section of the piece, but away from the edge it may be $1/3$ of the cross section. Only No. 1, which requires at least four rings per inch, has any restriction on number of rings. Both No. 1 and No. 2 dimension restrict the slope of grain. With dimension as with boards, the poorer the grade, the larger the allowable defects. The maximum allowable sound knots, knotholes, and wane are as shown above.
The samples shown include widths from 3 to 12 inches and lengths from 4 to 12 feet. The defects represented include knots, wane, and splits. The dotted lines show the cuttings as the grader would visualize them in determining the grade of the board. Under each piece is shown the grade, the surface foot contents, and the required yield for a piece of that grade and size.
Firsts (F)

To be acceptable in the grade of Firsts, the board must be at least 6 inches wide by 8 feet long. It must yield at least 91-2/3 percent (or 11/12) of its area in from one to three clear face cuttings depending on the size of the board. The cuttings themselves must be at least 4 inches by 5 feet or 3 inches by 7 feet. The two examples shown meet all requirements.

Seconds (S)

The grade of Seconds is very similar in most respects to Firsts except that the yield in cuttings need only be 83-1/3 percent or 10/12. The first board in the grade of Seconds is just large enough to be acceptable. The second board has the largest number of cuttings that are allowable in a piece of that size. Both pieces meet the yield requirements of 10/12.

No. 1 Common (1)

No. 1 Common accepts pieces down to 3 inches by 4 feet. Cuttings must be at least 4 inches by 2 feet or 3 inches by 3 feet and the required yield is 8/12. As many as five cuttings are acceptable in large boards. The first No. 1 board is 3 inches by 4 feet, the smallest piece that the grade permits. Pieces of this size must be clear. Pieces of 4-foot surface measure like the second No. 1 board are required to yield 8/12 in one cutting. Three cuttings are allowed in this grade in a piece as large as the third.

No. 2 Common (2)

No. 2 Common has the same minimum size board as No. 1, namely, 3 inches by 4 feet. Cuttings as small as 3 inches by 2 feet are accepted and the required yield is only 6/12. The maximum number of cuttings in any piece is seven.

The first piece is the smallest acceptable size. Pieces of this size are required to yield 6/12 in one cutting. Although 6/12 is the usual requirement, pieces containing 3 surface feet like the second No. 2 board are allowed only one cutting. The right hand board yields its 6/12 in four cuttings, the maximum allowable number in that size.