Lumber

Timber sawed or split into planks, boards. and similar products. Lumber can come in man); forms, species, and types from a wide variety of commercial sources. Because most lumber is manufactured similarly and graded by standardized rules, it is Fairly uniform throughout the United States. This article describes the manufacturing, processing, and grading of commercial lumber and the effects of moisture content. *See* WOOD PRODUCTS.

Manufacturing and processing. Lumber is manufactured from round logs primarily in rectangular shapes of different dimensions. Lumber length is recorded in actual dimensions. Width and thickness are traditionally recorded in nominal dimensions, which are somewhat more than actual dimensions. Softwood lumber is manufactured in length multiples of 305 mm (1 ft) as specified in various grading rules. In practice, 610-mm (2-ft) multiples are most common. Lumber width commonly varies from 38 to 38⁻ mm (nominal 2 to 16 in.). Lumber is classified by thickness into three categories: (1) board. lumber less than 38 mm (nominally 2 in.) thick: (3) dimension. lumber from 38 mm to, but not including, 114 mm (nominally 5 in.) thick; and (3) timber, lumber 114 mm (nominally 5 in.) or more in thickness in the least dimension. *See* LOGGING.

Lumber can be produced with either a rough or surfaced (dressed) finish. Rough-sawn lumber has surface imperfections caused by the primary sawing operations. Surfaced lumber is smoothed on either one or both sides and one or both edges.

Grades. In general, the grade of a piece of lumber is based on the number, character, and location of features that may lower the strength, durability, or utility value of the wood. Lumber grading can be divided into two main categories: remanufacture "shop grade" and structural "stress grade."

Shop grade. Sorting of lumber for remanufacture is based on visual inspection. The wood is designated shop grade on the proportion of defect-free or clear cuttings of a certain size that can be made from a piece of lumber. The larger volume and more frequent number of clear cuttings, the higher the grade. The rules adopted by the National Hardwood Lumber Association are considered standard in grading hardwood lumber intended for cutting into smaller pieces to make furniture or other fabricated products. Some shop grades commonly used for this material are Select, No. 1 Common, and No. 2A Common.

Stress grade. Pieces of lumber graded for structural uses are put into classes with similar mechanical properties called stress grades. Stress grades are characterized by (1) one or more sorting criteria, (2) a set of allowable properties for engineering design, and (3) a unique grade name. The allowable properties depend on the particular sorting criteria and additional factors that are independent of sorting criteria. Allowable properties are usually much lower than the properties of clear. straight-grained wood. The allowable properties are inferred through visual grading criteria or are determined nondestructively by machine-grading criteria.

Visually graded. Visual grading is the oldest stress-grading method. It is based on the premise that mechanical properties of lumber differ from mechanical properties of clear wood. Growth characteristics, which affect properties and can be seen and judged by eve, are used to sort the lumber into stress grades. Typical visual sorting criteria include density, decay, proportion of heartwood and sapwood. slope of grain. knots, shake. checks and splits, wane. and pitch pockets. Some grades commonly used for this material are Select Structual, No. 1, No. 2, and Construction. Two species with the same grade look alike but may have different individual properties.

Machine graded. Machine-graded lumber is evaluated by a machine using a nondestructive test followed by visual grading to evaluate certain characteristics that the machine cannot or may not properly evaluate. Machine-stress-rated (MSR), machine-evaluated (MEL), and E-rated lumber are three types of machine-graded lumber. Machine-graded lumber allows for better sorting of material for specific applications in engineered structures. The basic components of a machine-grading system are as follows: (1) sorting and prediction of strength through machine measured nondestructive testing coupled with visual assessment of growth characteristics; (2) assignment of design properties based on strength prediction, and (3) quality control to ensure that assigned properties are being obtained. The MSR and MEL systems differ in grade names, quality control, and coefficient of variation (COV) for modulus of elasticity (E) values. Grade names for MSR lumber are a combination of the design bending stress and average modulus of elasticity (such as 1650F 1.5E). whereas grade names for MEL lumber start with an M designation (such as M-14). Machine grading is species-independent

because grading is based on properties.

Moisture content. Clear, straight-grained lumber can be about 50% stronger when dry than when wet. For lumber containing knots, the increase in strength with decreasing moisture content is dependent on lumber quality. As the frequency and size of knots increase, the reduction in strength resulting from the knots begins to negate the increase in strength in the clear wood portion of the lumber. Very low quality lumber, which has many large knots, may be insensitive to changes in moisture content. Some strength values may decrease with decreasing moisture content (less than about 8%), and care should be exercised in these situations. For timber, often no adjustment for moisture content is made because properties are assigned on the basis of wood in the green condition. Timber is usually put into service without drying, and it is assumed that drying degrade offsets the increase in strength normally associated with loss in moisture. *See* WOOD PRODUCTS; WOOD PROPERTIES.

David E. Kretschmann

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