

Technical Bulletin

Colorado Wood Utilization and Marketing Program

Overview of Lumber Grades and Building Codes

Chris Jennings

Department of Forest, Range, and Watershed Stewardship
Colorado State University

Introduction

Lumber grading issues often serve as a point of confusion, and at times, frustration to the small sawmills of Colorado. Although lumber grade stamp requirements are often narrowly seen as a barrier to entry into certain markets, they actually provide utility to buyers, sellers, and users of lumber.

In essence, lumber grades provide an assurance of product standardization, meaning that multiple pieces of the same grade will have the same range of physical characteristics, regardless of the manufacturer, species, or log quality. Likewise, grades for dimensional lumber provide parameters for mechanical properties for use of the material in structural applications

This Technical Bulletin is provided to explore some of the basics behind lumber grades, such as: how they are developed, how mills can implement lumber grading programs, and when lumber grade stamps aren't required. Additional sources of information on these topics can be found in the Reference section or by contacting Colorado Wood Utilization and Marketing Program personnel.

Lumber Grade Development

Lumber grade rules are developed under the guidelines established by the American Softwood Lumber Standard – Product Standard 20 (ASLS PS-20). The ASLS establishes sizes, green/dry relationships, methods of assigning design values, industry nomenclature, provisions for inspection and re-inspection, and grade-marking requirements for use in the development of lumber grade rules. To simplify, the ASLS establishes the basis and guidelines under which grade rules can be developed.

The ASLS PS-20 is maintained by the American Lumber Standards Committee (ALSC), which is comprised of manufacturers, distributors, users, and consumers of lumber, who are appointed by the Secretary of Commerce every five years. The ASLC is responsible for electing a Board of Review (BOR), which performs and oversees certification and accreditation. Members of the BOR have no affiliation with industry. The BOR is responsible for: certifying lumber grades as conforming to ASLS PS-20, accreditation of agencies that grade under certified rules, and monitoring and enforcing agency performance.

The National Grading Rule Committee is an autonomous body functioning under bylaws approved by the ALSC, which maintains the National Grading Rule for Dimension Lumber (NGRDL). This rule is used in the grading of surfaced softwood lumber 2-4" thick, and 2" and wider (all nominal), which is used in structural framing members. In all, the NGRDL classifies dimension lumber into 3 width categories and 4 use categories, which include: Structural Light Framing and Light Framing (2-4" thick, 2-4" wide), Studs (2-4" thick, 2" + wide), and Structural Joists and Planks (2-4" thick, 5" + wide). The familiar terms Select Structural, 1, 2,3 & Stud refer to the grades in this rule.

Grade Rules and Grading Writing Agencies

There are currently seven lumber grade rules and grading writing agencies certified under

**Colorado
State
University**

Knowledge to Go Places



PS-20, by the Board of Review. They are:

- Standard Grading Rules for Northeastern Lumber – *Northeast Lumber Manufacturers Association (NeLMA)*
- Standard Grading Rules – *Northern Softwood Lumber Bureau (NSLB)*
- Standard Specification for Grades of California Redwood Lumber – *Redwood Inspection Service (RIS)*
- Standard Grading Rules for Southern Pine – *Southern Pine Inspection Bureau (SPIB)*
- Standard Grading Rules for West Coast Lumber – *West Coast Lumber Inspection Bureau (WCLIB)*
- Western Lumber Grading Rules – *Western Wood Products Association (WWPA)*
- Standard Grading Rules for Canadian Lumber – *National Lumber Grades Authority (NGLA)*

Where do the various grades apply ?

As is indicated by the titles of the grade rules, they are typically regional in nature, as they were originally developed for certain species and/or species mixes. However, it should be noted that there is overlap between certain grade rules. For example, in Colorado both Grading Rules for West Coast Lumber (WCLIB) and Western Lumber Grading Rules (WWPA) can apply.

Agencies that grade under the certified rules may be rules writing as well as grading agencies, or strictly grading agencies. For example, Western Wood Products Association (WWPA) is certified as a rules writing and grading agency, while Timber Products Inspection (TPI) is strictly a grading agency. Agencies may also be certified to grade under multiple grade rules. For example, West Coast Lumber Inspection Bureau is certified to grade under Export R (Pacific Lumber Inspection Bureau), Standard Grading Rules for Southern Pine (SPIB), Standard Grading Rules for Canadian Lumber (NGLA), and the Western Lumber Grading Rules (WWPA).

Basic Categories of Lumber Grades

Softwood lumber grades are classified into three general categories: yard, factory and shop, and structural.

Yard lumber Yard lumber is intended for non-structural construction applications, such as shelving or paneling, where appearance is of greater importance than structural integrity. As such, yard lumber is not stress-rated. No further remanufacturing of yard lumber is expected once it leaves the sawmill. Two general grades often associated with yard lumber are Selects and Commons. Selects may be patterned or surfaced on four sides (S4S), and are usually comprised of finish boards or specialty products. Common grades are generally used for construction and utility purposes, and are comprised of typical board grade material.

Factory and Shop Factory and Shop lumber is intended for remanufacture into component parts, such as those for windows and doors, by industrial customers. Grading is similar to that of hardwoods in that they are based on the number and size of clear cuttings that can be made from the piece.

Structural Lumber As the name of the category would imply, the structural properties of lumber in this category are of primary importance, rather than appearance. Unlike Factory and Shop, and Yard lumber categories where grade names vary between grading rules, there is a single, consistent set of grade names that are used throughout the U.S. for Structural lumber. These grades are based on the National Grade Rule for Dimension Lumber. Allowable stress ratings are published for each grade, and vary by species or species mix, as are evidenced in span tables.

How is lumber graded ?

Lumber can be graded either visually, mechanically, or a combination of both. Visual inspection is used to grade both appearance grade and structural lumber, while mechanical grading is limited to structural lumber.

Visual grading is based on the number, size, location, and type of defects throughout the piece. Mechanical grading, or mechanically stress rating (MSR), involves passing lumber through a machine that applies upward and downward loads on the piece, data from which is used to determine the stiffness (modulus of elasticity – E). These systems can handle very high throughput, (2200 feet per minute), and can be placed in-line with a planer.

Lumber Grades and the Sawmill

Who does the actual grading ?

Grading agencies can certify a mill to grade under a specific set of grade rules, which is the case found in a typical production setting. In this case, trained personnel from the mill perform the grading. The mill “carries” the grade stamp of the certifying agency, which is used on the lumber that is produced at that mill. The accuracy of the mill’s grading operation is inspected on a monthly basis by a grade agency representative to ensure that the mill continues to meet grading specifications.

Some grading agencies also provide on-call grading services for “batches” of lumber. In this case, personnel from the grading agency travel to the mill and perform the grading. A certificate of inspection is issued for the material and some notation is made on the individual pieces of lumber to indicate the grade of the piece, but a grade stamp is not applied.

Cost of stamp and services

Grading agencies typically charge a monthly fee based on the annual production volume of the mill. In addition, the fees will vary between grading agencies based on the level of service that they provide. For example, the flat rate charged by WWPA is approximately \$400/month, while the flat rate charged by TPI is approximately \$250/month. However, WWPA is also a trade association, and provides its members with access to a range of technical, informational, and economic services, as well as other benefits typical of an industry trade association. (*Additional information on grading agencies is available in the report Feasibility of Grading Lumber Produced by Independent Mills in the Interior West (Anthony 2003)*). The cost for on-site grading services for a batch of lumber can range between \$250 to \$400, depending on mill

location and the time required to grade the lumber.

Mills may carry more than one grade stamp from an individual grading agency for the same monthly fee. For example, a mill certified to grade timbers, structural lumber, and Factory & Shop grades, is required to pay only one fee, not fees for each category of lumber graded.

Requirements for a stamp

Mills must meet certain requirements to carry an agency's grade stamp. Some grading agencies prefer to deal with companies of a minimum size. For example, WWPA states that their services are targeted to mills with a minimum production of 1MMBf/month. Likewise, WCLIB does not offer services to small mills. Also, grade stamps are not typically granted to portable operations that do not run at an established facility, (i.e. the stamp cannot be carried to different locations).

As the grading conducted at a mill carrying a grading agency's stamp is performed by that mill's personnel, they must have a formal understanding of the grade rules under which lumber will be graded. Grading agencies will provide supervision and guidance during their monthly inspections, and are knowledgeable of formal lumber grading courses that are available to train mill personnel.

“Unofficial” Lumber Grades

Whether or not lumber needs to be grade stamped is primarily dependent on the requirements of the market, or specific customer to which the lumber will be sold. In almost all cases, dimension lumber requires a grade stamp when it is to be used in structural applications, as per building code requirements. Lumber sold into the open market will also typically require a grade stamp. In this case, the grade stamp serves as an assurance that the lumber meets the expectations the buyer would typically have of the material. However, alternatives to grade stamps for non-structural lumber are possible.

Mills may be able to develop proprietary, or in-house grades for certain applications or customers. One example of this would be the various grades of paneling that are offered by the aspen mills on the Western Slope. These grades are not recognized by the ASLS, yet represent a consistent and demonstrable level of features and quality that can be recognized by customers, and which meet those customer's needs or preferences.

Another variation of this concept would be for a mill working with a large industrial consumer to identify specific material needs, and to work together to develop a business-to-business recognized grade. A hypothetical example would be a cabinet shop that was interested in using pinion pine in a line of cabinets. As no grade rules cover pinion pine, the cabinet shop could work with a sawmill to develop an agreed upon grade that would meet their needs.

It should be noted that the absence of a grade stamp in these

situations also precludes the re-inspection assistance of a grading agency in event of a dispute between the buyer and seller. Re-inspection is a service offered by grading agencies, but is limited to lumber that has been made or sold under its standards, or which was graded under its supervision.

Building Codes and Grade Stamps

Until recently, the Council of Building Officials' (CABO) One and Two Family Dwelling Code set guidelines for residential construction practices in Colorado counties, in which it had been adopted. Recently, counties have begun to adopt the International Code Councils' International Residential Code in its place. Both model codes require that dimension lumber be grade stamped for use in structural applications. However, opportunities remain for the use of non-grade stamped lumber in residential construction in both of these model codes.

Board sheathing

Prior to the development and widespread adoption of structural panels such as plywood and OSB, the roofs, walls, and floors of houses were traditionally sheathed with boards. However, provisions within the residential model building codes still allow the use of un-graded boards of specified thickness in these applications. A back of the envelope calculation shows that if 1x6x8' sold for \$350/Mbf, the cost to sheath a 32ft² area (the square footage covered by a 4x8' structural panel) would be approximately \$11.20 for materials alone. The cost competitiveness of board sheathing against the recent high cost of panel products would have to be balanced against the economy of speed and ease of installation that panels provide, however.

Alternative Materials and Systems

Both model residential building codes contain a section entitled "Alternate Materials and Systems." This section of the building code is often quoted by those parties advocating new or different types of construction or construction materials (straw-bale home advocates, and certain portable mill manufacturers). As the title would indicate, this section allows for alternate materials, systems, appliances, or designs in residential construction. The sole requirement for this substitution is that the building official/department can be satisfied that it is at least equivalent to that prescribed in the code for: "suitability, quality, strength, effectiveness, fire resistance, durability, dimensional stability, safety, and sanitation." A careful, thorough presentation on the use of un-grade stamped lumber in certain residential projects could be successful if you were able to demonstrate the lumber meets requirements set forth by the grade rules. *A report sponsored by the Interior West Center examined some of the issues related to utilizing small-diameter roundwood in construction (Eisenberg 2003).*

Certificate of Inspection

As described earlier, certain grading agencies will provide grading services on an on-call basis for batches of lumber. The Certificate of Inspection that is issued can serve in-lieu of a grade stamp.

“Codeless” Counties

It should be noted, there are currently 15 counties in Colorado that have not formally adopted a building code (this is reported to be changing in some of these counties). These counties should be contacted to determine if local regulations have been adopted that would require a grade stamp on lumber used in construction. The counties are: Sedgwick, Morgan, Yuma, Kit Carson, Cheyenne, Kiowa, Prowers, Baca, Costilla, Custer, Rio Grande, Saguache, Montezuma, Dolores, and Delta.

Additional Sources of Information

Timber Products Inspection, Inc. (Western Region)
105 S.E. 124th Avenue
Vancouver, WA 98684
Phone: (360) 449-3840
Fax: (360) 449-3953
E-mail: pbrowne@tpinspection.com

Western Wood Products Association
522 SW Fifth Ave. Suite 500
Portland, Oregon 97204-2122
Tel: 503-224-3930
Fax: 503-224-3934
Email: info@wwpa.org

West Coast Lumber Inspection Bureau
P.O. Box 23145
Tigard, OR 97223
Phone: (503) 639-0651
Fax: (503) 684-8928
Email: info@wclib.org

Additional Resources

The following useful publications can be obtained by contacting Chris Jennings at (970) 491-2958, or can be found on-line at URL's given below:

Feasibility of Grading Lumber Produced by Independent Mills in the Interior West
2003 IWC Report submitted by: Anthony & Associates
Available on-line at: www.colostate.edu/programs/cowood - under Publications
Or <http://interiorwestwood.colostate.edu/program2.htm>

Overcoming Building Code-Related Challenges to Construction Uses of Locally-Sourced Forest Thinnings and Small Diameter Wood: A Guide and Checklist for Gaining Code Approval for Alternative Designs, Materials, and Methods of Construction
2003 IWC Report submitted by: Development Center for Appropriate Technology (Eisenberg)
Available at:
<http://interiorwestwood.colostate.edu/program2.htm>

Use of Custom-Sawn Lumber in Structures: Columbia, Clatsop, and Tillamook Counties, Oregon
Report for Northwest Oregon Economic Alliance
Prepared by Larry Swan, US Forest Service
And Joel Koch



Department of Forest, Range, and Watershed Stewardship
1472 Campus Delivery
Colorado State University
Fort Collins, CO 80523-1472