Establishing allowable design values for structural lumber of foreign species for use in the United States

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Abstract

Historically, market needs for structural lumber in the United States have been met from domestic and Canadian timber resources. In recent years, changing government policy related to the industrial use of federal timber has caused a major decline in commercially available timber, particularly in the northwestern United States. To fill this shortfall, manufacturers and consumers have begun to look to offshore sources. The procedures used for assigning allowable design values to structural lumber in the United States are not generally well understood outside of the regional lumber grading rules writing agencies. In addition, there have been many recent changes in the procedures as a result of the North American in-grade testing program. The purpose of this paper is to present a summary of the current procedures used to establish design values for structural lumber in the United States with special emphasis on species of foreign origin.

Introduction

Historically, market needs for structural lumber in the United States have been met from domestic and Canadian timber resources. In the 1980s, the growing public debate over the preferred use of publicly owned timberland in the northwest began to diminish the land base designated for commercial timber production and harvest. By the early 1990s, the continued contentious litigation over the northern spotted owl, and other species designated as threatened or endangered, has virtually halted all timber sales from federally owned timber in the Pacific Northwestern states of Washington, Oregon, and California.

Because the U.S. federal government owns approximately 32 percent of the unreserved timberland in the State of Washington, and 51 percent in Oregon, the disruptions in timber supply will continue at least until the federal government develops new management plans for federal land. It is further likely that even after new management plans are developed, the harvest levels will be substantially below historic levels. As a result, manufacturers in the Pacific Northwest have begun to look to offshore sources to meet some of the demand for timber. In order to import lumber or timber from foreign sources for structural purposes, the material must be approved for import by the USDA Animal and Plant Health Inspection Service, and have approved allowable design values assigned. The purpose of this paper is to present a brief summary of the procedures for obtaining approval of design values for use in the United States.

Model building codes

The United States has a rather unique system of approval for building components and systems. Approval of buildings, systems, and components are governed by local building departments which in turn subscribe to one of three regional model building codes (7,12,19). Some building jurisdictions choose...
to develop their own building codes. Often these are based on one of the major model codes.

While the local building officials are technically responsible for the approval of buildings and components, they have of necessity come to rely on the model codes to specify approved materials and construction practices. New, unique, or proprietary systems and components are evaluated by the model code organizations which issue research reports on their findings and approved uses.

Structural lumber, too, has a rather unique relationship with the model codes. The lumber industry has a standardization program which sets grade standards, evaluates third party inspection performance, and approves design values. This national system has been evolving over the last 70 years. The current system is described in Product Standard PS20-70, the American Softwood Lumber Standard (17). It is probably better known as the American Lumber Standards (ALS). The building codes and building officials have come to rely on the ALS and its certification and accreditation program to ensure the reliability and product performance of structural lumber.

**American Lumber Standards**

The American Lumber Standards Committee (ALSC) established Product Standard PS20-70 to develop standard grades and sizes of dimension structural lumber (nominal dimensions of 2 to 4 in. in thickness, 2 in. and wider), accredit grading and inspection agencies, monitor the performance of accredited agencies, and certify grading rules and assigned design values. The ALS system (Fig. 1) as established by PS20-70 is a consensus standards process with representative participation by all interested groups, producers, users, and general interest. Under this standard an independent Board of Review, elected by the ALSC and concurred in by the Secretary of Commerce, is established to carry out the accrediting and monitoring of grading agencies and certification of grading rules and design values.

Design values certified by the Board of Review, while published by a single rules writing agency, are non-proprietary. The design values apply to structural grades of all lumber produced of that certified species which is graded under the supervision of any ALS-certified grading or inspection agency. The U.S. Department of Commerce acts as the secretariat and publisher of Product Standard PS20-70. For a more detailed discussion of the structure and function of the American Lumber Standards Committee, the reader is referred to PS20-70. Copies of PS20-70 are available from the American Lumber Standards at the following address: American Lumber Stand-

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**Figure 1.** — American Softwood Lumber Standard PS20-70.
The design values which the grading agency develops are also submitted to the American Lumber Standards Board of Review for certification. The specifics of developing these proposed design values are discussed in greater detail by the West Coast Lumber Inspection Bureau (WCLIB) (22). The purpose of this section is to outline the general approval process.

When proposed design values are submitted for certification, the Board of Review refers the proposal to the National Institute for Standards and Technology (NIST) for review. Section 5.3.1 of PS20-70 requires that all standards or "other appropriate criteria" used in the development of proposed design values must be found to be appropriate by NIST. NIST makes its determination with the advice and counsel of the USDA Forest Products Laboratory. In addition, the Board of Review must determine that the requirements of the standards and "other criteria" were faithfully followed in preparation of the submission. The Board of Review utilizes the services of the USDA Forest Products Laboratory (FPL) in Madison, Wis. to perform the detailed review of the technical content of the submission. Upon completion of its review, the FPL issues a written report of its findings to the Board of Review.

Public notice is made of all proposals presented to the ALS Board of Review. This public notification permits other interested parties the opportunity to comment on the submission to the Board of Review. If the Board of Review finds that the proposed values were developed in accordance with the provisions of PS20-70 and the ALSC policies, the values are certified for publication by the submitting rules writing agency.

Upon approval the design values are published in the proponent's grading rules, and subsequently the National Design Specification Supplement (1). The approved values are also then submitted to the model codes for reference in the building codes.

Acceptance of foreign species

Prior to 1992, U.S. lumber design values were derived using the clearwood values of ASTM D 2555 (6) and the grade derivation of design values in ASTM D 245 (3). Because the process relied on clear wood data which is generally not available for foreign species, new procedures had to be developed. In 1975 Galligan and Ethington (8) developed procedures based on ASTM D 2915 (5), for establishing design values for foreign species for use in the United States, known by its initials as T/I/QC. This procedure required extensive testing of lumber properties and ongoing quality control. The program was accepted by the Board of Review, but no foreign lumber was ever commercially imported under the program.

In the late 1970s, the United States and Canada began a massive testing program to evaluate the mechanical properties of the major commercial softwood species used in the two countries. The program became known as the In-grade Testing Program (11). From the late 1970s to the mid-1980s, a total of some 70,000 pieces of lumber were tested, most to destruction. The results of this testing program were used as the basis to develop a new ASTM Standard D 1990 (4). ASTM D 1990 provides a standardized means of assigning allowable design values to dimension lumber based on tests of full-size specimens. After this standard was approved in 1991, new design values were developed by the regional grading rules writing agencies and approved by the ALS Board of Review.

ASTM D 1990 also provided a new method of acceptance of foreign lumber for structural use. Proposed new procedures for acceptance of foreign lumber were developed by Green and Shelley (9,10)

Table 1. — Design value approval process under PS20-70.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
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<tbody>
<tr>
<td>1.</td>
<td>Agency seeks approval to include species in grade rule book.</td>
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<td>2.</td>
<td>Agency develops sampling and testing plan with advice of ALS and USDA FPL.</td>
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<td>3.</td>
<td>Lumber is sampled and tested in accordance with approved sampling and testing plan.</td>
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<td>4.</td>
<td>Agency analyzes data by procedures of ASTM D 1990 and other appropriate standards, if needed.</td>
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<td>5.</td>
<td>Agency submits proposed design values to ALS Board of Renew.</td>
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<td>6.</td>
<td>Submission is reviewed by ALS staff and USDA FPL.</td>
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<td>7.</td>
<td>Submission is available for comment by other agencies and any other interested parties.</td>
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<tr>
<td>8.</td>
<td>ALS Board of Review approves (or disapproves) design values with modifications (if needed) based on all available information.</td>
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<tr>
<td>9.</td>
<td>Agency publishes new design values for the species.</td>
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in two papers which were submitted to the ALS Board of Review for approval. The first paper (9) discusses how to adapt ASTM D 1990 procedures for determining design values of foreign lumber that has been visually graded to standard ALS grades. The second paper (10) provides acceptance procedures for machine stress-rated lumber (MSR). These two procedures have been approved for use by the ALS Board of Review.

The general procedures for visually graded lumber covered by Green and Shelley were further explained in a publication of the WCLIB (22). The WCLIB publication included proposed sampling and testing schemes together with estimates of the costs of testing required to develop data for establishing allowable properties.

The procedures for MSR lumber are designed to verify the applicability of the U.S. grading model. Specifically, the procedures establish a standardized methodology for evaluating the relationships of mechanical properties as they relate to machine grading, and segregation by modulus of elasticity.

Conclusions

The new procedures approved to establish design values for foreign lumber provide a standardized basis whereby foreign species can enter the U.S. structural market and be treated the same as domestic species. To the present no foreign species have been approved under these new procedures. It is anticipated that when the economic conditions are favorable for the importation of foreign material, these procedures for their acceptance will be utilized.

Literature cited

8. Galligan, W.L. and R.L. Ethington. 1975. Philosophies of testing/inference where the goal is to judge whether an imported grade meets or exceeds an ALS approved grade of dimension lumber. A report to the Board of Review of the American Lumber Standards Committee.