MAINTENANCE PROCEDURES FOR NORTH AMERICAN VISUALLY-GRADED DIMENSION LUMBER DESIGN VALUES

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ABSTRACT: When ASTM D1990 Standard Practice for Establishing Allowable Properties for Visually-Graded Dimension Lumber from In-Grade Tests of Full-Size Specimens, which governs the development of design values for dimension lumber in the U. S, was adopted it was recognized that the resource for manufacturing lumber could change over time impacting allowable design properties. D1990 Section 13 instructed users of the standard to conduct a reassessment of property values derived by the practice if there is cause to believe that there has been a significant change in the raw material resource or product mix but no guidance was given for how to monitor or evaluate properties to determine if a reassessment of the allowable properties developed with D1990 is necessary. Guidance on design value maintenance is now being included in the ASTM D1990. This presentation presents the multiple stage design value maintenance provisions and the thought process behind developing these provisions for monitoring, evaluation, and reassessment for visually graded structural lumber being suggested.

KEYWORDS: Visually-Graded, Dimension Lumber, Monitoring, Evaluation, Reassessment

1 INTRODUCTION

Dimension lumber visually graded in accordance with the National Grading Rule and assigned design values derived in accordance with procedures found in the ASTM D1990 [1] has provided satisfactory performance in homes and other structural applications for many years. Since it was adopted it was recognized that there was a potential for the resource used to derive allowable properties to change with time. D1990 Section 13 instructed users of the standard to conduct a reassessment of values derived by the practice if there is cause to believe that there has been a significant change in the raw material resource or product mix but no guidance was given for how to monitor or evaluate properties to determine if a reassessment of the allowable properties developed with D1990 is necessary.

Revisions have been made to the D1990, since it was originally approved in 1991, to reflect the knowledge gained and the needs of the industry when deriving design values from in-grade full-size lumber testing programs. These include, for example, refinements to the Grade Quality Index and some guiding principles for deciding when a reassessment would be needed.

Significant progress has been made on standardizing the minimum requirements for monitoring, evaluation, and reassessment of lumber properties developed in accordance with D1990. This presentation presents the multiple stage design value maintenance provisions and the thought process behind developing these provisions for monitoring, evaluation, and reassessment for visually graded structural lumber being suggested.

2 BACKGROUND

It is useful to understand some important characteristics of lumber design values derived in accordance with D1990. Derivation of design properties are based on data from destructive testing of a matrix of bending, tension parallel to grain and compression parallel to grain samples of commercially produced structural lumber. Samples are representative of the entire growth region of the species or species group population. This data, when processed following the ASTM standards, results in a “global characteristic value”, which is a statistical estimate of an overall population property. Each size/grade sample was built from smaller samples of existing production or “production on the ground” [2].

Global characteristic values for bending stiffness are estimated at the mean level, while values for strength properties are determined at a “near minimum” value, or
specifically the 5th percentile value. Data are adjusted to standardized conditions of temperature, moisture content and size to increase the sample size used to establish a 5th percentile lower tail estimate. Substantial changes in resource will affect the global characteristic value. Methods for monitoring characteristic values have been discussed since the 1990s [3].

3 MAINTAINING LUMBER DESIGN VALUES

3.1 METHOD CONSIDERED

Several methods, such as targeted action thresholds, \( \chi^2 \) comparisons, and Anderson-Darling comparison for monitoring lumber design values were considered as ways to monitor for resource change. In the end, the Wilcoxon method was selected as the method of choice.

3.2 OVERVIEW

The proposed program for maintenance of lumber design values is divided into three stages: monitoring, evaluation and reassessment. A flow chart of a multiple stage periodic verification approach is presented in Figure 1.

Monitoring is the on-going portion of the program. Its role is to determine whether there is sufficient evidence to continue to support the use of the current design values.

Evaluation is the stage that is optionally entered after a change beyond the action level is confirmed by monitoring. The evaluation stage can try to identify cause and scope of change and develop process adjustments that would support the continued use of existing design value(s). The result of the evaluation stage is either a change to the process which will subsequently need to be confirmed as sufficient to allow the current design values, or a need to reassess and re-establish new design values.

Reassessment is the stage that is entered if evaluation is either not selected or is not successful. The result of reassessment is establishing new design values.

These stages rely on the application of a Wilcoxon statistical test to delineate the states where on-going monitoring can continue, and where actions need to be taken to change the lumber sorting or grading process and/or re-establish the lumber design values.

4 CONCLUSIONS

Further guidance on design value maintenance in D1990 was needed. Many options have been considered for design value maintenance. It has been decided, through a consensus process, that multiple stage design value maintenance provisions be used for monitoring, evaluation, and reassessment of North American visually-graded structural lumber.