

Southern Pine Design Value Forum

November 15-16, 2011

**Sheraton Gateway Hotel Atlanta Airport
Atlanta, Georgia**

Results of a working session of Southern Pine lumber producers, component manufacturers, builders, lumber dealers and technical experts regarding proposed design values for visually graded Southern Pine lumber

FINDINGS & RECOMMENDATIONS

**for consideration by the
Board of Governors of the Southern Pine Inspection Bureau, the
American Lumber Standard Committee (ALSC), and the
ALSC Board of Review**

December 15, 2011

EXECUTIVE SUMMARY

A *Southern Pine Design Value Forum* was held November 15-16, 2011 in Atlanta, Georgia. This forum provided the opportunity to develop recommendations regarding the design value changes proposed by the Southern Pine Inspection Bureau (SPIB). The Southern Forest Products Association facilitated the forum in cooperation with the Structural Building Components Association. Forum participants included Southern Pine lumber producers, component manufacturers, builders and technical experts.

The meeting began with an informational session devoted to learning more about the various data sets, the science behind the data, options to consider, the approval and implementation process, impacts on users, and Southern Pine producer capabilities. The forum participants subsequently broke into smaller groups, after which each group leader summarized their discussions for the entire group.

The overall consensus of the meeting participants was to develop a collective set of findings and recommendations to submit to the SPIB Board of Governors, the American Lumber Standard Committee (ALSC) and the ALSC Board of Review. In addition, participants were encouraged to forward their individual comments to both ALSC and SPIB, and to present their viewpoint in person at the next ALSC Board of Review meeting.

Three task groups were formed to conduct follow-up work. One group summarized the forum findings and coordinated this report. Another task group documented redundancies and conservatism built into the design of light-frame wood construction. The final group developed recommendations for a better procedural process for changing existing design values.

Findings & Recommendations¹

Several findings & recommendations emerged from this *Southern Pine Design Value Forum*.

Findings

1. An adequate margin of safety exists with in-market lumber such that existing or in-progress structures do not need re-evaluation. See “A Review of the Margin of Safety for In-Market Lumber” authored by professional engineers working together in a forum task group.
2. Consequently, there are no compelling barriers to completion of the full ASTM D1990-mandated test program prior to proposing revised design values for consideration by the ALSC Board of Review.
3. Instead, it is important to act prudently to ensure that sound science prevails in the data collection and analysis before revising design values.

¹ These findings and recommendations represent the collective consensus of the forum task groups, but may not represent each individual's point of view.

Recommendations

1. **There should be only ONE change in design values, if justified;** not one now and then another a few months later. Multiple design value changes within a short timeframe will erode public confidence and cause unnecessary, expensive design and implementation problems for all stakeholders.
 - **In the future, all potential design value changes should be addressed at the same time and coordinated with the code development process.**
2. **Complete the remaining testing of additional Southern pine grades and sizes as required by ASTM D1990 before making any design value changes.** This will ensure accuracy and build confidence and certainty in the result.
3. **Re-visit and expand the No.2 2x4 sampling and analysis.** Consider additional data and remaining and/or additional technical questions regarding sampling and testing procedures based on the change in the resource from the previous in-grade testing.
 - **The SPIB Technical Committee needs broader involvement to include other key stakeholders to analyze and evaluate other grade rule alternatives.** Enhancing transparency through broader involvement of stakeholders will greatly improve the acceptance of these and future changes.
 - **There remains a need for a visual dense grade option with associated higher design values.**
4. **SPIB and ALSC should adopt a standard change management process.** See “Proposed Process for Evaluating Existing Design Values” and corresponding “Flow Chart” authored by members of a forum task group. A change management process that allows an orderly transition will reduce impacts on both producers and end users. The proposed process is more transparent, inclusive and allows for stakeholder input and review. It is also more aligned with other self-monitored government rules agencies.
 - **The proposed process should be applied to the current proposed design values under review.**
 - a. In the Flow Chart included in this report, the January 5, 2012 ALSC Board of Review meeting is represented by the box at the end of the 60-day period shown in Step 2 that reads, “BOR Reviews Proposed Design Values and Considers Comments”.
 - b. Also according to the Flow Chart, following a 30-day review period to consider public comment, the Board of Review would meet again (no sooner than February 5, 2012). At that time, **the Board of Review should decide to have SPIB complete their full testing matrix**, thereby returning to the end of Step 1 in the proposed process.

- 5. The resource monitoring protocol needs to be re-evaluated and revised** to ensure more timely detection of smaller incremental changes in design values. **This includes** any needed changes to **ASTM D1990** and related documents, as well as the **procedures and policies followed by ALSC and rules-writing agencies.**

Conclusion

The *Southern Pine Design Value Forum* included representatives from a wide cross-section of stakeholders including lumber producers, component manufactures, builders, lumber dealers and other highly skilled and knowledgeable professionals. The resulting findings and recommendations were developed with considerable time, effort and due diligence by three task groups established at the forum. These findings and recommendations represent a collective consensus of the forum task groups, but may not represent each individual's point of view. The participants request that the Board of Governors of the Southern Pine Inspection Bureau, the American Lumber Standard Committee (ALSC) and the ALSC Board of Review give careful and deliberate consideration to this work to ensure that sound science prevails, disruptions in the marketplace are minimized, and confidence in the process is restored for all stakeholders.

A REVIEW OF THE MARGIN OF SAFETY FOR IN-MARKET LUMBER¹

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December 2011

Abstract

Proposed design value changes for visually graded Southern Pine dimension lumber raised the question of whether the observed 25-30% reduction warrants immediate change. Or, since the proposed changes are based on testing only No.2 2x4s, is there time to complete the full test matrix as stipulated by ASTM D1990 before establishing new design values across multiple grades and sizes? This paper summarizes a review of the safety factors built into the establishment of design values, the inherent conservatism in the design of conventional light-frame wood structures, and the comparison of two Southern Pine lumber datasets. The results show that, while design values may ultimately be adjusted, a margin of safety exists for in-market lumber such that existing or in-progress structures do not need re-evaluation. Subsequently, there is no compelling reason to rush to publish interim design values prior to completion of the remaining testing of additional grades and sizes.

Introduction

One overarching goal remains constant throughout the wood construction supply chain – to provide a product that performs in a safe and reliable manner when used as intended. This goal is the same whether it is a producer sending lumber to a dealer, a component manufacturer shipping wall panels and/or trusses to a contractor, or a builder handing keys to a new homeowner. Various codes and standards provide a regulatory framework to facilitate an orderly execution of the process along each step in the path to a finished structure. On October 6, 2011, the Southern Pine Inspection Bureau (SPIB) announced proposed design values approximately 25-30% lower than current design values, creating uncertainty throughout the supply chain. The uncertainty increased with the possibility that the proposed design values

¹ This paper was prepared in consideration of the Southern Pine Inspection Bureau's proposed design values and is in no part an argument for reducing the existing safety buffer intrinsic to light-frame wood construction.

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could become effective upon approval of the Board of Review of the American Lumber Standard Committee (ALSC) at their October 20, 2011 meeting, providing very little time for the supply chain to prepare for the changes. Fortunately, the ALSC Board of Review announced a second hearing on January 5, 2012 to provide the opportunity for comment on the SPIB submission.

A *Southern Pine Design Value Forum* was subsequently held in Atlanta on November 15-16, 2011. The forum provided an opportunity for Southern Pine lumber producers, component manufacturers, builders and others to come together regarding SPIB's proposed design values. A primary topic discussed was whether the design value change proposed by SPIB poses a level of concern to warrant implementation of new design values before completion of the full In-Grade test program consisting of multiple grades and sizes as required by the governing standard, ASTM D1990 (ASTM, 2010). A general consensus of the forum participants was that there is a series of redundancies and conservatism built into the design of light-frame wood construction to support the concept that there is not a product defect or safety issue for existing houses or projects in process. A task group was formed with the goal of documenting the underlying statistics behind establishing lumber design values and the inherent conservatism in the design of light-frame wood construction. In addition, the task group was charged with conducting a practical review of test data from only on-grade lumber selected in accordance with the governing standard and a separate study of lumber selected from the stream of commerce. While it is also recognized that conservatism exists in the process for determining the loads designers apply to structures, that discussion is beyond the scope of this paper.

Establishing Design Values

For decades, lumber design values have been established based on a near-minimum, determined as the 5th percentile with a 75% confidence level. As Vogt (2007) summarized in his discussion of lumber design values, using a near-minimum value ensures that the vast majority of the pieces used will exhibit a higher strength property than what has been assigned. Hoyle and Woeste (1989) provided a detailed discussion about establishing design values, and explained that the 5th percentile is then further reduced by a property adjustment factor made up of two components: (1) an adjustment to account for the time dependent strength of wood to convert from the test duration to the reference benchmark of 10 years used in wood design, and (2) an adjustment to account for several miscellaneous effects associated with manufacture and use which is often simply referred to as a safety factor. In the case of both bending and tension stresses, the factors are 1.6 and 1.3, respectively, which combined result in a property reduction factor of 2.1 (1.6*1.3) as shown in ASTM D1990, Table 2. The result of the 5th percentile value divided by the property reduction factor is a reference design value for use in Allowable Stress Design.

Madsen (1978) stated the factor of safety is somewhat obscure in assigning lumber design values and that, due to the conservatism in assessing individual factors used in deriving allowable stresses, the true factor of safety for wood is probably in excess of 1.6. While it may not be reasonable to assume that the entire 1.6 factor of safety suggested by Madsen exists, at a minimum the commonly stated factor of 1.3 is an indicator of a degree of conservatism built into the design values.

Figure 1 is a histogram of the No.2 2x4 Modulus of Rupture (MOR) data from SPIB’s recent bending tests (SPIB, 2011) adjusted per ASTM D1990. This figure illustrates the relationship between the average (10-minute test basis), 5th percentile (10-minute test basis), and reference design value (adjusted to 10-year duration).

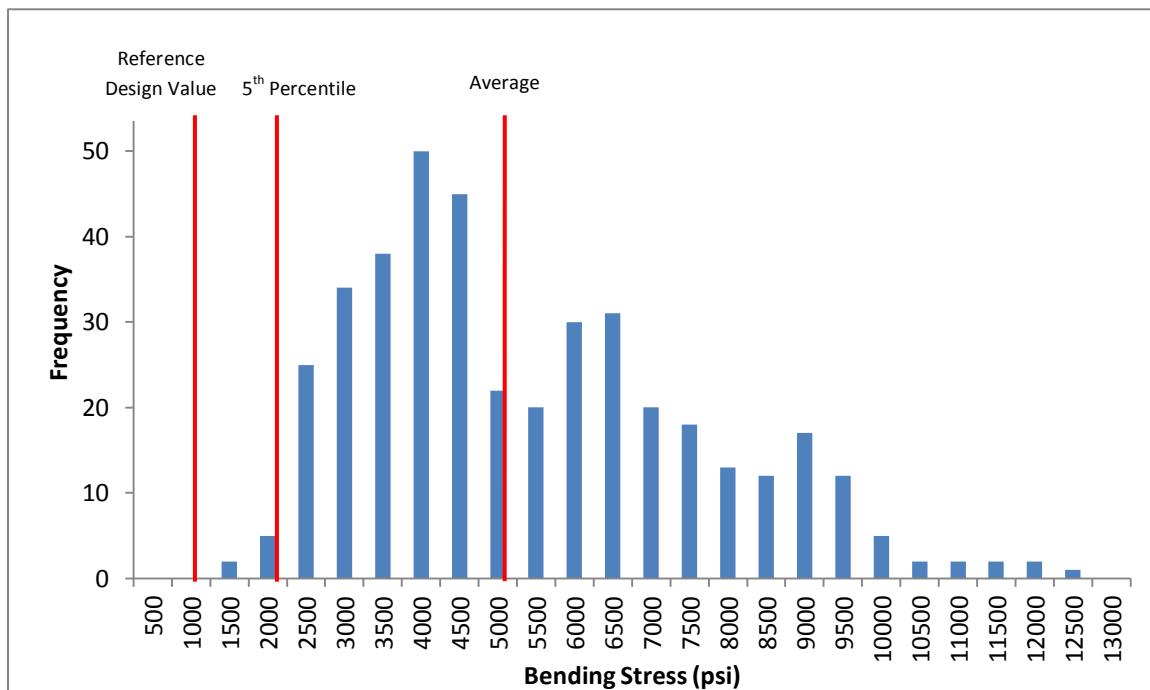


Figure 1: Relationship between the average, 5th percentile and design value for adjusted SPIB No.2 2x4 MOR data

Designing Light-Frame Wood Construction

The design process for conventional light-frame wood structures is also inherently conservative. As Galligan et. al. (1980) noted, the reliability of wood construction has withstood the test of in-service performance. Houses in the U.S. have been built using similar practices for nearly 100 years. Light-frame wood structures are built with multiple smaller members and possess some degree of redundancy. Testing conducted in the 1970's (Goodman et. al. 1974, Polensek and Atherton 1976, Tuomi and McCutcheon 1975) on full-scale houses showed they are generally overdesigned. Further, as Hoyle and Woeste (1989) suggested, the designer does not account for the benefits of joint rigidity in most applications as revealed in full-scale testing where real performance is far above calculated performance. Hoyle and Woeste estimated the amount of wood in structures could be reduced by 20-30% if design provisions were updated to account for such factors.

Because of the complexity of system design, the engineering community simplifies the design process. Structural components such as floor joists and roof trusses are generally designed as independent elements, but then installed and used in floor and roof assemblies. Gupta et. al. (2004) suggested there can be as much as 40% more capacity than single-element design predicts. Based on contemporary full-scale testing (e.g. References 5, 10, 13, 14, 24, 26-29), single-element design is conservative and cannot account for load-path interactions that take place in a real structure. For example, the partial composite action provided by floor and roof sheathing and gypsum board ceilings is not fully utilized in the design of lumber floor and roof assemblies. Inherent in this simplified approach is residual load-carrying capacity that is not fully utilized in the design process.

For more than 50 years, engineers and researchers have recognized and contemplated how to account for the higher performance observed for an assembly of components than predicted by the summation of the individual components. Starting as early as the late 1950's, Wood (1957) and May (1960) stated that lumber used as repetitive elements (such as joists, rafters and studs), had a performance level such that if a piece failed it was probable that the failure would go unnoticed throughout the life of the building and that a serious collapse or endangerment of human life was certainly not anticipated. This has proven to be the case in many structures where HVAC installers, plumbers and electricians cut truss members completely out during installation only to be found much later and then repaired.

Understanding full-system performance is complicated due to the interactions of a wide variety of components that add strength and stiffness but are ignored in design. These elements include, but are not limited to, non-bearing interior walls, wall/ceiling corner connections, stairway framing, etc. As an example, in a 1965 report on the wood-frame house as a structural unit, the National Forest Products Association tested a full-scale house. The test resulted in average floor deflections ranging from 33% to 70% of anticipated levels, depending on the presence and location of partition walls unaccounted for in design. Zahn (1970) investigated the strength of multiple-member structures, stating wood-frame structures are designed assuming a

structure's entire capacity is governed by the strength of its weakest member. The extra strength of other members, which may be several times stronger than the weakest due to the variability of wood, is effectively wasted and unaccounted for in design. There are numerous additional papers where load-sharing effects have been discussed or documented (e.g. References 3-6, 9, 13-15, 18, 19, 24).

Due to the complexity, design procedures for light-frame wood construction have yet to recognize their full benefits and remain conservative today. For example, the 2012 *National Design Specification for Wood Construction* (AWC, 2011) permits a simple repetitive-member increase of 15% for three or more members connected by a load-distributing element, but research suggests that even that number is conservative. Studies by Rosowsky and Ellingwood (1991) indicate the repetitive-member increase for Southern Pine assemblies may be as high as 30%. Among other factors, this system effect is a function of the ratio of the mean MOR (Modulus of Rupture) to the 5% characteristic MOR, and the ratio of the mean MOR to the design bending stress. These ratios for the current SPIB data are similar to those in the Rosowsky/Ellingwood study.

In summary, the preceding discussion documents numerous effects that increase the in-situ performance and safety of light-frame wood structures. These effects go unaccounted for in design, but should not go unrecognized by those evaluating the timeline and impacts of proposed design value changes.

Comparing Datasets

Two recent Southern Pine datasets have become publically available for comparison: the first where only on-grade lumber was sampled and tested by SPIB and Timber Products Inspection (TP) for the sole purpose of establishing design values per ASTM D1990; and the second where graded lumber from the stream of commerce was sampled and tested by Mississippi State University (MSU).

It is important to understand what this recent data collected on Southern Pine No.2 2x4s tells us. At the most basic level, the concerns can be framed in the context of how the as-tested pieces performed with respect to the existing design values independent of all adjustments used in the standardized process for determining new design values. That is, if one were to take a reasonably large sample of lumber and break it, how does the resulting distribution compare to the design value assigned to the grade?

SPIB Bending Test Data

For the first dataset, SPIB tested 408 pieces in bending. Figure 2 illustrates important points overlaid on a histogram of the unadjusted Modulus of Rupture (MOR) data. While SPIB's proposed bending design value derived from this dataset is about 30% lower than the current bending design value of 1500 psi, the figure clearly shows that none of the 408 pieces failed below 1500 psi. Continuing with additional comparisons, approximately 10% of the pieces fell below the In-Grade test MOR of 3150 psi (1500×2.1). By definition of a 5th percentile, 5% of the pieces are already expected to fall below 3150 psi; thus an additional 5% of the pieces fell below the results from the In-Grade sample. If the 1.6 duration-of-load adjustment is applied to the 1500 psi bending design value for a comparison at a 10-minute duration, 12 of the 408 pieces (3%) failed below 2400 psi (1500×1.6), which still includes a 1.3 factor of safety ($3150 / 1.3 = 2400$). Further, the vast majority of the sample tested well above this threshold. For example, 85% of the sample tested greater than 1.5 times 2400 psi, while 60% tested higher than 2.0 times that value.

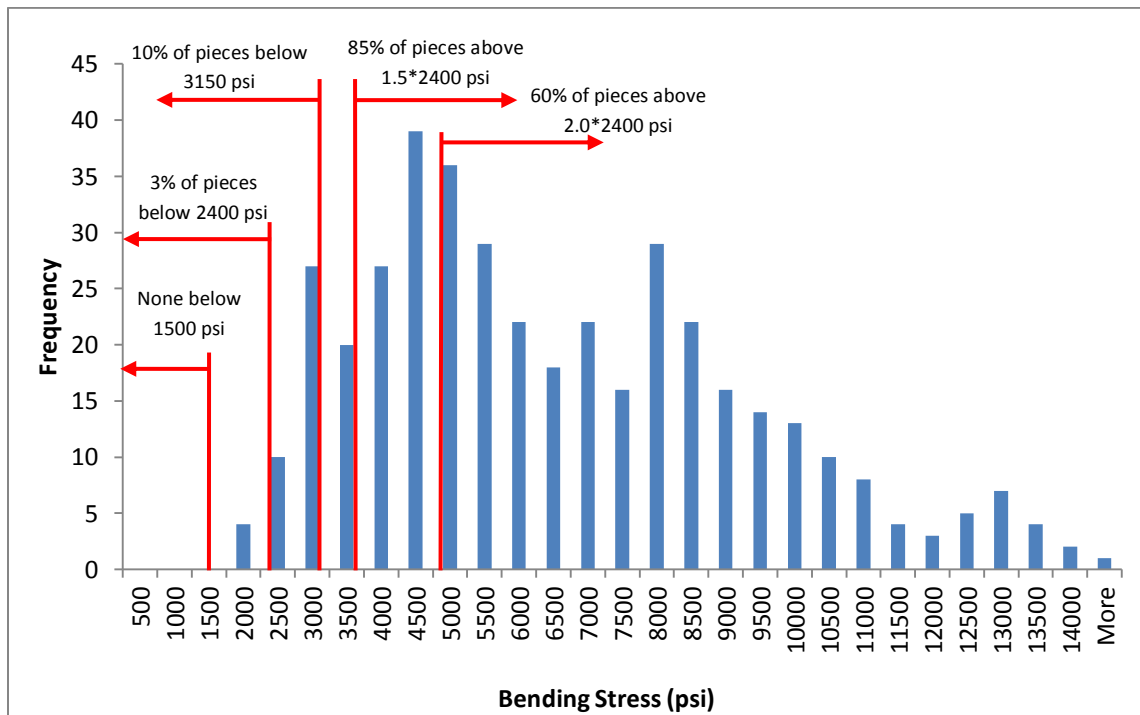


Figure 2: Relationships between various stress levels for unadjusted SPIB No.2 2x4 MOR data

SPIB Tension Test Data

In cooperation with SPIB, Timber Products Inspection tested an additional 410 pieces of No.2 2x4s in tension. Figure 3 illustrates important points overlaid on a histogram of the unadjusted Ultimate Tensile Strength (UTS) data. While SPIB's proposed tension design value derived from this dataset is about 20% lower than the current tension design value of 825 psi, the figure shows that only one of the 410 pieces failed below 825 psi. Continuing with additional comparisons, approximately 12% of the pieces fell below the In-Grade test UTS of 1733 psi (825×2.1). Again, by definition of a 5th percentile, 5% of the pieces are already expected to fall below 1733 psi; thus an additional 7% of the pieces fell below the results from the In-Grade sample. If the 1.6 duration-of-load adjustment is applied to the 825 psi tension design value for a comparison at a 10-minute duration, 11 of 410 pieces (<3%) failed below 1320 psi (825×1.6), which still includes a 1.3 factor of safety. Further, the vast majority of the sample tested well above this threshold. For example, 79% of the sample tested greater than 1.5 times 1320 psi, while 60% tested higher than 2.0 times that value.

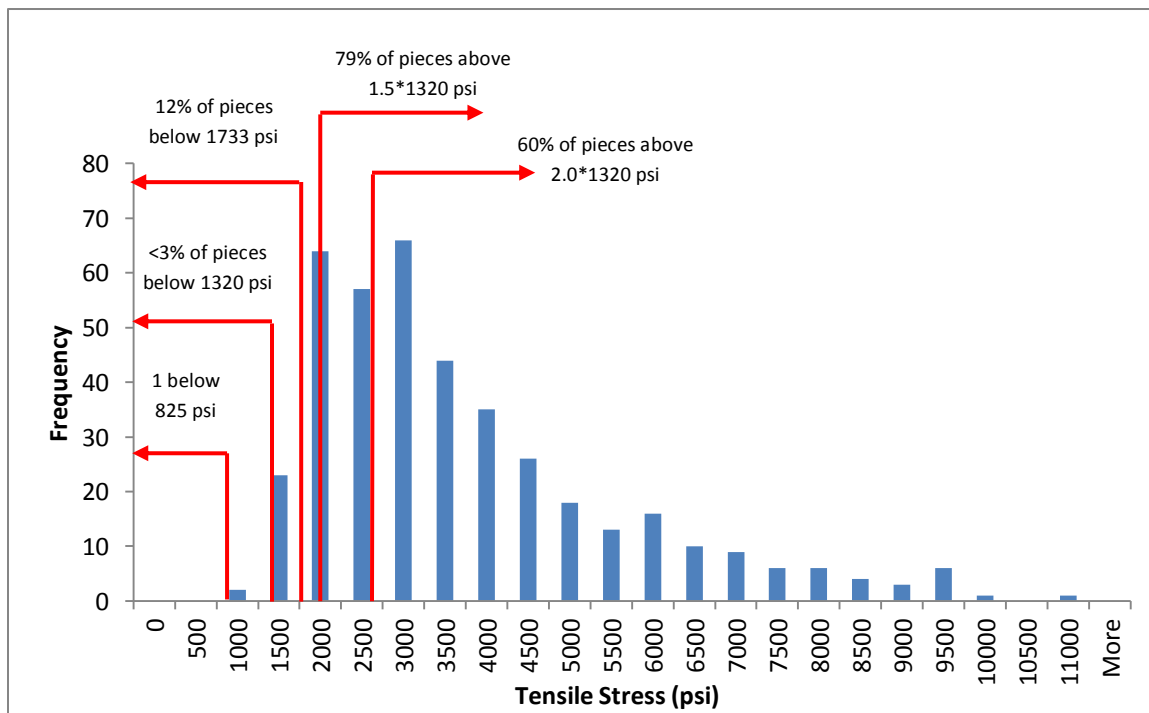


Figure 3: Relationships between various stress levels and unadjusted SPIB No.2 2x4 UTS data

While at first glance any samples failing below the design level may be concerning, it is important to consider that grading of lumber cannot be considered an exact science. Visual grading is based on a visual inspection of each piece and the judgment of the grader. The *American Softwood Lumber Standard, PS-20*, establishes a maximum of 5 percent below grade material as the tolerance allowed between graders (NIST, 2010). In theory, for the sample sizes tested, up to 20 pieces could be of a grade below the grademark and still deemed acceptable for use as on-grade material. As such, the population tested falls within an accepted range of material.

To comply with ASTM D1990, SPIB collected a sample of only on-grade lumber. This means that each piece contained attributes that met the No.2 grade, but specifically excluded any above-grade or below-grade pieces. The sample is technically correct in that it represents the potential for lumber packs if all pieces were exactly within the grade rule, but is likely conservative with respect to the quality and/or performance level of the typical pack of lumber in the market.

MSU Bending Test Data

Because lumber is bought and sold in packaged units, a separate study by Mississippi State University (MSU) sampled unitized packages as-graded following ASTM D2915 guidance: *“When trying to characterize how a certain population of lumber may perform in a structure, it may be deemed more appropriate to choose a sample unit, such as a package, that is more representative of how the lumber will be selected for use.”* Prior to testing, all lumber was graded by SPIB- or TP-certified mill graders to assure it met (or exceeded) the No.2 grade. It is possible, however, that this lumber included up to a maximum of 5 percent below grade material as the tolerance allowed between graders. It is also possible that some of the material was grademarked as No.2, but could have met a higher grade.

MSU's sampling of lumber from the stream of commerce yields considerably different results than SPIB's sampling of only on-grade material. In the MSU study, 744 pieces of No.2 2x4 lumber were tested in bending. After adjustments according to ASTM D1990, the 5th percentile divided by 2.1 was 1305 psi. The histogram shown in Figure 4 provides the distribution of MOR values from MSU testing. Compared to the SPIB data, the range (lowest to highest) is larger for the MSU data. This suggests that MSU sampled a greater diversity of lumber within the No.2 population compared to SPIB. Also, the average, 5th percentile, and 5th percentile divided by the 2.1 property adjustment factor is higher by approximately 1185 psi, 540 psi, and 255 psi, respectively, when compared to the SPIB data.

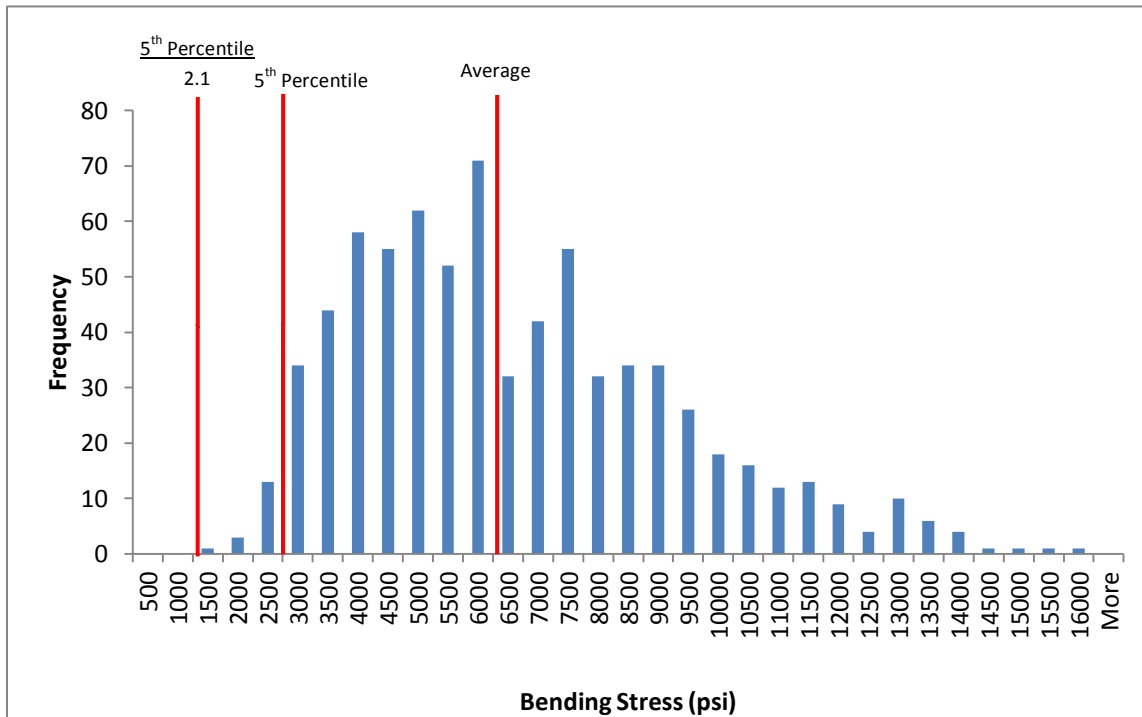


Figure 4: Relationship between the average, 5th percentile and design value for adjusted MSU No.2 2x4 MOR data

Figure 5 illustrates important points overlaid on a histogram of the unadjusted MOR data from MSU. Making the same comparisons as presented for the SPIB bending data, one piece failed at a stress lower than the 1500 psi established for design. Continuing with additional comparisons, approximately 6% of the pieces fell below the In-Grade test MOR of 3150 psi. As discussed previously, 5% of the pieces are expected to fall below 3150 psi; thus, for the MSU data, only 1% of the pieces fell below the results from the In-Grade sample. If the 1.6 duration of load adjustment is applied for a comparison at a 10-minute duration, six of the 744 pieces (< 1%) failed below 2400 psi, which still includes a 1.3 factor of safety ($3150/2.1=2400$). Further, nearly all of the pieces tested above this threshold. For example, 91% were greater than 1.5 times 2400 psi and 74% tested higher than 2.0 times that value.

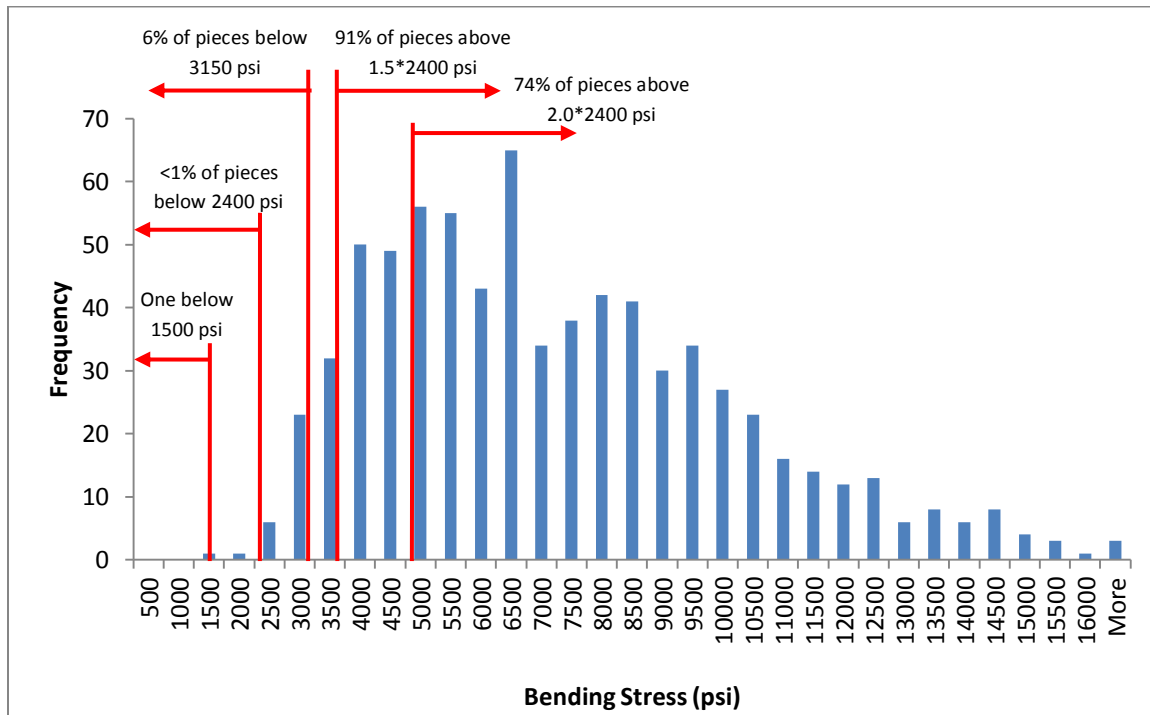


Figure 5: Relationships between various stress levels for unadjusted MSU No.2 2x4 MOR data

A review of the data available indicates that, when the effects of various modeling adjustments to standard conditions are set aside, a vast majority of the tested pieces from the on-grade SPIB sample were stronger than the currently established design value with the 1.3 factor of safety still maintained. Furthermore, virtually the entire population of pieces sampled from the stream of commerce tested above the design value.

Conclusion

Light-frame wood construction has a long history of reliable in-service performance. The preceding discussion documents numerous examples of the inherent conservatism built into each step of the design process on the resistance side of the design equation. This conservatism, combined with the inherent conservatism built into the process for determining the loads designers apply to structures, contribute to that successful performance and result in a system where the minimum margin of safety may still be somewhat greater than expected despite any potential Southern Pine resource changes. Based on these facts and review of the SPIB and MSU data presented, it is clear that an adequate margin of safety exists with in-market lumber such that existing or in-progress structures do not need reevaluation nor should there be any barriers to completion of the full ASTM D 1990-mandated test program prior to proposing revised design values for consideration by the ALSC Board of Review.

References

- 1) American Society for Testing and Materials.(2010). "Standard practice for establishing allowable properties for visually graded dimension lumber from in-grade tests of full-size specimens. " ASTM D1990. ASTM, Philadelphia, PA.
- 2) American Wood Council (2011). *2012 National Design Specification for Wood Construction*. AWC, Washington DC.
- 3) Bonnicksen, L.W., and Suddarth, S.K. (1965). "Structural Reliability Analysis of Wood Load Sharing Systems." Paper No. 82, ASTM Fifth National Meeting, Philadelphia, PA.
- 4) Douglas, B.K., and Line, P. (1996). "System effects in wood assemblies." Proceedings of the International Wood Engineering Conference, New Orleans, LA.
- 5) Dung, D. (1999). "A practical approach to analyze the system effects of a metal-plate-connected wood truss assembly." MS thesis, Oregon State Univ., Corvallis, OR.
- 6) Forest Products Research Society. (1983). "Wall & floor systems: design and performance of light-frame structures." Proceedings 7313 Forest Products Research Society, Madison, WI.
- 7) Hoyle, R.J., and Woeste, F.E. (1989). *Wood Technology in the Design of Structures* (5th ed.). Iowa State Univ. Press, Ames, IA.
- 8) Galligan, W.L., Green, D.W., Gromala, D.S., and Haskell, J.H. (1980). "Evaluation of lumber properties in the United States and their application to structural research." *Forest Prod. J.*, 30(10): 45-50.
- 9) Goodman, J.R., Criswell, M.E., and Bodig, J. (1974). "A rational analysis of wood joist housing floor systems." Final rept. Natl. Sci. Found. Grant GK-30853. Colorado State Univ. Fort Collins, CO.
- 10) Gupta R, Miller T.H. & Dung, D. (2004). "Practical solution to wood truss assembly design problems." *ASCE Practice Periodical on Structural Design and Construction*, Vol. 9(1): 54–60.
- 11) Madsen, B. (1978). "In-grade testing: problem analysis." *Forest Prod. J.*, 28(4): 42-50.
- 12) May, T.M. (1960). "Determining the useful strength of yard lumber of the common grades." ASTM special tech pub No.282 *Papers on building constructions*. ASTM, Philadelphia, PA.
- 13) Mtenga, P. V. (1998). "Impact of using a system factor in the design of light-frame roof assemblies." *Forest Products J.*, 48(5): 27–34.
- 14) Mtenga, P. V., Cramer, S. M., Peyrot, A. H., and Wolfe, R. W. (1995). "System factors for light-frame wood truss assemblies." *J. Struct. Eng.*, 121(2): 290–300.
- 15) National Association of Home Builders Research Foundation. (1974). "Stress and deflection reduction in 2x4 studs spaced 24 inches on center due to the addition of interior and exterior surfacings." NAHB Research Foundation, Rockville, MD.
- 16) National Forest Products Association (1965). "The wood-frame house as a structural unit." National Forest Products Association, Washington, DC.

- 17) National Institute of Standards and Technology. (2010). *Voluntary Product Standard PS 20 American Softwood Lumber Standard*. U.S. Government Printing Office, Washington DC.
- 18) Philpot, T. A., Rosowsky, D. V., and Fridley, K. J. (1995). "Reliability of wood joist floor systems with creep." *J. Struct. Eng.*, 121(6): 946–954.
- 19) Polensek, A. (1976). "Rational Design Procedure for Wood-Stud Walls Under Bending and Compression Loads," *Wood Science*, Vol. 9, No. 1: 8–10.
- 20) Polensek, A., and Atherton, G.H., (1976). "Compression-bending strength and stiffness of walls with utility grade studs." *Forest Prod. J.* 26(11): 17-25.
- 21) Rosowsky, D. V., and Ellingwood, B. R. (1991). "System reliability and load-sharing effect in light-frame wood construction." *J. Struct. Eng.*, 117(4): 1096–1114.
- 22) SPIB (2011). "Submission of revised design values for visually graded southern pine dimension lumber." Unpublished technical paper.
- 23) Tuomi, R.L., and McCutcheon, W.J. (1975). "Conventional house challenges simulated forces of nature." *Forest Prod. J.* 25(6): 13-20.
- 24) Varoglu, E. (1985) "Structural analysis of trusses and truss systems." *Research Rep.*, Forintek Canada, Vancouver, Canada.
- 25) Vogt, J. (2007). "The 5 Percents of Lumber." *Structural Building Components Magazine*, Dec., 36-39.
- 26) Wolfe, R. W. (1990). "Performance of light-frame redundant assemblies." *Proc., 1990 Int. Timber Engineering Conf.*, 1: 124–131.
- 27) Wolfe, R. W., and LaBissoniere, T. (1991). "Structural performance of light-frame roof assemblies. II. Conventional truss assemblies." *Research Paper FPL-RP-499*, U.S. Dept. of Agriculture, Madison, WI.
- 28) Wolfe, R. W., and McCarthy, M. (1989). "Structural performance of light-frame roof assemblies. I: Truss assemblies designed for high variability and wood failure." *Research Paper FPL-RP-492*, U.S. Dept. of Agriculture, Madison, WI.
- 29) Wolfe, R. W., Percival, D. H., and Moody, R. C. (1986). "Strength and stiffness of light-frame sloped trusses." *Research Paper FPL 471*, U.S. Dept. of Agriculture, Madison, WI.
- 30) Wood, L.W. (1957). "Strength qualities of dimension lumber." ASTM special tech pub No.209 *Design and tests of building structures: symposiums on seismic and shock loading glued laminated and other constructions*. ASTM, Philadelphia, PA.
- 31) Zahn, J. J. (1970). "Strength of multiple-member structures." *Research Paper FPL 139*, U.S. Dept. of Agriculture, Madison, WI.

PROPOSED PROCESS FOR EVALUATING EXISTING DESIGN VALUES

December 2011

Introduction

A *Southern Pine Design Value Forum* was held in Atlanta on November 15-16, 2011. The forum provided an opportunity for Southern Pine lumber producers, component manufacturers, builders and others to come together regarding SPIB's proposed design values. This task group¹ was established to "provide guidance about what the implementation process should be for current and future proposed changes to design values." The task group developed a process that would be applicable to existing design values, recognizing design values for new species may be afforded a more expedited process.

The goal of the proposed process is to create certainty, transparency, and opportunity for public deliberation where changes are proposed for existing design values. The task group believes the proposal leaves unharmed the important roles and responsibilities of both the Board of Review (BOR) of the American Lumber Standard Committee (ALSC) and the rules-writing agencies, such as the Southern Pine Inspection Bureau (SPIB).

The proposed process for existing design value changes describes the points most in need of transparency and deliberation: the sampling & testing plan; the proposed design values; and, the grading rule supplement with design values. The steps are designated as:

- 1) Approval of Sampling & Testing Plan
- 2) Acceptance of Proposed Design Values Pending Approval of Grading Rule Supplement
- 3) Approval of Proposed Grading Rule Supplement

Each step requires that notice be given to stakeholders, and each step requires all materials be made available to stakeholders and other interested parties. Each step also includes a comment period and creates a decision loop whereby the ALSC Board of Review either accepts a proposal or returns it with substantial comments to a rules-writing agency based on comments from stakeholders and other input.

In the case of Step 2, in review of the test data and proposed design value changes, and all comments received during the 60-day comment period, the BOR would take not less than 30 days to fully consider

¹ This task group included Task Group Leader Frank Moore with NLBMDA, Clayton Traylor with Leading Builders of America, Ed Sutton with NAHB, Steve Stroder with Pro-Build/SBCA, Steven Spradlin with Capital Structures, Neal Shunk with Weyerhaeuser, James Travis with Travis Lumber, Kerlin Drake with Anthony Forest Products and Cathy Kaake with SFPA. This report represents the collective consensus of the task group, but may not represent an individual member's point of view.

all comments and recommendations. In all three steps, it is the rules-writing agency that initiates the process. In all three steps, it is also the BOR that creates a transparent and deliberative process.

The task group determined the current Southern Pine deliberations best fit in Step 2 of the proposed process. The announced January 5, 2012 meeting of the Board of Review would represent the meeting set after the initial 60-day comment period. The BOR will use this meeting to receive additional comments and ask questions of stakeholder participants, including SPIB. The BOR would then determine if further comments are needed or whether it will begin its 30-day period of deliberation.

Proposed Process for Evaluating Existing Design Values

1. Approval of Sampling & Testing Plan

- Immediate notice to stakeholders² that a testing & sampling plan has been submitted to the Board of Review for approval

30 Days Prior to BOR Meeting

- Notice to stakeholders of BOR meeting to review proposed sampling & testing plan and hear comments from all interested parties
- All material is made available³ to stakeholders and other interested parties (including proposed sampling and testing plan, notices given and comments received)
- At such time that the BOR approves a plan, ALSC would provide immediate notice to stakeholders and make the final plan available to stakeholders and other interested parties

2. Acceptance of Proposed Design Values Pending Approval of Grading Rule Supplement

- Immediate notice to stakeholders that proposed design value changes have been submitted to the BOR for acceptance pending approval of grading rule supplement

60 Days prior to BOR Meeting or Deadline for Written Comments

- Notice to stakeholders of BOR meeting to review proposed design values and hear comments from all interested parties

² The ALSC will develop a system to allow interested parties from the general public to receive notices of public hearings and related materials.

³ The ALSC will develop the capabilities to post all materials, plans, proposals, comments and other pertinent data and information on a designated location on its website.

- All material is made available to stakeholders and other interested parties (including proposed design value changes, test results, and all supporting materials, notices given and comments received)

30-Day Review Period for BOR to consider public comments

- If, after the 30 days, the BOR accepts proposed design values pending approval of the grading rule supplement, it would provide immediate notice to stakeholders and make the final proposed design values pending approval of the grading rule supplement available to stakeholders and other interested parties.

3. Approval of Grading Rule Supplement with Design Values

- Immediate notice to stakeholders that the proposed final text for design value changes has been submitted to the BOR for approval

90 Days Prior to BOR Meeting

- Notice to stakeholders of BOR meeting to vote of the final text submitted to the BOR
- Proposed grading rule supplement with design values (including specific text and tables for new design values, notices given, and comments received) is made available to stakeholders and other interested parties

Narrative

Sampling and testing plans

Upon submission of a sampling & testing plan by a rules-writing agency to the Board of Review, the BOR will immediately notify all identified stakeholders it is in receipt of such plan. The BOR will make the plan and relevant materials available to stakeholders and interested parties by posting materials to a designated page on its website.

The BOR will schedule a public meeting where interested parties may present comments. The BOR will also provide for the filing of written comments. To provide adequate time for public review and comments, notice of the meeting must be given and all relevant material must be made available at least 30 days before the public meeting. The BOR should give due consideration of these comments and either refer back to the rules-writing agency with recommendations and concerns or approve the plan as submitted.

Where the BOR refers a plan back to a rules-writing agency with substantive recommendations or concerns, upon submission of a revised plan by the agency to the Board, the process of consideration

will begin anew with notification, posting of material, scheduled meeting and comment period. The process would not be expected to begin anew where only editorial revisions were required.

At such time the BOR approves a plan, ALSC will provide immediate notice to stakeholders and make the approved plan available to stakeholders and other interested parties.

Test results and proposed design value changes

Upon submission of any test results and proposed design value changes by a rules-writing agency to the Board of Review, the BOR will immediately notify all identified stakeholders that it is in receipt of such testing results and proposal. The BOR will make such results and proposal available to all stakeholders and interested parties by posting all material to a designated page on its website.

The BOR will schedule a public meeting where interested parties may present comments. The Board will also provide for the filing of written comments. To provide adequate time for public review and comments, notice of the meeting must be given and all relevant material must be made available at least 60 days before the public meeting. The BOR should give due consideration of these comments and either 1) refer back to the rules-writing agency with recommendations or concerns regarding the testing or the proposed design value changes, or 2) accept the proposed design values as submitted pending approval of the grading rule supplement, and request that the rules-writing agency submit a grading rule supplement with the design values and final proposed text as it would be published by the rules-writing agency if approved by the BOR.

Where the BOR refers a plan back to a rules-writing agency, upon submission of additional testing results and/or revised proposed design values by the agency to the BOR, the process of consideration will begin anew, with the specified notification, posting of material, scheduled meeting and comment period.

At such time the BOR accepts proposed design values pending approval of the grading rule supplement, ALSC will provide immediate notice to stakeholders and make the final proposed design values pending approval of the grading rule supplement available to stakeholders and other interested parties.

Proposed grading rule supplement with design values

Upon submission of the proposed grading rule supplement by the rules-writing agency to the Board, the Board will immediately notify all identified stakeholders that it is in receipt of such final proposed text. The Board will make such text and any other relevant material available to all stakeholders and interested parties by posting all material to a designated page on its website.

The Board will schedule (**not less than 90 days** from the time it makes the proposed grading rule supplement available to the general public), a public meeting where it will consider and vote on the grading rule supplement as submitted. During this time period, the general public may file comments and concerns with the Board, which the Board will make available by posting to its website and take into consideration prior to its vote.

The Board should give due consideration of these comments and either 1) refer back to the rules-writing agency with recommendations or concerns regarding the proposed grading rule supplement, or 2) approve the grading rule supplement as submitted.

At such time that the BOR approves the grading rule supplement, it would provide immediate notice to stakeholders and make the final grading rule supplement available to stakeholders and other interested parties.

Rationale

A standardized process known to all participants and stakeholders is proposed for any evaluation of existing design values. Because the potential impact on existing lumber products and their applications is greatest where design values are already established, this process is not suggested for the development of new design values. Similarly, if at any point in the process a life-safety issue is identified, the BOR could expedite the process to address that specific issue.

The proposed process balances 1) the need for a transparent opportunity for stakeholder involvement and collaborative deliberation with 2) the desire to allow for the timely and efficient evaluation of existing design values. The proposal establishes opportunities for review and deliberation around proposed sampling and testing plans, test results and proposed changes to existing design values. It also provides for adequate public notice of a final proposed text (as it would be published in a grading rule supplement by the rules-writing agency) that the BOR will vote on.⁴ This would significantly reduce avoidable adverse impacts on the marketplace while allowing for all necessary design value changes to be made and published.⁵

The deliberative process proposed establishes a minimum period for public review, first of proposed sampling and testing plan and second of any proposed design value changes, based on published test results. However, the process in no way interferes with the BOR's authority to approve or not approve any proposal submitted to it by a rules-writing agency.

The process also provides for, but does not require in every instance, that the BOR will return a proposal to a rules-writing agency for further consideration, with specific recommendations and concerns. The

⁴ This is consistent with the theme that emerged from the *Southern Pine Design Value Forum*, November 15 and 16 in Atlanta: "There needs to be a change management process similar to other building code design change processes, whereby 1) the change is announced followed by 2) a comment period then 3) an implementation period prior to 4) the effective date (the exception would be in the case of a product defect). An orderly implementation will build confidence in future changes and reduce the concerns and claims regarding inventory devaluation and in-process work". See *Minutes: Southern Pine Design Value Forum, November 15-16, 2011, Sheraton Gateway Hotel Atlanta Airport*.

⁵ It was noted at the *Southern Pine Design Value Forum*, November 15 and 16 in Atlanta, that evaluations could be timed to coincide, where possible, with code updates and developments. This emerged as a theme: "Preferably all species would be changed at the same time to create a fair competitive environment." See *Minutes: Southern Pine Design Value Forum, November 15-16, 2011, Sheraton Gateway Hotel Atlanta Airport*.

public comment period is intended to assist the BOR in the important aspect of the process. To create public confidence in the process, the BOR would allow at least 60 days for stakeholders and interested parties to review and comment on proposed changes to existing design values, and at least 30 days to consider such comments before making any decisions. Nothing in the proposed process is intended to weaken the respective authorities and duties of the BOR and rules-writing agency. Ultimately, the rules-writing agency may propose and eventually publish its revised design values (in the form of the grading rule supplement), and the BOR may consider a proposed grading rule supplement, returning it for further consideration or approving it as proposed or as modified by the rules-writing agency.

The public notice of a final proposed change in design values is consistent with established rulemaking procedures and adheres to the current Administration's call for openness and transparency. It provides for an effective 90-day period before BOR approval and subsequent publication by the rules-writing agency. (The proposed process anticipates in Step 3 that the rules-writing agency will submit a proposed grading rule supplement, with design values previously accepted pending approval of the supplement.) The proposed process establishes certainty for all participants and stakeholders as to what the actual text of the grading rule supplement, and it allows those involved to determine if the final text is consistent with recommendations, comments, and proposals established above. It is anticipated that this 90-day period will also provide a final opportunity for stakeholders to provide comments to the BOR before its actual vote.

Task Group Determination: Status of Southern Pine in Proposed Process for Evaluating Existing Design Values

In addition to the charge to develop a proposed process for the evaluation of design values, the Task Group was directed to determine where the Southern Pine design value evaluation fell within that proposed process.⁶

The Task Group has developed a three-step process: 1) Approval of Sampling & Testing Plans; 2) Acceptance of Proposed Design Values Pending Approval of the Grading Rule Supplement; and 3) Approval of the Proposed Grading Rule Supplement with Design Values.

The Task Group determined that immediate notice was never given to stakeholders that SPIB had submitted sampling and testing plans for Southern Pine to the Board of Review. It was determined that this is the case both for the No.2 2x4 sampling and testing that became the basis for the SPIB recommendations for design value changes, and for the testing plan that has been approved for the other dimensions and grades of Southern Pine and approved in executive session on October 20, 2011.

The Task Group discussed that No.2 2x4 Southern Pine could be considered to be in Step 2 of the proposed process.

⁶ The charge for Task Group 3 was: "The third task group will provide guidance about what the implementation process should be for current and future proposed changes to design values". See *Minutes: Southern Pine Design Value Forum, November 15-16, 2011, Sheraton Gateway Hotel Atlanta Airport*.

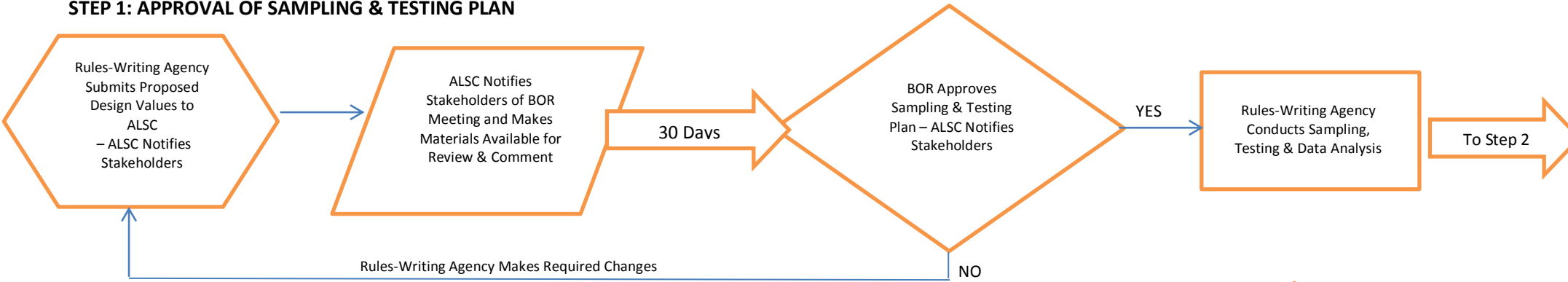
Given the fact that debate continues on the sampling and methodology used for the No.2 2x4, the Task Group determined that sampling, testing and evaluation of testing data for Southern Pine should be re-united into a single process, starting with a re-submission of a complete in-grade sampling and testing plan at Step 1 of the proposed process, or re-submission of proposed design values as supported by a complete in-grade testing regime.⁷

Acknowledging that the process to date regarding the sampling, testing, conclusions, extrapolations, and proposals for design values has failed, applying the proposed process to the current Southern Pine issue, the Board of Review would use its January 5, 2012 meeting to review comments and hear verbal presentations of interested stakeholders as described in Step 2, Acceptance of Proposed Design Values Pending Approval of the Grading Rule Supplement. At the conclusion of its January 5 meeting, or at the conclusion of the BOR's decision to accept additional written or verbal comments, the BOR would have not less than 30 days to consider all comments. The BOR would determine 1) if the proposed design values should be returned with recommendations informed by comments received, or 2) if the proposed design values should be accepted pending approval of the grading rule supplement.

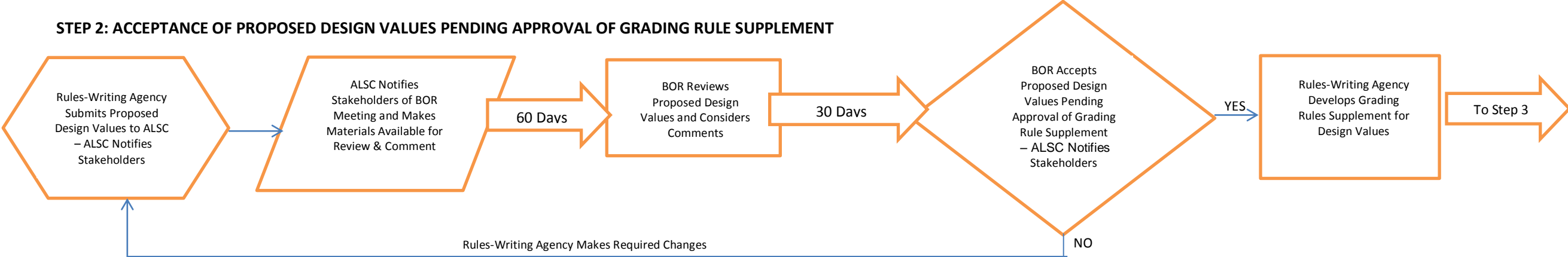
If the BOR returns the current proposal, any re-submission by SPIB would restart Step 2, where the BOR would immediately notify stakeholders a proposal has been received. If the BOR accepts the proposed design value changes, it would do so pending its approval of the grading rule supplement. That supplement, as described in Step 3, would be submitted by SPIB, whereupon the BOR would immediately provide notice to stakeholders. The BOR would make the proposed grading rule supplement with design values available to stakeholders and schedule a public meeting where it would vote to approve or return with recommendations. The meeting would not be scheduled earlier than 90 days after the proposed grading rule supplement was made available to stakeholders.

⁷ This is consistent with a theme that emerged at the *Southern Pine Design Value Forum*, November 15 and 16 in Atlanta: that there "needs to be only one change in design values; not one now and then another in six months. The full in-grade testing of all cells should be completed before changes are made. Multiple changes for one species in a short time erode public confidence and cause unnecessary, expensive design and implementation changes." See *Minutes: Southern Pine Design Value Forum, November 15-16, 2011, Sheraton Gateway Hotel Atlanta Airport*.

STEP 1: APPROVAL OF SAMPLING & TESTING PLAN



STEP 2: ACCEPTANCE OF PROPOSED DESIGN VALUES PENDING APPROVAL OF GRADING RULE SUPPLEMENT



STEP 3: APPROVAL OF GRADING RULE SUPPLEMENT WITH DESIGN VALUES

