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Southern Pine Lumber Design Value Restoration Conceptual Proposal

By the Lumber Design Value Task Group[1]

November 2011

Standard Visually Graded Lumber Production – Lumber Design Value Proposal

For those lumber manufacturers that desire to be primarily focused on general lumber production, the default lumber visual grading and subsequent lumber design value assignment could be as proposed by SPIB or as a change to the Mixed Southern Pine grade.

This results in design values as defined in SPIB's "Table 4 Southern Pine and Mixed Southern Pine Design Values" or as Mixed Southern Pine as found in Appendix A.

There is precedent for using Mixed Southern Pine based on Temple Inland's approach for their Rome Georgia mill as found in Appendix B.

Enhanced Visually Graded – Lumber Design Value Proposal

For those lumber manufacturers that desire to gain greater value with respect to the forest lands from which they are buying logs, it is proposed that these lumber manufacturers are allowed to take a visual grading and/or related quality control action(s) that will assure that they can obtain higher design values from their lumber resource through standard visual grading techniques.

The goal of this proposal is to allow a pathway that any lumber manufacturer can pursue through implementing a higher degree of visual grading quality control, where the purpose is to provide greater assurance that the lumber they are producing can achieve and maintain the current design values for Southern Pine as found in the current *SPIB 2002 Grading Rules for Southern Pine Lumber, Appendix A – Design Values* and as shown in the current *NDS Supplement* in Appendix C. This enhanced Visual Grading process, as outlined below, can take form of:

1. Use the current dense grade rule concepts to extract lumber that meets the current visual grading system.
    a. Dense has been defined as follows:

DENSE GRAIN: Requires 6 rings/inch & 1/3 summerwood or 4 rings/inch & 1/2 summerwood.
EXCEPTIONALLY LIGHT WEIGHT PIECES: Should not be placed in No.2N and higher grades (Exceptionally light weight pieces have less than 15% summerwood).

[1] A group of lumber mills represented by Gilbert Travis, Travis Lumber Company in Mansfield AR, Zach Lowe, CLW, Inc. in Cleveland, TX and a group of SBCA members led by Dan Holland, Clearspan Components, Meridian, MS, Scott Ward, Southern Components, Shreveport, LA and Steven Spradlin, Capital Structures, Fort Smith AR.

b. Modifications to this can be made to assure that lumber of the proper design values fits the current grading rules for:
    i. Dense SS, Dense #1 and Dense #2, or
    ii. SS, #1 and #2
c. Anything not meeting the regular SP grade classification system will fall into another grade category per the SPIB grade rules that will need to be written.
    i. Low strength material would be separated into a new grade, e,g, "Open Grain."

2. Strong consideration should be given to implementing some type of quality assurance program to confirm that the visual grading process is providing expected design values from the visual grading process being used.
    a. This can take any form that provides a higher degree of assurance and reliability of visually graded design properties, when compared to the Standard Visually Graded Lumber Production.
    b. Additional QC concepts that could be used include:
        i. More frequent double checks on the visual grading process to ensure that open grain and dense selections are being made reliably.
        ii. Periodic testing of visually graded material through some mechanical means (e.g., non-destructive MOE, simple non-destructive mechanical bending, etc.).
            1. Data can correlate to and confirm that the lumber design values as designed by the applied lumber grade-mark are accurate.
        iii. The lumber manufacturer will undertake _____ QA confirmation through _____ (QA means) on _____ (on what frequency seems reasonable) by grade and size produced_____ (for what period based on the QC frequency).

Mechanically Graded Lumber Production

A lumber manufacturer can use any of the available non-destructive MSR or MEL machines available to grade lumber. See Appendix D for the resulting design values that could be produced.

Goals and Objectives of the Foregoing Conceptual Proposal

1. Consumers of structural lumber are buying lumber design values to use in standard structural engineering equations to provide resistance to applied loads.
2. Suppliers of the lumber need to be supplying reliable lumber design values that can be used by lumber buyers as specified for load carrying end use applications as defined through traditional engineering oriented lumber associations (e.g. AWC, CWC, etc.).
3. We need to provide a common sense pathway for lumber manufacturers to be able to:
    a. Provide the market with confidence in the lumber design values they are providing.
    b. Use their timber resource to their market advantage based on the design property value that the logs they are buying provide.
4. It is important to consider as we go through this process that:
    a. Rather than eliminating density classification as has been proposed by SPIB, density classification should be required for all visually graded SYP.
    b. Full in-grade testing should be performed on all density classes of all sizes prior to any design value changes.
    c. This last point is reinforced by the highlighted section of SPIB's report below:

8.0 Dense Classifications for Southern Pine

When the original in-grade testing was used to develop design values, enough data existed to sort out those pieces that met the grading rule definition of "dense" lumber. Increase factors were calculated by comparing property estimates for the dense subsets to those of the unclassified data. Likewise, what was left over after the dense material was sorted out was, understandably, lower in strength than the unclassified data and reduction factors for nondense material were applied. At this point in time, there is not enough data to justify publishing separate design values for lumber visually graded as dense. Therefore, at least until more data can be collected, dense lumber will carry the same design values as the unclassified grades.

Next Steps

As of November 8, 2011, we believe with a reasonable degree of certainty, that the following concepts are currently being worked through:

1. A general agreement has been reached that developing an approach to define grade rules for lumber that would be classified as "Open Grain" has many positive attributes for the current conditions all collective lumber related industries find themselves in.
2. SPIB, Mississippi State University (maybe also Michigan Tech) and Timber Products Inspection are working on the grading rules that can be implemented inside the lumber manufacturing industry's current process and procedures.
3. The SPIB and Mississippi State data is being used to define the "Open Grain" grading process and presumably how this fits into the current Southern Pine and Mixed Southern Pine system.
4. A first cut "Open Grain" grading proposal will be provided for review and discussion at the forthcoming SFPA meeting in Atlanta, GA, November 15th and 16th.
    a. This will include the concepts surrounding the current Southern Pine and Mixed Southern Pine grades.
    b. It is expected that the Atlanta meeting will define the next steps needed to finalize a comprehensive proposal that can be positively embraced by SPIB and its process.
    c. Then additional meetings will be held based on this foundation, quickly, to finalize a revised or new SPIB approach to SP lumber design values.
5. Any agreement will need to be finalized and SPIB will need to get this approved through the SPIB process and then through ALSC.
6. There has been discussion regarding this grading procedure being an interim step in between the original testing that SPIB has already undertaken and a broader and more thorough in-grade testing program that would fill out the testing matrix much like was performed roughly 30 years ago.

There is a very positive development. We believe that all lumber related industries stand to benefit from collaboration. Finally it is clear to us that:

1. There is justifiable concern over the:
    a. Volume and value of "open grain" graded lumber on one side.
    b. Devaluation of lumber stock for a log resource that can produce regular SP design values on the other side.

2. We firmly believe that both sides of this equation can be winners. Here's how:
    a. If the Structural Building Components Industry has reliable lumber properties and good resulting real world performance, it can design structural building products and components using those properties.
    b. There is good value with lower design value lumber because in engineered applications there are many areas where the applied load resistance stresses needed are not high.
    c. Creative component manufacturers with strong engineering acumen will find ways to use any material that has sound properties and allows them to be as competitive as the market allows.
3. Finally the SBC industry believes that creative and innovative lumber producers have the opportunity to get closer to their end use customers and use this situation as incentive for positive change. This may result in many changes in the way lumber design values are assigned to meet specific general and proprietary needs in the market.
4. The opportunity available is significant, but it will require hard work and continued strong collaboration between the lumber industry and the SBC industry along with all our collaborative industries.

Appendix A

Table 4. Southern Pine and Mixed Southern Pine Design Values

MOE given in 10^6 psi
MOR, UTS, UCS given in psi.

Grade	Size	F_b	F_t	F_v	$F_{c\perp}$	$F_{c//}$	E
SS	2x4	2050	1250	175	565	1400	1.6
	2x6	1800	1100	175	565	1350	1.6
	2x8	1650	1000	175	565	1300	1.6
	2x10	1450	875	175	565	1250	1.6
	2x12	1350	825	175	565	1200	1.6
No.1	2x4	1300	800	175	565	1200	1.5
	2x6	1150	700	175	565	1150	1.5
	2x8	1050	650	175	565	1100	1.5
	2x10	925	575	175	565	1050	1.5
	2x12	875	525	175	565	1050	1.5
No.2	2x4	1050	650	175	565	1100	1.4
	2x6	925	575	175	565	1000	1.4
	2x8	850	525	175	565	975	1.4
	2x10	725	450	175	565	950	1.4
	2x12	700	425	175	565	925	1.4
No.3 & Stud	2x4	600	375	175	565	625	1.2
	2x6	525	325	175	565	600	1.2
	2x8	500	300	175	565	575	1.2
	2x10	425	275	175	565	550	1.2
	2x12	400	250	175	565	525	1.2
Construction	2x4	800	500	175	565	1150	1.3
Standard	2x4	450	275	175	565	950	1.2
Utility	2x4	200	125	175	565	625	1.1

(1) For Construction, Standard, and Utility grades, the F_b, F_t, and $F_{c//}$ values apply to 4" widths only.

(2) For 4" thick material that is 8" or greater in width, the F_b value may be multiplied by 1.1.

(3) For sizes wider than 12", use 90% of the F_b, F_t, and $F_{c//}$ specified for the 12" width. Use 100% of the F_v, $F_{c\perp}$, and MOE specified for the 12" width.

(4) In construction where three or more load-carrying members such as joists, rafters, studs or decking are contiguous or are spaced not more than 24 inches in frame construction and are joined by transverse floor, roof or other load distributing elements, an increase in bending stress of 15% for members used in such systems is allowed as a design consideration, as provided in ASTM D1990.

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Table 4B (Cont.) Reference Design Values for Visually Graded Southern Pine Dimension Lumber (2" – 4" thick)[1,2,3,4]

(Tabulated design values are for normal load duration and dry service conditions, unless specified otherwise. See NDS 4.3 for a comprehensive description of design value adjustment factors.)

USE WITH TABLE 4B ADJUSTMENT FACTORS

Species and commercial grade	Size classification	Design values in pounds per square inch (psi)							Grading Rules Agency
		Bending F_b	Tension parallel to grain F_t	Shear parallel to grain F_v	Compression perpendicular to grain $F_{c\perp}$	Compression parallel to grain F_c	Modulus of Elasticity E	Modulus of Elasticity E_{min}	
SOUTHERN PINE		(Surfaced Dry - Used in dry service condtions - 19% or less moisture content)							
Dense Structural 86	2" & wider	2,600	1,750	175	660	2,000	1,800,000	660,000	SPIB
Dense Structural 72		2,200	1,450	175	660	1,650	1,800,000	660,000	
Dense Structural 65		2,000	1,300	175	660	1,500	1,800,000	660,000	
SOUTHERN PINE		(Surfaced Green - Used in any service condtion)							
Dense Structural 86	2-1/2" & wider	2,100	1,400	165	440	1,300	1,600,000	580,000	SPIB
Dense Structural 72		1,750	1,200	165	440	1,100	1,600,000	580,000	
Dense Structural 65	2-1/2"-4" thick	1,600	1,050	165	440	1,000	1,600,000	580,000	
MIXED SOUTHERN PINE									
Select Structural	2" - 4" wide	2,050	1,200	175	565	1,800	1,600,000	580,000	
No.1		1,450	875	175	565	1,650	1,500,000	550,000	
No.2		1,300	775	175	565	1,650	1,400,000	510,000	
No.3 and Stud		750	450	175	565	950	1,200,000	440,000	
Construction	4" wide	1,000	600	175	565	1,700	1,300,000	470,000	
Standard		550	325	175	565	1,450	1,200,000	440,000	
Utility		275	150	175	565	950	1,100,000	400,000	
Select Structural	5" - 6" wide	1,850	1,100	175	565	1,700	1,600,000	580,000	
No.1		1,300	750	175	565	1,550	1,500,000	550,000	
No.2		1,150	675	175	565	1,550	1,400,000	510,000	
No.3 and Stud		675	400	175	565	875	1,200,000	440,000	
Select Structural	8" wide	1,750	1,000	175	565	1,600	1,600,000	580,000	
No.1		1,200	700	175	565	1,450	1,500,000	550,000	
No.2		1,050	625	175	565	1,450	1,400,000	510,000	
No.3 and Stud		625	375	175	565	850	1,200,000	440,000	
Select Structural	10" wide	1,500	875	175	565	1,600	1,600,000	580,000	
No.1		1,050	600	175	565	1,450	1,500,000	550,000	
No.2		925	550	175	565	1,450	1,400,000	510,000	
No.3 and Stud		525	325	175	565	825	1,200,000	440,000	
Select Structural	12" wide	1,400	825	175	565	1,550	1,600,000	580,000	
No.1		975	575	175	565	1,400	1,500,000	550,000	
No.2		875	525	175	565	1,400	1,400,000	510,000	
No.3 and Stud		500	300	175	565	800	1,200,000	440,000	

1. **LUMBER DIMENSIONS.** Tabulated design values are applicable to lumber that will be used under dry conditions such as in most covered structures. For 2" to 4" thick lumber the DRY dressed sizes shall be used (see Table 1A) regardless of the moisture content at the time of manufacture or use. In calculating design values, the natural gain in strength and stiffness that occurs as lumber dries has been taken into consideration as well as the reduction in size that occurs when unseasoned lumber shrinks. The gain in load carrying capacity due to increased strength and stiffness resulting from drying more than offsets the design effect of size reductions due to shrinkage.
2. **STRESS-RATED BOARDS.** Information for various grades of Southern Pine stress-rated boards of nominal 1", 1¼" and 1½" thickness, 2" and wider is available from the Southern Pine Inspection Bureau (SPIB) in the "Standard Grading Rules for Southern Pine Lumber."
3. **SPRUCE PINE.** To obtain recommended design values for Spruce Pine graded to SPIB rules, multiply the appropriate design values for Mixed Southern Pine by the corresponding conversion factor shown below and round to the nearest 100,000 psi for E; to the next lower multiple of 5 psi for F_c and $F_{c\perp}$; to the next lower multiple of 50 psi for F_b, F_t and Fc if 1000 psi or greater, 25 psi otherwise.
4. **SIZE FACTOR.** For sizes wider than 12", use size factors for F_b, F_t and F_c specified for the 12" width. Use 100% of the F_v, $F_{c\perp}$ and E specified for the 12" width.

CONVERSION FACTORS FOR DETERMINING DESIGN VALUES FOR SPRUCE PINE

	Bending F_b	Tension parallel to grain F_t	Shear parallel to grain F_v	Compression perpendicular to grain $F_{c\perp}$	Compression parallel to grain F_c	Modulus of Elasticity E
Conversion Factor	0.78	0.78	0.98	0.73	0.78	0.82

AMERICAN FOREST & PAPER ASSOCIATION

Appendix B

Temple-Inland

August 3, 2010

Dear Valued Customer:

This is a follow up to our letter mailed August 2, 2010.

We have purchased lumber strength testing equipment for our Rome sawmill that is scheduled for installation and commissioning by mid-September 2010.

As an interim step we will begin stamping lumber from our Rome mill with a Mixed Southern Pine stamp while we evaluate a wider variance than expected in lumber strength values. Please refer to Southern Pine Inspection Bureau grade rules for the associated design values.

It is our intention to return to the Southern Pine stamp after the Rome lumber strength testing equipment is operational.

Any questions, please feel free to contact myself or another Temple-Inland employee. My office number is 936-829-1625, cell 936-366-0949.

Sincerely,

Pat Patranella
Vice President, Sales Solid Wood

Sales and Marketing • Building Products Operation • 303 S. Temple Drive • Diboll, TX 75941 • Tel. 800.231.6060

Appendix C

Table 4B Reference Design Values for Visually Graded Southern Pine Dimension Lumber (2" – 4" thick)[1,2,3,4]

(Tabulated design values are for normal load duration and dry service conditions, unless specified otherwise. See NDS 4.3 for a comprehensive description of design value adjustment factors.)

USE WITH TABLE 4B ADJUSTMENT FACTORS

Species and commercial grade	Size classification	Design values in pounds per square inch (psi)							Grading Rules Agency
		Bending F_b	Tension parallel to grain F_t	Shear parallel to grain F_v	Compression perpendicular to grain $F_{c\perp}$	Compression parallel to grain F_c	Modulus of Elasticity E	Modulus of Elasticity E_{min}	
SOUTHERN PINE									
Dense Select Structural		3,050	1,650	175	660	2,250	1,900,000	690,000	
Select Structural		2,850	1,600	175	565	2,100	1,800,000	660,000	
Non-Dense Select Structural		2,650	1,350	175	480	1,950	1,700,000	620,000	
No.1 Dense		2,000	1,100	175	660	2,000	1,800,000	660,000	
No.1	2" - 4" wide	1,850	1,050	175	565	1,850	1,700,000	620,000	
No.1 Non-Dense		1,700	900	175	480	1,700	1,600,000	580,000	
No.2 Dense		1,700	875	175	660	1,850	1,700,000	620,000	
No.2		1,500	825	175	565	1,650	1,600,000	580,000	
No.2 Non-Dense		1,350	775	175	480	1,600	1,400,000	510,000	
No.3 and Stud		850	475	175	565	975	1,400,000	510,000	
Construction		1,100	625	175	565	1,800	1,500,000	550,000	
Standard	4" wide	625	350	175	565	1,500	1,300,000	470,000	
Utility		300	175	175	565	975	1,300,000	470,000	
Dense Select Structural		2,700	1,500	175	660	2,150	1,900,000	690,000	
Select Structural		2,550	1,400	175	565	2,000	1,800,000	660,000	
Non-Dense Select Structural		2,350	1,200	175	480	1,850	1,700,000	620,000	
No.1 Dense		1,750	950	175	660	1,900	1,800,000	660,000	
No.1		1,650	900	175	565	1,750	1,700,000	620,000	
No.1 Non-Dense	5" - 6" wide	1,500	800	175	480	1,600	1,600,000	580,000	
No.2 Dense		1,450	775	175	660	1,750	1,700,000	620,000	
No.2		1,250	725	175	565	1,600	1,600,000	580,000	
No.2 Non-Dense		1,150	675	175	480	1,500	1,400,000	510,000	
No.3 and Stud		750	425	175	565	925	1,400,000	510,000	
Dense Select Structural		2,450	1,350	175	660	2,050	1,900,000	690,000	
Select Structural		2,300	1,300	175	565	1,900	1,800,000	660,000	
Non-Dense Select Structural		2,100	1,100	175	480	1,750	1,700,000	620,000	SPIB
No.1 Dense		1,650	875	175	660	1,800	1,800,000	660,000	
No.1	8" wide	1,500	825	175	565	1,650	1,700,000	620,000	
No.1 Non-Dense		1,350	725	175	480	1,550	1,600,000	580,000	
No.2 Dense		1,400	675	175	660	1,700	1,700,000	620,000	
No.2		1,200	650	175	565	1,550	1,600,000	580,000	
No.2 Non-Dense		1,100	600	175	480	1,450	1,400,000	510,000	
No.3 and Stud		700	400	175	565	875	1,400,000	510,000	
Dense Select Structural		2,150	1,200	175	660	2,000	1,900,000	690,000	
Select Structural		2,050	1,100	175	565	1,850	1,800,000	660,000	
Non-Dense Select Structural		1,850	950	175	480	1,750	1,700,000	620,000	
No.1 Dense		1,450	775	175	660	1,750	1,800,000	660,000	
No.1	10" wide	1,300	725	175	565	1,600	1,700,000	620,000	
No.1 Non-Dense		1,200	650	175	480	1,500	1,600,000	580,000	
No.2 Dense		1,200	625	175	660	1,650	1,700,000	620,000	
No.2		1,050	575	175	565	1,500	1,600,000	580,000	
No.2 Non-Dense		950	550	175	480	1,400	1,400,000	510,000	
No.3 and Stud		600	325	175	565	850	1,400,000	510,000	
Dense Select Structural		2,050	1,100	175	660	1,950	1,900,000	690,000	
Select Structural		1,900	1,050	175	565	1,800	1,800,000	660,000	
Non-Dense Select Structural		1,750	900	175	480	1,700	1,700,000	620,000	
No.1 Dense		1,350	725	175	660	1,700	1,800,000	660,000	
No.1	12" wide	1,250	675	175	565	1,600	1,700,000	620,000	
No.1 Non-Dense		1,150	600	175	480	1,500	1,600,000	580,000	
No.2 Dense		1,150	575	175	660	1,600	1,700,000	620,000	
No.2		975	550	175	565	1,450	1,600,000	580,000	
No.2 Non-Dense		900	525	175	480	1,350	1,400,000	510,000	
No.3 and Stud		575	325	175	565	825	1,400,000	510,000	

Appendix D

Table 4C Reference Design Values for Mechanically Graded Dimension Lumber[1,2,3]

(Tabulated design values are for normal load duration and dry service conditions, unless specified otherwise. See NDS 4.3 for a comprehensive description of design value adjustment factors.)

USE WITH TABLE 4C ADJUSTMENT FACTORS

Species and commercial grade	Size classification	Design values in pounds per square inch (psi) Bending F_b	Tension parallel to grain F_t	Compression parallel to grain F_c	Modulus of Elasticity E	Modulus of Elasticity E_{min}	Grading Rules Agency
MACHINE STRESS RATED (MSR) LUMBER							
900f-1.0E		900	350	1,050	1,000,000	510,000	WCLIB, WWPA, NELMA, NSLB
1200f-1.2E		1,200	600	1,400	1,200,000	610,000	NLGA, WCLIB, WWPA, NELMA, NSLB
1250f-1.4E		1,250	800	1,475	1,400,000	710,000	WCLIB, WWPA
1350f-1.3E		1,350	750	1,600	1,300,000	660,000	NLGA, WCLIB, WWPA, NELMA, NSLB
1400f-1.2E		1,400	800	1,600	1,200,000	610,000	NLGA, WWPA
1450f-1.3E		1,450	800	1,625	1,300,000	660,000	NLGA, WCLIB, WWPA, NELMA, NSLB
1450f-1.5E		1,450	875	1,625	1,500,000	760,000	WCLIB, WWPA
1500f-1.4E		1,500	900	1,650	1,400,000	710,000	NLGA, WCLIB, WWPA, NELMA, NSLB
1600f-1.4E		1,600	950	1,675	1,400,000	710,000	NLGA, WWPA
1650f-1.3E		1,650	1,020	1,700	1,300,000	660,000	NLGA, WWPA
1650f-1.5E		1,650	1,020	1,700	1,500,000	760,000	NLGA, SPIB, WCLIB, WWPA, NELMA, NSLB
1650f-1.6E-1075f_t		1,650	1,075	1,700	1,600,000	810,000	WCLIB, WWPA
1650f-1.6E		1,650	1,175	1,700	1,600,000	810,000	WCLIB, WWPA
1650f-1.8E		1,650	1,020	1,750	1,800,000	910,000	WCLIB, WWPA
1700f-1.6E	2" and less	1,700	1,175	1,725	1,600,000	810,000	WCLIB, WWPA
1750f-2.0E	in thickness	1,750	1,125	1,725	2,000,000	1,020,000	WCLIB, WWPA
1800f-1.5E		1,800	1,300	1,750	1,500,000	760,000	NLGA, WWPA
1800f-1.6E	2" and wider	1,800	1,175	1,750	1,600,000	810,000	NLGA, SPIB, WCLIB, WWPA, NELMA, NSLB
1800f-1.8E		1,800	1,200	1,750	1,800,000	910,000	WCLIB, WWPA
1950f-1.5E		1,950	1,375	1,800	1,500,000	760,000	SPIB, WWPA
1950f-1.7E		1,950	1,375	1,800	1,700,000	860,000	NLGA, SPIB, WCLIB, WWPA, NELMA, NSLB
2000f-1.6E		2,000	1,300	1,825	1,600,000	810,000	NLGA, WWPA
2100f-1.8E		2,100	1,575	1,875	1,800,000	910,000	NLGA, SPIB, WCLIB, WWPA, NELMA, NSLB
2250f-1.7E		2,250	1,750	1,925	1,700,000	860,000	NLGA, WWPA
2250f-1.8E		2,250	1,750	1,925	1,800,000	910,000	NLGA, WCLIB, WWPA
2250f-1.9E		2,250	1,750	1,925	1,900,000	970,000	NLGA, SPIB, WCLIB, WWPA, NELMA, NSLB
2250f-2.0E-1600f_t			2,250	1,600	1,925	2,000,000	1,020,000 WCLIB, WWPA
2250f-2.0E		2,250	1,750	1,925	2,000,000	1,020,000	WCLIB, WWPA
2400f-1.8E		2,400	1,925	1,975	1,800,000	910,000	NLGA, WWPA
2400f-2.0E		2,400	1,925	1,975	2,000,000	1,020,000	NLGA, SPIB, WCLIB, WWPA, NELMA, NSLB
2500f-2.2E		2,500	1,750	2,000	2,200,000	1,120,000	WCLIB, WWPA
2500f-2.2E-1925f_t			2,500	1,925	2,000	2,200,000	1,120,000 WCLIB, WWPA
2550f-2.1E		2,550	2,050	2,025	2,100,000	1,070,000	NLGA, SPIB, WCLIB, WWPA, NELMA, NSLB
2700f-2.0E		2,700	1,800	2,100	2,000,000	1,020,000	WCLIB, WWPA
2700f-2.2E		2,700	2,150	2,100	2,200,000	1,120,000	NLGA, SPIB, WCLIB, WWPA, NELMA, NSLB
2850f-2.3E		2,850	2,300	2,150	2,300,000	1,170,000	NLGA, SPIB, WCLIB, WWPA, NELMA, NSLB
3000f-2.4E		3,000	2,400	2,200	2,400,000	1,220,000	NLGA, SPIB

Table 4C (Cont.) Reference Design Values for Mechanically Graded Dimension Lumber[1,2,3]

(Tabulated design values are for normal load duration and dry service conditions, unless specified otherwise. See NDS 4.3 for a comprehensive description of design value adjustment factors.)

USE WITH TABLE 4C ADJUSTMENT FACTORS

Species and commercial grade	Size classification	Design values in pounds per square inch (psi) Bending F_b	Tension parallel to grain F_t	Compression parallel to grain F_c	Modulus of Elasticity E	Modulus of Elasticity E_{min}	Grading Rules Agency
MACHINE EVALUATED LUMBER (MEL)							
M-5		900	500	1,050	1,100,000	510,000	SPIB
M-6		1,100	600	1,300	1,000,000	470,000	SPIB
M-7		1,200	650	1,400	1,100,000	510,000	SPIB
M-8		1,300	700	1,500	1,300,000	610,000	SPIB
M-9		1,400	800	1,600	1,400,000	650,000	SPIB
M-10		1,400	800	1,600	1,200,000	560,000	NLGA, SPIB
M-11		1,550	850	1,675	1,500,000	700,000	NLGA, SPIB
M-12		1,600	850	1,675	1,600,000	750,000	NLGA, SPIB
M-13		1,600	950	1,675	1,400,000	650,000	NLGA, SPIB
M-14		1,800	1,000	1,750	1,700,000	790,000	NLGA, SPIB
M-15		1,800	1,100	1,750	1,500,000	700,000	NLGA, SPIB
M-16	2" and less	1,800	1,300	1,750	1,500,000	700,000	SPIB
M-17[4]	in thickness	1,950	1,300	2,050	1,700,000	790,000	SPIB
M-18		2,000	1,200	1,825	1,800,000	840,000	NLGA, SPIB
M-19	2" and wider	2,000	1,300	1,825	1,600,000	750,000	NLGA, SPIB
M-20[4]		2,000	1,600	2,100	1,900,000	890,000	SPIB
M-21		2,300	1,400	1,950	1,900,000	890,000	NLGA, SPIB
M-22		2,350	1,500	1,950	1,700,000	790,000	NLGA, SPIB
M-23		2,400	1,900	1,975	1,800,000	840,000	NLGA, SPIB
M-24		2,700	1,800	2,100	1,900,000	890,000	NLGA, SPIB
M-25		2,750	2,000	2,100	2,200,000	1,030,000	NLGA, SPIB
M-26		2,800	1,800	2,150	2,000,000	930,000	NLGA, SPIB
M-27[4]		3,000	2,000	2,400	2,100,000	980,000	SPIB
M-28		2,200	1,600	1,900	1,700,000	790,000	SPIB
M-29		1,550	850	1,650	1,700,000	790,000	SPIB
M-30		2,050	1,050	1,850	1,700,000	790,000	SPIB
M-31		2,850	1,600	2,150	1,900,000	890,000	SPIB

Effective October 26, 2011

This supplement makes no changes in the provisions of the 2002 SPIB Standard Grading Rules except for the following MSR/MEL classifications added:

601. MACHINE STRESS RATED LUMBER

Allowable Design Values (in psi)

Fiber Stress in Bending "F_b" (1)	"f-E" Classification	Modulus of Elasticity (million psi) "E"	Tension Parallel to Grain "F_t"	Compression Parallel To Grain "$F_{c//}$"
750	750f-1.4E	1.4	425	925
850	850f-1.4E	1.4	475	975
975	975f-1.6E	1.6	550	1450
1050	1050f-1.2E	1.2	450	1225
1050	1050f-1.6E	1.6	575	1500
1200	1200f-1.3E	1.3	600	1400
1200	1200f-1.6E	1.6	650	1550
1250	1250f-1.6E	1.6	725	1600
1350	1350f-1.4E	1.4	750	1600
1450	1450f-1.3E	1.3	825	1600
1450	1450f-1.5E	1.5	825	1600
1500	1500f-1.5E	1.5	900	1650
1500	1500f-1.6E	1.6	825	1650
1650	1650f-1.7E	1.7	900	1750
1850	1850f-1.7E	1.7	1050	1850
2550	2550f-1.8E	1.8	1400	2000
2850	2850f-1.8E	1.8	1600	2100

Major Species Southern Pine:			Specific
E Level	F_v	$F_{c\perp}$	Gravity
1.7 million psi and less:	175 psi	565 psi	0.55
1.8 million psi:	See paragraph 600.5(a).		
1.9 million psi and higher:	190 psi	805 psi	0.57

604. MACHINE EVALUATED LUMBER
Design Values (in psi)

Grade Name	Fiber Stress in Bending "F_b" (1)	Tension Parallel To Grain "F_t"	Compression Parallel to Grain "$F_{c//}$"	Modulus of Elasticity (million psi) "E"
M-32	750	425	925	1.4
M-33	850	475	975	1.4
M-34	975	550	1450	1.6
M-35	1050	575	1500	1.6
M-36	1200	650	1550	1.6
M-37	1250	725	1600	1.6
M-38	1500	825	1650	1.6
M-39	1650	900	1750	1.7
M-40	1850	1050	1850	1.7
M-41	2550	1400	2000	1.8
M-42	2850	1600	2100	1.8

Major Species Southern Pine: E Level	F_v	$F_{c\perp}$	Specific Gravity
1.7 million psi and less:	175 psi	565 psi	0.55
1.8 million psi	See paragraph 603.5(b).		
1.9 million psi and higher:	190 psi	805 psi	0.57

Adopted by the Board of Governors of the Southern Pine Inspection Bureau.