APPENDIX A

DESIGN VALUES FOR WOOD

Wood is a natural product subject to variations in geography, climate, specific site characteristics, silvacultural practices, and harvesting decisions. Its strength properties are not only anisotropic (vary by principal axis) but also can vary with proximity to the center of the tree. These characteristics complicate the assignment of individual pieces into design value groups based on the visual appearance. ASTM International consensus standards D245, D2555 and D1990 are all used to assign design values for bending, tension and compression parallel to grain to visually graded lumber. The standard used is dependent upon the species or species grouping under consideration and the size of the member. Design values for horizontal shear and compression perpendicular to grain for visually graded lumber are derived using only the procedures specified in ASTM D245 and ASTM D2555. Design values for Timbers and industrial lumber are also established using only ASTM D245 and ASTM D2555. The use of D245 and D2555 results in design values which are based upon testing clear wood samples of each species or each species within a species grouping. For species groups, the strength values for each species are combined into a single value by using a weighting procedure based on standing timber volume of each species in the group. On the other hand, design values for visually graded dimension lumber for some species such as Southern pine are established using ASTM D1990. These values are based upon testing a representative sample of lumber meeting the visual requirements of the grade group under consideration. Not

every grade group is tested nor is every physical property tested. Interpolations and modelling are used to provide design values for the grade groups. While the Modulus of Elasticity is represented by an average value, other properties such as bending strength and compression parallel to grain are represented by a lower 5% exclusion value. The sample data is adjusted for testing conditions, adjusted to a characteristic size, and ranked by value (numerical order). This procedure, following the ASTM D2915, produces a tolerance limit that provides 75% confidence that the true population 5th percentile value is higher than this estimate. This value is then used to establish the design value. Each piece or lot of visually graded lumber is not mechanically tested to verify strength properties. Since the stress ratings are representative of the entire producing region, lots from a specific location may have physical properties at the extremes of the property range or statistical distribution representing that range of strength values.

MIXED SOUTHERN PINE

Southern Pine of the minor species of pond pine and Virginia pine are treated as a separate species group and are so identified on the grade mark. Spruce pine and sand pine are treated as a separate species and are so identified. These species are the only minor species which exist in sufficient volume to find their way into lumber production in certain limited areas, and for which standing timber volume data are published in ASTM D2555.

The characteristics permitted and limiting provisions for grades in the minor species shall be the same as the corresponding grades of the principal species. When the minor species of pond pine and Virginia pine are grade-marked, the mark will indicate the particular species or show "Mixed Southern Pine" or abbreviated "MSP" and the grades of these species are assigned design values as shown in Tables 10-12. When spruce pine is grade-marked, the mark will indicate "spruce pine" and sand pine will indicate "sand pine". Design values are assigned according to the Appendix A Table 1 below.

CONVERSION FACTORS FOR SPRUCE PINE AND SAND PINE						
Design Category	Extreme Fiber in Bending "F_b"	Tension Parallel to Grain "F_t"	Horizontal Shear "F_v"	Compression Perpendicular to Grain "$F_{c\perp}$"	Compression Parallel to Grain "$F_{c\|\|}$"	Modulus of Elasticity (million psi) "E"
Spruce Pine Factor	0.78	0.78	0.98	0.73	0.78	0.82
Sand Pine Factor	1.0	1.0	1.0	1.0	1.0	0.84

Appendix A Table 1: Conversion Factors for Determining Spruce Pine and Sand Pine Design Values

Note: To obtain a recommended design value for spruce pine or sand pine, multiply the design value for the corresponding grade of Mixed Southern Pine by the appropriate conversion factor. Resulting values may be rounded to the nearest whole number

LOAD AND RESISTANCE FACTOR DESIGN REFERENCE RESISTANCE VALUES

The design values shown in Appendix A Tables 2 through 16 as well as the design values for MSR and MEL (Sections **601** and **611**, respectively) Scaffold Plank (Sections **500.1**, **500.3** and **510.1**), and the Decking, Structural, and Industrial lumber covered by SPIB Special Product Rules, are for use with Allowable Stress Design (ASD). Load and Resistance Factor Design (LRFD) is an alternative engineering method. The design values for LRFD, called reference resistance values, can be computed by multiplying the ASD design values by the conversion factors listed in Appendix A Table 18:

These factors have been established in accordance with the procedures set forth in ASTM Standard D5457. The reference resistance values derived using these factors are in units of psi (million psi for "E"). To obtain units of ksi, divide the reference resistance values in psi by 1000.

CONVERSION FACTORS FOR LRFD					
Extreme Fiber in Bending "F_b"	Tension Parallel to Grain "F_t"	Horizontal Shear "F_v"	Compression Perpendicular to Grain "$F_{c\perp}$"	Compression Parallel to Grain "$F_{c\parallel}$"	Modulus of Elasticity "E"
2.54	2.70	2.88	2.08	2.40	1.00

Appendix A Table 18: Conversion Factors for LRFD Use