LEGACY REPORT

PFC-5579

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Legacy report on the 1997 *Uniform Building Code*™ and the 2000 *International Building Code*®

DIVISION: 06—WOOD AND PLASTICS
Section: 06180—Glued-Laminated Construction

SSI GLUED-LAMINATED BEAMS AND HIGH-STRENGTH COMPOSITE (HSC) LAMINATED BEAMS

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1.0 SUBJECT

SSI Glued-Laminated Beams and High-strength Composite (HSC) Laminated Beams.

2.0 DESCRIPTION

2.1 General:

Standard Structures, Inc. (SSI), Glued-laminated Beams are fabricated to combinations 22F-1.8E/SPF, 20F-1.6E/SPF and 18F-1.6E/SPF; and the SSI High-strength Composite (HSC) laminated beams are glued-laminated timber members fabricated to combinations 32F-2.1E/DF, 30F-2.1E/DF, 30F-2.0E/DF and 24F-1.8E/SPF using laminated veneer lumber (LVL) as tension laminations. The beams consist of mechanically graded spruce-pine-fir (SPF) lumber or mechanically graded Douglas fir lumber with visually graded Douglas fir lumber. Individual laminations are 2 inches (51mm) or less in net thickness. Beam widths of $2^1/_2$ inches (63.5 mm) and larger are available.

Quality control for lumber grading is monitored by the American Plywood Association—The Engineered Wood Association and West Coast Lumber Inspection Bureau, which are approved by the American Lumber Standards Committee for grading laminating stock. The quality control for the fabrication of the glued-laminated beams is monitored by APA—The Engineered Wood Association.

Beams must meet the requirements noted in the Engineered Wood Systems GAP computer program (as delineated in evaluation report NER-486) for determining design stresses, and comply with the Engineered Wood Systems quality control procedures applicable to these layup combinations.

2.2 Materials:

2.2.1 Adhesives: Face and end-joint bonding adhesives comply with ASTM D 2559 for exterior wet use.

2.2.2 End Joints: End joints comply with ANSI A190.1-92 and APA—The Engineered Wood Association quality control requirements.

2.2.3 Laminating Stock: The beams are manufactured using mechanically graded solid-sawn lumber laminations having known ultimate tensile strength and plank MOE values. HSC beams are manufactured using LVL as tension laminations complying with the ICC-ES Acceptance Criteria for Structural Composite Lumber (AC47), and additional requirements specified in the approved quality control manual. The lumber laminations are approved visually graded or mechanically graded lam stock that have also passed additional visual requirements, and are identified as proprietary grades. Mechanical grade requirements are set forth in the approved quality control manual for lumber used in various lamination combinations listed in this report. Grade specifications are noted in the approved quality control manual. Supplemental requirements, of APA—The Engineered Wood Association, for these layup combinations are noted in Table 2.

2.3 Layup:

Manufacturing grade and layup requirements for the grade combinations are per the Standard Structures, Inc., Glulam Procedures and Quality Control Manual. Manufacturing details are provided by APA—The Engineered Wood Association and are included in the procedures and quality control manual. Lamination grades and zones are as defined in the GAP computer program, described in Section 2.1 of this report, for determining design stresses.

2.4 Design:

Design stress values are listed in Table 2, and are for beams having five or more laminations stressed primarily in bending due to loads applied perpendicular to the wide faces of the laminations. Design and installation requirements for structural glued-laminated beams and connections must comply with the applicable code.

2.5 Identification:

Standard Structures Glued-laminated Beams and High-strength Composite Laminated Beams are identified by a stamp bearing the name of Standard Structures, Inc.; the species; the manufacturing plant number (Mill 1013); the lumber combination symbol; the evaluation report number (PFC-5579); and the name of the inspection agency (APA—The Engineered Wood Association). Unbalanced beams are further marked with a stamp bearing the designation “TOP.” See Figure 1.

3.0 EVIDENCE SUBMITTED

Reports of testing of structural glued-laminated timber using proprietary laminations; and quality control manuals for the grading of lamination stock and the fabrication of glued-laminated beams.

4.0 FINDINGS

That the Standard Structures Glued-laminated Beams and High-strength Composite Laminated Beams described in this report are acceptable alternates to those specified in the 1997 *Uniform Building Code*™ and the 2000 *International Building Code*®, subject to the following conditions:

4.1 Design stresses for normal conditions of loading do not exceed those set forth in Table 2 of this report.

4.2 Design calculations, signed and sealed by a registered engineer or architect, and verifying compliance with this report and design requirements of the code, are provided.

4.3 Beams are fabricated by Standard Structures, Inc., at their manufacturing facility located in Windsor, California, with quality control by APA—The Engineered Wood Association (AA-649).

This report is subject to re-examination in two years.

TABLE 1 DOWEL BEARING STRENGTH FOR BOLTS & NAILS (1)

GRADE MOE PSI X 10^6	SPECIFIC GRAVITY	DOWEL BEARING STRENGTH (PSI)
SPF/WL4 1.6	0.44	3,650
SPF/WL3 1.8	0.47	4,150
SPF/WL2 2.0	0.50	4,650
SPF/WL1 2.0	0.50	4,650
LVL Tension Lamination - Nails Lateral Only	0.50	4,650
DF/All Grades	0.50	4,650

For SI: 1 psi = 6.89 kPa
(1) Values determined in accordance with ASTM D 5764.

TABLE 2 DESIGN VALUES FOR STRUCTURAL GLUED-LAMINATED TIMBER INTENDED PRIMARILY FOR MEMBERS STESSED IN BENDING DUE TO LOADS APPLIED PERPENDICULAR TO WIDE FACES OF THE LAMINATIONS FOR NORMAL DURATION OF LOADS AND DRY CONDITIONS OF USE

		Bending About X-X Axis							Bending About Y-Y Axis					Axial Loaded		
		Loaded Perpendicular to Wide Face of Laminations							Loaded Parallel to Wide Face of Laminations							
		Extreme Fiber Bending F_{bY}		Compression Perpendicular to Grain F_{Cperpy}												
Combination Symbol	Species Core Lams/ Outer Lams (5)	Tension Zone Stressed in Tension psi	Compression Zone Stressed in Tension psi	Tension Face psi	Compression Face psi	Shear Parallel to Grain F_{VX} psi		Modulus of Elasticity E_X 10^ psi	Extreme Fiber in Bending F_{bY} psi	Compression Perpendicular to Grain F_{Cperpy} psi	Shear Parallel to Grain F_{VY} psi		Modulus of Elasticity E_Y 10^ psi	Tension Parallel to Grain F_t psi	Compression Parallel to Grain $F_{C//}$ psi	Modulus of Elasticity E 10^ psi
1	2	3	4	5	6	7	8	9	10	11	12	13	16	17	18	19
The following combinations are not balanced and are intended primarily for simple-span applications																
32F-2.1E/DF	DF/Special	3,200	2,000	510	650	240	190	2.1	1,950	560	215	175	1.9	1200	1850	1.9
30F-2.1E/DF	DF/Special	3,000	2,000	510	650	240	190	2.1	1,800	560	215	175	1.8	1050	1850	1.8
30F-2.0E/DF	DF/Special	3,000	2,000	510	650	240	190	2.0	1,800	560	215	175	1.8	1050	1850	1.8
24F-1.8E/SPF	SPF/Special	2,400	1,850	560	560	195	160	1.8	2,200	470	170	140	1.6	1,350	1,950	1.6
22F-1.8E/SPF	SPF/SPF	2,200	1,850	560	560	195	160	1.8	2,200	470	170	140	1.6	1,350	1,950	1.6
20F-1.6E/SPF	SPF/SPF	2,000	1,500	560	560	195	160	1.6	2,000	470	170	140	1.6	1,250	1,850	1.6
18F-1.6E/SPF	SPF/SPF	1,800	1,300	560	470	195	160	1.6	1,800	470	170	140	1.5	1,250	1,700	1.5
The following combinations are balanced and are intended primarily for multiple-span applications																
32F-2.1E/DF	DF/Special	3,200	3,200	510	510	240	190	2.1	3,200	560	215	175	1.9	1200	1850	1.9
30F-2.1E/DF	DF/Special	3,000	3,000	510	510	240	190	2.1	3,000	560	215	175	1.8	1050	1850	1.8
30F-2.0E/DF	DF/Special	3,000	3,000	510	510	240	190	2.0	3,000	560	215	175	1.8	1050	1850	1.8
24F-1.8E/SPF	SPF/Special	2,400	2,400	560	560	195	160	1.8	2,400	470	170	140	1.6	1,350	1,950	1.6
22F-1.8E/SPF	SPF/SPF	2,200	2,200	560	560	195	160	1.8	2,200	470	170	140	1.6	1,350	1,950	1.6
20F-1.6E/SPF	SPF/SPF	2,000	2,000	560	560	195	160	1.6	2,000	470	170	140	1.6	1,250	1,850	1.6
18F-1.6E/SPF	SPF/SPF	1,800	1,800	560	560	195	160	1.6	1,800	470	170	140	1.5	1,250	1,700	1.5
Wet-use factors (2)		0.8	0.8	0.53	0.53	0.875		0.833	0.8	0.53	0.875		0.833	0.8	0.73	0.833

For **SI:** 1 psi = 6.89 kPa.

(1) The combinations in this table are applicable to structural glued-laminated timbers that are intended primarily for members stressed in bending due to loads applied perpendicular to the wide faces of the laminations. Design values are tabulated, however, for loading both perpendicular and parallel to the wide faces of the laminations.

(2) The tabulated design values are for dry conditions of use (moisture content in service is less than 16% as in most covered structures). For wet conditions of use (moisture content service is 16% or higher), multiply the tabulated values by the factors shown at end of the table.

(3) The tabulated design values are for normal duration of loading. For other durations of loading see applicable building code.

(4) The combination symbol relates to a specific combination using proprietary grades of laminating lumber, as described in the Procedures & Quality Control Manual.

(5) The symbol used for species is SPF = Spruce-Pine-Fir & DF = Douglas fir.

(6) The tabulated design values in bending, F_{bx}, are based on members 5-1/8 inches (130mm) in width by 12inches (305mm) in depth by 21 feet (6,400mm) in length. For members with a larger volume, F_{bx} shall be multiplied by a volume factor, C_v, determined in accordance with applicable building code.

(7) The design values in bending about the X-X axis, Fbx in this column for bending members shall be multiplied by 0.75 for depth > 15 inches or 0.85 for depth < or = to 15 inches (381 mm) when the member is manufactured without the required special tension lamination(s).

(8) Design values in this column are for extreme fibre stress in bending when member is loaded such that the compression zone laminations are subject to tensile stresses.

(9) The compression perpendicular to grain design values in this table are not subject to the duration of load modifications.

(10) The values F_{by} were calculated based on members 12 inches (305 mm) in depth (bending about Y-Y axis). When the depth is less than 12 inches (305 mm), the values of F_{by} shall be permitted to be increased by multiplying by the following factors:

All Species	**Beam Depth, inches**				
	10 3/4 or 10 1/2	8 3/4 or 8 1/2	6 3/4	5 1/8 or 5	3 1/8 or 3
Factor	1.01	1.04	1.07	1.1	1.16

For **SI:** 1 inch = 25.4 mm.

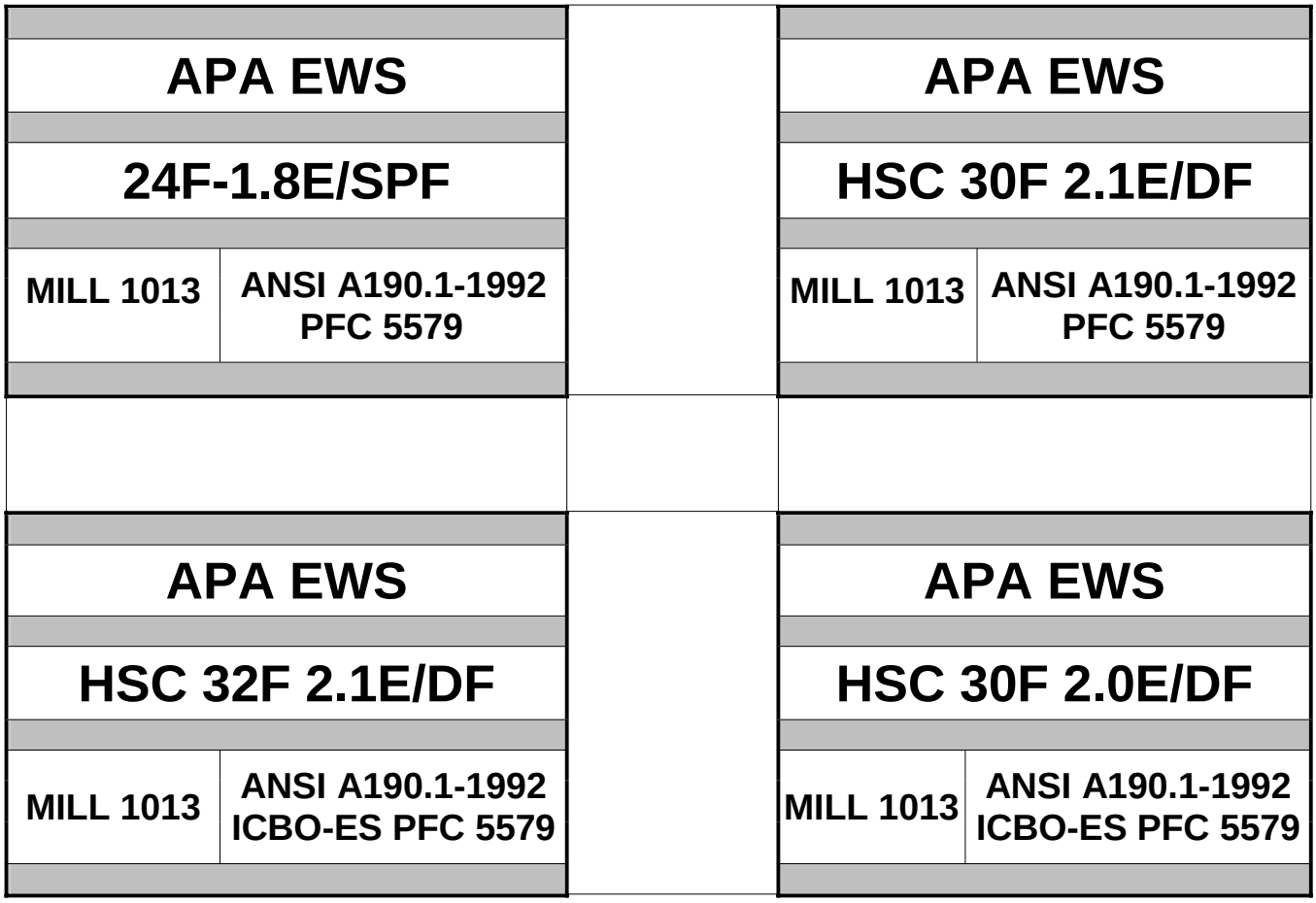
For member with depth greater than 12 inches (305 mm), the value of F_{by} shall be reduced by applying the size factor, (12/d)1/9, where *d* is the beam depth in inches.

(11) These values for shear parallel to grain, F_{vy}, apply to members manufactured using multiple piece laminations with unbonded edge joints. For members manufactured using single piece laminations or using multiple piece laminations with bonded edge joints, the shear (parallel to grain) values in Columns 12 and 13 apply. The values in this column do not apply to members with 5,7 or 9 laminations when unbonded edge joints occur in alternate laminations at mid-depth of the member with no edge joints in adjacent laminations and the outside lamination contains unbonded edge joints. The value in this column shall be reduced by 16 percent for members containing 5 lamination when unbonded edge joints occur in each lamination forming a staggered pattern in the member with no edge joint closer than 1 inch to the mid-depth of the member.

(12) These tabulated shear values are applicable to prismatic glulam members subject to typical static and transient dead, live, snow, wind and earthquake loading but excluding impact or cyclic loading such as may occur in bridges or crane rail applications. These values allow for checking of up to 10% of the glulam width in the shear critical zone.

(13) These tabulated shear values are applicable to non-prismatic glulam members subjected to typical static and transient loads and all members subjected to impact or cyclic loads such as may occur in bridges or crane rail applications. These values allow for checking up to 10% of the glulam width in the shear critical zone.

(14) The minimum number of laminations for beams noted in Table 2 is five laminations.


APA EWS
24F-1.8E/SPF
MILL 1013
ANSI A190.1-1992
PFC 5579
APA EWS
HSC 30F 2.1E/DF
MILL 1013
ANSI A190.1-1992
PFC 5579
APA EWS
HSC 32F 2.1E/DF
MILL 1013
ANSI A190.1-1992
ICBO-ES PFC 5579
APA EWS
HSC 30F 2.0E/DF
MILL 1013
ANSI A190.1-1992
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TOP

FIGURE 1