Design Capacities for Oriented Strand Board

Allowable Stress Design (ASD)

The design values in this document correspond with those published in the 2005 edition of the AF&PA American Wood Council's *Allowable Stress Deign (ASD)/LRFD Manual for Engineered Wood Construction*. TECO has chosen to do so to provide harmony among users--architects, engineers, specifiers and the regulatory community. These are "Industry Recommended" values, but are not rigorously evaluated for on-going verification.

Load capacities, which are presented here for allowable stress design (ASD) (Table A), are applicable to commodity OSB panels qualified in accordance with TECO test protocol. Nominal panel thickness (Table B) assists in calculation of geometric cross-sectional properties. The applicable section properties (Table C) can be divided into load capacity to determine design strength and stiffness. Load capacities in Table A are based on normal duration of load for untreated panels under dry conditions. Because these values are OSB-specific, the appropriate panel grade and construction adjustment factors, C_G, have already been applied. Designers must be careful to avoid making the C_G adjustments again.

Adjustment factors for other conditions of use are permitted in accordance with applicable code provisions. The *National Design Specification for Wood Construction* (NDS) provides guidance on the use of adjustment factors.

General Design Information

Methods presented in this section may be used to calculate uniform load capacity of structural-use panels in floor, roof and wall applications. The design capacities presented in Table A include the grade and construction factor, C_G. Other applicable adjustment factors as specified in Section 9.3 of the 2005 edition of the ANSI/AF&PA NDS-2005, National Design Specifications (NDS) for Wood Construction ASD/LRFD and Section C9.3 of the 2005 Edition of the AF&PA American Wood Councils' *Commentary National Design Specification (NDS) for Wood Construction ASD/LRFD*, should be applied to the design capacities.

There are three possible span conditions to consider when computing the uniform load capacities of structural-use panels depending on the size and orientation of the panel and the spacing of the framing support members. These include single-span, two-span and three-span (see below). For normal framing practice and standard panel size (i.e., 4x8 foot), when the panel strength axis is perpendicular to framing supports, the three-span condition is used for support spacing up to and including 32 inches on center. Use the two-span condition for support spacing greater than 32 inches on center but no greater than 48 inches on center. When the panel strength axis is placed parallel to framing supports, the three-span condition is used for support spacing up to and including 16 inches on center. Use the two-span condition for support spacing greater than 16 inches but no greater than 24 inches on center. Use the single-span condition for support spacing greater than 24 inches on center.

The formulas presented are for computing uniform loads on structural-use panels applied over conventional framing. These equations are based on standard beam formulas altered to accept the mixed units. For support spacing less than 48 inches, nominal two-inch framing members are assumed. For support spacing 48 inches and greater, nominal four-inch framing members are assumed. Since the formulas assume that no blocking is used, the formulas are for one-way "beam" action rather than two-way "plate" action. The resulting load is for the structural panels only and does not account for the design of the framing support members. The resulting loads calculated from the equations are assumed to apply to full size panels in standard sheathing applications. Considerations for concentrated loads should be made in compliance with local building codes and maximum span recommendations.

Table A
Wood Structural Panel Design Capacities Based on Span Ratings[(a)]

Span Rating	Strength							Planar Shear	Stiffness and Rigidity				
	Bending $F_b S$ (lb-in/ft of width)		**Axial Tension** $F_t A$ (lb/ft of width)		**Axial Compression** $F_c A$ (lb/ft of width)		**Shear through the thickness** [(b)] $F_v t_v$ (lb/in of shear-resisting panel length)	**Planar Shear** F_s (lb/Q) (lb/ft of width)	**Bending** EI (lb-in^2/ft of width)		**Axial**[(a1)] EA (lb/ft of width x 10^6)		**Rigidity through the thickness** $G_v t_v$ (lb/in of panel depth)
	Capacities relative to strength axis [(c)]												
	0°	90°	0°	90°	0°	90°	0° / 90°	0° / 90°	0°	90°	0°	90°	0° / 90°
Sheathing Span®													
24/0	300	97	2,300	780	2,850	2,500	155	130	60,000	11,000	3.35	2.50	77,500
24/16	385	115	2,600	1,300	3,250	2,500	165	150	78,000	16,000	3.80	2.70	83,500
32/16	445	165	2,800	1,650	3,550	3,100	180	165	115,000	25,000	4.15	2.70	83,500
40/20	750	270	2,900	2,100	4,200	4,000	195	205	225,000	56,000	5.00	2.90	88,500
48/24	1,000	405	4,000	2,550	5,000	4,300	220	250	400,000	91,500	5.85	3.30	96,000
Floor Span®													
16 oc	500	180	2,600	1,900	4,000	3,600	170	205	150,000	34,000	4.50	2.70	83,500
20 oc	575	250	2,900	2,100	4,200	4,000	195	205	210,000	40,500	5.00	2.90	87,000
24 oc	770	385	3,350	2,550	5,000	4,300	215	250	300,000	80,500	5.85	3.30	93,000
32 oc	1,050	685	4,000	3,250	6,300	6,200	230	300	650,000	235,000	7.50	4.20	110,000
48 oc	1,900	1,200	5,600	4,750	8,100	6,750	305	385	1,150,000	495,000	8.20	4.60	155,000

(a) The design values in this table correspond with those published in the 2005 edition of the AF&PA American Wood Council's *Allowable Stress Deign (ASD)/LRFD Manual for Engineered Wood Construction* Tables M9.2.1- M9.2.4, which are available from the AF&PA American Wood Council.

(a1) In late January 2008, revised Axial EA 90° (perpendicular) values were submitted for modification to AF&PA based on an industry-wide consensus. The appropriate panel grade and construction adjustment factor, C_G, has already been incorporated into these design values—do not apply the C_G factor a second time. These values do not apply to Structural I panels. See Tables M9.2.1 – M9.2.4 for the appropriate multipliers for Structural I panels.

(b) Shear through the thickness design capacities are limited to sections two feet or less in width; wider sections may require further reductions.

(c) Strength axis is defined as the axis parallel to the face and back orientation of the flakes, which is generally the long panel direction, unless otherwise marked.

Table B
Relationship Between Span Rating and Nominal Thickness for OSB[(a)]

Span Rating	Nominal Thickness[(b)] (in.)										
	3/8	7/16	15/32	1/2	19/32	5/8	23/32	3/4	7/8	1	1-1/8
	Sheathing Span®										
24/0	**0.375**	0.437	0.469	0.500							
24/16		**0.437**	0.469	0.500							
32/16			**0.469**	0.500	0.594	0.625					
40/20					**0.594**	0.625	0.719	0.750			
48/24							**0.719**	0.750	0.875		
	Floor Span®										
16 oc					**0.594**	0.625					
20 oc					**0.594**	0.625					
24 oc							**0.719**	0.750			
32 oc									**0.875**	1.000	
48 oc											**1.125**

(a) The values in this table correspond with those published in the 2005 edition of the AF&PA American Wood Council's *Commentary National Design Specification (NDS) for Wood Construction ASD/LRFD* Table C9.2.3, which is available from the AF&PA American Wood Council.
(b) The predominant thickness for each span rating is highlighted in **bold**.

Table C
Panel Section Properties[(a,b)] for OSB

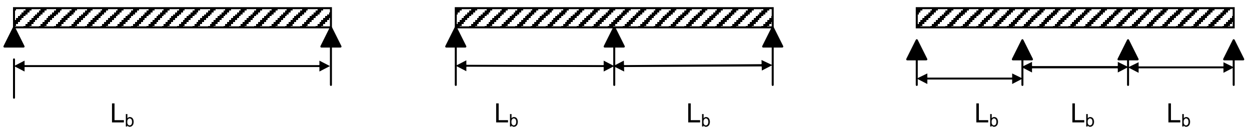
Nominal Thickness, t (in.)		Weight[(c)] (psf)	Cross Sectional Area, A (in.^{2}/ft)	Moment of Inertia, I (in.^{4}/ft)	Section Modulus, S (in.^{3}/ft)	Statical Moment, Q (in.^{3}/ft)	Shear Constant, Ib/Q (in.^{2}/ft)
Fraction	Decimal						
3/8	0.375	1.2	4.500	0.053	0.281	0.211	3.00
7/16	0.437	1.4	5.250	0.084	0.383	0.287	3.50
15/32	0.469	1.5	5.625	0.103	0.440	0.330	3.75
½	0.500	1.7	6.000	0.125	0.500	0.375	4.00
19/32	0.594	2.0	7.125	0.209	0.705	0.529	4.75
5/8	0.625	2.1	7.500	0.244	0.781	0.586	5.00
23/32	0.719	2.4	8.625	0.371	1.033	0.775	5.75
¾	0.750	2.5	9.000	0.422	1.125	0.844	6.00
7/8	0.875	2.9	10.500	0.670	1.531	1.148	7.00
1	1.000	3.3	12.000	1.000	2.000	1.500	8.00
1-1/8	1.125	3.7	13.500	1.424	2.531	1.898	9.00

(a) The values in this table correspond with those published in the 2005 edition of the AF&PA American Wood Council's *Commentary National Design Specification (NDS) for Wood Construction ASD/LRFD* Table C9.2.4, which is available from the AF&PA American Wood Council.
(b) Based on a rectangular cross sectional width of one foot.
(c) Weight is based on an assumed panel density of 40 pcf.

Uniform Load Formulas for Structural-Use Panels[1]

Uniform Loads Based on Bending

The following formulas may be used to calculate uniform loads based on bending (M):



Single span:

$$w_b = \frac{96\,M}{L_b^{\,2}}$$

Two-span condition:

$$w_b = \frac{96\,M}{L_b^{\,2}}$$

Three-span condition:

$$w_b = \frac{120\,M}{L_b^{\,2}}$$

where:

w_b = uniform load based on bending strength (psf)
M = Bending Strength Capacity, F_bS in (lb.-in./ft.)
L_b = span (center-to-center of supports, in.)

Uniform Loads Based on Shear

The following formulas may be used to calculate uniform loads based on planar shear (V_s):

Single span:

$$w_s = \frac{24\,V_s}{L_s}$$

Two-span condition:

$$w_s = \frac{(19.2)\,V_s}{L_s}$$

Three-span condition:

$$w_s = \frac{20\,V_s}{L_s}$$

where:

w_s = uniform load based on shear strength (psf)
V_s = Planar Shear Capacity, $F_s(Ib/Q)$ in (lb./ft.)
L_s = clear span (in., center-to-center of supports minus support width, in.)

Uniform Loads Based on Deflection Requirements

The following formulas may be used to calculate deflection under uniform load, or allowable loads based on deflection requirements.

Single span:

$$\Delta = \frac{w L_{\Delta}^{4}}{(921.6)EI}$$

Two-span condition:

$$\Delta = \frac{w L_{\Delta}^{4}}{(2220)EI}$$

Three-span condition:

$$\Delta = \frac{w L_{\Delta}^{4}}{(1743)EI}$$

where:

Δ = deflection (in.)
$w = w_{LL}$ = uniform live load (psf)
— Or —
$w = w_{TL}$ = uniform total load (psf)
EI = Bending Stiffness Capacity (lb.-in.^{2}/ft.)
L_{Δ} = clear span + SW (in.)
SW = support width factor, 0.25 inch for two-inch nominal lumber framing and 0.625 inch for four- inch nominal lumber framing.

[1]The formulas are standard beam formulas adjusted to accept mixed units. It is assumed the resulting loads are applied on all spans to full-sized panels in standard sheathing applications. Refer to the 2005 edition of the ANSI/AF&PA NDS-2005, National Design Specifications (NDS) for Wood Construction ASD/LRFD, for further requirements regarding the use of these formulas and appropriate adjustment factors available from the AF&PA American Wood Council.

OSB Roof Design Example Calculations Using ASD

4x8 foot, 24/16 TECO SHEATHING SPAN® oriented strand board (OSB) panels are installed as roof sheathing over roof trusses (nominal 2 inch wide) spaced at 24 inches on-center. The panels are installed with the long panel direction (strength axis) perpendicular to the roof truss members. The job specifications indicate that the roof is to be designed to support a 40 psf snow load @ 1.15 load duration with an allowable live load deflection (w_{LL}) of span/240 and an allowable total load deflection (w_{TL}) of span/180. Determine if the specified panel will adequately meet these requirements.

Bending Strength

From Table A, the bending capacity, $M = F_bS$, of a 24/16 SHEATHING SPAN® panel installed with the stress applied parallel to the strength axis is equal to 385 lb-in/ft of width. The factor, C_G, of 1.20 (panel grade and construction factor) has already been applied to this capacity, but the load duration factor, C_D, of 1.15 can also be applied for snow load. Since the trusses are spaced at 24 in. on center and the panels are oriented with their 8 ft dimension perpendicular to the framing, use the equation for the three-span condition.

$$w_b = \frac{120\ F_b\ S}{L_b^{\ 2}}$$

$$w_b = \frac{120\,(385\,\text{lb-in/ft})(1.15)}{(24\,\text{in})^2}$$

$$\underline{w_b = 92\ \text{psf}}$$

Shear in the Plane Strength

From Table A, the planar shear capacity, $V_s=F_s$ (Ib/Q), of a 24/16 SHEATHING SPAN® panel installed with the stress applied parallel to the strength axis is equal to 150 lb/ft of width. The C_G factor (panel grade and construction factor) has already been applied to this capacity, but the load duration factor, C_D, of 1.15 can also be applied for snow load.

$$w_s = \frac{20\ F_s\ (Ib/Q)}{L_s}$$

$$w_s = \frac{20\,(150\,\text{lb/ft})\,(1.15)}{(24\,\text{in} - 1.5\,\text{in})}$$

$$\underline{w_s = 153\,\text{psf}}$$

Bending Stiffness

From Table A, the EI (bending stiffness capacity) of a 24/16 SHEATHING SPAN® panel installed with the stress applied parallel to the strength axis is equal to 78,000 lb-in^2/ft of width. The C_G factor (panel grade and construction factor) has already been applied to this capacity. Notice that the load duration factor, C_D does not apply to bending stiffness.

$$\Delta_{LL} = \frac{w_{LL} L_\Delta^{\ 4}}{(1743)EI}$$

$$w_{LL} = \frac{(1743)EI\,\Delta_{LL}}{L_\Delta^{\ 4}} \quad \text{where } \Delta_{LL} = \text{span}/240$$

$$w_{LL} = \frac{(1743)(78{,}000\ \text{lb-in}^2/\text{ft})(1/240)}{(24\ \text{in} - 1.5\ \text{in} + .25\ \text{in})^3}$$

$$\underline{w_{LL} = 48\ \text{psf}}$$

$$\Delta_{TL} = \frac{w_{TL} L_\Delta^{\ 4}}{(1743)\ EI}$$

$$w_{TL} = \frac{(1743)EI\,\Delta_{TL}}{L_\Delta^{\ 4}} \quad \text{where } \Delta_{TL} = \text{span}/180$$

$$w_{TL} = \frac{(1743)(78{,}000\ \text{lb-in}^2/\text{ft})(1/180)}{(24\ \text{in} - 1.5\ \text{in} + .25\ \text{in})^3}$$

$$\underline{\underline{w_{TL} = 64\ \text{psf}}}$$

Based on the specifications for this design example, the design capacity of the OSB sheathing is controlled by bending stiffness. The 64 psf represents the maximum uniform load that can be applied to the panels before the deflection criterion of span/180 is exceeded. As long as the dead load of the roof system (i.e., weight of panels, shingles, etc.) does not exceed 24 psf (i.e. 68 psf total load – 40 psf snow load), the 24/16 SHEATHING SPAN® OSB will meet the design specifications for this project.