

Allowable Bearing Stress

The required bearing lengths for beams, columns and joists to prevent crushing of the wood at bearing points is a commonly overlooked aspect of the design process. The following tables list the Allowable Bearing Stress (also called compression perpendicular to grain [$f_{c\perp}$]) for commonly used beam and plate members and allowable end grain stress for different column materials [$f_{c||}$] (*please note that the Allowable Stress-End Grain value for columns should not be used alone to size a column, things such as the length of the column and how it is used will reduce the allowable load for columns*). The second page provides an example on how to check to make sure there is adequate bearing area based on the member reaction.

$$\text{Bearing Area} = (\text{Member Width}) \times (\text{Actual Bearing Length})$$

$$\text{Bearing Stress} = \text{Member Reaction} / \text{Bearing Area}$$

Beam Products in Joist Orientation	Allowable Stress - $F_{c\perp}$ (psi)
2.2E Parallam® PSL (West)	625
2.0E Parallam® PSL (East)	750
1.3E TimberStrand® LSL	710
1.5E TimberStrand® LSL	860
1.55E TimberStrand® LSL	900
2.0E Microllam® LVL	750
1.8E Parallam® PSL ⁽²⁾	545
Douglas Fir Glulam	650

Wall Plates in Plank Orientation	Allowable Stress - $F_{c\perp}$ (psi)
Southern Pine plate*	565
Douglas Fir plate*	625
Spruce-Pine-Fir (S-P-F) plate*	425
Hemlock Fir plate*	405
StrandGuard® TimberStrand® LSL plate	670
1.3E TimberStrand® LSL plate ⁽³⁾	670
1.5E TimberStrand® LSL plate	750
1.55E TimberStrand® LSL plate	775

Column Products	Allowable Stress - End Grain $F_{c }$ (psi)
Douglas Fir (4x4 and smaller)*	1350
Douglas Fir (5x5 and larger)*	700
Hemlock Fir (4x4 and smaller)*	1300
Hemlock Fir (5x5 and larger)*	575
SPF (4x4 and smaller)*	1150
SPF (5x5 and larger)*	500
Parallam® PSL (all grades) ⁽¹⁾	2500
TimberStrand® LSL (all grades) ⁽¹⁾	1835

* #2 or better dimension lumber values based on 2018 NDS Supplement

⁽¹⁾ The actual member bearing on these will control design

⁽²⁾ 1.8E Parallam® PSL used in header orientation

⁽³⁾ For TimberStrand® LSL labeled 'Rimboard', $F_{c\perp}$ = 635 psi in plank orientation

$$\text{Bearing Area} = (\text{Member Width}) \times (\text{Actual Bearing Length})$$

$$\text{Bearing Stress} = \text{Member Reaction} / \text{Bearing Area}$$

Example

5¼" x 14" Parallam® PSL (West) on a 2x4 Hem-Fir plate
Beam reaction = 6,500 pounds

Look at the allowable bearing stress of both the Parallam® PSL beam and Hem-Fir plate and use the lesser of the 2 values as the controlling value (for this case it is the Hem-Fir plate at 405 psi).

$$\text{Bearing area} = 5\frac{1}{4}" \times 3\frac{1}{2}" = 18.38 \text{ sq in}$$

$$\text{Bearing stress} = 6,500 / 18.38 = 354 \text{ psi}$$

354 psi < 405 psi OK

If the bearing stress was greater than the allowable, one could look at a wider beam, bearing accessory (cap) or other means to increase bearing area to prevent crushing of the wood plate.