

Lateral Bracing of Joists and Beams

Bracing is a critical item of all structural components. A lack of bracing is can be very apparent in column and stud applications, as shown in Figure 1. Axial loads create compression stress in the member. Without proper bracing, buckling causes excessive displacement and possible structural failure.

Bracing of joists and beams is as important, though may not be as apparent. When a joist or beam is loaded, compression and tension forces develop within the product. For simple span applications, the top flange of I-joists and top edge sections of beams are subjected to compression stress. As with vertical products, these compression forces can cause buckling if the top edge is not braced laterally (see Figure 2). Improper or absence of bracing significantly reduces the load-carrying capacity of the joist or beam.

Both the span and load tables shown in all Boise Cascade EWP literature and the BC Calc[®] sizing software program assume that all joists and beams have proper lateral bracing. In most applications, direct-attached sheathing provides sufficient lateral bracing, as shown in Figure 3.



Figure 1: Column Buckling

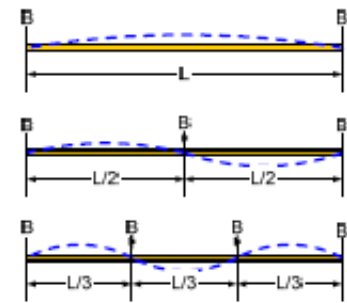


Figure 2: Top Edge Buckling of Joists and Beams

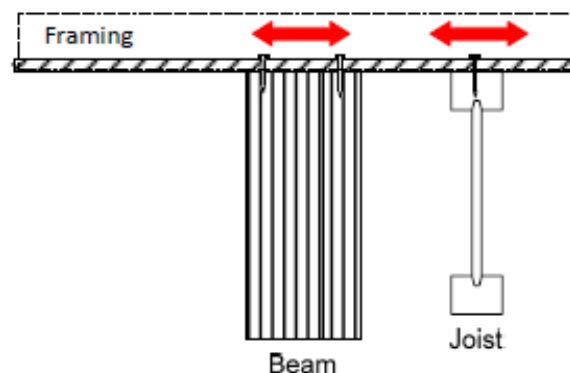


Figure 3: Direct-Attached Sheathing to Top-Edge

The following are examples of conditions that are not considered properly braced. Improperly braced applications should not be sized with either BC Calc or Boise Cascade EWP literature. For further information regarding beam bracing, see the Wood I-Joist Manufacturers Association (WIJMA) *Dropped Header Design Guide* at <http://i-joist.org/policies-publications>.

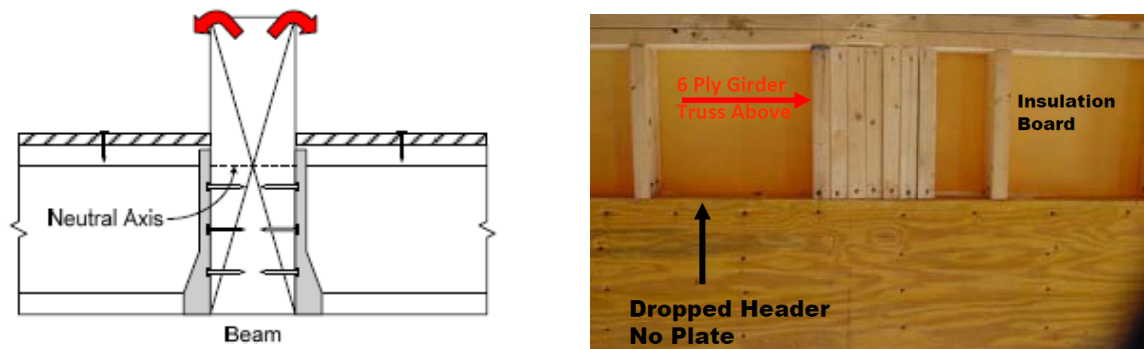


Figure 4: Examples of Improper Lateral Bracing

Ceiling/attic joists are typically not sheathed in residential construction. When installing BCI[®] / AJS[®] joists in this application, the top flanges shall be laterally braced. In lieu of sheathing, 1x4 bracing can be installed perpendicular to the joists and attached with (2) 8d nails into each flange. This bracing shall be installed at 24" on-center along the length of the joist. With bracing installed, joists may be sized utilizing BC Calc or the allowable floor PLF tables shown in Boise Cascade literature. An exception to this bracing schedule is the prescriptive ceiling joist design shown on page 13 of the Boise Cascade EWP Specifier Guides.

Failures may occur due to improper joist/beam bracing. As shown in Figure 5, top flange buckling is likely when bracing is inadequate.



Figure 5: Example of I-Joist Failure Due to Improper Flange Bracing



Bonus room joists, where only the center portion of the span is sheathed for the living space above, requires top flange bracing between joist ends and knee walls as well. Sheathing or 24" oc bracing shall be installed in these areas.

There are conditions where the bottom flange or edge of a joist or beam is in compression. In multiple span conditions, compression exists on the bottom edge at and near intermediate supports. In joist applications, the required connection of the bottom flange to the bearing support is typically considered adequate bracing in these areas. Bottom edge compression may also occur in roof framing with significant wind uplift. The uplift forces cause a stress reversal in the joist. This condition typically occurs with flatter roofs in higher wind load areas. In lieu of a detailed analysis of the specific application, a prescriptive bracing schedule of 1x4's at 24" oc is adequate for bottom flange bracing.

Bracing is a critical element of each joist and beam application. If sheathing is not directly attached to the top edge of the member, the project's design professional of record shall consider other bracing options. Failure to correctly store, use, or install VERSA-LAM[®], Boise Glulam[®], ALLJOIST[®], and BCI[®] Joist in accordance with Boise Cascade EWP product literature will void the limited warranty. For further questions, please feel free to contact Boise Cascade EWP Engineering at 800.232.0788.