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.

Figure 1: Column Buckling

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.

The span and load tables shown in all Boise Cascade EWP literature, in addition to 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.

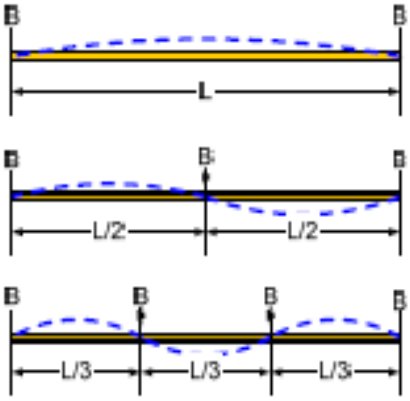

Figure 2: Top Edge Buckling of Joists and Beams

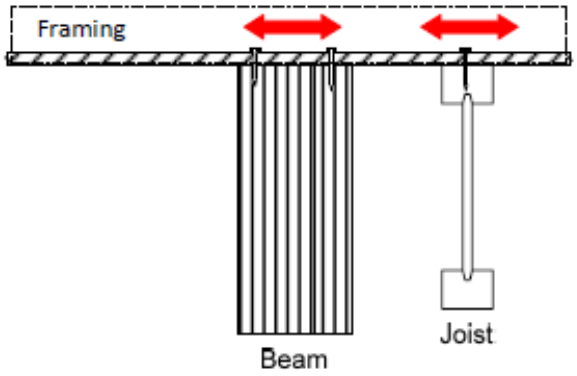

Figure 3: Direct-Attached Sheathing to Top-Edge

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 www.i-joist.org.

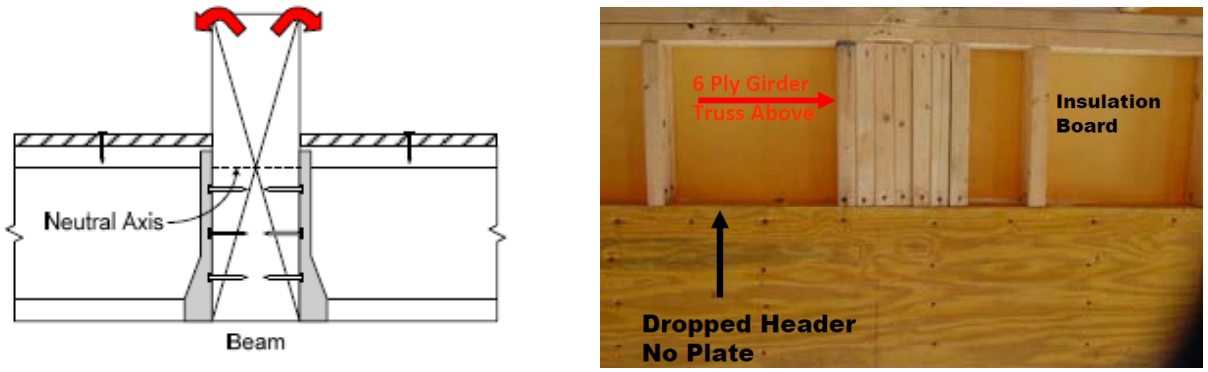

Figure 4: Examples of Improper Lateral Bracing

Ceiling/attic joists are typically not sheathed in residential construction. When installing AJS® / BCI® 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 top flange. This bracing shall be installed at 24" on-center along the length of the joist. With this 1x4 bracing, joists may be sized utilizing BC Calc® or the allowable floor PLF tables shown in Boise Cascade literature. The only exception to this bracing spacing is the prescriptive ceiling joist design shown on page 14 of the BCI's and page 15 of the AllJoist Specifier Guides.

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

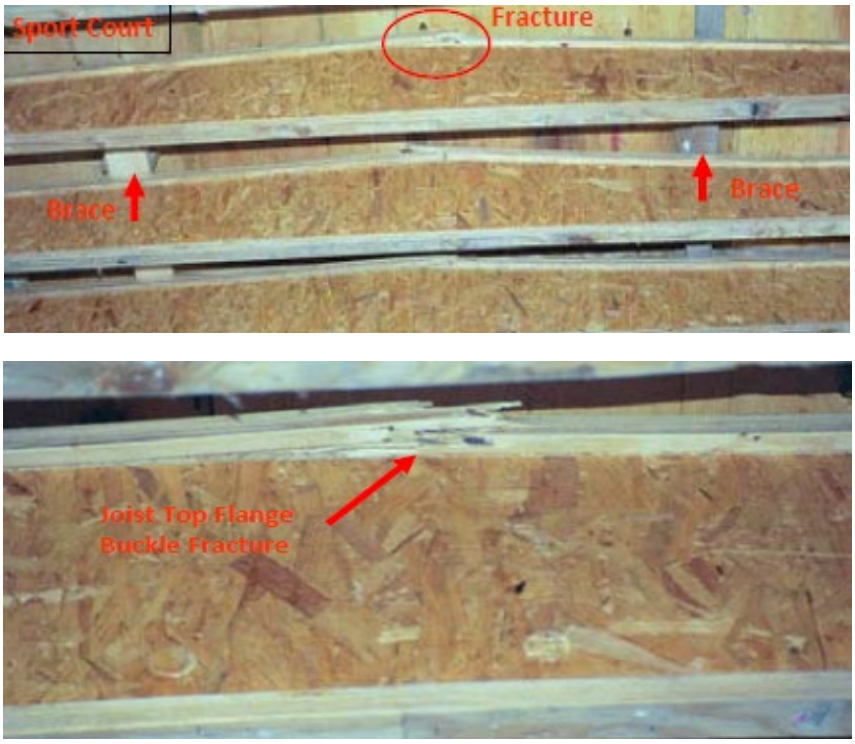

Figure 5: Example of I-Joist Failure Due to Improper Flange Bracing

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" o.c. 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. Typically, in joist applications, the required connection of the bottom flange to the bearing support is 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" o.c. would be adequate for the bottom flanges.

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. For further questions, please contact Boise Cascade EWP Engineering.