Technical Q & A

Brace the Lateral Restraint

by Jim Vogt, P.E.

Why web member bracing is critical.

Trusses are designed to carry loads applied within their plane (i.e., the plane that includes the length and depth of the truss). As with other types of structural framing components such as joists, beams, studs, columns, etc., trusses require lateral support in order to perform as intended. This lateral support is typically provided by bracing. Truss bracing in turn:

- Prevents out-of-plane buckling of truss members due to compression forces developed under the design load conditions,
- Maintains the proper truss spacing and position, and
- Resists and transfers lateral loads from wind and seismic forces applied perpendicular to the truss.

Without bracing, the entire truss, or a portion of its members, will buckle (i.e., badly deform or fail) at loads far less than the design loads the truss is intended to carry. People often become confused about what is required to permanently brace trusses and their members. The most common mistake is thinking that the truss design drawing (TDD) provides ALL of the bracing requirements for the truss. In reality, it does not.

Question

I have noticed that truss design drawings will typically specify a continuous lateral brace (CLB) consisting of 2x4 lumber to be applied to specific webs in a particular truss. By applying the CLB(s) as shown, will these webs be adequately braced?

Answer

First, note that a very important terminology change has recently been implemented concerning the term continuous lateral brace (CLB). In the 2006 Edition of BCSI continuous lateral brace has been replaced by the term "continuous lateral restraint" (CLR). This change was made to highlight the fact that a CLB is not a brace. The CLR specified on the truss design drawing, by itself, does not ensure that the web members it is attached to are adequately braced. Additional bracing, typically diagonal bracing, is required.

To answer the question above, no, installation of only CLR does not generally ensure that the web members will be adequately braced. The lateral restraint you are referring to is being specified because the design software has determined that that particular web (or webs) is prone to buckle due to the axial compression force developed under the load conditions for which the truss is being designed. By restraining the web member at the location(s) specified on the drawing, the unsupported length of the web member is reduced, making it a "shorter column," which typically means it can carry more load and have less of a tendency to buckle.

A certain amount of force is required to prevent the web member from buckling. The lateral restraint and its connection to the web must resist and transfer this force, which theoretically increases proportionally with each successive truss that the lateral restraint is attached to. This lateral force must eventually be transferred to something in the structure that is capable of resisting and transferring it safely into the ground.

at a glance

- A common mistake is thinking that the truss design drawing provides all of the bracing requirements for the truss.
- In the 2006 Edition of BCSI continuous lateral brace has been replaced in by the term "continuous lateral restraint."
- Bracing the lateral restraint is critical for ensuring truss stability; failure to do so can result in serviceability problems or structural collapse.

EXAMPLES OF DIAGONAL BRACING WITH CONTINUOUS LATERAL RESTRAINT

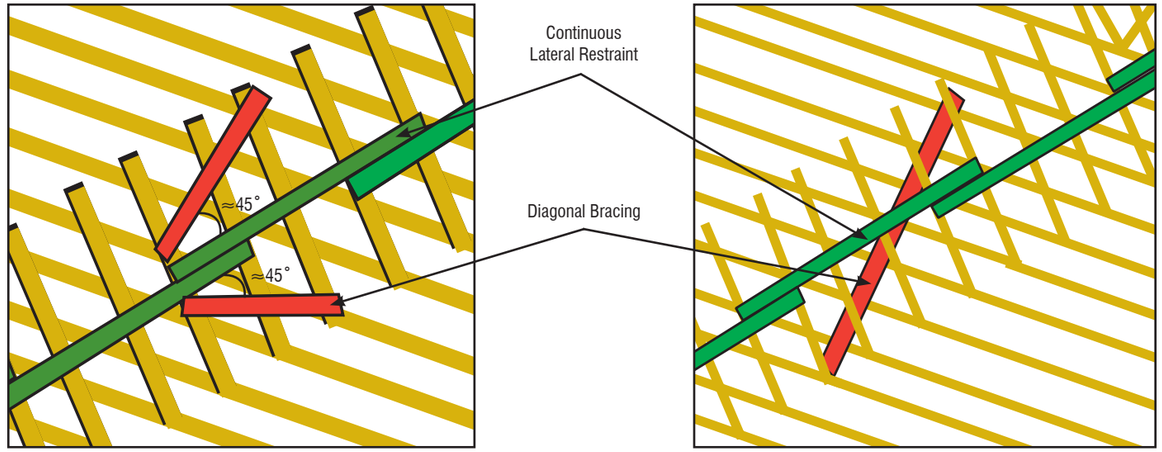

Figure 1. Examples of diagonal bracing applied to webs with a single row of continuous lateral restraint.

A common method for resisting and transferring the web lateral forces is to attach dimensional lumber diagonally, at an angle of approximately 45° to the lateral, to a series of webs that require restraint. Be sure to extend the diagonal bracing from the top chord to the bottom chord, attaching the bracing to each web that it crosses. The diagonal bracing prevents the webs from displacing laterally and transfers the cumulative force from the CLR into the roof and/or ceiling diaphragm. Unless a closer spacing is specified by the building designer, repeat the diagonal bracing at intervals of no more than 20 feet.

Figure 1 illustrates two acceptable ways of diagonally bracing webs with a single row of CLR. Figure 2 illustrates one way of diagonally bracing webs with two rows of CLR in trusses that are spaced wider than 2-ft on center. The concepts are the same as those used to brace a single row of CLR. Attaching the diagonal bracing in close proximity to the CLR helps to provide rigidity and to minimize out-of-plane bending forces in the web.

Bracing the lateral restraint is critical for ensuring the stability of the trusses; failure to do so can result in serviceability problems, and under severe conditions, can lead to very poor structural performance and even collapse. Photo 1 illustrates what can happen when diagonal bracing is not used. Here, the fractured and broken main compression web in a series of roof trusses is shown. In this case, the CLR had been properly attached, but diagonal bracing was not. The web members buckled out of plane and ultimately failed at approximately 80 percent of design load for the truss.

There are certainly other effective means for restraining the CLR, but dimensional lumber diagonal bracing is by far the most common. Chapter B3 of the 2006 Edition of *BCSI—Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses* provides basic information and installation guidelines on how to permanently restrain and brace the various planes of a truss. You can view an electronic copy or purchase a paper copy by visiting the WTCA website at www.sbcindustry.com. SBC

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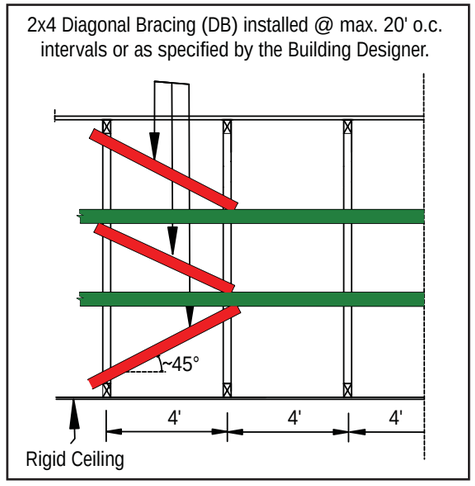

Figure 2. Example of diagonal bracing applied to webs with two rows of continuous lateral restraint.

Photo 1. Example of broken compression webs in which the CLR was attached but had no diagonal bracing. The red arrows point to the broken webs in two adjacent trusses. Note that the CLR is still attached to one of the webs.

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