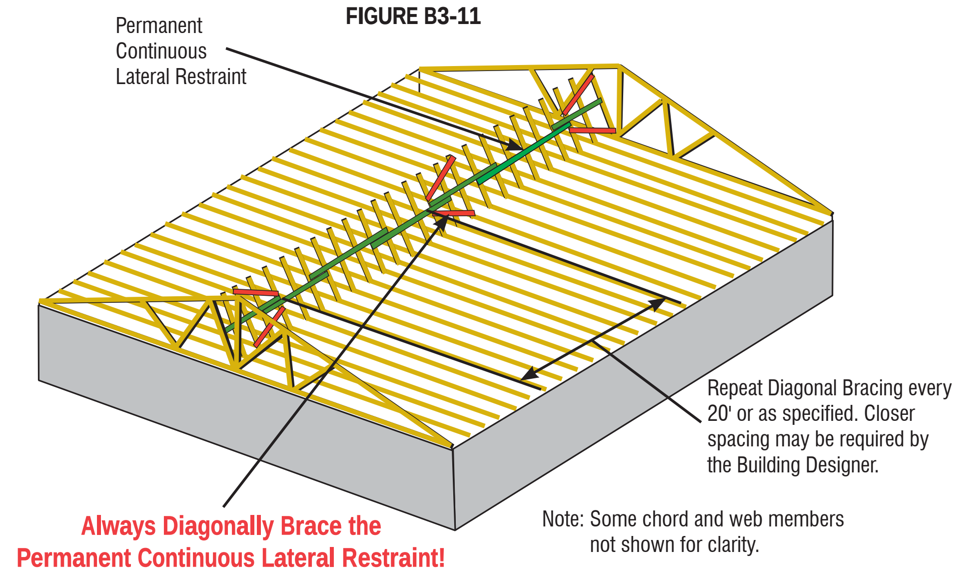
TRUSS BRACE SPLICING METHODS

by Ken Watters, P.E. & Patrick A. Phillips, P.E.

The Building Component Safety Information (BCSI) booklet, jointly produced by WTCA and the Truss Plate Institute, recognizes three planes requiring restraint in a roof truss. These three planes are the top chord plane, the bottom chord plane and the web member plane. This issue is dedicated to the importance of truss bracing in maintaining a safe and useful structure, and in order to accomplish this all three planes must be addressed satisfactorily. However, for this article, and for brevity's sake, only the web member plane is examined.

FIGURE B3-11



EXAMPLES OF DIAGONAL BRACING WITH CONTINUOUS LATERAL RESTRAINT

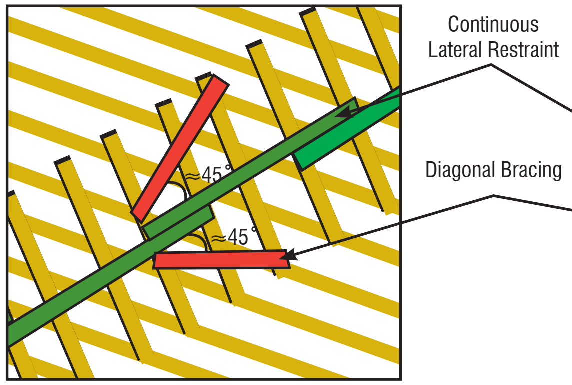


FIGURE B3-12

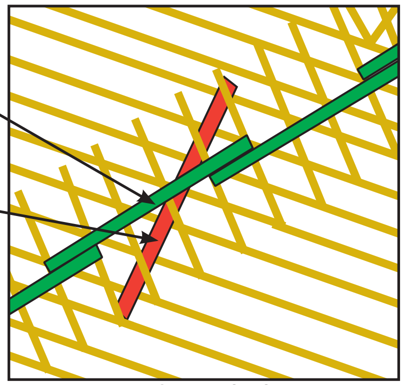


FIGURE B3-13

Figures B3-11 through B3-13 of BCSI provide a good illustration of bracing the web member plane in a series of roof truss components. Observation of this illustration reveals that the bracing is comprised of two parts. The first part consists of a continuous lateral restraint (CLR) and the second part consists of a series of diagonal bracing members ("spaced at 20' intervals") designed to distribute the cumulative lateral web member forces into the roof or ceiling diaphragm. Closer scrutiny of this illustration highlights the need to overlap the termination of the CLRs at adjacent trusses. This means that for every 16' piece of CLR installed, 4' of lumber is lost in the transition between each successive member. The obvious question is can the CLR be installed without overlapping adjacent trusses (i.e. a butt joint)?

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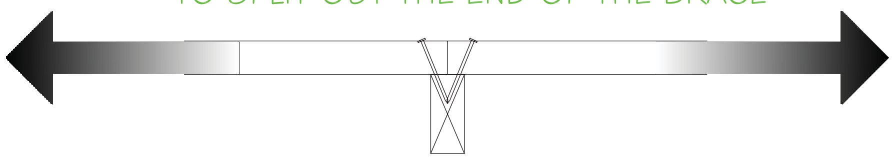
at a glance

- This new bracing detail eliminates significant wood waste.
- Bracing is comprised of two parts—continuous lateral restraint (CLR) and a series of diagonal bracing members ("spaced at 20' intervals").
- For every 16' piece of CLR installed, 4' of lumber is lost.

NAIL IS LOADED IN WITHDRAWL AND WANTS TO SPLIT OUT THE END OF THE BRACE



SECTION VIEW

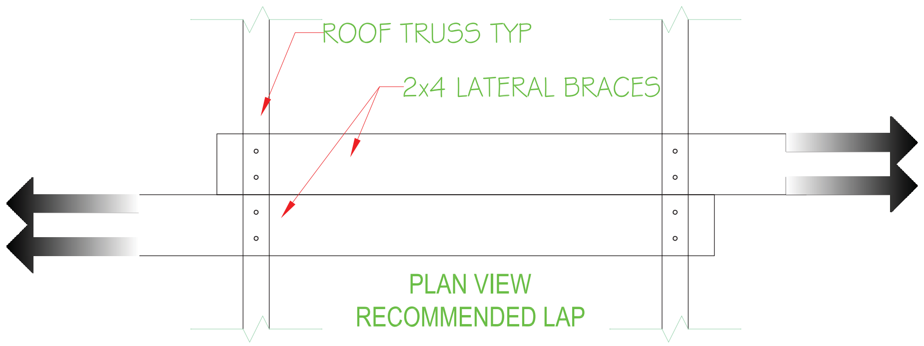


Figure 1. Overlaps of 28" or 52" min for 2' and 4' on-center spacing respectively.

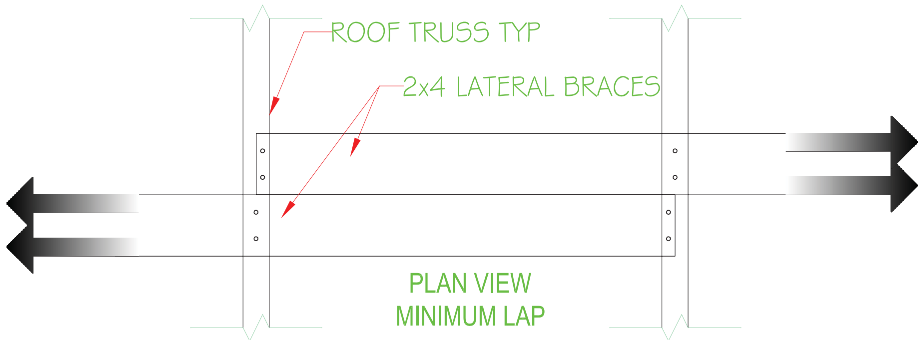


Figure 2. Overlaps of 24" or 48" for 2' and 4' on-center spacing respectively.

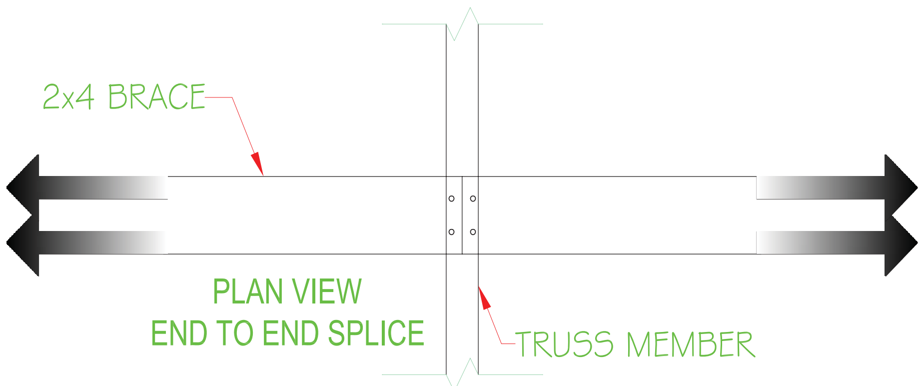


Figure 3. Butt end to end.

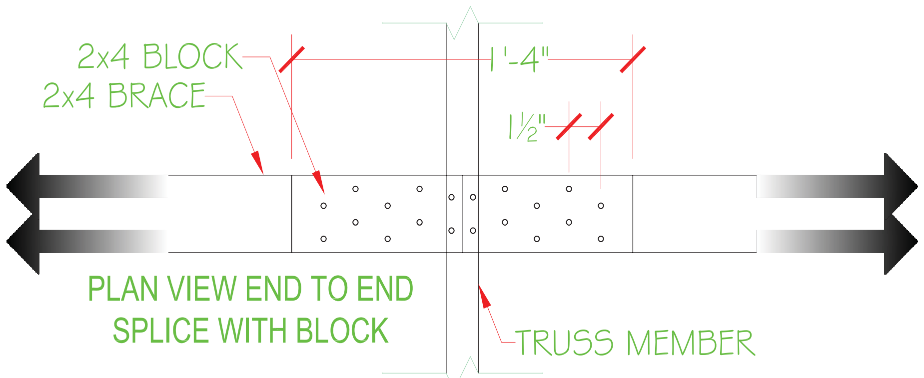


Figure 4. Butt end to end with a scab block.

Truss Brace Splicing Methods

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Technical Values & Calculations

In order to subject this matter to careful adjudication, a number of design considerations and assumptions need to be made. First, BCSI states that the CLR is to be 2x4 dimension lumber, thus 2x4 SPF #2 will be chosen. Second, the web material of the truss component itself is assumed to be 2X4 SYP #2. Third, it is assumed that all the trusses have the same geometry and thus the same web pattern. Fourth, the lateral force in the web member is a result of static loading, in this case snow loading is assumed. Fifth, 10d gun nails will be the fastener of choice because they are commonly used in construction and are readily available at most hardware stores. This particular nail has a length of 3” and a diameter of 0.131” and the lateral capacity of this particular nail is 106 lbs. This lateral capacity is arrived at by judicious application of the yield limit equations found in Table 11.3.1A of the National Design Specification for Wood Construction 2005 Edition (NDS). This 106-lb capacity per nail includes a 15 percent snow load duration increase; however, no additional increases or reductions have been taken.

We need to make one more assumption for the purpose of calculating forces. This is the value of a nail driven at an angle at the very end of a board. For the purposes of this article, a 50 percent reduction in capacity for this “end nail” condition has been assumed. The NDS gives no guidance on this type of connection: the actual capacity is just one bit of valuable information the SBC Research Institute (SBCRI) may be able to provide to the industry in the future.

Common Types of Lumber Splices & Approximate Capacities

Typically, two nails are used to secure each brace at every truss intersection. The following values should be used as a comparison from one method to the other.

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1.) Overlaps of 28" or 52" min for 2' and 4' on-center spacing respectively: **4 nails * 106#/nail = 424#** (See Figure 1.)

2.) Overlaps of 24" or 48" for 2' and 4' on-center spacing respectively: **4 end nails * 53#/nail = 212#** (See Figure 2.)

3.) Butt end to end: **2 end nails * 53#/nail = 106#** (See Figure 3.)

4.) Butt end to end with a scab block:
(8 nails * 106#/nail) = 848#
(end nail contribution ignored) (See Figure 4.)

Obviously, the application of a scab block yields the greatest capacity of the four connection details examined. It does not increase the capacity of the connection to the web (i.e., the lateral force in the web must be less than 212#); however, it does increase capacity across the web.

Usage example

As an added benefit, this type of installation can save over 2-1/2' of lumber per splice. The following list gives the amount of lumber needed for each type of splice previously discussed for one row in a 100-foot building with trusses 2' on-center. It is not uncommon to have thirty rows or more of bracing in some buildings. Alternately, it is not uncommon for a residential house to have 4 or 5 rows of bracing; however, that same house can be built 100 times a year.

- End to end – 98 lineal feet (see #3 above)
- End to end with block – 120 lineal feet (see #4 above)
- Min overlap – 132 lineal feet (see #2 above)
- Recommended overlap – 156 lineal feet(see #1 above)

Conclusion

End to end splicing or the minimum overlap splicing may not be able to develop the required capacity needed in a particular bracing system and should be avoided. Butting braces end to end with a scab block, recognizing that this is a continuity connection across the web because the brace forces are cumulative, results in the greatest capacity of the connection details discussed. The block length can be increased as required and more nails added if more load transfer is required in certain circumstances. This connection makes the most use of the lumber and makes use of small blocks that in many cases can be salvaged from the scrap pile.

Proper bracing and the splicing of that bracing into long runs is essential for trussed roof systems and should always be given proper attention. In many situations it is a good idea to seek the advice of a structural engineer to help with the design of the overall truss bracing system. SBC

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