Composite Fastener Design for Ply-to-Ply Connections

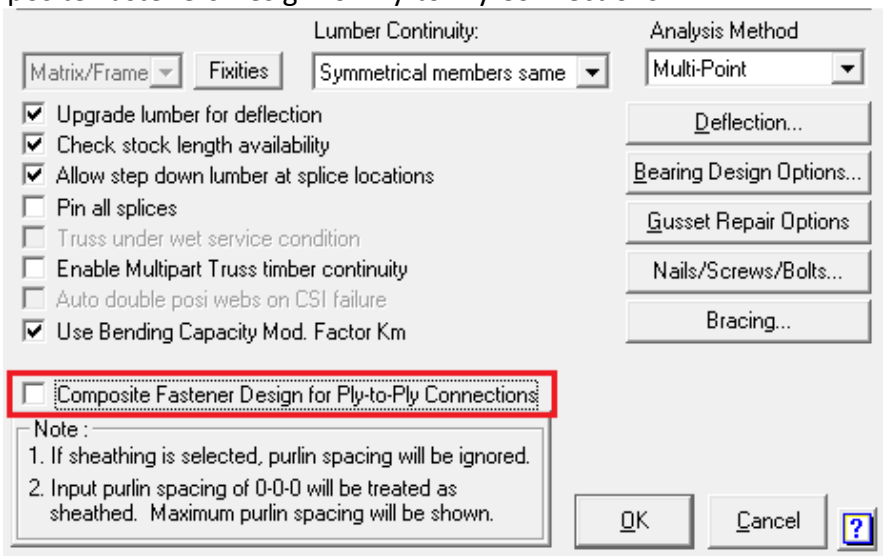
Girder trusses are trusses specially designed to carry extra load from tie-in trusses and equipment. If a single ply is insufficient to carry the entire load, the truss designer specifies a multiply girder, that is made of identical trusses and fastened together to act as one unit to support the load. Fasteners may be nails, screws or bolts depending on the amount of load and number of girder plies. Multiply girders perform according to the design only if all plies are properly attached together. Engineering principles and various code referenced standards provide guidance as to type and extent of connections that may be required.

When we have load applied to a multiply girder truss, in order to design the fasteners, we assume all plies take an equal amount of load. According to ANSI/TPI section 7.5.5.2, multi-ply girder ply-to-ply connections shall be adequate to carry the cumulative load of the remaining plies. For example, if a 3000 lb point load is applied to a 3-ply girder truss, we assume each ply carries 1000 lbs. The connection between the 1st and 2nd ply would have to be designed to transfer the sum of the 2nd and 3rd ply loads, or 2000 lbs in this example.

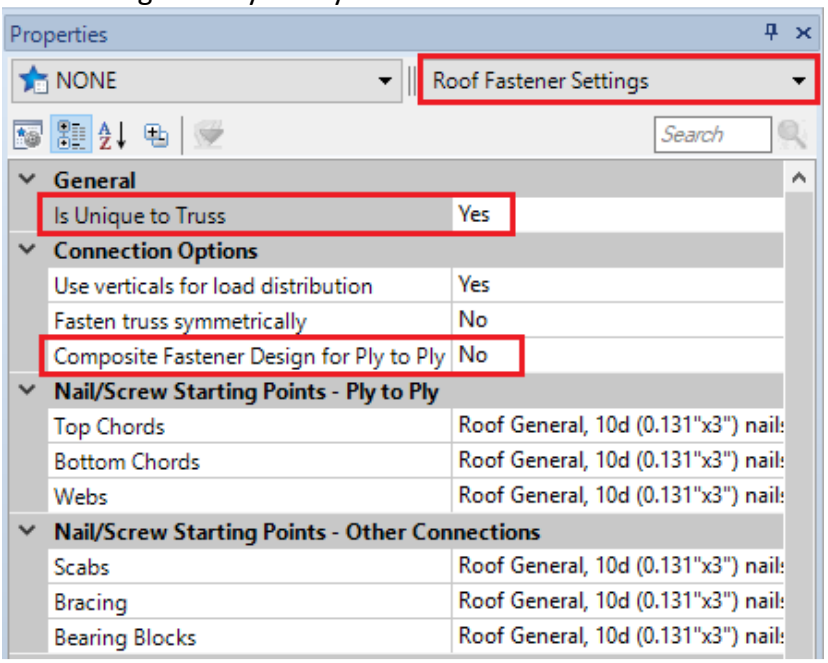
To ensure composite action provided by the fasteners (in other words to ensure connected plies act as a single unit), section 15.3.3 of NDS limits the maximum spacing between adjacent fasteners in a row to $6t_{min}$, where t_{min} is thickness of the rectangular truss member, i.e. 1-1/2". That is why, when fasteners are designed to provide composite action for ply-to-ply connections, this limits the fasteners to 9" o.c. maximum spacing. It does not matter what fasteners are being used to transfer load: nails, screws or bolts.

Section 7.5.5.4 of ANSI/TPI allows up to 12"o.c. nails spacing for ply-to-ply connection. However with spacing over 9" o.c., composite action is only partially developed, that is why each ply must be checked for buckling as a single ply.

To turn off composite member design in MiTek 20/20 Engineering, go to "Design Info" and uncheck "Composite Fasteners Design for Ply-to-Ply Connections".



To turn off composite member design in Structure with Truss Design, in Properties dialog box select “Roof Fastener Settings”, change to “Yes” in “Is Unique to Truss” and to “No” in “Composite Fasteners Design for Ply-to-Ply Connections”.



This will allow for greater ply-to-ply fasteners spacing:

Nails:

- 12” max spacing
- 1 row for depths less than 5.5”
- 2 rows for depths equal to and larger than 5.5”

Screws:

- 24” max spacing
- 1 row for depths less than 7.25”
- 2 rows for depths equal to and larger than 7.25”

The advantage is that this will reduce the number of nails or screws required for ply-to-ply connection of multi-ply trusses. The disadvantage is that chord analysis may have a greater CSI and could require more bracing, and you may see additional bracing on webs.

For additional information, or if you have questions, please contact the MiTek Engineering department.