Multiple-Ply Girder Load Distribution Change in ANSI/TPI 1-2022.

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.

Based on ANSI/TPI 1-2014 and earlier versions of Section 7.5.2.4, the maximum number of plies shall be five, if loads are attached to one side of the girder, or six, if loads are attached to both sides of the girder. When side load was applied to a multiply girder truss, it was assumed all plies take an equal amount of load. For example, if a 2400 lb side point load is applied to a 3-ply girder truss, each ply was designed to carry 800 lbs. But if a 2400 lb side point load is applied to a 4-ply girder truss, each ply was designed to carry 600 lbs.

According to ANSI/TPI 1-2022 Section 7.5.2.4: *The maximum number of plies shall be six, for Trusses with plies no greater than 2 inches thick with a structural member imposing a load attached to one side of the multiple-ply girder, and each ply of the Truss shall be designed to carry no less than the following proportion of the side-applied girder load from that structural member:*

For 2-ply Trusses: 50%
For 3-ply Trusses: 37%
For 4-ply Trusses: 29%
For 5-ply Trusses: 28%
For 6-ply Trusses: 25%

The maximum number of plies shall be three, for Trusses with plies no greater than 4 inches thick with a structural member imposing a load attached to one side of the multiple-ply girder, and each ply of the Truss shall be designed to carry no less than the following proportion of the side-applied girder load from that structural member:

For 2-ply Trusses: 55%
For 3-ply Trusses: 41%

As you can see, the load distribution percentages for multiple-ply girders have increased. The first above-mentioned distribution is applicable to lumber on edge and the second is applicable to lumber on flat applications. The amount of increase varies based on the number of plies. Applying ANSI/TPI 1-2022 load distribution to example mentioned above, if a 2400 lb side point load is applied to a 3-ply girder truss, each ply shall be designed to carry 888 lbs. And if a 2400 lb point load is applied to a 4-ply girder truss, each ply shall be designed to carry 696 lbs.

With increased load, there will be impact to the design of each individual truss ply, including plates, lumber, and deflection. Note that even though each individual ply is designed for a higher amount of load, the overall truss is still designed for the actual loads applied.

Increase of load percentage in the individual ply will not affect the ply-to-ply fastening schedule. As in previous versions of the standard, according to ANSI/TPI 1-2022 Section 7.5.5.2: *multi-ply girder ply-to-ply connections shall be adequate to carry the cumulative load of the remaining plies and the load used for ply-to-ply connection design shall be based upon a distribution of load to each ply equal to 1/n fraction of the total side load, where n equal the number of plies.* So, in example mentioned above, if a 2400 lb point side load is applied to a 3-ply girder truss, 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 1600 lbs in this example. But if a 2400 lb point load is applied to a 4-ply girder truss, the connection between the 1st and 2nd ply would have to be designed to transfer the sum of the 2nd, 3rd and 4th ply loads, or 1800 lbs in this example.

For additional information, or if you have questions, please refer to ASI/TPI 1-2022 or contact the MiTek Engineering department.