Repetitive Member Increase (C_r) and Additional Repetitive Increase.

A Repetitive Member Increase (**C_r**) in truss design accounts for the load-sharing and composite action that occurs when multiple members, connected by load-distributing elements, act together as a system.

This is an adjustment to allowable stresses of multiple members (like trusses, joists, rafters, or studs) that share the same load together, rather than supporting this load as individual members. If one member is slightly weaker or more heavily loaded, adjacent members can help carry the excess load, reducing the likelihood of failure in any single member. The probability of all members being at their weakest strength simultaneously is low and this statistical redundancy allows for a modest increase in allowable stresses. This concept is recognized in design standards such as the National Design Specification (NDS) for Wood Construction and ANSI/TPI 1 (National Design Standard for Metal Plate Connected Wood Truss Construction).

Per ANSI/TPI 1 section 6.4.2 *Repetitive member design values apply to all Truss chord members where three or more Trusses are positioned side by side, are in contact, or are spaced no more than 24 inches on center and are joined by roof sheathing, flooring, gypsum, or other load distributing elements attached directly to the chords, as follows:*

(a) For solid sawn lumber members to which structural wood sheathing is mechanically attached: use the repetitive member design value listed in the recognized lumber grading rules, or 15 percent increase to F_b and 10 percent increase to F_c, F_t and E_{min}.

(b) For solid sawn lumber members to which structural wood sheathing is not attached: use the repetitive member design value listed in the recognized lumber grading rules, or 10 percent repetitive member design value increase to F_b , F_c , F_t and E_{min}.

(c) For Structural Composite Lumber: repetitive member design values shall be limited to no more than a 4 percent increase to F_b and no (zero) increase to other allowable design values.

Where F_b - Bending Stress, F_c - Compression Stress, F_t - Tension Stress and E_{min} - Modulus of Elasticity.

The repetitive member increase permits up to a 15 percent increase in some allowable stresses. This means that some trusses with slightly overstressed lumber may not require lumber upgrades, if the repetitive member increase is applicable.

For example, a run of three or more common trusses spaced at a maximum 24 inches on center and joined by roof sheathing could use the repetitive member increase. However, a one- or two-ply girder truss that carries these common trusses would not qualify for the use of repetitive member increase because a girder truss that supports other trusses does not share the same loading with adjacent trusses. Per ANSI/TPI section 6.4.2.2 single-ply and two-ply girder trusses are not permitted to use the repetitive member increase. In contrast, girder trusses with three or more plies may take advantage of the increase. Whether the members are attached to each other or spaced up to 24 inches, as long as they share the same load, a repetitive member increase is applicable.

Repetitive Member Increase (C_r) and Additional Repetitive Increase.

Section 7.5.3.7 of ANSI/TPI 1-2022 introduces a new provision, Additional Repetitive Increase, which allows the bending stress in trusses with three or more plies to be further increased when the ply-to-ply connection capacity is at least 2.1 pounds per square inch (psi). The amount of the increase varies depending on the number of plies and the lumber grade:

7.5.3.7.1 Visually Graded Chords.
Trusses with 3 plies: *1.17*
Trusses with 4 or more plies: *1.22*

7.5.3.7.2 MSR/MEL Chords.
Trusses with 3 plies: *1.09*
Trusses with 4 or more plies: *1.13*

When the Additional Repetitive Increase is used, it helps to reduce the CSI of the applicable chord members, but the ply-to-ply fastening schedule must be adjusted to meet the 2.1 psi requirement. Additional Repetitive Increase can only be applied when the standard Repetitive Member Increase is also applicable.

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