



**EVALUATION OF JOISTS AND THEIR
TYPICAL REINFORCEMENT IN STEEL-
FRAMED BUILDINGS:
SUGGESTIONS OF JOIST MEMBERS
REINFORCEMENT**

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SUMMARY

Many types of joist reinforcement taking into account loads, role of each joist member and existing welds.

EVALUATION OF JOISTS AND THEIR TYPICAL REINFORCEMENT IN STEEL-FRAMED BUILDINGS

Unforeseen changes often occur in the design loads on a building, either during construction or afterwards in the existing structure. One of the structural components that is highly impacted by any change in loading is the open-web steel joist. The most common design change in the field is due to concentrated loads such as HVAC units. Therefore, it is imperative that the building owner or general contractor notify the joist fabricator or design engineer immediately of any changes to the loads before proceeding with any installations or reinforcements.

Among the services provided by Canam is the evaluation and re-design of its joists, no matter when they were fabricated. First, the information from the joist tag (Figure 1) is required to check on the data that is already available in Canam's records. Subsequently, further field information may be required such as the joist member sizes and their geometry.



Figure 1

Loading pattern

In this article, the principal types of reinforcement will be examined. When a joist is subjected to standard uniform loads, as usually prescribed by the building's design engineer, the function of the joist members generally corresponds to the following load-bearing patterns (Figure 2):

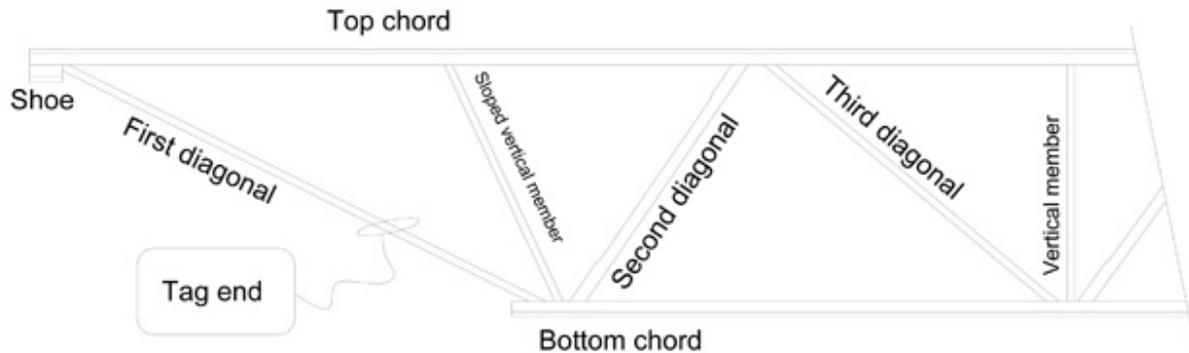


Figure 2

- The top chord members (composed of two angles welded together back-to-back) are subjected to compressive forces.
- The bottom chord members (composed of two angles welded together back-to-back) are subjected to tensile forces.
- The first or end diagonal is primarily subjected to tensile forces.
- The second diagonal and the other diagonals sloped in the same direction from the bottom chord (generally towards the centre of the joist) are primarily subjected to compressive forces.
- The third diagonal and the other diagonals sloped in the same direction from the bottom chord (generally towards the end of the joist) are primarily subjected to tensile forces.
- The vertical members are normally subjected to compressive forces. (The first vertical, usually located between the first and second diagonals, may be inclined from the bottom chord towards the end of the joist.)

Canam considers that a joist member is overstressed when its compressive or tensile load-carrying capacity is exceeded.

Round bars reinforcement

The most commonly used type of reinforcement for top chords and bottom chords is the addition of round rods having a diameter according to the capacity of each existing member subjected to the added applied forces (Figure 3). In addition to the welds prescribed for the modification or repair of the joists, Canam recommends that the rods be welded to each panel point or node (i.e. the intersection of the joist diagonals and verticals at the top or bottom chords).

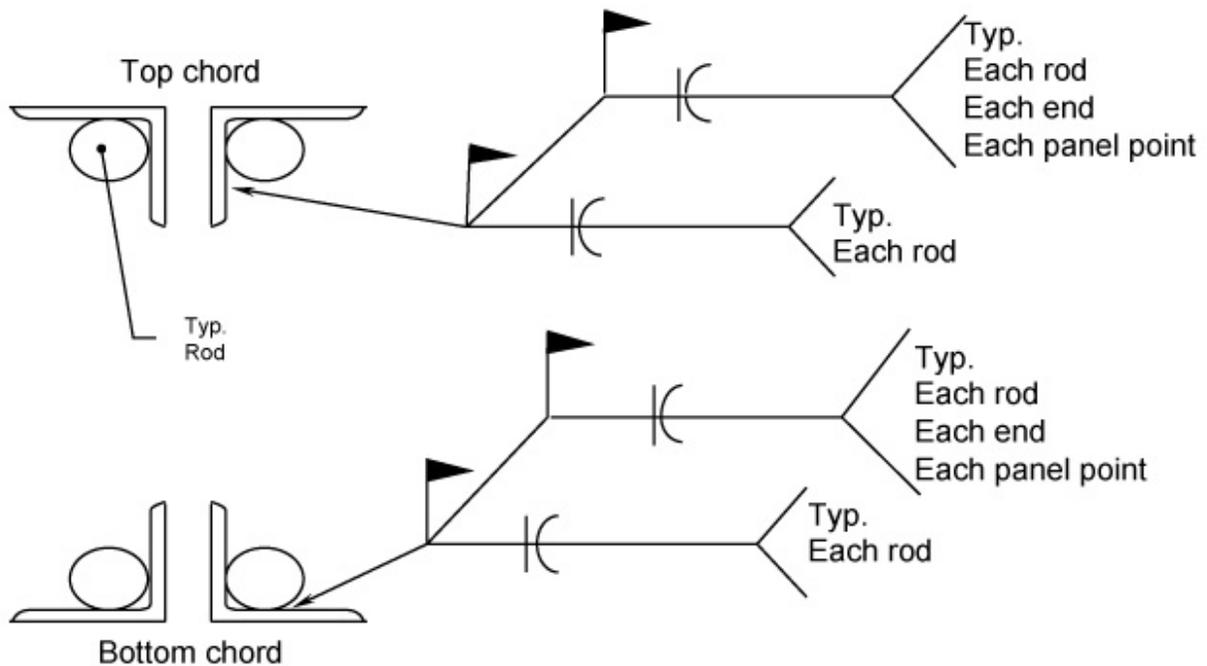


Figure 3
 For information purposes only

Angle reinforcement

For diagonal or vertical members subjected to overstressing of the compressive or tensile forces, the type of repair procedure may vary. To reinforce these members, the best option is to add two angles, one on either side of the affected member (Figure 4). The weld, which is essential in distributing the load, is also applied to the top and bottom chord members. However, if the top and bottom chords also need to be reinforced, a solution must be chosen so as not to interfere with the chord members (Figures 3 and 4).

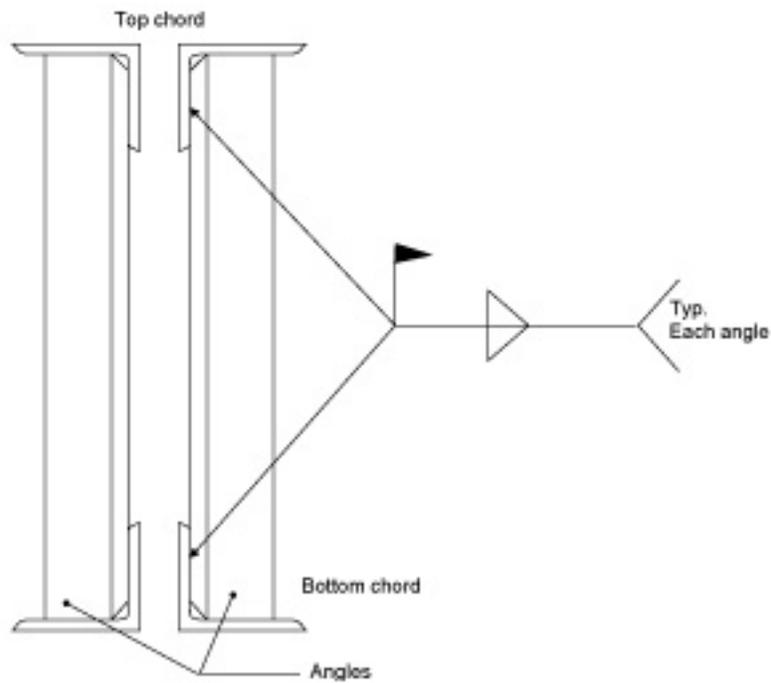
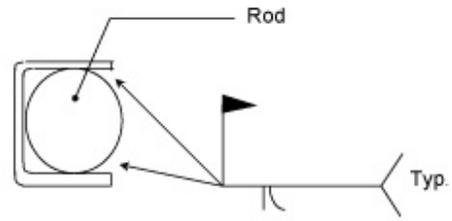
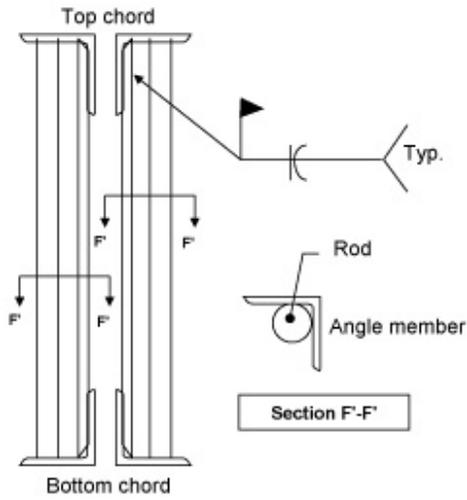


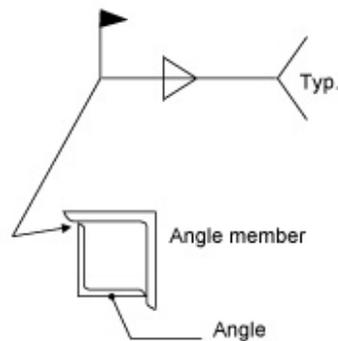
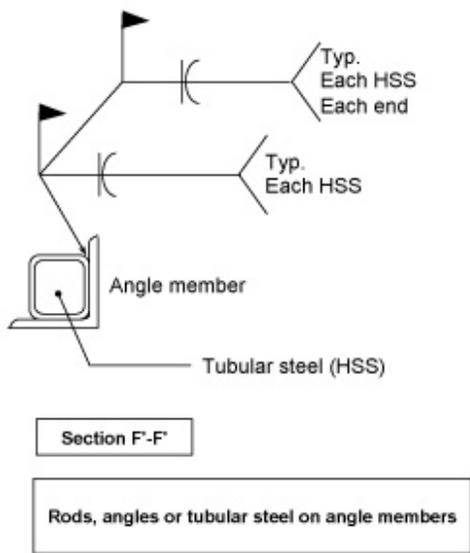
Figure 4
For information purposes only

Reinforcement with other types of sections

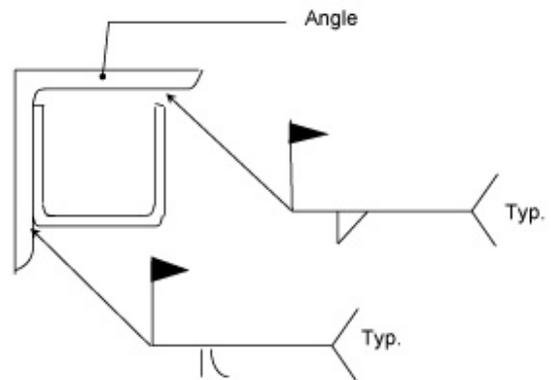
When a vertical or diagonal member is subjected to complete compression, it can be reinforced with other types of cold-formed or hot-rolled sections (Figure 5) to avoid interference with other members that need repair. The choice of reinforcement depends on the geometry of the existing member.



Rod inside a U member



Section F'-F'



Additional angle on a U member

Figure 5

Conclusion

To summarize the principles of joist reinforcement, consideration must be given to the function of each member according to the type of forces it supports and to the existing welds (i.e. effective depths and lengths). The type of reinforcement must meet the design engineer's requirements, comply with prescribed standards and stay within the project budget.



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