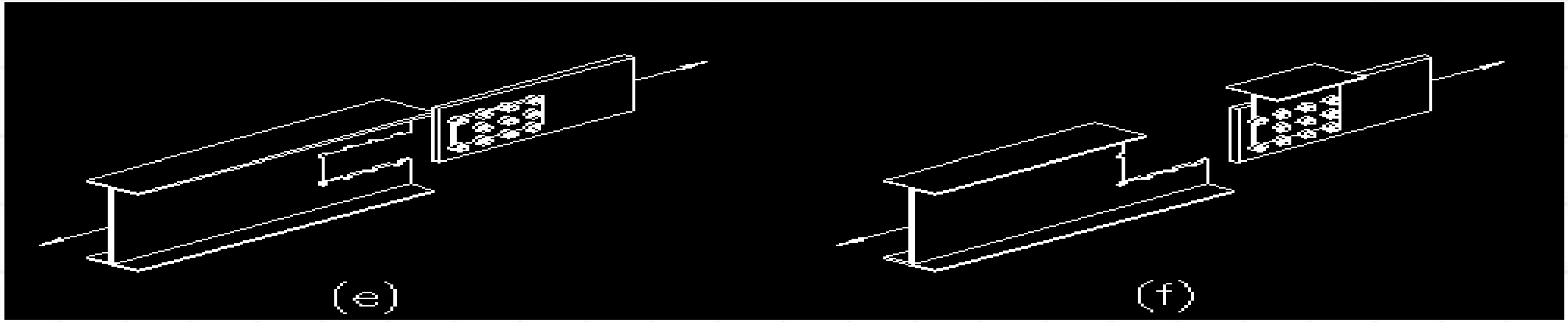
- Block shear Failure path graph

- Coped beam — Obs Value Conditions

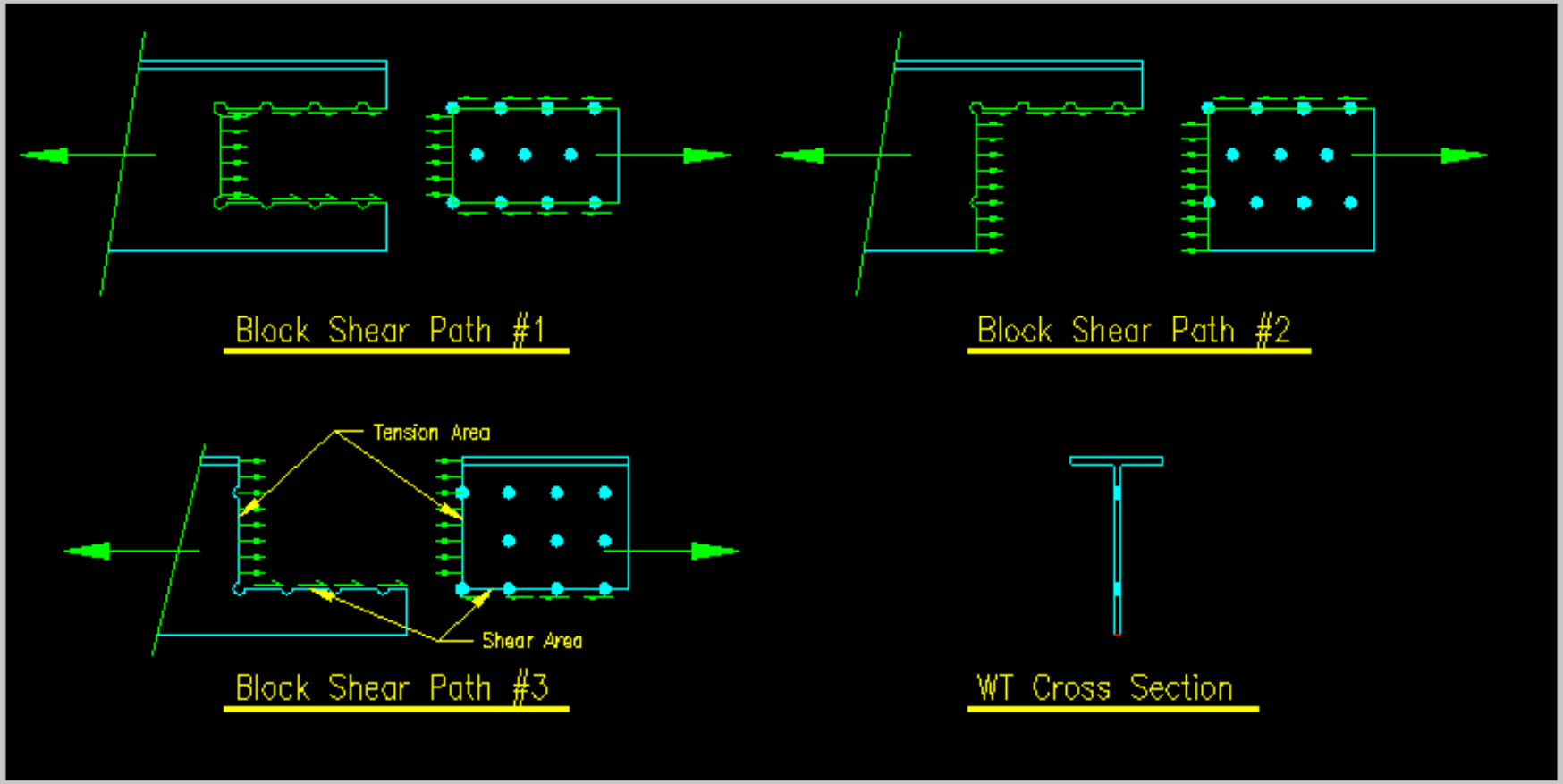
https://www.bgstructuralengineering.com/BGSCM16/BGSCM003/BGSCM00307.htm

Block shear occurs when a "block" of the member is "torn" out as depicted in Figures 3.1.1(e) and 3.1.1(f). Block shear is characterized by a failure that includes both tension (i.e. normal to the force) and shear (i.e. parallel to the force) failure planes. Like tensile rupture, there are frequently multiple valid failure paths that must be investigated. The capacity of each failure path is a sum of the capacities of each of the failure surfaces in the path. Each tension area capacity equals the tension area (either gross or net) times a tensile stress (yield or ultimate). Each shear area capacity equals the shear area (either gross or net) times a shear stress (yield or ultimate).



https://www.bgstructuralengineering.com/BGSCM16/BGSCM003/BGSCM00307.htm

Figure 3.7.1
Block Shear Failure Paths



Prepared by Eng.Maged Kamel.

3. Block Shear Strength

The available strength for the limit state of block shear rupture along a shear failure path or paths and a perpendicular tension failure path shall be determined as follows:

$$\phi P_n \; R_n = 0.60F_uA_{nv} + U_{bs}F_uA_{nt} \le 0.60F_yA_{gv} + U_{bs}F_uA_{nt} \qquad \text{(J4-5)}$$

$$\phi = 0.75 \text{ (LRFD)} \qquad \Omega = 2.00 \text{ (ASD)}$$

where

A_{nt} = net area subject to tension, in.^{2} (mm^2)

Where the tension stress is uniform, $U_{bs} = 1$; where the tension stress is nonuniform, $U_{bs} = 0.5$. Gusset plate

User Note: Typical cases where U_{bs} should be taken equal to 0.5 are illustrated in the Commentary.

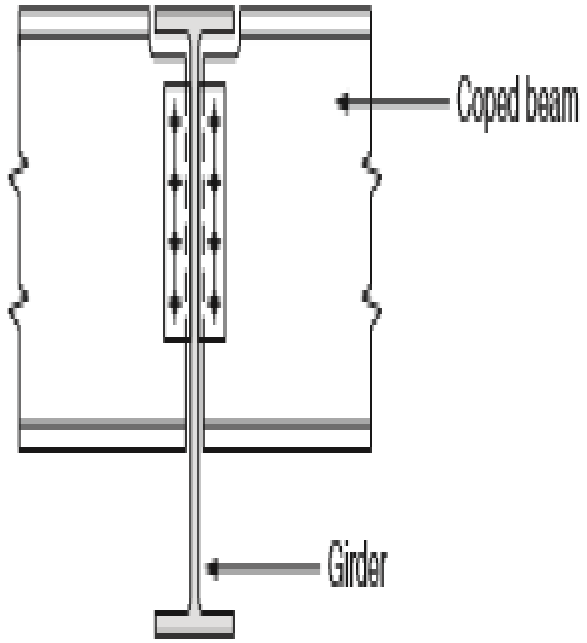


Figure 5.7 Coped beams.

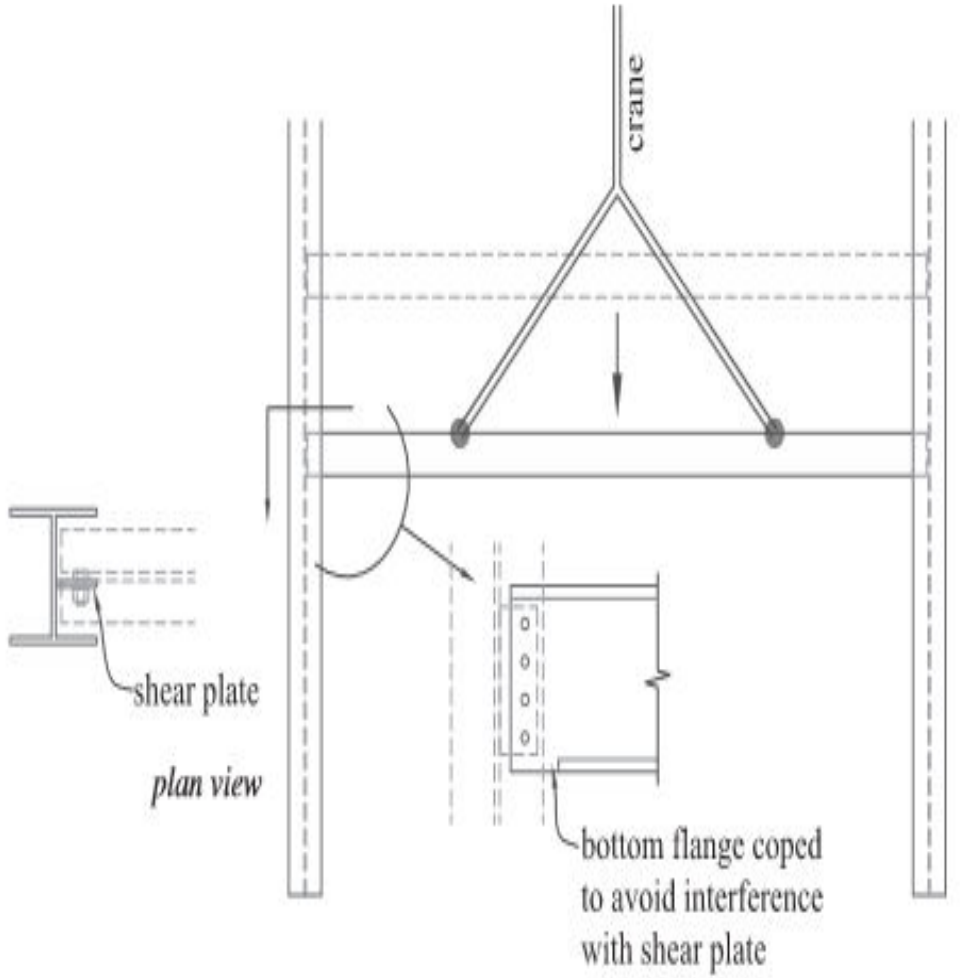


Figure 11-1 Coped bottom flange due to construction sequence.

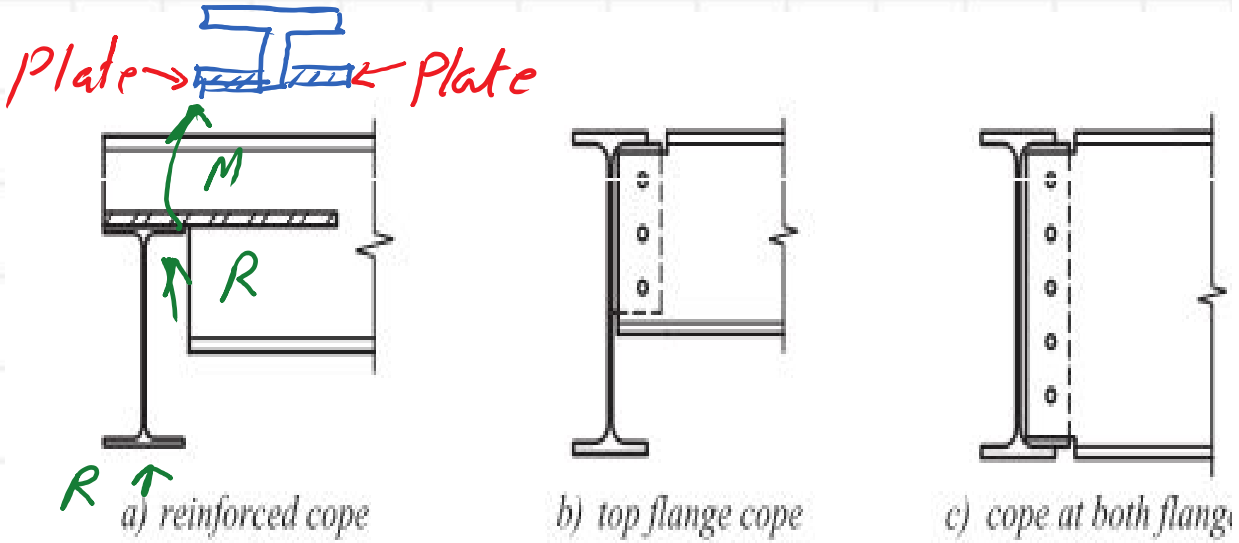


Figure 11-2 Types of beam copes.

member. In some cases, field conditions may dictate the requirement of a cope. For example, Figure 11-1 shows a beam framing into the web of a column. When this beam is erected into its final position, it is dropped down in between the column flanges. This particular beam would require a coped bottom flange in order to be placed without an obstruction. Other common coped beam connections are shown in Figure 11-2.

Additional beam modifications for connections are shown in Figure 11-3. A beam *cope* is defined as the removal of part of the beam web and flange. A *block* is the removal of the flange only, and a *cut* is the removal of one side of a flange. In each of these cases, it is common to refer to any of them as copes since the analysis and design procedures are similar.

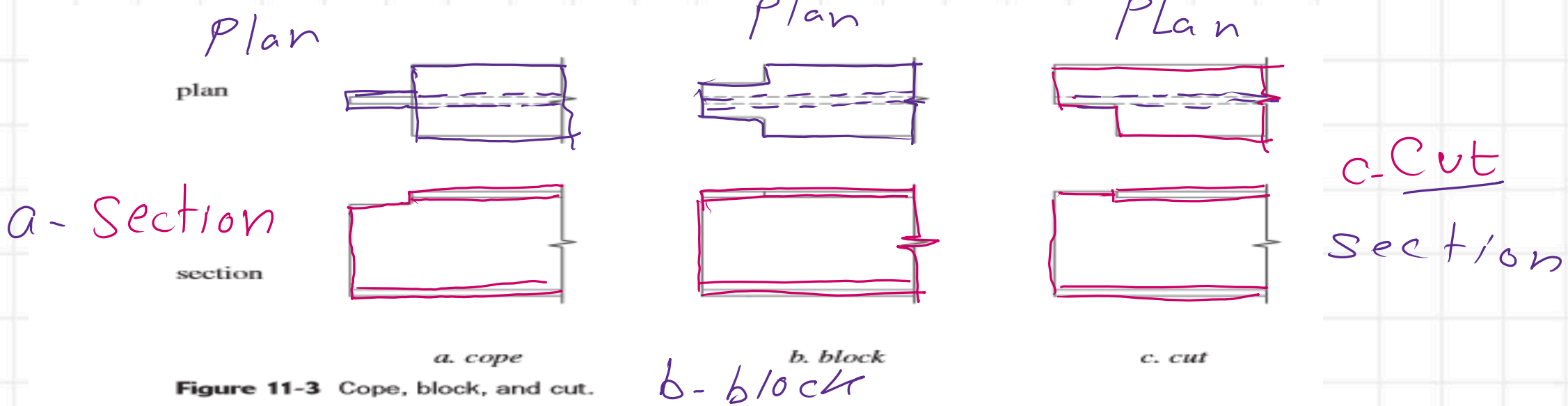


Figure 11-3 Cope, block, and cut.

AISC Commentary

J. 4 16.1_445

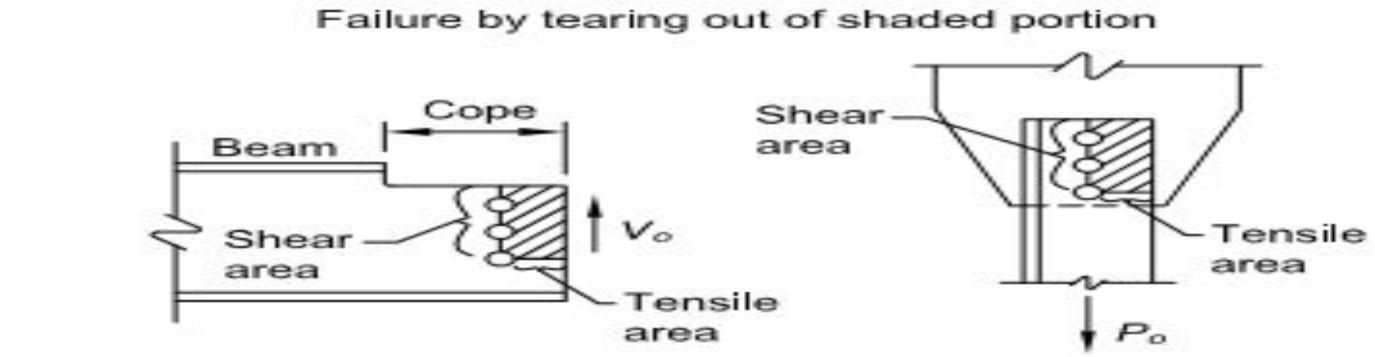
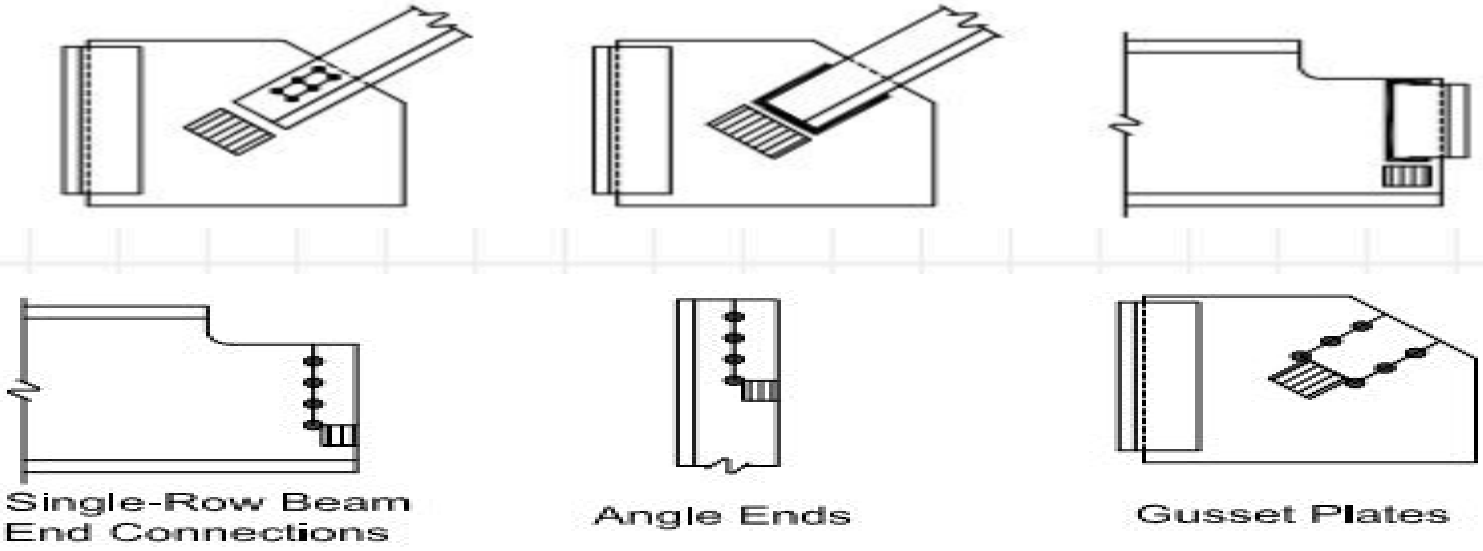
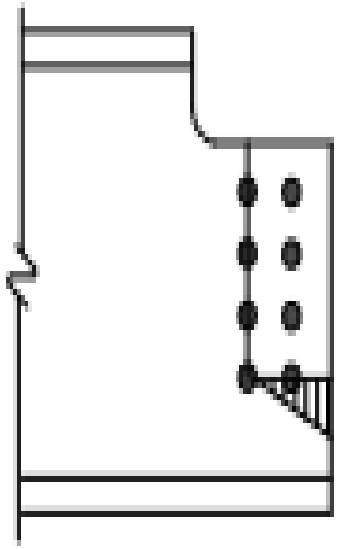


Fig. C-J4.1. Failure surface for block shear rupture limit state.



(a) Cases for which $U_{bs} = 1.0$



Multiple-Row Beam-End Connections

(b) Cases for which $U_{bs} = 0.5$

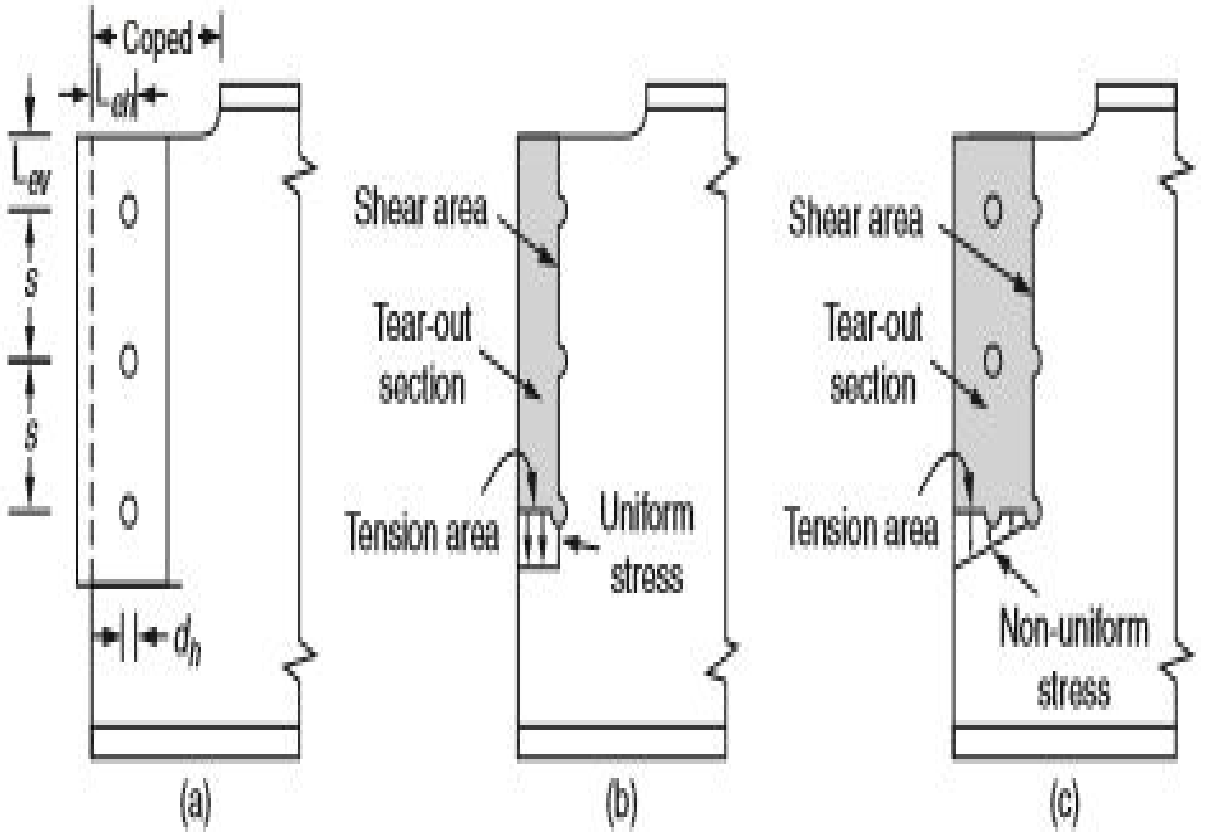


FIGURE 5.8 Web tear out in coped beams.