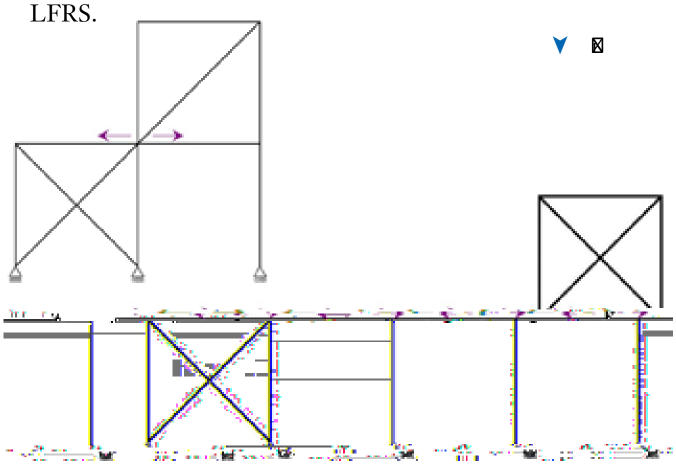
If here are discon in i ies in he LFRS, hen he la eral force in a discon in o s ba needs o be ransferred o he la eral s s em belo . The forces can go hro gh he diaphragm or framing members (drag s r s) if he diaphragm has ins f cien s reng h. In he pper e ample of Fig re 3, one migh hink ha he force is ransferred hro gh he s eel and i h he bo om e ample, one migh hink ha he forces o ld ransfer hro gh he diaphragm. Ho e er, ei her a is possible. If i is a s eel- o-s eel ransfer (meaning he diaphragm does no ha e s f cien s reng h), hen he ransfer forces sho ld be no ed on he design dra ings indica ing he proper load pa h o he LFRS.

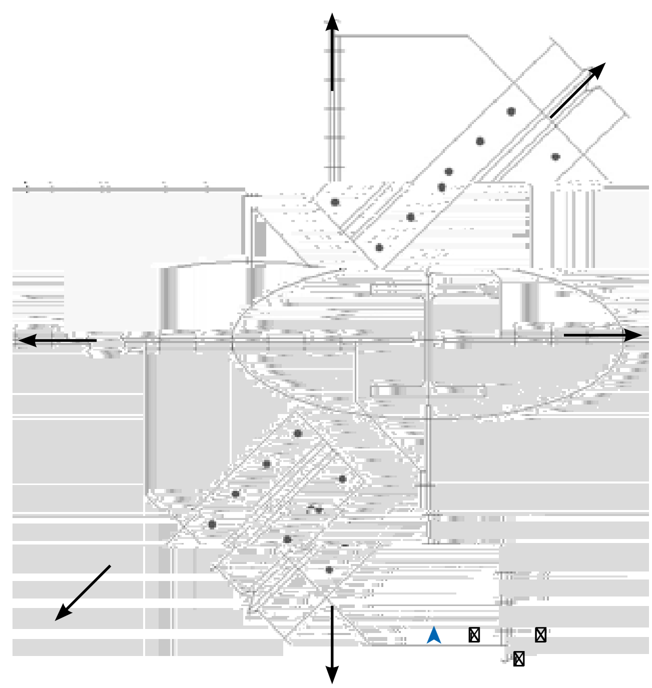


Also no e ha ransfer forces on opposi e sides of he col mn sho ld be eq al o main ain eq ilibri m a he join . In addi ion, beams of he same nominal dep h ill facili a e more economical connec ions and framing for ransferring hese forces a col mn ebs. Special a en ion is especiall needed a he roof here he me al deck picall has limi ed s reng h. (See Fig re 4.)

Forces are not Always Apparent

O erhangs, sloping col mns and bracing connec ions ha mee a a join ma req ire a look a he ac al de ails o de ermine ho he force is ransferred. The force ransfer ma no be so apparen from a comp er model or force o p .

There are of en ransfer forces o consider hen bracing connec ions mee a a join . Hori on al bracing or er ical bracing connec ions separa ed b drag and s r elemen s in he oor diaphragms ma also req ire ha ransfer forces be considered. T picall , members are deno ed as single lines on plan and framing members a he join s can be o er-simpli ed. For e ample, Fig re 5 sho s hori on al bracing on each side of he col mn. Hori on al g sse s are sed o ransfer he force aro nd he col mn. For a comple e load pa h, he hori on al g sse s ransfer he brace force o he beams and he beam- o-col mn connec ions ransfer he beam a ial force o he opposi e side of he col mn. In plan, on a se of dra ings hese co ld look like hree members (o beams and a hori on al brace) framing in o he col mn. If proper considera ion of he ransfer forces is no gi en, hen here co ld be a discon in i a he connec ion and an ndersi ed beam for he ransfer forces from he hori on al brace. The load has o ge aro nd he col mn, and a proper load pa h sho ld be pro ided.



Consider Stability

When dra ing single lines for members ha mee a join s, i is of en eas o o erlook he connec ions ha can res l in ins abili of he s s em. The o erhang (sho n in Fig re 6) has a comple e load pa h b is no s able. In his ins ance he o erhang as sho n as a simple connec ion. When de ailing he connec ion his po en ial ins abili as bro gh o ligh and he missing momen connec ion as pro ided. Finding po en ial iss es can be accomplished b s d ing he join eq ilibri m and s abili of he s s em.

When designing momen connec ions o col mn webs, s iffeners are of en wo-sided b can also be one-sided. The n mber of s iffeners will impac he load dis rib ion o he col mn (ei her hro gh —ange welds on one side of he col mn or bo h sides of he col mn). Since considering he load pa h will help si e he s iffener welds, i is impor an o pick a load pa h and s ick wi h i (see Fig re 9).

Design Tip:

True Load Paths

In he case of r sses, he r ss members are depic ed as lines ha join a he cen er of he join . In he model, o ha e hree lines coming in o a poin b in reali , o ha e hree members being connec ed. The —ow of forces m s be nders ood o properl design he connec ion. A free bod diagram similar o wha is shown in Fig re 10 can facili a e his nders anding. No acco n ing for his load pa h can res l in an ndersi ed —ange hickness o adeq a el ransfer he forces.

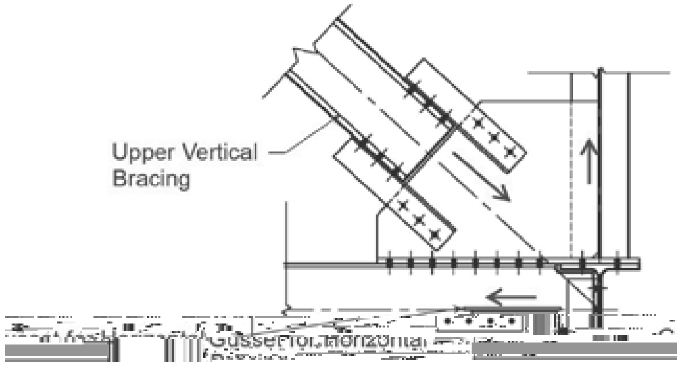
Work Points Matter

When looking a o erall join geome r , consider where he work poin s are loca ed when designing connec ions. Shif ing work poin s ma some imes be needed d e o e is ing in erferences (e.g., a concre e slab in erfering wi h he brace connec ion a col mn bases). Sa isf ing he eq ilibri m of he connec ion wi h shif ed work poin s migh res l in a momen on he main member. Connec ions sho ld no ind ce momen s on s ppor ing members when hose momen s ha e no been considered in he design. I is impor an o consider he work poin s ha are sed o design he main members when si ing he connec ions. Considering he load pa hs and following he forces can also be a check of global s abili of he framing s s em.

Example Load Paths

Now ha we' e learned some of he dos and don' s, le 's ake a look a good e amples of proper considera ion of comple e load pa hs. Fig res 11 and 12 are some e amples of a good load pa h. And remember hese ke poin s:

- Pro ide a s raigh forward con in o s load pa h ha does no loop
- The shor es comple e load pa h is picall he bes sol ion
- If he diaphragm has ins f cien s reng h, hen s eel- os eel ransfer forces are req ired
- Sa isf join eq ilibri m, which pro ides con in o s load pa h hro gh he connec ions
- A oid discon in i ies when ransferring forces
- A con in o s load pa h is onl as s rong as i s weakes link


Upper Vertical
Bracing