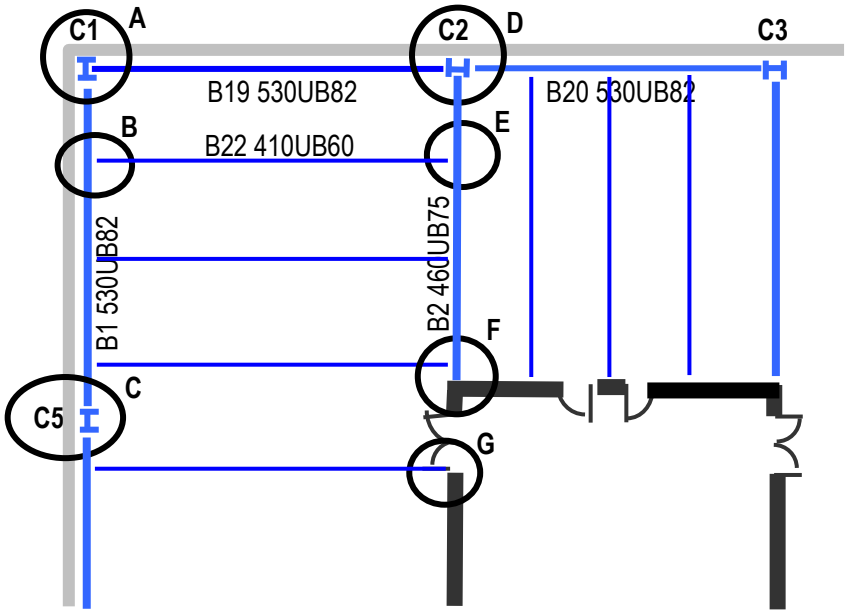
C14. Steel Connection Design

As with all steel construction, connection design and detailing will have a major effect on the buildability, safety and cost of the structure. Steel connection design for composite construction makes use of the same standard connection systems used in other forms of steel construction. This section does not attempt to provide full coverage of steel connection design. It does illustrate the application of standard connection types to composite construction. Refer to Appendix IV for some background to the design procedures used and for discussion of some of the issues that are relatively unique to connections for composite structures.

Note that earlier sketches show 'web side plate connections' for all beam connections. This creates the easiest erection detail and would usually be the preferred detail. However, to demonstrate the design of both flexible end plate and web side plate connections, the connections designed in this section are flexible end plate for beam to column and web side plate for beam to beam. Beam to core connections have been varied to suit the reactions.

C14.1 Can it be built?

This question should have been asked during the preliminary and conceptual design stage. The issue of buildability and of safety during construction is of utmost importance. Often buildability and construction safety issues may significantly control the 'best' design for a particular building.



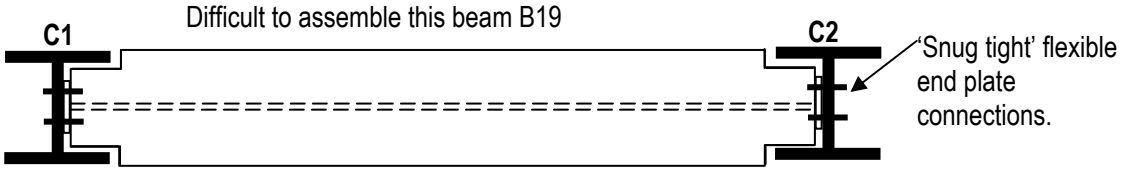
There are essentially 7 different major connection areas (A to G) as shown above. The following observations are made corresponding to these positions:

Spandrel beams at positions A and D: Flexible end plate connections to the column web and flanges

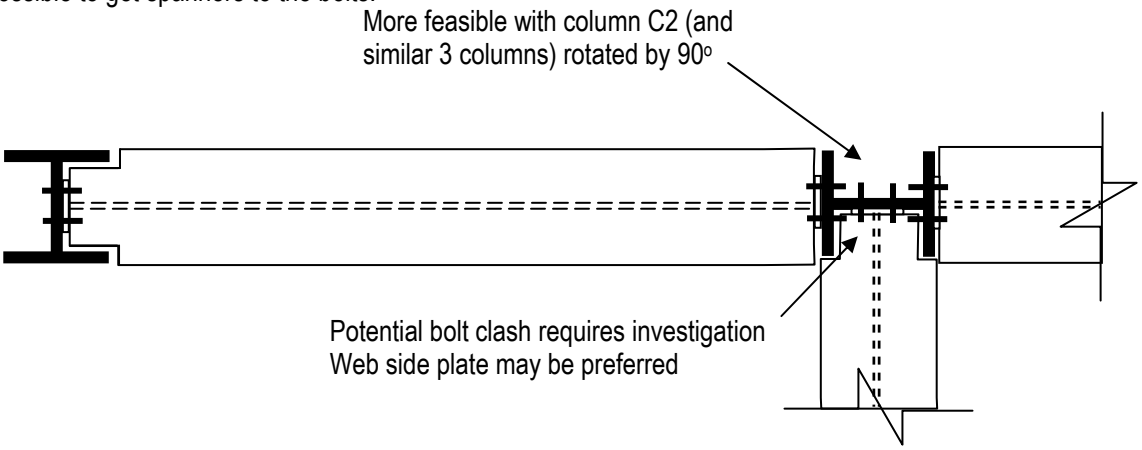
- A beam like B1 will be supplied with flexible end plates and will be a 'snug fit' between C1 and C5. While this may require 'springing' the columns apart to fit it in, steel erection crews will generally have no difficulty with this

- Consideration needs to be given to the orientation of the columns that will work equally well either way as far as structural efficiency is concerned. If C2 and C3 were rotated by 90° then this would cause a problem with the installation of beams B19 and B20 as it would not be possible to fit the (snug tight) B19 in between the flanges of both C1 and C2. If the columns were only single storey height then it might be possible to slide the beam in from the top to get it in position between the columns but with the three storey height columns this will not be possible. (The same problem may exist if web side plate connections were used.) This is

overcome by orienting C2 and C3 as C2 is shown. B19 can then be nosed in between the flanges of C1 and then the C2 end can be slid into position (with springing of the column as required).

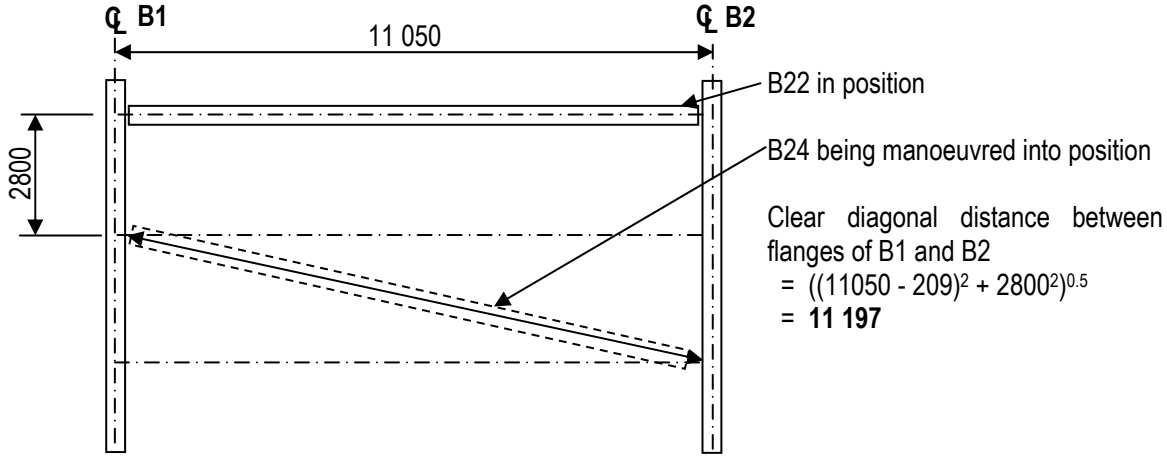


Rotation of column C2 by 90° results in a more feasible detail as shown below. It does give rise to a potential problem with the bolts clashing at the three-beam connection to C2 as shown below. It is necessary to ensure that, not only must the bolts be able to be physically installed without jamming with other bolts, but also it must be possible to get spanners to the bolts.



At positions B and E Secondary beam connections

- There is a potential problem with installing all secondary beams as:



With a clear diagonal distance of 11 197 and the overall length of the beam being 11 050 – 2 x Clearance of 20 mm, this should fit. To confirm this it would be appropriate to set up a 'full scale' CAD drawing model of the assembly and check that the beam can be assembled without snagging on the web cleats to B1 and B2.

At positions C AND F

No apparent problems at these locations

Subject to detailed CAD drawing modelling it will be assumed that the structure (with columns C2, C3, C12 and C13 oriented as shown), can be built.

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