Chapter 7 DESIGN CONCEPT FOR STRUCTURAL STEEL SYSTEM

7.1 STRUCTURAL STEEL SYSTEM

- Steel column/ beam/ metal deck

The building vertical design loads comprise of the dead weight of the structure and the live loads. The secondary steel universal beams are spaced to support the composite slab such that during casting, no additional props are required. The main steel beams support the secondary beams and transfer load to the columns. The composite slab with its welded mesh form horizontal ties. The composite slab laterally restrains the beams.

Columns can be in the form of steel hollow section columns with concrete in-fill or steel H-sections with fireproofed box-up to provide for a half-hour fire rating resistance.

All exposed steel members are to be painted with approved coating e.g. zinc chromate primer prior to two coats of enamel paint.

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7.2 CONNECTION AND DETAILING

Joints can be designed as pin supports. Bolted connections can be considered for easier installation on site. All structural steel members, plates, bolts and nuts used should be hot-dipped galvanised.

For connections to varies structural elements, the following are recommended:

Column to Foundation

The base connections should be designed as pin joints. Bolts can be cast together with the stump. Base plates are to be bolted and leveled with non-shrink grout. Steel columns are to be lowered and welded to base plate.

Column to column

Splice connection between steel columns can be butt welded with splice plates.

Beam to column and beam to beam

Bolt connections for column-to-beams and beam-to-beam connection will allow for ease of installation.

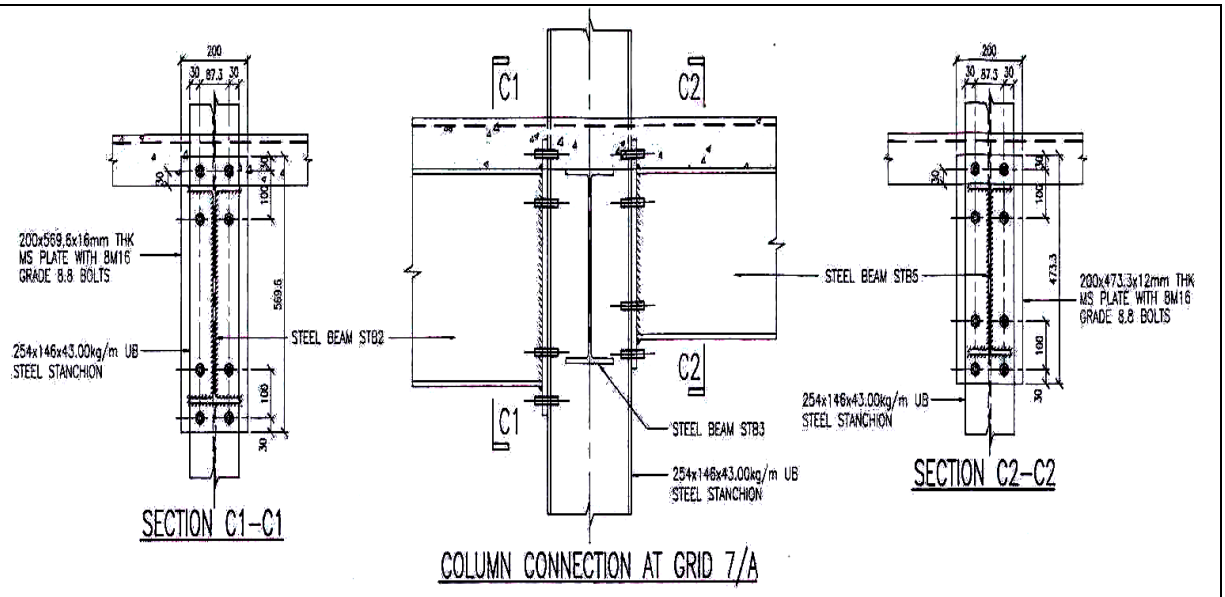


Figure 7.1 Connection details 1 (details and sizes shown are indicative only)

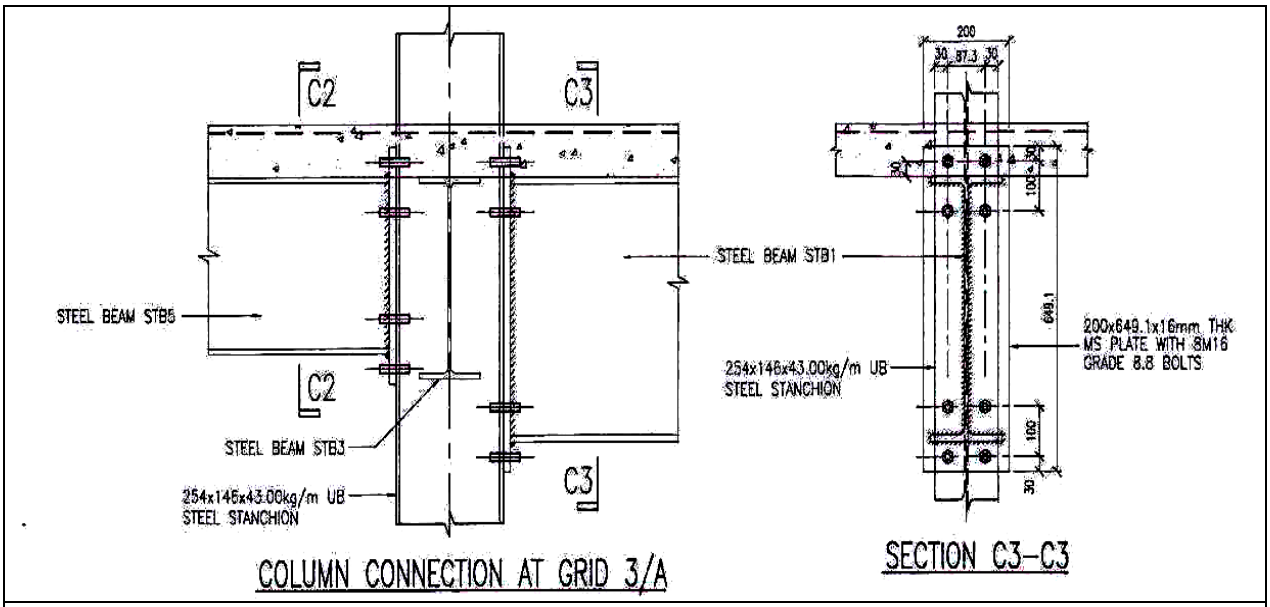


Figure 7.2 Connection details 2 (details and sizes shown are indicative only)

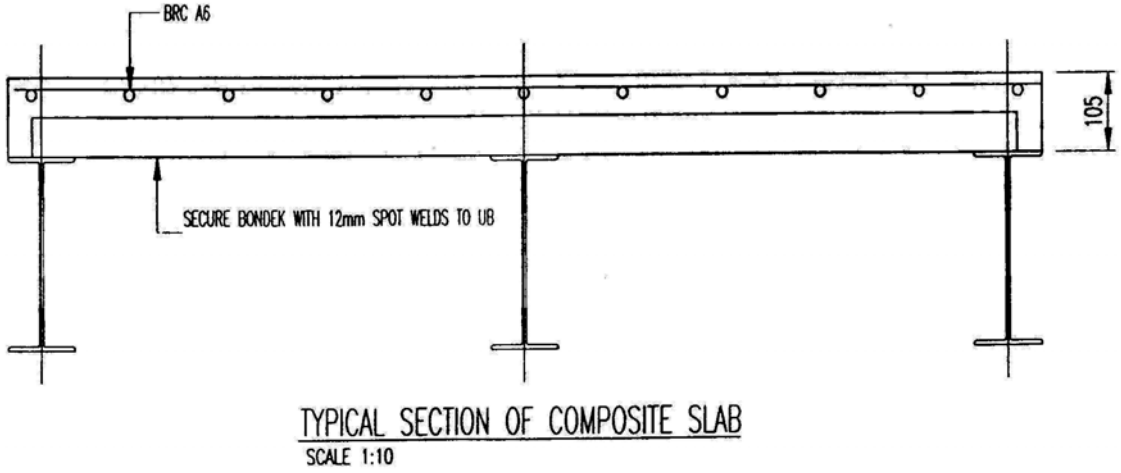
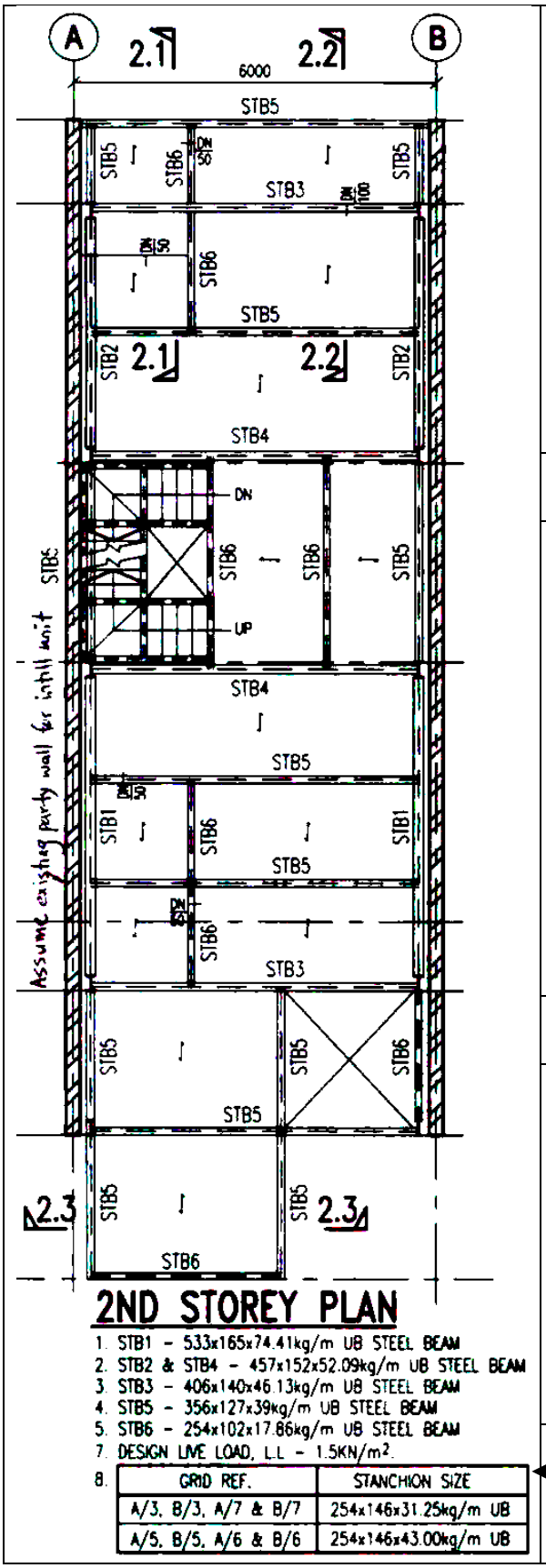


Figure 7.3 Typical section of composite slab (details and sizes shown are indicative only)



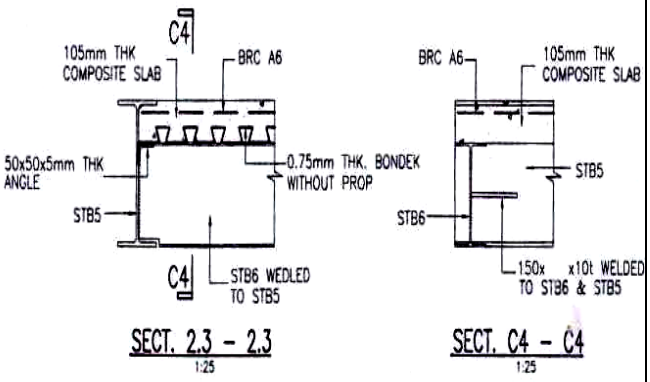


Figure 7.4 Slab details (details and sizes shown are indicative only)

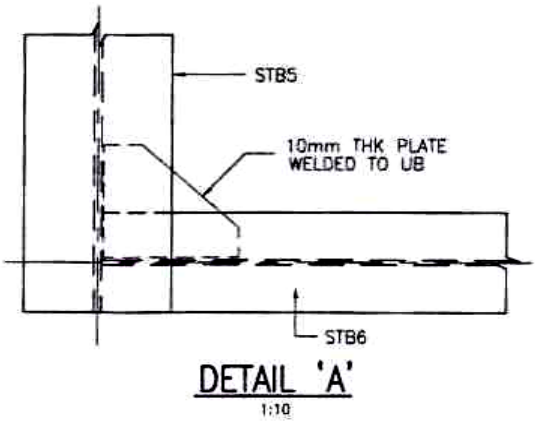


Figure 7.5 Details for cantilever joint (details and sizes shown are indicative only)

Figure 7.6 Layout plan of a typical in-fill unit (details and sizes shown are indicative only)

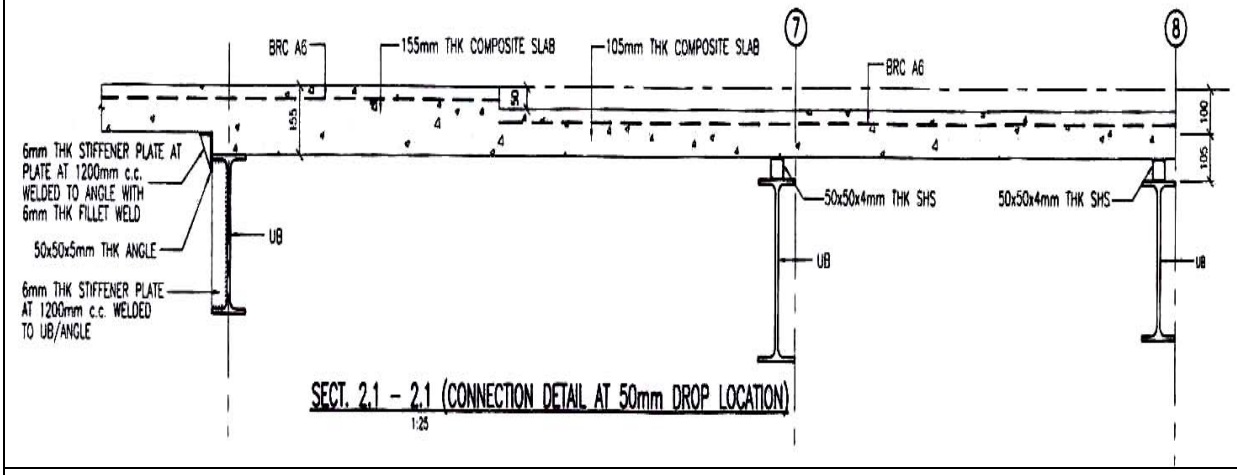


Figure 7.7 Connection details for 50mm drop in slab (details and sizes shown are indicative only)

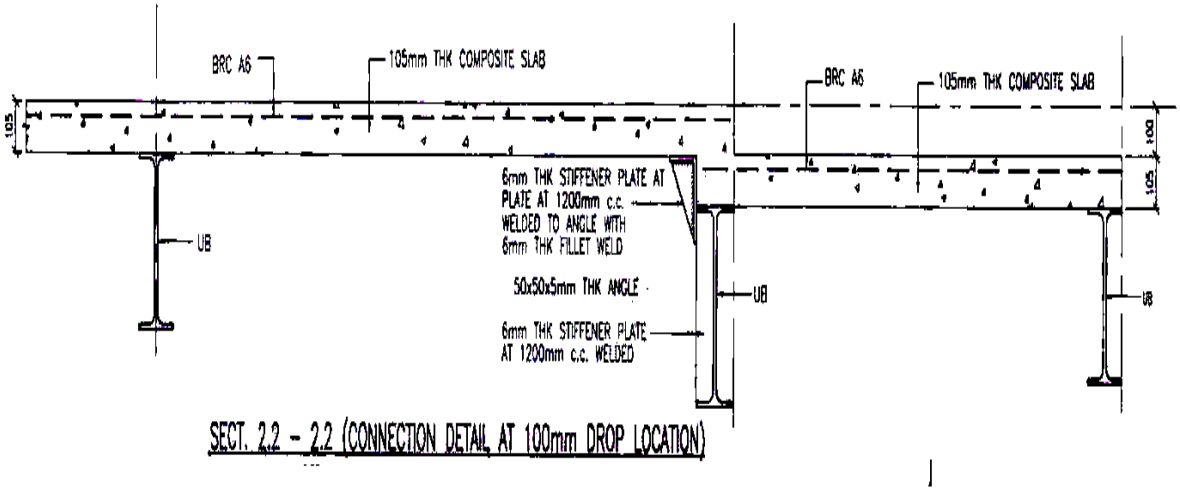


Figure 7.8 Connection details for 100mm drop in slab (details and sizes shown are indicative only)

Treatment of M&E services

A common practice of incorporating M&E services within the floor of steel-framed building is to form openings in the webs of I-section beams. These openings can be a significant proportion of the beam depth. Web stiffeners are often added to consider the local buckling and moment-shear transfer across the opening as it is subjected to high combined stresses from axial force from global bending and local moments.

The openings in the webs and stiffeners are to allow for during fabrication of steel beams in factory, as these elements are to be hot-dipped galvanized. They require early planning of M&E services in the preliminary design stage.

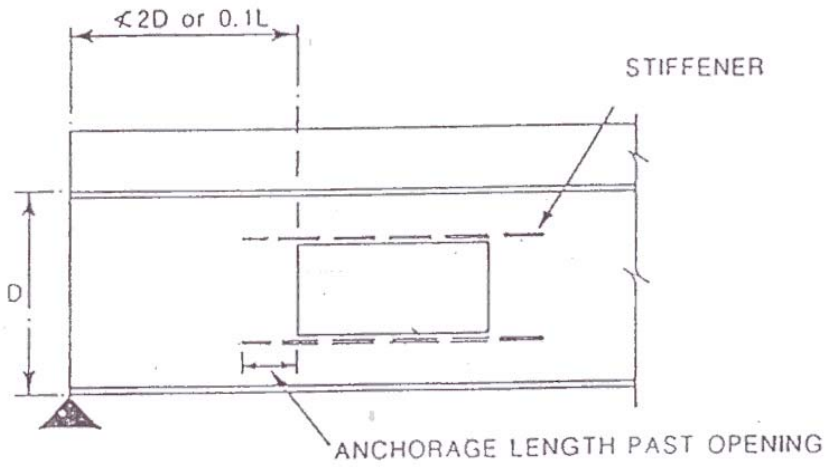


Figure 1 – Position of Web Openings

Figure 7.9 Position of web opening for services

Alternatively, castellated beams may be considered if beam depth is not a constraint. The beams are formed by profile cutting and welding to produce a 50% deeper section. The M&E servcies can penetrate through the web openings. Its usage is often in long span of 6m or more and subjected to light loads as it may not withstand high shear loads unless the castellation is filled in with plate.

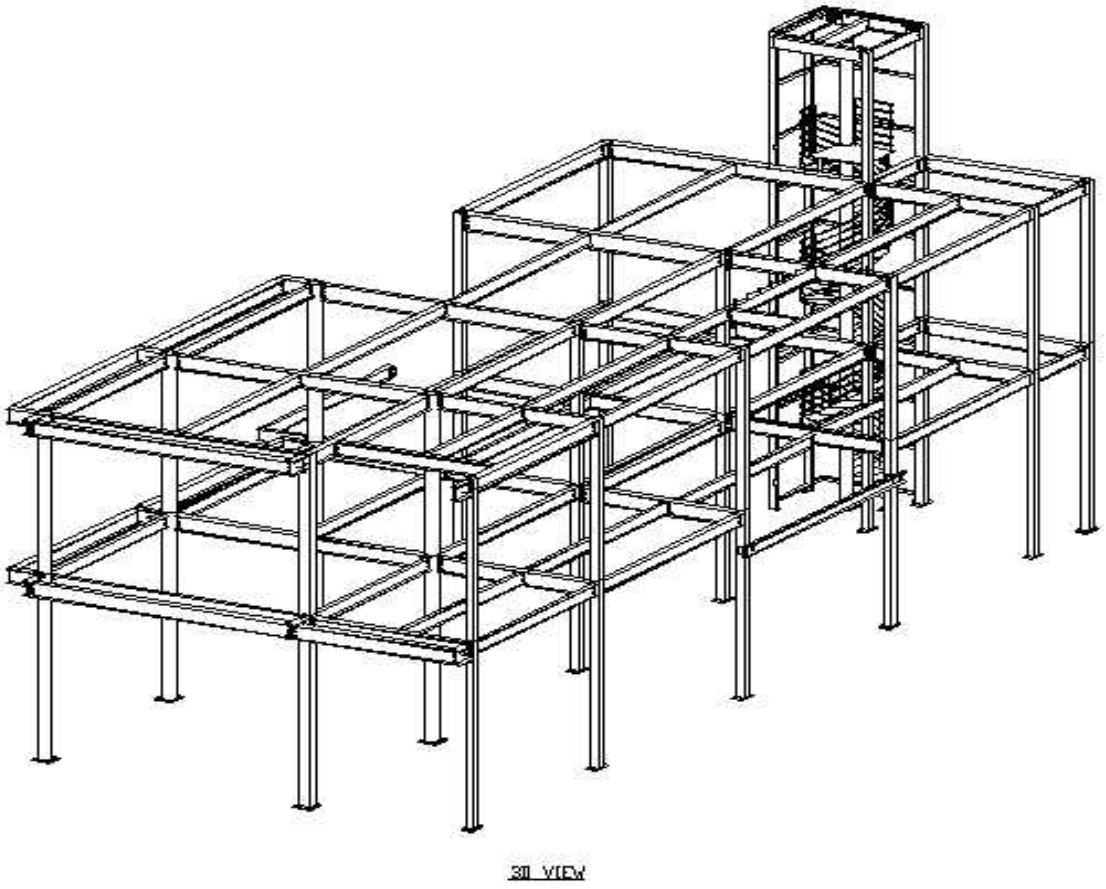


Figure 7.10 3-D graphic presentation of steel frame