



Manual Drawing

Structural Steelwork

Industrial Centre

The Hong Kong Polytechnic University

Definition

- The structural steel is steel structure made up of the following load-bearing steel elements connected by bolts or welding :
 - beams- girders- trusses - stanchions
 - bracing
- إن الأبنية بنظام الهيكلية الفولاذية تتركب من العناصر الحاملة التالية تستخدم وصلات بالمزاليح أو اللحام: - جوائز - عوارض - جملونات - دعائم - عناصر تثبيت

Structural Steel work (BS 449, BS 5950)

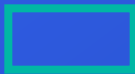

- Grade 43
- Grade 50
- Grade 55

Structural Design

- Safety-آمن

- Serviceability-نفعي

Steel Cross-Section

- I - Universal Beam/Column
- U - Channel
- L - Angle
- T - Tee
-   - Hollow Sections
- Girder

Beams

- Beams are structural elements carrying loads from slabs.
- The loads are resisted **تحمل** by bending and shear in the beams
- There are 3 types of beams:
 - Simply support beams
 - Continuous beams
 - Cantilevered beams

Columns/Stanchions

- Stanchions are vertical members supporting floors and beams in building

Connections

- Connections join individual elements together to form the structural frame, for example, floor beams to stanchions in a building

Types of Connections

- Bolts
- Welding

Bolt Connections

- Black bolts
- High-strength friction-grip bolts

Basic components (3)

- The nominal form of the steel components (members) and bolts are standardized in series and specified by the relevant Standards, such as BS4190, BS3692, BS4395 and BS5135.

Common form of Steelworks

Steelworks can appear in the following form :

- To carry loads over a span :
 - ▣ Universal beam
 - ▣ Castellated beam
 - ▣ Plate girder
 - ▣ Truss
 - ▣ Lattice
 - ▣ Vierendeel girder
 - ▣ Portal frame
 - ▣ Space frame
- To carry vertical loads
 - Universal column
 - ▣ Laced stanchion
 - Battened stanchion

Use together with concrete

- Steelworks are in some situations used with concrete for :
 - ▣ composite beam (concrete to be the compression member at top)
 - ▣ foundations
 - ▣ Protection to steel

Drawings contents

The drawings should show the steelworks for different levels of details :

- (a) layout of the whole structures for which the steel works are to form – by plans and elevations
- (b) Layout of the steelworks (e.g. a truss) – by plans and elevations
- (c) Details of connections of the steelworks– by plans, elevations and sections, even isometric views.

Drawing for Steelworks layout

The following information are relevant :

- ▣ The general dimensions of the steelworks
- ▣ The nominal size of the members
(e.g. 305x102x25kg/m UB)
- ▣ The centre lines (or line of centroid) of members forming the framework.
- ▣ The arrangements of connection (referred to enlarged details where necessary)

Drawings for connection details

The following information are relevant :

(a) for bolting

- ▣ The number and diameter of bolts
- ▣ Provision of washers
- ▣ Diameter of bolt holes
- ▣ Position/spacing of bolt holes
- Edge distance to hole

(b) for welding

- ▣ form of weld (e.g. fillet, butt.)
- ▣ size of weld (leg length)
- ▣ weld length
- ▣ spacing of intermittent welds
- symbols as recommended by BS 499.

Glossary

The following terms may be used in drawing to describe steelworks :

- ▣ Flange
- ▣ Web
- ▣ Web stiffener
- ▣ Cleat
- ▣ Bracket
- ▣ End plate to tube
- ▣ Base
(to stanchion)
- ▣ Gusset
- ▣ Splice
- ▣ Tie (of a truss)
- ▣ Top chord
(of a truss)
- ▣ Bottom chord
(of a truss)
- ▣ Strut (of a truss)
- ▣ Countersunk bolt
- ▣ Shank/thread of bolt
- Backing
(to contain weld)

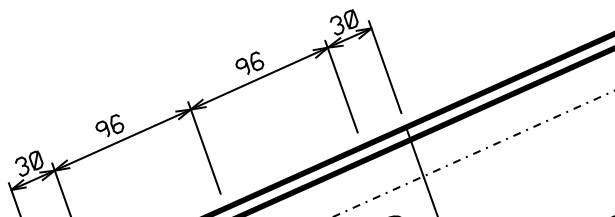
Specifications given in the drawings

The drawing notes may specify the following :

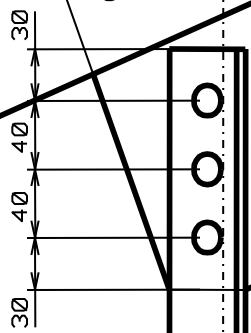
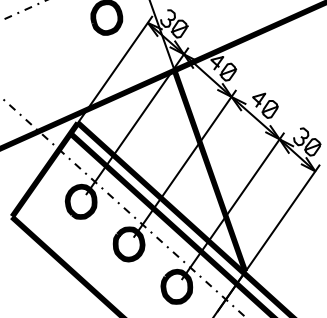
- ▣ Grade of the steel members.(e.g. Grade 43C)
- ▣ Grade of the bolts (e.g. Black bolts, stainless steel bolts.)
- ▣ Method to form holes and to cut member
- ▣ Method of welding
- ▣ Tolerance of fabrication
- Treatment to steel surface (hot-dip galvanized, painting, etc.)

Typical Connection of Joint

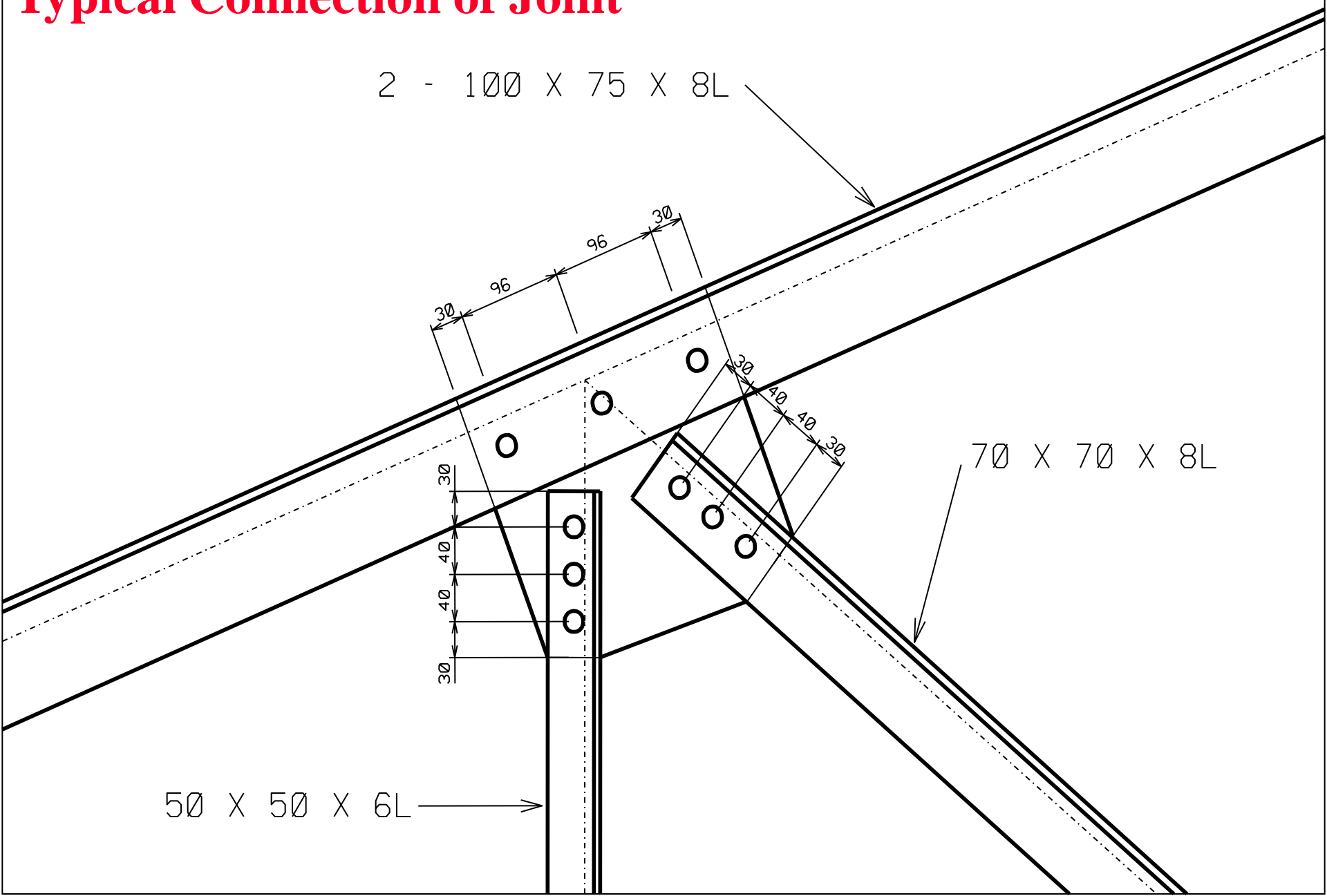
2 - 100 X 75 X 8L



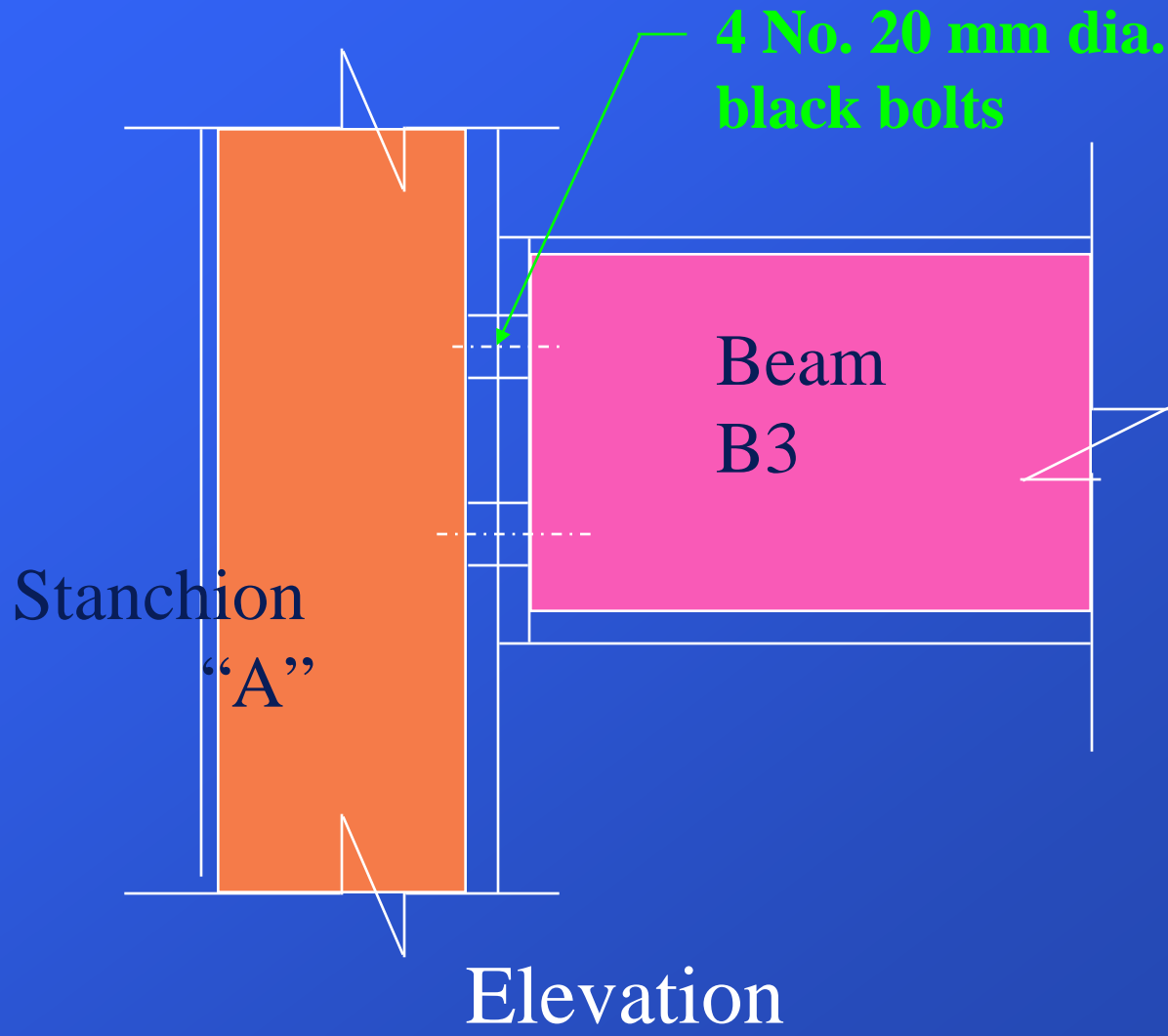
70 X 70 X 8L

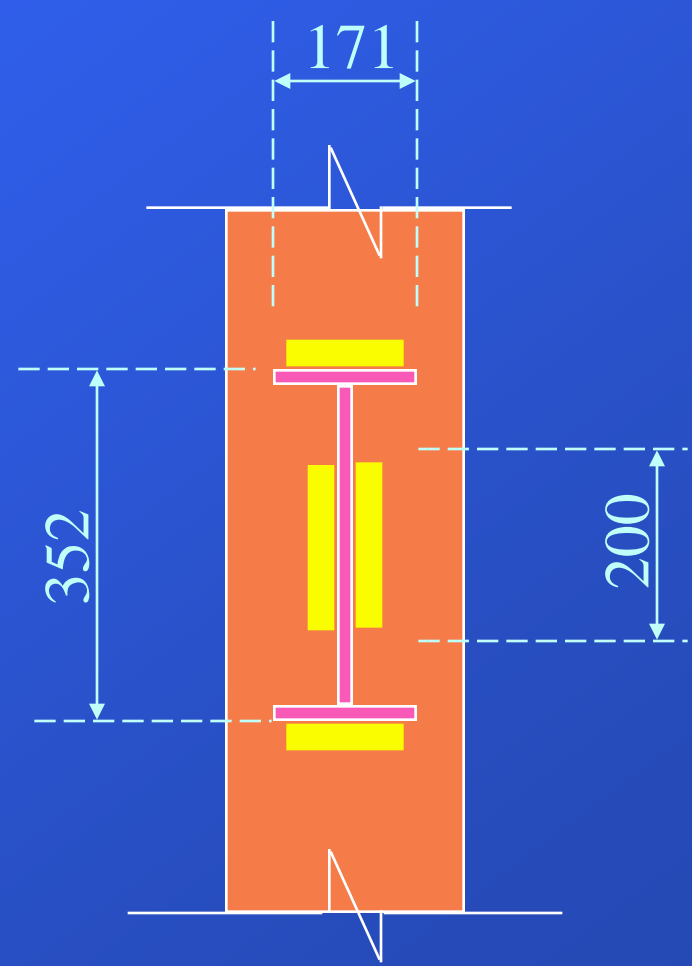
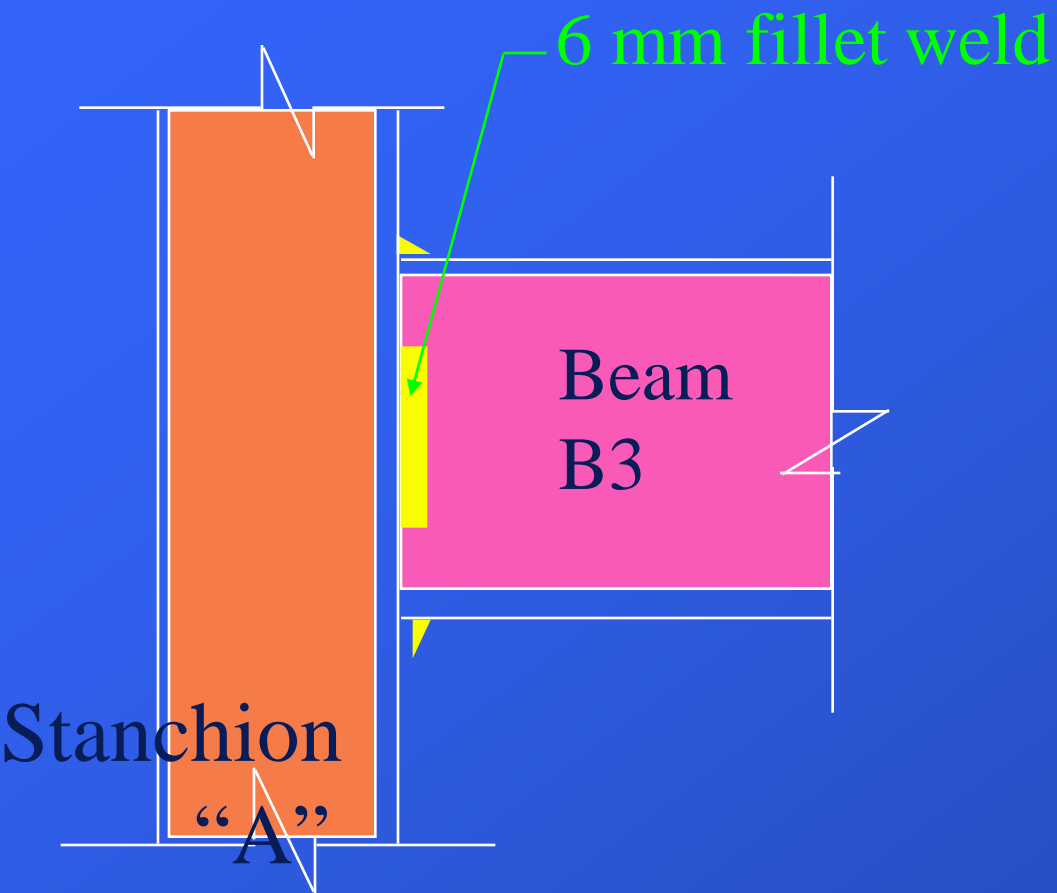


50 X 50 X 6L



Black Bolts Connections





Elevation

STEEL TRUSS

Make a detail drawing for joint 1, 2 & 3 of the truss shown.

The truss is to be bolted connection

Scale: Elevation 1 : 20 Joint: 1 : 5

Notes:

- 1. All dimensions are in millimetre
- 2. All steel to BS 4360 Grade 43A
- 3. All bolts are 16 mm diameter black bolts
- Grade 4.6 except otherwise stated
- 4. All gusset plate are of 8 mm thick
- 5. All member clearances are 5 mm

