Reinforced Concrete Drawings

K. M. Kwok

The Hong Kong Polytechnic University

Types of Drawing

- Architectural
- Structural
- Building Services
- Special type
  - e.g. curtain wall system, playground, gardening, etc.

Standard

BS1192: Construction drawing practice

- Reinforced Concrete drawing indicates ways in which detailing can be standardized and simplified

General Principles

- Drawings are prepared so that the structural designer can communicate his requirements through the detailer to the constructor in a clear concise and unambiguous manner.
- Various kinds of drawing are required to convey instructions on the shape, size, materials, colours, etc. of the structure to the constructor.

General Principles

- The more usual system of drawings consists of
  - General Arrangement
  - Detail Drawings

Sizes of Drawing Sheets

- A1 594 x 841 mm
- A2 420 x 594 mm
- A3 297 x 420 mm
- A4 210 x 297 mm

Layout of Sheet

Figure 1 — Layout of drawing sheets (not to scale)

Layout of Sheet

All dimensions are in millimetres.

Figure 2 — Examples of size and position of title and information panels

Metric System

- Metric system (m, mm) has now been introduced into the construction industry

Projection

E
D
A
C
F
B
View F may be placed
on the left or right
symbol
First angle

B
C
A
D
F
E
View F may be placed
on the left or right
symbol
Third angle

Concrete Grade

- Design Strength/Largest Size of aggregate.
  - e.g. 20/20, 30/20, 35/20, etc.
- Design Strength on 28th day
  - 25 mPa
  - 40 N/mm^2

Form of Steel Reinforcement

- Steel reinforcement may be bought as individual bars.
- The longitudinal and transverse spacings of bars in standard meshes (200x200, 100x100, 100x200, 100x400 etc.)

Standard Range of Steel Bar sizes

- The standard diameters in mm
  - 8, 10, 12, 16, 20, 25, 32, and 40.
  - 6, and 50 are seldom used.
- For standard wire meshes
  - A393, B283, etc.
  - http://www.collins-reinforcements.co.uk/fabric.htm

Type of Steel Reinforcement
BS 4449

- Two types of bar are commonly in use:
  - High yield steel bars with a yield strength of 460 N/mm^2 (Grade 460). Abbreviated as ‘T’ or ‘Y’ on drawings.
  - Mild steel bars with a yield strength of 250 N/mm^2 (Grade 250). Abbreviated as ‘M’ or ‘R’ on drawings.

Cover of steel bars

- Protection of steel.
- Bonding strength.
- Minimum dimension must be stated
  - e.g. minimum cover to be 15 mm
  - e.g. minimum cover to be 50 mm

Connection of steel bars

- Overlap the bars (the most common method)
  - The length of lapping must be stated
    - e.g. All lap length to be 42d, or
    - Marking the dimensions in position on the drawing.
- Using coupler
- Welding (is seldom used)

Standard Shape Code
BS 4466 : 1989

- http://www.collins-reinforcements.co.uk/bs4466.htm

- http://www.collins-reinforcements.co.uk/bs8666.htm

Plans

- Plans will be drawn to show the member which is being described

Elevations

- An elevation on a portion of a structure will be taken as vertical section adjacent to the element under consideration

Sections

- Only the material cut by the section plane should be shown
- The directions of sections should be taken looking consistently in the same direction

Plan and Section

Elevation and Section

Detail of Materials

- Detail of materials to be used will normally be given in separate specifications and reference to the concrete.

Spacing of Bars

- The detailer must consider the spacing of the bars and ensure that the concrete can be placed and consolidated without difficulty.

Spacing of Bars

- It is particularly necessary to remember that at position where bars are lapped. There will be double the quantity of reinforcement: this must be taken into account, when considering the normal spacing of bars.

Standard Method of Scheduling

- BS 4466: 1989 defines a standard method of scheduling and provides a set of bar shapes which are sufficient for any problem of reinforcement detailing that can arise.

Special Requirements

- Details of cambers
- Details of chamfers
- Type of joints etc..

Types of Drawing / Scales

- General Arrangement Drawings

  Plans, Elevations, Sections
  (scale: 1:200 or 1:100)

  Detail Drawings: Beams, Column, Sections
  (scale: 1:50 or 1:20)

  Outline Drawings: Large Scale
  (scale 1:5 or 1:2 or Full Size)

Reinforcement on Drawings

- When referring to reinforcement on drawings, the sequence of description should be as follows:

Number, Type, Size, Mark, Centre, Location or Comment

Reinforcement on Drawings

Abbreviation

- RC = Reinforcement Concrete
- bwk = brickwork
- drg = drawing
- FS = full size
- NTS = not to scale
- FFL = finished floor level
- SFL = structural floor level

Abbreviation

- hor = horizontal
- vert = vertical
- dia = diameter
- EW = each way
- EF = each face
- FF = far face
- NF = near face

- VAR = length varies
- T = top
- B = bottom
- AP = alternately placed
- AR = alternately reversed
- AS = alternately staggered

Grid lines

- The method of numbering beams and columns constructed in reinforced concrete should be related to grid lines
- Grid lines in one direction should be marked A, B, C etc.. in the other direction, 1, 2, 3 etc..

Grid lines

Figure 4 — Plan: structural grid, based on centre lines of columns

Grid lines

Figure 5 — Grid using co-ordinates

Level

Figure 14 — Section through a building showing floor levels and a temporary bench mark (TBM) as a datum

Emphasis

Figure 15 — Emphasis by outline

Figure 16 — Emphasis by hatching (or shading)

Figure 17 — Limiting of hatching (or shading) to zones near outlines

Figure 18 — Interruption of hatching (or shading) for lettering

Terminator

a) open arrowheads;

b) solid arrowheads;

c) short oblique strokes cutting the dimension line;

d) dots or circles on the dimension line.

Lettering

Figure 24 — Orientation of lettering

Table 7 — Heights of letters and numerals

Application	Drawing sheet size	Minimum character height	
		Upper case and numerals	Lower case
		mm	mm
Titles, drawing numbers,etc.	A0, A1, A2 and A3	7	4
	A4	5	3
Dimensions and notes	A0	3.5	2
	A1, A2, A3 and A4	2.5	1.5

Symbols

Table 5.1 Concrete reinforcing bars, side view*†

Symbols	Symbols (continued)	Applications
5.101 **straight bar**	5.104 **bent bar, standard minimum radius**	End anchorage bend 5.101/5.104
5.102 **end of lapped bar**	5.105 **bent bar, specified radius**	End anchorage hook 5.101/5.105
5.103 **bent bar, small scale**		

*For methods of annotating bars see 'Standard Method of Detailing Reinforced Concrete'.
†For scheduling of bars see BS 4466.

Symbols

Table 5.2 Groups of identical bars‡§

Symbols	Application
5.201 **intersection of leader line with bar drawn full length** (alternative to 5.202)	Group of identical bars showing: one bar drawn full length; end bars drawn short.
5.202 **intersection of leader line with bar drawn full length** (alternative to 5.201)	
5.203 **termination of leader line at end bar of group**	5.101 5.201/5.203

‡For methods of annotating groups of bars see 'Standard Method of Detailing Reinforced Concrete'.
§For scheduling of bars see BS 4466.

Symbols

Table 5.3 Concrete reinforcing bars, end view

Symbols	Symbols (continued)	Symbols (continued)
5.301 **straight bar**	5.303 **bent bar**	
5.302 **straight bar beyond cutting plane**		

*Symbols

Table 1

No.	Description	Simplified representation
2.1	Bar, general representation, continuous extra-thick line	
2.2	Section of bar	
2.3	a) Elevation of bar terminating in a 90° bend b) Elevation of bar terminating in a 180° hook c) Plan of bar terminating in a bend or hook	
2.4	Bar without end anchorages, if necessary to indicate ends of more than one bar where bars are not separated on the drawing	1 2 1 2 1 1 2 2
2.5	Anchorage ring or plate a) Elevation or plan view b) End view	
2.6	Bar bent at right angle away from the viewer [but use **2.3** c) for standard end anchorage]	
2.7	Bar bent at right angle towards the viewer [but use **2.3** c) for standard end anchorage]	
2.8 2.8.1	Bars joined by mechanical couplers General representation a) Tension coupler b) Compression coupler	

*Symbol

Table 3

No.	Convention	Simplified representation
4.4	Bars placed in groups spaced equidistantly and containing an identical number of identical bars, may be indicated as shown in the example	
4.5	Two-way reinforcement shall be shown in section, or marked with text or the double-headed arrow in the example in order to show the directions of bars in the outside layer on each face of the construction in plan or elevation	
4.6	The location of layers of reinforcement on plan drawings shall be indicated as follows, where B = Bottom layer T = Top layer 1 = Layer nearest the concrete face 2 = Second layer from the concrete face NOTE 1 B and T are used for the English language; equivalent letters for other languages a) Bottom and top layers shown on separate plans b) Bottom and top layers shown on the same plan; the bottom layer shall be indicated by a dashed extra-thick line	
4.7	The location of layers of reinforcement on elevation drawings shall be indicated as follows, where N = Near face F = Far face 1 = Layer nearest the concrete face 2 = Second layer from the concrete face NOTE 2 N and F are used for the English language; equivalent letters for other languages a) Near-face and far-face reinforcement shown on separate elevations b) Near-face and far-face reinforcement shown on the same elevation; the far-face layer shall be indicated by a dashed extra-thick line	
4.8	If the arrangement of the reinforcement is not clearly shown by the section, an additional detail showing the reinforcement may be drawn outside the section	

*Symbols

Table 3

No.	Convention	Simplified representation
4.9	All the types of links present shall be indicated on the drawing. If the arrangement is complicated, it may be clarified by the aid of a detail outside the section	