Symbols

General

f_{cu} - characteristic strength of concrete
f_y - characteristic strength of reinforcement
G_k - characteristic dead load
Q_k - characteristic imposed load
W_k - characteristic wind load
SLS - serviceability limit state
ULS - ultimate limit state
$_f$ - partial safety factor for load
$_m$ - partial safety factor for strength of materials

Section properties

A_c net cross-sectional area of concrete in a column
A_s area of tension reinforcement
A_{sc} area of main vertical reinforcement
b width of section
b_c breadth of compression face of a beam
b_v breadth of section used to calculate the shear stress
d effective depth of tension reinforcement
h overall depth of section
x depth to neutral axis
z lever arm

Bending

A_s area of tension reinforcement
b width of section
d effective depth of tension reinforcement
f_{cu} characteristic strength of concrete
f_y characteristic strength of reinforcement
K coefficient obtained from design formula for rectangular beams
K' 0.156 when redistribution of moments does not exceed 10 per cent
M design ultimate resistance moment; or
M_u design ultimate bending moment due to ultimate loads
x depth to neutral axis
z lever arm

Deflection

b width of section
d effective depth of tension reinforcement
f_y characteristic strength of reinforcement
M design ultimate bending moment at centre of the span or, for a cantilever, at the support

Shear

A_s area of tension reinforcement
A_{sb} cross-sectional area of bent-up bars
A_{sv} total cross-section of links at the neutral axis
b_v breadth of section used to calculate the shear stress
d effective depth of tension reinforcement
f_{cu} characteristic strength of concrete
f_{yv} characteristic strength of links (not to exceed 460 N/mm^2)
s_b spacing of bent-up bars
s_v spacing of links along the member
V design shear force due to ultimate loads
V_b design shear resistance of bent-up bars
v design shear stress at a cross-section
v_c design concrete shear stress (from BS 8110 Table 3.9)
q angle of shear failure plane from the horizontal angle between a bent-up bar and the axis of a beam
b angle between the compression strut of a system of bent-up bars and the axis of the beam

Compression

A_c net cross-sectional area of concrete in a column
A_{sc} area of vertical reinforcement
b width of column
f_{cu} characteristic strength of concrete
f_y characteristic strength of reinforcement
h depth of section
l_e effective height
l_{ex} effective height in respect of major axis
l_{ey} effective height in respect of minor axis
l_o clear height between end restraints
N design ultimate axial load on a column

BS 8110 Part 1: 1985 Table 2.1

Load combinations and values of γ_f for the ultimate limit state (BS 8110 Part 1 1985 Table 2.1)

Load combination	Dead load		Imposed load		Earth and water pressure	Wind load
	Adverse	Beneficial	Adverse	Beneficial		
Dead and imposed (and earth and water pressure)	1.4	1.0	1.6	0	1.4	—
Dead and wind (and earth and water pressure)	1.4	1.0	—	—	1.4	1.4
Dead and wind and imposed (and earth and water pressure)	1.2	1.2	1.2	1.2	1.2	1.2

Concrete compressive strength (BS 5328 Part 1 1990 Table 9)

Concrete grade	Characteristic compressive strength at 28 days (N/mm^2 = MPa)
C7.5	7.5
C10	10.0
C12.5	12.5
C15	15.0
C20	20.0
C25	25.0
C30	30.0
C35	35.0
C40	40.0
C45	45.0
C50	50.0
C55	55.0
C60	60.0

Durability (Exposure Conditions)

Table 3.5 Exposure conditions (BS 8110 Part 1 1985 Table 3.2)

Environment	Exposure conditions
Mild	Concrete surfaces protected against weather or aggressive conditions
Moderate	Concrete surfaces sheltered from severe rain or freezing whilst wet Concrete subject to condensation Concrete surfaces continuously under water Concrete in contact with non-aggressive soil (see class 1 of Table 6.1 of BS 8110)*
Severe	Concrete surfaces exposed to severe rain, alternate wetting and drying, or occasional freezing or severe condensation
Very severe	Concrete surfaces exposed to sea water spray, de-icing salts (directly or indirectly), corrosive fumes or severe freezing conditions whilst wet
Extreme	Concrete surfaces exposed to abrasive action, e.g. sea water carrying solids or flowing water with pH ≤ 4.5 or machinery or vehicles

Table 3.6 Nominal cover to all reinforcement (including links) to meet durability requirements (BS 8110 Part 1 1985 Table 3.4)

Conditions of exposure‡	Nominal cover (mm)				
Mild	25	20	20*	20*	20*
Moderate	—	35	30	25	20
Severe	—	—	40	30	25
Very severe	—	—	50†	40†	30
Extreme	—	—	—	60†	50
Maximum free water/cement ratio	0.65	0.60	0.55	0.50	0.45
Minimum cement content (kg/m^3)	275	300	325	350	400
Lowest grade of concrete	C30	C35	C40	C45	C50

* These covers may be reduced to 15 mm provided that the nominal maximum size of aggregate does not exceed 15 mm.

† Where concrete is subject to freezing whilst wet, air-entrainment should be used (see clause 3.3.4.2 of BS 8110).

‡ For conditions of exposure see Table 3.5 of this chapter.

Note 1: This table relates to normal-weight aggregate of 20 mm nominal maximum size.

Note 2: For concrete used in foundations to low rise construction (see clause 6.2.4.1 of BS 8110).