Concise Eurocode 2

25 February 2010

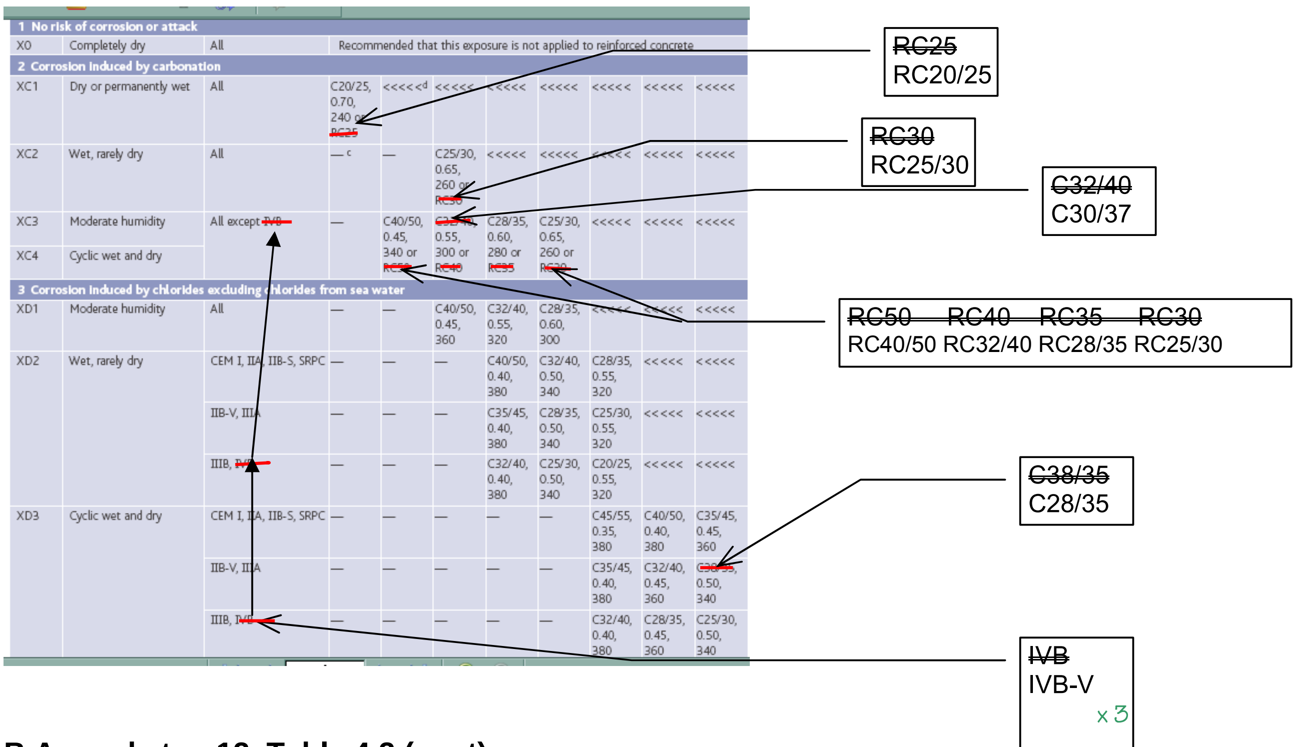
Revisions required to Concise Eurocode 2 (Oct 06 edition) due to revisions in standards, notably Amendment 1 to NA to BS EN 1992-1-1:2004 dated Dec 2009, and interpretations.

Page	Where	Why/old text	Revised text
11	Table 4.2	Revisions to BS 8500-1	See A below
12	Table 4.2 cont	Revisions to BS 8500-1	See B below
13	Table 3	Revisions to BS 8500-1	See C below
13	4.4	New reference	BS 8500-1 A.2.4
14	4.5	NA Amd 1 The minimum cover for concrete cast on prepared ground (including blinding) is 40 mm and that for concrete cast directly against soil is 65 mm.	The nominal cover for concrete cast on prepared ground (including blinding) should be at least 40 mm and that for concrete cast directly against soil should be at least 75 mm.
30	5.6.2.1	Interpretation For columns in braced systems e_i = l_0/400 (i.e. θ_i = l/200 for most braced columns). The design eccentricity should be at least (h/30) but not less than 20 mm.	For columns in braced systems e_i = l_0/400 (i.e. θ_i = l/200 for most braced columns). The design eccentricity should be at least e_0 = (h/30) but not less than 20 mm.
30	5.6.2.1	5.2.7	5.2.7 6.1(4)
31	Figure 5.10	Edit M_{0e} ~~$+ M_2$~~	See D below
43	7.3.2	NA Amd 1 ν_1 $V_{Rd,max} = b_w z \nu f_{cd} /(\cot\theta + \tan\theta) \geq V_{Ed}$ with vertical links $= b_w z \nu f_{cd}(\cot\theta + \cot\alpha)/(1 + \cot^2\theta) \geq V_{Ed}$ with inclined links	$V_{Rd,max} = b_w z \nu_1 f_{cd} /(\cot\theta + \tan\theta) \geq V_{Ed}$ with vertical links $= b_w z \nu_1 f_{cd}(\cot\theta + \cot\alpha)/(1 + \cot^2\theta) \geq V_{Ed}$ with inclined links
43	7.3.2	NA Amd 1 Additional text ……normally be used $\nu = 0.6 [1 - (fck/250)] = . . .$	……normally be used $\nu_1 = \nu (1 - 0.5 \cos\alpha)$ where $\nu = 0.6 [1 - (fck/250)] = . . .$
43	7.3.2	NA Amd 1 Additional text θ = angle of inclination of the strut, such that cot θ lies between 1.0 and 2.5. The value of cot θ should be obtained by substituting V_{Ed} for $V_{Rd,max}$	θ = angle of inclination of the strut, such that cot θ lies between 1.0 and 2.5. The value of cot θ should be obtained by substituting V_{Ed} for $V_{Rd,max}$. For sections under axial tension (not restraint) cot θ should be limited to 1.25

43	7.3.2	NA Amd 1 Additional text For vertical links cot α = 0.	For vertical links cot α = 0 and cos α = 0.
53	8.6	NA Amd 1 Additional text . . . . given in Table 7.2.	At the . . . . given in Table 7.2. In addition at the first control perimeter v_{Ed} should be limited to $2v_{Rd,c}$
56	9.2	Edit Torsional resistance governed by the area of closed links is given by: $T_{Rd} = A_{sw}/s) = T_{Ed}/(2A_k \cot \theta) f_{ywd}$	Torsional resistance governed by the area of closed links is given by: $T_{Rd} = 2A_k(f_{ywd}A_{sw}/s)\cot \theta$ Therefore $A_{sw}/s = T_{Ed}/(2A_k \cot \theta\ f_{ywd})$
72	12.4.3	Interpretation Revise text The intention is to provide an even distribution/density of punching shear reinforcement within the zone where it is required. One simplification to enable rectangular perimeters of shear reinforcement is to use an intensity of A_{sw}/u_1 around rectangular perimeters.	The intention is to provide A_{sw} on each perimeter.
74	12.5.2 Para 3	NA Amd 1 Additional text The spacing of transverse reinforcement should be the least of	For concrete class ≤ C50/60, the spacing of transverse reinforcement should be the least of
77	13.2	Corrigendun No 1 Revised text $F_{tie,per} = (20 + 4n_0)$ kN ≤ 60 kN where n_0 = number of storeys	$F_{tie,per} = (20 + 4n_0)$ kN ≥ 60 kN where n_0 = number of storeys
80	14.1	NA Amd 1 Revised text Generally the design tensile strength $f_{ctd,pl} = 0.6\ f_{ctk,0.05}/\gamma_c$ (as shown in Table 14.1).	Generally the design tensile strength $f_{ctd,pl} = 0.8\ f_{ctk,0.05}/\gamma_c$ (as shown in Table 14.1).
80	Table 14.1	NA Amd 1 Revised data. New values of f_{ctd} $\sigma_{c,\ lim}$	See E Below
82	Table 14.2	NA Amd 1 Revised data. New values of f_{cvd}	See F Below
93	F3	NA Amd 1 Revision to interpretation of σ_s Delete text. See G below	See G below
94	15.8	NA Amd 1 Revision to interpretation of σ_s for l/d The appropriate SLS stress in reinforcement, σ_s, may be determined as outlined for F3 in Section 15.7.	The appropriate SLS stress in reinforcement, σ_s, may be determined as outlined below + text from F3. See H below
100	References	NA Amd 1 **1a** National Annex to Eurocode 2-Part 1-1. BSI 2005	**1a** National Annex to Eurocode 2- Part 1-1. Incorporating Amendment No.1 BSI 2009

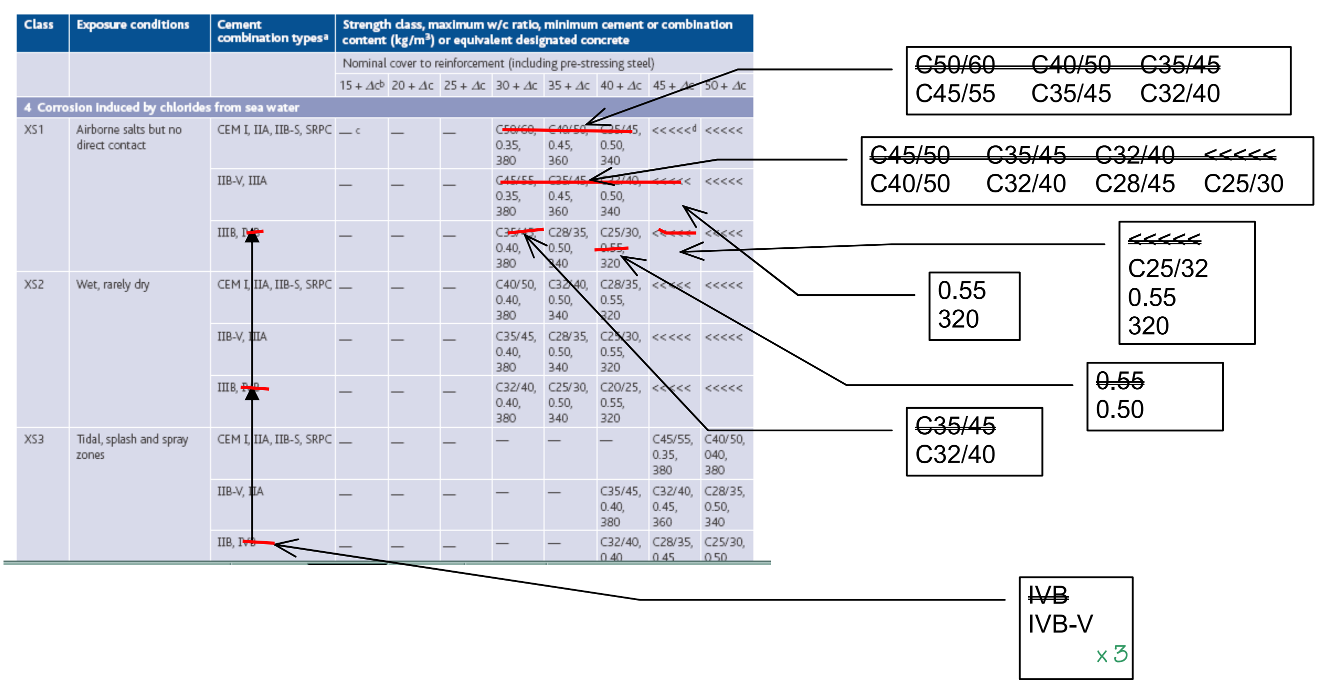
103	Table A1	Edit 2nd γ_G under Partial factor on actions γ_F should read γ_Q	γ_Q

A Amends to p11 Table 4.2



1 No risk of corrosion or attack										
XO	Completely dry	All	Recommended that this exposure is not applied to reinforced concrete							
2 Corrosion induced by carbonation										
XC1	Dry or permanently wet	All	C20/25, 0.70, 240 or ~~RC25~~	<<<<<[d]	<<<<<	<<<<<	<<<<<	<<<<<	<<<<<	<<<<<
XC2	Wet, rarely dry	All	—[c]	—	C25/30, 0.65, 260 or ~~RC30~~	<<<<<	<<<<<	<<<<<	<<<<<	<<<<<
XC3	Moderate humidity	All except ~~IVB~~	—	C40/50, 0.45, 340 or ~~RC50~~	~~C32/40~~, 0.55, 300 or ~~RC40~~	C28/35, 0.60, 280 or ~~RC35~~	C25/30, 0.65, 260 or ~~RC30~~	<<<<<	<<<<<	<<<<<
XC4	Cyclic wet and dry									
3 Corrosion induced by chlorides excluding chlorides from sea water										
XD1	Moderate humidity	All	—	—	C40/50, 0.45, 360	C32/40, 0.55, 320	C28/35, 0.60, 300	<<<<<	<<<<<	<<<<<
XD2	Wet, rarely dry	CEM I, IIA, IIB-S, SRPC	—	—	—	C40/50, 0.40, 380	C32/40, 0.50, 340	C28/35, 0.55, 320	<<<<<	<<<<<
		IIB-V, IIIA	—	—	—	C35/45, 0.40, 380	C28/35, 0.50, 340	C25/30, 0.55, 320	<<<<<	<<<<<
		IIIB, ~~IVB~~	—	—	—	C32/40, 0.40, 380	C25/30, 0.50, 340	C20/25, 0.55, 320	<<<<<	<<<<<
XD3	Cyclic wet and dry	CEM I, IIA, IIB-S, SRPC	—	—	—	—	—	C45/55, 0.35, 380	C40/50, 0.40, 380	C35/45, 0.45, 360
		IIB-V, IIIA	—	—	—	—	—	C35/45, 0.40, 380	C32/40, 0.45, 360	~~C38/35~~, 0.50, 340
		IIIB, ~~IVB~~	—	—	—	—	—	C32/40, 0.40, 380	C28/35, 0.45, 360	C25/30, 0.50, 340

B Amends to p12 Table 4.2 (cont)



Class	Exposure conditions	Cement combination types[a]	Strength class, maximum w/c ratio, minimum cement or combination content (kg/m³) or equivalent designated concrete							
			Nominal cover to reinforcement (including pre-stressing steel)							
			15 + Δc[b]	20 + Δc	25 + Δc	30 + Δc	35 + Δc	40 + Δc	45 + Δc	50 + Δc
4 Corrosion induced by chlorides from sea water										
XS1	Airborne salts but no direct contact	CEM I, IIA, IIB-S, SRPC	—[c]	—	—	~~C50/60~~, 0.35, 380	~~C40/50~~, 0.45, 360	~~C35/45~~, 0.50, 340	<<<<<[d]	<<<<<
		IIB-V, IIIA	—	—	—	~~C45/55~~, 0.35, 380	~~C35/45~~, 0.45, 360	~~C32/40~~, 0.50, 340	~~<<<<<~~	<<<<<
		IIIB, ~~IVB~~	—	—	—	~~C35/45~~, 0.40, 380	C28/35, 0.50, 340	C25/30, ~~0.55~~, 320	~~<<<<<~~	<<<<<
XS2	Wet, rarely dry	CEM I, IIA, IIB-S, SRPC	—	—	—	C40/50, 0.40, 380	C32/40, 0.50, 340	C28/35, 0.55, 320	<<<<<	<<<<<
		IIB-V, IIIA	—	—	—	C35/45, 0.40, 380	C28/35, 0.50, 340	C25/30, 0.55, 320	<<<<<	<<<<<
		IIIB, ~~IVB~~	—	—	—	C32/40, 0.40, 380	C25/30, 0.50, 340	C20/25, 0.55, 320	<<<<<	<<<<<
XS3	Tidal, splash and spray zones	CEM I, IIA, IIB-S, SRPC	—	—	—	—	—	—	C45/55, 0.35, 380	C40/50, 040, 380
		IIB-V, IIA	—	—	—	—	—	C35/45, 0.40, 380	C32/40, 0.45, 360	C28/35, 0.50, 340
		IIB, ~~IVB~~	—	—	—	—	—	C32/40, 0.40	C28/35, 0.45	C25/30, 0.50

C Amends to p13 Table 4.3

Table 4.3
Concrete quality and cover to reinforcement for durability for an intended working life of 100 years

Class	Exposure conditions	Cement combination types[a]	Strength class, maximum w/c ratio, minimum cement or combination content (kg/m³) or equivalent designated concrete							
			Nominal cover to reinforcement (including pre-stressing steel)							
			$15 + \Delta c$[b]	$20 + \Delta c$	$25 + \Delta c$	$30 + \Delta c$	$35 + \Delta c$	$40 + \Delta c$	$45 + \Delta c$	$50 + \Delta c$
1 No risk of corrosion or attack										
X0	Completely dry	All	Recommended that this exposure is not applied to reinforced concrete							
2 Corrosion induced by carbonation										
XC1	Dry or permanently wet	All	C20/25, 0.70, 240 or ~~RC25~~	<<<<<[d]	<<<<<	<<<<<	<<<<<	<<<<<	<<<<<	<<<<<
XC2	Wet, rarely dry	All	—[c]	—	C25/30, 0.65, 260 or ~~RC30~~	<<<<<	<<<<<	<<<<<	<<<<<	<<<<<
XC3	Moderate humidity	All except IVB	—	—	—	C40/50, 0.45, 340 or ~~RC50~~	C35/45, 0.50, 320 or ~~RC45~~	~~C32/40~~, 0.55, 300 or ~~RC40~~	C28/35, 0.60, 280 or ~~RC35~~	<<<<<
XC4	Cyclic wet and dry									

Key
a Cement or combination types:
CEM I – Portland cement
IIA – Portland cement with 6 – 20% fly ash, ggbs or 20% limestone
IIB – Portland cement with 21 – 35% fly ash or ggbs
IIIA – Portland cement with 36 – 65% ggbs
IIIB – Portland cement with 66 – 80% ggbs
IVB – Portland cement with 36 – 55% fly ash
SRPC – Sulphate resisting Portland cement
–S – slag i.e. ground granulated blastfurnace slag (ggbs)
–V – fly ash (pfa)
b Δc – an allowance for deviations (see Section 4.5)
c — – not recommended, use greater cover
d <<<<< – quality of concrete given in the previous column should not be reduced

~~RC25~~
RC20/25

~~RC30~~
RC25/30

~~RC30~~
RC25/30

~~RC50 RC45 RC40 RC35~~
RC40/50 RC35/45 RC32/40 RC28/35

~~IVB~~
IVB-V

Note
For corrosion induced by chlorides see BS8500-1 Table A.5

D Amend to p31 Figure 5.10

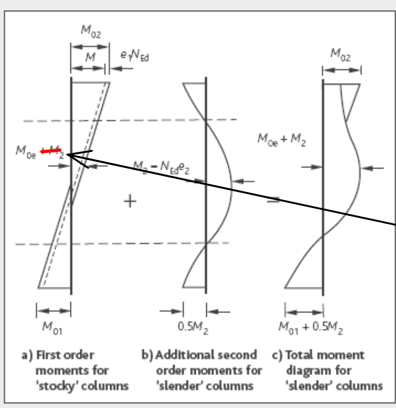


Figure 5.10
Moments in slender columns

~~$M_{0e} + M_2$~~
M_{0e}

E Amends to p80 Table 14.1

f_{ck}	12	16	20	25	30	35	40	45	50
$f_{cd,pl}$	4.8	6.4	8.0	10.0	12.0	14.0	16.0	18.0	20.0
$f_{ctk,0.05}$	1.10	1.33	1.55	1.80	2.03	2.25	2.46	2.66	2.85
f_{ctd}	0.59	0.71	0.83	0.96	1.08	1.20	1.31	1.42	1.52
$\sigma_{c, lim}$	1.24	1.90	2.60	3.52	4.48	5.46	6.48	7.51	8.56

Revised numbers in red

F Amends to p81 Table 14.2 for f_{cvd}

σ_{cp}(MPa)	f_{ck}								
	12	16	20	25	30	35	40	45	50
0.0	0.59	0.71	0.83	0.96	1.08	1.20	1.31	1.42	1.52
1.0	0.97	1.10	1.23	1.37	1.50	1.62	1.74	1.85	1.96
2.0	1.17	1.39	1.53	1.68	1.83	1.96	2.08	2.20	2.31
3.0	1.16	1.53	1.77	1.95	2.10	2.24	2.38	2.50	2.62
4.0	0.89	1.50	1.87	2.17	2.34	2.50	2.64	2.77	2.90
5.0		1.29	1.84	2.27	2.55	2.73	2.88	3.02	3.15
6.0		0.76	1.66	2.26	2.66	2.92	3.09	3.24	3.38
7.0			1.27	2.14	2.67	3.04	3.29	3.45	3.60
8.0				1.89	2.59	3.07	3.41	3.64	3.80
9.0				1.43	2.41	3.02	3.45	3.77	3.99
10.0					2.09	2.88	3.42	3.82	4.12

G Amends to p 93

F2 = factor to account for brittle partitions in association with long spans. Generally F2 = 1.0 but if brittle partitions are liable to be damaged by excessive deflection, F2 should be determined as follows:
a) in flat slabs in which the longer span is greater than 8.5 m, F2 = $8.5/l_{eff}$
b) in beams and other slabs with spans in excess of 7.0 m, F2 = $7.0/l_{eff}$
Values of F2 may be taken from Table 15.13

F3 = factor to account for service stress in tensile reinforcement = ~~$310/\sigma_s \le 1.5$~~
~~Conservatively, if a service stress, σ_s, of 310 MPa is assumed for the designed area of reinforcement, $A_{s,req}$, then F3 = $A_{s,prov}/A_{s,req}$~~ ≤ 1.5.

~~More accurately, the serviceability stress, σ_s, may be calculated from SLS moments or may be estimated as follows:~~
~~$\sigma_s = f_{yk}/\gamma_s[(G_k + \psi_2 Q_k)/(1.25G_k + 1.5Q_k)]\ [A_{s,req}/A_{s,prov}]\ (1/\delta)$~~
~~or~~
~~$\sigma_s = \sigma_{su}\ [A_{s,req}/A_{s,prov}]\ (1/\delta)$~~
~~where~~
~~σ_{su} = the unmodified SLS steel stress, taking account of γ_M for reinforcement and of going from ultimate actions to serviceability actions~~
~~= $500/\gamma_s(G_k + \psi_2 Q_k)/(1.25G_k + 1.5Q_k)$~~
~~σ_{su} may be estimated from Figure 15.3 as indicated by the blue arrow~~
~~$A_{s,req}/A_{s,prov}$ = area of steel required divided by area of steel provided.~~
~~$(1/\delta)$ = factor to 'un-redistribute' ULS moments so they may be used in this SLS verification (see Table 15.14)~~

Actual l/d = actual span divided by effective depth, d.

New text:
as either

- $310/\sigma_s$ using characteristic load combinations to determine the service stress, σ_s

or

- $(500/f_{yk})(A_{s,prov}/A_{s,req})$

In either case the modification factor is restricted to a maximum of 1.50.

Delete text here but use on p 94

H Amends to p94

15.8 Control of cracking

Section 10.2

Cracking may be controlled by restricting either maximum bar diameter or maximum bar spacing to the relevant diameters and spacings given in Table 15.15. The appropriate SLS stress in reinforcement, σ_s, may be determined as outlined ~~for F3 in Section 15.7.~~

below.

~~More accurately~~, the serviceability stress, σ_s, may be calculated from SLS moments or may be estimated as follows:
$\sigma_s = f_{yk}/\gamma_s[(G_k + \psi_2 Q_k)/(1.25G_k + 1.5Q_k)]\ [A_{s,req}/A_{s,prov}]\ (1/\delta)$
or
$\sigma_s = \sigma_{su}\ [A_{s,req}/A_{s,prov}]\ (1/\delta)$
where
σ_{su} = the unmodified SLS steel stress, taking account of γ_M for reinforcement and of going from ultimate actions to serviceability actions
= $500/\gamma_s(G_k + \psi_2 Q_k)/(1.25G_k + 1.5Q_k)$
σ_{su} may be estimated from Figure 15.3 as indicated by the blue arrow
$A_{s,req}/A_{s,prov}$ = area of steel required divided by area of steel provided.
$(1/\delta)$ = factor to 'un-redistribute' ULS moments so they may be used in this SLS verification (see Table 15.14)

New text ex F3 on p 93

chg 25 Feb 2010