NATIONAL ANNEX

NA+A2:2014
to BS EN
1992-1-1:2004
+A1:2014

UK National Annex to Eurocode 2: Design of concrete structures —

Part 1-1: General rules and rules for buildings

ICS 91.010.30; 91.080.40

British Standards

Committees responsible for this National Annex

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Mineral Products Association

British Precast Concrete Federation Ltd.

Building Research Establishment

Concrete Society

Department of Transport (Highways Agency)

Institution of Civil Engineers

Institution of Structural Engineers

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National Annex (informative) to BS EN 1992-1-1:2004+A1:2014, Eurocode 2: Design of concrete structures — Part 1-1: General rules and rules for buildings

Introduction

This National Annex has been prepared by BSI Subcommittee B/525/2, Structural use of concrete. In the UK it is to be used in conjunction with BS EN 1992-1-1:2004+A1:2014.

NA+A2:2014 to BS EN 1992-1-1:2004+A1:2014 supersedes NA to BS EN 1992-1-1:2004, which is withdrawn.

The start and finish of text introduced or altered by National Amendment No.1 is indicated in the text by tags A1⟩ ⟨A1. Minor editorial changes are not tagged.

The start and finish of text introduced or altered by National Amendment No.2 is indicated in the text by tags A2⟩ ⟨A2. Minor editorial changes are not tagged.

National Amendment No.1 was made to reflect Corrigendum No. 1 to BS EN 1992-1-1:2004. National Amendment No. 2 was made to reflect Amendment No. 1 to BS EN 1992-1-1:2004.

NA.1 Scope

NA.1.1 This National Annex gives:

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b) the UK decisions on the status of BS EN 1992-1-2:2004+A1:2014 informative annexes; and

c) references to non-contradictory complementary information.

NA.2 Nationally determined parameters

UK decisions for the Nationally determined parameters described in BS EN 1992-1-1:2004+A1:2014 are given in Table NA.1

Table NA.1 — UK decisions for Nationally Determined Parameters described in BS EN 1992-1-1:2004

Subclause	Nationally Determined Parameter	Eurocode A) recommendation	UK decision
2.3.3 (3)	Value of d_{joint}	30 m	Use the recommended value
2.4.2.1 (1)	Partial factor for shrinkage action γ_{SH}	1,0	Use the recommended value
2.4.2.2 (1)	Partial factor for prestress $\gamma_{P,fav}$	1,0	0,9
2.4.2.2 (2)	Partial factor for prestress $\gamma_{P,unfav}$	1,3	1,1
2.4.2.2 (3)	Partial factor for prestress $\gamma_{P,unfav}$ for local effects	1,2	Use the recommended value
2.4.2.3 (1)	Partial factor for fatigue loads $\gamma_{F,fat}$	1,0	Use the recommended value
2.4.2.4 (1)	Partial factors for materials for ultimate limit states γ_C and γ_S	Table 2.1N	Use the recommended values
2.4.2.4 (2)	Partial factors for materials for serviceability limit states γ_C and γ_S	1,0	Use the recommended value
2.4.2.5 (2)	Value of k_f	1,1	Use the recommended value
3.1.2 (2)P	Value of C_{max}	C90/105	Use the recommended value. However, the shear strength of concrete classes higher than C50/60 should be determined by tests, unless there is evidence of satisfactory past performance of the particular mix including the type of aggregates used. Alternatively, shear strength of concrete strength classes higher than C50/60 may be limited to that of C50/60.
3.1.2 (4)	Value of k_t	0,85	1,0
3.1.6 (1)P	Value of α_{cc}	1,0	0,85 for compression in flexure and axial loading and 1,0 for other phenomena. However, α_{cc} may be taken conservatively as 0,85 for all phenomena.
3.1.6 (2)P	Value of α_{ct}	1,0	Use the recommended value
3.2.2 (3)P	Upper limit of f_{yk}	600 MPa	Use the recommended value
3.2.7 (2)	Design assumptions for reinforcement: value of ε_{ud}	$0,9\varepsilon_{uk}$	Use the recommended value
3.3.4 (5)	Value of k	1,1	Use the recommended value

[A2⟩ A) Table NA.1 and the 'Recommended values' noted therein relate to BS EN 1992-1-1 incorporating corrigenda January 2008, November 2010, February 2014 and amendment A1:2014. ⟨A2]

Table NA.1 — UK decisions for Nationally Determined Parameters described in BS EN 1992-1-1:2004 (*continued*)

Subclause	Nationally Determined Parameter	Eurocode[A)] recommendation	UK decision
3.3.6 (7)	Design assumptions for prestressing tendons: value of ε_{ud}	$0,9\varepsilon_{uk}$ or if more accurate values are not known: $\varepsilon_{ud} = 0,02$ $f_{p0,1k}/f_{pk} = 0,9$	Use the recommended values
4.4.1.2 (3)	Value of $c_{min,b}$	Post-tensioned bonded tendons in rectangular ducts: greater of the smaller dimension or half the greater dimension. Post-tensioned bonded tendons circular ducts: diameter. Pre-tensioned tendons: 1,5 × diameter of strand or plain wire, 2,5 × diameter of indented wire.	Use the recommended values
4.4.1.2 (5)	Structural classification and values of minimum cover due to environmental conditions $c_{min,dur}$	Table 4.3N for structural classification Tables 4.4N and 4.5N for values of $c_{min,dur}$	[A1⟩ Use data in BS 8500 for recommendations for concrete quality for a particular exposure class and cover reinforcement c. ⟨A1]
4.4.1.2 (6)	Value of $\Delta c_{dur,\gamma}$	0 mm	Use the recommended value
4.4.1.2 (7)	Value of $\Delta c_{dur,st}$	0 mm	0 mm unless justified by reference to specialist literature such as the Concrete Society's guidance on the use of stainless steel reinforcement [1].
4.4.1.2 (8)	Value of $\Delta c_{dur,add}$	0 mm	0 mm unless justified by reference to specialist literature
4.4.1.2 (13)	Value of k_1, k_2, k_3	$k_1 = 5$ mm $k_2 = 10$ mm $k_3 = 15$ mm	Use the recommended value
4.4.1.3 (1)P	Value of Δc_{dev}	10 mm	Use the recommended value
4.4.1.3 (3)	Value of Δc_{dev} under controlled conditions	Expressions (4.3N) and (4.4N)	Use the recommended values

[A2⟩ A) Table NA.1 and the 'Recommended values' noted therein relate to BS EN 1992-1-1 incorporating corrigenda January 2008, November 2010, February 2014 and amendment A1:2014. ⟨A2]

Table NA.1 — UK decisions for Nationally Determined Parameters described in BS EN 1992-1-1:2004 (*continued*)

Subclause	Nationally Determined Parameter	Eurocode[A)] recommendation	UK decision
4.4.1.3 (4)	Values of k_1 and k_2	k_1 = 40 mm k_2 = 75 mm	[A1] Use the recommended values [/A1]
5.1.3 (1)P	Simplified load arrangements	The following load arrangements should be considered: a) alternate spans carrying the design variable and permanent load ($\gamma_Q Q_k + \gamma_G G_k + P_m$), other spans carrying only the design permanent load $\gamma_G G_k + P_m$; b) any two adjacent spans carrying the design variable and permanent loads ($\gamma_Q Q_k + \gamma_G G_k + P_m$); all other spans carrying only the design permanent load, $\gamma_G G_k + P_m$.	Use any of the following three options. a) Consider the two load arrangements recommended in the Eurocode for alternate and adjacent spans. b) Consider the two following arrangements for all spans and alternate spans: 1) all spans carrying the design variable and permanent load ($\gamma_Q Q_k + \gamma_G G_k + P_m$); 2) alternate spans carrying the design variable and permanent load ($\gamma_Q Q_k + \gamma_G G_k + P_m$), other spans carrying only the design permanent load $\gamma_G G_k + P_m$; the same value of γ_G should be used throughout the structure; c) For slabs, use the all spans loaded arrangement described in b)1) if: 1) in a one-way spanning slab the area of each bay exceeds 30 m^2; 2) the ratio of the variable load Q_k to the permanent load G_k does not exceed 1,25; and 3) the variable load Q_k does not exceed 5 kN/m^2 excluding partitions. In option c), when analysis is carried out using the load arrangement described in b)1), the resulting support moments except those at the supports of cantilevers should be reduced by 20%, with a consequential increase in the span moments. In this context a bay means a strip across the full width of a structure bounded on the other two sides by lines of support. The load arrangements in a), b) and c) are drafted using BS EN 1990:2002+A1:2005, Expression (6.10). Although not shown here, they can also be drafted using BS EN 1990:2002, Expressions (6.10a) and (6.10b).
5.2 (5)	Value of θ_0	1/200	Use the recommended value

[A2] A) Table NA.1 and the 'Recommended values' noted therein relate to BS EN 1992-1-1 incorporating corrigenda January 2008, November 2010, February 2014 and amendment A1:2014. [/A2]

Table NA.1 — UK decisions for Nationally Determined Parameters described in BS EN 1992-1-1:2004 (*continued*)

Subclause	Nationally Determined Parameter	Eurocode[A)] recommendation	UK decision
5.5 (4)	Moment redistribution formula: values of k_1, k_2, k_3, k_4, k_5 and k_6	k_1 = 0,44 k_2 = 1,25(0,6 + 0,001 4/ε_{cu2}) k_3 = 0,54 k_4 = 1,25(0,6 + 0,001 4/ε_{cu2}) k_5 = 0,7 k_6 = 0,8	For steels with $f_{yk} \leq$ 500 MPa $k_1 = k_3$ = 0,4 $k_2 = k_4$ = 0,6 + 0,001 4/ε_{cu2} k_5 = 0,7 k_6 = 0,8 For steels with f_{yk} > 500 MPa, more restrictive values than those given for steels with $f_{yk} \leq$ 500 MPa may be need to be used. PD 6687 gives further guidance on the redistribution of bending moments.
5.6.3 (4)	Values of $\theta_{pl,d}$	Figure 5.6N	Use the recommended values
5.8.3.1 (1)	Value of λ_{lim}	$\lambda_{lim} = 20 \cdot A \cdot B \cdot C / \sqrt{n}$	Use the recommended value
5.8.3.3 (1)	Value of k_1	0,31	Use the recommended value
5.8.3.3 (2)	Value of k_2	0,62	Use the recommended value
5.8.5 (1)	Methods of second order analysis	Choice of the following two simplified methods. a) Method based on nominal stiffness. b) Method based on nominal curvature.	Use either method
5.8.6 (3)	Value of γ_{cE}	1,2	Use the recommended value
5.10.1 (6)	Methods to avoid brittle failure of prestressed members	Methods A to E	Any of the methods A to E may be used.
5.10.2.1 (1)P	Maximum stressing force: values of k_1 and k_2	k_1 = 0,8 k_2 = 0,9	Use the recommended value
5.10.2.1 (2)	Maximum stressing force: value of k_3	0,95	Use the recommended value
5.10.2.2 (4)	Minimum strength of concrete at various stages of prestressing: values of k_4 and k_5	k_4 = 50 % k_5 = 30 %	Use the recommended value

[A2) A) Table NA.1 and the 'Recommended values' noted therein relate to BS EN 1992-1-1 incorporating corrigenda January 2008, November 2010, February 2014 and amendment A1:2014. (A2]

Table NA.1 — UK decisions for Nationally Determined Parameters described in BS EN 1992-1-1:2004 (*continued*)

Subclause	Nationally Determined Parameter	Eurocode[A)] recommendation	UK decision
5.10.2.2 (5)	Increase of stress at time of transfer of prestress: value of k_6	$k_6 = 0,7$	Use the recommended value
5.10.3 (2)	Prestressing force immediately after tensioning: values of k_7 and k_8	$k_7 = 0,75$ $k_8 = 0,85$	Use the recommended value
5.10.8 (2)	Value of $\Delta\sigma_{p,ULS}$	100 MPa	100 MPa unless the tendon is outwith βd from the tension face, in which case $\Delta\sigma_{p,ULS} = 0$. $\beta = 0,1$ for $d \geq 1\ 000$ mm; $\beta = 0,25$ for $d \leq 500$ mm; the value of β may be interpolated for the values of d between 500 mm and 1 000 mm.
5.10.8 (3)	Values of $\gamma_{\Delta P,sup}$ and $\gamma_{\Delta P,inf}$	$\gamma_{\Delta P,sup} = 1,2$ $\gamma_{\Delta P,inf} = 0,8$ Both values taken as 1,0 if linear analysis with uncracked sections is applied	Use the recommended value
5.10.9 (1)P	Values of r_{sup} and r_{inf}	For pre-tensioning, unbonded tendons: $r_{sup} = 1,05$ and $r_{inf} = 0,95$ For post-tensioning, bonded tendons: $r_{sup} = 1,10$ and $r_{inf} = 0,90$ When appropriate measures (e.g. direct measurements of pretensioning) are taken: $r_{sup} = 1,0$ and $r_{inf} = 1,0$	$r_{sup} = 1,0$ $r_{inf} = 1,0$
6.2.2 (1)	Values of $C_{Rd,c}$, v_{min}, and k_1 for normal shear	$C_{Rd,c} = 0,18/\gamma_c$ $v_{min} = 0,035k^{3/2}f_{ck}{}^{1/2}$ $k_1 = 0,15$	Use the recommended values See also **3.1.2** (2)P for a requirement for concrete class > C50/60
6.2.2 (6)	Value of ν	$\nu = 0,6[1 - f_{ck}/250]$	Use the recommended value See also **3.1.2** (2)P for a requirement for concrete class > C50/60
6.2.3 (2)	Limiting value of $\cot\theta$	$1 \leq \cot\theta \leq 2,5$	$1 \leq \cot\theta \leq 2,5$, except in elements in which shear co-exists with externally applied tension (i.e. tension caused by restraints is not considered here). In these elements, [A2⟩ the value of $\cot\theta$ should lie between [A1⟩ 1.0 and 1,25 ⟨A1] ⟨A2].

[A2⟩ A) Table NA.1 and the 'Recommended values' noted therein relate to BS EN 1992-1-1 incorporating corrigenda January 2008, November 2010, February 2014 and amendment A1:2014. ⟨A2]

Table NA.1 — UK decisions for Nationally Determined Parameters described in BS EN 1992-1-1:2004 (*continued*)

Subclause	Nationally Determined Parameter	Eurocode[A)] recommendation	UK decision
6.2.3 (3)	Values of ν_1 and α_{cw}	$\nu_1 = \nu$ as described by Expression ([A2⟩ 6.6N ⟨A2]) or takes the values given in Expressions (6.10.aN) and (6.10.bN) α_{cw} takes the values given in Expressions (6.11.aN), (6.11.bN) and (6.11.cN)	[A1⟩ $\nu_1=\nu(1–0,5\cos\alpha)$ ⟨A1] However, if the design stress of the shear reinforcement is below 80 % of the characteristic yield stress f_{yk}, ν_1 may be taken as: $\nu_1 = 0,54(1 – 0,5\cos\alpha)$ for $f_{ck} \leq 60$ MPa $\nu_1 = (0,84 – f_{ck}/200)(1 – 0,5\cos\alpha) > 0,5$ for $f_{ck} \geq 60$ MPa α_{cw} is as follows: 1 for non-prestressed structures $(1 + \sigma_{cp}/f_{cd})$ for $0 < \sigma_{cp} \leq 0,25f_{cd}$ 1,25 for $0,25f_{cd} < \sigma_{cp} \leq 0,5f_{cd}$ $2,5(1 – \sigma_{cp}/f_{cd})$ for $0,5f_{cd} < \sigma_{cp} < 1,0f_{cd}$ where: σ_{cp} is the mean compressive stress, measured positive, in the concrete due to the design axial force. This should be obtained by averaging it over the concrete section taking account of the reinforcement. The value of σ_{cp} need not be calculated at a distance less than $0,5d\cot\theta$ from the edge of the support. Note that the values of ν_1 and α_{cw} should not be such as to give rise to a value of $V_{Rd,max}$ greater than $200(b_w)^2$ at sections more than d from the edge of a support. For this purpose the value of b_w does not need to be reduced for ducts. In the case of straight tendons, a high level of prestress ($\sigma_{cp}/f_{cd} > 0,5$) and thin webs, if the tension and the compression chords are able to carry the whole prestressing force and blocks are provided at the extremity of beams to disperse the prestressing force it may be assumed that the prestressing force is distributed between the chords. In these circumstances, the compression field due to shear only should be considered in the web, i.e. $\alpha_{cw} = 1$. See also **3.1.2** (2)P for a requirement for concrete class > C50/60.

[A2⟩ A) Table NA.1 and the 'Recommended values' noted therein relate to BS EN 1992-1-1 incorporating corrigenda January 2008, November 2010, February 2014 and amendment A1:2014. ⟨A2]

Table NA.1 — UK decisions for Nationally Determined Parameters described in BS EN 1992-1-1:2004 (*continued*)

Subclause	Nationally Determined Parameter	Eurocode[A)] recommendation	UK decision
6.2.4 (4)	Range of values of $\cot\theta_f$	$1,0 \leq \cot\theta_f \leq 2,0$ for compression flanges $1,0 \leq \cot\theta_f \leq 1,25$ for tension flanges	Use the recommended value
6.2.4 (6)	Value of k	0,4	Use the recommended value
6.4.3 (6)	Values of β	$\beta = 1,5$ for a corner column $\beta = 1,4$ for an edge column $\beta = 1,15$ for an internal column	Use the recommended values
6.4.4 (1)	Values of $C_{Rd,c}$, v_{min} and k_1 for punching shear	$C_{Rd,c} = 0,18/\gamma_c$ $v_{min} = 0,035k^{3/2}f_{ck}{}^{1/2}$ $k_1 = 0,1$	Use the recommended value See also **3.1.2** (2)P for a requirement for concrete class > C50/60
A2⟩ **6.4.5** (1)	Limiting value of punching shear resistance $v_{Rd,cs\ i}$	$k_{max}\ v_{Rd,c} = 1.5\ v_{Rd,c}$	$k_{max}\ v_{Rd,c} = 2.0\ v_{Rd,c}$ ⟨A2
6.4.5 (3)	The value of maximum punching resistance adjacent to column $V_{Rd,max}$	A1⟩ $v_{Rd,max}$= A2⟩ 0.4 ⟨A2 vf_{cd}	$v_{Rd,max} = 0,5vf_{cd}$ ⟨A1 A2⟩ *text deleted* ⟨A2
6.4.5 (4)	The distance kd of the outer perimeter of punching shear reinforcement from the perimeter U_{out}	$k = 1,5$	A1⟩ k=1,5 Unless the perimeter at which reinforcement is no longer required is less than 3d from the face of the loaded area/column. In this case the reinforcement should be placed in the zone 0,3d and 1,5d from the face of the loaded area/column. The first perimeter of reinforcement should be no further than 0,5d from the face of the loaded area/column. ⟨A1
6.5.2 (2)	Value of v'	$v' = 1 - f_{ck}/250$	Use the recommended value
6.5.4 (4)	Value of k_1, k_2, k_3	$k_1 = 1,0$ $k_2 = 0,85$ $k_3 = 0,75$	Use the recommended value
6.5.4 (6)	Value of k_4	$k_4 = 3,0$	Use the recommended value
6.8.4 (1)	Values of A2⟩ *text deleted* ⟨A2 parameters for S-N curves	A2⟩ *text deleted* ⟨A2 Values of parameters for S-N curves for reinforcing steels given in Table 6.3N Values of parameters for S-N curves for prestressing steels given in Table 6.4N	Use the recommended values

A2⟩ A) Table NA.1 and the 'Recommended values' noted therein relate to BS EN 1992-1-1 incorporating corrigenda January 2008, November 2010, February 2014 and amendment A1:2014. ⟨A2

Table NA.1 — UK decisions for Nationally Determined Parameters described in BS EN 1992-1-1:2004 (*continued*)

Subclause	Nationally Determined Parameter	Eurocode[A)] recommendation	UK decision
6.8.4 (5)	Value of $k2$	5	To be determined by consulting specialist literature
6.8.6 (1)	Values of k_1 and k_2	k_1 = 70 MPa k_2 = 35 MPa	Use the recommended values unless other values are agreed with appropriate authorities
6.8.6 (3)	Value of k_3	0,9	1,0
6.8.7 (1)	Fatigue: values for N and k_1	$N = 10^6$ cycles k_1 = 0,85	Use the recommended value
7.2 (2)	Value of k_1	0,6	Use the recommended value
7.2 (3)	Value of k_2	0,45	Use the recommended value
7.2 (5)	Value of k_3, k_4, k_5	k_3 = 0,8 k_4 = 1,0 k_5 = 0,75	Use the recommended value
7.3.1 (5)	Limitations of crack width w_{max}	Table 7.1N	Use Table NA.4
7.3.2 (4)	Value of $\sigma_{ct,p}$	$f_{ct,eff}$ in accordance with **7.3.2** (2)	Use the recommended value
7.3.4 (3)	Maximum crack spacing in Expression (7.11): values for k_3 and k_4	k_3 = 3,4 k_4 = 0,425	Use the recommended value
7.4.2 (2)	Values of basic span/depth ratios	Table 7.4N	Use Table NA.5
8.2 (2)	Values of k_1 and k_2	k_1 = 1 mm k_2 = 5 mm	Use the recommended value
8.3 (2)	Minimum mandrel diameter $\phi_{m,min}$	Table 8.1N	Use in Table NA.6a) and Table NA.6b)
8.6 (2)	Anchorage capacity of a welded bar	$F_{btd} = l_{td}\phi_t\sigma_{td} \leq F_{wd}$	Use the recommended value
8.8 (1)	Additional rules for large diameter bars: limiting bar size	ϕ_{large} > 32 mm	ϕ_{large} > 40 mm
9.2.1.1 (1)	Beams: minimum reinforcement areas	$A_{s,min} = 0{,}26(f_{ctm}/f_{yk})b_t d \geq 0{,}001\ 3 b_t d$	Use the recommended value
9.2.1.1 (3)	Beams: maximum reinforcement areas	$A_{s,max} = 0{,}04 A_c$	Use the recommended value

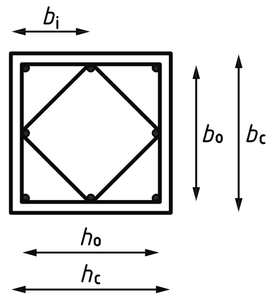
[A2] A) Table NA.1 and the 'Recommended values' noted therein relate to BS EN 1992-1-1 incorporating corrigenda January 2008, November 2010, February 2014 and amendment A1:2014. [A2]

Table NA.1 — UK decisions for Nationally Determined Parameters described in BS EN 1992-1-1:2004 *(continued)*

Subclause	Nationally Determined Parameter	Eurocode[A)] recommendation	UK decision
9.2.1.2 (1)	Beams: minimum ratio of span bending moment to be assumed at supports in monolithic construction	$\beta_1 = 0{,}15$	$\beta_1 = 0{,}25$
9.2.1.4 (1)	Anchorage of bottom reinforcement at an end support: area of steel provided over supports with little or no end fixity in design	$\beta_2 = 0{,}25$	Use the recommended value
9.2.2 (4)	Minimum ratio of shear reinforcement in the form of links	$\beta_3 = 0{,}5$	Use the recommended value
9.2.2 (5)	Minimum shear reinforcement	$\rho_{w,min} = (0{,}08\sqrt{f_{ck}})/f_{yk}$	Use the recommended value
9.2.2 (6)	Maximum longitudinal spacing of shear assemblies	$s_{l,max} = 0{,}75d(1 + \cot\alpha)$	Use the recommended value
9.2.2 (7)	Maximum longitudinal spacing of bent-up bars	$s_{b,max} = 0{,}6d(1 + \cot\alpha)$	Use the recommended value
9.2.2 (8)	Maximum transverse spacing of links	$s_{t,max} = 0{,}75d \le 600$ mm	Use the recommended value
9.3.1.1 (3)	Value of $s_{max,slabs}$	For principal reinforcement: $3h \le 400$ mm For secondary reinforcement: $3{,}5h \le 450$ mm Except in areas with concentrated loads or maximum moment where: For principal reinforcement: $2h \le 250$ mm For secondary reinforcement: $3h \le 400$ mm	Use the recommended values except for post-tensioned slabs where reference may be made to specialist literature such as The Concrete Society's design handbook [2].
9.5.2 (1)	Minimum diameter of longitudinal reinforcement in columns	$\phi_{min} = 8$ mm	$\phi_{min} = 12$ mm
9.5.2 (2)	Minimum area of longitudinal reinforcement in columns	$A_{s,min} = 0{,}10N_{Ed}/f_{yd}$ or $0{,}002A_c$, whichever is greater	Use the recommended value

A2 A) Table NA.1 and the 'Recommended values' noted therein relate to BS EN 1992-1-1 incorporating corrigenda January 2008, November 2010, February 2014 and amendment A1:2014. A2

Table NA.1 — UK decisions for Nationally Determined Parameters described in BS EN 1992-1-1:2004 (*continued*)

Subclause	Nationally Determined Parameter	Eurocode[A)] recommendation	UK decision
9.5.2 (3)	Maximum area of longitudinal reinforcement in columns	$A_{s,max}$ = 0,04A_c outside laps unless it can be shown that the integrity of the concrete will not be affected and that the full strength is achieved at the ULS. $A_{s,max}$ = 0,08A_c at laps	The recommended values apply. The designer should consider the practical upper limit taking into account the ability to place the concrete around the rebar. This issue is considered further in PD 6687.
9.5.3 (3)	Maximum spacing of transverse reinforcement in columns $s_{cl,tmax}$	$s_{cl,tmax}$ should take the least of the following three values: a) 20 times the minimum diameter of the longitudinal bars; b) the lesser dimension of the column; c) 400 mm.	[A1⟩ Use the recommended value for concrete class ≤ C50/60. For concrete class > C50/60, transverse reinforcement should satisfy the following: $\alpha_n \alpha_s \omega_{wd} \geq 0{,}04$, in which ω_{wd} = (Volume of confining hoops × f_{yd}/volume of concrete × f_{cd}) For rectangular columns: [A2⟩ $\alpha_n = 1 - \Sigma(b_i^2/6\ b_0\ h_0)$ ⟨A2] $\alpha_s = [1 - (s/2b_0)]\ [1 - (s/2h_0)]$ where: n is the number of longitudinal bars laterally restrained by links or ties b_i is the distance between consecutive bars that are laterally restrained s is the longitudinal spacing of links b_0 and h_0 are the widths of confinement in the two directions (dimension to the centre of links).  For circular columns with circular links: $\alpha_n = 1$ $\alpha_s = (1 - s/2D_0)^2$ For circular columns with spiral links $\alpha_n = 1$ $\alpha_s = (1 - s/2D_0)$ where D_0 is the diameter of the confined core (to the centre line of links). ⟨A1]

[A2⟩ A) Table NA.1 and the 'Recommended values' noted therein relate to BS EN 1992-1-1 incorporating corrigenda January 2008, November 2010, February 2014 and amendment A1:2014. ⟨A2]

Table NA.1 — UK decisions for Nationally Determined Parameters described in BS EN 1992-1-1:2004 (*continued*)

Subclause	Nationally Determined Parameter	Eurocode[A)] recommendation	UK decision
9.6.2 (1)	Minimum and maximum area of vertical reinforcement in walls	$A_{s,vmin} = 0{,}002A_c$ $A_{s,vmax} = 0{,}04A_c$ outside lap locations unless it can be shown that the integrity of the concrete is not affected and that the full strength is achieved at the ULS. This limit may be doubled at laps.	Use the recommended value
9.6.3 (1)	Minimum area of horizontal reinforcement in walls	$A_{s,hmin}$ = 25 % or $0{,}001A_c$, whichever is greater	Use the recommended values. Where crack control is important early age thermal and shrinkage effects should be considered explicitly.
9.7 (1)	Minimum area of distribution reinforcement in deep beams	$A_{s,dbmin}$ = 0,1 % but not less than 150 mm^2/m in each face and in each direction	0,2 % in each face
9.8.1 (3)	Value of ϕ_{min} for pile caps	8 mm	Use the recommended value
9.8.2.1 (1)	Value of ϕ_{min} for columns and wall footings	8 mm	Use the recommended value
9.8.3 (1)	Value of ϕ_{min} for tie beams	8 mm	Use the recommended value
9.8.3 (2)	Minimum downward load for tie beams	q_1 = 10 kN/m	To be determined for each individual project
9.8.4 (1)	Values of q_2 and ϕ_{min}	q_2 = 5 MPa ϕ_{min} = 8 mm	Use the recommended values
9.8.5 (3)	[A1) Values of A_c and $A_{s,bpmin}$	A_c from Table 9.6N (A1] $A_{s,bpmin}$ from Table 9.6N	Use the recommended values
9.10.2.2 (2)	[A1) Force to be resisted by peripheral tie: values of q_1 and Q_2	q_1 = 10 kN/m Q_2 = 70 kN	$q_1 = (20 + 4n_0)/l_i$ where n_0 is the number of storeys and l_i is the length of the end span Q_2 = 60 kN (A1]

[A2) A) Table NA.1 and the 'Recommended values' noted therein relate to BS EN 1992-1-1 incorporating corrigenda January 2008, November 2010, February 2014 and amendment A1:2014. (A2]

Table NA.1 — UK decisions for Nationally Determined Parameters described in BS EN 1992-1-1:2004 (*continued*)

Subclause	Nationally Determined Parameter	Eurocode A) recommendation	UK decision
9.10.2.3 (3)	Minimum tensile force that an internal tie is capable of resisting	$F_{tie,int}$ = 20 kN/m	$F_{tie,int} = [(q_k + g_k)/7,5](l_r/5)(F_t) \geq F_t$ kN/m where $(q_k + g_k)$ is the sum of the average permanent and variable floor loads (in kN/m^2); l_r is the greater of the distances (in m) between the centres of the columns, frames or walls supporting any two adjacent floor spans in the direction of the tie under consideration; and $F_t = (20 + 4n_0) \leq 60$. Maximum spacing of internal ties = 1,5l_r.
9.10.2.3 (4)	Internal ties on floors without screed: values of q_3 and [A2] Q_4 [/A2]	q_3 = 20 kN/m [A2] Q_4 [/A2] = 70 kN	$F_{tie} = (1/7,5)(g_k + q_k)(l_r/5)F_t \geq F_t$ kN/m where $(g_k + q_k)$ is the sum of the average permanent and variable floor loads (in kN/m^2); l_r is the greater of the distances (in m) between the centres of the columns, frames or walls supporting any two adjacent floor spans in the direction of the tie under consideration; and $F_t = (20 + 4n_0) \leq 60$. Maximum spacing of transverse ties = 1,5l_r.
9.10.2.4 (2)	Force to be resisted by horizontal ties to external columns and/or walls provided at each floor level: values of $F_{tie,fac}$ and $F_{tie,col}$	$F_{tie,fac}$ = 20 kN per metre of the façade $F_{tie,col}$ = 150 kN	$F_{tie,fac} = F_{tie,col}$ = the greater of $2F_t \leq L_s/2,5F_t$ and 3 % of the total design ultimate vertical load carried by the column or wall at that level. $F_{tie,fac}$ in kN per metre run of wall. $F_{tie,col}$ in kN per column. Tying of external walls is only required if the peripheral tie is not located within the wall. L_s is the floor to ceiling height in m. PD 6687 gives additional requirements related to the building regulations in the UK.
11.3.5 (1)P	Value of α_{lcc} (lightweight aggregate concrete)	0,85	Use the recommended value
11.3.5 (2)P	Value of α_{lct} (lightweight aggregate concrete)	0,85	Use the recommended value

[A2] A) Table NA.1 and the 'Recommended values' noted therein relate to BS EN 1992-1-1 incorporating corrigenda January 2008, November 2010, February 2014 and amendment A1:2014. [/A2]

Table NA.1 — UK decisions for Nationally Determined Parameters described in BS EN 1992-1-1:2004 (*continued*)

Subclause	Nationally Determined Parameter	Eurocode[A)] recommendation	UK decision
11.3.7 (1)	Value of k	k = 1,1 for lightweight aggregate concrete with sand as fine aggregate k = 1,0 for lightweight aggregate (both fine and coarse aggregate) concrete	Use the recommended value
11.6.1 (1)	Values of $C_{lRd,c}$, $v_{l,min}$ and k_1	[A1⟩ $C_{lRd,c} = 0,15/\gamma_c$ [A2⟩ $v_{1,min} = 0,028k^{3/2}f_{lck}{}^{1/2}$ ⟨A2] $k_1 = 0,15$	Use the recommended values ⟨A1]
11.6.2 (1)	Value of v_1	$v1 = 0,5\ \eta_1[1 - f_{lck}/250]$	[A2⟩ Use the recommended value ⟨A2]
11.6.4.1 (1)	Value of k_2	0,08	Use the recommended value
[A2⟩ **11.6.4.2** (2)	Value of $v_{lRd,max}$	$0.4f_{lcd}$	Use the recommended value Note that $v = v_1$ given by Exp (11.6.6N) ⟨A2]
12.3.1 (1)	Values of $\alpha_{cc,pl}$ and $\alpha_{ct,pl}$ (plain concrete)	$\alpha_{cc,pl} = 0,8$ $\alpha_{ct,pl} = 0,8$	$\alpha_{cc,pl} = 0,6$ [A1⟩ $\alpha_{ct,pl} = 0,8$ ⟨A1]
12.6.3 (2)	Value of k	1,5	Use the recommended value
A.2.1 (1)	Value of $\gamma_{s,red1}$	1,1	Use the recommended value
A.2.1 (2)	Value of $\gamma_{c,red1}$	1,4	Use the recommended value
A.2.2 (1)	Value of $\gamma_{s,red2}$ and $\gamma_{c,red2}$	$\gamma_{s,red2} = 1,05$ $\gamma_{c,red2} = 1,45$	Use the recommended values
A.2.2 (2)	Value of $\gamma_{c,red3}$	1,35	Use the recommended value
A.2.3 (1)	Value of η and $\gamma_{c,red4}$	$\eta = 0,85$ $\gamma_{c,red4} = 1,3$	Use the recommended values
C.1 (1)	Values for fatigue stress range, minimum relative rib area [A2⟩, β and exceptions to fatigue rules ⟨A2]	Table C.2N $\beta = 0,6$ [A2⟩ Exceptions: Reinforcement is for predominantly static loading or higher values of fatigue stress range and/or the number of cycles are shown to apply by testing. ⟨A2]	Use the recommended value [A2⟩ and the recommended exceptions ⟨A2]
C.1 (3)	Values of a, f_{yk}, k, ε_{uk}	For f_{yk} a = 10 MPa For k and ε_{uk} $a = 0$ Minimum and maximum values for f_{yk}, k, ε_{uk} in accordance with Table C.3N	Use the recommended values

[A2⟩ A) Table NA.1 and the 'Recommended values' noted therein relate to BS EN 1992-1-1 incorporating corrigenda January 2008, November 2010, February 2014 and amendment A1:2014. ⟨A2]

Table NA.1 — UK decisions for Nationally Determined Parameters described in BS EN 1992-1-1:2004 (*continued*)

Subclause	Nationally Determined Parameter	Eurocode[A)] recommendation	UK decision
E.1 (2)	Values of indicative strength classes	Table E.1N	Does not apply in the UK — see the guidance in **4.4.1.2** (5)
J.1 (2)	Value of $A_{s,surfmin}$	$0{,}01A_{ct,ext}$	Does not apply in the UK — see PD 6687 for an alternative Annex J
J.2.2 (2)	Value of $\tan\theta$	$0{,}4 \leq \tan\theta \leq 1$	Does not apply in the UK — see PD 6687 for an alternative Annex J
J.3 (2)	Value of k_1	0,25	Does not apply in the UK — see PD 6687 for an alternative Annex J
J.3 (3)	Value of k_2	0,5	Does not apply in the UK — see PD 6687 for an alternative Annex J

[A2] A) Table NA.1 and the 'Recommended values' noted therein relate to BS EN 1992-1-1 incorporating corrigenda January 2008, November 2010, February 2014 and amendment A1:2014. [A2]

[A1) *Tables deleted.* (A1]

Table NA.4 — Recommended values of w_{max}

Exposure	Reinforced members and prestressed members without bonded tendons (quasi-permanent load combination) mm	Prestressed members with bonded tendons (frequent load combination) mm
X0, XC1	0,3[a]	0,2
XC2, XC3, XC4	0,3	0,2[b]
XD1, XD2, XD3, XS1, XS2, XS3		0,2 and decompression[c]

[a] For X0, XC1 exposure classes, crack width has no influence on durability and this limit is set to produce acceptable appearance. In the absence of specific requirements for appearance this limit may be relaxed.

[b] For these exposure classes, in addition, decompression should be checked under the quasi-permanent combination of loads.

[c] w_{max} = 0,2 mm applies to parts of the member that do not have to be checked for decompression.

In the absence of specific requirements (e.g. water-tightness), it may be assumed that limiting the calculated crack widths to the values of w_{max} given in Table NA.4, under the quasi-permanent combination of loads, will generally be satisfactory for reinforced concrete members in buildings with respect to appearance and durability.

The durability of prestressed members may be more critically affected by cracking. In the absence of more detailed requirements, it may be assumed that limiting the calculated crack widths to the values of w_{max} given in BS EN 1992-1-1:2004+A1:2014, Table 7.1N, under the frequent combination of loads, will generally be satisfactory for prestressed concrete members. The decompression limit requires that all parts of the bonded tendons or duct lie at least 25 mm within concrete in compression.

[A1) In BS EN 1992-1-1:2004+A1:2014, Expression (7.11) the cover, c should be taken as c_{nom}. The use of the resulting value of $s_{r,max}$ in BS EN 1992-1-1:2004+A1:2014, Expression (7.8) will then provide an estimation of the crack width at the surface of the concrete. In some situations, such as structures cast against the ground, c_{nom} will be significantly greater than the cover required for durability. Where there are no appearance requirements it is reasonable to determine the crack width at the cover required for durability and verify that it does not exceed the relevant maximum crack width.

This may be done by multiplying the crack width determined at the surface by $(c_{min,dur} + \Delta c_{dev})/c_{nom}$ to give the crack width at the cover required for durability, and verifying that it is not greater than w_{max}. This approach assumes the crack width varies linearly with zero width at the face of the bar. (A1]

Table NA.5 — Basic ratios of span/effective depth for reinforced concrete members without axial compression

Structural system	*K*	Concrete highly stressed $\rho = 1,5$ %	Concrete lightly stressed $\rho = 0,5$ %
Simply supported beam, one- or two-way spanning simply supported slab	1,0	14	20
End span of continuous beam or one-way continuous slab or two-way spanning slab continuous over one long side	1,3	18	26
Interior span of beam or one-way or two-way spanning slab	1,5	20	30
Slab supported on columns without beams (flat slab) (based on longer span)	1,2	17	24
Cantilever	0,4	6	8

NOTE 1 The values given have been chosen to be generally conservative and calculation may frequently show that thinner members are possible.
NOTE 2 For two-way spanning slabs, the check should be carried out on the basis of the shorter span. For flat slabs the longer span should be taken.
NOTE 3 The limits given for flat slabs correspond to a less severe limitation than a mid-span deflection of span/250 relative to the columns. Experience has shown this to be satisfactory.
A1 NOTE 4 The values of *k* in the table might not be appropriate when the form-work is struck at an early age or when the construction loads exceed the design load. In these cases, the deflections may need to be calculated using advice in specialist literature, e.g. the Concrete Society's report on deflecions in concrete slabs and beams and an article for the Magazine of Concrete Research entitled *Are existing span to depth rules conservative for flat slabs*?, both of which are referenced in **NA.4**.
NOTE 5 When the span/depth ratio obtained from **NA.3** or Expressions (7.16a) or (7.16b) is adjusted using either $(310/\sigma_s)$ or $(500/f_{yk})(A_{s,prov}/A_{s,req})$, such adjustment should be limited to a maximum value of 1.5. σ_s should be calculated under characteristic combination of load at serviceability limit state.
NOTE 6 The absolute value of span/depth may not, in any case, exceed 40*K*. A1

Table NA.6a) — Minimum mandrel diameter to avoid damage to reinforcement for bars and wire

Bar diameter, ϕ mm	Minimum mandrel diameter, $\phi_{m,min}$ for bends, hooks and loops (see BS EN 1992-1-1:2004, Figure 8.1) mm
≤16	4ϕ
>16	7ϕ
NOTE Scheduling, dimensioning, bending and cutting of reinforcement should generally be in accordance with BS 8666.	

Table NA.6b) — Minimum mandrel diameter to avoid damage to reinforcement for welded reinforcement and fabrics bent after welding

Location of transverse bar defined as a multiple of the bar diameter bar diameter, ϕ mm	Minimum mandrel diameter, $\phi_{m,min}$ mm
Transverse bar inside or outside a bend or centre of a transverse bar ≤4ϕ from a bend	20ϕ
Centre of transverse bars >4ϕ from a bend	4ϕ for $\phi \leq 16$
	7ϕ for $\phi \leq 20$
NOTE Scheduling, dimensioning, bending and cutting of reinforcement should generally be in accordance with BS 8666.	

NA.3 Decisions on the status of informative annexes

BS EN 1992-1-1:2004+A1:2014 informative Annexes A, B, D, F, G, H and I may be used in the UK.

BS EN 1992-1-1:2004+A1:2014 informative Annexes E and J are not applicable in the UK. PD 6687 provides an alternative informative Annex J that is acceptable for use in the UK.

NA.4 References to non-contradictory complementary information

NA.4.1 *General references*

The following is a list of references that contain non-contradictory complementary information for use with BS EN 1992-1-1.

— PD 6687-1:2010, *Background paper to the National Annexes to BS EN 1992-1 and BS EN 1992-1.*

— PD 6687-2:2008, *Recommendations for the design of structures to BS EN 1992-2:2005.*

— *Guidance on the use of stainless steel reinforcement*, Technical Report 51, Concrete Society, 1998 [1].

— P*ost-tensioned concrete floors — Design handbook*, Technical Report 43, The Concrete Society, 2005 [2].

— *Deflections in concrete slabs and beams*, Technical Report No. 58, Concrete Society, 2005 [3].

— VOLLUM, R.L. and T.R. HOSSAIN, *Are existing span to depth rules conservative for flat slabs?,* Magazine of Concrete Research, vol. 54, issue 6, 2002 [4].

— *Standard method of detailing structural concrete — A manual for best practice*, The Institution of Structural Engineers/Concrete Society, [5].

NA.4.2 *References for conforming to building regulations in the UK*

[A1) The Building Regulations 2000 (England and Wales) [1,2], Building (Scotland) Regulations 2004 [3,4,5], and Building Regulations (Northern Ireland) 2000 [6] require that a building is constructed so that in the event of an accident the building will not suffer collapse to an extent disproportionate to the cause. Provisions of EN 1992-1-1 are not considered sufficient in some respects and details and design approaches for satisfying this requirement are included in PD 6687 as non-contradictory complimentary information. (A1]

Bibliography

Standards publications

BS 8110 (all parts), *Structural use of concrete.*

[A2⟩ BS 8500-1:2015, *Concrete — Complementary British Standard to BS EN 206-1 — Part 1: Method of specifying and guidance for the specifier.*

BS 8500-2:2015, *Concrete — Complementary British Standard to BS EN 206-1 — Part 2: Specification for constituent materials and concrete.*

BS 8666, *Scheduling, dimensioning, bending and cutting of steel reinforcement for concrete. Specification.*

BS EN 1990:2002+A1:2015, *Eurocode — Basis of structural design.*

BS EN 206:2013, *Concrete — Part 1: Specification, performance, production and conformity.*

PD 6687-1:2010, *Background paper to the UK National Annexes to BS EN 1992–1–1 and BS EN 1992-1-2* ⟨A2]

[A1⟩ PD 6687-2:2008, *Recommendations for the design of structures to BS EN 1992-2:2005* ⟨A1]

Other publications

[A1⟩ [1] GREAT BRITAIN. The Building Regulations 2000. London: The Stationery Office.

[2] GREAT BRITAIN. The Building Regulations 2000 Approved Document A: Structure. London: The Stationery Office, 2004.

[3] GREAT BRITAIN. Building (Scotland) Regulations 2004, as amended: The Stationery Office.

[4] GREAT BRITAIN. The Scottish Building Standards Technical Handbook Domestic: The Stationery Office.

[5] GREAT BRITAIN. The Scottish Building Standards Technical Handbook Non-Domestic: The Stationery Office.

[6] GREAT BRITAIN. Building Regulations (Northern Ireland) 2000. Belfast: The Stationery Office. ⟨A1]

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