

Deflection · span / depth

Beams and slabs · EN 1992-1-1 §7.4.2 · UK NA / PN-EN

Reference	NAE-RC-005 · version 1.0
Standards	BS EN 1992-1-1:2004 with UK NA · PN-EN 1992-1-1:2008 with Polish NA (NDP sources listed on the NDP sheet)
National Annex	Selectable: UK NA to BS EN 1992-1-1 or Polish NA to PN-EN 1992-1-1
Issued	29 October 2026

What it does

Deflection control without direct calculation: the limiting span/effective depth ratio of 7.4.2 for beams and slabs, modified for steel stress, flanged sections and long spans, compared with the actual span/depth ratio.

How to use

1. Open the Calculation sheet and select the National Annex.
2. Fill in the shaded input cells. Everything else is calculated.
3. Read the Results block; every step below it quotes its clause. Print or save as PDF for your calculation package.

Scope and limitations

Reinforced (not prestressed) beams and slabs without significant axial compression. The basic ratio uses Expressions (7.16a) and (7.16b) with K from Table 7.4N (UK NA Table NA.5). For two-way slabs use the shorter span; for flat slabs the longer span (UK NA Table NA.5, Note 2). The method does not cover early striking or construction loads above the design load; calculate deflections in those cases.

The second-generation EN 1992-1-1:2023 is not yet implemented.

Further reading and independent cross-check

- The Concrete Centre, How to design concrete structures using Eurocode 2: Deflection calculations.
- The Concrete Centre, RC Spreadsheets v4, TCC11 Element Design and TCC31 One-way slabs (licensed products) can be used as an independent cross-check.
- The Concrete Society, TR58 Deflections in concrete slabs and beams.

NA Engineering is not affiliated with The Concrete Centre or CIRIA; their publications are referenced for information only.

About NA Engineering

NA Engineering is a structural engineering consultancy delivering structural design, reinforced concrete modelling and detailing, and steel detailing for residential, commercial, infrastructure, energy and refurbishment projects. We share tools like this one because good engineering should be transparent: every formula here is visible and referenced. If you need a design, a check or a full detailing package, talk to us.

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Disclaimer

This spreadsheet is provided free of charge, as is, for use by competent engineers. It does not replace engineering judgement. The user is responsible for the input, for checking that the method suits the element being designed and for verifying the results. NA Engineering accepts no liability for any loss arising from its use. Sheets are password-protected and the workbook structure is locked so that the formulas and the NA Engineering details cannot be changed; only the shaded input cells can be edited.

Revision history

v1.0	29 Oct 2026 · First issue
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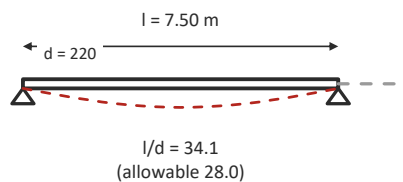
Project
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Date

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Checked

Inputs

Shaded cells only

	National Annex		UK NA (BS EN)		
Table 3.1	Concrete strength class		C30/37		
3.2.2	Reinforcement characteristic yield strength (≤ 500 MPa)	f_{yk}	500	MPa	
Table 7.4N	Structural system		End span		
5.3.2.2	Effective span	l_{eff}	7.50	m	Flat slab: longer span
	Effective depth	d	220	mm	
	Width of web / slab strip	b	1000	mm	
7.4.2(2)	Effective flange width (= b if rectangular)	b_{eff}	1000	mm	
	ULS tension reinforcement required, mid-span (support: cantile)	$A_{s,req}$	1050	mm ²	Same section and width b
	Tension reinforcement provided at the same section	$A_{s,prov}$	1131	mm ²	$\geq A_{s,req}$
	ULS compression reinforcement required	$A_{s2,req}$	0	mm ²	
7.4.2(2)	Supports partitions or finishes liable to damage?		Yes		Long-span factor F2
	Inputs valid and consistent				OK

Your member, span and depth to scale · the deflected shape grows with actual ÷ allowable l/d


Results

Allowable span / effective depth	l/d_{lim}	28.0	
Actual span / effective depth	l/d	34.1	FAIL
Utilisation		1.22	

Calculation

7.4.2(2)	Upper limit on the stress / area factor		1.50	NDP sheet
7.4.2(2)	$L/d \leq 40K$ applies (1 = yes)		1.00	NDP sheet
Table 3.1	Characteristic cylinder strength	f_{ck}	30	MPa
Table 3.1	Mean tensile strength	f_{ctm}	2.90	MPa
	System index		2	
Table 7.4N	Structural system factor	K	1.3	
(7.16)	Reference reinforcement ratio $\sqrt{f_{ck}} \cdot 10^{-3}$	ρ_o	0.00548	
(7.16)	Required tension reinforcement ratio $A_{s,req} / (b d)$	ρ	0.00477	$b = \text{web width (EN 7.4.2(2))}$
(7.16)	Required compression reinforcement ratio	ρ'	0.00000	
(7.16a), (7.16b)	Basic span / effective depth ratio	l/d_{basic}	27.85	

7.4.2(2)	Flanged sections: 0.8 if $b_{eff} / b_w > 3$	F_1	1.00	
7.4.2(2)	Long spans with brittle partitions: $7/l_{eff}$ (> 7 m), flat $8.5/l_{eff}$	F_2	0.933	
(7.17)	Steel stress factor $(500/f_yk)(A_{s,prov}/A_{s,req})$	F_3	1.077	UK NA: ≤ 1.5
7.4.2	Allowable span / effective depth	l/d_{lim}	28.00	UK NA: ≤ 40 K
	Actual span / effective depth	l/d	34.09	

The $(500/f_yk)(A_{s,prov}/A_{s,req})$ form of (7.17) assumes the characteristic SLS steel stress is proportional to $f_yk A_{s,req}/A_{s,prov}$, with $A_{s,req}$ the ULS requirement. Two-way slabs: shorter span; flat slabs: longer span. Deflections should be calculated where formwork is struck early or construction loads exceed the design load (UK NA Table NA.5, Note 4).

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Nationally Determined Parameters

Values used by the Calculation sheet for the selected National Annex. Sources: UK NA to BS EN 1992-1-1:2004, Table NA.1; PN-EN 1992-1-1:2008, Załącznik krajowy NA. Edit only if your project specifies different values.

Parameter	Clause	UK NA	PL NA	Notes
Partial factor, concrete γ_c	2.4.2.4(1)	1.5	1.4	Persistent & transient. UK NA: recommended; PL: NA.2, Table NA.2
Partial factor, reinforcement γ_s	2.4.2.4(1)	1.15	1.15	UK NA: recommended; PL: NA.2, Table NA.2
α_{cc} (compression in flexure / axial)	3.1.6(1)	0.85	1	UK NA: 0.85; PL: recommended (NA.9)
α_{cc} (shear and punching)	3.1.6(1)	1	1	UK NA: 1.0 for other phenomena; PL: recommended (NA.9)
α_{ct} (design tensile strength)	3.1.6(2)	1	1	Recommended value in both annexes
CRd,c numerator (CRd,c = value / γ_c)	6.2.2(1), 6.4.4(1)	0.18	0.18	Recommended value in both annexes
k1 (axial stress term, punching)	6.4.4(1)	0.1	0.1	Recommended value in both annexes
$v_{Rd,max}$ factor ($v_{Rd,max} = \text{factor} \cdot v \cdot f_{cd}$)	6.4.5(3)	0.5	0.4	UK NA: 0.5 v fcd; PL: recommended value (NA.9), 0.4 v fcd since EN 1992-1-1 AC:2010 (PN-EN 1992-1-1:2008)
kmax ($v_{Ed} \leq k_{max} \cdot v_{Rd,c}$ at u1)	6.4.5	2	1.5	UK NA 6.4.5(3): 2 vRd,c. PL: no limit in PN-EN 1992-1-1:2008; 1.5 (A1:2014 recommendation) applied conse
ϕ_{large} (large bar threshold, mm)	8.8(1)	40	32	UK NA: 40 mm; PL: 32 mm recommended (NA.9)
cot θ upper limit (variable strut)	6.2.3(2)	2.5	2	UK NA: 2.5 (1.25 with axial tension); PL: NA.4, $1 \leq \cot \theta \leq 2.0$
k1 (x/d limit, $\delta \geq k_1 + k_2 x_u/d$)	5.5(4)	0.4	0.44	UK NA for $f_{yk} \leq 500$ MPa; PL: recommended (NA.9)
k2 (x/d limit, $\epsilon_{cu2} = 0.0035$)	5.5(4)	1	1.25	UK NA: $0.6 + 0.0014/\epsilon_{cu2}$; PL: $1.25(0.6 + 0.0014/\epsilon_{cu2})$
Upper limit on the (310/ σ_s) factor (0 = none)	7.4.2(2)	1.5	0	UK NA Table NA.5 Note 5: (310/ σ_s) or (500/ f_{yk})($A_{s,prov}/A_{s,req}$) ≤ 1.5 ; PL: none
L/d not to exceed 40 K (1 = applies)	7.4.2(2)	1	0	UK NA Table NA.5 Note 6; not in EN text
ϕ_{min} (longitudinal bars in columns, mm)	9.5.2(1)	12	6	UK NA: 12 mm; PL: NA.6, 6 mm
k3 (crack spacing)	7.3.4(3)	3.4	3.4	Recommended value in both annexes
k4 (crack spacing)	7.3.4(3)	0.425	0.425	Recommended value in both annexes