Plain concrete footing

Unreinforced strip or pad footing · EN 1992-1-1 §12.9.3 · UK NA / PN-EN

Reference	NAE-RC-032 · 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) · EN 1990 load combination by the user
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

Depth of a plain (unreinforced) concrete strip footing under a wall or pad footing under a column, carrying an axial load: the projection beyond the face against the depth by (12.13), the simplified rule $h_F / a \geq 2$, and the gross bearing pressure against an allowable value.

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

Axially loaded strip or pad footing of plain concrete to 12.9.3, the wall or column central (no moment, no eccentricity), static loads: dynamic effects (rotating machinery, traffic) excluded as 12.1(2). (12.13): $0.85\, h_F / a \geq \sqrt{(3\, \sigma_{gd} / f_{ctd,pl})}$, with a the larger projection from the face of the wall or column, h_F the depth and $f_{ctd,pl} = \alpha_{ct,pl}\, f_{ctk,0.05} / \gamma_c$ (3.16, 12.3.1), $\alpha_{ct,pl} = 0.8$ in both annexes (UK NA Amd 1 keeps 0.8 for $\alpha_{ct,pl}$, its $\alpha_{cc,pl} = 0.6$ is not used here; PL NA the recommended value). σ_{gd} is taken as the gross design ground pressure, the footing and backfill weights included (conservative: they cause no bending). The simplified rule $h_F / a \geq 2$ (12.9.3(1)) is shown for information; the check is (12.13). Bearing is checked with characteristic loads against an allowable gross pressure from the geotechnical engineer; EN 1997-1 bearing resistance, sliding and settlement are not covered. Mass concrete footings to old practice (load spread at 45°, $h_F \geq a$) are not the Eurocode rule and are not used. Concrete classes up to C50/60.
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: Foundations (plain concrete footings).
- The Concrete Centre, Concise Eurocode 2, 12 (plain concrete).
- The Concrete Centre, RC Spreadsheets v4 (licensed product) can be used as an independent cross-check.

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About NA Engineering

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Disclaimer

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Revision history

v1.0	29 Oct 2026 · First issue

Project		Job no.	
Element		Made by	
Date		Checked	

Inputs · geometry

Shaded cells only

	National Annex		**UK NA (BS EN)**		
Table 3.1	Concrete strength class		**C25/30**		
	Footing		**Strip (wall; per metre)**		
	Footing width (across the wall; pad: along x)	B	**900**	mm	
	Pad: footing length along y (strip: not used)	L	**900**	mm	
	Depth of the footing	h_F	**500**	mm	
	Wall thickness (pad: column side along x)	t	**300**	mm	
	Pad: column side along y	c_y	**300**	mm	

Inputs · loads and ground

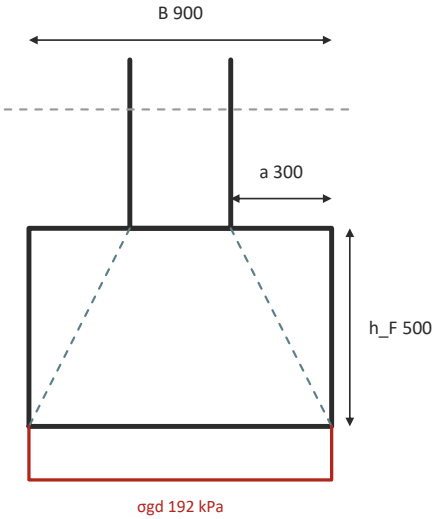
At the top of the footing; strip per metre run

	Load, permanent (kN/m strip, kN pad)	G_k	**80.0**	kN	
	Load, variable	Q_k	**30.0**	kN	
EN 1990 A1.2(B)	Partial factor, permanent	γ_G	**1.35**		
EN 1990 A1.2(B)	Partial factor, variable	γ_Q	**1.50**		
	Depth of backfill over the footing	D_s	**300**	mm	
	Unit weight of backfill	γ_{soil}	**18.0**	kN/m³	
	Allowable gross bearing pressure	q_{allow}	**150**	kPa	From the ground investigation
	Inputs valid and consistent				**OK**

Results

	Depth √(3 σgd / fctd,pl) / (0.85 hF / a) (12.13)		**0.55**		OK
	Bearing pressure, characteristic q / q_allow	q	**0.92**		OK
	Least depth by (12.13), rounded up	$h_{F,min}$	**268**	mm	
	Simplified rule hF / a ≥ 2 (for information)	$h_{F/a}$	**1.67**		**not met**

Your footing · section across the wider projection: the footing, the wall or column, the projection a and the depth hF



Calculation · ground pressure

2.4.2.4(1)	Partial factor, concrete	γ_c	1.50		NDP sheet
Table 3.1	Characteristic cylinder strength	f_{ck}	25	MPa	
Table 3.1	Mean tensile strength	f_{ctm}	2.56	MPa	
	Base area (strip: B × 1 m; pad: B × L)	A	0.900	m²	
	Footing and backfill 25 hF A + γsoil Ds (A − wall or column)	W	14.49	kN	
	Characteristic gross pressure (Gk + Qk + W) / A	q_k	**138.3**	kPa	
	Against the allowable pressure	q_{allow}	150	kPa	OK
EN 1990 (6.10)	Design gross ground pressure (γG (Gk + W) + γQ Qk) / A	σ_{gd}	**191.7**	kPa	

Calculation · depth, 12.9.3

Table 3.1	Characteristic tensile strength (5 % fractile)	$f_{ctk,0.05}$	1.80	MPa	
12.3.1	αct,pl (UK NA Amd 1 and PL NA: 0.8)	$\alpha_{ct,pl}$	0.8		
(3.16), 12.3.1	Design tensile strength αct,pl fctk,0.05 / γc	$f_{ctd,pl}$	0.958	MPa	
12.9.3(1)	Projection beyond the face (larger of the two for a pad)	a	300	mm	
(12.13)	Left side 0.85 hF / a		1.417		
(12.13)	Right side √(3 σgd / fctd,pl)		0.775		
(12.13)	0.85 hF / a ≥ √(3 σgd / fctd,pl)		1.417		OK
	Pressure without the footing weight σ0 = σgd − 0.025 γG hF	σ_0	174.9	kPa	
(12.13)	Least depth (0.85 h / a)² = 3 (σ0 + 0.025 γG h) / (1000 fctd,pl), s	$h_{F,min}$	267.9	mm	
	Depth to adopt at least (rounded up to the mm)	h_F	268	mm	

The least depth includes the weight of that footing. The footing must be cast against undisturbed ground or on blinding, and the concrete class chosen for the exposure (EN 206 / BS 8500).

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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 γc	2.4.2.4(1)	**1.5**	**1.4**	Persistent & transient. UK NA: recommended; PL: NA.2, Table NA.2
Partial factor, reinforcement γs	2.4.2.4(1)	**1.15**	**1.15**	UK NA: recommended; PL: NA.2, Table NA.2
αcc (compression in flexure / axial)	3.1.6(1)	**0.85**	**1**	UK NA: 0.85; PL: recommended (NA.9)
αcc,pl (plain concrete, compression)	12.3.1(1)	**0.6**	**0.8**	UK NA Table NA.1: 0.6; PL: recommended (NA.9)
αcc (shear and punching)	3.1.6(1)	**1**	**1**	UK NA: 1.0 for other phenomena; PL: recommended (NA.9)
αct (design tensile strength)	3.1.6(2)	**1**	**1**	Recommended value in both annexes
CRd,c numerator (CRd,c = value / γc)	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
vRd,max factor (vRd,max = factor · ν · fcd)	6.4.5(3)	**0.5**	**0.4**	UK NA: 0.5 ν fcd; PL: recommended value (NA.9), 0.4 ν fcd since EN 1992-1-1 AC:2010 (PN-EN 1992-1-1:200
kmax (vEd ≤ kmax · vRd,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
ϕlarge (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 ≤ cot θ ≤ 2.0
k1 (x/d limit, δ ≥ k1 + k2 xu/d)	5.5(4)	**0.4**	**0.44**	UK NA for fyk ≤ 500 MPa; PL: recommended (NA.9)
k2 (x/d limit, εcu2 = 0.0035)	5.5(4)	**1**	**1.25**	UK NA: 0.6 + 0.0014/εcu2; PL: 1.25(0.6 + 0.0014/εcu2)
Upper limit on the (310/σs) factor (0 = none)	7.4.2(2)	**1.5**	**0**	UK NA Table NA.5 Note 5: (310/σs) or (500/fyk)(As,prov/As,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
ϕmin (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