

Plain concrete wall

Unreinforced wall under vertical load · EN 1992-1-1 §12.6.5 · UK NA / PN-EN

Reference	NAE-RC-038 · 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
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What it does

Vertical load capacity of a braced plain (unreinforced) concrete wall per metre run by the simplified method of 12.6.5.2: effective length from the restraint of its edges (Table 12.1), slenderness, the eccentricity factor Φ and the least thickness for the load entered.

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

Braced wall of plain concrete cast in situ, constant thickness h_w , clear height l_w between floors, laterally restrained top and bottom and, where entered, along one or two vertical edges by transverse walls a distance b apart (three edges: b from the transverse wall to the free edge). $l_0 = \beta l_w$ with β from Table 12.1 (1.0; $1 / (1 + (l_w / 3b)^2)$; $1 / (1 + (l_w / b)^2)$ when $b \geq l_w$ or $b / 2 l_w$ when $b < l_w$), factored by 0.85 where top and bottom are connected rigidly by in situ concrete and reinforcement (12.6.5.1(4)). Transverse walls must meet 12.6.5.1(3) (depth $\geq 0.5 h_w$, same height, length $\geq l_w / 5$ without openings); openings taller than $l_w / 3$ or larger than 1/10 of the wall area reduce the restraint to two edges (Table 12.1, Note); chases and recesses are not covered (12.6.5.1(2)). $NR_d = b h_w f_{cd,pl} \Phi$ (12.10), $\Phi = 1.14 (1 - 2 e_{tot} / h_w) - 0.02 l_0 / h_w \leq 1 - 2 e_{tot} / h_w$ (12.11), $e_{tot} = e_0 + e_i$ with e_0 the first-order eccentricity entered (floor clamping moments and horizontal actions included, either sign) and $e_i = l_0 / 400$ (5.2(9)); $f_{cd,pl} = \alpha_{cc,pl} f_{ck} / \gamma_c$ with $\alpha_{cc,pl} = 0.6$ (UK NA) or 0.8 (PL NA, recommended value). Slenderness $\lambda = l_0 / i$, $i = h_w / \sqrt{12}$, not above 86 (12.6.5.1(5)); thickness at least 120 mm (12.9.1(1)). Concentrated loads, local bearing (RC-029) and shear are not covered. 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, Concise Eurocode 2, 12 (plain concrete).
 - IStructE, Manual for the design of concrete building structures to Eurocode 2 (walls).
 - The Concrete Centre, RC Spreadsheets v4 (licensed product) can be used as an independent cross-check.
- NA Engineering is not affiliated with The Concrete Centre or CIRIA; their publications are referenced for information only.

About NA Engineering

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Disclaimer

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Revision history

v1.0	29 Oct 2026 · First issue
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Project

Element

Date

Job no.

Made by

Checked

Inputs · wall

Shaded cells only; per metre run

	National Annex		UK NA (BS EN)	
Table 3.1	Concrete strength class		C25/30	
	Lateral restraint		Top and bottom (two edges)	
12.6.5.1(4)	Top and bottom connected rigidly (in situ, reinforced)		No	
	Wall thickness	h_w	200	mm
	Clear height between floors	l_w	3000	mm
	Transverse walls: distance b (three edges: to the free edge)	b	4000	mm

Inputs · load

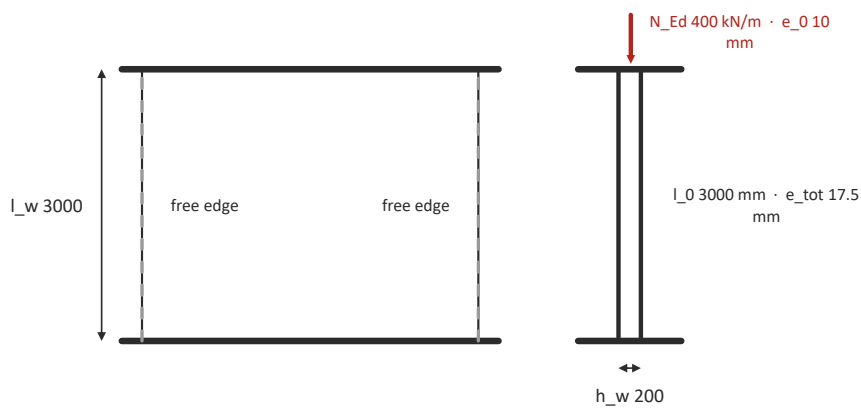
Ultimate limit state

	Design vertical load	N_{Ed}	400.0	kN/m	
	First-order eccentricity (either sign)	e_0	10.0	mm	M0Ed / NEd
	Inputs valid and consistent				OK

Results

Axial N_{Ed} / N_{Rd} (12.10)		0.31		OK
Slenderness $\lambda / 86$ (12.6.5.1(5))		0.60		OK
Thickness $h_w \geq 120$ mm (12.9.1)	h_w	200	mm	OK
Axial resistance	N_{Rd}	1281.0	kN/m	
Least thickness for N_{Ed} , $\lambda \leq 86$ and 120 mm (rounded up)	$h_{w,min}$	123	mm	
Effective length	l_0	3000	mm	
Eccentricity factor (12.11)	Φ	0.641		

Your wall · elevation with the restrained edges (thick) and free edges (dashed), and a section through it to the same scale with the load at its eccentricity



Calculation · effective length, 12.6.5.1

Table 12.1	Restrained edges	n	2	
Table 12.1	β (2: 1.0; 3: $1/(1+(l_w/3b)^2)$; 4: $1/(1+(l_w/b)^2)$ or $b/2l_w$)	β	1.000	
12.6.5.1(4)	Rigid top and bottom (Yes: $\times 0.85$)		1.00	
(12.9)	Effective length βl_w	l_0	3000	mm
(12.8)	Slenderness l_0 / i , $i = h_w / \sqrt{12}$	λ	52.0	
12.6.5.1(5)	$\lambda \leq 86$ ($l_0 / h_w \leq 25$)		52.0	OK
12.9.1(1)	$h_w \geq 120$ mm, cast in situ	h_w	200	mm OK

Calculation · axial resistance, 12.6.5.2

2.4.2.4(1)	Partial factor, concrete	γ_c	1.50	NDP sheet
12.3.1(1)	Coefficient on compressive strength (plain concrete)	$\alpha_{cc,pl}$	0.60	NDP sheet
Table 3.1	Characteristic cylinder strength	f_{ck}	25	MPa
Table 3.1	Mean tensile strength	f_{ctm}	2.56	MPa
(3.15), 12.3.1	Design strength $\alpha_{cc,pl} f_{ck} / \gamma_c$	$f_{cd,pl}$	10.00	MPa
5.2(9)	Imperfection $e_i = l_0 / 400$	e_i	7.5	mm
(12.12)	$e_{tot} = e_0 + e_i$	e_{tot}	17.5	mm
(12.11)	$1.14 (1 - 2 e_{tot} / h_w) - 0.02 l_0 / h_w$		0.641	
(12.11)	Upper limit $1 - 2 e_{tot} / h_w$		0.825	
(12.11)	Φ (not below 0)	Φ	0.641	
(12.10)	$N_{Rd} = b h_w f_{cd,pl} \Phi$ ($b = 1$ m)	N_{Rd}	1281.0	kN/m
(12.10)	$N_{Ed} \leq N_{Rd}$	N_{Ed}	400.0	kN/m OK

Calculation · least thickness

(12.11)	From the first branch $(NEd / f_{cd,pl} + 2.28 e_{tot} + 0.02 l_0) / 1.14$	122.7	mm
(12.11)	From the upper limit $NEd / f_{cd,pl} + 2 e_{tot}$	75.0	mm
12.6.5.1(5)	For $\lambda \leq 86 \sqrt{12 l_0} / 86$	120.8	mm
	Least thickness (and 120 mm)	$h_{w,min}$	122.7 mm
	Rounded up to the mm	h_w	123 mm

The least thickness keeps the eccentricity e_0 entered; where e_0 comes from a slab bearing on part of the wall, it changes with the thickness. With openings beyond the Table 12.1 limits, check the parts between the openings as restrained on two edges only. Chases and recesses need their own strength and stability check and a larger δ (12.6.5.1(2), 12.9.1(2)): not covered here.

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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)
$\alpha_{cc,pl}$ (plain concrete, compression)	12.3.1(1)	0.6	0.8	UK NA Table NA.1: 0.6; 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
vRd,max factor (vRd,max = factor · v · fcd)	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 (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
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, $\delta \geq k1 + k2 x_u/d$)	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