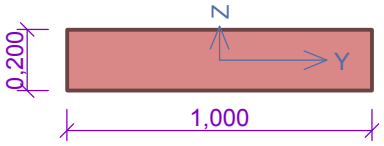
1 Project _1

2 Wall 200mm

2.1 Input data

Section



ZDIVO, STANDARDNÍ - RECTANGLE	
Cross-section dimension	
cross-section height	h = 0,200 m
cross-section width	b = 1,000 m

Material

Name: Autoclaved aerated concrete masonry P2 - Mortar for thin joints

Strength in compression	f_k	1,442 MPa
Shear strength	f_{vko}	0,3 MPa
Tensile strength upon bending about horizontal axis	f_{xk1}	0,15 MPa
Tensile strength upon bending about vertical axis	f_{xk2}	0,2 MPa
Partial material factor	γ_M	2,7
Creep coefficient	φ	1

Internal forces

no.	Load name	N_{Ed} [kN]	V_{Edz} [kN]	V_{Edy} [kN]	M_{Edy} [kNm]	M_{Edz} [kNm]	Type
1	ZP 1	-50,00	0,00	0,00	2,00	0,00	Top
2	ZP 2	-55,00	0,00	0,00	1,20	0,00	Centre
3	ZP 3	-60,00	0,00	0,00	-1,80	0,00	Bottom

Support

Support method: 

Ceiling type: Concrete
Wall height: 2,600m
Wall length: 5,000m
Buckling height: 2,498m

2.2 Results

Ultimate limit state

Štíhlost prvku h_{ef}/t_{ef} = 12,49 ≤ 27 ⇒ **Pass**

no.	Name	N_{Ed} / N_{Rd} [kN]	V_{Edz} / V_{Ed} [kN]	V_{Edy} / V_{Rd} [kN]	M_{Edy} / M_{Ed} [kNm]	M_{Edz} / M_{Rd} [kNm]	Check
1	ZP 1	-50,00	0,00	0,00	2,00	0,00	Pass
		-56,57	0,00	6,31	2,00	-	
2	ZP 2	-55,00	0,00	0,00	1,20	0,00	Pass
		-58,32	0,00	8,41	1,20	-	
3	ZP 3	-60,00	0,00	0,00	-1,80	0,00	Pass
		-66,96	0,00	7,47	1,80	-	

Ultimate limit state - PASS

Serviceability limit state

Member thickness (smalles dimension) t_{ef} = 0,200m ≥ 0,100m ⇒ Pass
Proportion of member height and thickness h/t_{ef} = 13,000 ≤ 1,7E308 ⇒ Pass
Proportion of member length and thickness l/t_{ef} = 25,000 ≤ 146,000 ⇒ Pass

Serviceability limit state - PASS
Overall check - Section PASS

Worst load

ZP 2

Štíhlost prvku h_{ef}/t_{ef} = 12,49 ≤ 27 ⇒ **Pass**

Compression

$\rho_4 = \rho_2 / [1 + (\rho_2 \times h / l)^2] = 2 / [1 + (2 \times 2,6 / 5)^2] = 0,961$
$h_{ef} = \rho_4 \times h = 0,961 \times 2,6 = 2,498$ m
$f_k = K \times f_b{}^{\alpha} = 0,8 \times 2^{0,85} = 1,442$ MPa
$\lambda = h_{ef} / t_{ef} \times \sqrt{(f_k / E)} = 2,498 / 0,2 \times \sqrt{(1,442 / 1\,009)} = 0,472$
$e_{mk} = \max(M_{md} / N_{md} + h_{ef} / 450; 0,05 \times t) = \max(1,2 / 55 + 2,498 / 450; 0,05 \times 0,2) = 0,0274$ m
$u = (\lambda - 0,063) / (0,73 - 1,17 \times e_{mk} / t) = (0,472 - 0,063) / (0,73 - 1,17 \times 0,0274 / 0,2) = 0,718$
$\Phi_m = A_1 \times e^{(-u^2 / 2)} = (-0,707) \times e^{(-0,718^2 / 2)} = -0,546$
$f_d = f_k / \gamma_M = 1,442 / 2,7 = 0,534$ MPa
$N_{Rd} = \Phi_m \times A \times f_d = (-0,546) \times 0,2 \times 0,534 = -58,32$ kN

Ultimate limit state - compression PASS

Shear

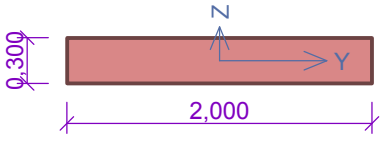
$f_{vk} = \min(f_{vko} + 0,4 \times \sigma_d; 0,065 \times f_b) = \min(0,3 + 0,4 \times 0,275; 0,065 \times 2) = 0,13$ MPa
$f_{vd} = f_{vk} / \gamma_M = 0,13 / 2,7 = 0,0481$ MPa
$V_{Rd} = f_{vd} \times A = 0,0481 \times 0,175 = 8,414$ kN

Ultimate limit state - shear PASS

3 Column

3.1 Input data

Section



MASONRY, STANDARD - RECTANGLE	
Cross-section dimension	
cross-section height	h = 0,300 m
cross-section width	b = 2,000 m

Material

Name: Calcium silicate masonry P16 - Ordinary mortar M2,5

Strength in compression	f_k	5,042 MPa
Shear strength	f_{vko}	0,15 MPa
Tensile strength upon bending about horizontal axis	f_{xk1}	0,05 MPa
Tensile strength upon bending about vertical axis	f_{xk2}	0,2 MPa
Partial material factor	γ_M	2,2
Creep coefficient	φ	1,5

Internal forces

no.	Load name	N_{Ed} [kN]	V_{Edz} [kN]	V_{Edy} [kN]	M_{Edy} [kNm]	M_{Edz} [kNm]	Type
1	Load 1	-22,00	0,00	0,00	0,38	0,00	Centre

Support

Support method: 

Wall height: 2,650m
Buckling height: 5,300m

3.2 Results

Ultimate limit state

Štíhlost prvku h_{ef}/t_{ef} = 17,67 ≤ 27 ⇒ **Pass**

no.	Name	N_{Ed}	V_{Edz}	V_{Edy}	M_{Edy}	M_{Edz}	Check
		N_{Rd}	V_{Ed}	V_{Rd}	M_{Ed}	M_{Rd}	
		[kN]	[kN]		[kNm]		
1	Load 1	-22,00	0,00	0,00	0,38	0,00	Pass
		-733,23	0,00	41,78	0,38	-	

Ultimate limit state - PASS

Serviceability limit state

Member thickness (smalles dimension) t_{ef} = 0,300m ≥ 0,100m ⇒ Pass
Proportion of member height and thickness h/t_{ef} = 8,833 ≤ 30,000 ⇒ Pass

Serviceability limit state - PASS
Overall check - Section PASS

Worst load

Load 1

Štíhlost prvku h_{ef}/t_{ef} = 17,67 ≤ 27 ⇒ **Pass**

Compression

h_{ef} = $\rho_2 \times h = 2 \times 2,65 = 5,3$ m
f_k = $K \times f_b^{\alpha} \times f_m^{\beta} = 0,55 \times 16^{0,7} \times 2,5^{0,3} = 5,042$ MPa
λ = $h_{ef} / t_{ef} \times \sqrt{(f_k / E)} = 5,3 / 0,3 \times \sqrt{(5,042 / 5\,042)} = 0,559$
e_m = $M_{md} / N_{md} + h_{ef} / 450 = 0,38 / 22 + 5,3 / 450 = 0,0291$ m
e_k = $0,002 \times \varphi \times h_{ef} / t_{ef} \times \sqrt{(t \times e_m)} = 0,002 \times 1,5 \times 5,3 / 0,3 \times \sqrt{(0,3 \times 0,0291)} = 0,00495$ m
e_{mk} = $\max(e_m + e_k; 0,05 \times t) = \max(0,0291 + 0,00495; 0,05 \times 0,3) = 0,034$ m
u = $(\lambda - 0,063) / (0,73 - 1,17 \times e_{mk} / t) = (0,559 - 0,063) / (0,73 - 1,17 \times 0,034 / 0,3) = 0,83$
Φ_m = $A_1 \times e^{(-u^2 / 2)} = (-0,752) \times e^{(-0,83^2 / 2)} = -0,533$
f_d = $f_k / \gamma_M = 5,042 / 2,2 = 2,292$ MPa
N_{Rd} = $\Phi_m \times A \times f_d = (-0,533) \times 0,6 \times 2,292 = -733,2$ kN

Ultimate limit state - compression PASS

Shear

f_{vk} = $\min(f_{vko} + 0,4 \times \sigma_d; 0,065 \times f_b) = \min(0,15 + 0,4 \times 0,0367; 0,065 \times 16) = 0,165$ MPa
f_{vd} = $f_{vk} / \gamma_M = 0,165 / 2,2 = 0,0748$ MPa
V_{Rd} = $f_{vd} \times A = 0,0748 \times 0,558 = 41,78$ kN

Ultimate limit state - shear PASS