1 Demo01

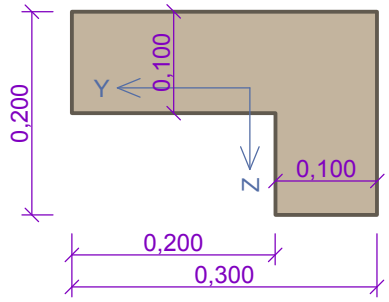
Calculation factors

According to standard CSN EN 1992-1-1.

2 Column 7

2.1 Input data

Section



Materials

Concrete : C 25/30

f_{ck} = 25,0 MPa; f_{ctm} = 2,6 MPa; E_{cm} = 30500,0 MPa

Tensile strength of concrete not considered.

Internal forces - design (ULS)

no.	Load name	N_{Ed} [kN]	V_{Edz} [kN]	V_{Edy} [kN]	M_{Edy} [kNm]	M_{Edz} [kNm]	QP coef. [-]
1	Load 1	-300,00	20,00	10,00	2,83	7,12	1,000

2.2 Results

Check of ultimate limit state

no.	Name	N_{Ed} N_{Rd} [kN]	V_{Edz} V_{Rdz} [kN]	V_{Edy} V_{Rdy} [kN]	M_{Edy} M_{Rdy} [kNm]	M_{Edz} M_{Rdz} [kNm]	Check
1	Load 1	-300,00	20,00	10,00	3,38	8,51	Pass
		-345,17	54,83	27,42	4,34	10,91	

Ultimate limit state (bent-up bar, shear) PASS

Detailed check COMPRESSION AND BENDING: Load 1

Imperfection

e_i = l_0 / 400 = 2 / 400 = 0,005 m

M_{0Edy} = M_y + e_i × |N_{Ed}| × 0,369 = 2,83 + 0,005 × |-300| × 0,369 = 3,384 kNm

M_{0Edz} = M_z + e_i × |N_{Ed}| × (-0,929) = (-7,12) + 0,005 × |-300| × (-0,929) = -8,514 kNm

Deformation in marginal cross-section fibres

Smallest deformation in concrete: -3,50 ‰
Largest deformation in concrete: 1,06 ‰
Direction of neut. axis: 325,68 °

CS check for compression and bending PASS

Detailed check SHEAR: Load 1

Calculation for plain concrete in compr. used

f_{ctd} = $\alpha_{ct,pl}$ × $f_{ctk0,05}$ / γ_C = 0,7 × 1,8 / 1,5 = 0,84 MPa

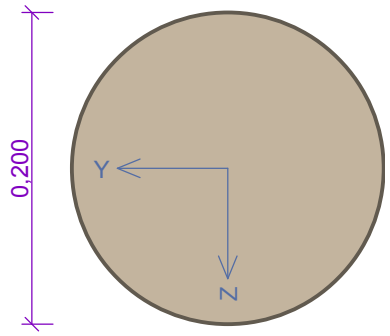
$\sigma_{c,lim}$ = f_{cd} - 2 × √[f_{ctd} × (f_{ctd} + f_{cd})] = 13,33 - 2 × √[0,84 × (0,84 + 13,33)] = 6,432 MPa

f_{cvd} = $\sqrt{\{f_{ctd}^2 + \sigma_{cp} \times f_{ctd} - [(\sigma_{cp} - \sigma_{c,lim}) / 2]^2\}}$ = $\sqrt{\{0,84^2 + 8,494 \times 0,84 - [(8,494 - 6,432) / 2]^2\}}$ = 2,603 MPa
V_{Rdc} = $f_{cvd} \times A_{cc} / k$ = 2,603 × 35 321 / 1,5 = 61,3 kN
Cross-section capacity in shear PASS

3 Cross 1

3.1 Input data

Section



Materials

Concrete : C 12/15
f_{ck} = 12,0 MPa; f_{ctm} = 1,6 MPa; E_{cm} = 26000,0 MPa

Tensile strength of concrete not considered.

Internal forces - design (ULS)

no.	Load name	N_{Ed} [kN]	V_{Edz} [kN]	V_{Edy} [kN]	M_{Edy} [kNm]	M_{Edz} [kNm]	QP coef. [-]
1	Load 1	-100,00	0,00	0,00	1,57	1,64	1,000

3.2 Results

Check of ultimate limit state

no.	Name	N_{Ed} N_{Rd} [kN]	V_{Edz} V_{Rdz} [kN]	V_{Edy} V_{Rdy} [kN]	M_{Edy} M_{Rdy} [kNm]	M_{Edz} M_{Rdz} [kNm]	Check
1	Load 1	-100,00	0,00	0,00	1,57	1,64	Pass
		-142,94	25,53	0,00	2,83	2,95	

Ultimate limit state (bent-up bar, shear) PASS

Detailed check COMPRESSION AND BENDING: Load 1

Calculate min eccentricity

e_0 = max(h / 30; 0,02) = max(0,2 / 30; 0,02) = 0,02 m
M_{0Edy} = max(M_y; $e_0 \times |N_{Ed}| \times 0,692$) = max(1,57; 0,02 × |-100| × 0,692) = 1,57 kNm
M_{0Edz} = min(M_z; $e_0 \times |N_{Ed}| \times (-0,722)$) = min(-1,64; 0,02 × |-100| × (-0,722)) = -1,64 kNm

Deformation in marginal cross-section fibres

Smallest deformation in concrete: -3,50 ‰
Largest deformation in concrete: 0,70 ‰
Direction of neut. axis: 313,75 °

CS check for compression and bending PASS

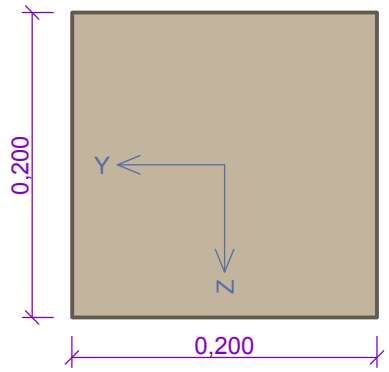
Detailed check SHEAR: Load 1

CS is not subject to shear.

4 Column A3

4.1 Input data

Section



Materials

Concrete : C 30/37

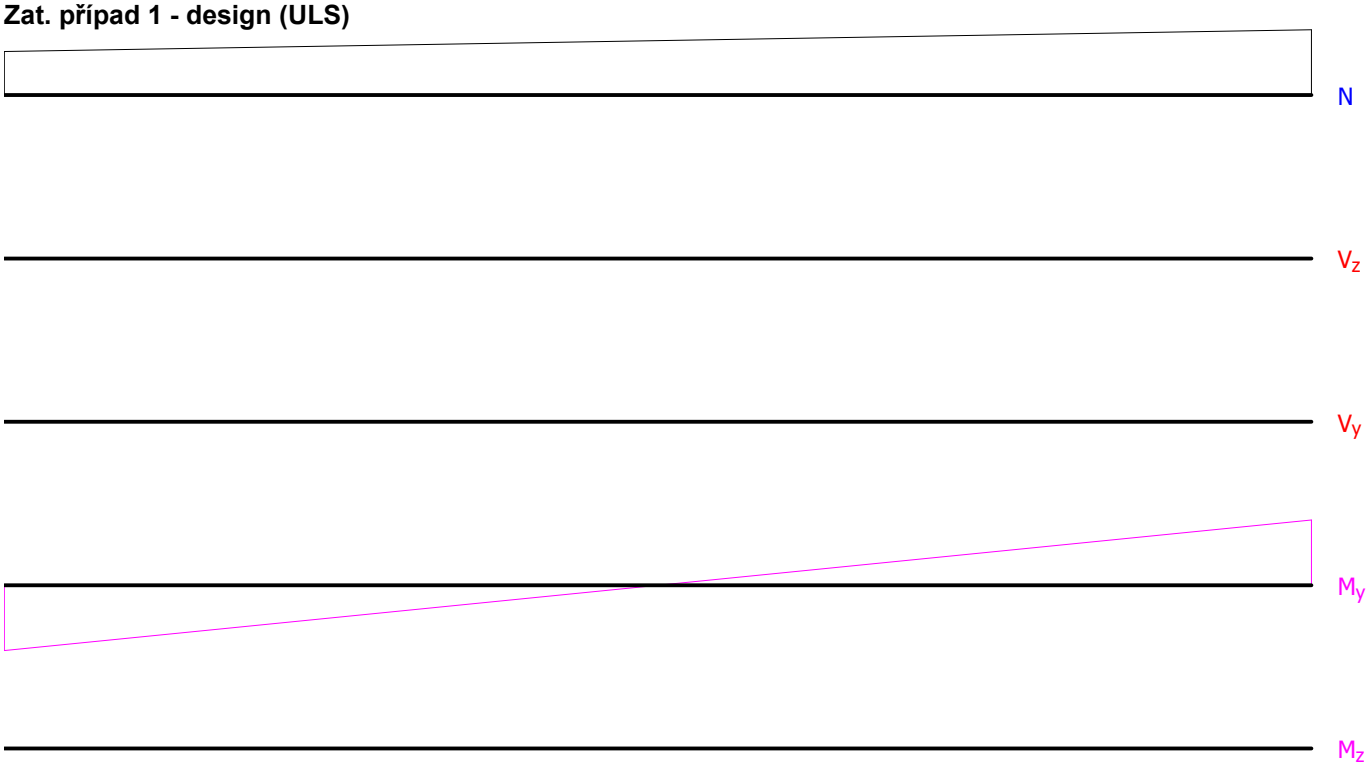
f_{ck} = 30,0 MPa; f_{ctm} = 2,9 MPa; E_{cm} = 32000,0 MPa

Tensile strength of concrete not considered.

Internal forces

ZAT. PŘÍPAD 1 - DESIGN (ULS)					
Position [m]	N_{Ed} [kN]	V_{Edz} [kN]	V_{Edy} [kN]	M_{Edy} [kNm]	M_{Edz} [kNm]
0,00	-200,00	0,00	0,00	12,00	0,00
3,00	-300,00	0,00	0,00	-12,00	0,00

Zat. případ 1 - design (ULS)



Buckling

Sector no.: 1, (0,00m - 3,00m)

Length [m]	Buckling coef. [–]	Buckling length [m]
2,00	0,50	1,00

4.2 Results

Ultimate limit state (ULS) is checked
Maximal utilization: 88,4%; Zat. případ 1; X=0,000m.
Count of entered cross-sections on member: 1
Member PASSES