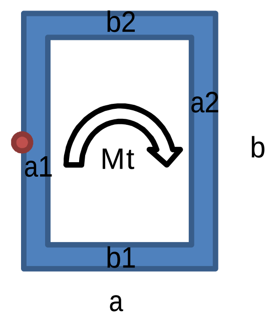
UNIFORM TORSION: shear stress comparison between thin and thick cross-section beams

Torsion of Rectangular Thin Cross-Section (no warping)

	Physical Quantities	Calcs	Units	Expression
minor dim.	a	350	mm	
thickness minor_lhs	a1	16	mm	
thickness minor_rhs	a2	16	mm	
maggior dim.	b	350	mm	
thickness maggior_upper	b1	16	mm	
thickness maggior_down	b2	16	mm	
applied torsional moment	Mt	2,5E+07	N.mm	
	Ω	1,12E+05	mm^2	Ω=(a-(a1+a2)/2)(b-(b1+b2)/2)
max shear stress	τmax	7,00	N/mm^2	τmax=M/(2*Ω*bmin) : Bredt formula



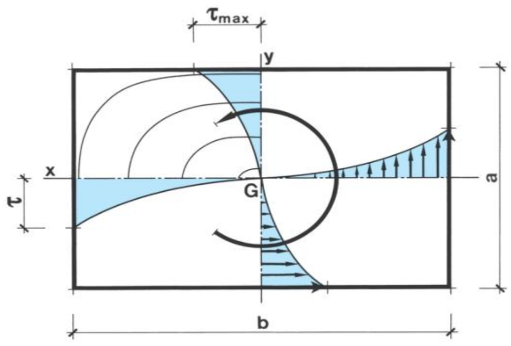
Torsion of Rectangular Thick Cross-Section (with warping)

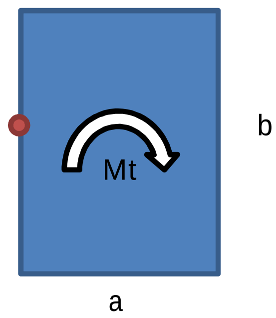
	Physical Quantities	Calcs	Units	Expression
minor dim	a	350	mm	
maggior dim	b	350	mm	
aspect ratio	b/a	1		
applied torsional moment	Mt	2,5E+07	N.mm	
empirical formula	α	4,800	[1]	α=3+1,8*a/b (empirical)
max shear stress	τmax	2,80	N/mm^2	τmax=α*M/(b*a^2) : Bredt formula

Attention: table values differs from the empirical formula for higher aspect ratios....

Tabella 1

b/a	1	1,1	1,2	1,3	1,4	1,5	1,6	1,7	1,8
α	4,804	4,67	4,57	4,48	4,40	4,33	4,27	4,21	4,16
b/a	2	2,5	3	4	5	6	8	10	20
α	4,07	3,88	3,74	3,55	3,43	3,35	3,26	3,20	3,10

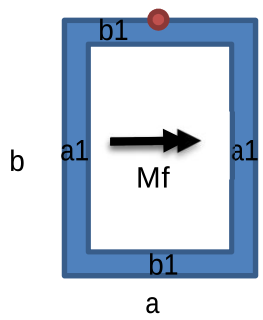




UNIAXIAL BENDING: normal stress comparison between thin and thick cross-section beams

Bending of Rectangular Thin Section

	Physical Quantities	Calcs	Units	Expression
width x	a	350	mm	
thickness x_lhs	a1	16	mm	
thickness x_rhs	a2	16	mm	
hight y	b	350	mm	
thickness y_upper	b1	16	mm	
thickness y_down	b2	16	mm	
	Mf	2,5E+07	N.mm	
moment of inertia	I	3,98E+08	mm^4	I=a*b^3/12-(a-(a1+a2))*(b-(b1+b2))^3/12
max normal stress	σmax	10,98	N/mm^2	σmax=(M*b/2)/I : Navier formula



Bending of Rectangular Thick Section

	Physical Quantities	Calcs	Units	Expression
minor dim	a	350	mm	
maggior dim	b	350	mm	
moment of inertia	I	1,25E+09	mm^4	I=a*b^3/12-(a-(a1+a2))*(b-(b1+b2))^3/12
applied torsional moment	Mf	2,5E+07	N.mm	
max normal stress	σmax	3,50	N/mm^2	σmax=(M*b/2)/I : Navier formula