



Section Properties Module

Back Rectangular Flanged Double Circular Steel Other Help

User-defined Pipe Shape

40.0
5.0

1
2

Rotate
0
90
180
270

Mohr's Circle

Compute

End

Elastic Modulus
15

Material Elastic Modulus
psi MPa
ksi GPa

Composite Beam

Material A
0.00 Modulus for Material A (left mouse button select)

Material B
0.00 Modulus for Material B (right mouse button select)

Cross-Section Properties

Z-Z Properties Y-Y Properties Print Details

Z - Z Properties

Elastic Modulus	E	15.0000	GPa
From bottom to centroid	Y bot	20.0000	mm
From centroid to top	Y top	20.0000	mm
Area of shape	A	1,237.0021	mm ²
Moment of Inertia	Iz	125,633.0265	mm ⁴
Section Modulus	Sz	6,281.6513	mm ³
Section Modulus (bottom)	S bot	6,281.6513	mm ³
Section Modulus (top)	S top	6,281.6513	mm ³
Radius of Gyration	rz	10.0778	mm
Plastic Modulus	Zz	10,645.8333	mm ³
Shape Factor		1.6948	
From bottom to plastic n.a.	Yp bot	20.0000	mm
From plastic n.a. to top	Yp top	20.0000	mm
Polar Moment of Inertia	J	251,266.0531	mm ⁴
Product of Inertia	Iyz	0.0000	mm ⁴
Maximum Moment of Inertia	Imax	125,633.0265	mm ⁴
Minimum Moment of Inertia	Imin	125,633.0265	mm ⁴
Angle from z axis to Imax axis	B	0.0000	degrees
		Clockwise	

Euler Column Buckling Module
 Back Cross-Section Help

Total Column Length
 400
 in mm
 ft m

Fixity at Top
 Pinned
 Fixed
 Free
 Guided

Slenderness Ratio
 $KL/r = 39.691$

Intermediate Support

Effective Length Factor
 $K = 1.000$

Fixity at Bottom
 Pinned
 Fixed

Compute
 End

Fixity at Top
 Pinned
 Fixed
 Free
 Guided

Slenderness Ratio
 $KL/r = 39.691$

Intermediate Support

Effective Length Factor
 $K = 1.000$

Fixity at Bottom
 Pinned
 Fixed

Critical Euler Buckling Load
 116.25 kN
 lbs N
 kips kN

Critical Euler Buckling Stress
 93.97 MPa
 psi kPa
 ksi MPa

Critical Stress vs. Slenderness Ratio

Buckling about the Y-axis

Buckling about the Z-axis

I was sitting in the doctors office for my cast and stumbled along these column. On the second photo I made red marks to show what I used for columns. I looked online and found a site that had modulus of Elasticity for femurs which I averaged to 15 GPa. Dimensions of the femurs were estimated by memory of the skeleton. The femur is not solid bone (bone marrow) so there is a small hole placed in my cross sectional area. The femur is connected to the hip at the top and to the tibia at the bottom. These connections allow a person to move so they are pin connections.

The website used was:

http://www.feppd.org/ICB-Dent/campus/biomechanics_in_dentistry/ldv_data/mech/basic_bone.htm#mechanics

comment from professor: bone strength similar to cast iron (up to 200 MPa)!