

Structural Steel Pipes

F<sub>y</sub> := 260·MPa

E := 200000·MPa

v := 0.3

ϕ<sub>b</sub> := 0.9

ϕ<sub>c</sub> := 0.85

ϕ<sub>v</sub> := 0.85

D := 50·cm

external diameter

t := 6·mm

L := 4·m

K := 1

assume corresponds to real plane of buckling

support := 0

0 for simply supported  
1 for clamped

- out of roundness imperfection less than 1%
- if more the checks could become unconservative

Axial Load Strength

P<sub>n</sub> = 239.84 ton

ϕ<sub>c</sub>·P<sub>n</sub> = 203.86 ton

σ<sub>n</sub> = 0.97 F<sub>y</sub>

Bending Strength

M<sub>n</sub> = 34.94 m·ton

ϕ<sub>b</sub>·M<sub>n</sub> = 31.44 m·ton

M<sub>n</sub> = 0.9 M<sub>p</sub>

M<sub>n</sub> = 1.16 M<sub>y</sub>

Beam-column: Axial load, bending, torsion and shear combined

Factored loads

P<sub>u</sub> := 125·ton

T<sub>u</sub> := 2·m·ton

V<sub>u</sub> := 10·ton

M<sub>u</sub> := 8·m·ton

- substitute amplified moment if required
- combine vectorially M<sub>x</sub> and M<sub>y</sub> at the point to get M<sub>u</sub>

Note that a proper K must be entered in former input above for a proper check.

Shear\_buckling = "inelastic"

$\tau_c = 1.37 \tau_y$

- inelastic shear action is assumed to start at buckling stress=0.8·τ<sub>y</sub>
- the elastic or inelastic critical shear buckling stress, hence

$\tau_n = 1 \tau_y$

for most common structural pipes the nominal shear stress will correspond to yield stress

$$\frac{\sigma_u}{\sigma_n} + \left(\frac{\tau_u}{\tau_n}\right)^2 = 0.94$$

- must be equal to or less than 1 for the strength to be OK (interaction supported in p.172)
- note that the different strength reduction factors have already been taken into account by enlarging (in the collapsed area) the factored longitudinal and transverse stresses to be checked

- the failure to consider interaction with high shear stresses may be one fundamental cause of failure under earthquake or strong wind forces
- when strong lateral forces are being considered, don't forget to consider shear plus all other actions combined at both the joints and members