Gusset Plate Straining actions :

Tension = T = 4 tons

Compression = C = 18 tons

use gusset plate = 20mm

weld thickness = 1.2cm

Leff = 18/ ( 2 \* 1 \* 0.2 \* 5.2 ) = 7.2 cm

Lact = Leff + 2 Sw = 10 cm

Gusset plate height = 10 cm

Gusset plate length = 20 cm

Gusset plate section Area = 10 \* 2 = 20 cm

Gusset plate applied stress = 18 / 20 = 0.9 ton/cm2

Gusset plate effective length = 20 \* 2 = 40cm ….. fixed free

Gusset plate smallest inertia = 23 \* 10 / 12 = 6.67 cm4

Leff/imin = 40 / ( 6.67 / 20 )0.5 = 69.3 < 180 ………ok

Fcr = 0.58fy – (KL/i)2 ( 0.58fy – 0.75 ) /10000 = 1.6 ton/cm2 > fapplied  …………safe

Bolts Design :

Normal force = 18 tons

**Using 3 bolts , M20, grade 10.9**

Shear for bolt = 18/3 = 6 tons

Using gusset plate thickness for bolts = 10 mm

Plate Bearing resistance Rb = 1cm \* 5.2 ton/cm2 \* 2cm = 10.4 tons

Shear resistance Rsh = Bolt Area \* Fsh \* shear plans = (3.14 \* 22 \*0.25) \* (0.2\*10.9) \* 1 = 6.8 t

Rmax = 6.8 t

Max Normal force = 6.8 \* 3 = 20.4 tons > applied Normal force …… safe