Gusset Plate Straining actions :

Tension = T = 5.5 \* cos(3) + 15.5 \* cos(45) = 16.5 tons

Shear = Q = 5.5 \* sin(3) + 15.5 \* cos(45) = 11.3 tons

use gusset plate = 20mm

Bolts Design :

Group A :

Normal force = 5.5 tons

**Using 2 bolts , M16, grade 10.9**

Shear for bolt = 5.5/2 = 2.8 tons

Using gusset plate thickness for bolts = 10 mm

Plate Bearing resistance Rb = 1cm \* 5.2 ton/cm2 \* 1.6cm = 8.8 tons

Shear resistance Rsh = Bolt Area \* Fsh \* shear plans = (3.14 \* 1.62 \*0.25) \* (0.2\*10.9) \* 1 = 4.4 t

Rmax = 4.4 t

Max Normal force = 4.4 \* 2 = 8.8 tons > applied Normal force …… safe

Group B :

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

Shear for bolt = 15.5/3 = 5.2 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