TESEER1

Manual design of beams :

* Length of beam(L) = 3500 mm
* Width (b) = 230 mm
* Depth (d) = 300 mm
* Cover (d|) = 25 mm
* fck = 30 mpa
* fy = 500 mpa

**CALUCLATIONS OF LOADS :**

Dead load = 25 \* 0.23 \* 0.3 = 1.725 Kn/m

Live load = 15 Kn/m

Floor load = 1.5Kn/m

Factored load (w) = 1.5(1.725+15+1.5) = 27.33Kn/m

Bending moment Mu = w\*l\*l/8 = 41. 86 KN/m

Mulimit = 0.133 \* fck \* b \* d \* d = 82.62 KN/m

Since mu < mu limit it is singly reinforced.

From Is 456 : Clause 38.1

Mu = 0.87 \* fy \* Ast \* d \*(1-Ast\*fy/b d fck)

From above eq area of steel obtained as : 265.56 sq.m

For the same beam area of steel from STAAD pro is : 229.69 sq.m

So both the design results are almost similar we can say that our input to software is accurate and there are no bugs in the programme.

Length of the column (L) = 3m

Width of the column (b) = 0.4m

Depth of the column (D) = 0.4m

Factored load (Pu) = 694.68KN

Factored bending moments:

Mux = 21.78KN.m and Muy = 4.16KN.m

FCK = 30Mpa

Fy = 500Mpa

Effective length of the column (Le) = 0.85L = 0.85X3000 = 2550mm

Calculation of slenderness ratio:

Le/b = 2550/400 = 6.375<12

Le/D = 2550/400 = 6.375<12

Hence the column is short

Calculation of minimum eccentricity:

ex min = L/500 + b/30 = 2550/500 + 400/30 = 18.44mm

ey min = L/500 + D/30 = 2550/500 + 400/30 = 18.44mm

Calculation of applied eccentricity:

ex =Mux/Pu = 21.78X106/694.68X103 = 31.231mm

ey = Muy/Pu = 4.16X106/694.68X103 = 5.98mm

Since ey is less than ey min, Muy becomes

Muy = ey min X Pu = 24.816 X 2070.68 X 103 = 51.385KN.m

Net bending moment Mu = 1.15√Mux2 + Muy2 = 1.15√(21.78)2 + (4.16)2 = 25.641KN.

Let us assume Effective cover d’ = 60mm

Then d’/D = 60/525 = 0.114 mm

Now Pu/FCKbD =694.68 X 103/30 X 400 X 400 = 0.144

Mu/ FCKbD2 = 25.641 X 106/30 X 400 X 4002 = 0.013

Ref SP 16; chart number 48;

p/FCK = 0.045

∴ percentage of steel required (preq) = 0.045 X FCK

= 0.045 X 25 = 0.57%

Ast (req) = (preq/100) X b X D = (0.57/100) X 400 X 400

= 2214.84mm2

We know that

Ast (req) = number of bars X (π/4) X (diameter of bar)2

Let us assume diameter of bar (ϕ ) = 12 mm

Ast (req) = n X (π/4) X (ϕ)2

2214.84 = n X (π/4) X (12)2

n = 19.583 ~ 20

∴ Number of bars required =20

Design results from STAAD Pro

Ast (req) = 2229mm2

Percentage of steel required = 1.14%

Diameter of bars = 12mm

Number of bars (n) required = 20

* In the same way the other Columns are also designed.