**ALGORITHEMS**

**SINGLE REINFORCEMENT**

*Area of Steel*

**b d Mu fc fy**

****

**Check Max(take minimum of max)**

**Check Ast min**

Area of Steel

**xu** known

**Balance steel limit Max**

**Number of Bars**

Check

**xu As** unknown

*Area of Steel* Method 2

**b d Mu fc fy**

****

**Check Max(take minimum of max)**

**Check Ast min**

Area of Steel

**Balance steel limit Max**

**Number of Bars**

Check

**check**

d min from equilibrium

***percentage of Steel limit***

**b d Mu fc fy**

***Xu / d Limit***

**b d Mu fc fy**

***X / d Ratio beam***

**b d Mu**

***X / d Ratio beam***

**b d Ast fc fy**

**ALGORITHEMS**

**DOUBLE REINFORCEMENT**

**b d Mu fc fy**

**** *Area of Steel*

d=d-cc-Dia/2

Mu limit

Balance Steel

d’=cc+D/2

**Min Ast min Compression**

**Min Ast min Tensile**

**Balance steel limit Max**

Ast maxTension

Ast max compression

**(take minimum of max)**

**As** = Max of Min and min of max Ast

**Number of Bars As1+**

***Min area of steel Tension***

**b d fy**

***Min area of steel Compression***

**b d**

****

***Max area of steel Tension***

**b d**

***Max area of steel Compression***

**b d**

***Balance area of steel***

**b d Mu fc fy**

***Resisting Moment of Single Reinforcement Beam Mu Tensile Concrete***

**b d As fc fy Xu**

***Resisting Moment of Single Reinforcement Beam Mu Compression Concrete***

**b d fc Xu**

***Resisting Moment of Doule Reinforcement Beam Mu Compression Concrete***

**b d fc fy xu**

***fsc Compression steel***

**Es d d’ fc Xumax**

***Min Shear reinforcement***

**b d fy**

**Asv**= area of stirrups legs

***Shear Strength of Concrete Tc***

**b d fy fc As**

**Βut not lessthan 1**

**Asv**= area of stirrups legs

***Shear Strength of Concrete Tcmax***

**f**c

**Asv**= area of stirrups legs

**Minimum *Skin Reinforcement Area/Spacing***

**b d**

**d >= 750**

**Steel Must be at tensile part below the neutral axis ?**

***Shear Reinforcement***

**b d As fc fy**

****

Table 19 20

**Number of Bars**

**d = D-cc- d/2**

**Check Tcmax llimits**

**Asv**= 2 \* pi \* 10 \* 10 / 4 = 157

**Asv**= area of stirrups legs

**N no of legs**

**Sv Spacing**

**Ø Diameter**

**T BEAM**

**Neutral axis is within the flange xu ≤ Df**

**Area of Steel**

**bw d Mu fc fy**

****

**Check Max(take minimum of max)**

**Check Ast min**

Area of Steel

**xu** known

**Balance steel limit Max**

**Number of Bars**

Check

**xu As** unknown

*Area of Steel* Method 2

**bw d Mu fc fy**

****

**Check Max(take minimum of max)**

**Check Ast min**

Area of Steel

**Balance steel limit Max**

**Number of Bars**

Check

**check**

d min from equilibrium

x/d from function where b is bw

**T BEAM**

**Neutral axis is within the flange xu > Df &Df/ d ≤ 0.2**

**Area of Steel**

**bw d tf bf Mu fc fy**

****

**Check Max(take minimum of max)**

**Number of Bars**

**xu As** unknown

**xu** known

Check

CLARIFY THIS OR THIS AS IS BW

Ask

Lhs is rt

Clause 26.5.1.1

Area of Steel

**Check Ast min**

**Balance steel limit Max**

**T BEAM**

**Neutral axis is within the flange xu > Df &Df/ d > 0.2**

**Area of Steel**

**bw d tf bf Mu fc fy**

****

**Check Max(take minimum of max)**

**Number of Bars**

**xu As** unknown

**Df = Yf**

**Yf = (0.15 xu + 0.65 Df)**

**xu** known

Check

Area of Steel

**Check Ast min**

**Balance steel limit Max**

***Limiting Moment of Beam Single***

**b d As fy xumax fc**

***Limiting Moment of T-Beam***

**xu > Df &Df/ d ≤ 0.2**

**bf Df  bw d As fy xumax fc**

***Limiting Moment of T-Beam***

**xu < Df**

**bf Df  bw d As fy xumax fc**

***Limiting Moment of T-Beam***

**xu > Df &Df/ d > 0.2**

**bf Df  bw d As fy xumax fc**

**Yf = (0.15 xu + 0.65 Df)**

**T-BEAM DOUBLE REINFORCEMENT**

**b d Mu fc fy**

**** *Area of Steel*

**Only Moments Calculation changes**

**Remaining calculation same**

**As per case 1 or 2 or 3**

**Mlimits <= Mugiven**

or

d=d-cc-Dia/2

Mu limit

Balance Steel

d’=cc+D/2

**Min Ast min Compression**

**Min Ast min Tensile**

**Balance steel limit Max**

Ast maxTension

Ast max compression

**(take minimum of max)**

**As** = Max of Min and min of max Ast

**Number of Bars As1+**

**Short term Deflection**

fcd b fc z

****

**Yt = d/2**

**Δ**

**M ≤**

**M**

Δ (deflection)

***Long Term Deflection***

***Shrinkage Deflection***

D L Pt Pc esh

Δsh = K3 Ψ

***Creep Deflection***

D L Pt Pc esh

Δi+cp =

Ece  =

Δcp = Δi+cp – Δi=D

**Deflection Limits**

**E DL LL b d fc fy**

**E LL b d fc fy**

or **≤ 20**

***X / d Ratio T- beam***

**bf bw Df Mu**

***.***

***Tensile force beam***

**Ast fy**

**T = 0.87 fy As**

**Steel yield or write in terms of some factor ?**

***Compression force beam***

**b d x fc**

**C = 0.36 fc b x**

***Tensile force T-beam***

**Ast fy**

**T = 0.87 fy As**

**Steel yield or write in terms of some factor ?**

***Compression force T- beam***

**Df bf bw d x fc**

**C = 0.36 fc bw x + 0.45 fc (bf - bw) Df**

Torsion

**EQUILENT TORSION AND SHEAR**

**Me = Mu + Tu(1 + D/b)/1.7**

**Ve = Vu + 1.6 Tu/b**