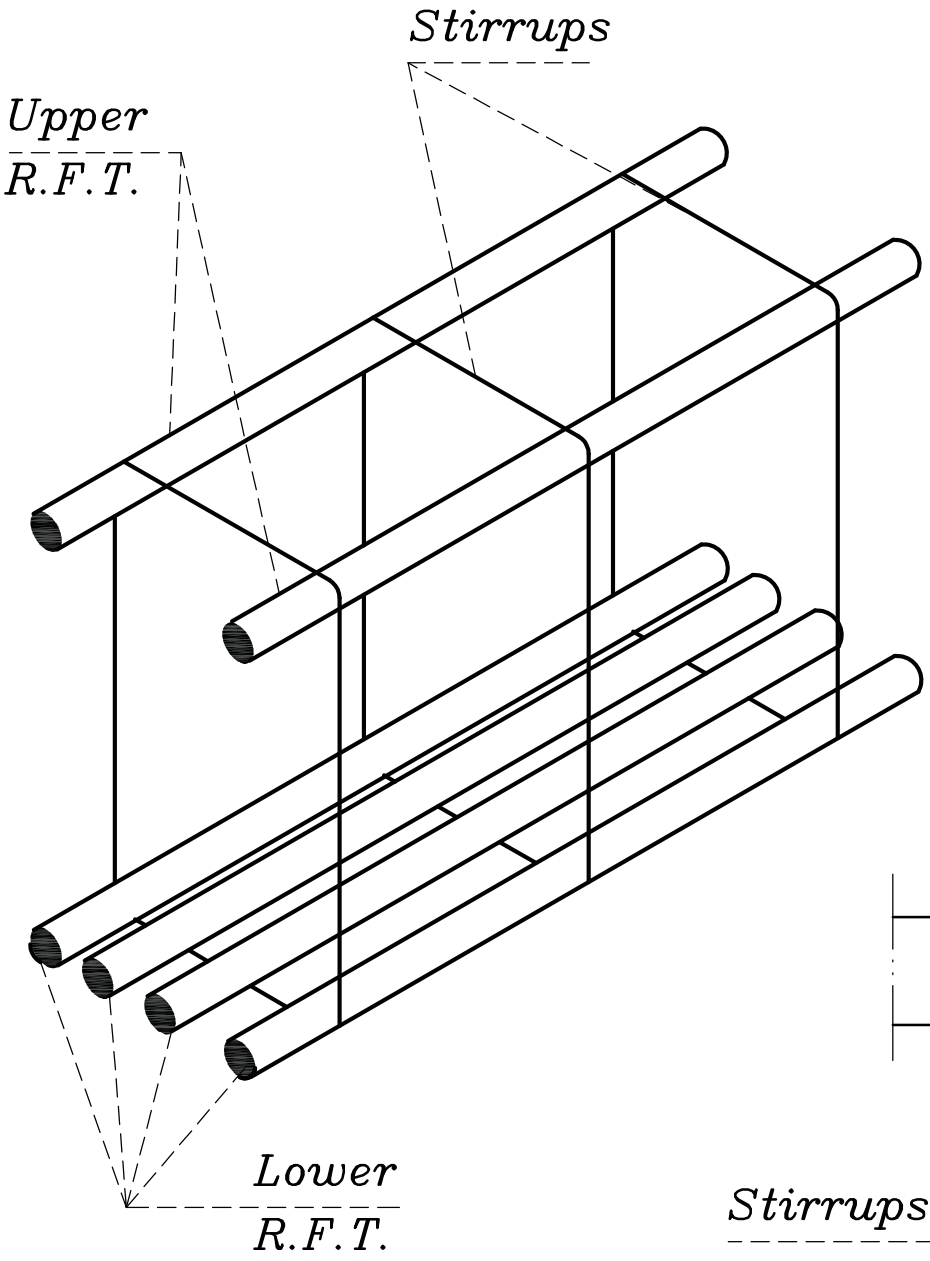
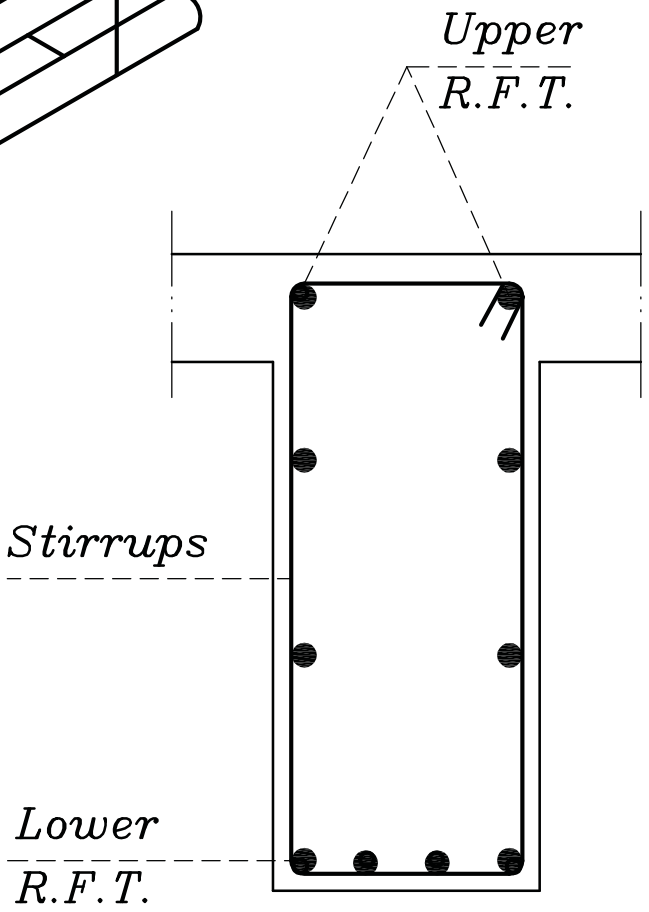
Detail of Reinforcement of Beams

Detail of RFT. of Beams (in Cross-section)





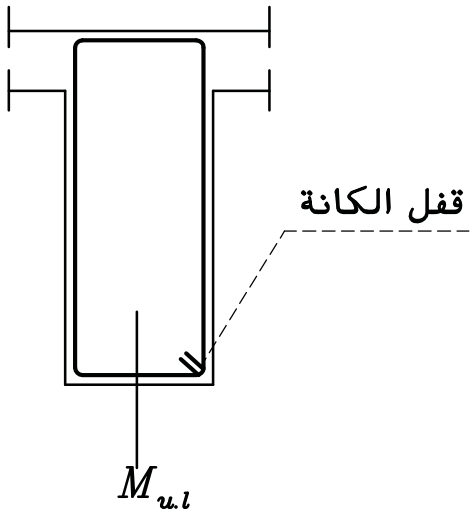
Stirrups (الكانات)

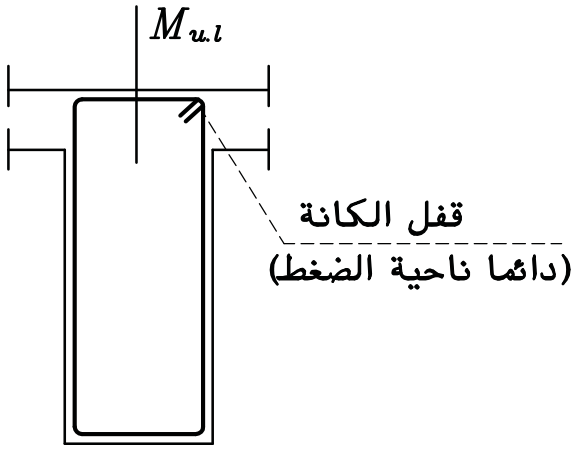
وظيفة الكانات فى الكمرة

- مقاومة اجهادات القص (Shear Stress)
- لربط الحديد العلوى

$min\ Stirrup = 5ø8/m$

اى خمسة كانات كل متر طولى من الكمرة



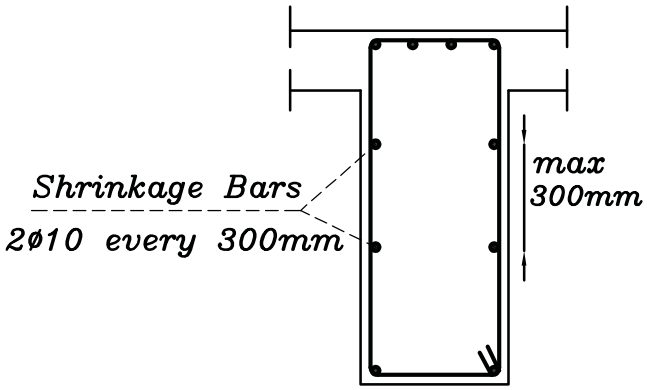


Shrinkage Bars

هى اسياخ توضع فى جانب الكمرة لمقاومة الانكماش

توضع Shrinkage Bars فقط عندما تكون $t > 700mm$

$A_{s\ Shrinkage}$ — $8\ \%\ A_{s\,main}$ / $2ø10\ every\ 300mm$

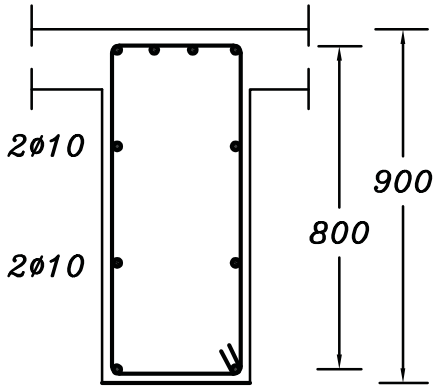


Example

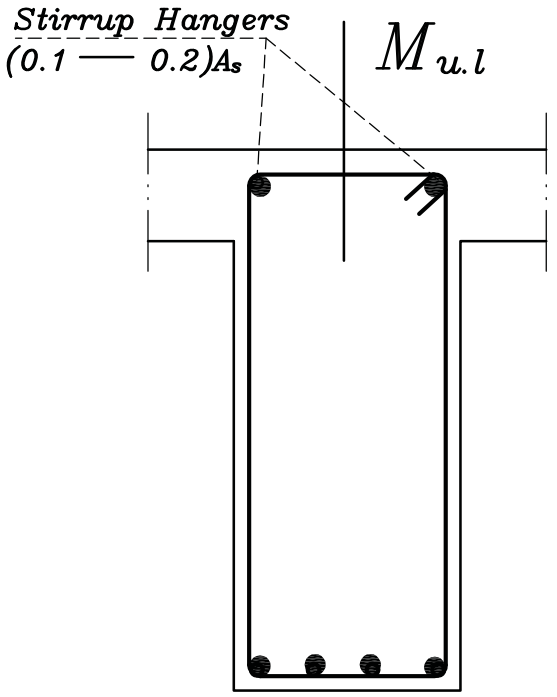
$t=900mm$

$spaces=\frac{900-100}{300}=2.67=3.0spaces$

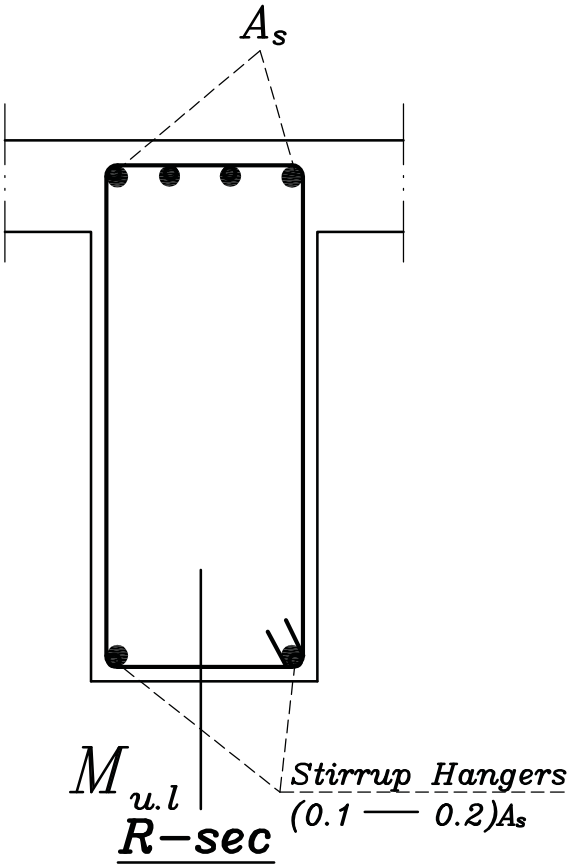
use 2 bars each side



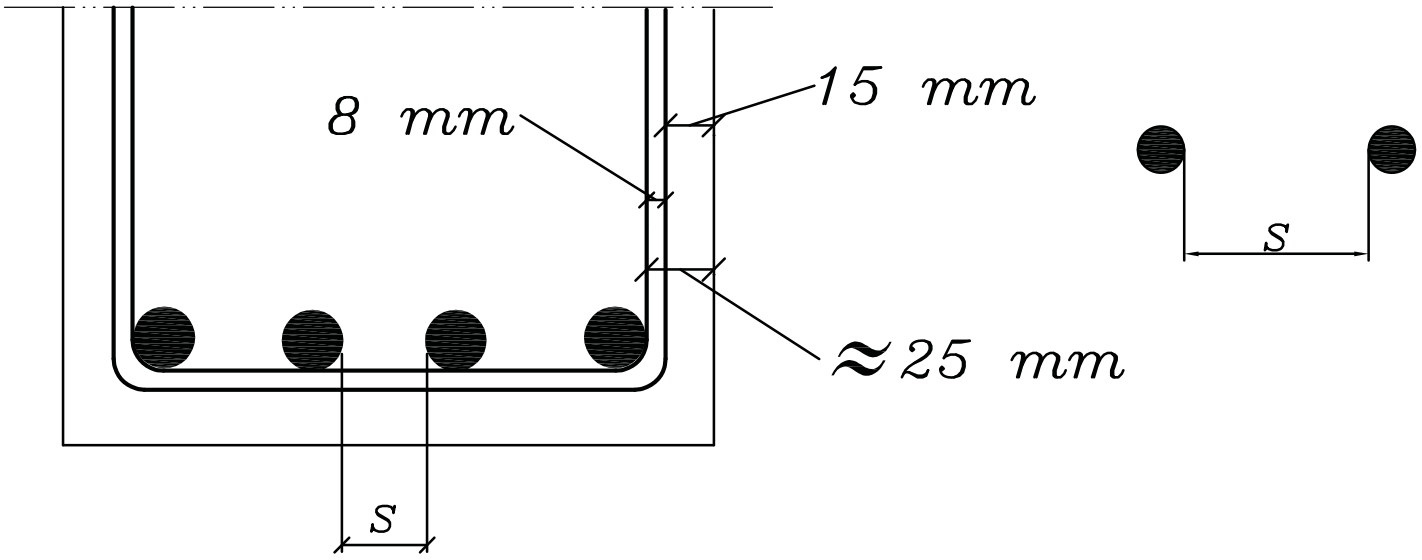
Stirrup Hangers
(حديد تعليق الكانات)



T–sec



R–sec



$$S = \begin{cases} 25mm \\ \text{ø } Max \\ 1.5*Max\ nominal\ size\ of\ aggregate \end{cases} \quad \text{الاكبر} \quad S \approx 25\ mm$$

اذن لا يجب ان تقترب الاسياخ أكثر من مسافة S

و بالتالى يوجد عدد اقصى لا يمكن الزيادة عنه (n)

$$b-50mm=n\phi+(n-1)S$$

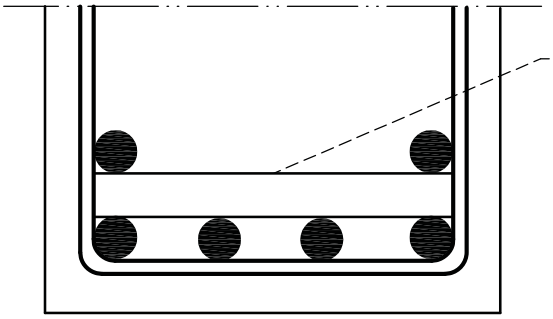
$$\therefore b-50=n\phi+(n-1)*25$$

$$\therefore b-50=n(\phi+25)-25$$

$$\boxed{n=\frac{b-25}{\phi+25}}$$

اذا زاد العدد عن(n) يتم استخدام صف اخر من الاسياخ

ولن بشرط يون فكل صمالا يل عن سيخين

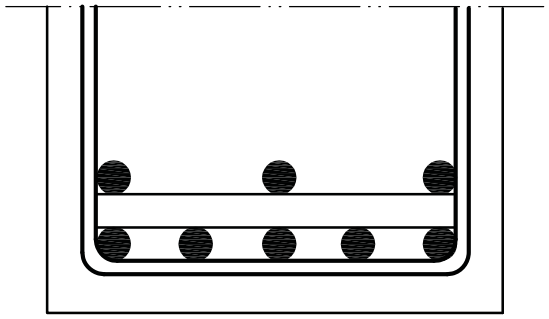


سيخ للفصل بين الصفوف يستخدم من
فضل حديد التسليح فى الموقع

Example

We need to use A_s=8ø16
For section of b=250mm

$$n=\frac{b-25}{\phi+25}=\frac{250-25}{16+25}=5.48\approx 5\ bars$$

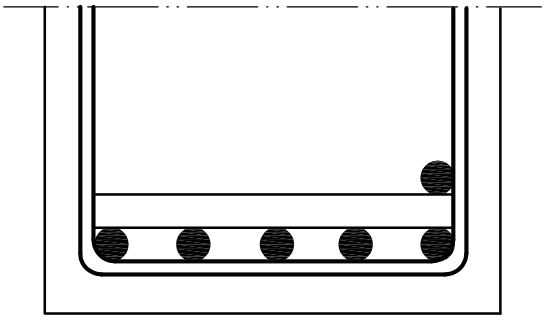


Example

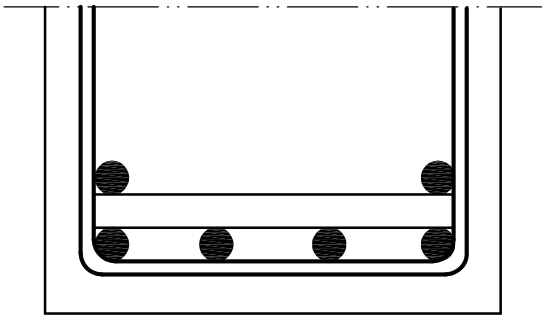
$A_s = 6\phi16$, $b = 250mm$

$$n = \frac{b-25}{\phi+25} = \frac{250-25}{16+25} = 5.48 \approx 5 \text{ bars}$$

لا يقل عدد الاسياخ فى الصف عن ٢



(✗)



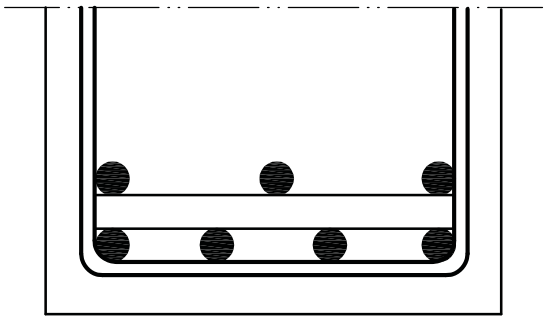
(✓)

Example

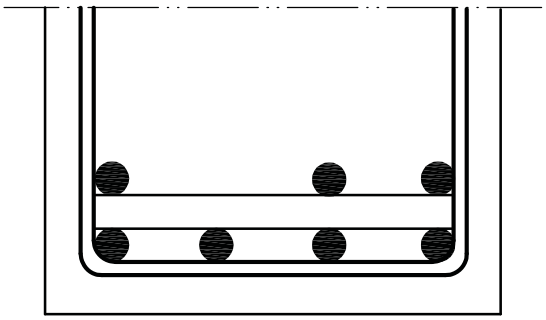
$A_s = 7\phi22$, $b = 250mm$

$$n = \frac{b-25}{\phi+25} = \frac{250-25}{22+25} = 4.79 \approx 4 \text{ bars}$$

يجب ان توضع الاسياخ فوق بعضها حتى لا يحدث تعشيش



(✗)



(✓)

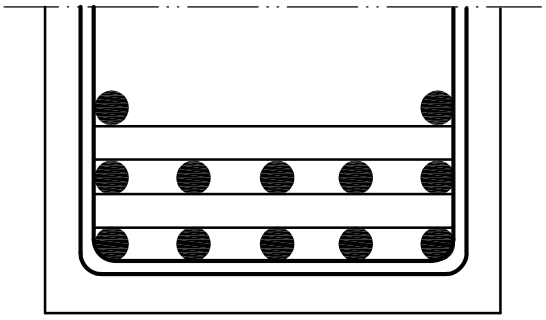
Example

$A_s = 12\text{ø}16$, $b = 250mm$

$$n = \frac{b-25}{\text{ø}+25} = \frac{250-25}{16+25} = 5.48$$

$$\approx 5 \ bars$$

يمكن زيادة عدد الصفوف عن ٢



Question 3-a

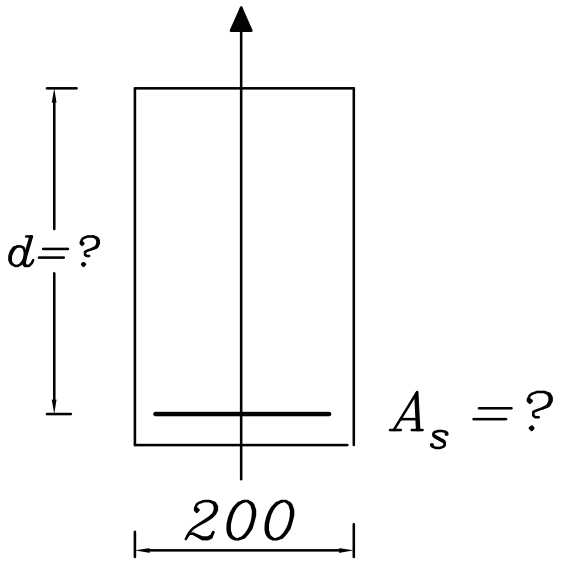
Given

$f_{cu} = 20\ N/mm^2$

$f_y = 360\ N/mm^2$

$b = 200\ mm$

$M_{u.l.} = 350\ kN.m$



Required Design of section (Get d, A_s)

Solution

$$\rho_{min.} = \frac{1.1}{f_y} = \frac{1.1}{360} = 0.0031 = 0.31\ \%$$

$$\rho_{max.} = 5.00*10^{-4} f_{cu} = 5.00*10^{-4}*20 = 0.01 = 1.0\%$$

Assume $\rho = 0.8\%$

- Get $R_u = \rho (f_y/\gamma_s) \left[1 - \rho \frac{(f_y/\gamma_s)}{\frac{4}{3}(f_{cu}/\gamma_c)}\right]$

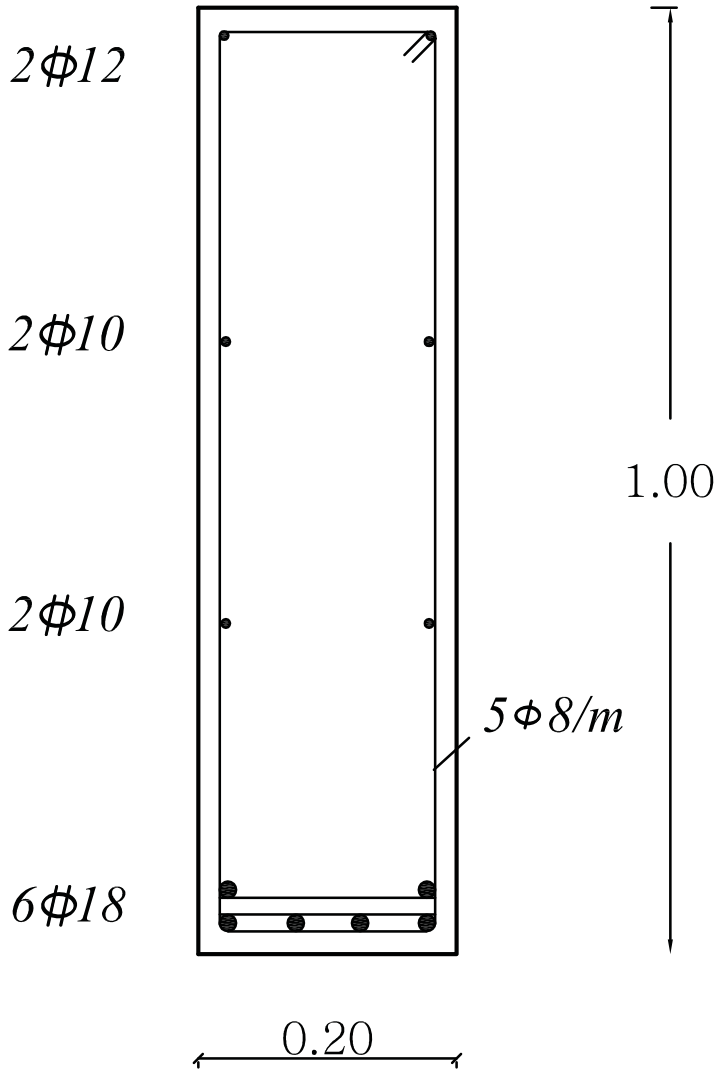
$$R_u = 0.008\left(\frac{360}{1.15}\right)\left[1 - 0.008*\frac{(360/1.15)}{\frac{4}{3}(20/1.5)}\right] = 2.15$$

- Get $d = \sqrt{\frac{M_{u.l.}}{R_u b}} = \sqrt{\frac{350*10^6}{2.15*200}} = 902mm$

Take $d = 950mm$, $t = 1000mm$

- Get $A_s = \rho\ bd = 0.008*200*902 = 1443mm^2$

6Ø18

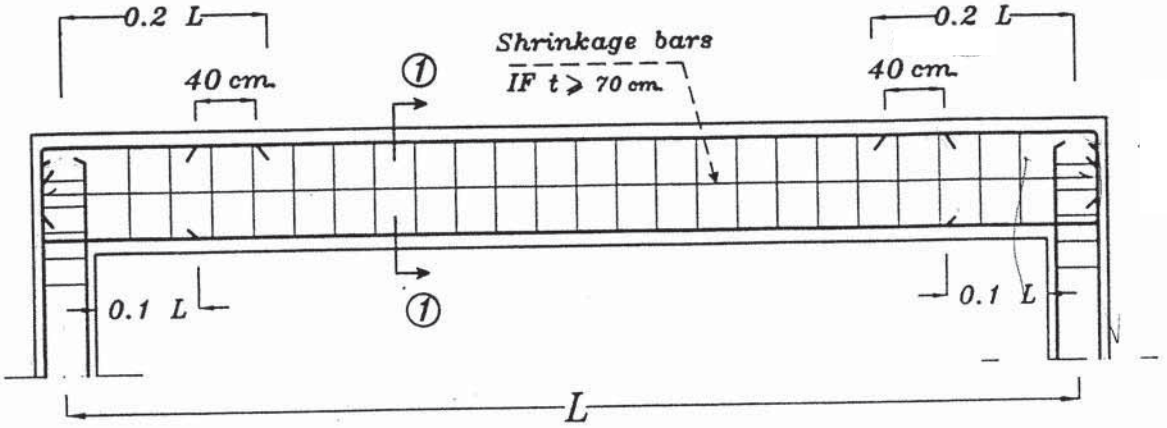


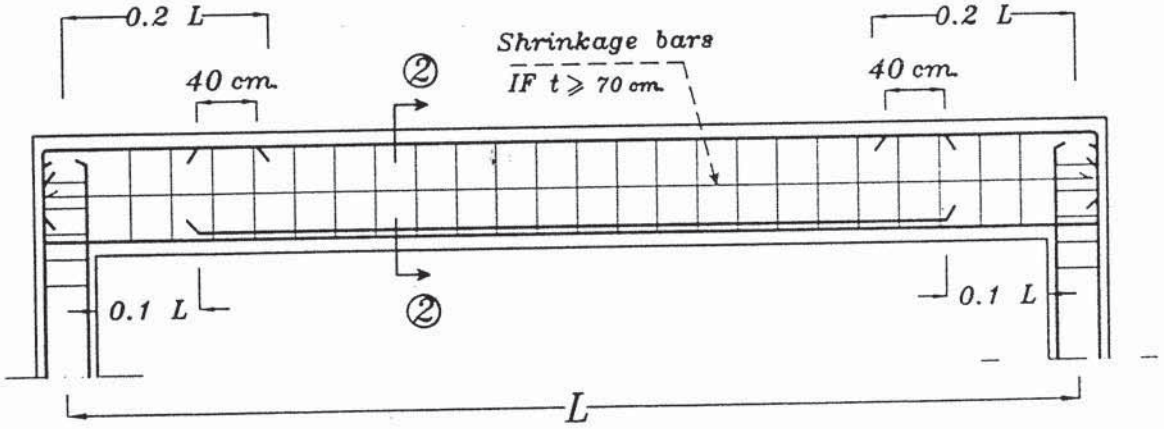
Detail of Cross-section

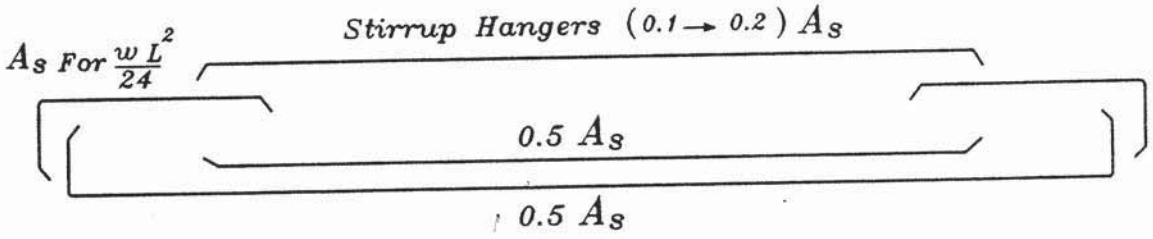
RFT. of Beams using Imperical Beam

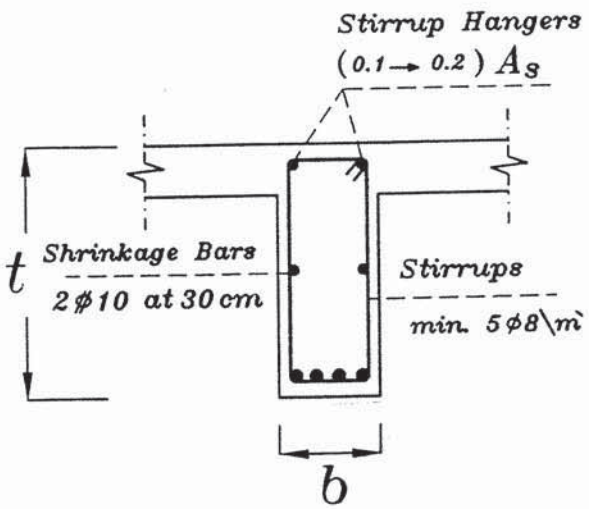
Simple Beam.
Straight Bars.

Scale
1:50
1:25



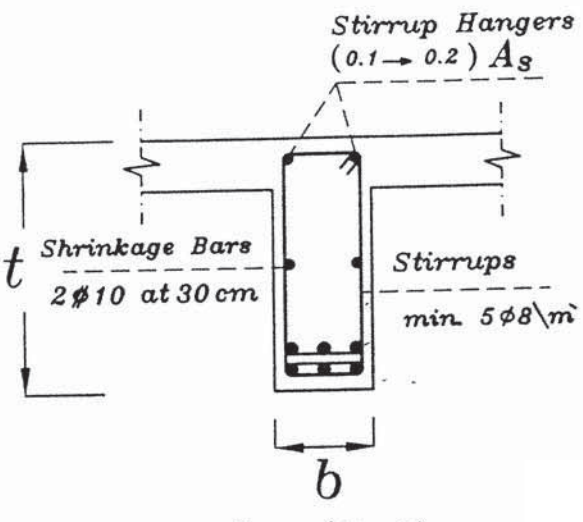






Sec. (1–1)

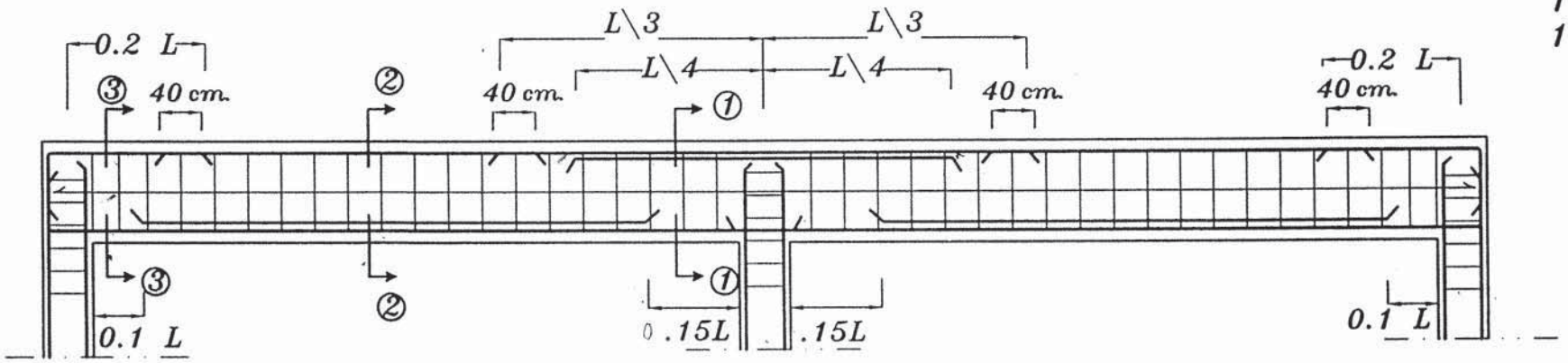
Scale
1:25
1:10

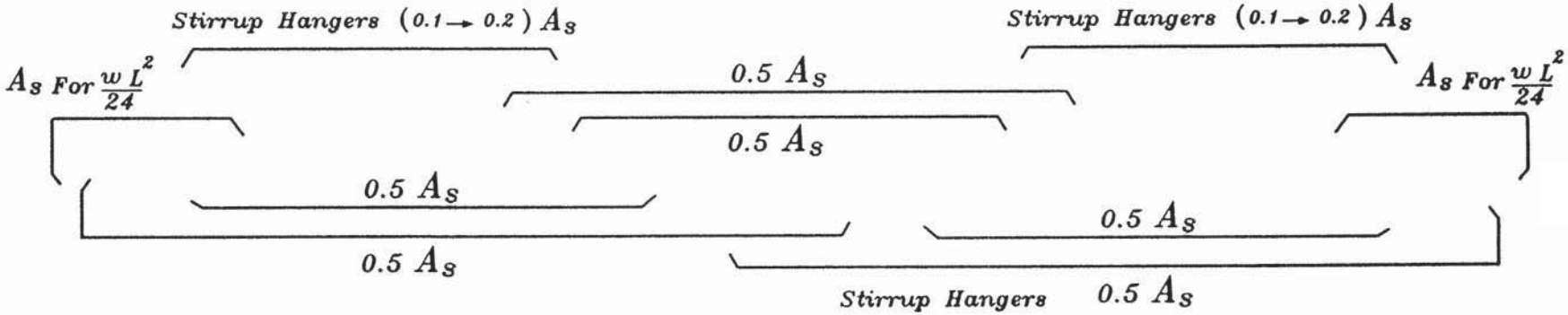


Sec. (2–2)

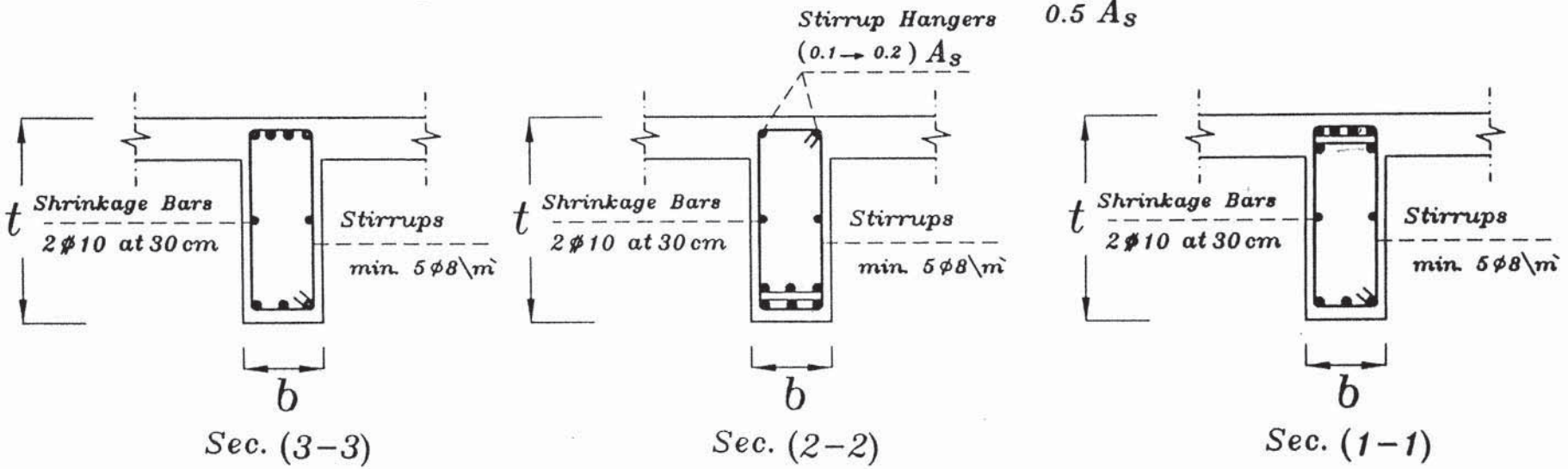
Continuos Beam (2 Spans)
Straight Bars.

Scale
1:50
1:25



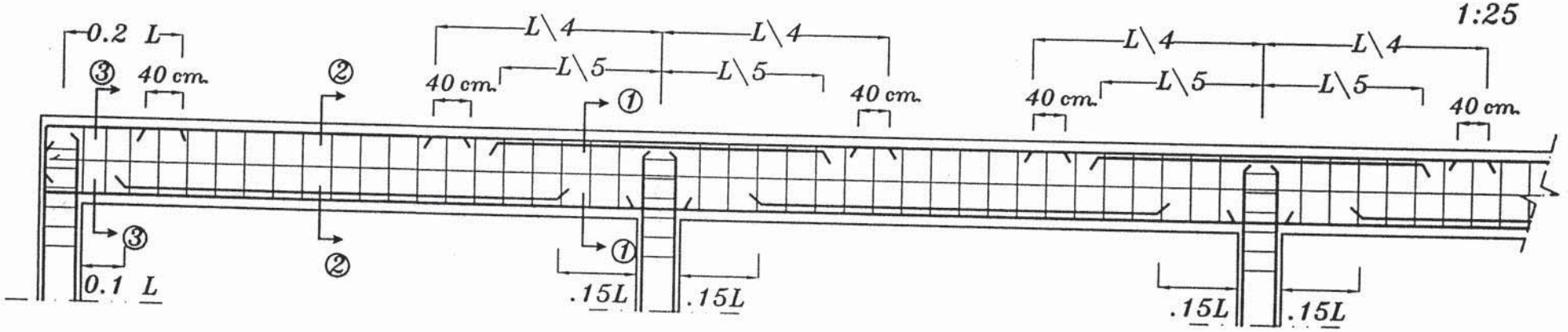


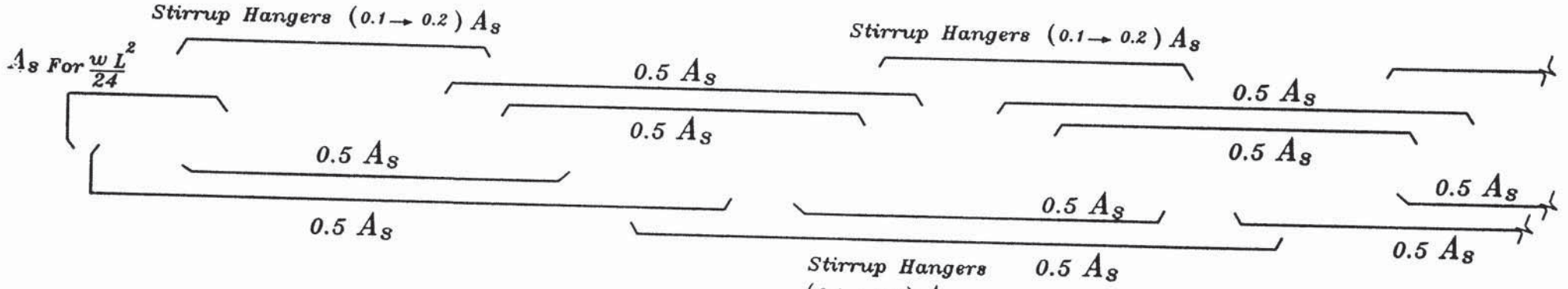
Scale
1:25
1:10



Continuos Beam (More than 2 Spans)
Straight Bars.

Scale
1:50
1:25





Scale
1:25
1:10