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Subject PRC'D

Semester 6th

Section B

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Assignment no: 02

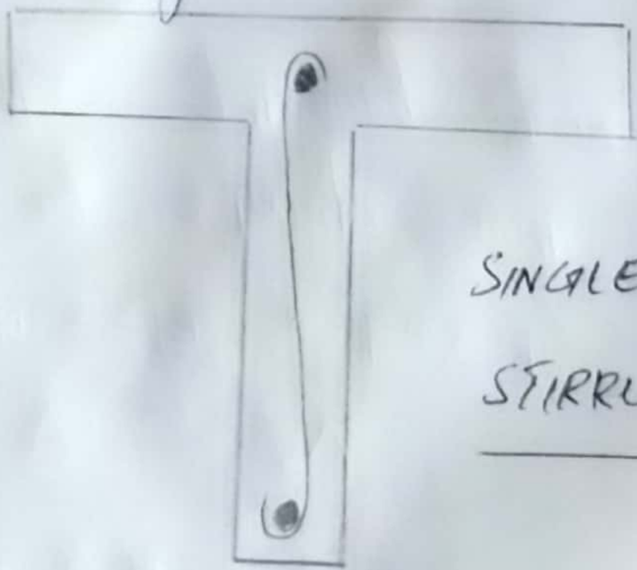
Q1 ANSWERS:

Following are the types of stirrups

- Single legged stirrups
- Two legged or Double legged stirrups
- Four legged stirrups.
- Six legged stirrups.

1) SINGLE LEGGED STIRRUPS:

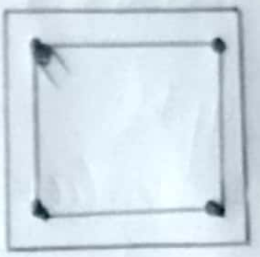
These type of stirrups are used to hold the longitudinal bars in position and prevent bucking.



SINGLE LEGGED STIRRUP.

DOUBLE LEGGED STIRRUP:

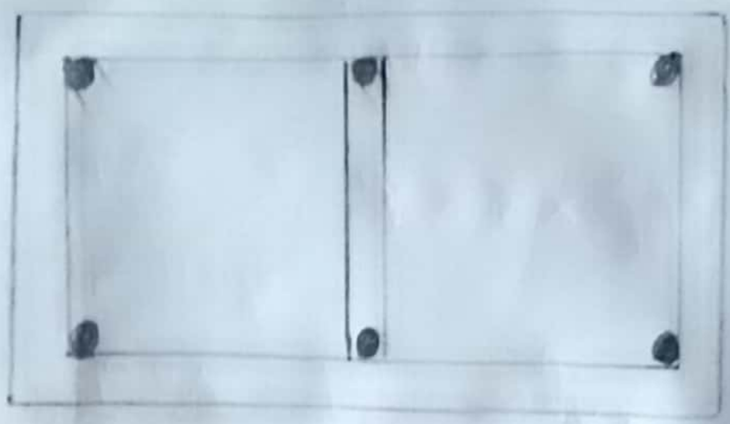
We use a single stirrup to tide a beam or a column at a time, we say it is two legged stirrup. Double legged stirrup are adequate for typical beams with relatively short width.



Two - legged stirrups.

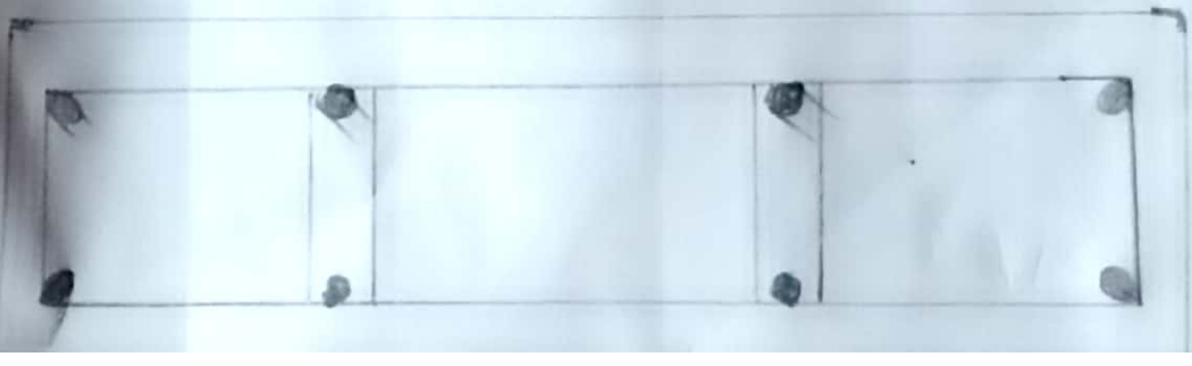
FOUR LEGGED STIRRUPS:

We use double stirrups to tie a beam or column at a time we say it is four legged stirrups. For beam having longer width multiple legged or four legged stirrups are required.



SIX LEGGED STIRRUP:

These six legged stirrups are generally used for a continuous beam structure, it consists of regular upholding of structure at each junction while joints at the joining of beam and column



(2) Compute shear strength capacity of concrete, $V_c = 2 \times \sqrt{f_c} \times b_w \times d$

(3) Compute Minimum Web Reinforcement.

If $V_u \leq \phi \times V_c$ so no web reinforcement needed. If it is not applicable then min area of web reinforcement equal to:

i) $A_{v_{min}} = 0.75 \times \sqrt{f_c'} \times \dfrac{b_w \times s}{f_y}$ OR $A_{v_{min}} = \dfrac{50 \times b_w s}{f_y}$

→ Max spacings can be found by these formulas.

$$S_{max} = \frac{A_v \times f_y}{0.75 \times \sqrt{f_c} \times b_w} \text{ OR } S_{max} = \frac{A_v \times f_y}{50 \times b_w}$$

(4) If $V_u \leq \dfrac{\phi V_c}{2}$, if is true no stirrups are required.

(5) First stirrup is provided at a distance $S/2$

6 Between "V_u" and "ϕV_c" spacing b/w web reinforcement is found by formula

$$S = \frac{\phi \times A_v \times f_y \times d}{V_u - \phi V_c}$$

If $V_s \leq 4 \times \sqrt{f'_c} \times b_w \times d$; Then max spacing of stirrups will be smallest of the following four conditions.

1- $24''$ 2- $\frac{d}{2}$ 3- $S_{max} = \frac{A_v \times f_y}{0.75 \times \sqrt{f'_c} \times b_w}$

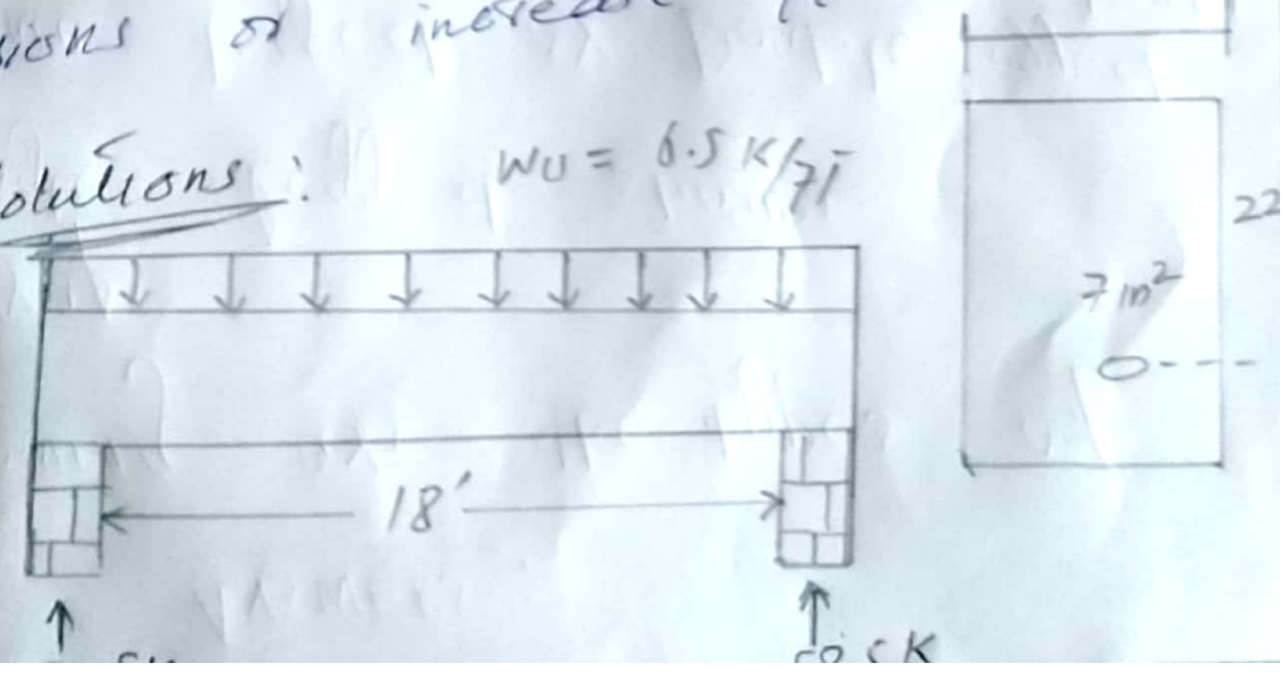
4- $S_{max} = \frac{A_v \times f_y}{50 \times b_w}$

If $V_s > 4 \times \sqrt{f'_c} \times b_w \times d$ → Then max spacing will be halved.

If $V_s > 8 \times \sqrt{f'_c} \times b_w \times d$

Then either increase cross-sectional Dimensions or increase f'_c.

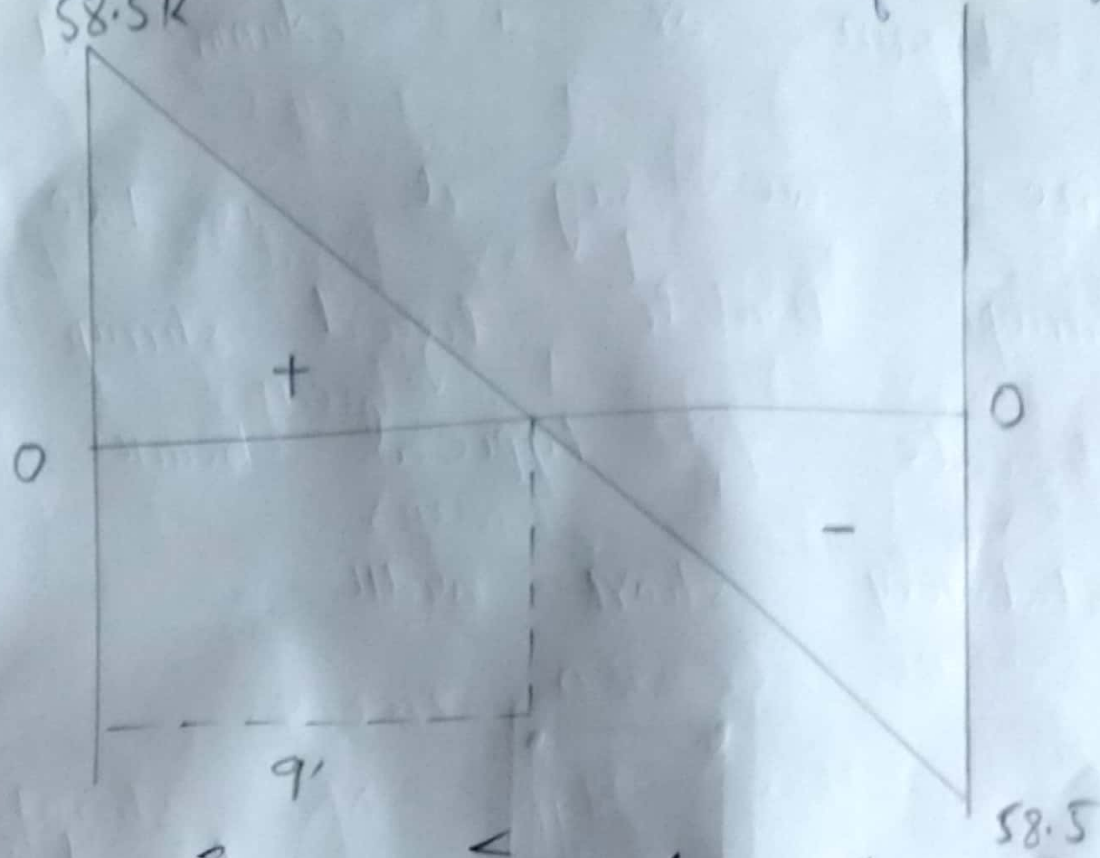
) Solutions:



Step-01: Find the Reaction on Support

Total load = $\frac{6.5 \times 18}{2}$ = 58.5K

Steps-02: Draw its shear force Diagram

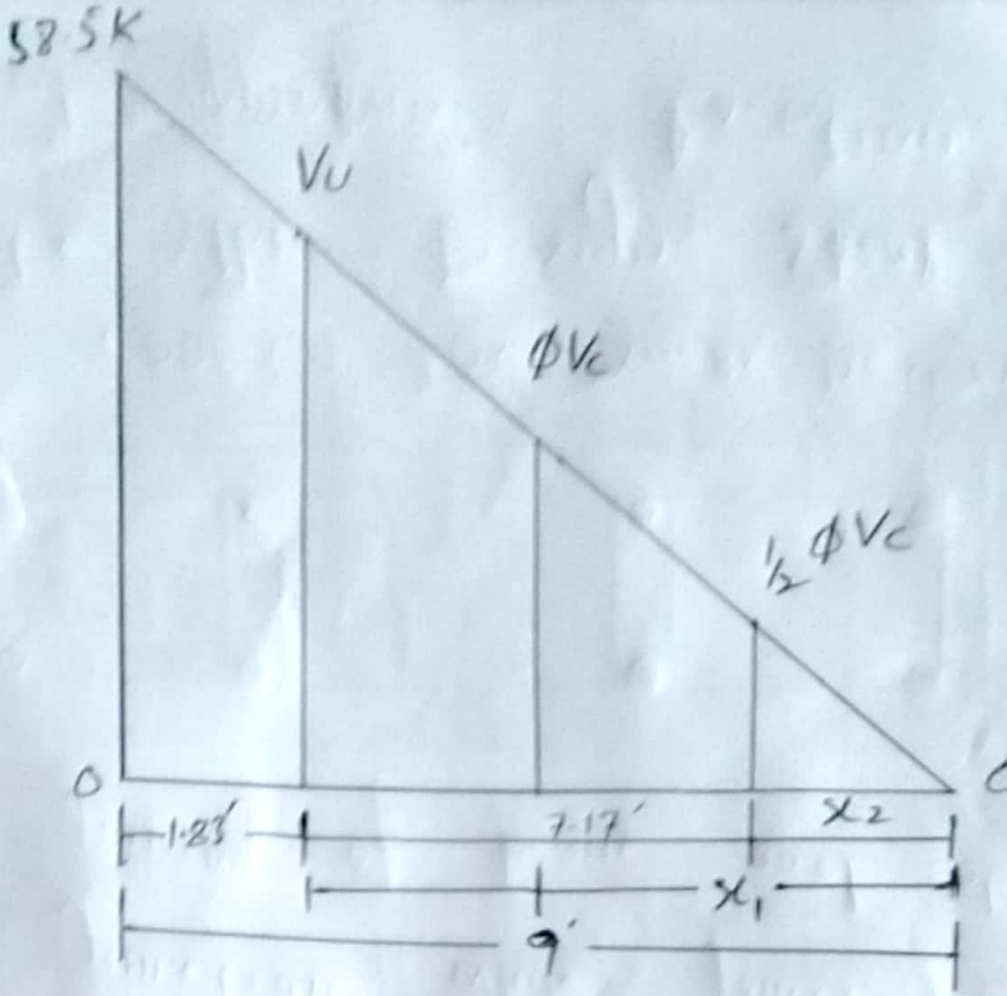


Step: 3 Finding the value of critical stress "Vu" and its locations.

As we know that critical shear is located at a distance (d) from the face of supports $d = 22'' = 1.8$

Using Similarity of Triangles.

P.T.O



$$\frac{58.5}{9} = \frac{V_u}{7.17}$$

$$V_u = \frac{58.5 \times 7.17}{9} = 46.605K.$$

Step # 4 Finding the Value of "ϕVc" and "½ ϕVc" and also its distance from zero shear to right side.

By formula,

$$\Rightarrow \phi V_c = \phi \times 2 \times \sqrt{f'_c} \times b_w \times d$$

$$= 0.75 \times 2 \times \sqrt{4000} \times 14 \times 22.$$

$$= \boxed{29.21K}$$

* Location of "ϕV_c" by similar Triangles

$$\frac{58.5}{9} = \frac{\phi V_c}{x_1} \Rightarrow \frac{58.5}{9} = \frac{29.21}{x_1}$$

$$\Rightarrow \boxed{x_1 = 4.49'}$$

Now

→ $\frac{1}{2} \phi V_c = \frac{29.21}{2} = 14.60K$

→ Location of $\frac{1}{2} \phi V_c$ will be

$$\frac{58.5}{9} = \frac{14.60}{x_2}$$

$$\boxed{x_2 = 2.24'}$$

Step 05: Finding the value of "ϕV_s"

$$\phi V_s = V_u - \phi V_c$$

$$= 46.605 - 29.21$$

$$\boxed{\phi V_s = 17.395}$$

Step 06: Check on Section adequacy

By formula.

$$= \phi \times 8 \times \sqrt{f'c} \times bw \times d$$

$$= 0.75 \times 8 \times \sqrt{4000} \times 14 \times 22$$

$= 116.87K$

As $\phi \times 8 \times \sqrt{f'_c} \times b_w \times d > \phi V_s$ Thus section is adequate.

Step 07: Check on Max spacing for stirrups

By Formulas:

$= \phi \times 4 \times \sqrt{f'_c} \times b_w \times d = 0.75 \times 4 \times \sqrt{4000} \times 14 \times 22$

$= 58.43K$

As $\phi \times 4 \times \sqrt{f'_c} \times b_w \times d > \phi V_s$

So Max spacing will be selected from The following condition.

1 - $24''$ 2 - $\frac{d}{2} = \frac{22}{2} = 11''$ 3 - $S_{max} = \frac{A_v \times f_y}{0.75 \times \sqrt{f'_c}}$

Let suppose we use #3 stirrup,

$dia = 3/8'' = 0.375''$

$Area = \frac{\pi}{4}(0.375)^2 = 0.11 \ in^2$

Scanned with CamScanner

For 2- legged stirrup Area × 2

$= 0.11 \times 2 = 0.22\ in^2$

3- $S_{max} = \dfrac{0.22 \times 60000}{50 \times b_w} = 18.25''$

4- $S_{max} = \dfrac{0.22 \times 60000}{50 \times b_w} = 18.25''$

(5) $S_{max} = \dfrac{A_v \times f_y}{50 \times b_w} = \dfrac{0.22 \times 60000}{50 \times 14}$

$= 19.87''$

So we choose the least value from the above values $S_{max} = 11''$

Step # 08: Stirrups spacing from/at critical section.

By formula.

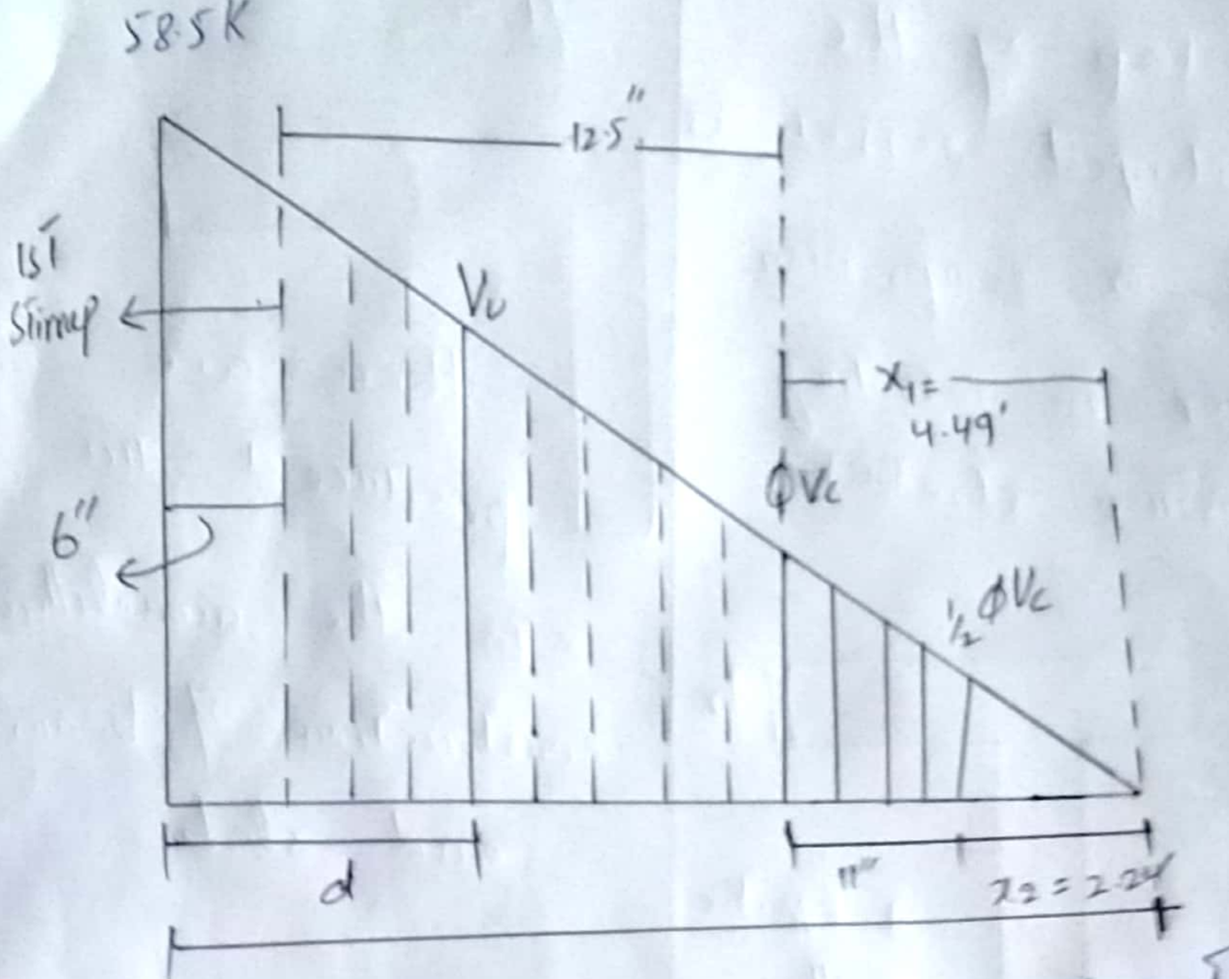
$$S = \frac{\phi \times A_v \times f_y \times d}{V_u - \phi V_c}$$

$$= \frac{0.75 \times 0.22 \times 60 \times 22}{46.605 - 29.21}$$

$S = 12.52 \approx 12.5''$

So $12.5''$ c/c

Step# 09 Final Sketch will be.



First stirrup from face of support

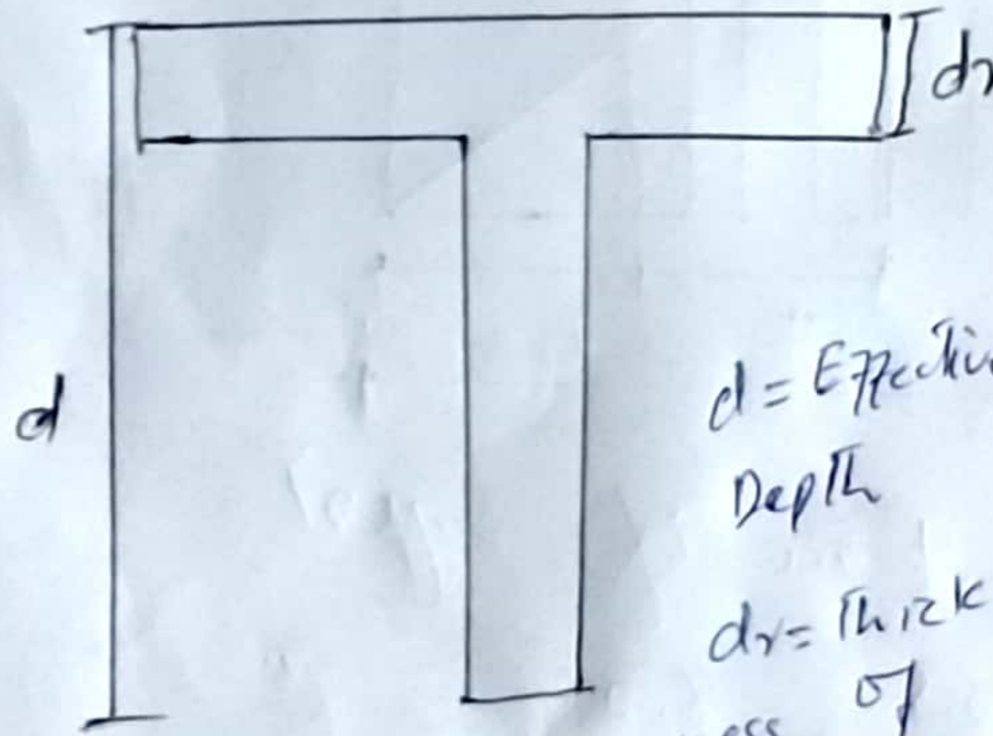
$$S/2 = \frac{12.5}{2} = 6.25 \approx 6''$$

) Definition:

T- Beam:	L- Beam
It is load bearing structure of reinforced concrete, wood or metal, with	A beam whose has the form of inverted L; usu placed so that top flange forms

a T- shaped cross-section

(i) The Top of the T- shaped serves as Flange or compression member in resisting compressive stresses.



d = Effective Depth

dr = Thickness of Flange slab