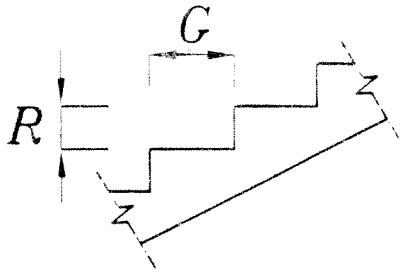
بسم الله الرحمن الرحيم

Stairs

Dimensions.

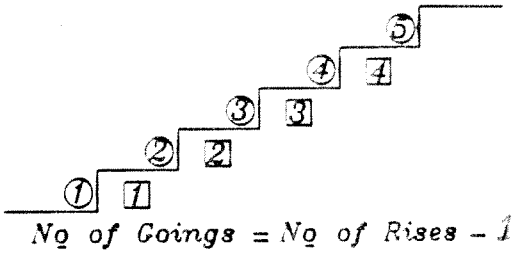


- *Rise* (قائمة) $= R = (14 \longrightarrow 18\ cm.)$
- *Going* (نائمة) $= G = (26 \longrightarrow 30\ cm.)$

$R = 15\ cm \quad , \quad G = 30\ cm$ عاده تؤخذ

- *max. No of Rises \ Flight = 14* أكبر عدد من الدرجات فى القلبة الواحده

- *No of Goings = No of Rises – 1*



- *min. width of stair = 120 cm.*

- $t_s = \frac{L_s}{20} = \frac{L_s}{24} = \frac{L_s}{28}$ } *One way slab*

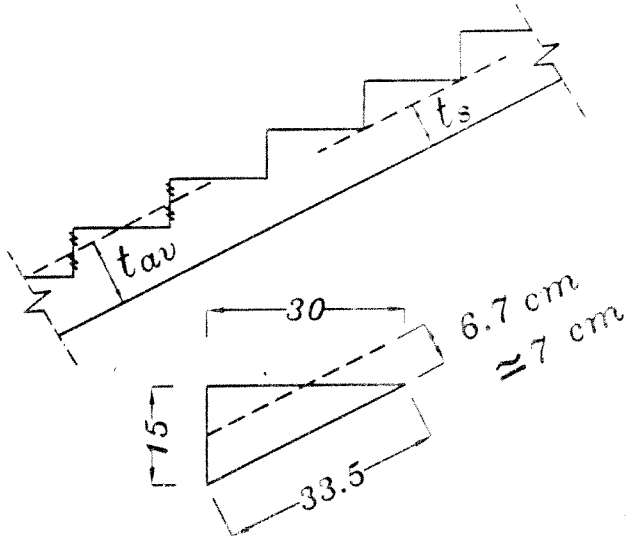
يفضل أن تكون
بلاطة القلبة
One way slab

- $t_{av} = t_s + 7\ cm.$

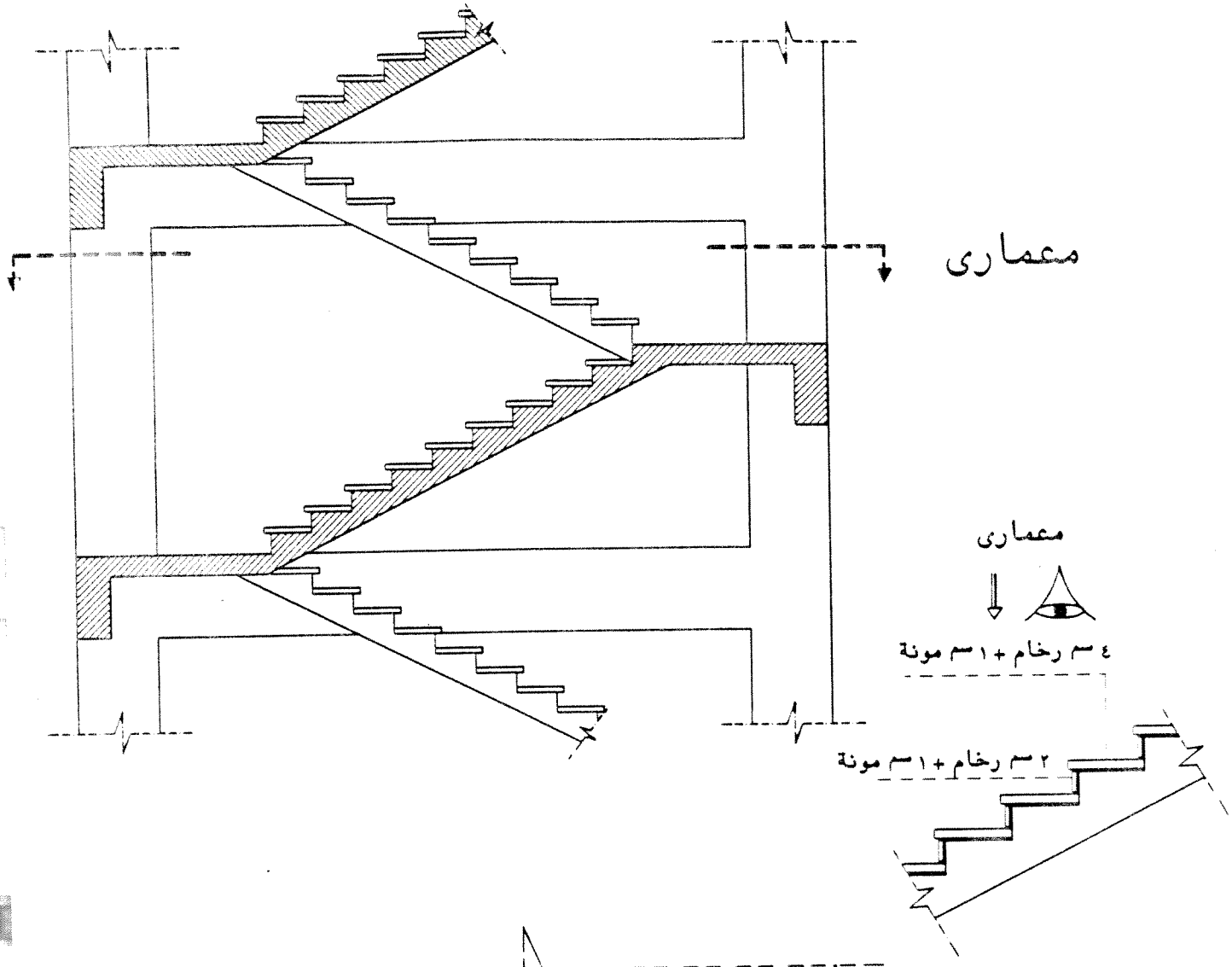
- t_s تستخدم فى التصميم.

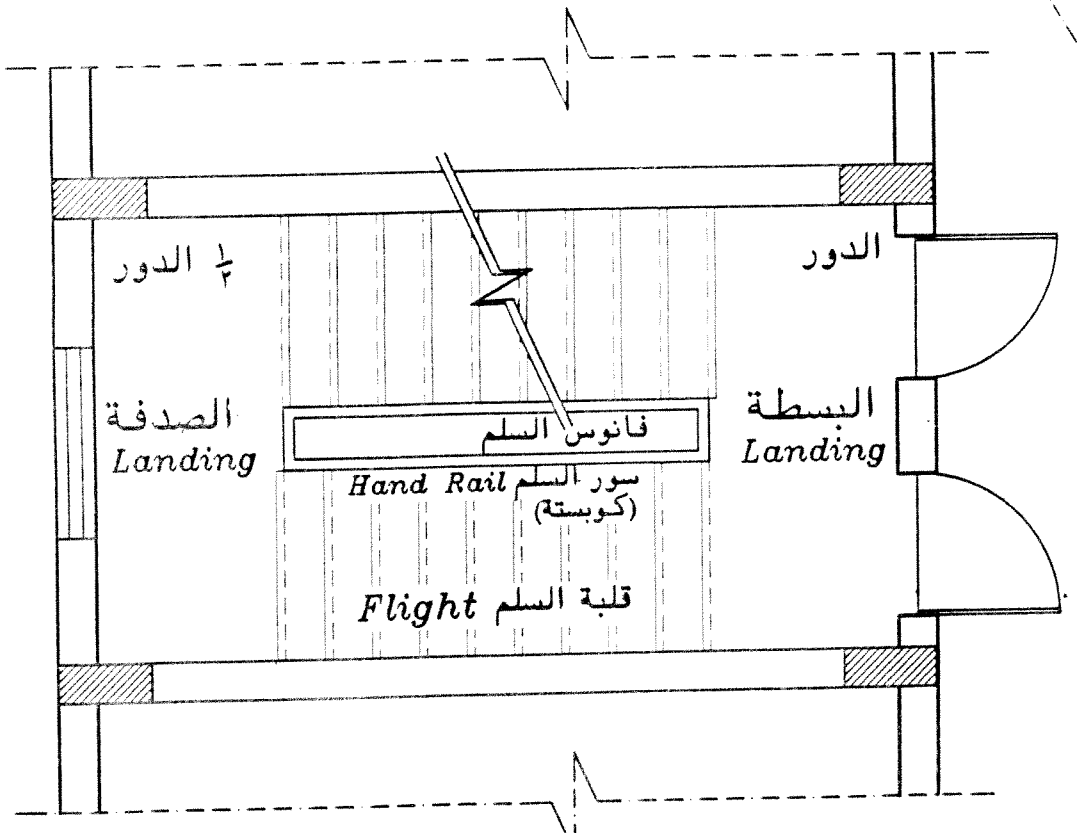
$d = t_s - 1.5\ cm.$

- t_{av} تستخدم فى حساب الأحمال فقط.

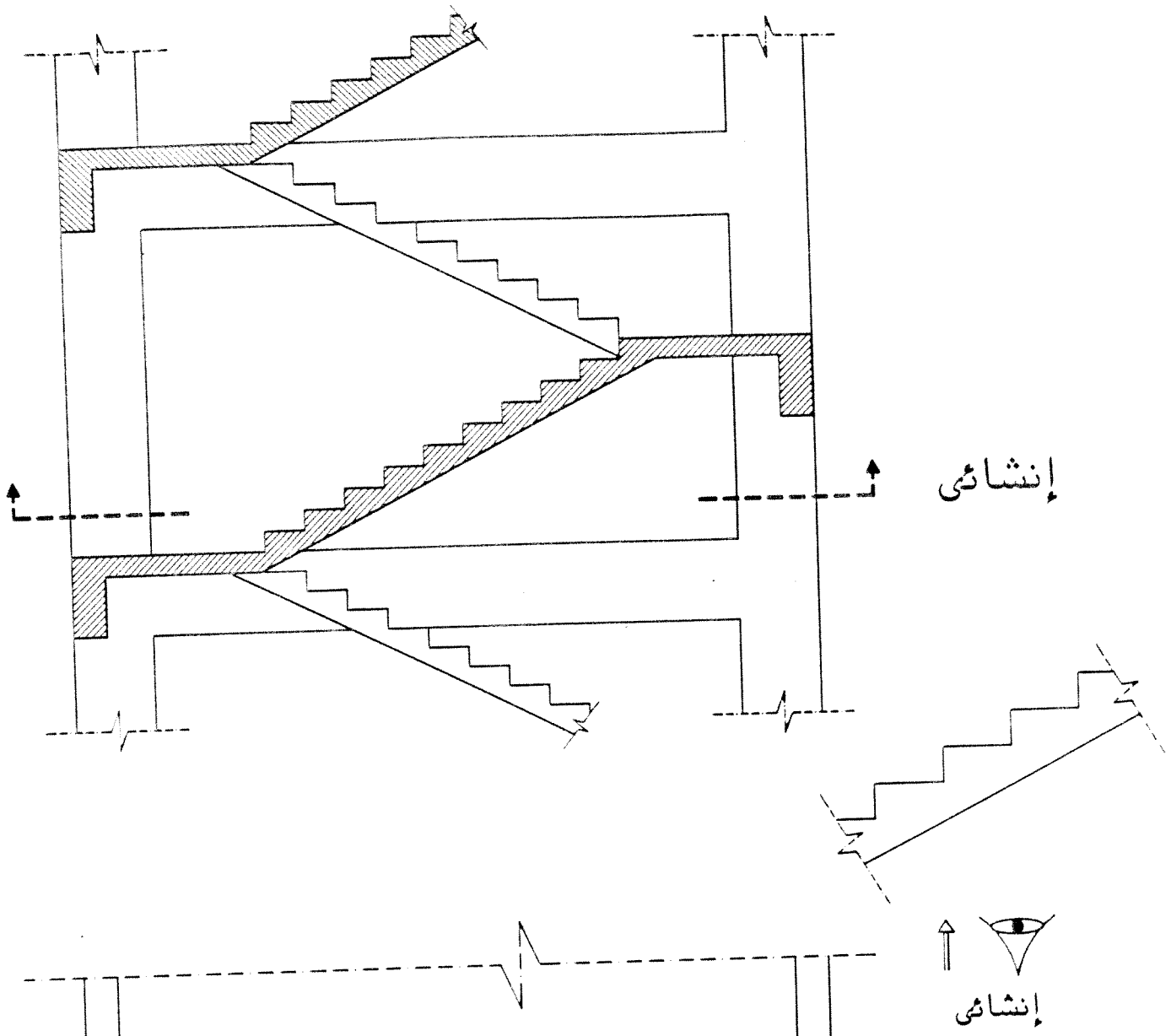


$$\frac{\frac{1}{2} * 15 * 30}{33.5} = 6.7 \simeq 7.0\ cm.$$


معمارى
معمارى
٤ سم رخام + ١ سم مونة
٢ سم رخام + ١ سم مونة


½ الدور
الدور
الصدفة
Landing
فانوس السلم
البسطة
Landing
Hand Rail سور السلم
(كوبستة)
Flight قلبة السلم

Arc. Plan

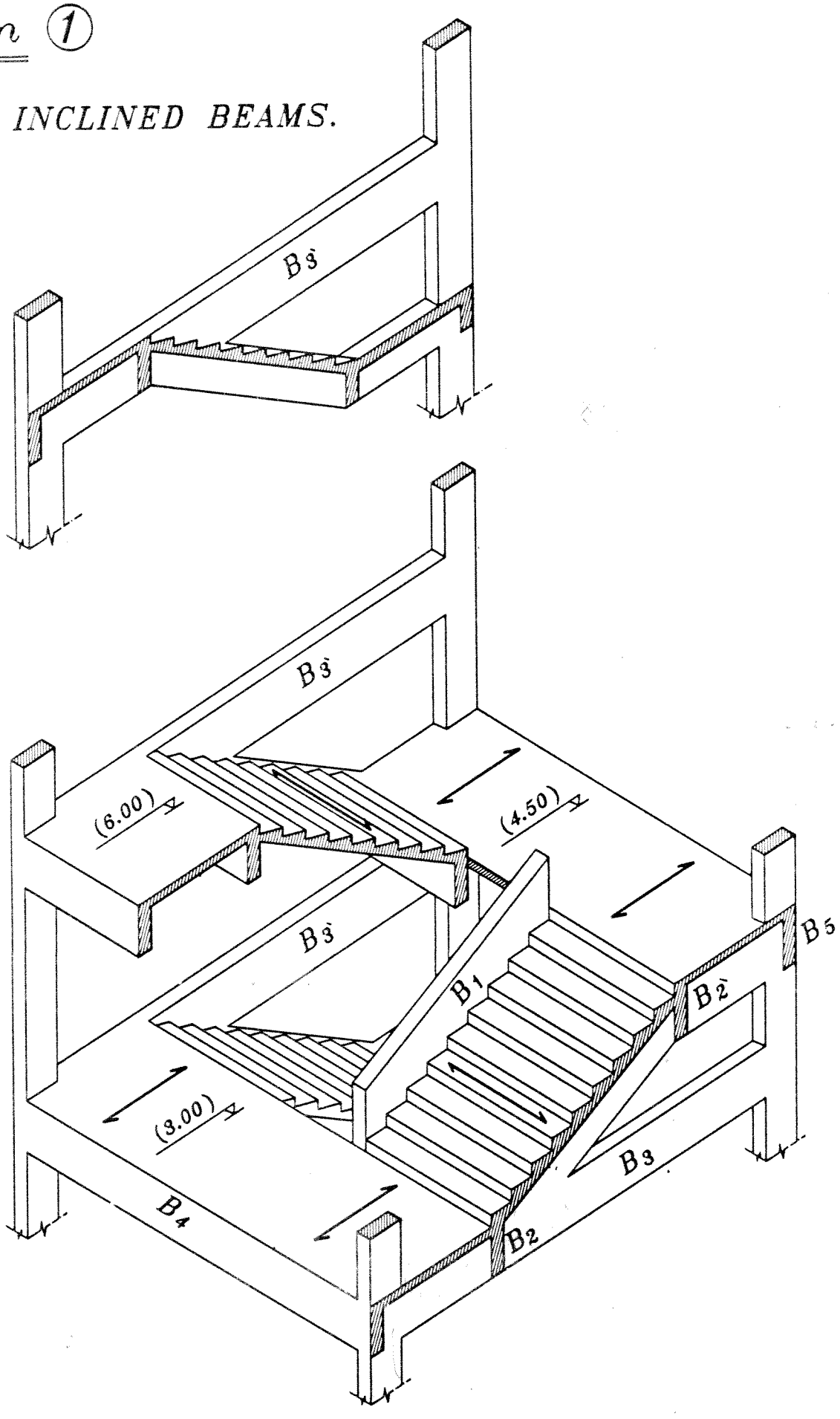


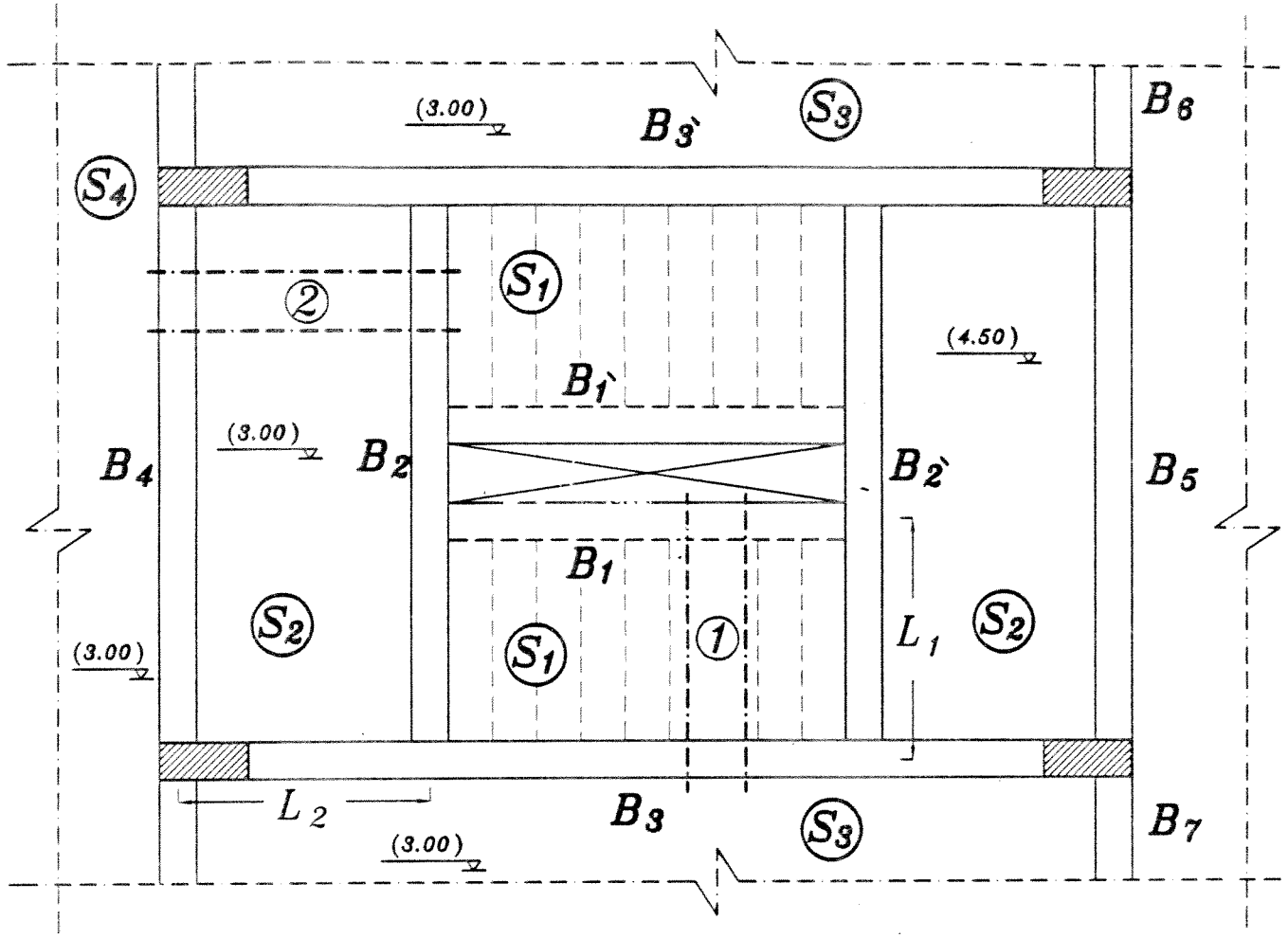
Structural Plan

Systems of Stairs used in ordinary buildings.

System ①

USING INCLINED BEAMS.





Slabs.

$t_{s\ min} = 12$ cm.

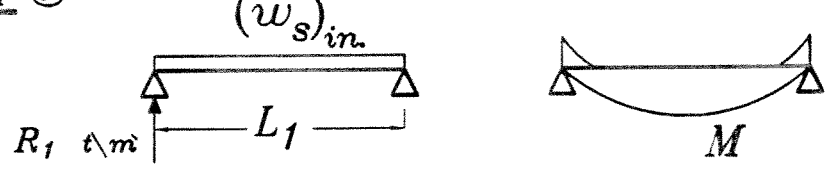
- $t_s = \frac{L_s}{20}$ $\quad t_s = \frac{L_s}{24}$ $\quad t_s = \frac{L_s}{28}$

- $t_{av} = t_s + 7$ cm.

- $(w_s)_{Hl.} = t_s \gamma_c + F.C. + L.L.$

- $(w_s)_{in.} = t_{av} \gamma_c + F.C. + L.L. \cos\theta$

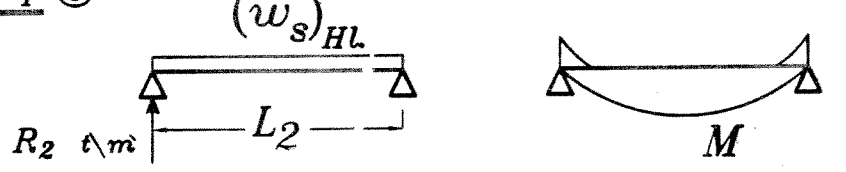
Strip ①



$M_{des.} = M \cos\theta$

$d = t_s - 1.5$ cm.

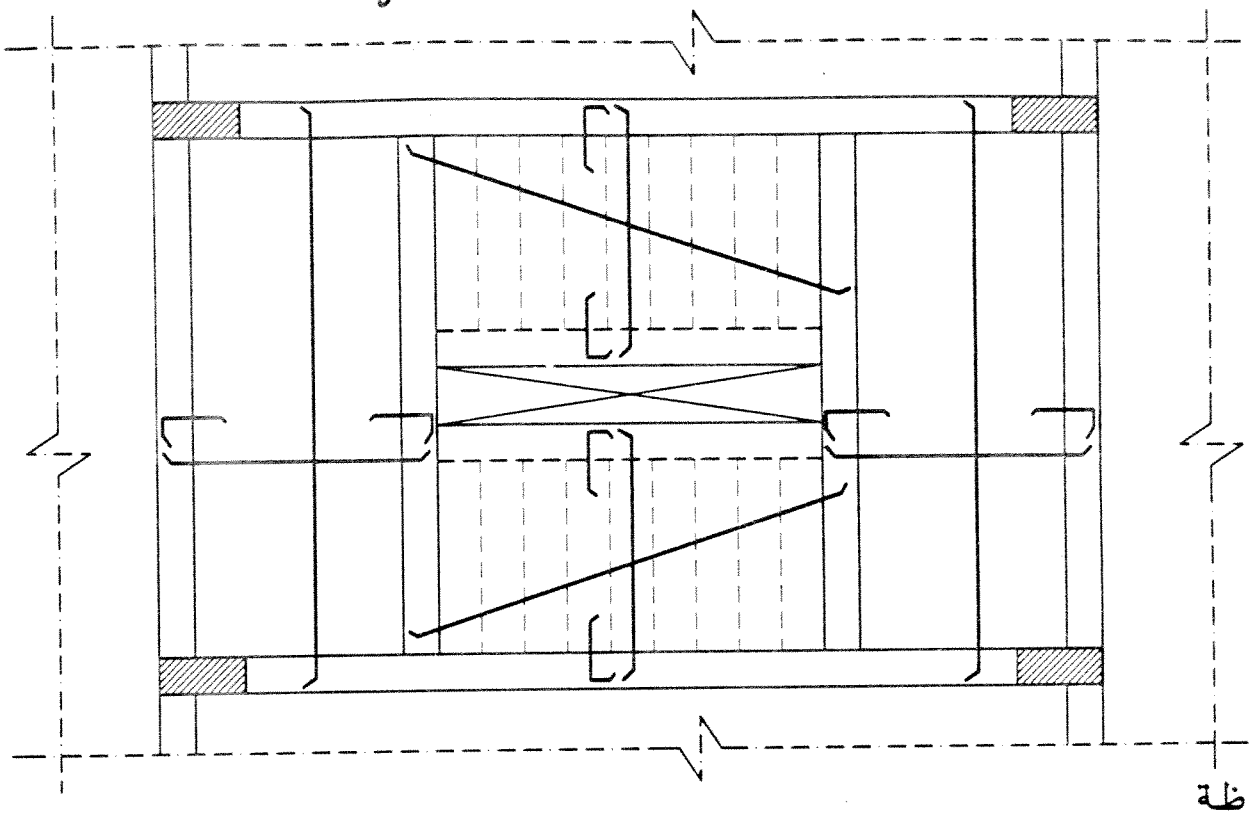
Strip ②



$M_{des.} = M$

$d = t_s - 1.5$ cm.

RFT. of the slab.



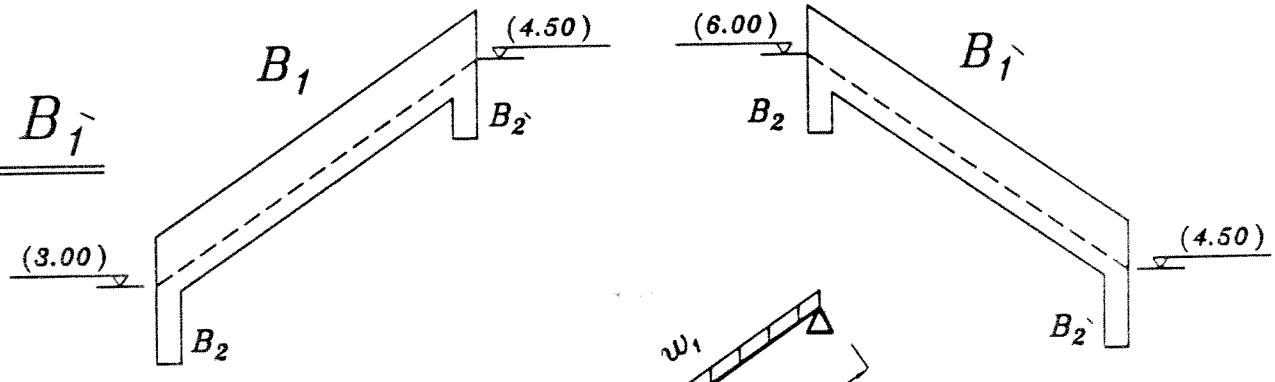
ملحوظة

عاده تسلح بلاطة السلم بحيث تكون مفصولة عن بقية المبنى أى تسلح على أنها *Simple Slab*

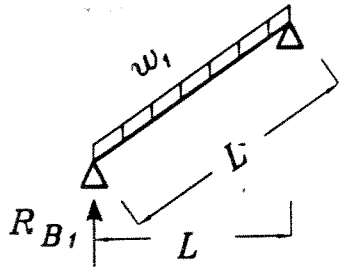
لتحديد الاحمال على الكمرات ممكن ان نأخذ الـ *Reaction* من شريحة البلاطة + *o.w.* للكمره بدلا من عمل *Load Dist.* و هذه الطريقة تكون مع الشرائح للبلاطات الـ *One way & Cantilever* فقط و لكن مع البلاطات الـ *Two way* فنضطر لعمل *Load Dist.* .

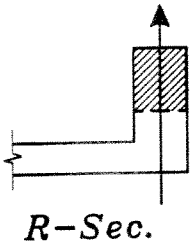
Beams.

B_1 , B_1`



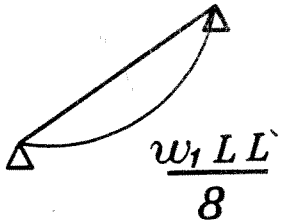
$w_1 = o.w. + \frac{1}{2} S_1 = o.w. + R_1$



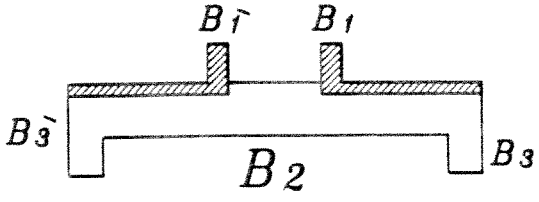


R–Sec.

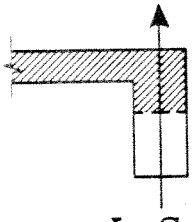
كمره مقلوبة



B_2 , $B_{2'}$

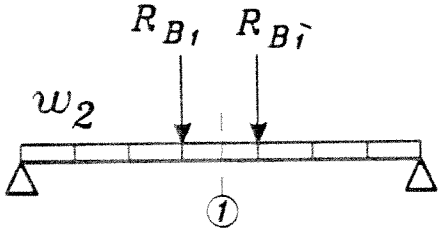


$$w_2 = o.w. + \frac{1}{2} S_2 = o.w. + R_2$$



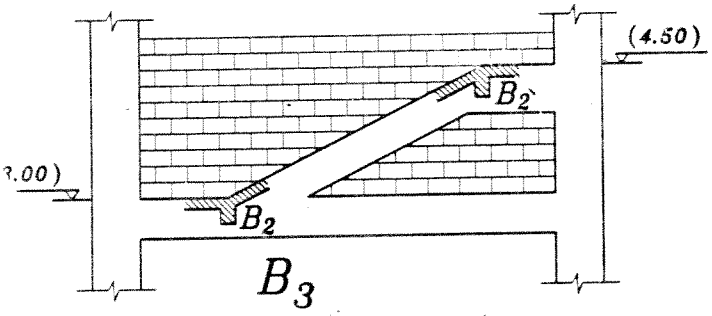
L–Sec.

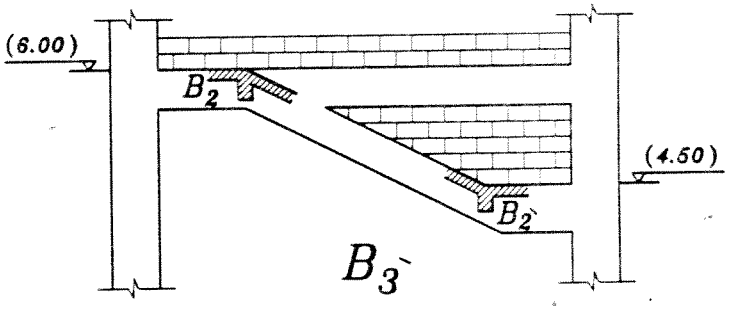
L–Sec.
Sec.(1–1)

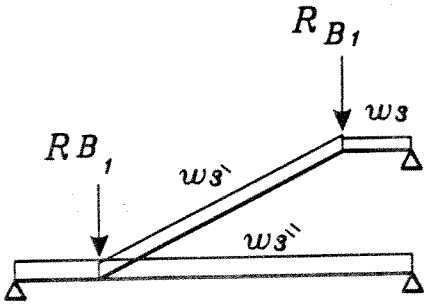


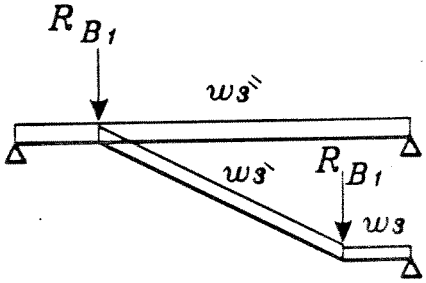
$$B = \begin{cases} C.L. - C.L. \\ 6\,t_s + b \\ K\frac{L}{10} + b \end{cases}$$ الأقل

B_3 , $B_{3'}$









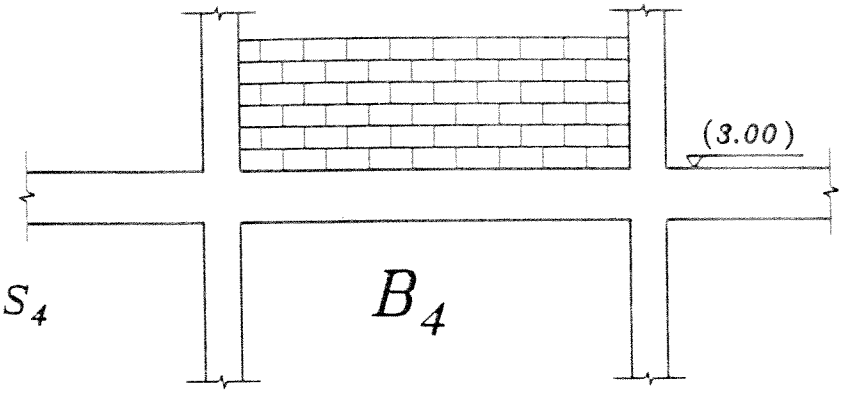
$$w_3 = o.w. + walls$$

$$w_{3'} = o.w. + walls + R_1$$

$$w_{3''} = o.w. + walls + S_3$$

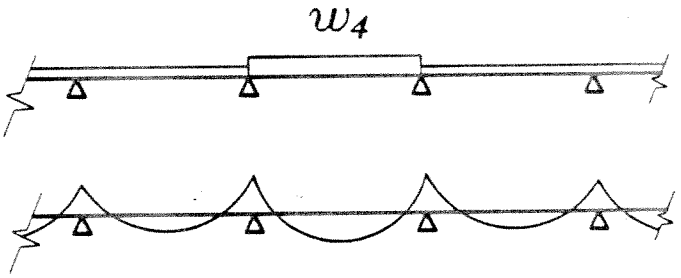
B_3 designed as a Frame

B_4

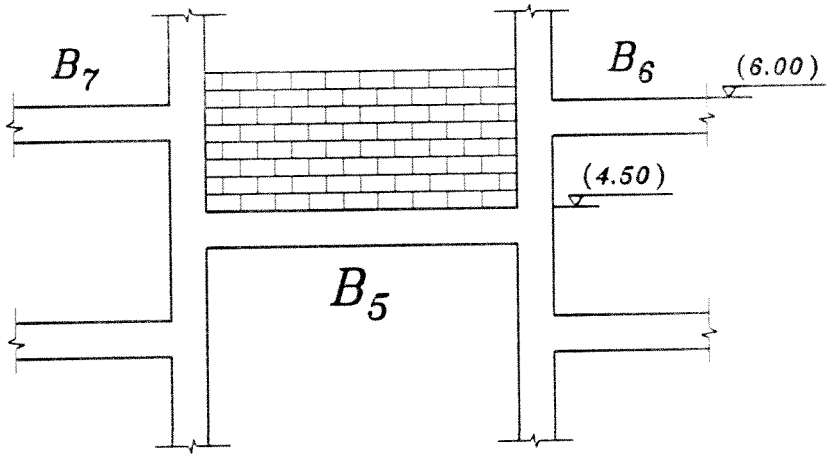


$w_4 = o.w. + walls + R_2 + S_4$

Continous Beam.

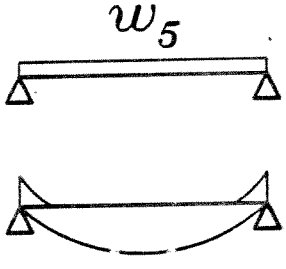


B_5



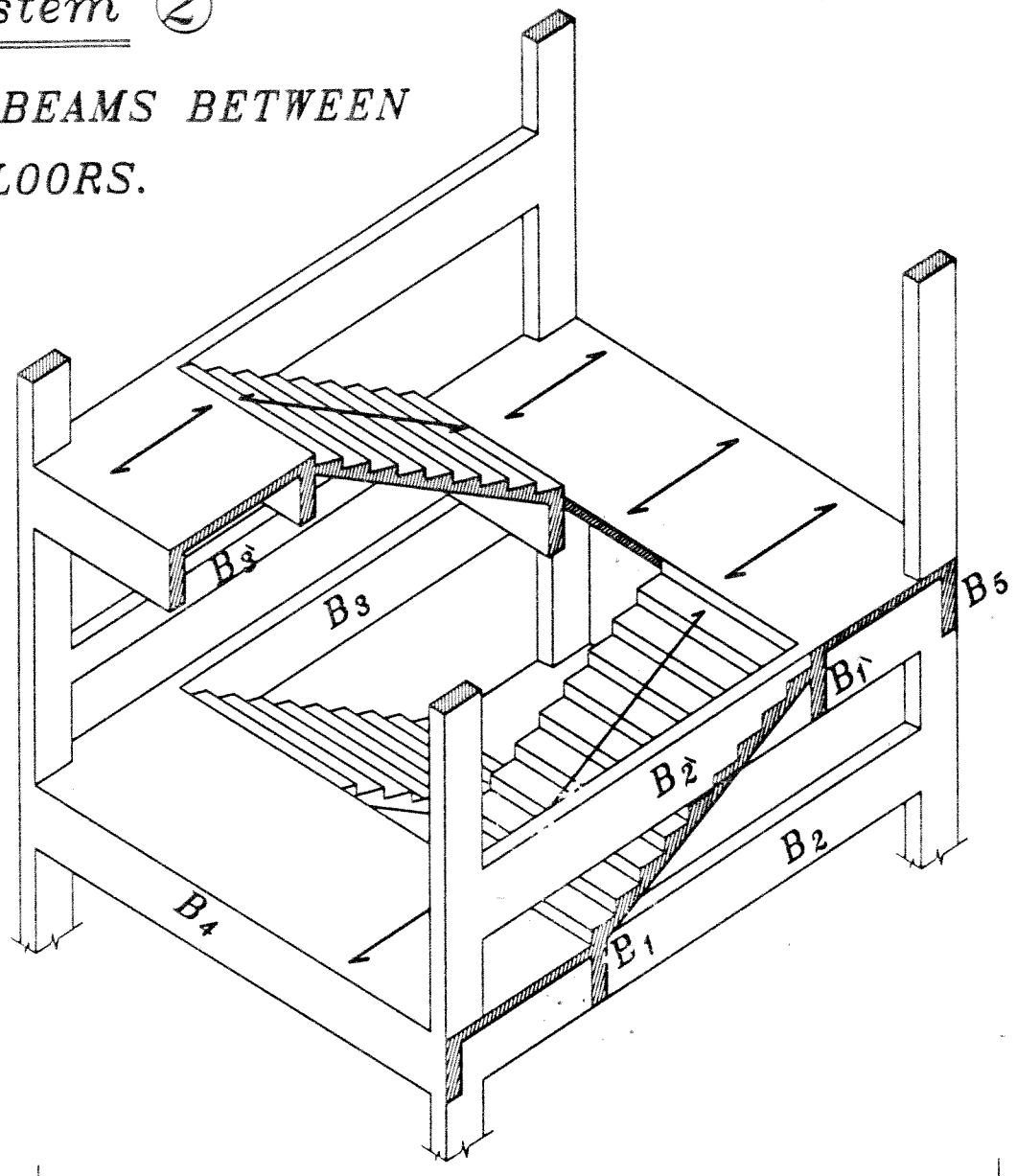
B_5 Simple Beam.

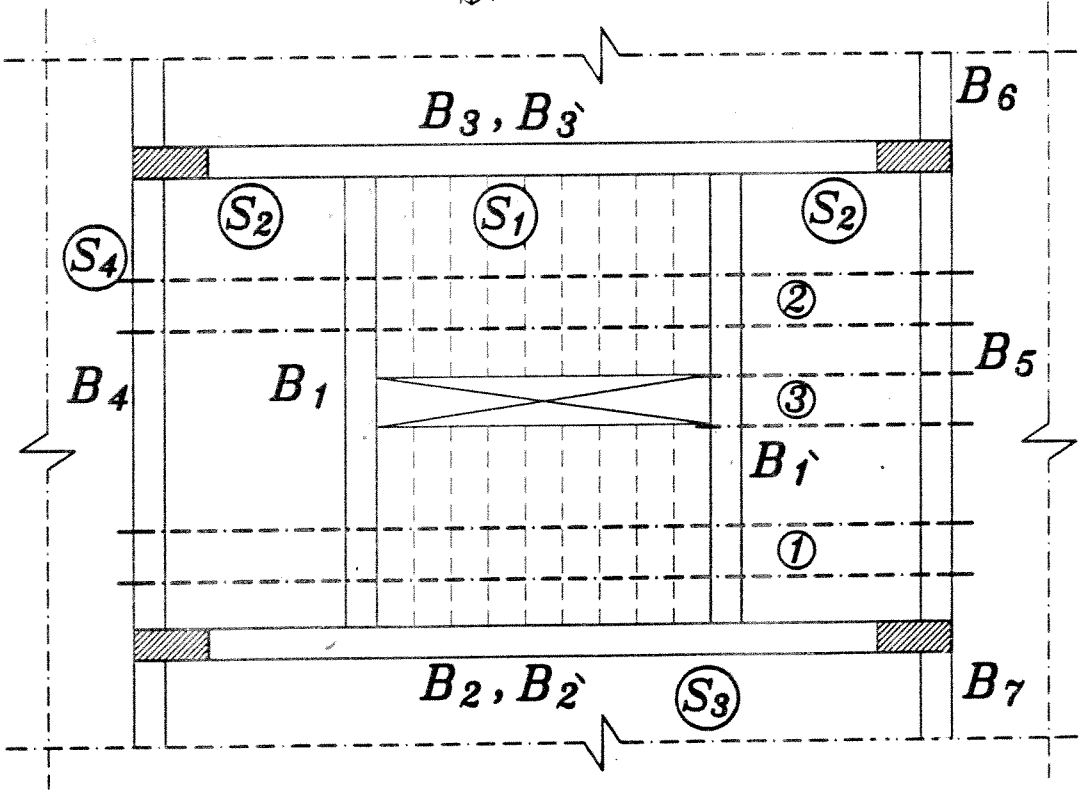
$w_5 = o.w. + walls + R_2$



System ②

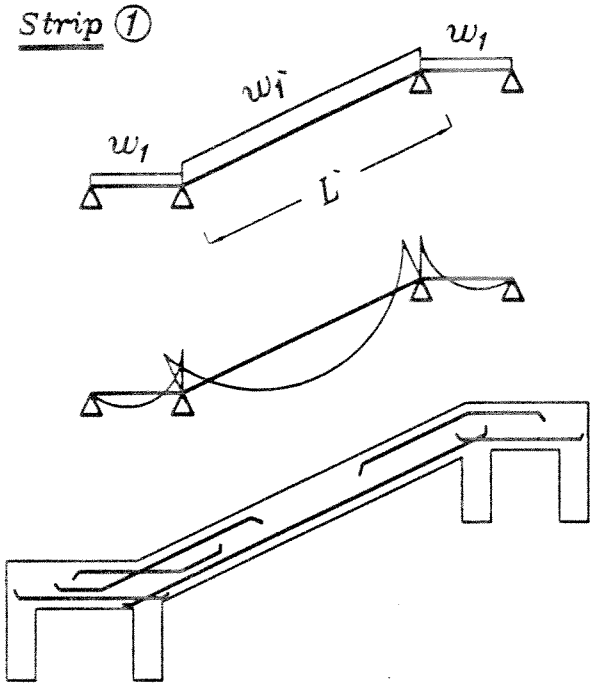
USING BEAMS BETWEEN THE FLOORS.



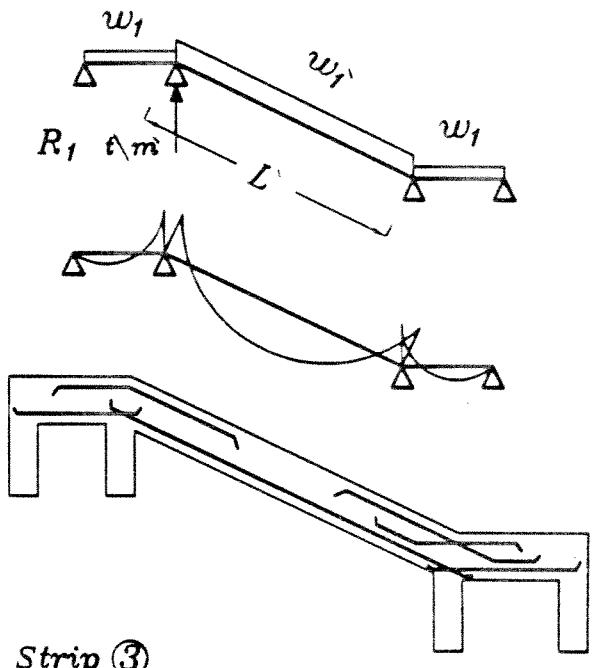


Slabs.

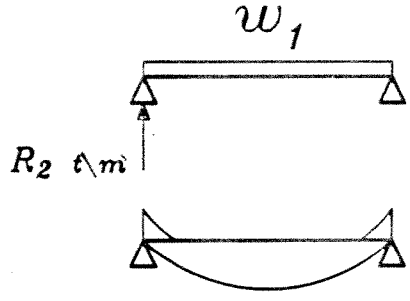
Strip ①



Strip ②



Strip ③

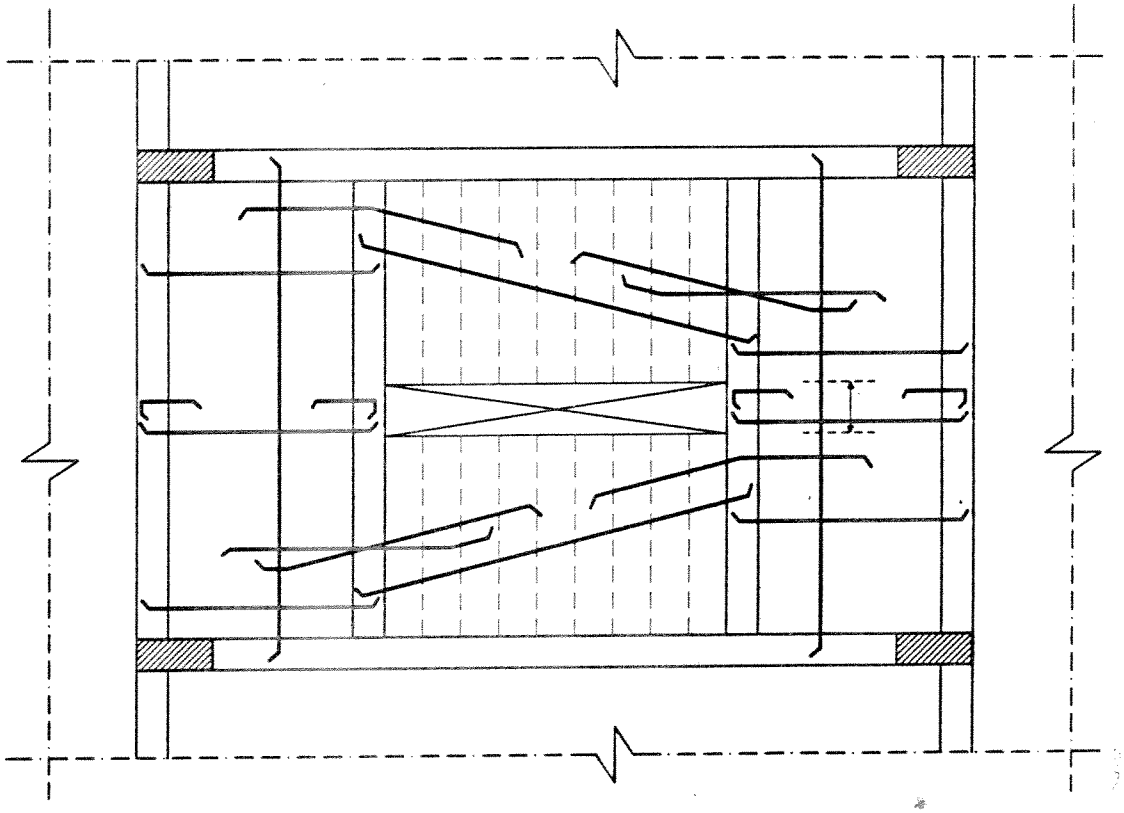


$$t_s = \frac{L`}{28}$$

$$t_{av} = t_s + 7\ cm.$$

$$w_1 = t_s \gamma_c + F.C. + L.L.$$

$$w_1` = t_{av} \gamma_c + F.C. + L.L. \cos\theta$$



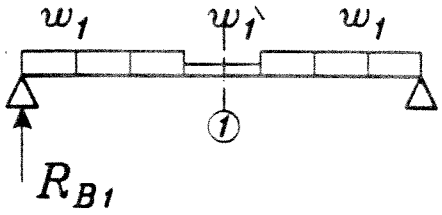
Beams.

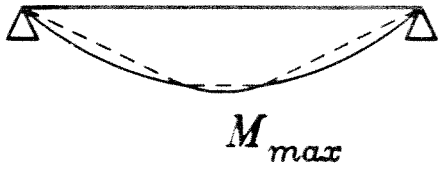
B_1 , $B_{1`}$

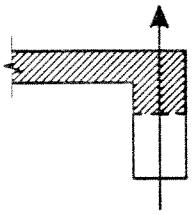
w_1 = o.w.+ R_1 t\m`

$w_{1`}$ = o.w.+ $R_2$ t\m`

Designed as L–Sec.





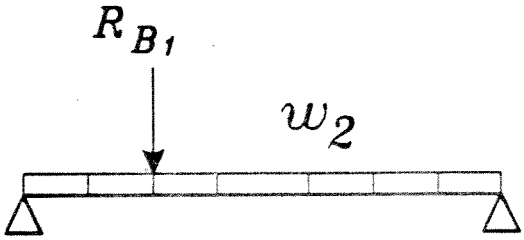


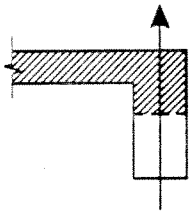
L–Sec.
Sec.(1–1)

B_2

w_2 = o.w.+ walls + S_3

Designed as L–Sec.



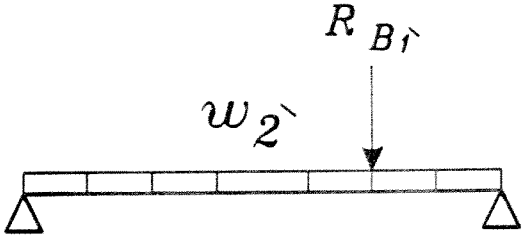


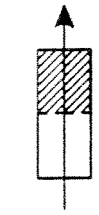
L–Sec.

$B_{2`}$

$w_{2`}$ = o.w.+ walls

Designed as R–Sec.





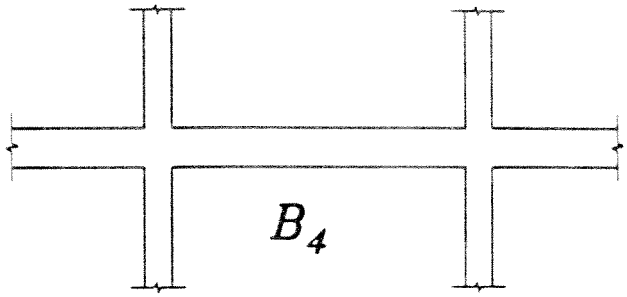
R–Sec.

B_3 the same as B_2

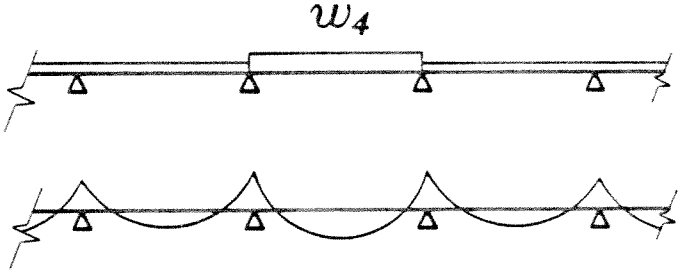
, $B_{3`}$ the same as $B_{2`}$

B_4

$w_4 = o.w. + walls + \frac{1}{2} S_2 + S_4$

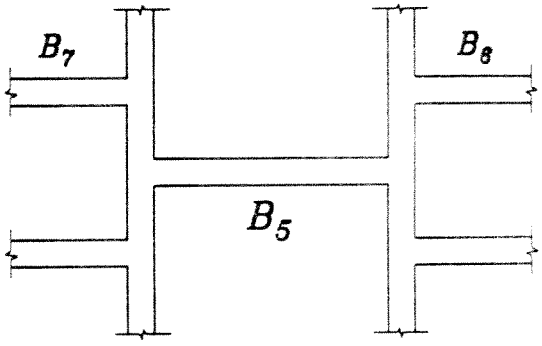


Continous Beam.

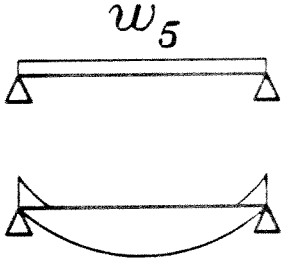


B_5

$w_5 = o.w. + walls + \frac{1}{2} S_2$

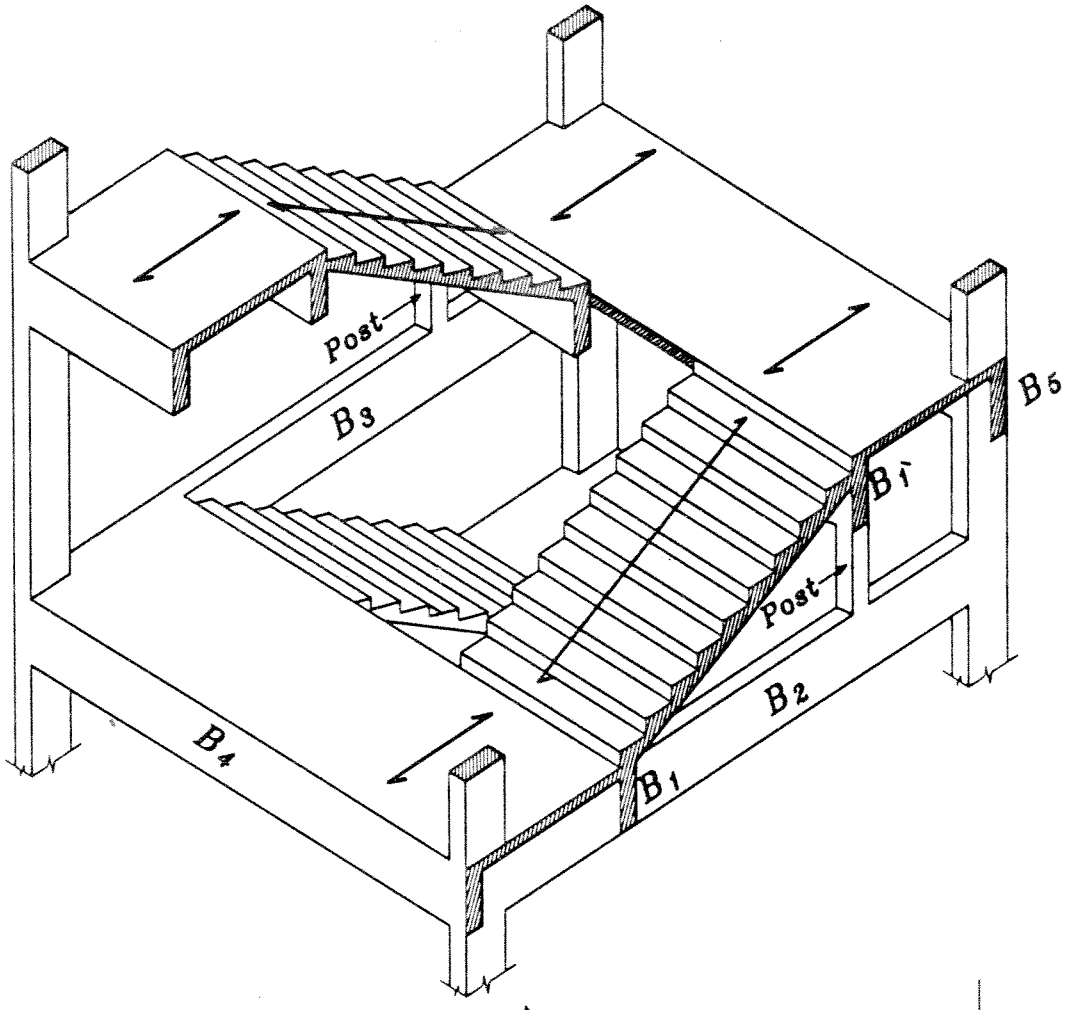


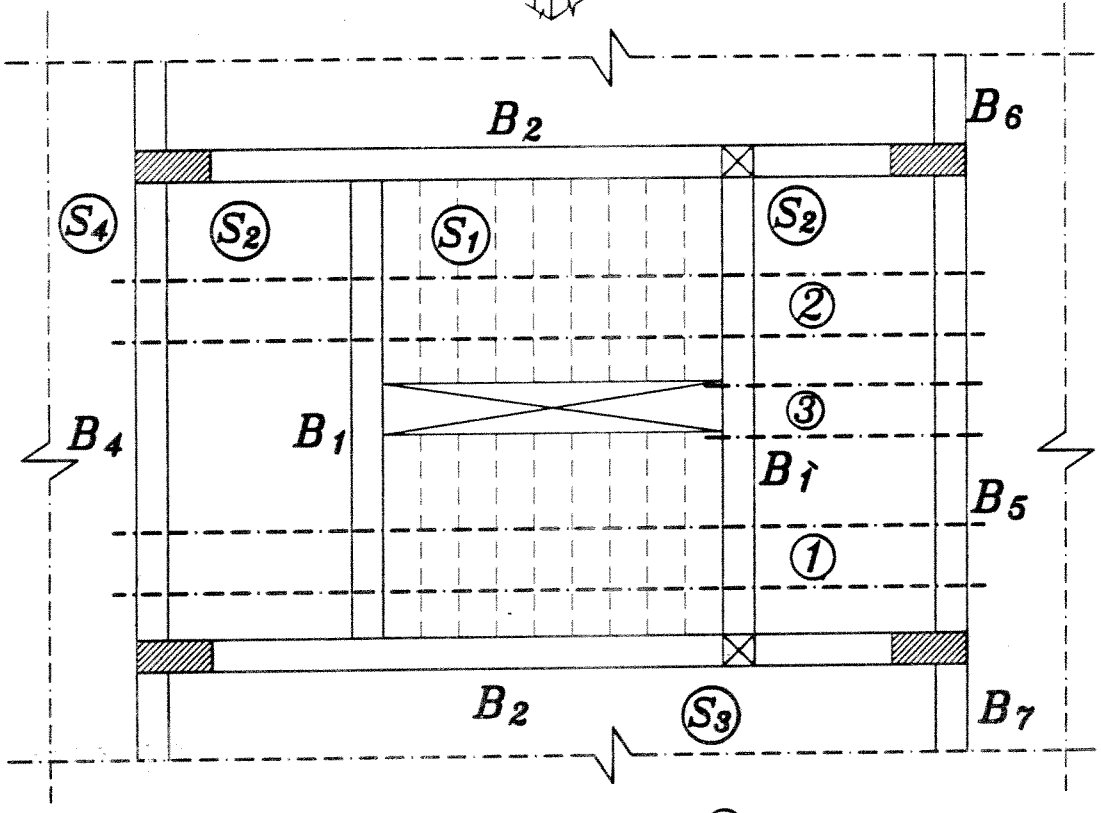
B_5 Simple Beam.



System ③

USING 2 POSTS INSTEAD OF THE BEAMS BETWEEN THE FLOORS.





system ③ is the same as system ②
but not For Beams B_2

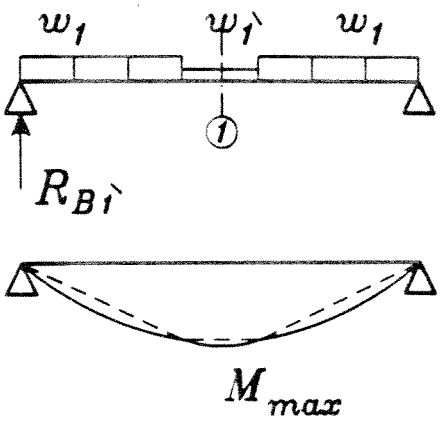
Beams.

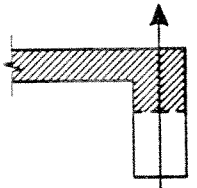
B_1

w_1 = o.w.+ R_1 t\m

w_1' = o.w.+ R_2 t\m

Designed as L-Sec.



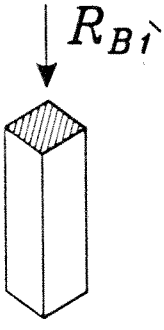


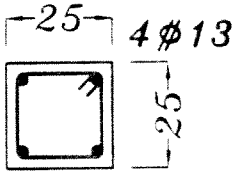
L-Sec.
Sec.(1-1)

Post.

$P = O.W._{(Post)} + R_{B1}$

$O.W._{(Post)} \simeq 0.35\ t$

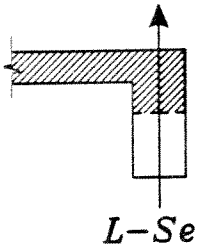




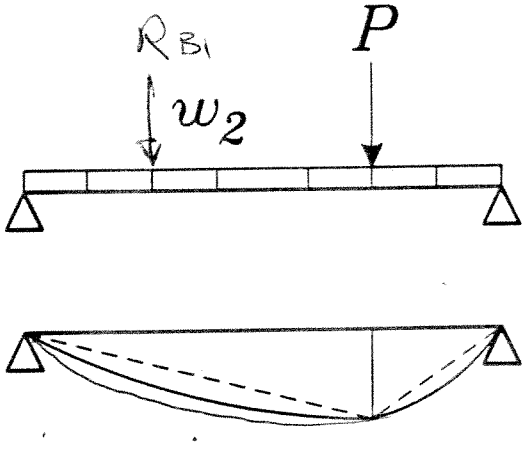
B_2

w_2 = o.w.+ walls + S_3

Designed as L-Sec.

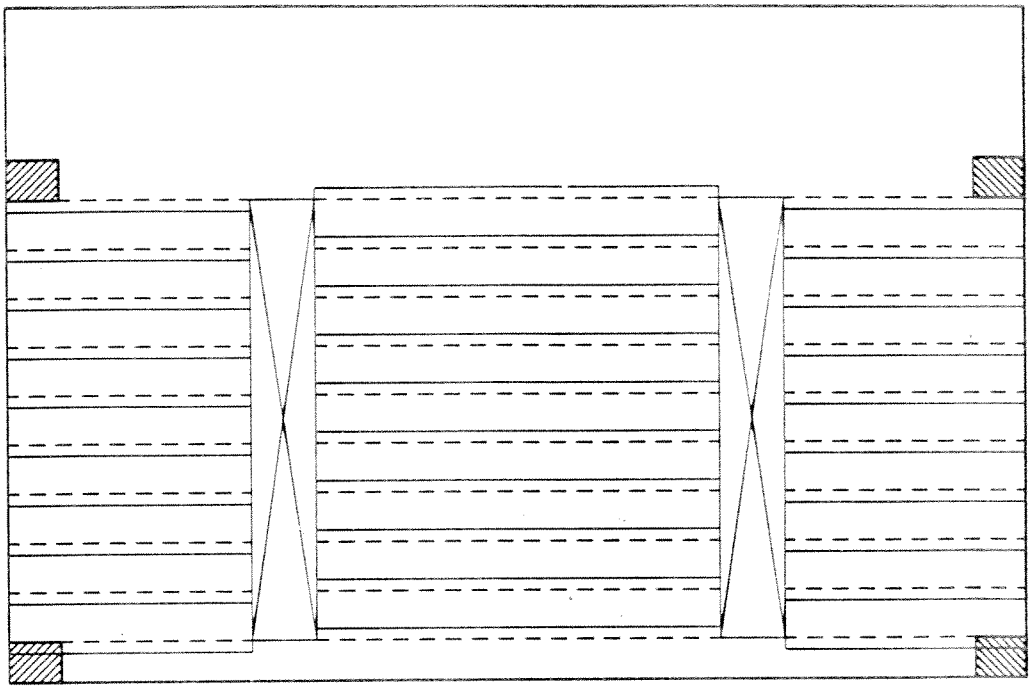


L-Sec.

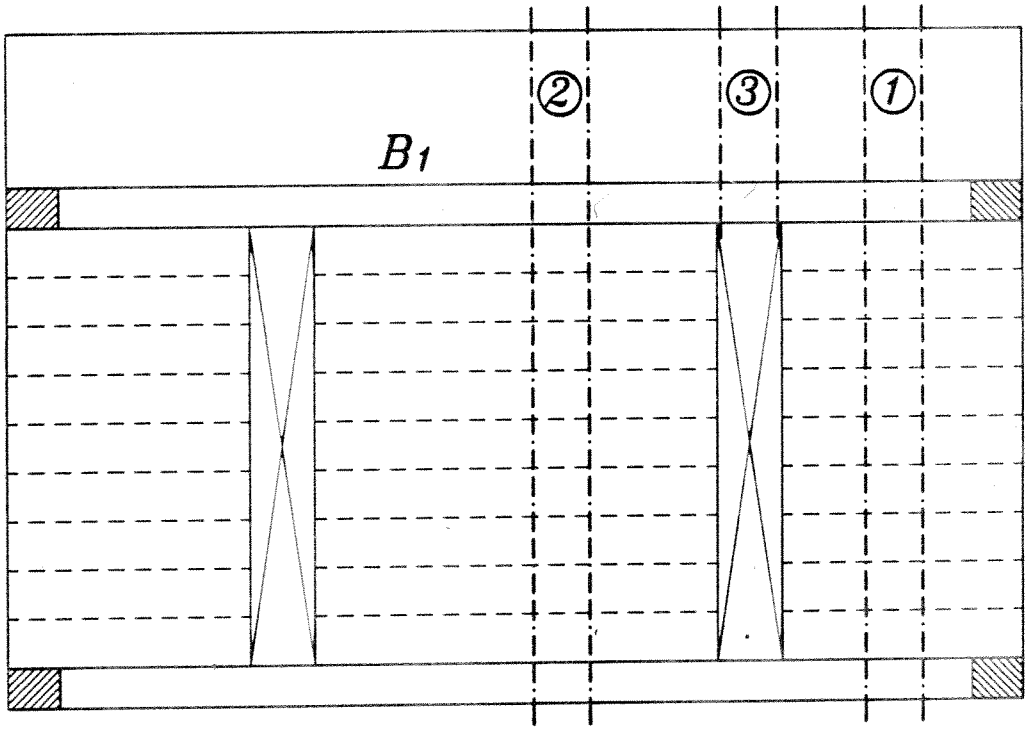


Example.

Arc. Plan

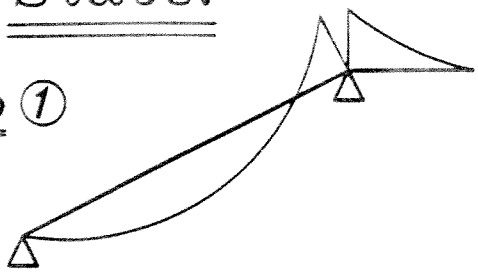


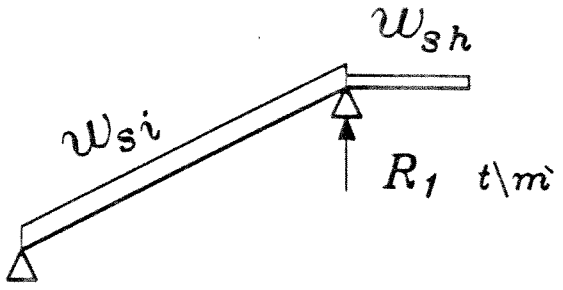
Struc. Plan



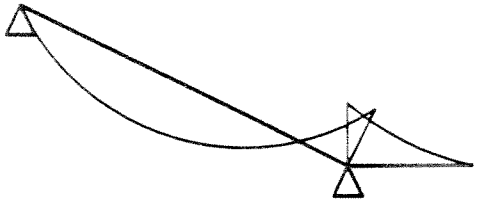
Slabs.

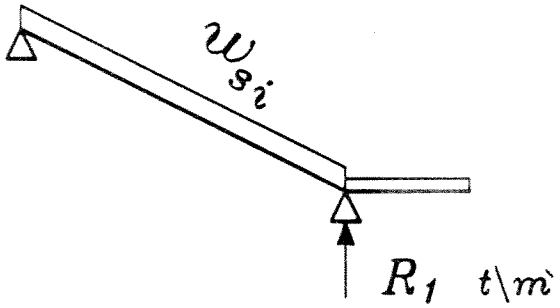
Strip ①





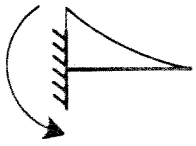
Strip ②

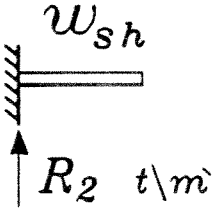




Strip ③

m_t m.t\m` ← Torsion تعمل على B_1

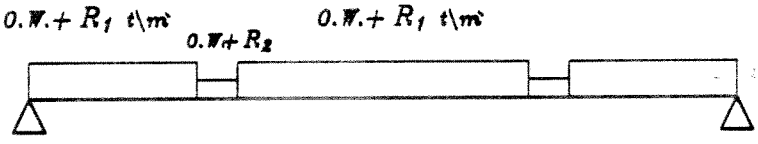




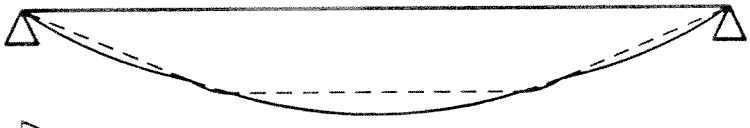
Beams.

B1

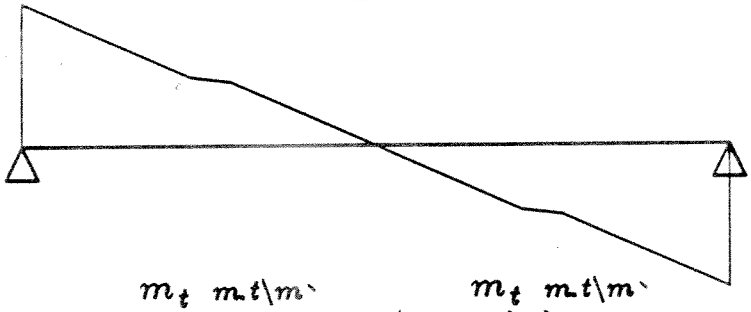
Loads



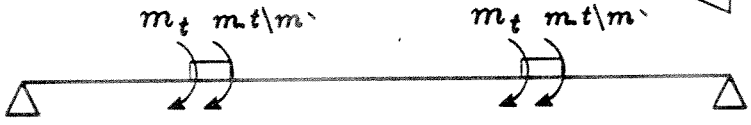
B.M.D.



S.F.D.

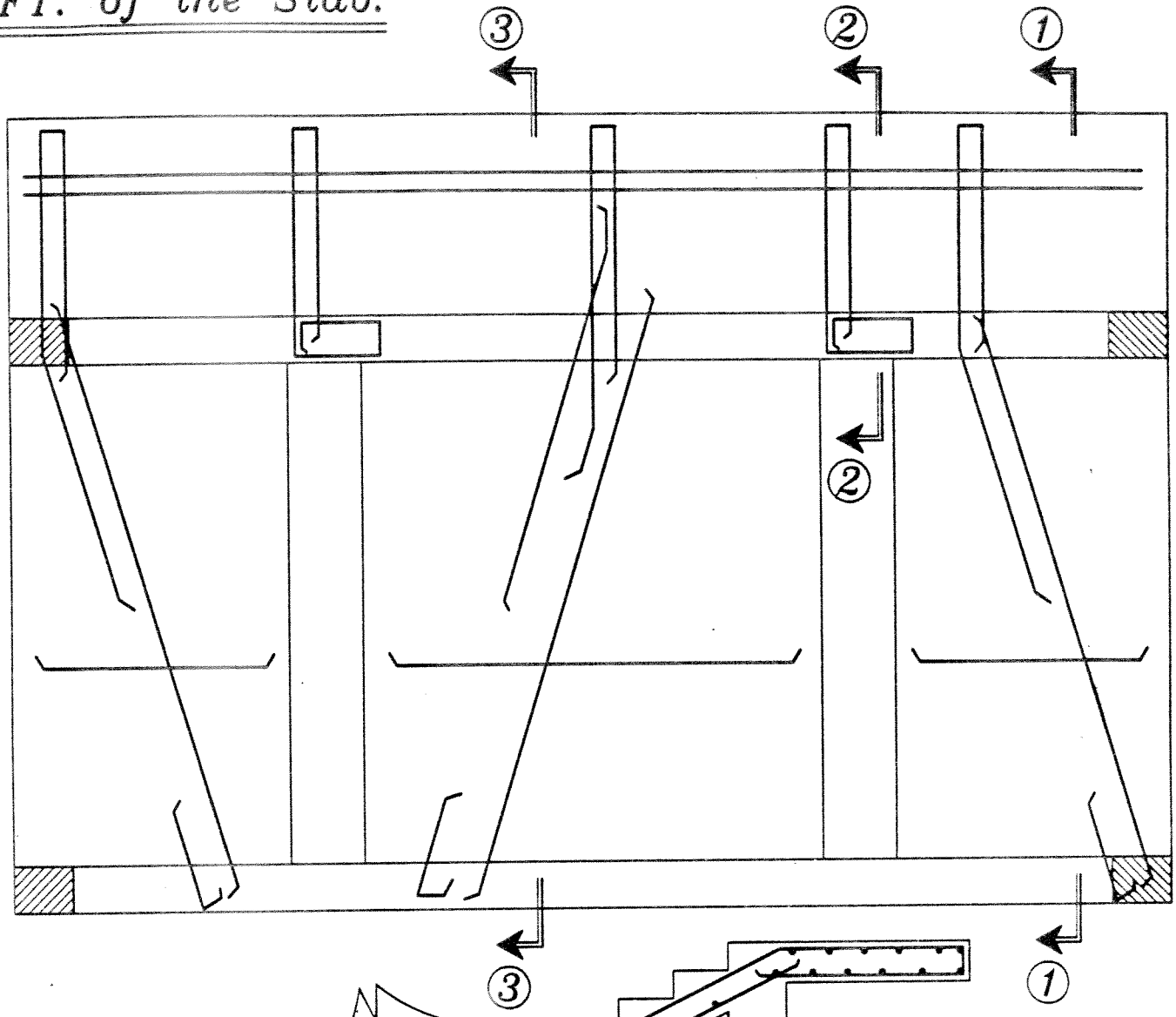


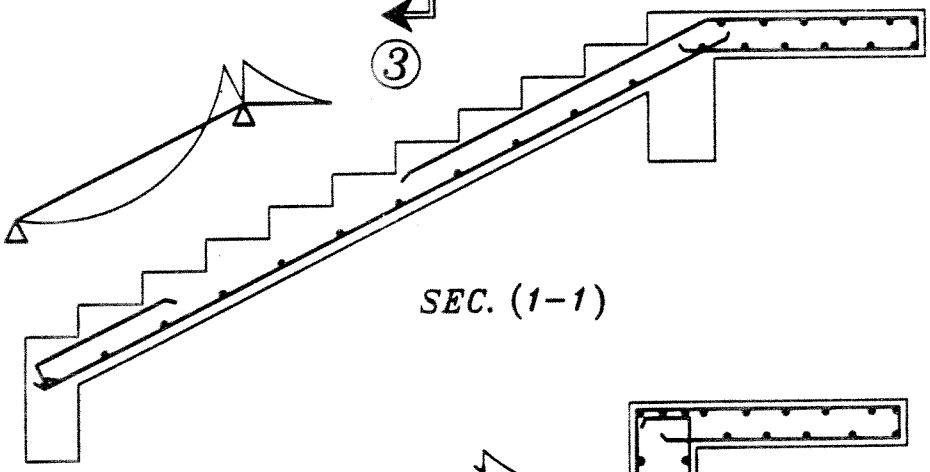
M_t



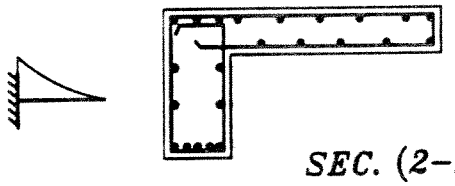
T.M.D.

RFT. of the Slab.

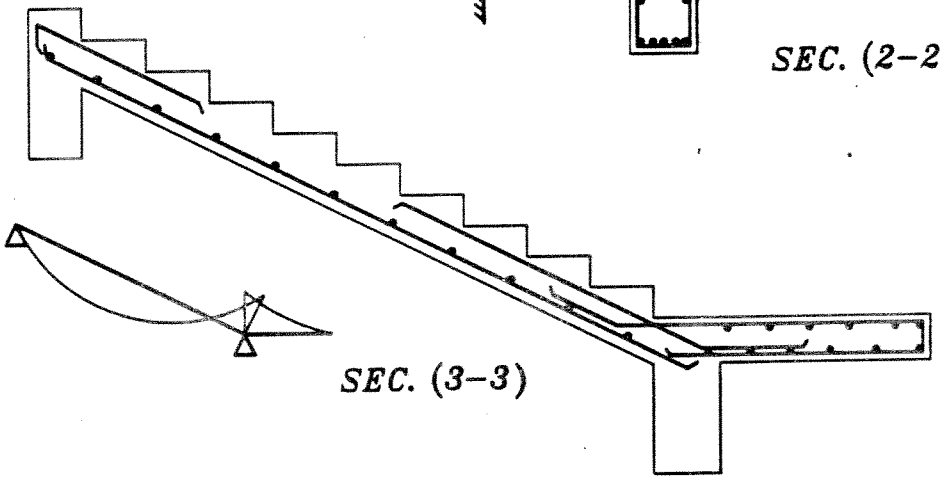




SEC. (1-1)



SEC. (2-2)

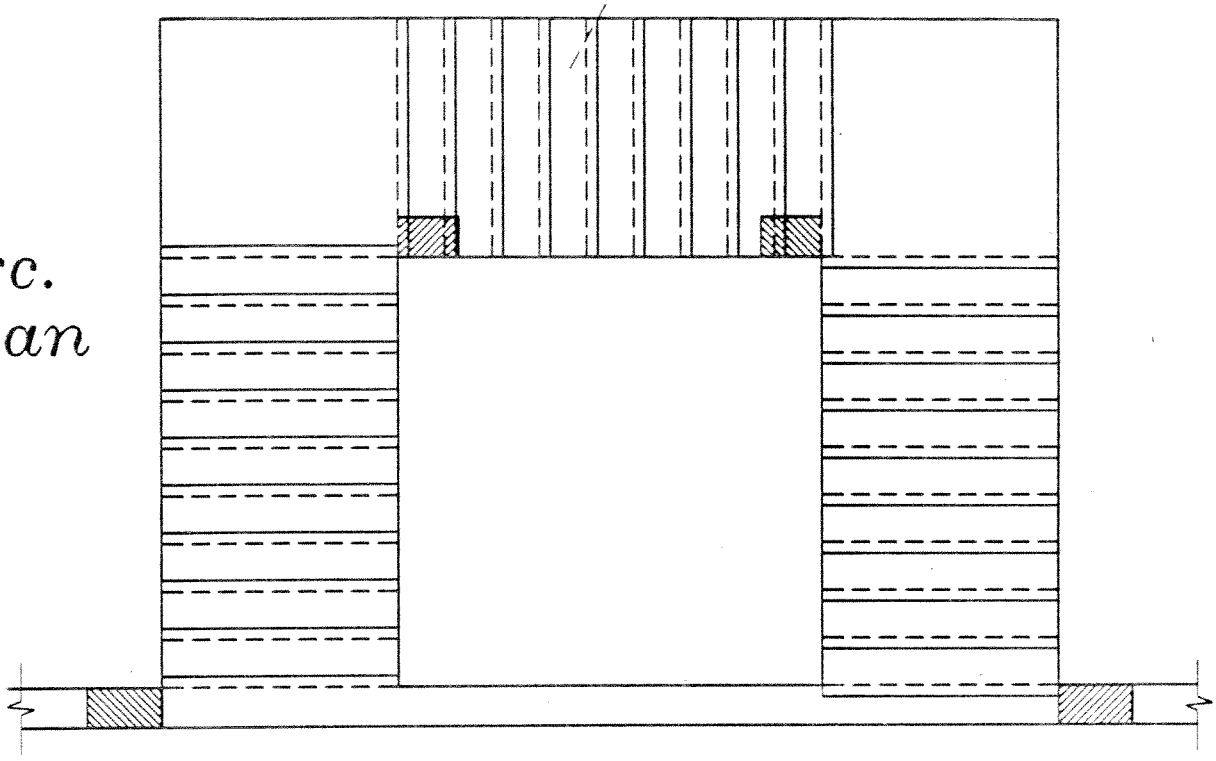


SEC. (3-3)

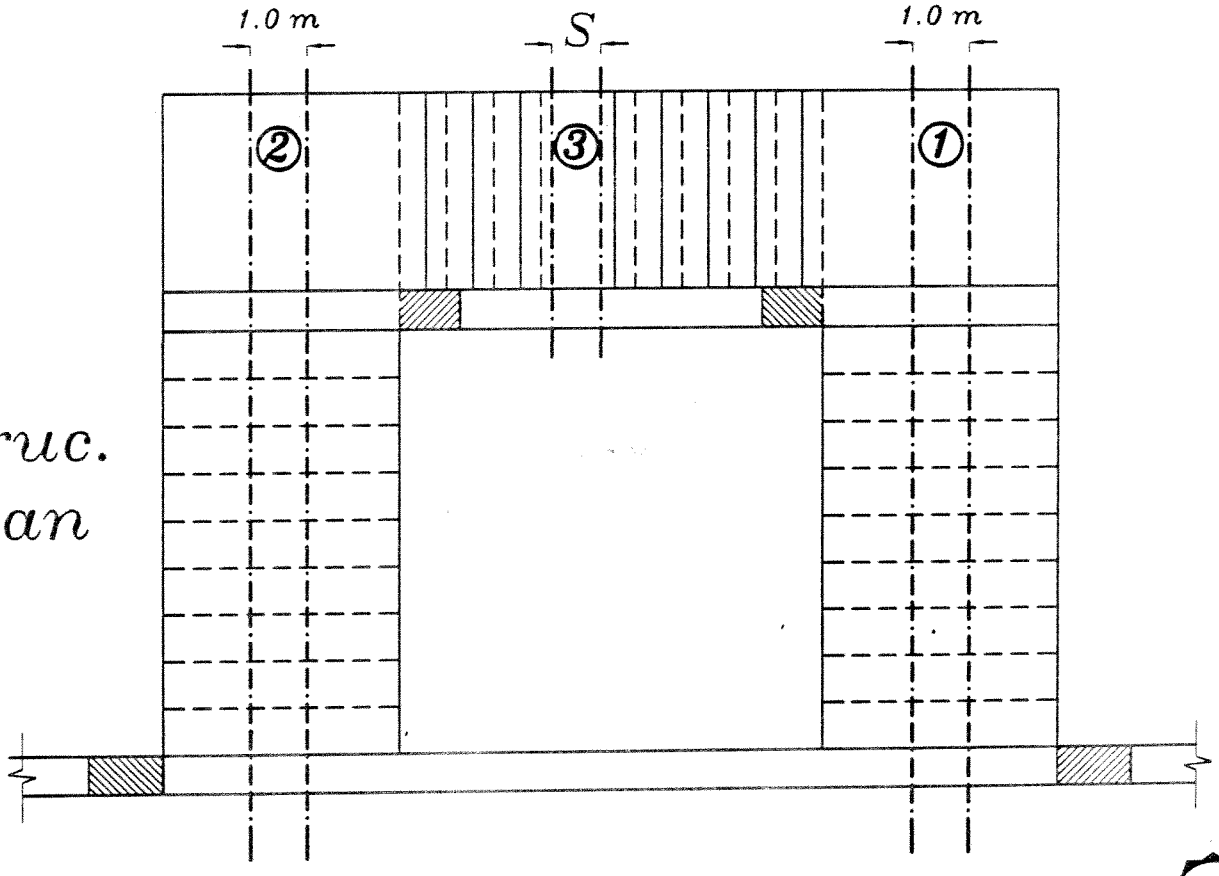
Example.

Saw Tooth Stair

Arc. Plan

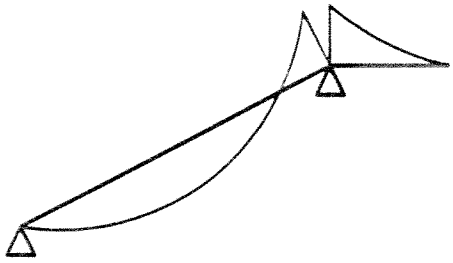


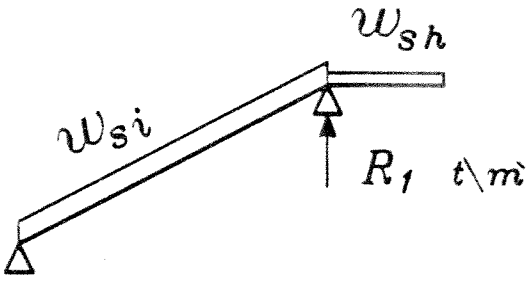
Struc. Plan



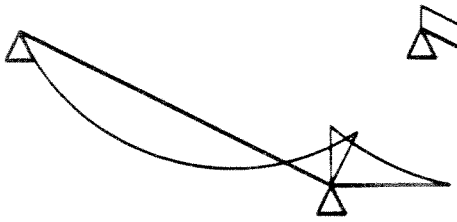
Slabs.

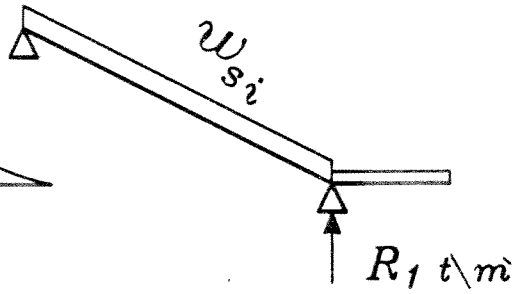
Strip ①





Strip ②



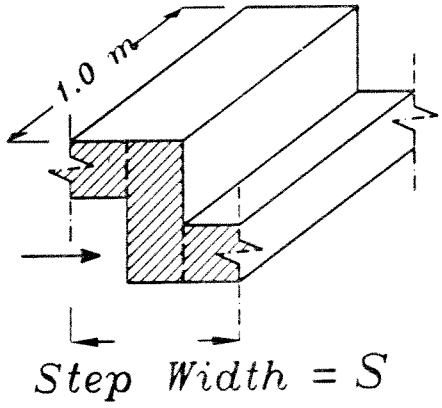


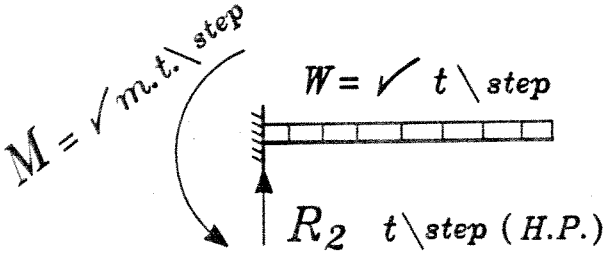
Strip ③ Strip in Saw Tooth steps

ملحوظة هامة جدا

فى السلالم الـ Saw Tooth يجب أن يكون اتجاه الـ Load موازى لاتجاه السلمة

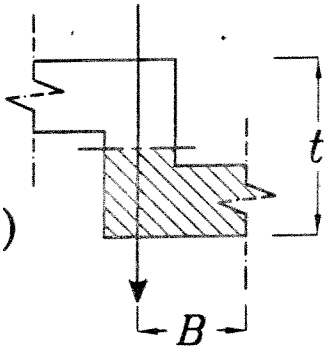
V = O.W. (For step) + (L.L. + F.C.) (S) = ✓ t \ step





Strip ③

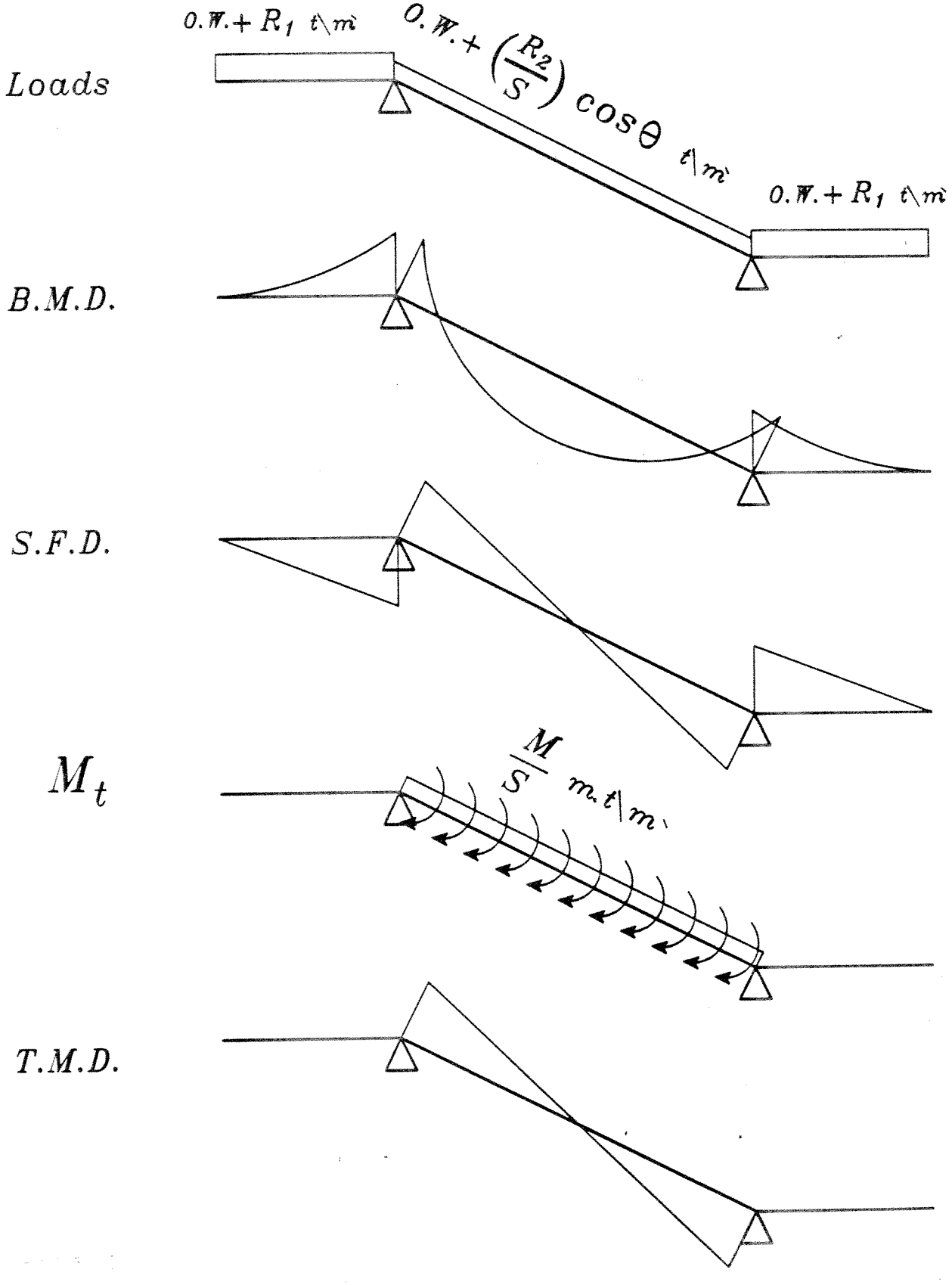
Design the strip as Beam (L-Sec.)



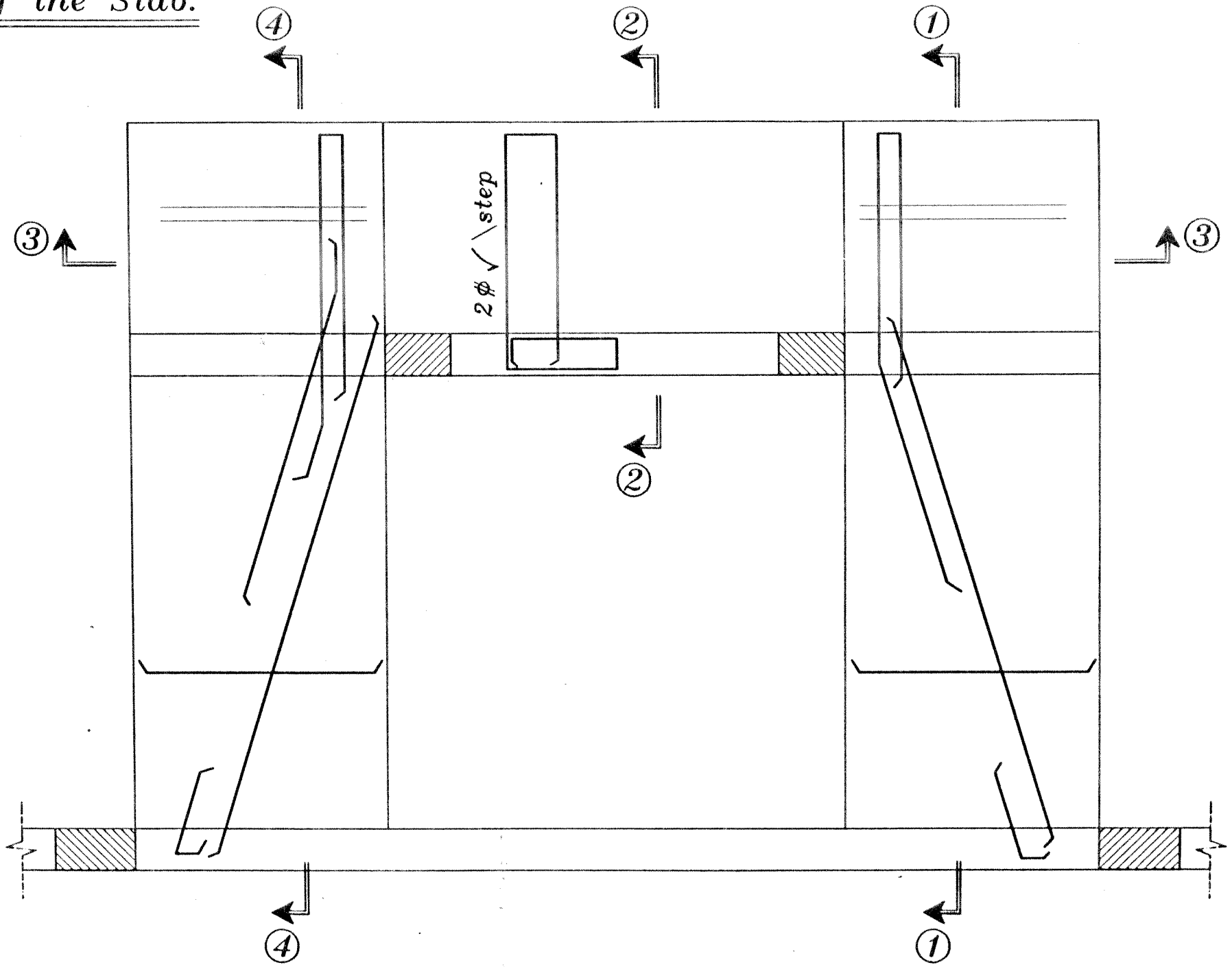
(L-Sec.)

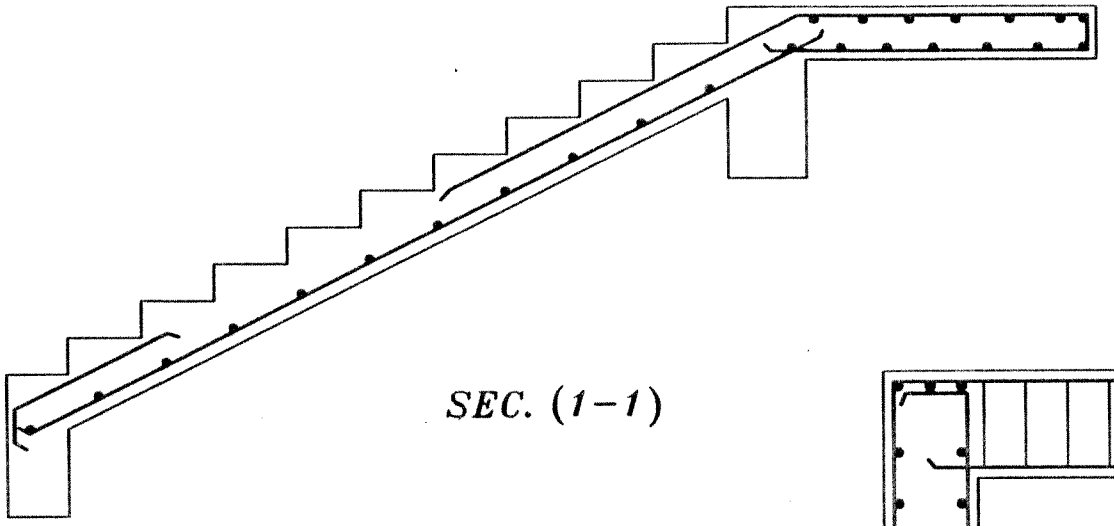
Beams.

B 1

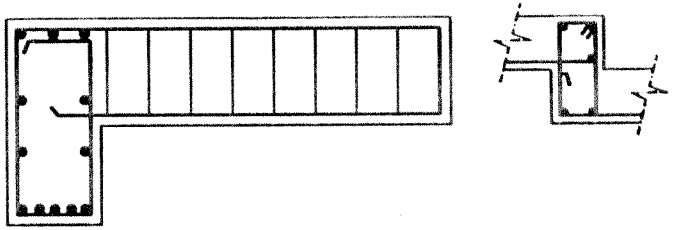

Loads
O.W. + R_1 t\m
O.W. + $\left(\frac{R_2}{S}\right)\cos\theta$ t\m
O.W. + R_1 t\m
B.M.D.
S.F.D.
M_t
$\frac{M}{S}$ m.t\m
T.M.D.

RFT. of the Slab.

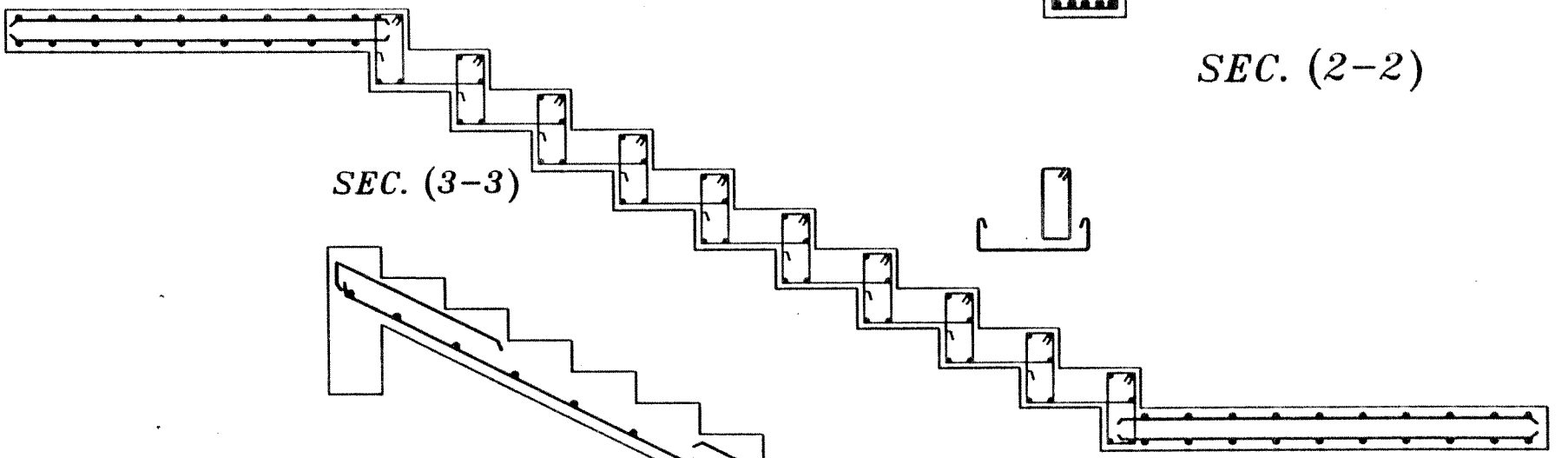




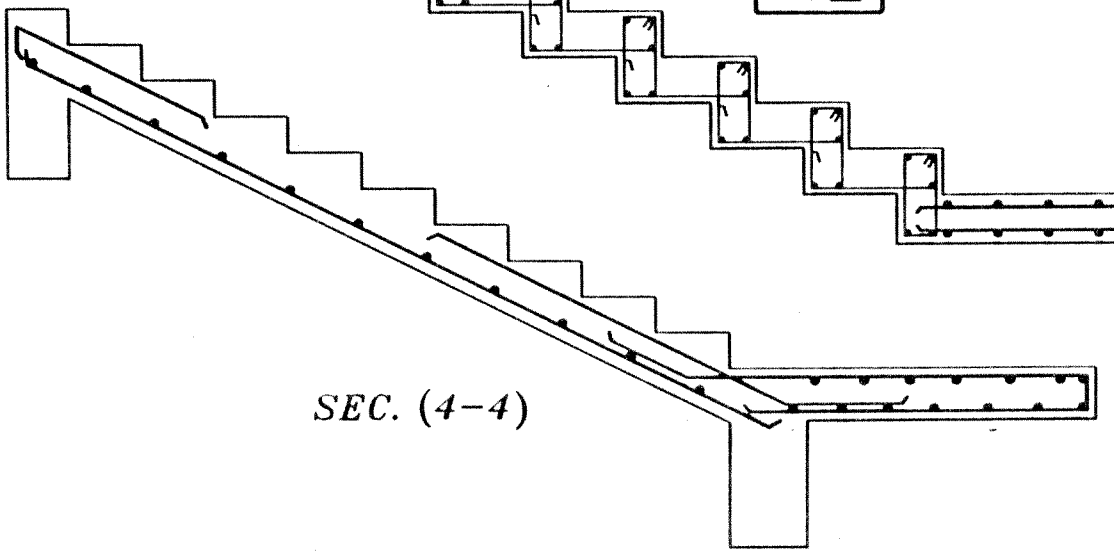
SEC. (1–1)



SEC. (2–2)



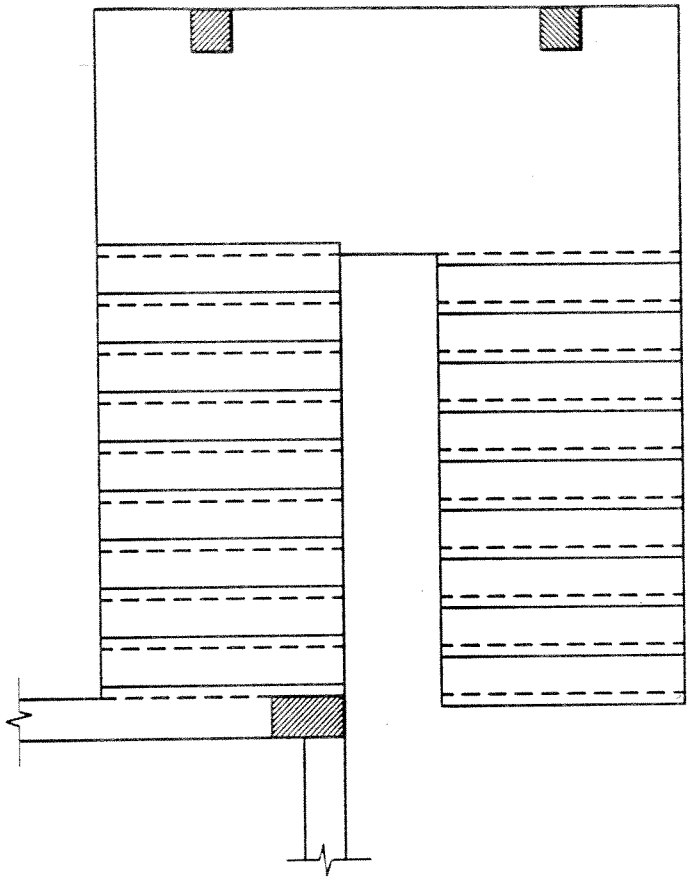
SEC. (3–3)



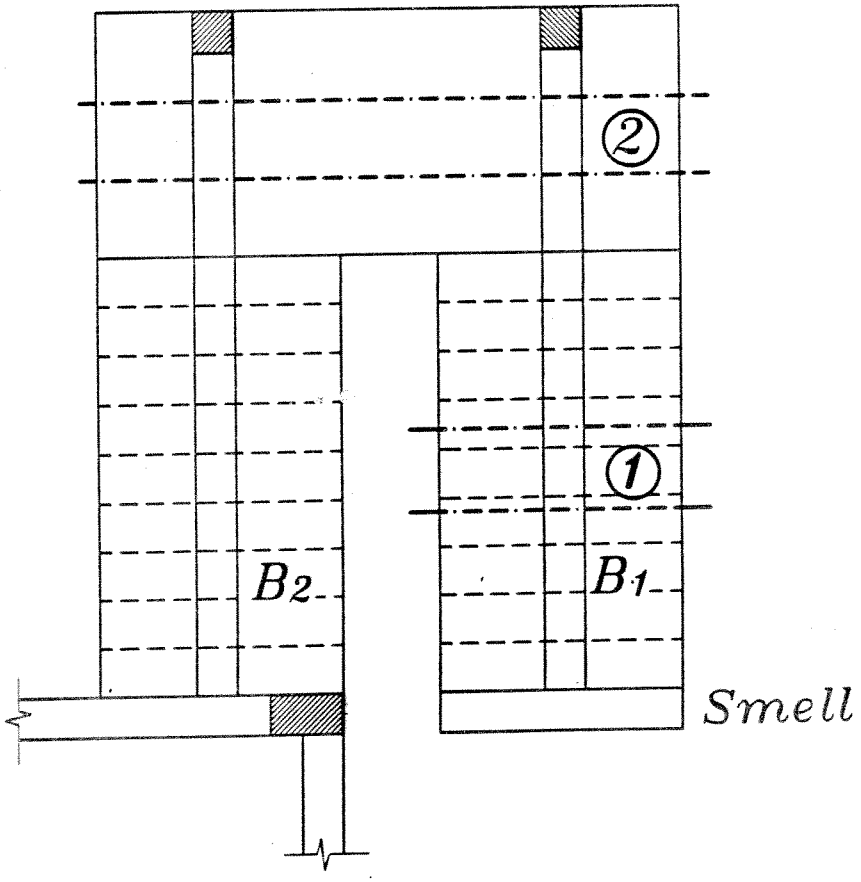
SEC. (4–4)

Example.

Arc. Plan

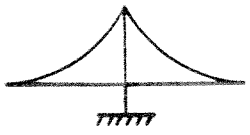


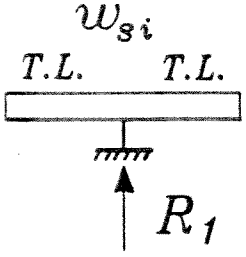
Struc. Plan



Slabs.

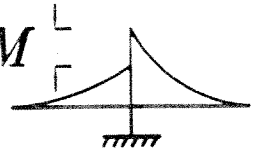
Strip ①

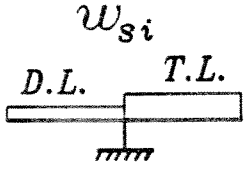




To design the slab

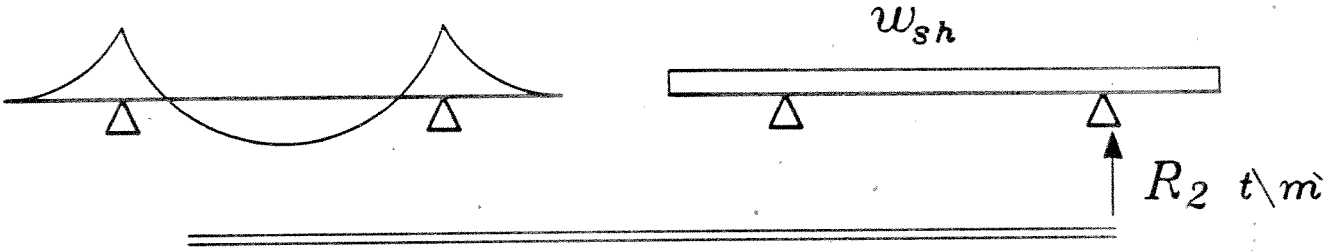
Torsion تعمل على B_1





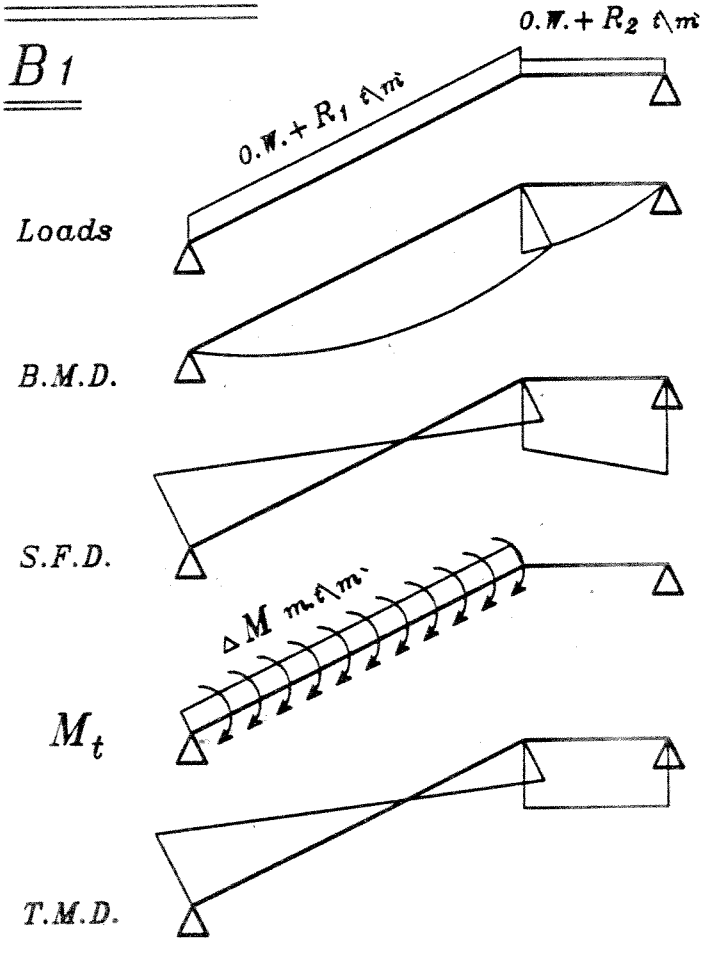
To get max. Torsion

Strip ②

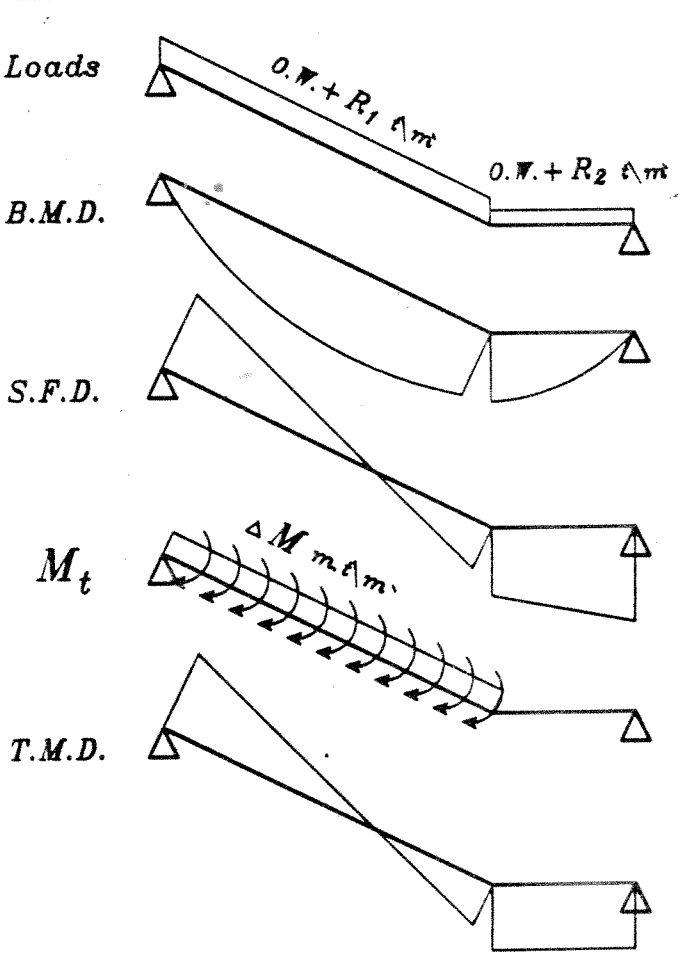


Beams.

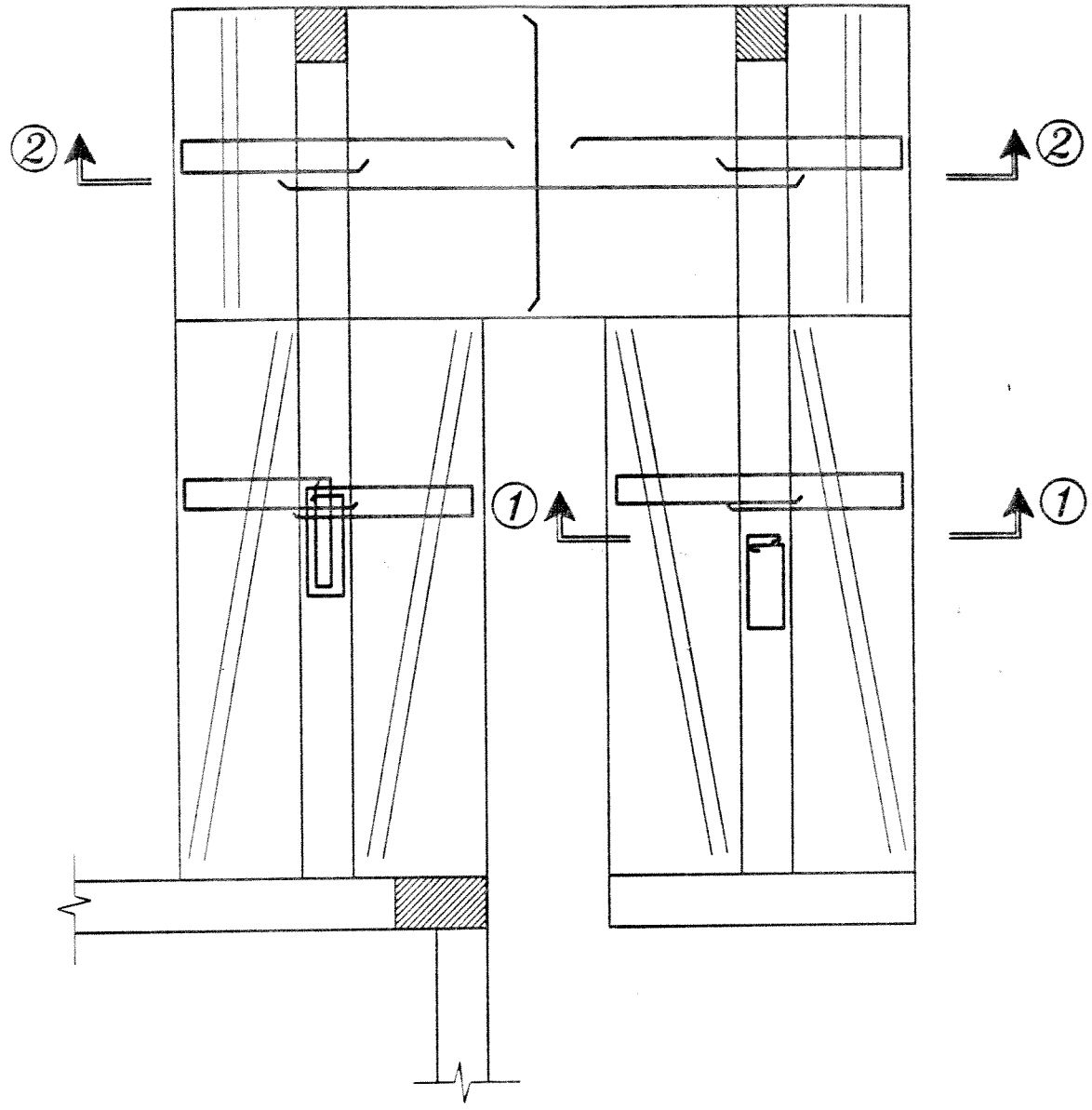
B1

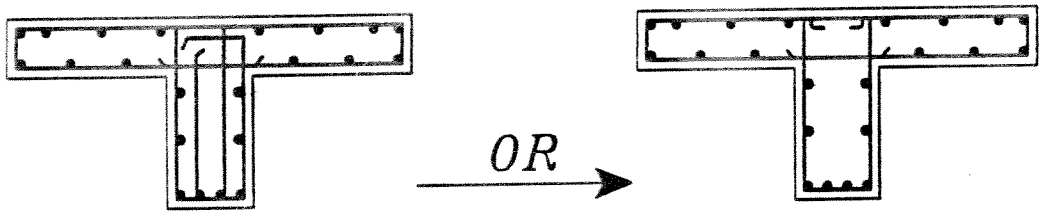


B2



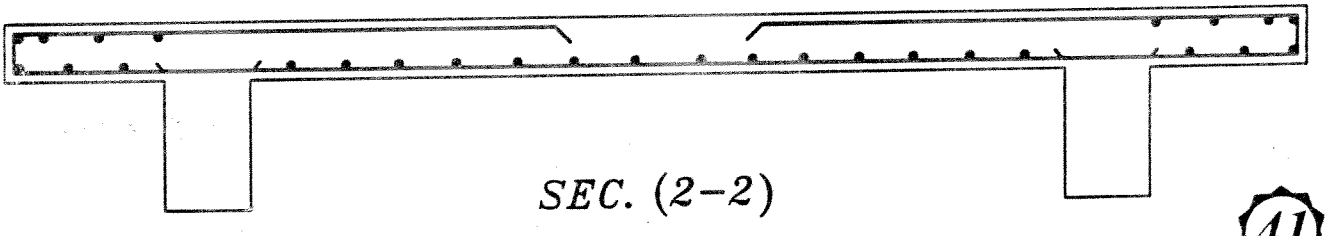
RFT. of the Slab.





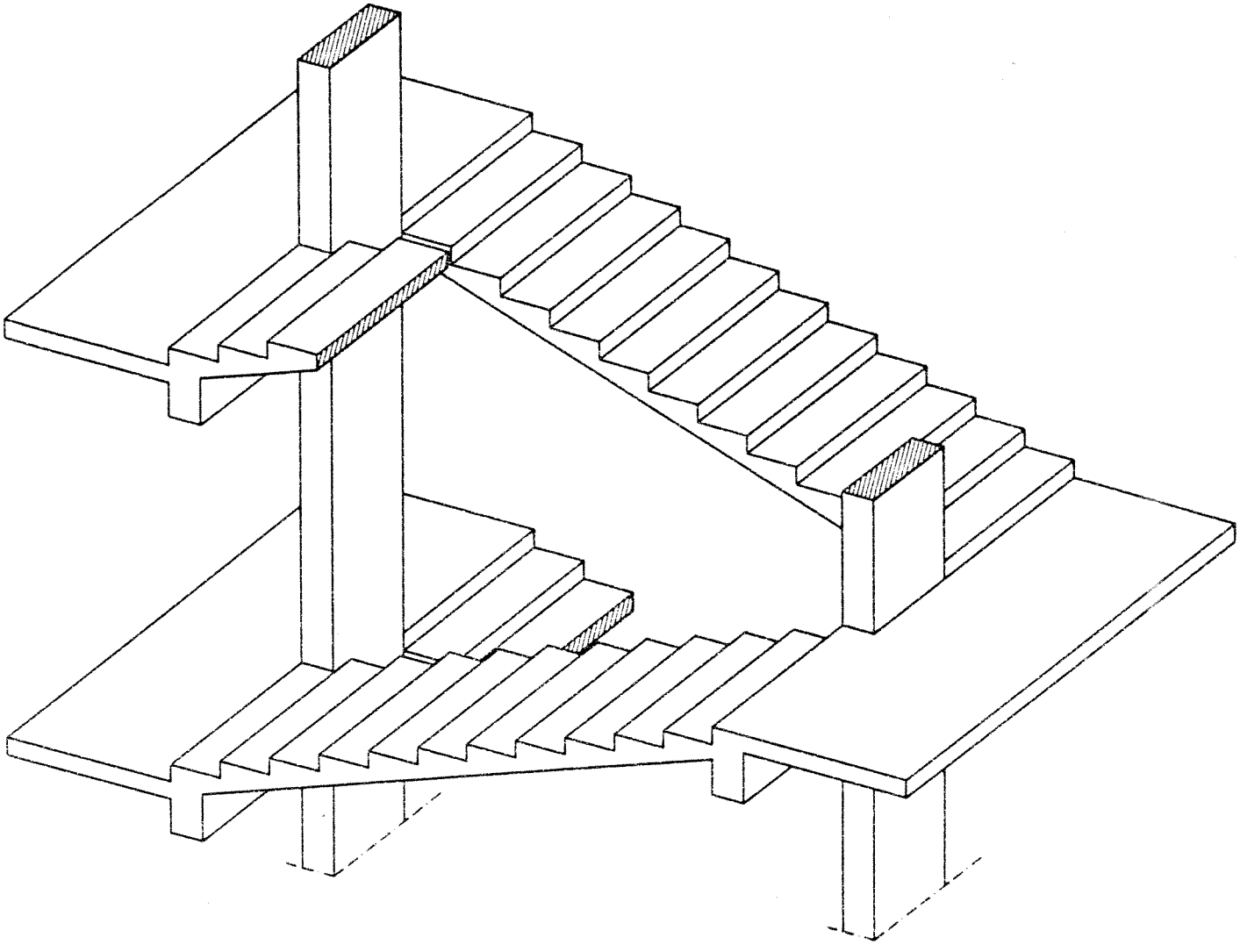
SEC. (1-1)

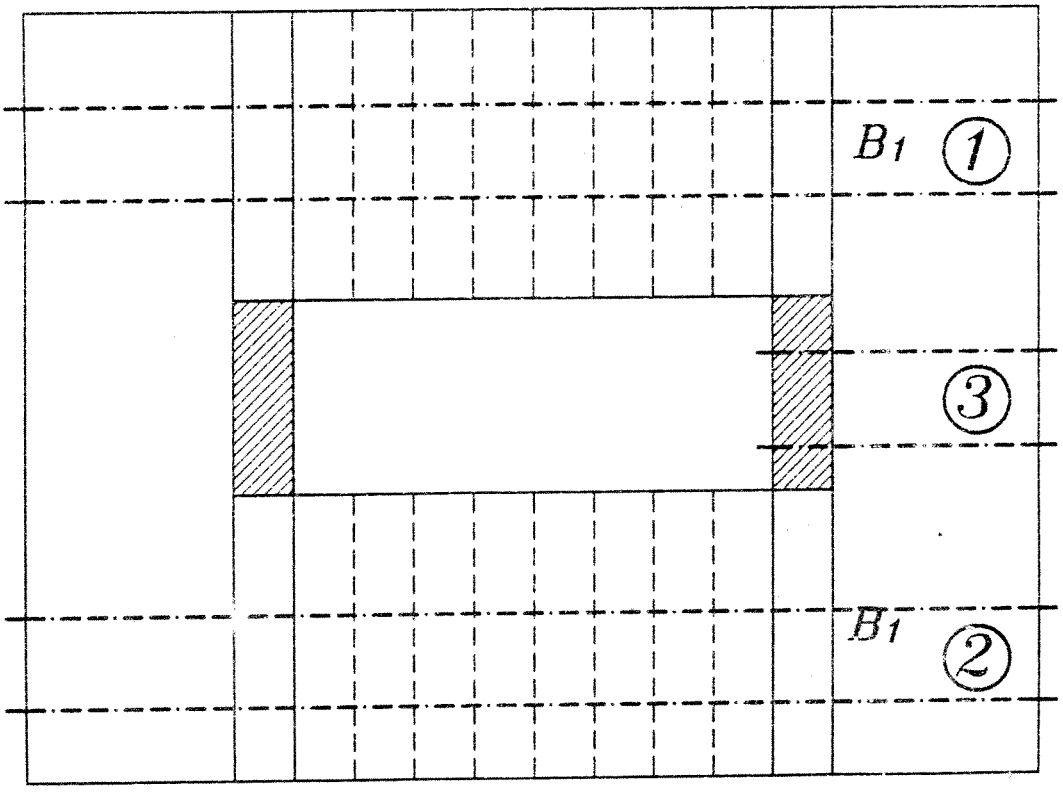
SEC. (1-1)



SEC. (2-2)

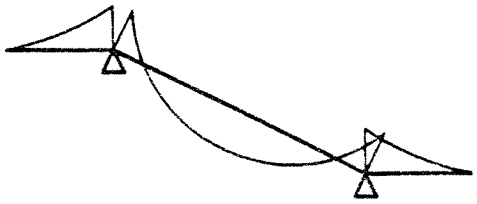
Example.

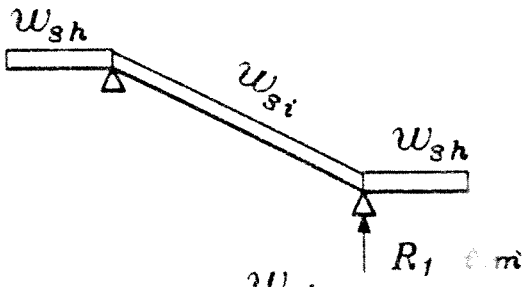




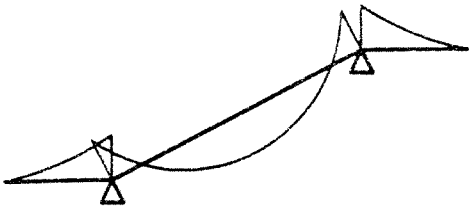
Slabs.

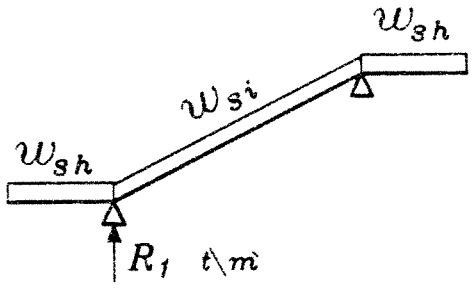
Strip ①





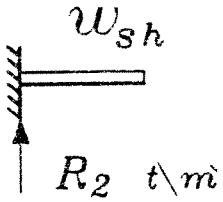
Strip ②





Strip ③

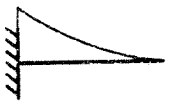
M_2 ← moment تعمل على العمود



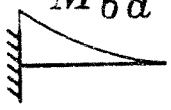
Beams.

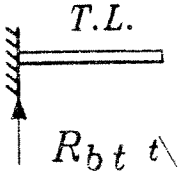
B1

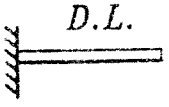
M_{bt} ← moment تعمل على العمود



M_{bd}







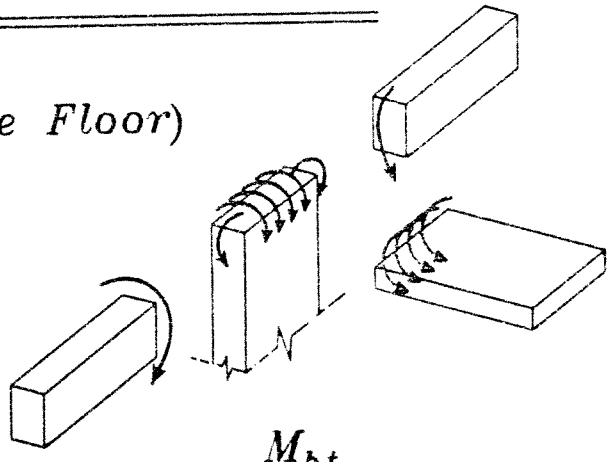
Column.

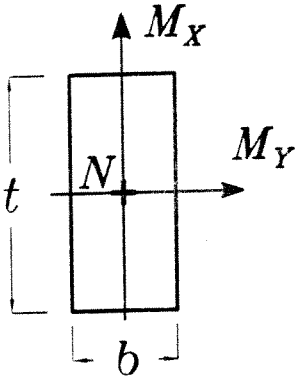
(Loads From one Floor)

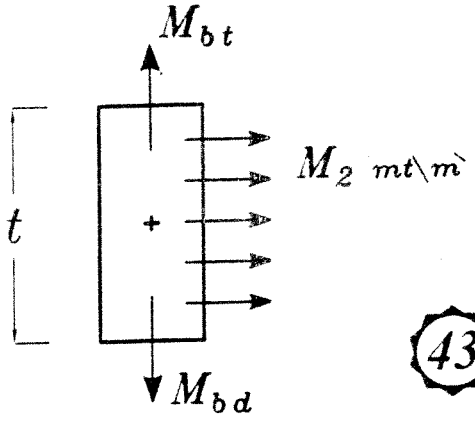
$N = R_2 * t + 2(R_{bt})$

$M_Y = M_2 * t = \checkmark$ m.t.

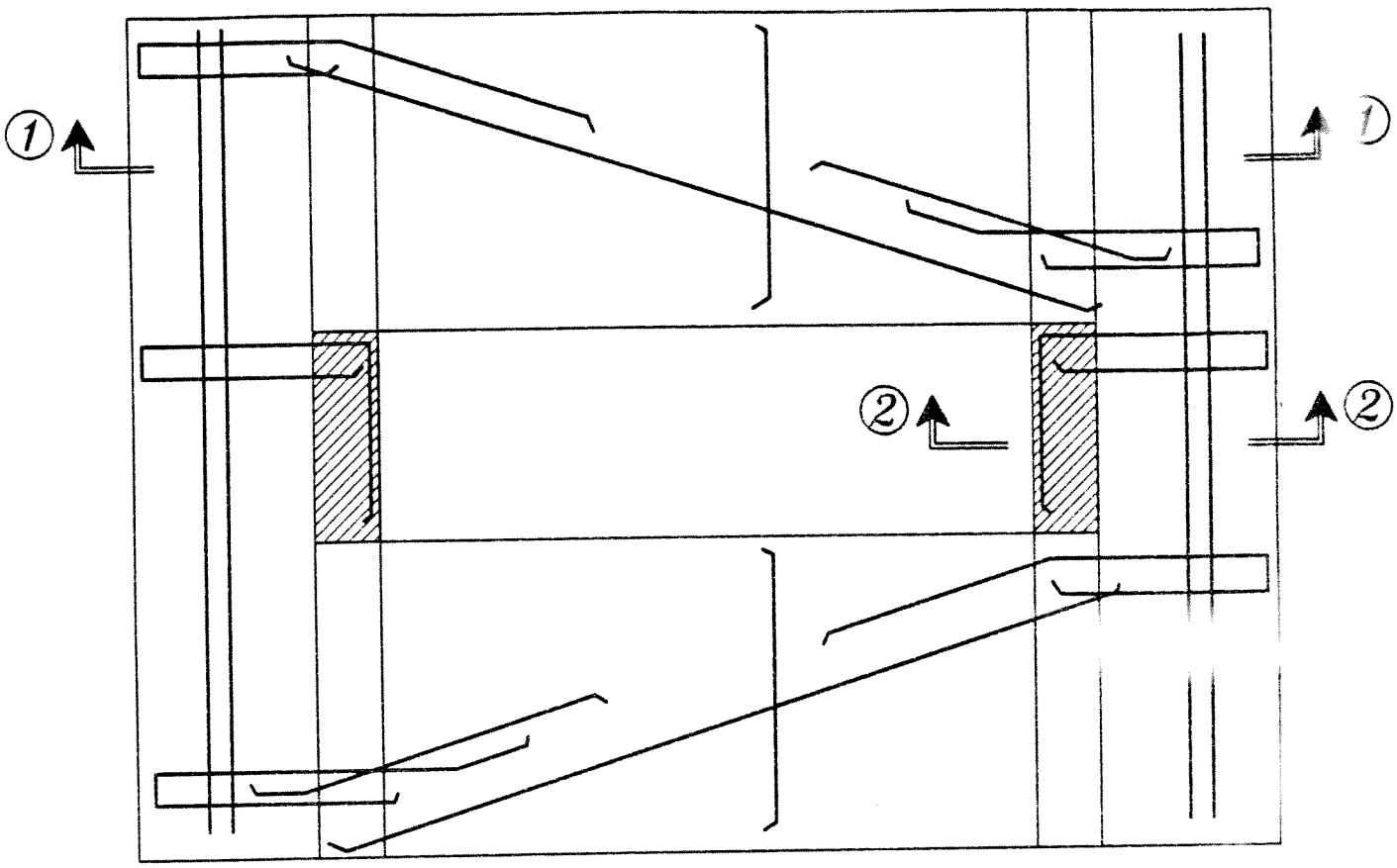
$M_X = M_{bt}\uparrow - M_{bd}\downarrow = \checkmark$ m.t.

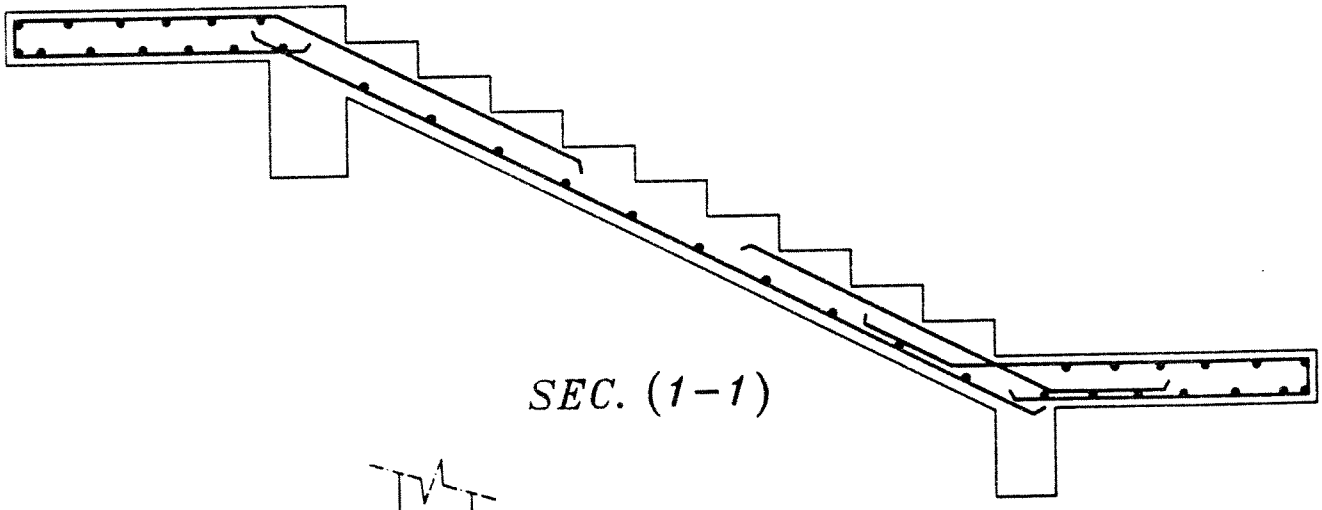




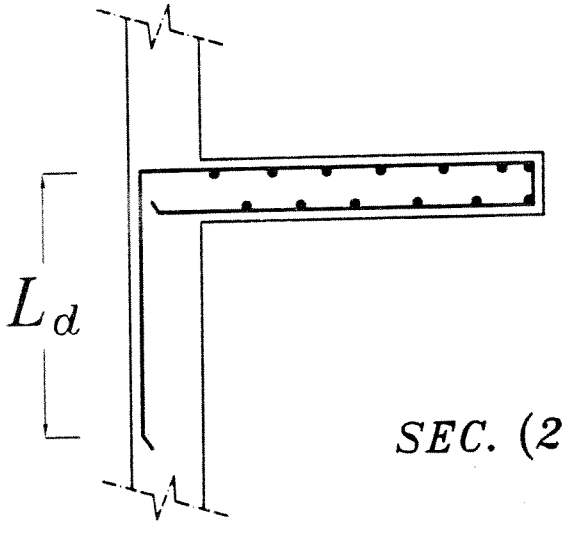


RFT. of the Slab.





SEC. (1-1)



SEC. (2-2)