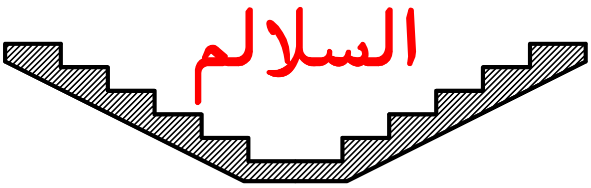
Stairs

السلالم

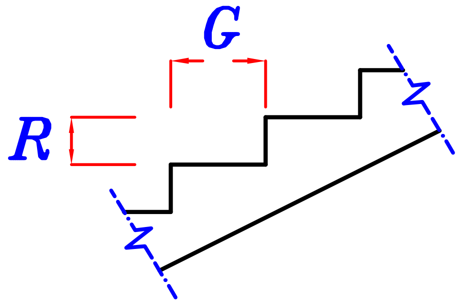


نسألكم الدعاء

Stairs. Table of Contents.

Dimensions.

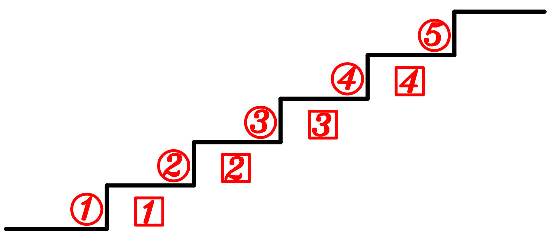
- Rise (قائمه) $= R = (14 \rightarrow 18\ cm)$
- Going (نائمه) $= G = (26 \rightarrow 30\ cm)$



$R = 15\ cm\ ,\ G = 30\ cm$ عاده تؤخذ

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

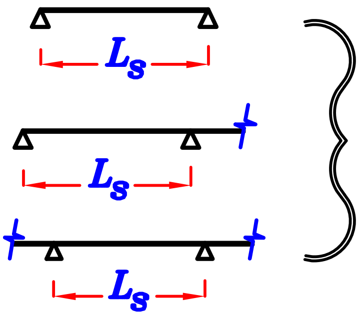
- No of Goings = No of Rises − 1



No of Goings = No of Rises − 1

- min. width of stair $= 120\ cm$

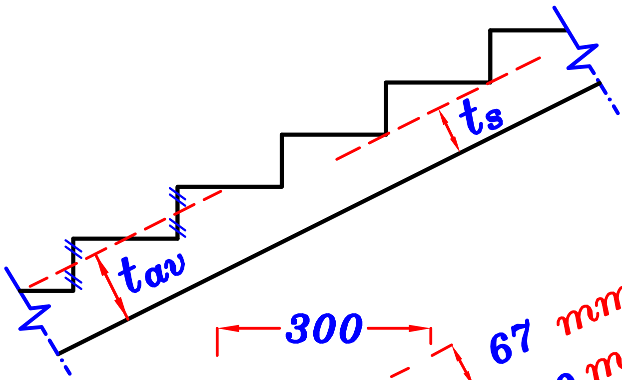
- $t_s = \frac{L_s}{25}$
  $= \frac{L_s}{30}$
  $= \frac{L_s}{36}$



One way slab

يفضل أن تكون بلاطه القلبه One way slab

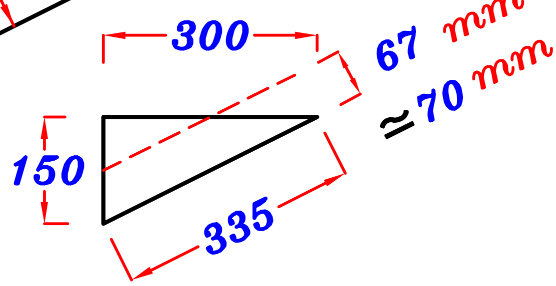
- $t_{av} = t_s + 70\ mm$



- t_s تستخدم فى التصميم .

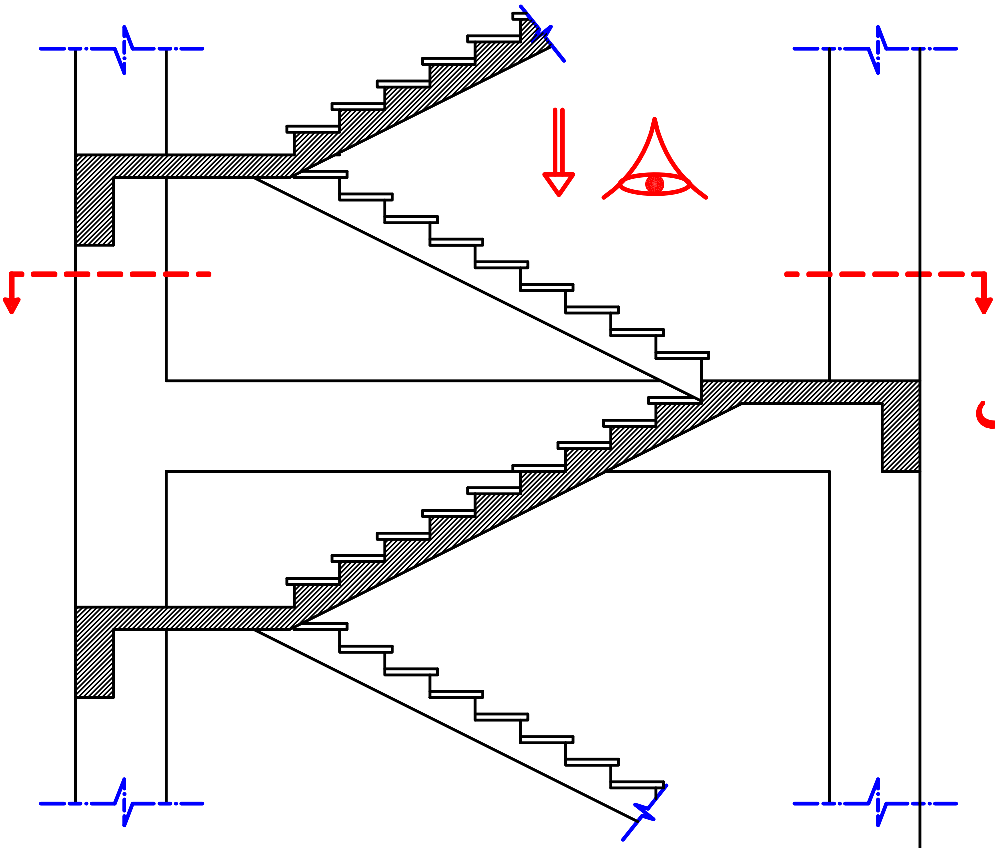
$d = t_s - 20\ mm$

- t_{av} تستخدم فى حساب الأحمال فقط .

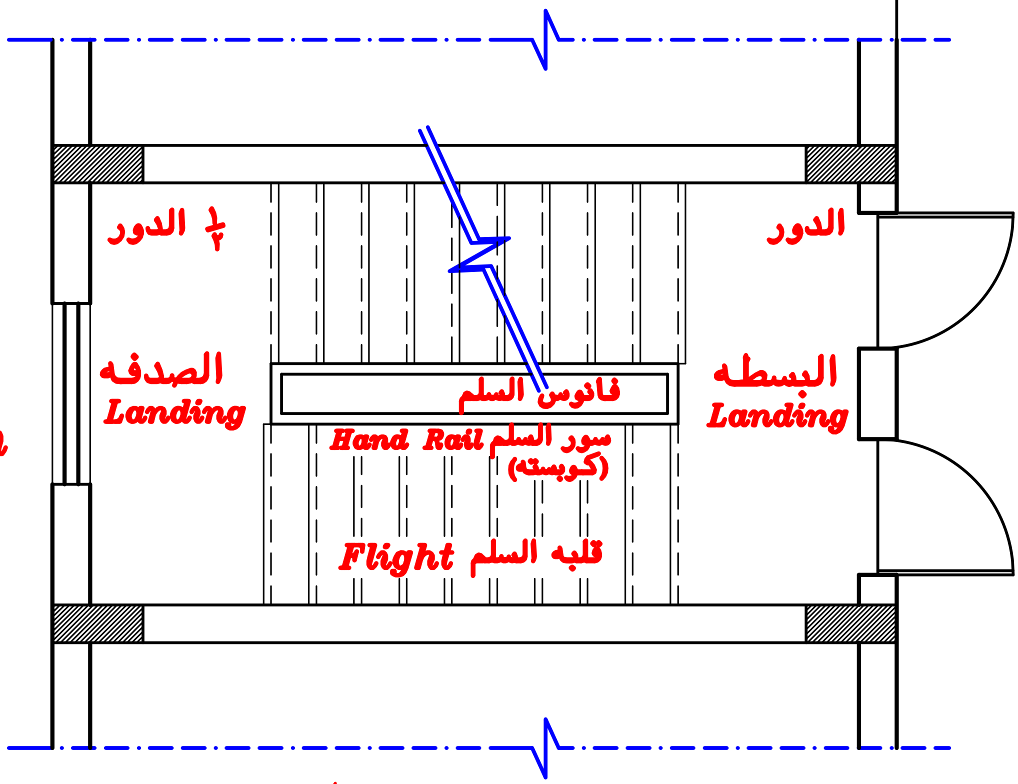


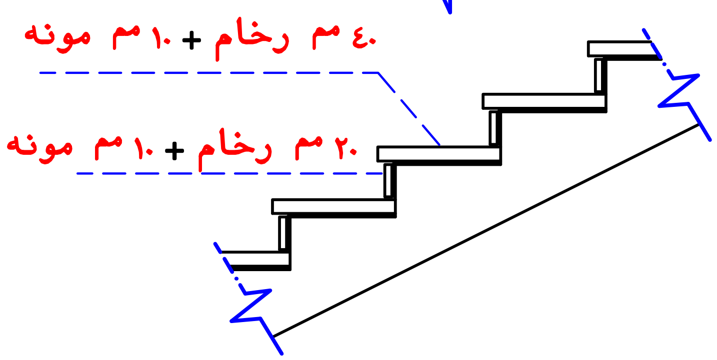
$$\frac{\frac{1}{2} * 150 * 300}{335} = 67 \simeq 70\ mm$$

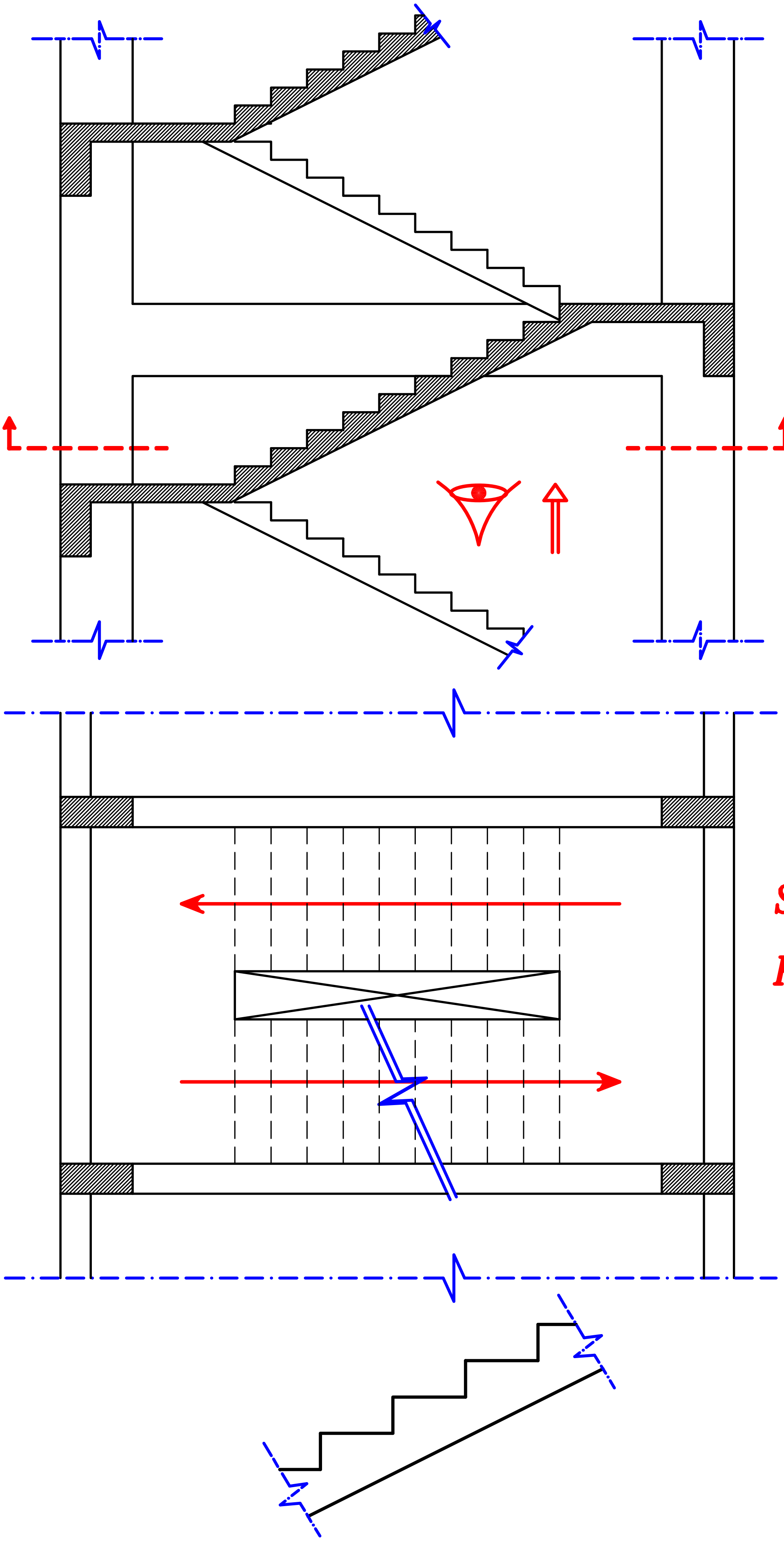
معمارى



Arc. Plan



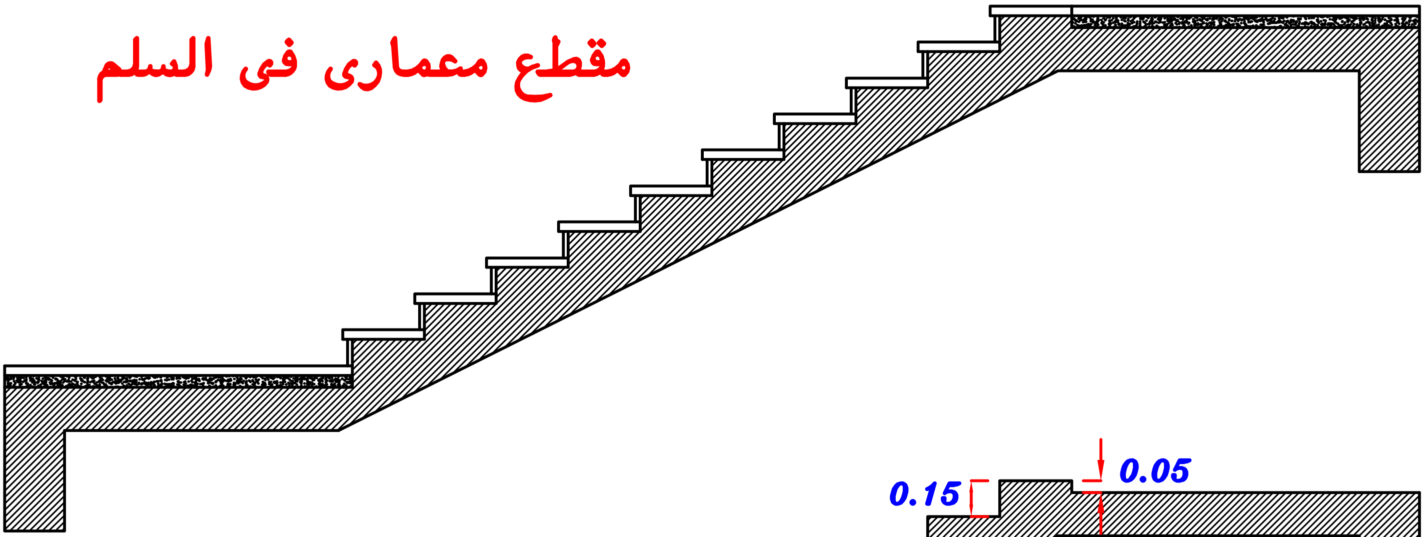




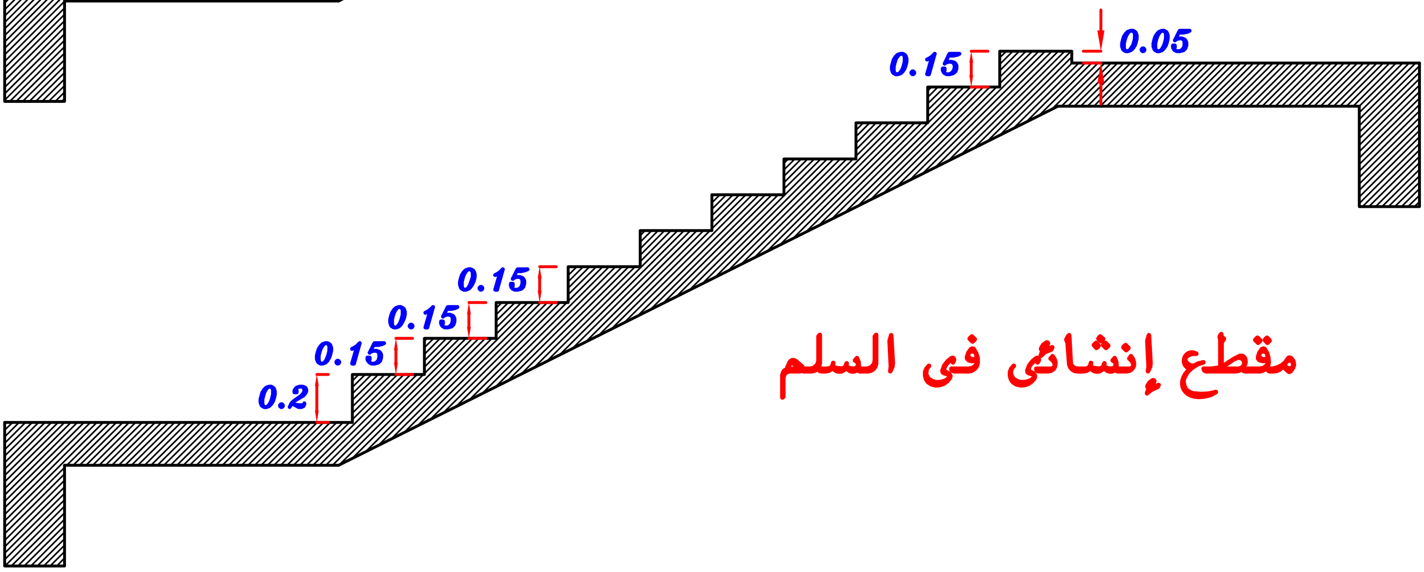
إنشائى

Structural Plan

مقطع معمارى فى السلم



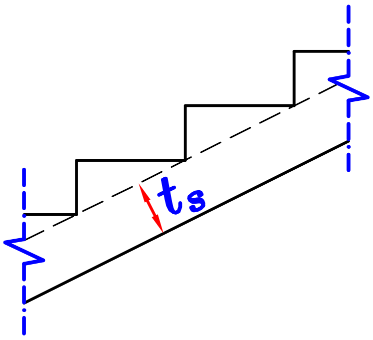
مقطع إنشائى فى السلم

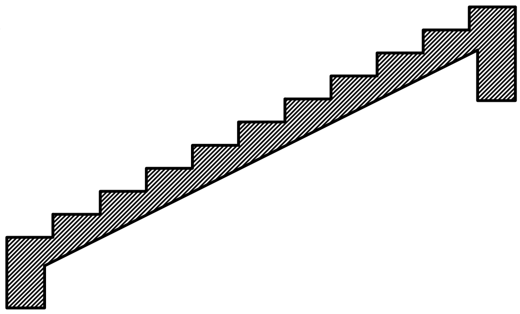


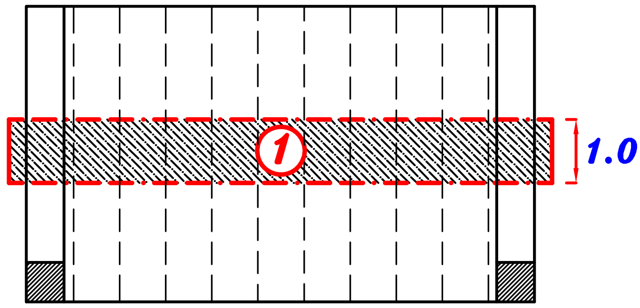
Design of Stairs.

اذا كانت الشريحه عموديه على درجات السلم

Take the strip width = 1.0 m

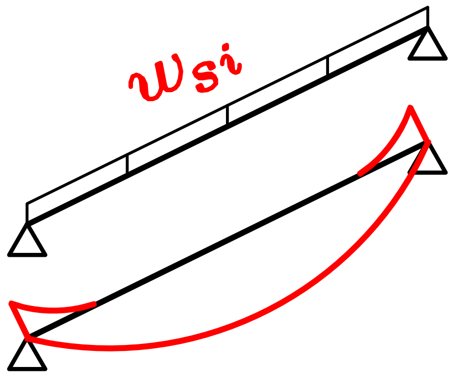




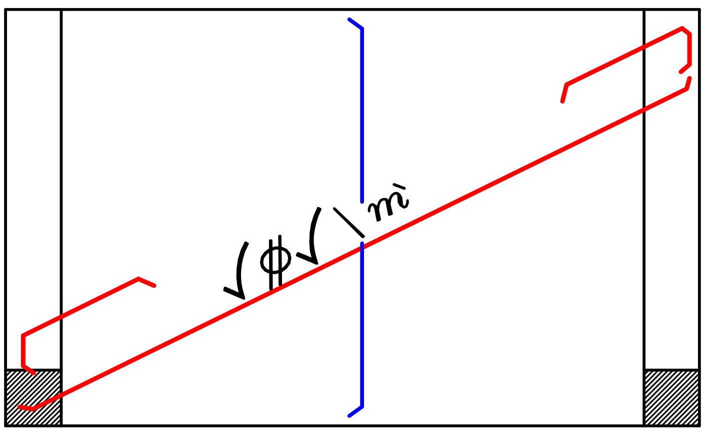


- $t_{av} = t_s + 70\ mm$
- $(w_{si}) = 1.4\ (t_{av.}\ \gamma_c + F.C.) + 1.6\ (L.L.)\ Cos\ \theta$
- $d = t_s - 20\ \ mm$
- $d = C_1 \sqrt{\dfrac{M_{U.L.}}{F_{cu}\ B}}$, $B = 1000\ mm$

Get $C_1 \longrightarrow J$

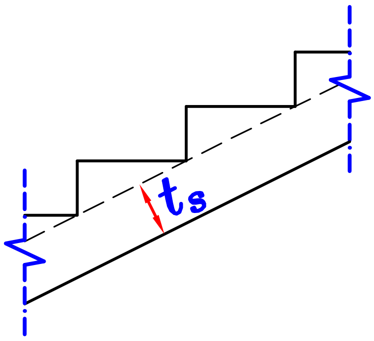


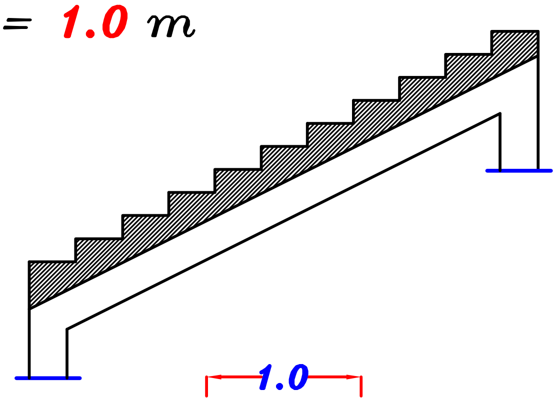
- $A_s = \dfrac{M_{U.L.}}{J\ F_y\ d} = \checkmark\ mm^2 \backslash m' = \checkmark \phi \checkmark \backslash m'$

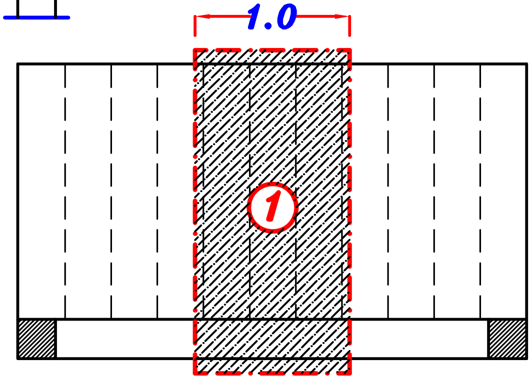


Method ①

Take the strip width = 1.0 m





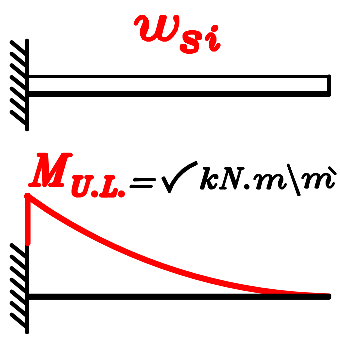


- $t_{av} = t_s + 70\ mm$

- $(w_{si}) = 1.4\,(t_{av.}\,\gamma_c + F.C.) + 1.6\,(L.L.)\,\cos\theta$

- $d = t_s - 20\ mm$

- $M_{des} = M_{U.L.} * \cos\theta$

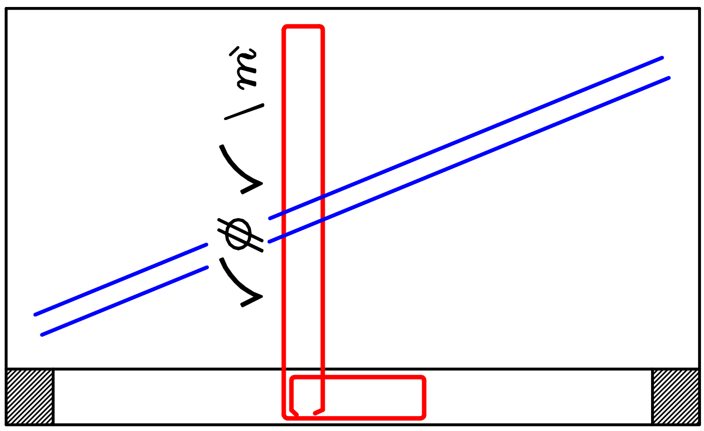


- $d = C_1 \sqrt{\dfrac{M_{des}}{F_{cu}\,B}}$, $B = 1000\ mm$

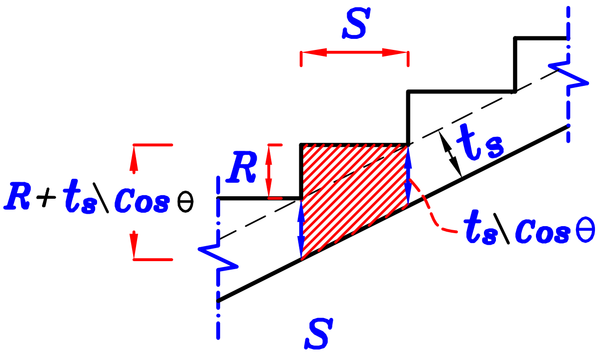
  Get $C_1 \longrightarrow J$

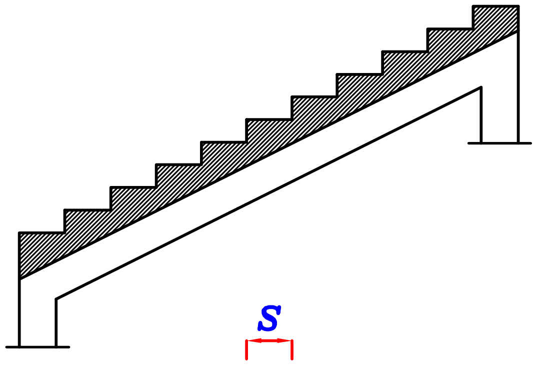
شريحة أفقية فى بلاطة مائلة

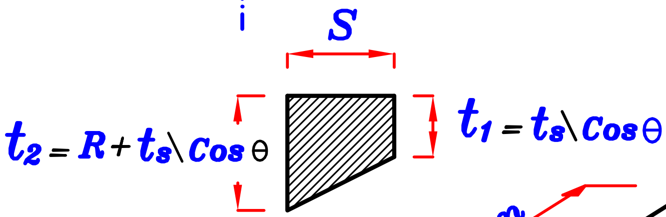
- $A_s = \dfrac{M_{U.L.}}{J\,F_y\,d} = \checkmark\ mm^2 \backslash m' = \checkmark \phi \checkmark \backslash m'$

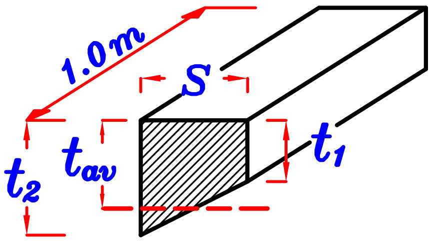


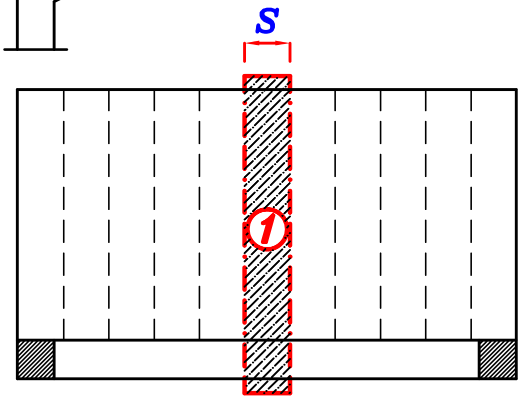
Method ② Take the strip width = S = Step width



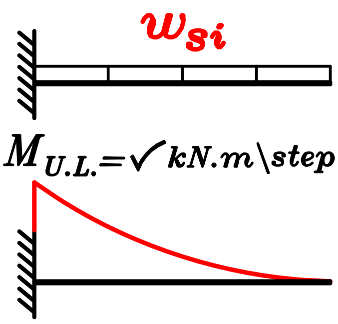




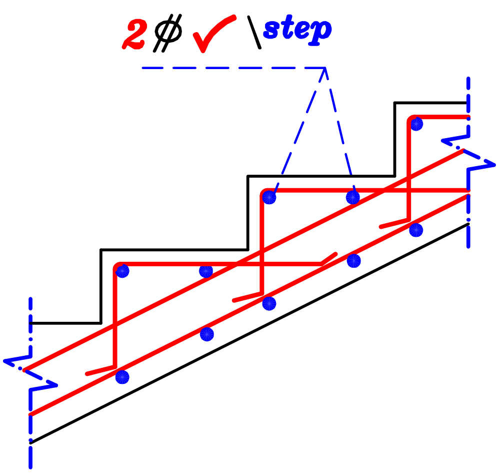


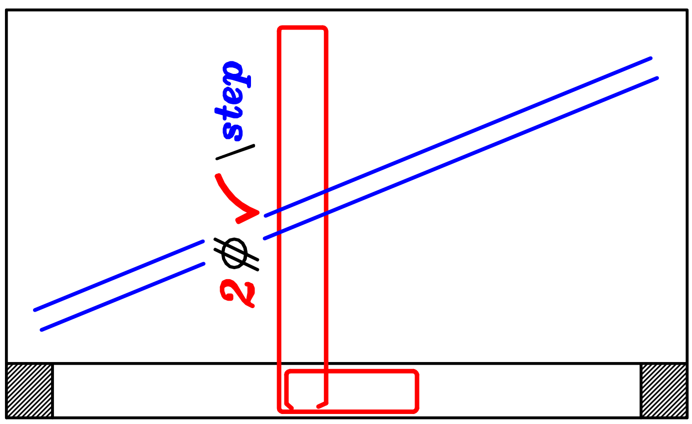


$$t_{av} = \frac{t_1 + t_2}{2}$$



- $o.w.\ (For\ step) = t_{av} * S * \gamma_c \quad (kN\backslash m`)$
- $w_{si} = 1.4\left[o.w.\ (For\ step) + F.C.(S)\right] + 1.6\left[L.L.(S)\right]$
- $d = t_{av} - 20\ mm$
- $d = C_1 \sqrt{\dfrac{M_{U.L.}}{F_{cu}\ S}}$, Get $C_1 \longrightarrow J$
- $A_S = \dfrac{M_{U.L.}}{J\ F_y\ d} = ✓\ mm^2\backslash\ step = 2\ \phi\ ✓\backslash\ step$



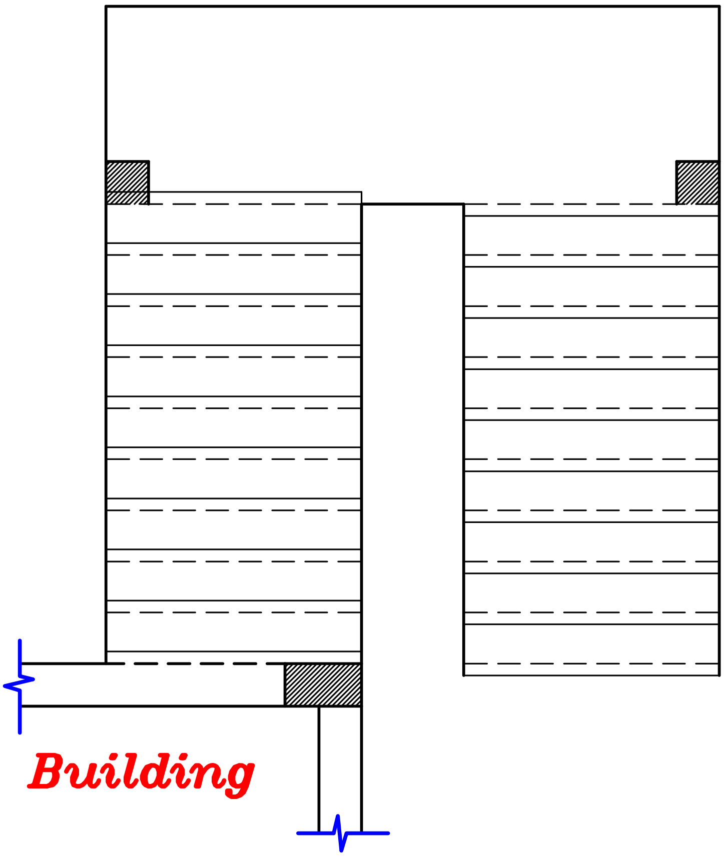


Outdoor Stairs

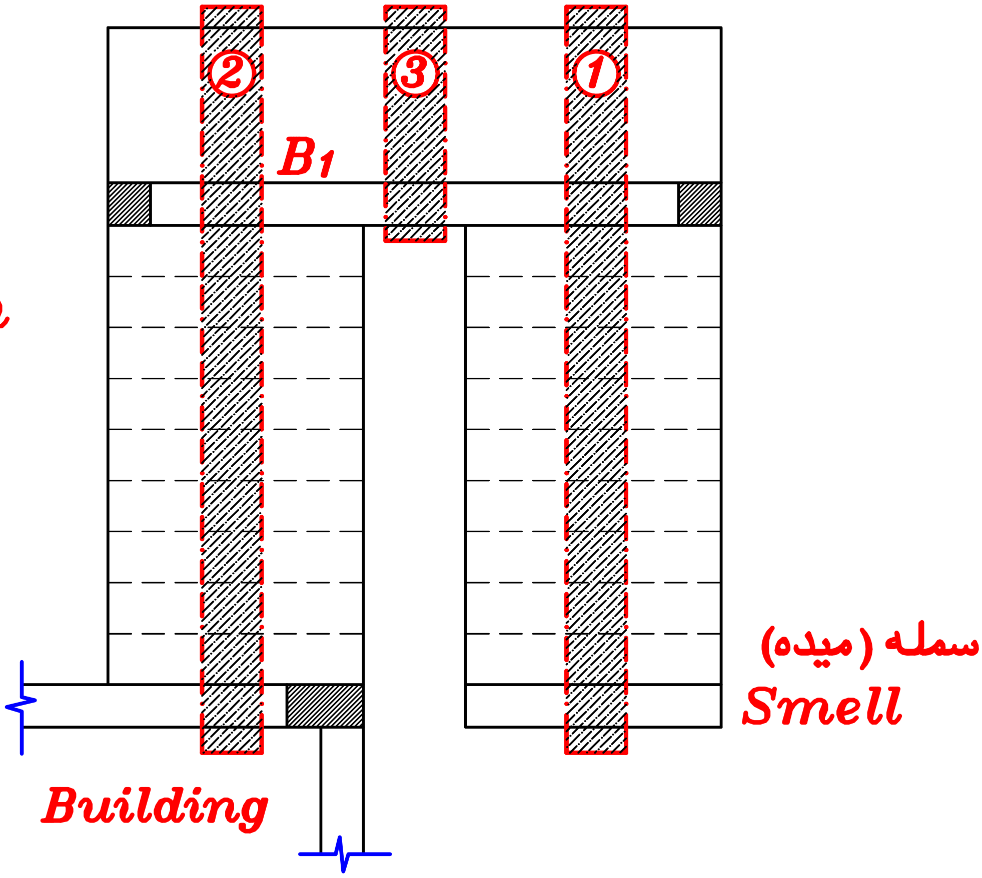
و هى السلالم الخارجيه التى تكون خارج المبنى مثل مدرجات الكليه

Example.

Arc. Plan



Struc. Plan



Slabs.

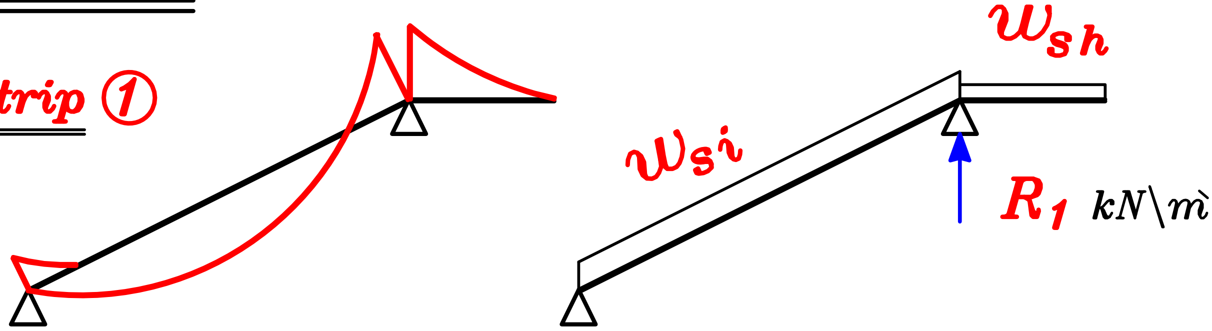
$$t_s = \left.\begin{matrix} \frac{L_s}{30} \\ \frac{L_c}{10} \end{matrix}\right\} \text{الاكبر}$$

$$t_{s_{min}} = 120\ mm$$

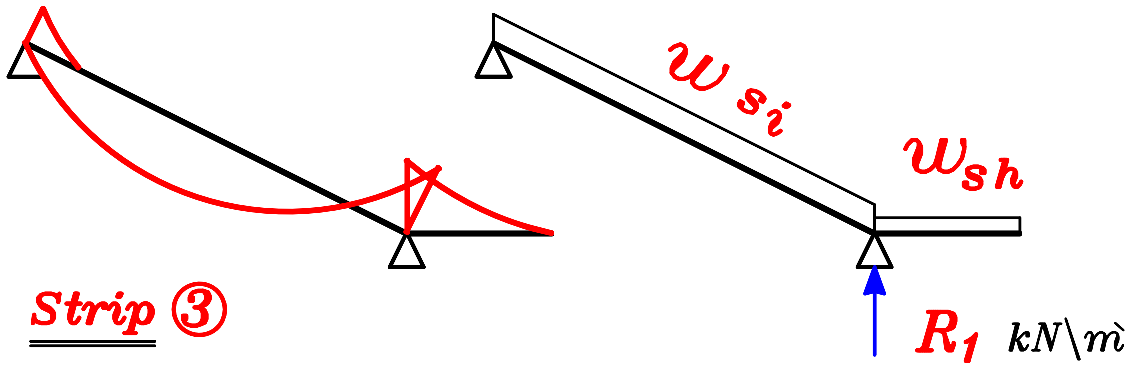
- $t_{av} = t_s + 70\ mm$
- $(w_s)_{Hl.} = t_s \gamma_c + F.C. + L.L.$
- $(w_s)_{in.} = t_{av} \gamma_c + F.C. + L.L. \cos\theta$

Slabs.

Strip ①

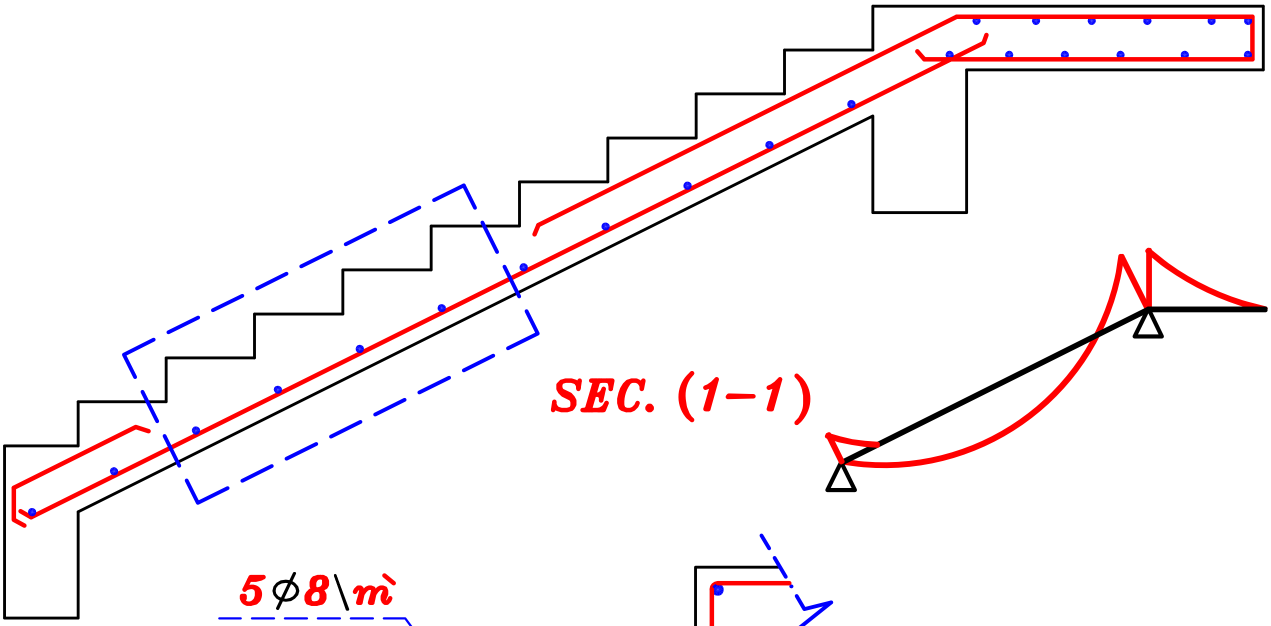


Strip ②

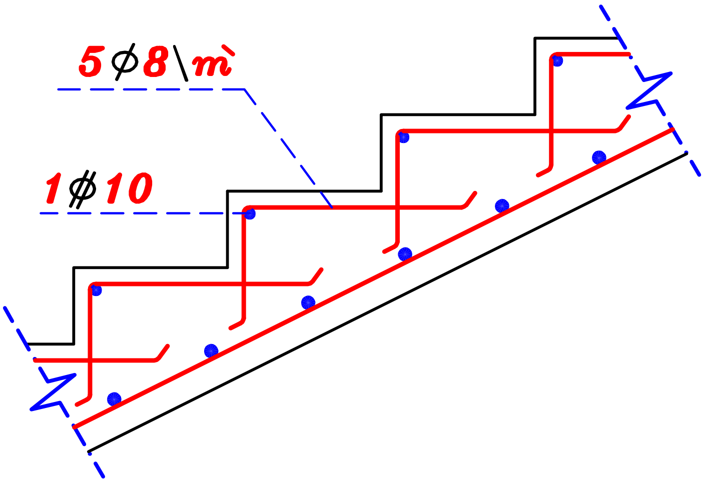


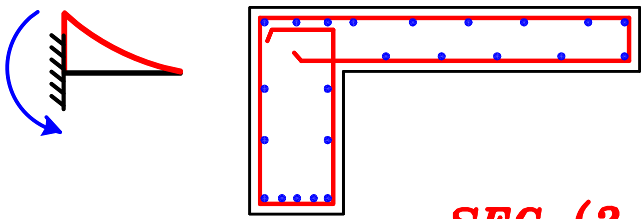
Strip ③

m_t kN.m\m` ← Torsion تعمل على B_1

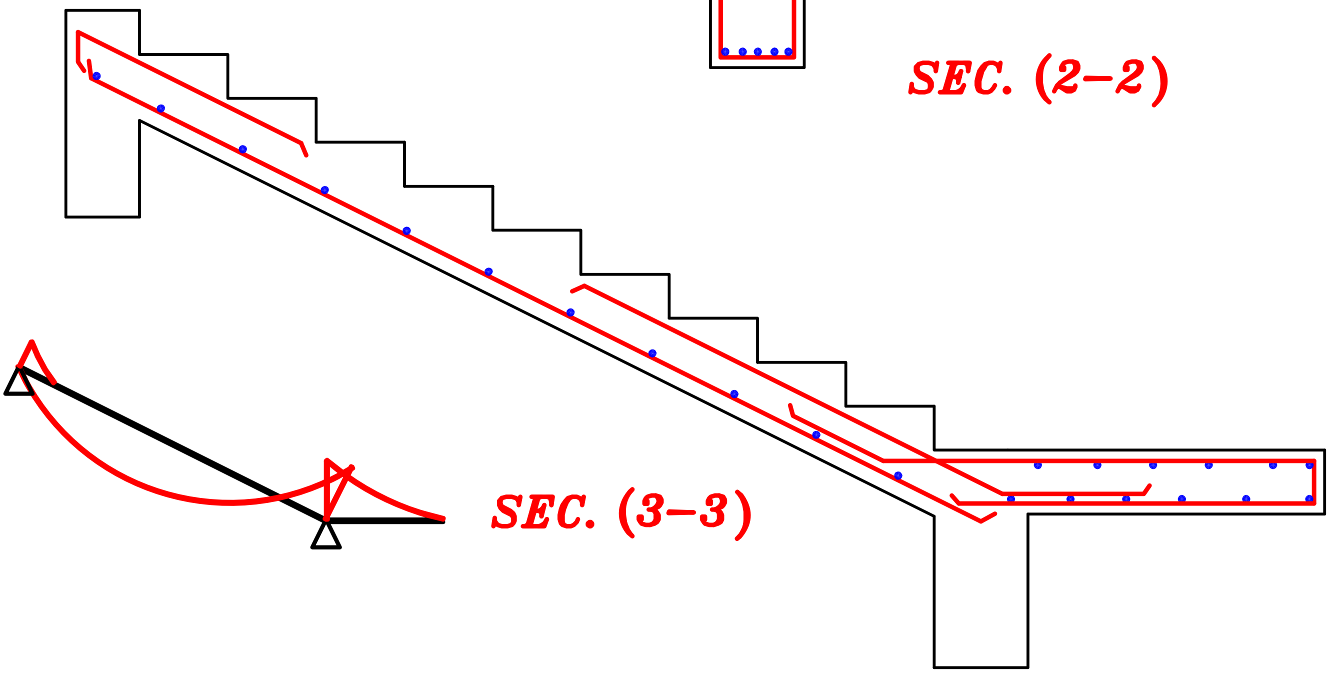


SEC. (1-1)



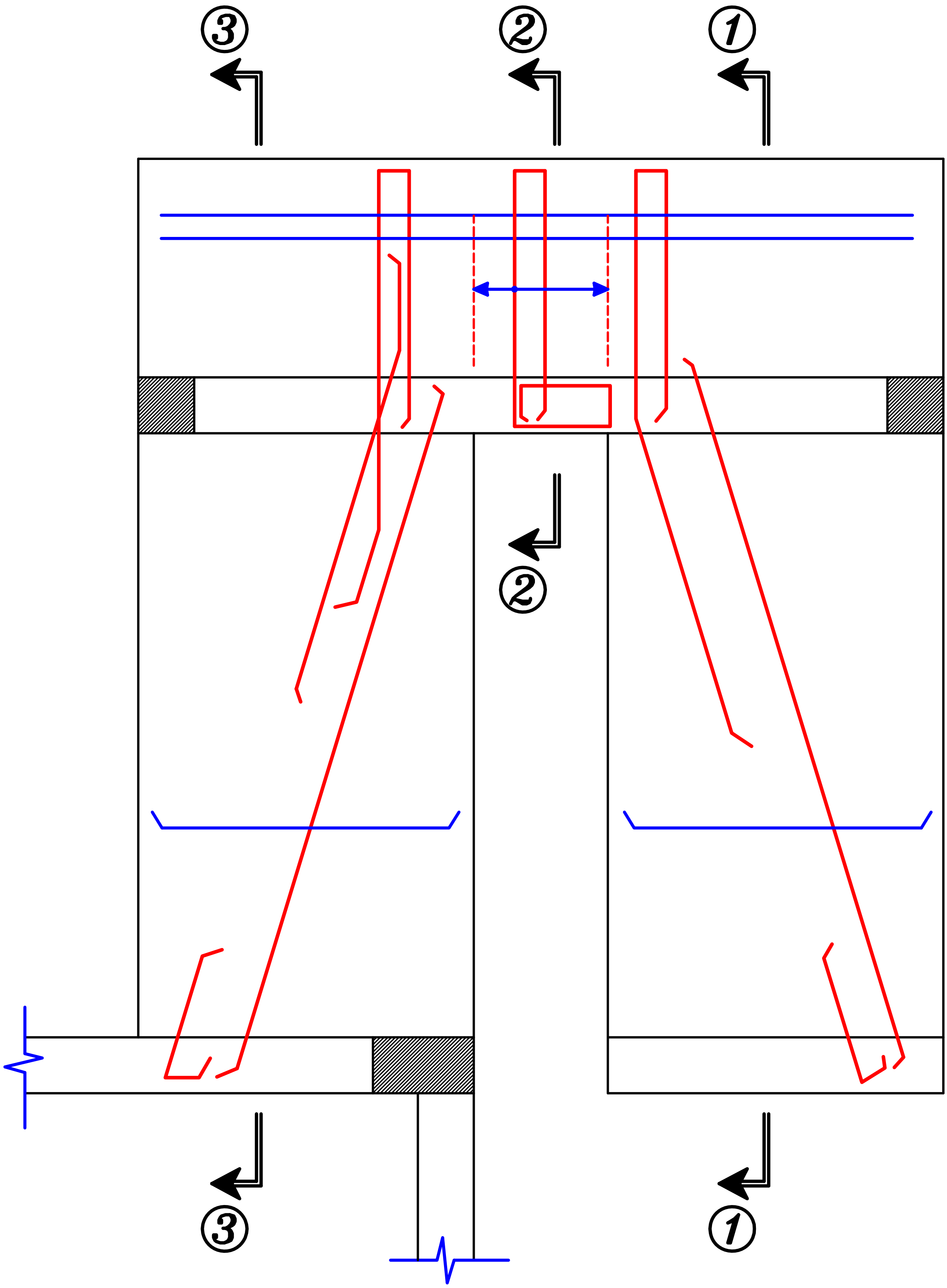


SEC. (2-2)



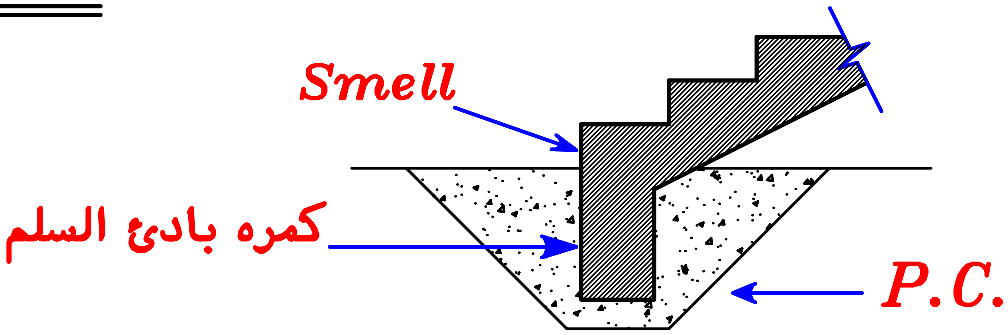
SEC. (3-3)

RFT. of the Slab.



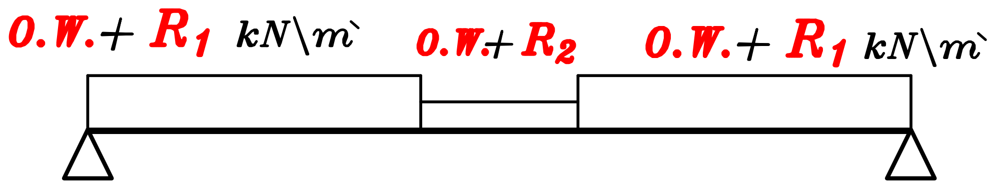
Beams.

Smell.

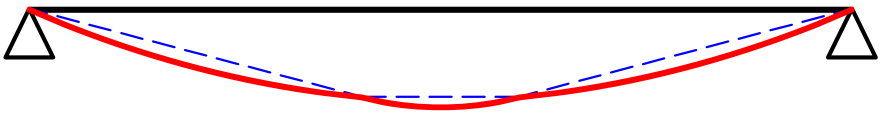


B_1

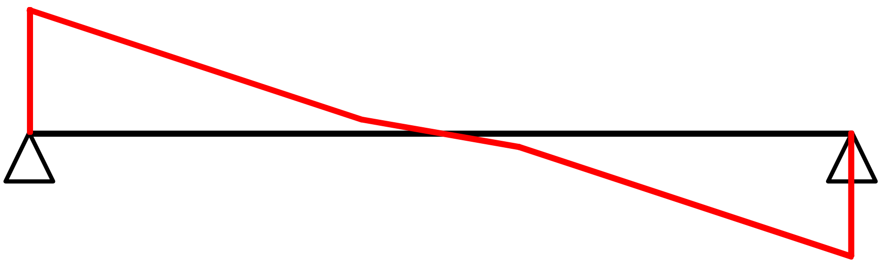
Loads



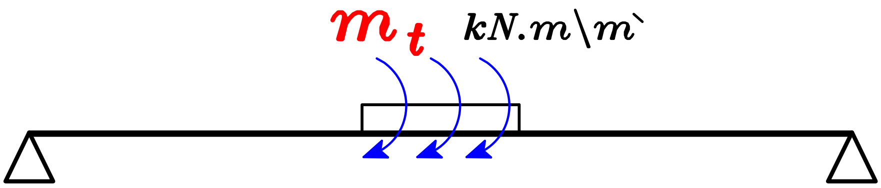
B.M.D.



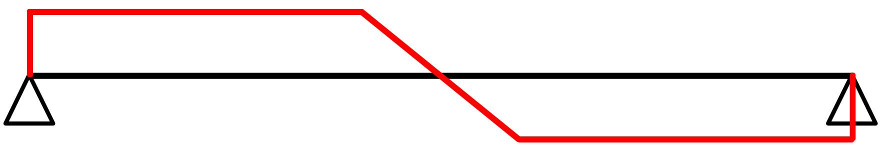
S.F.D.



M_t

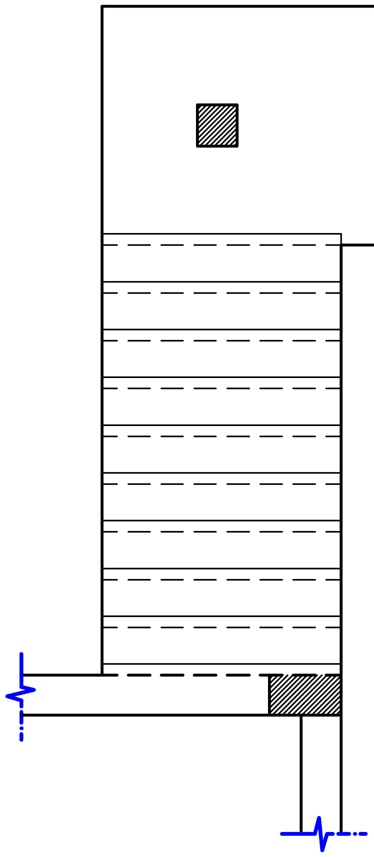


T.M.D.

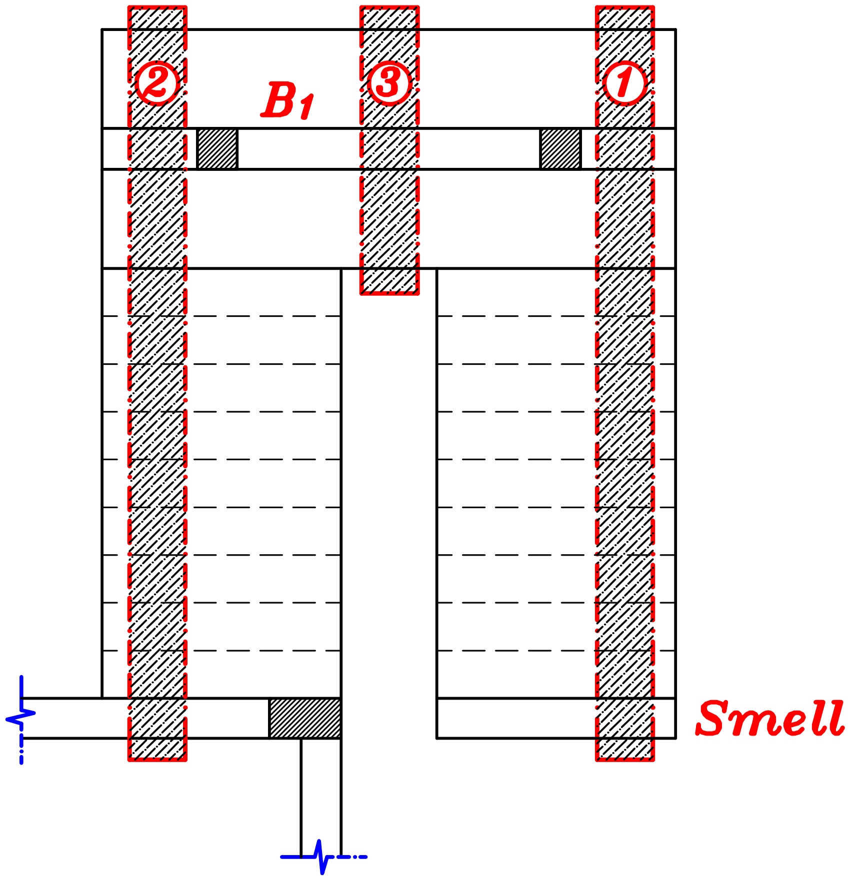


Example.

Arc. Plan

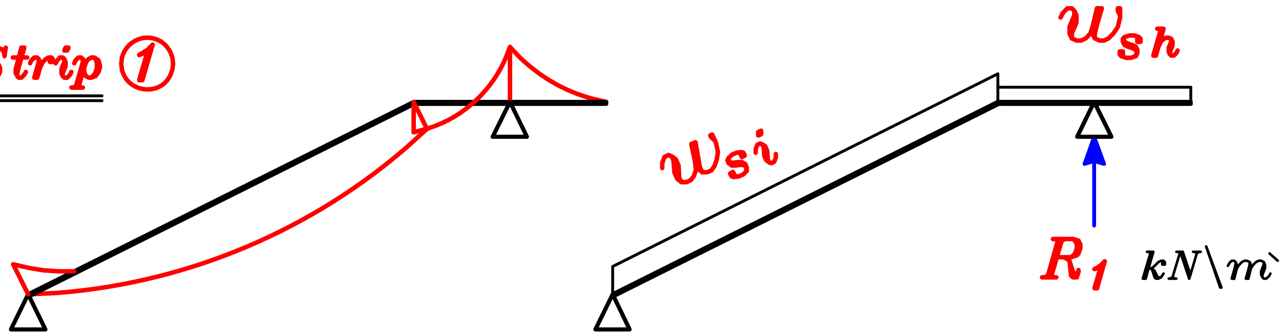


Struc. Plan

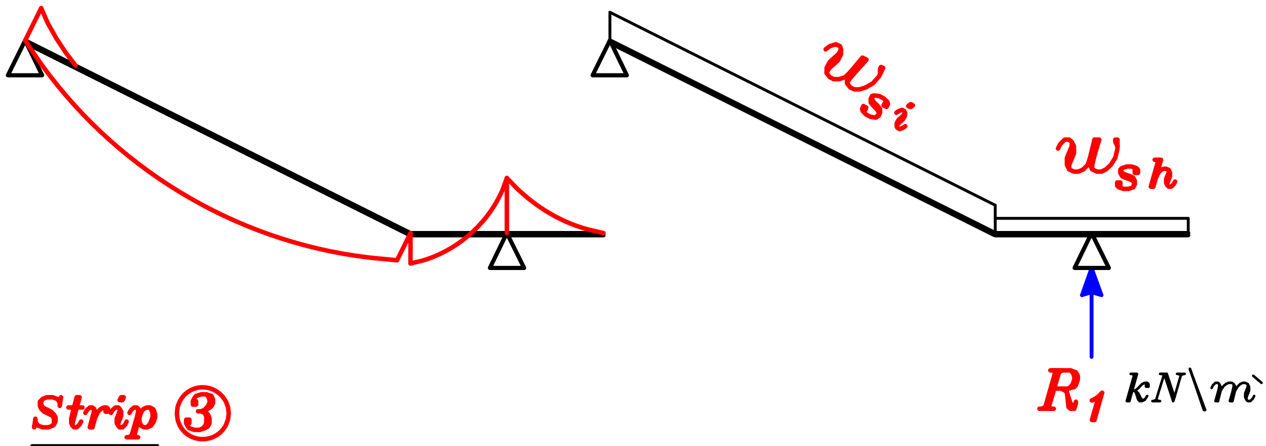


Slabs.

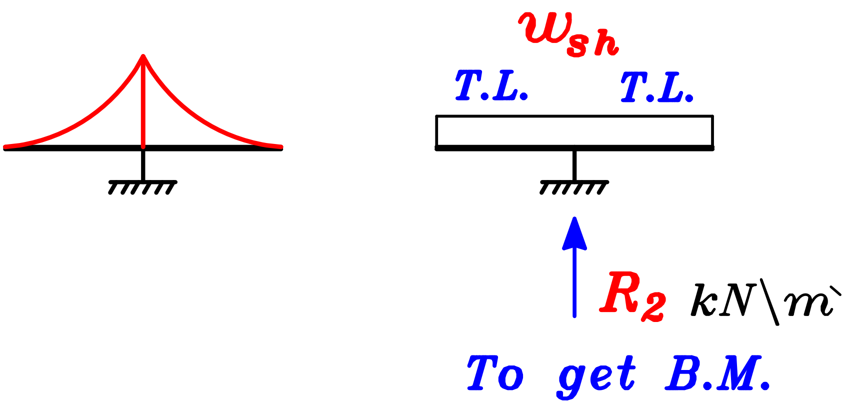
Strip ①

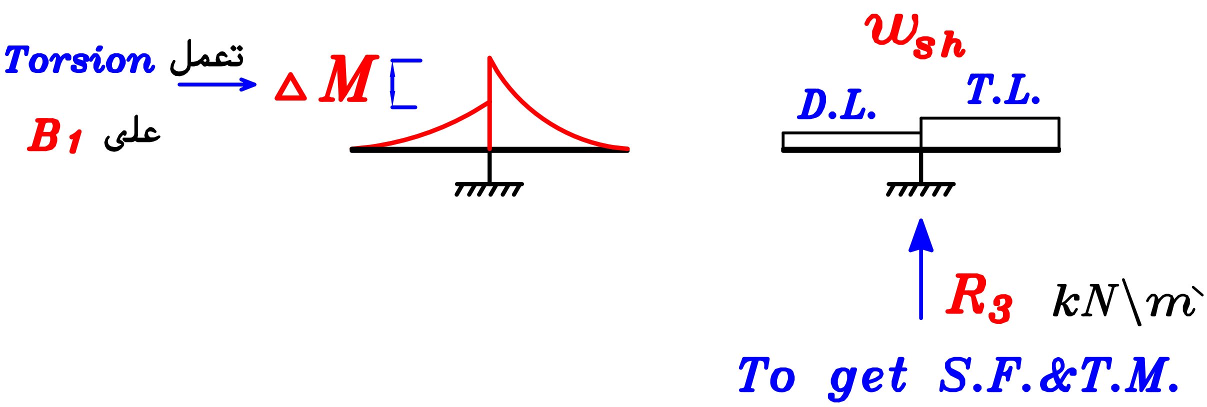


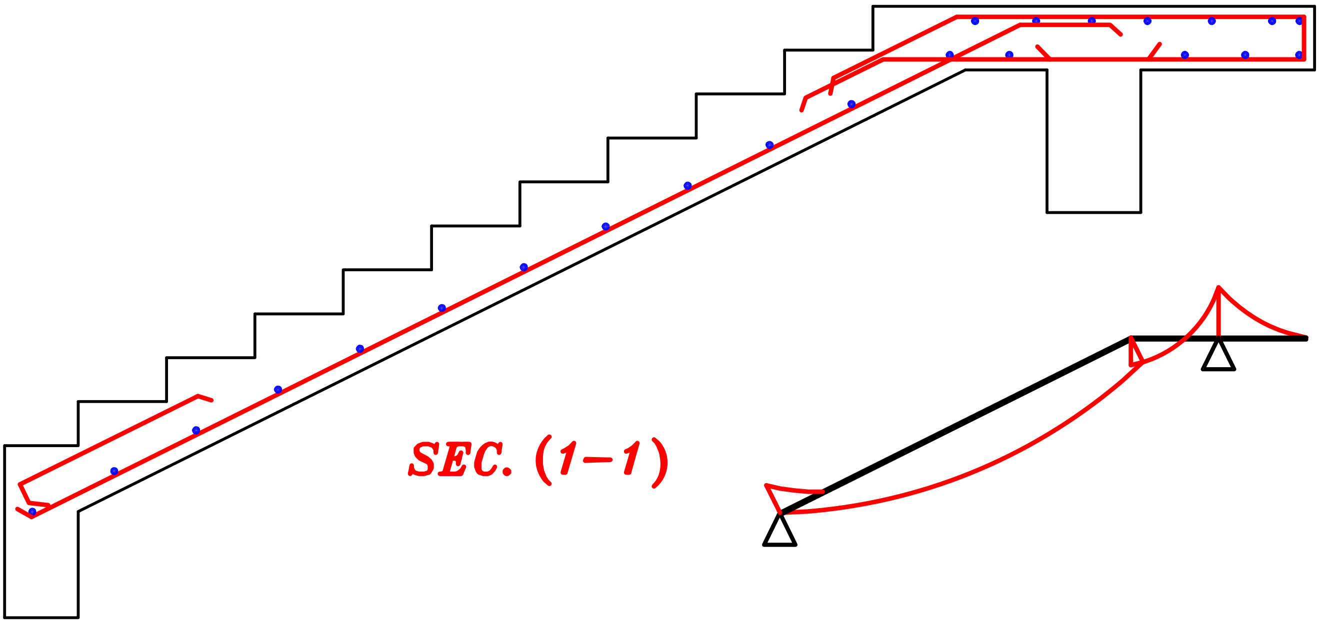
Strip ②



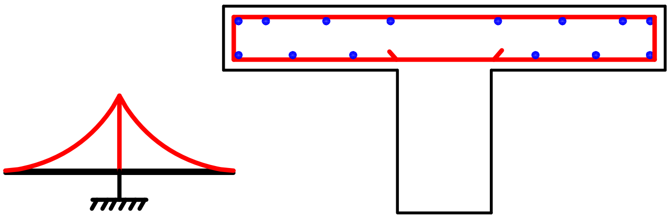
Strip ③



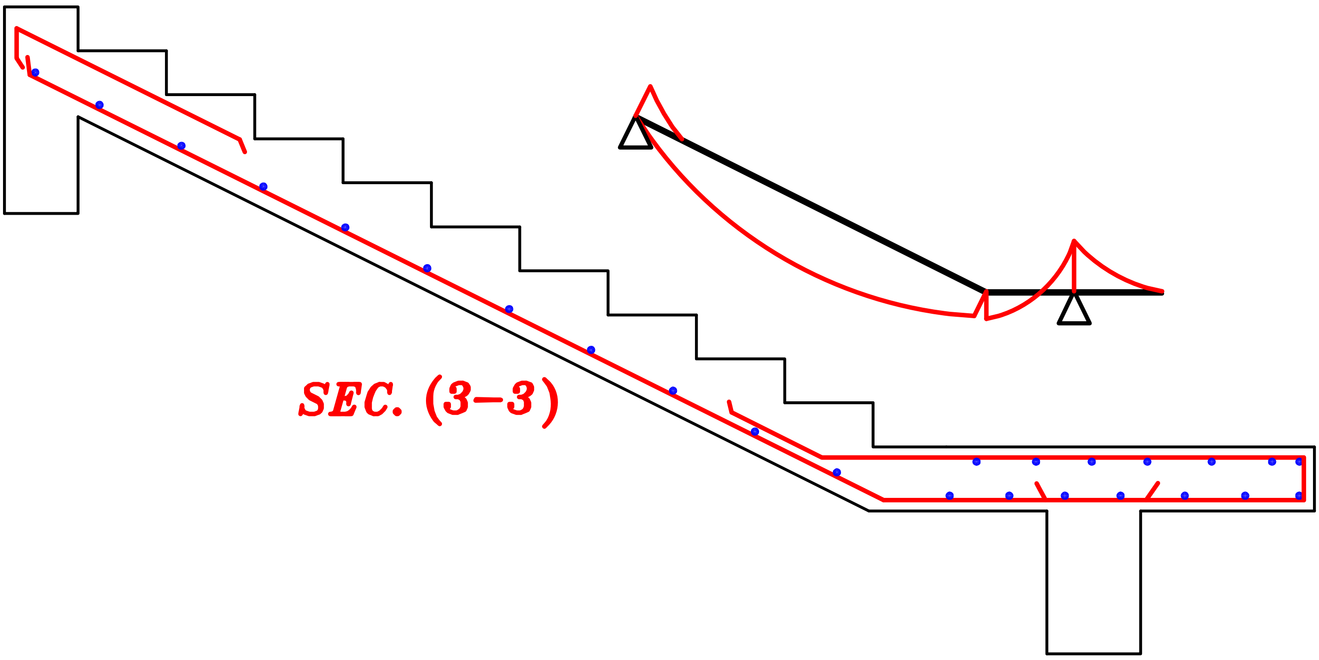




SEC. (1-1)

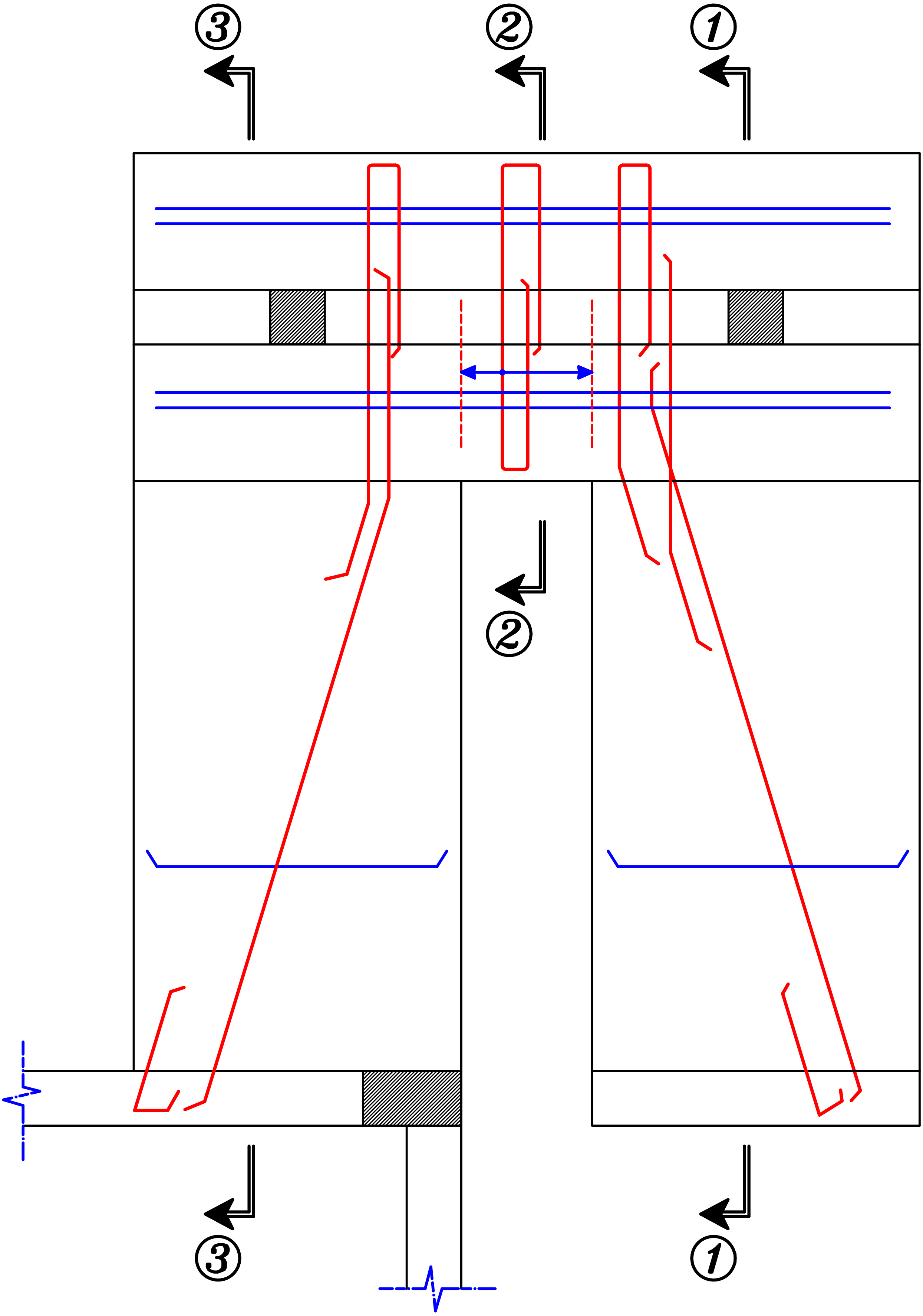


SEC. (2-2)



SEC. (3-3)

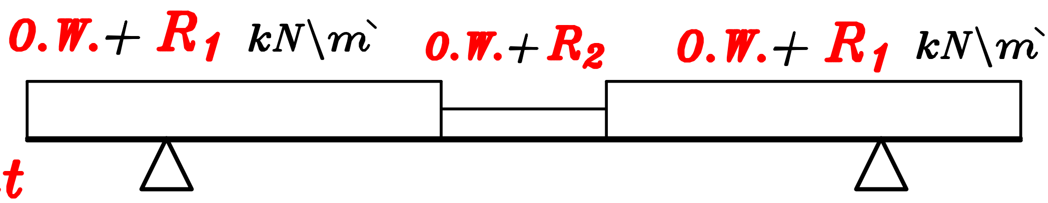
RFT. of the Slab.



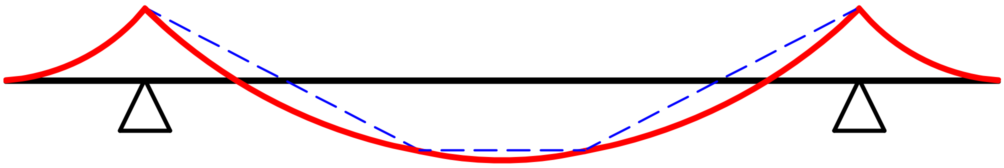
Beams.

B_1

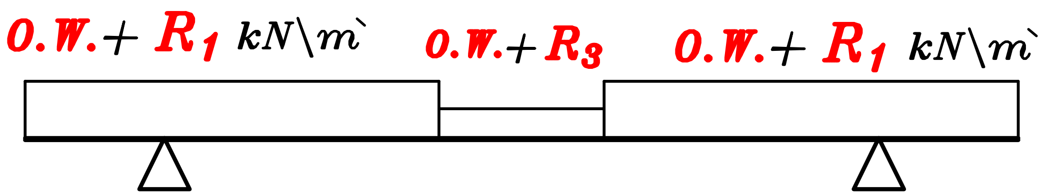
Loads For Moment



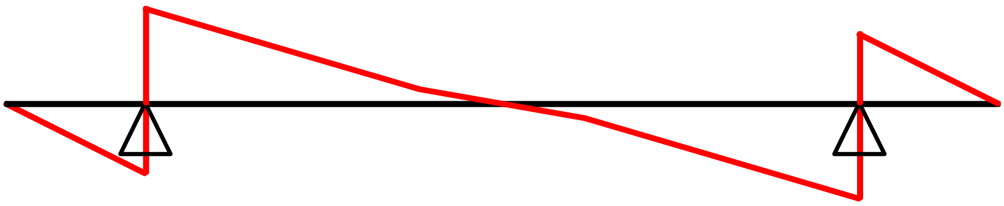
B.M.D.



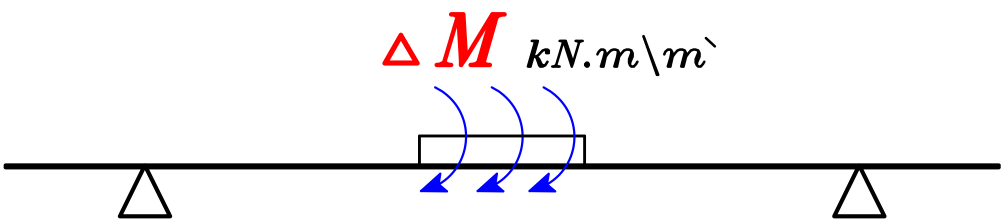
Loads For Shear



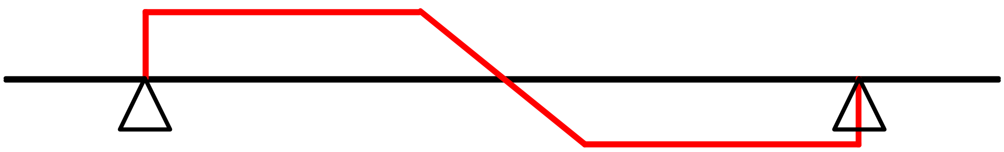
S.F.D.



M_t

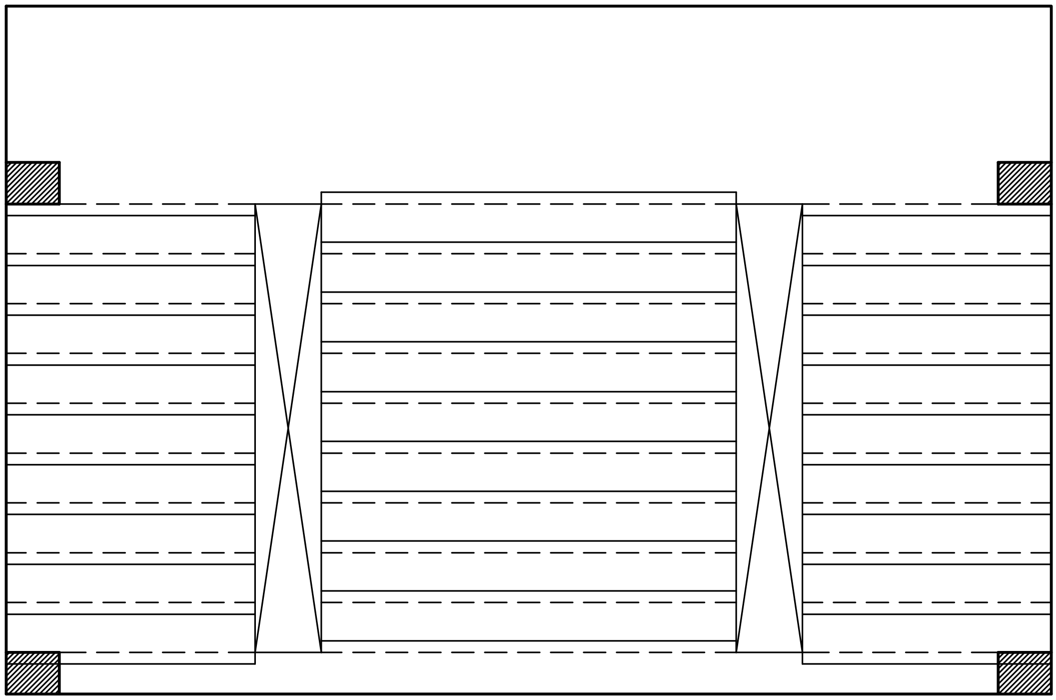


T.M.D.

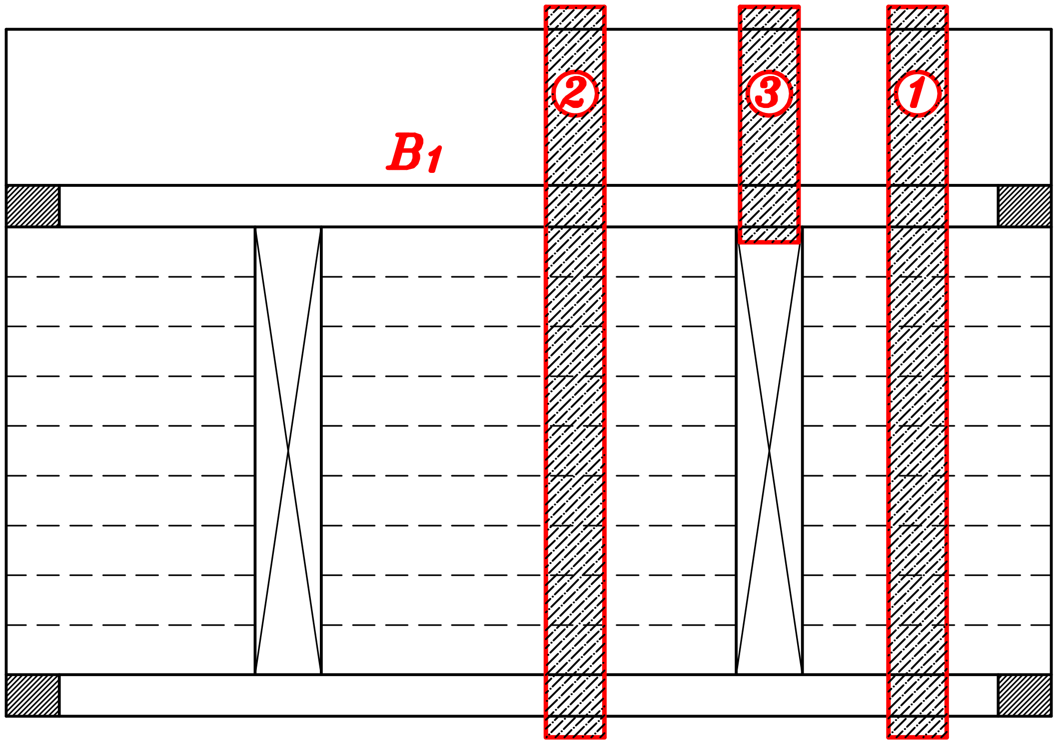


Example.

Arc. Plan

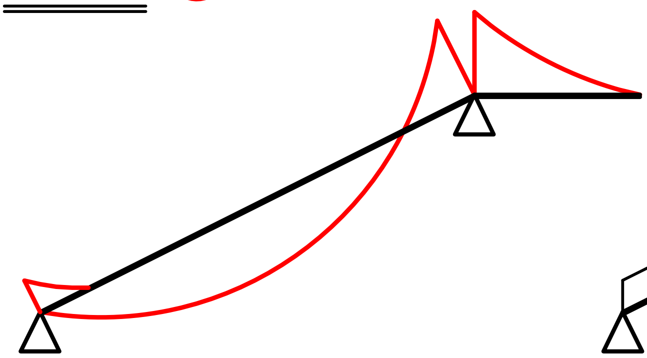


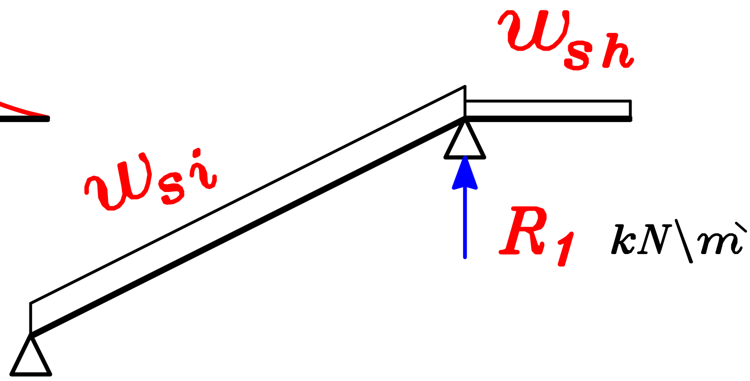
Struc. Plan



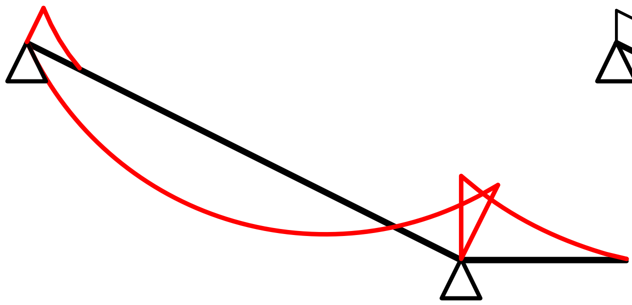
Slabs.

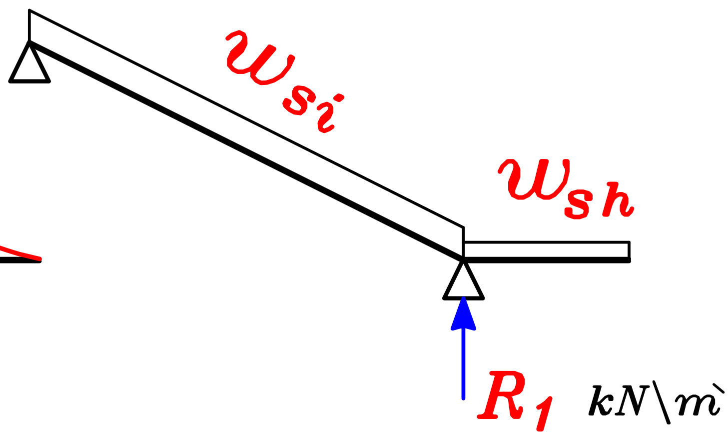
Strip ①





Strip ②

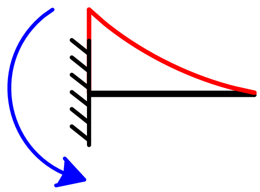


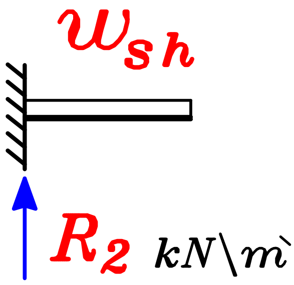


Strip ③

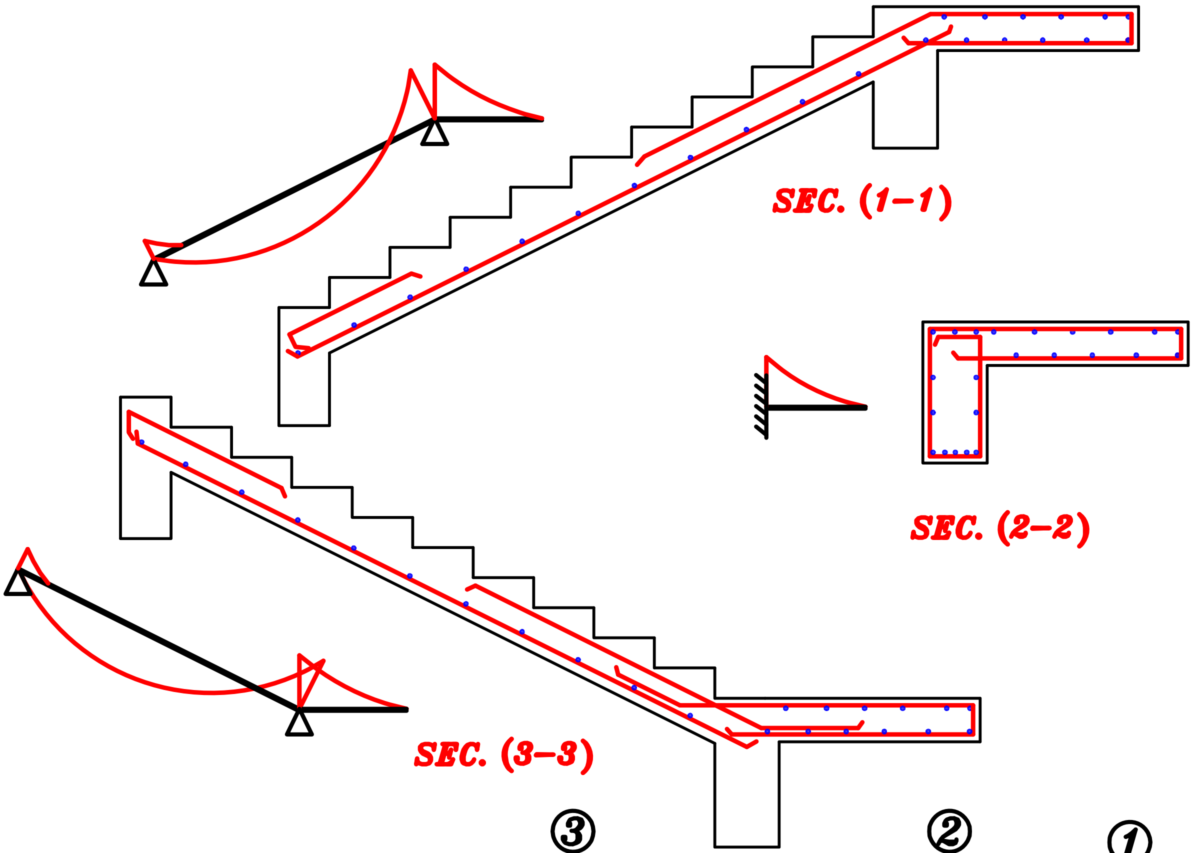
m_t kN.m\m` ← Torsion تحمل

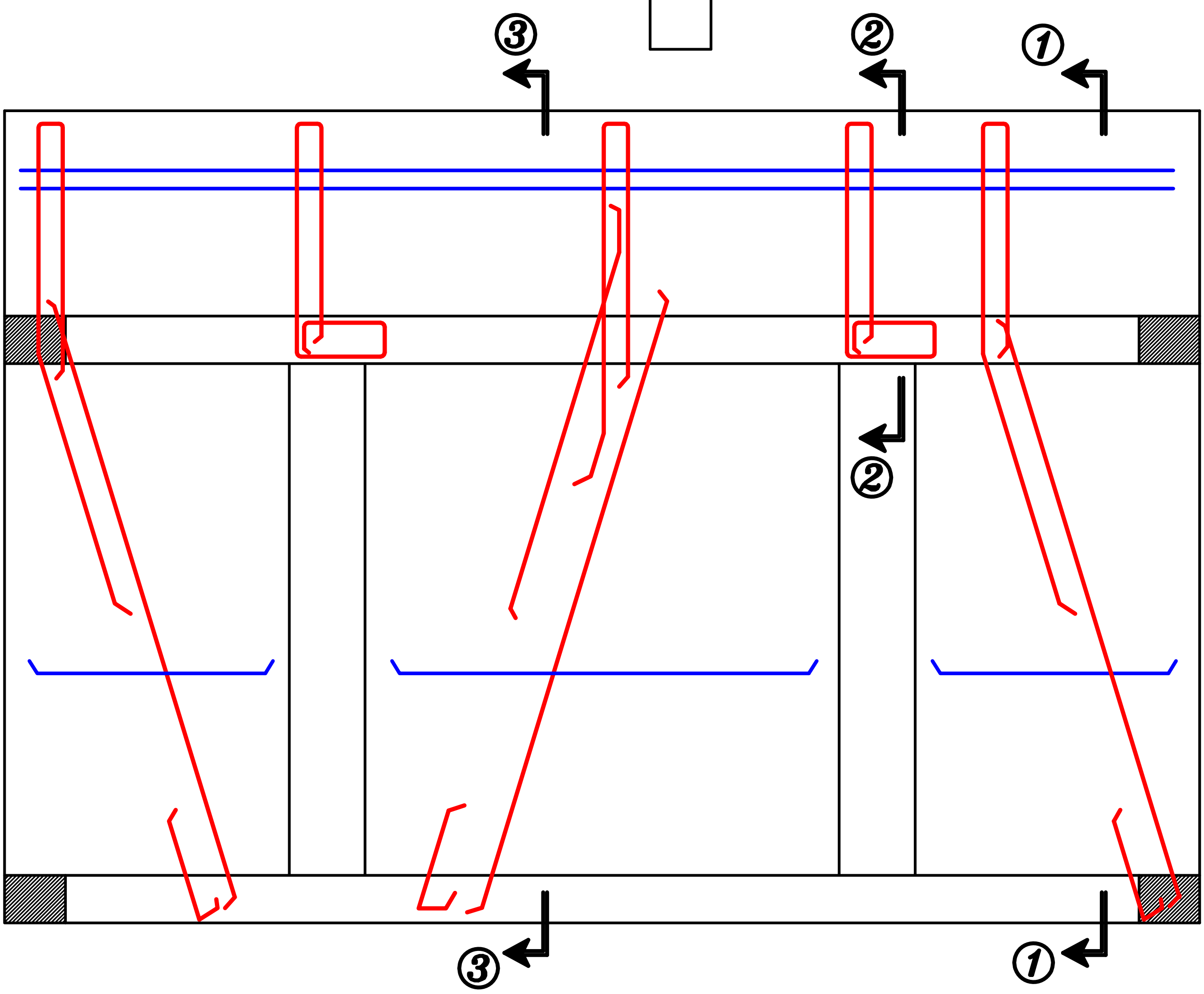
B_1 على





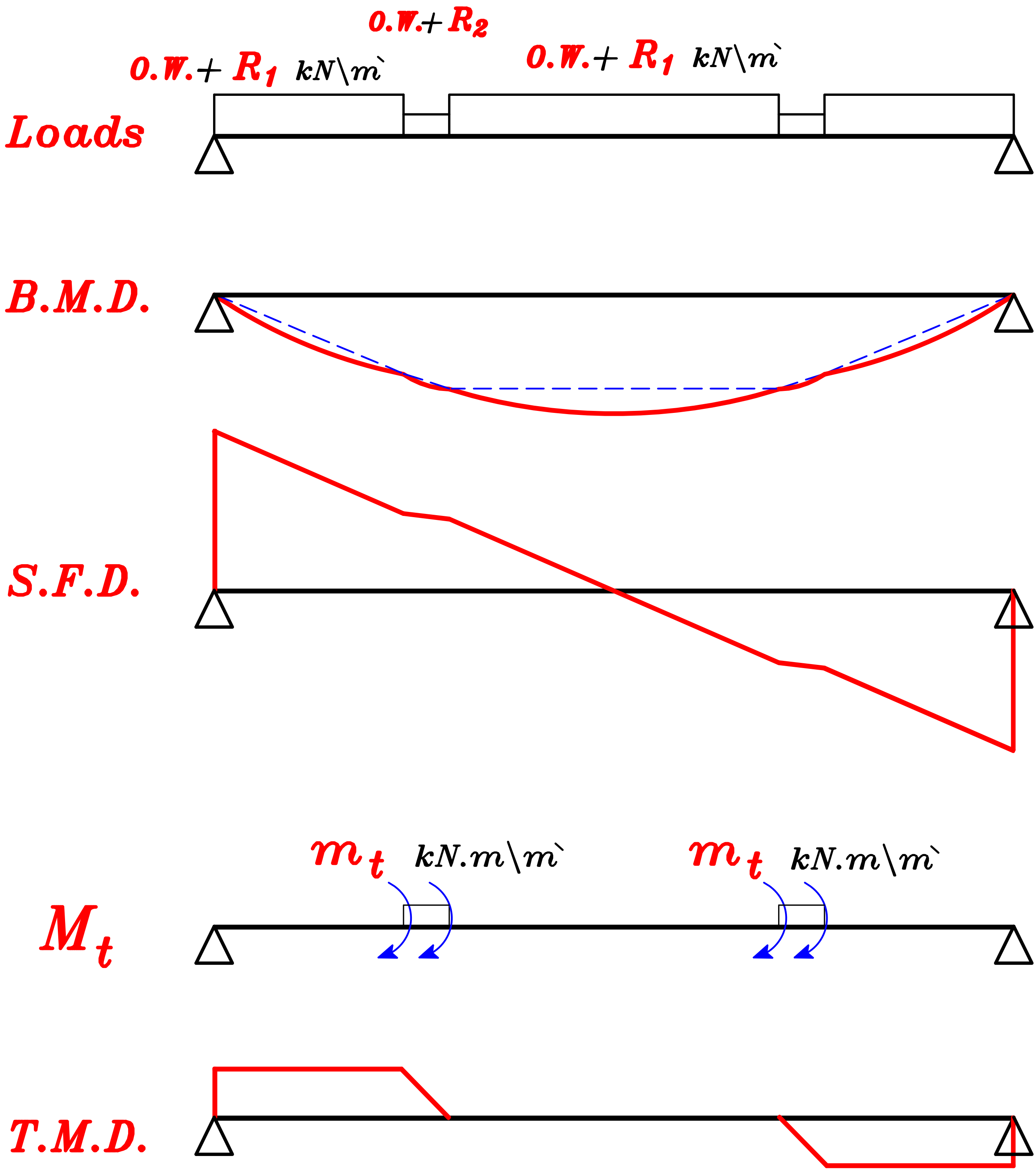
RFT. of the Slab.





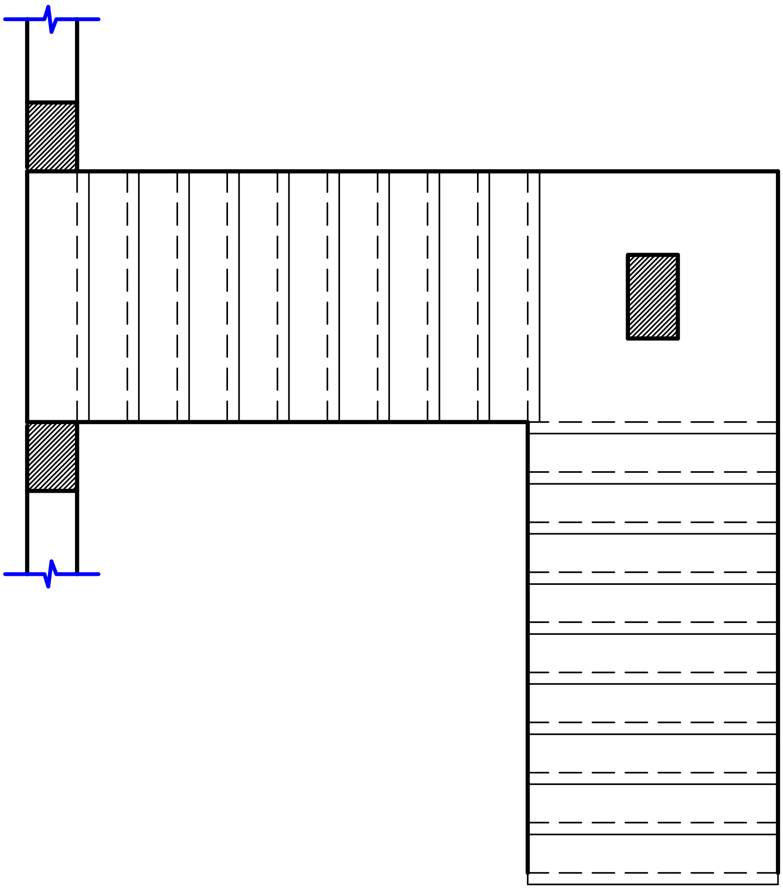
Beams.

B1

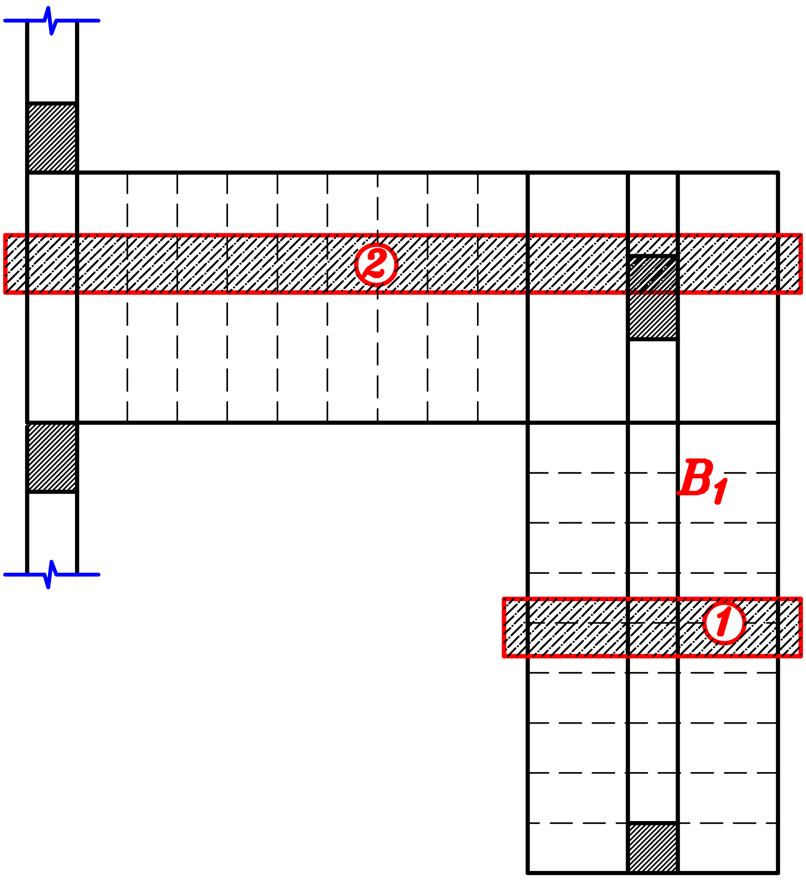


Example.

Arc. Plan

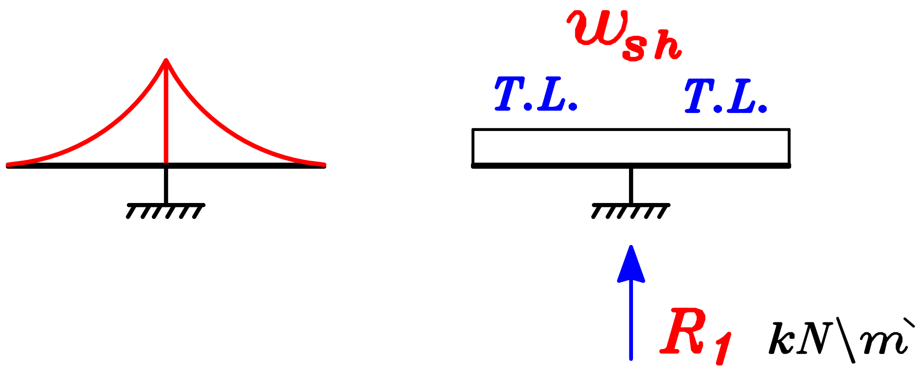


Struc. Plan



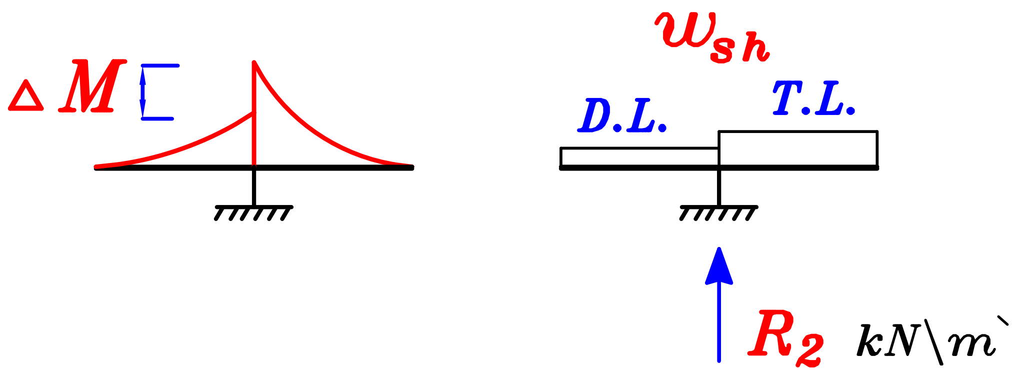
Slabs.

Strip ①



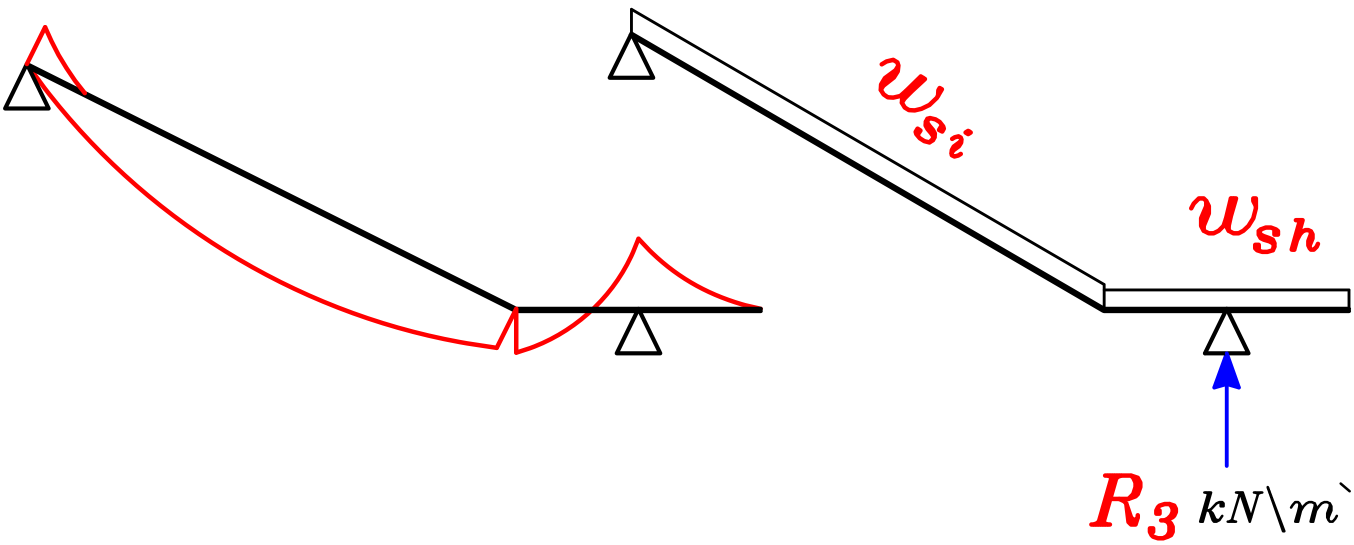
To get B.M.

Torsion تعمل → على B_1

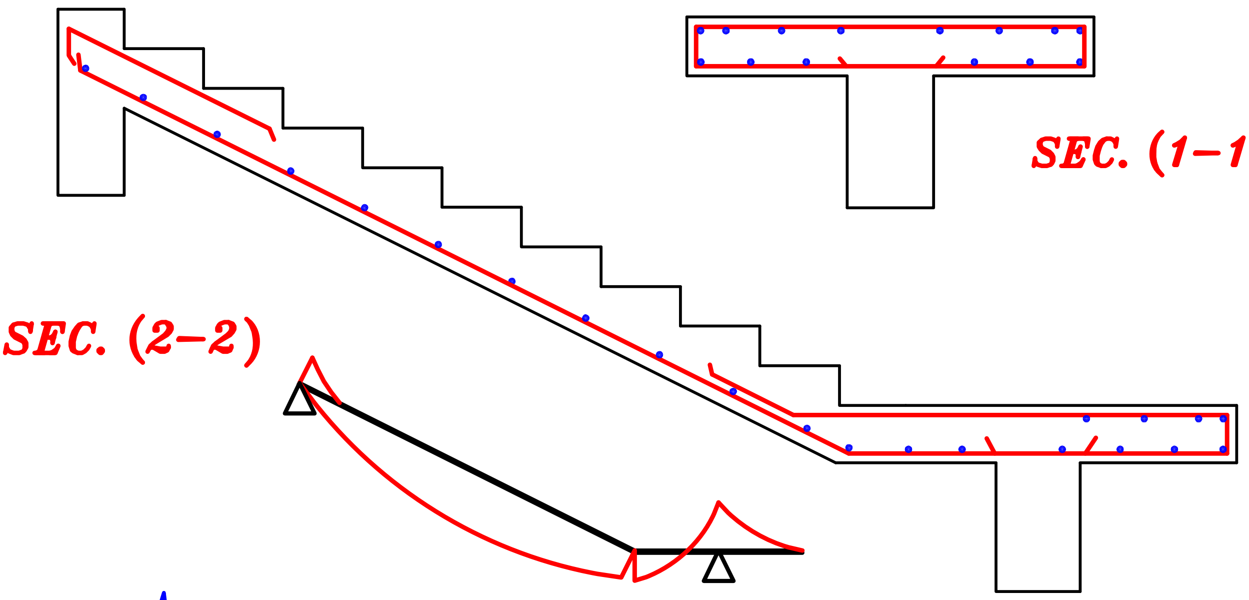


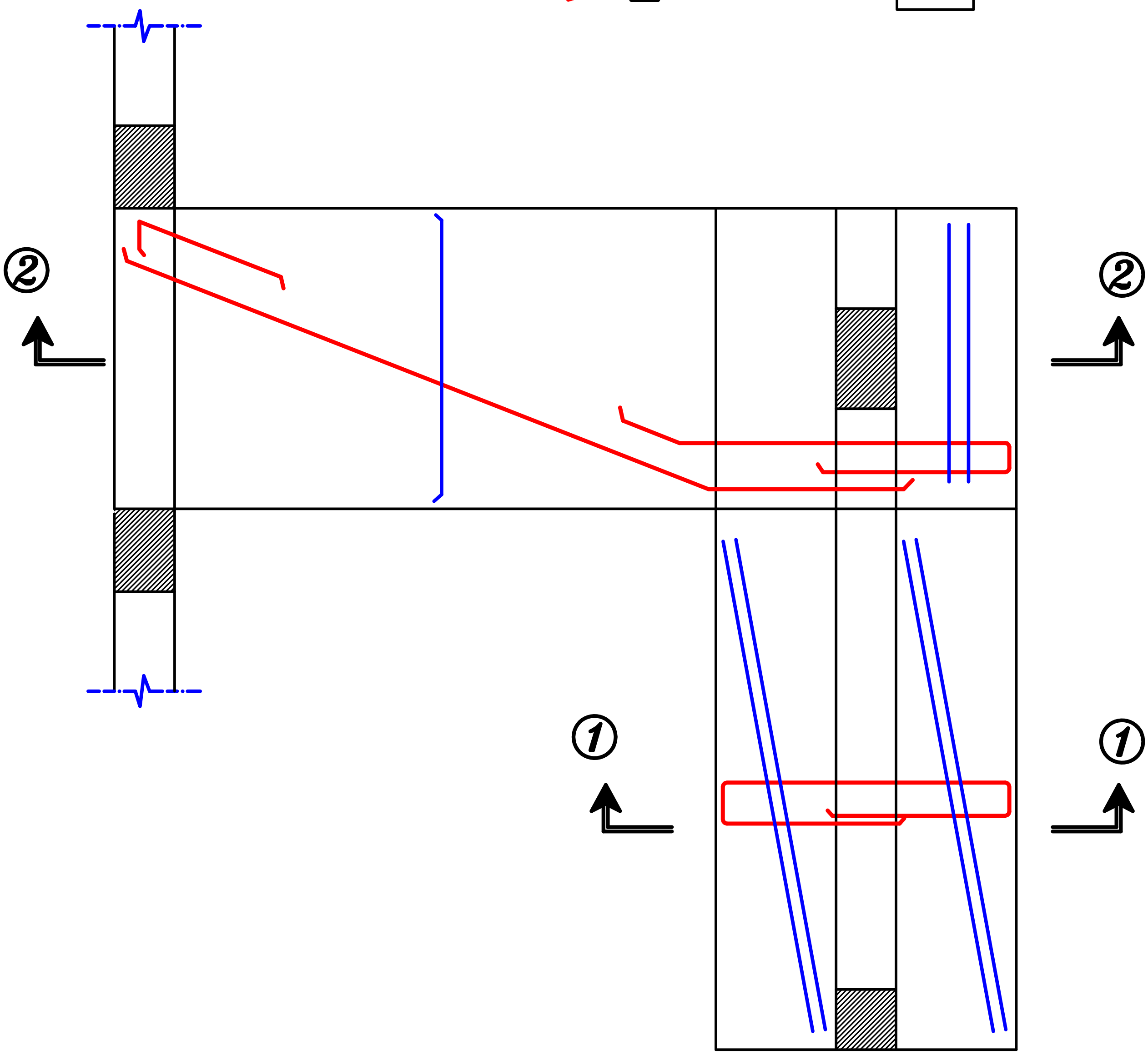
To get S.F.&T.M.

Strip ②



RFT. of the Slab.

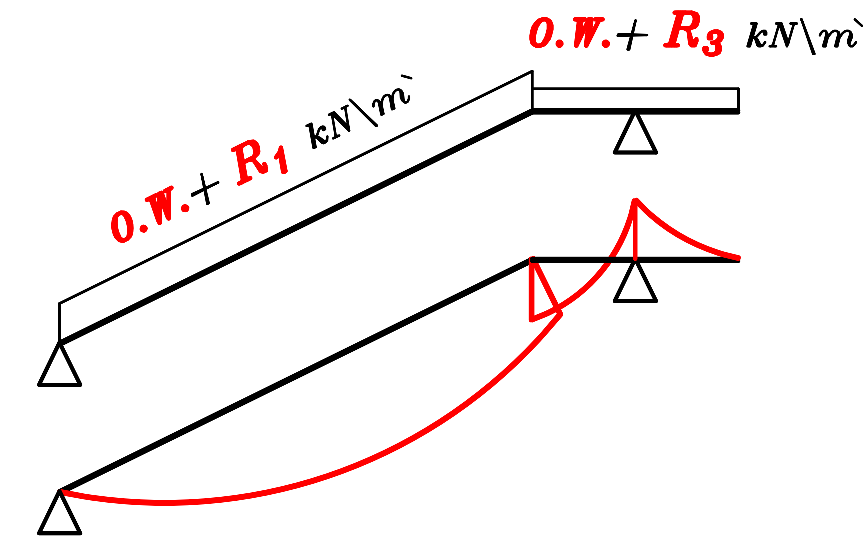




Beams.

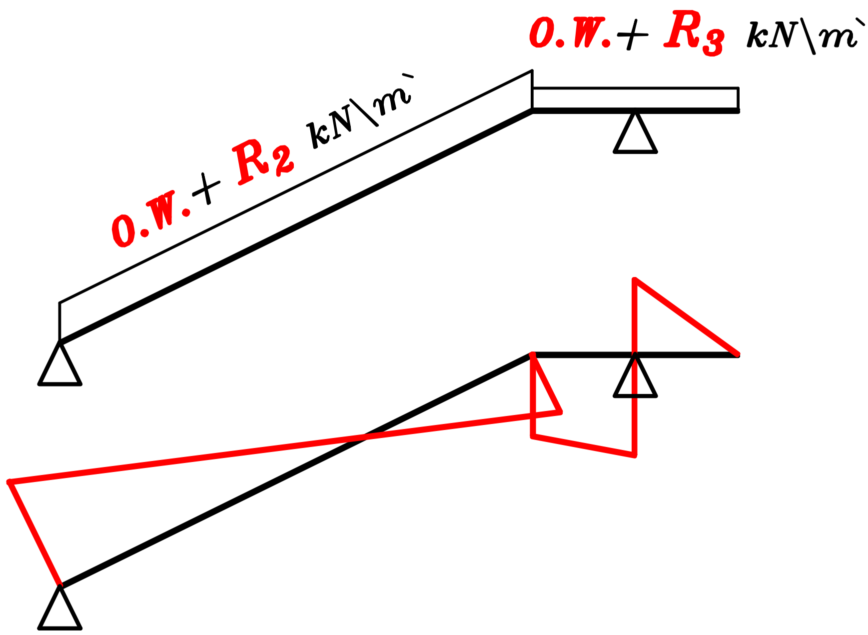
B_1

Loads
For Moment



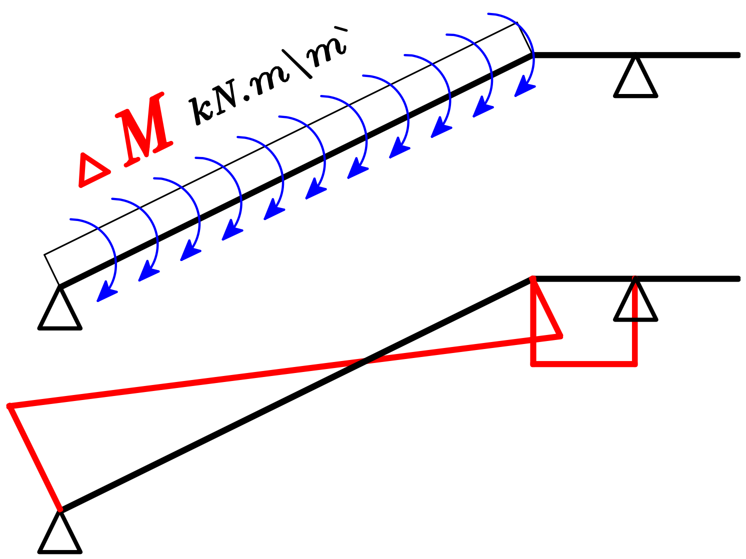
B.M.D.

Loads
For Shear



S.F.D.

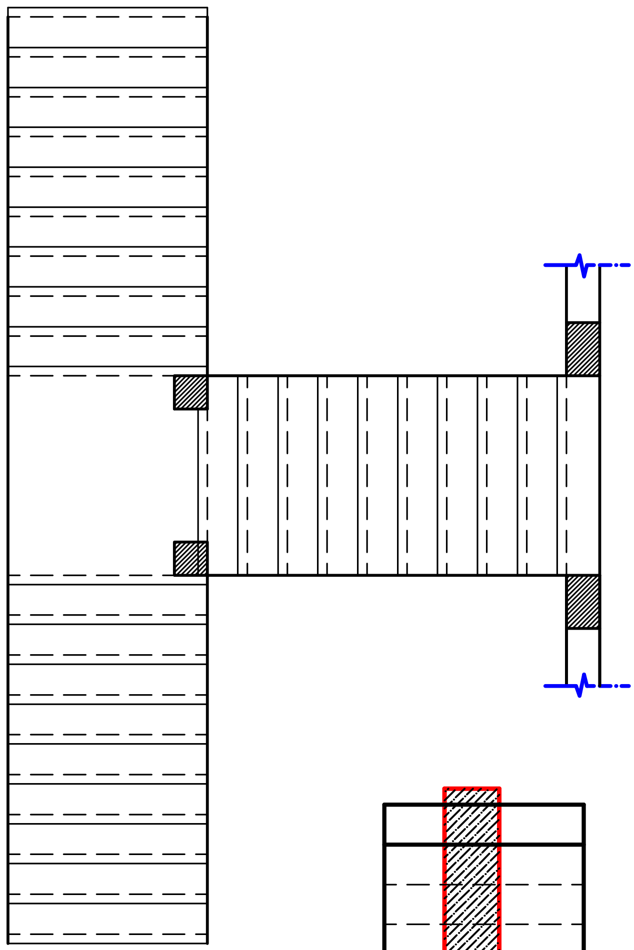
M_t

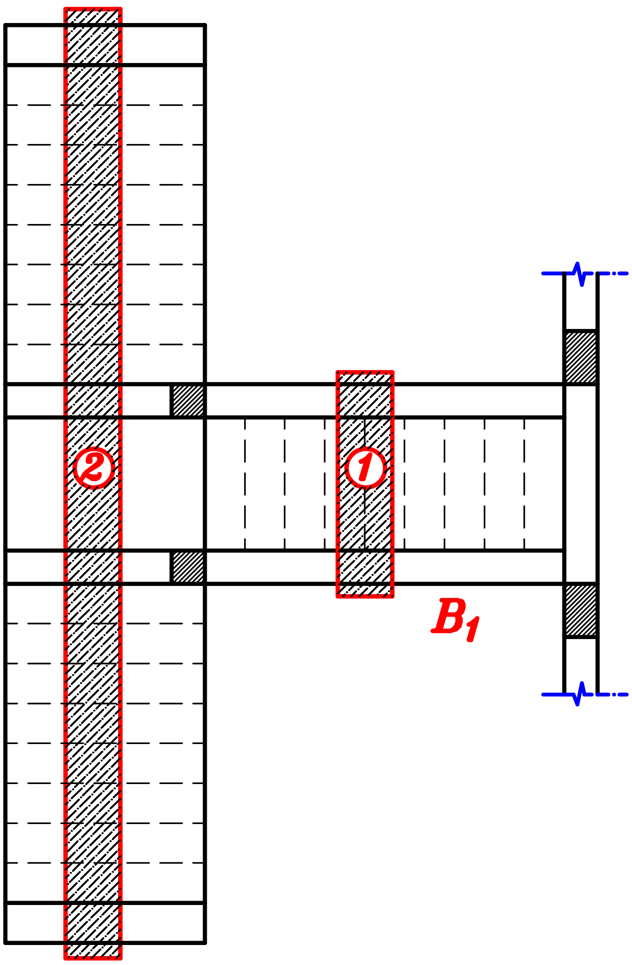


T.M.D.

Example.

Arc.
Plan

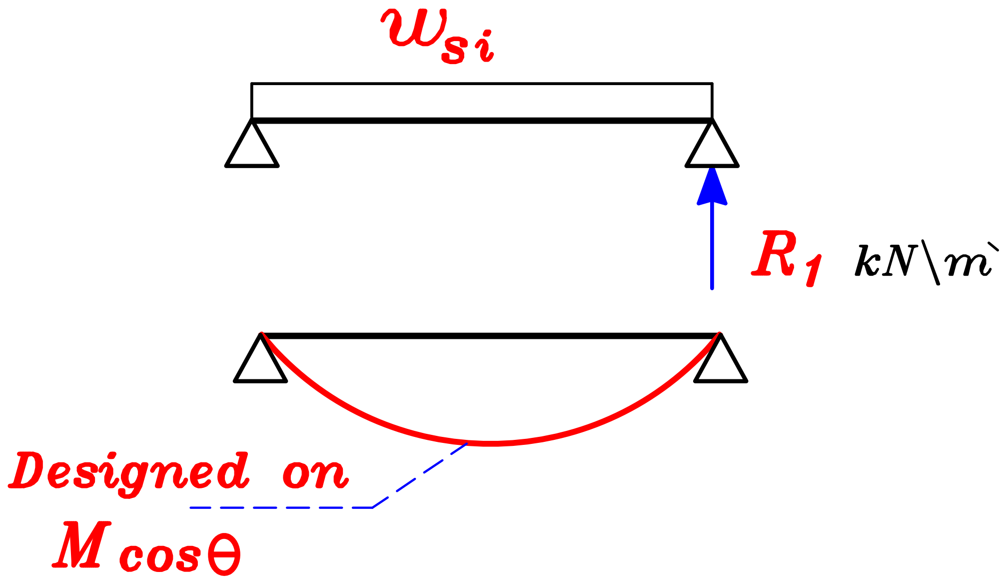




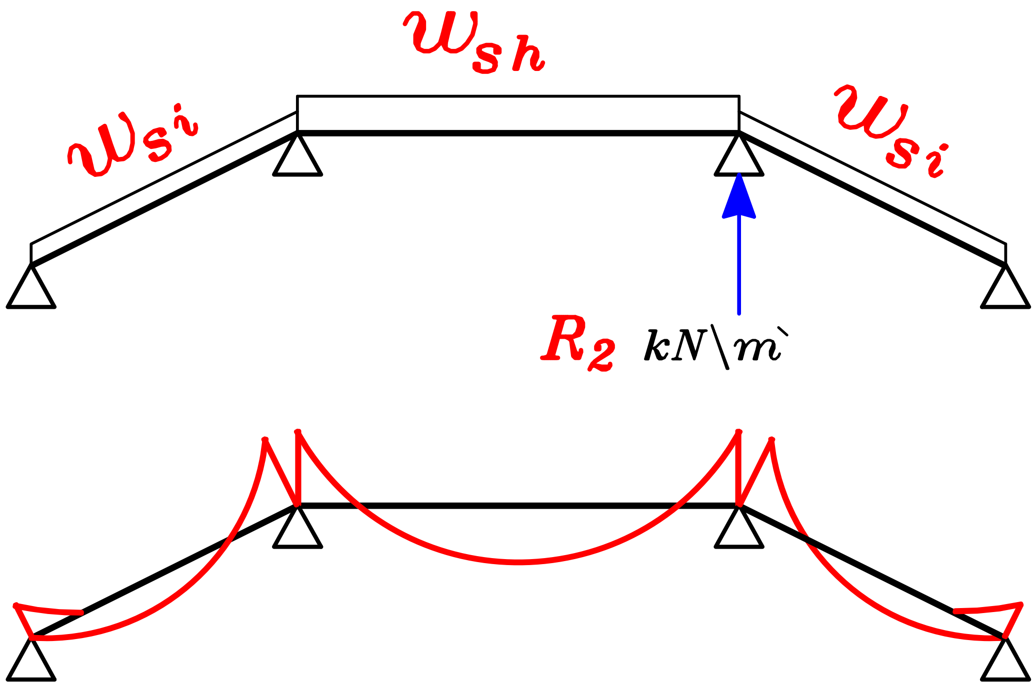
Struc.
Plan

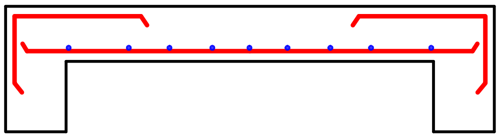
Slabs.

Strip ①

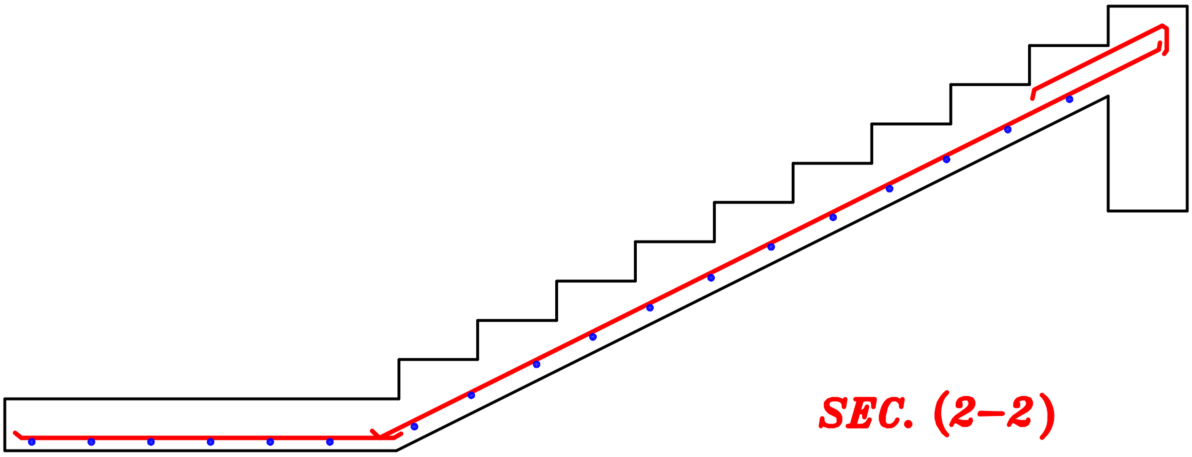


Strip ②

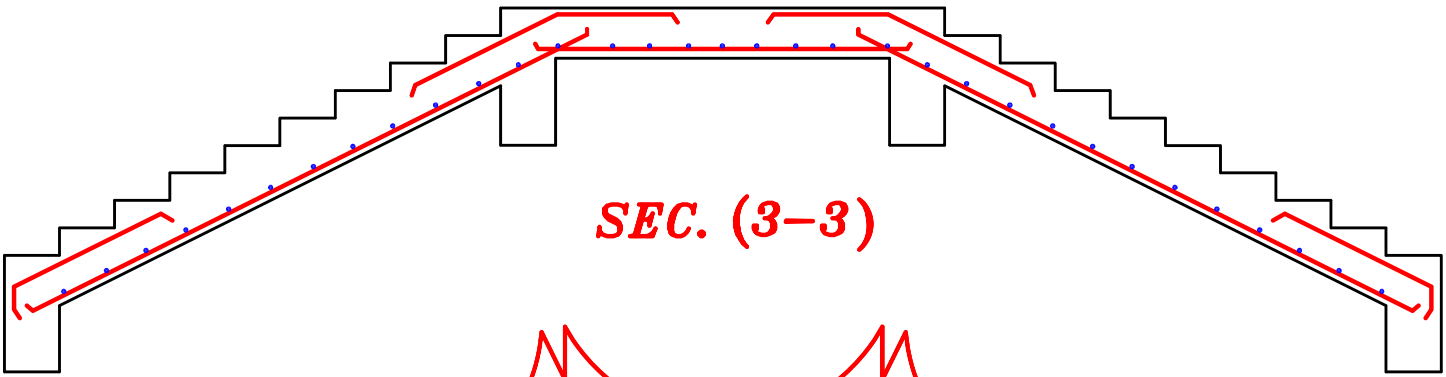




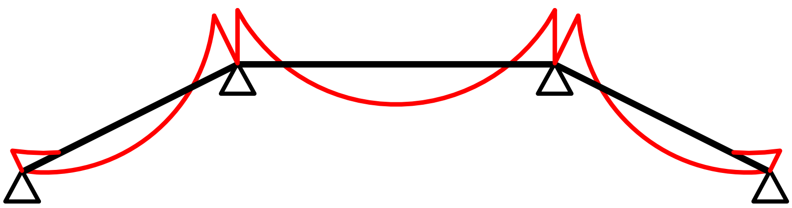
SEC. (1–1)



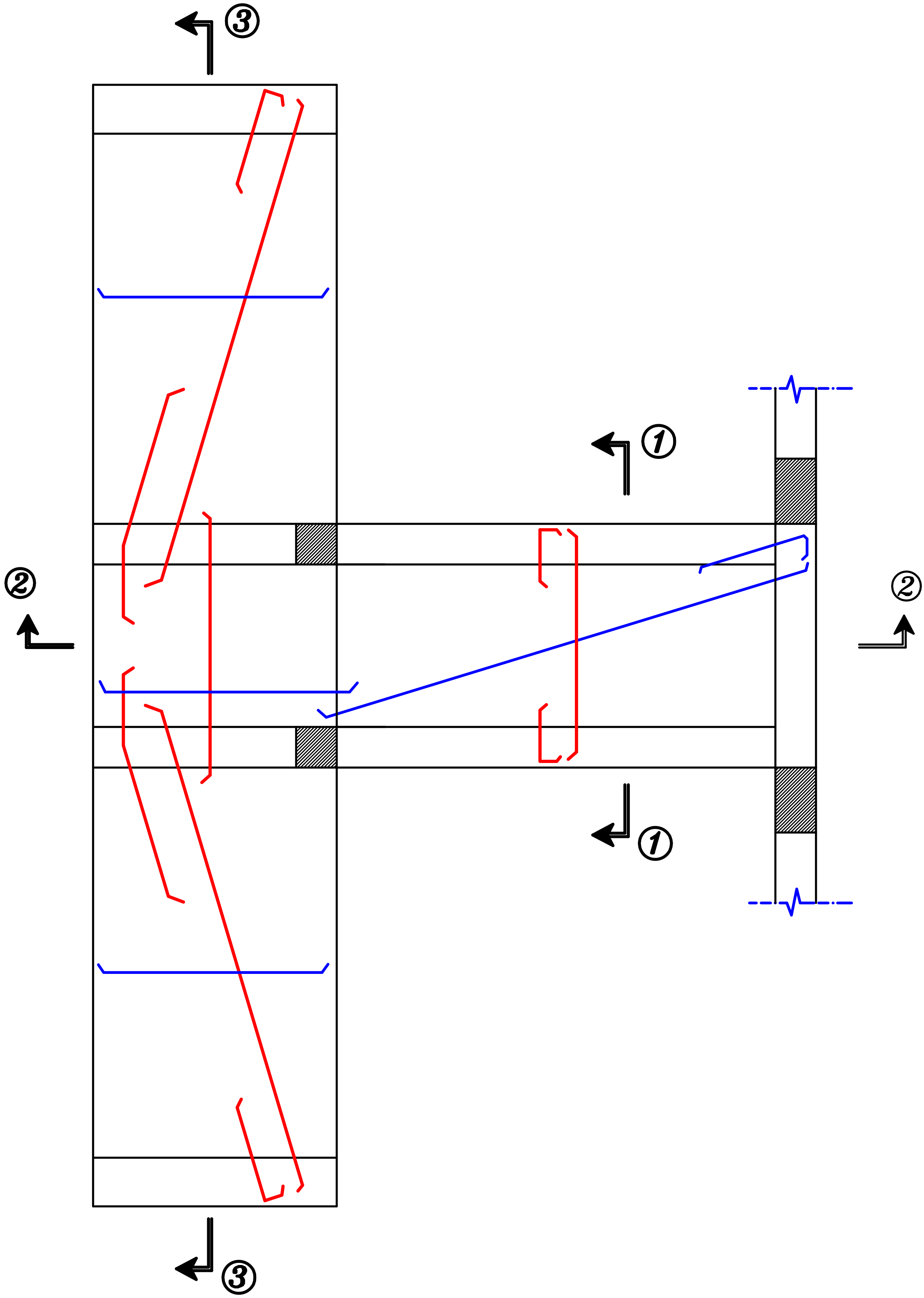
SEC. (2–2)



SEC. (3–3)



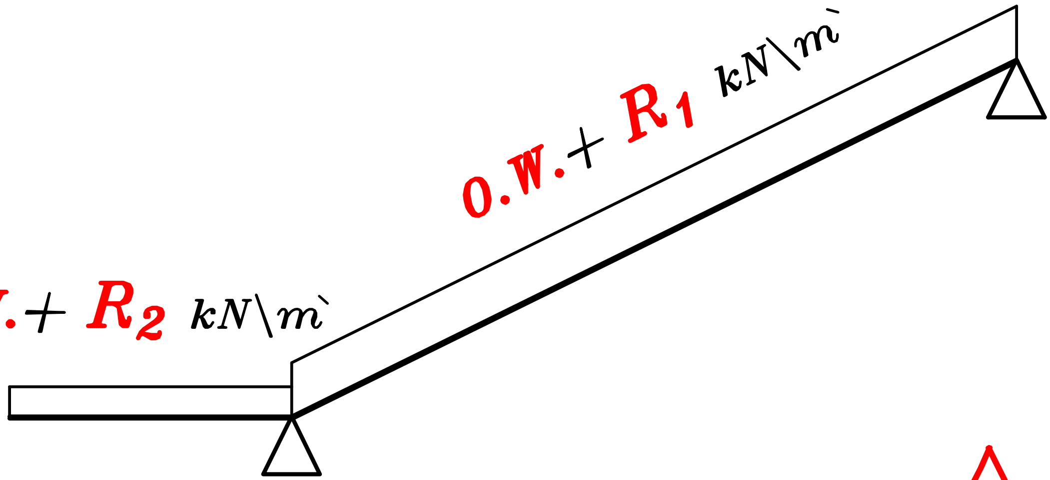
RFT. of the Slab.



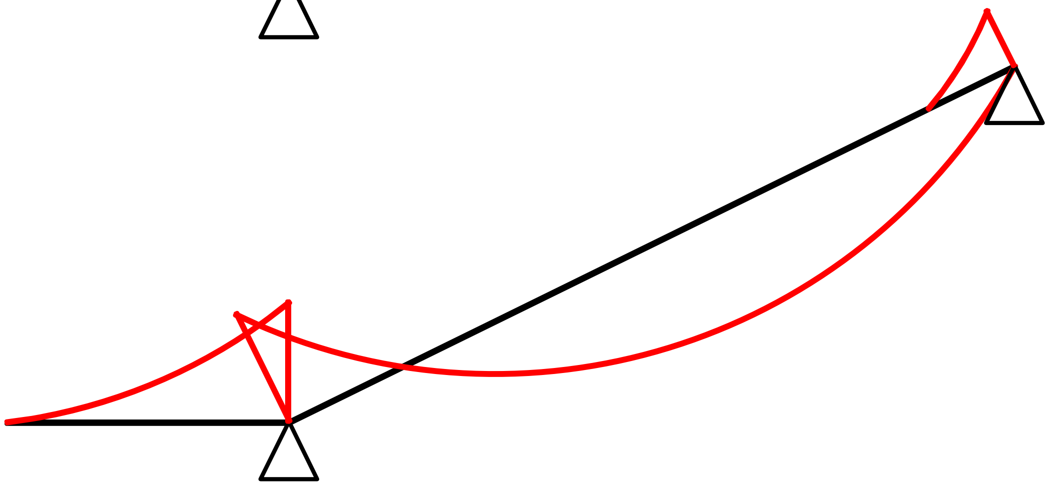
Beams.

B_1

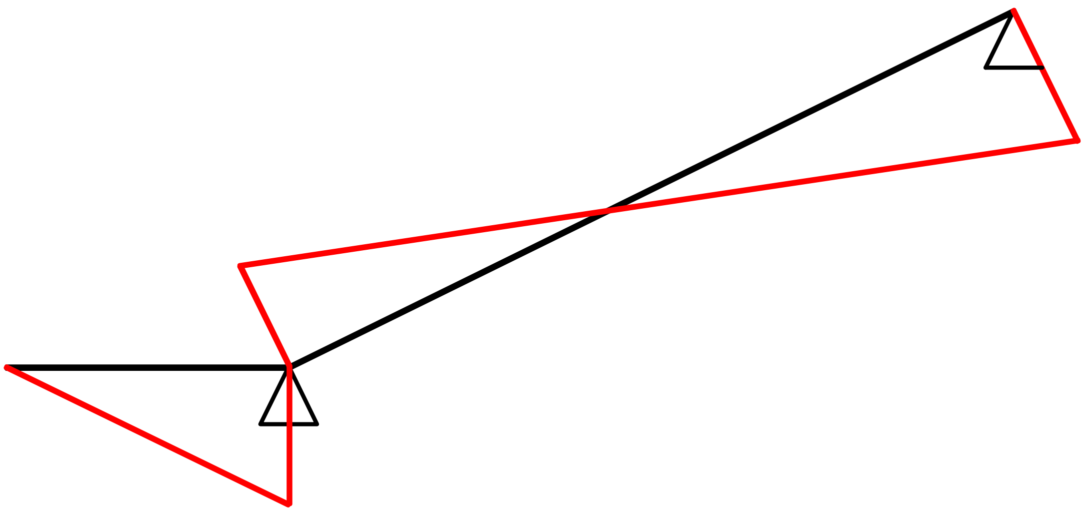
Loads



B.M.D.

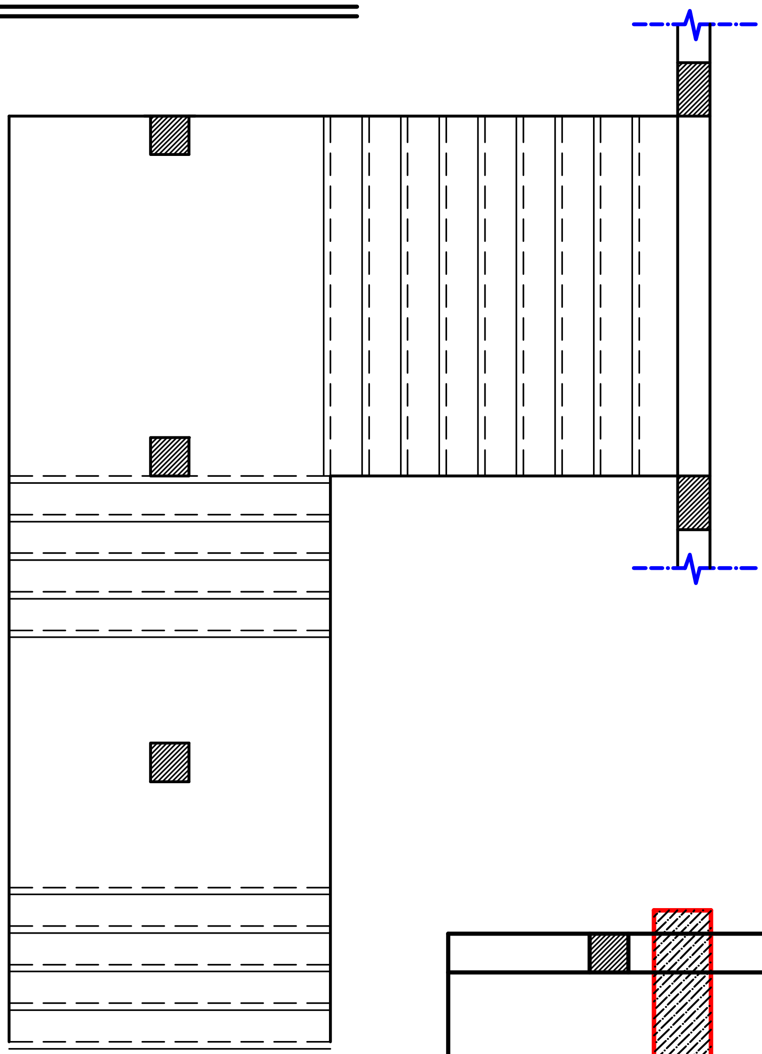


S.F.D.

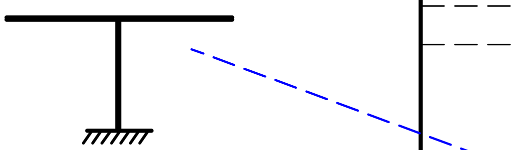


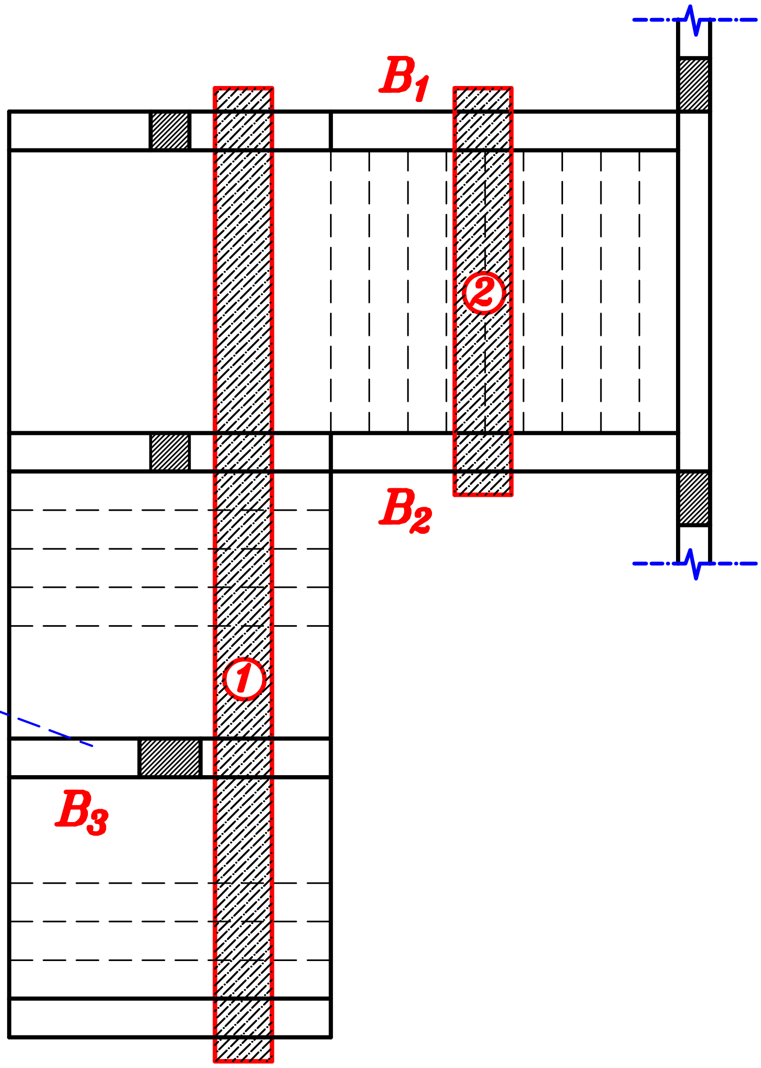
Example.

Arc.
Plan



Cantilever
Frame

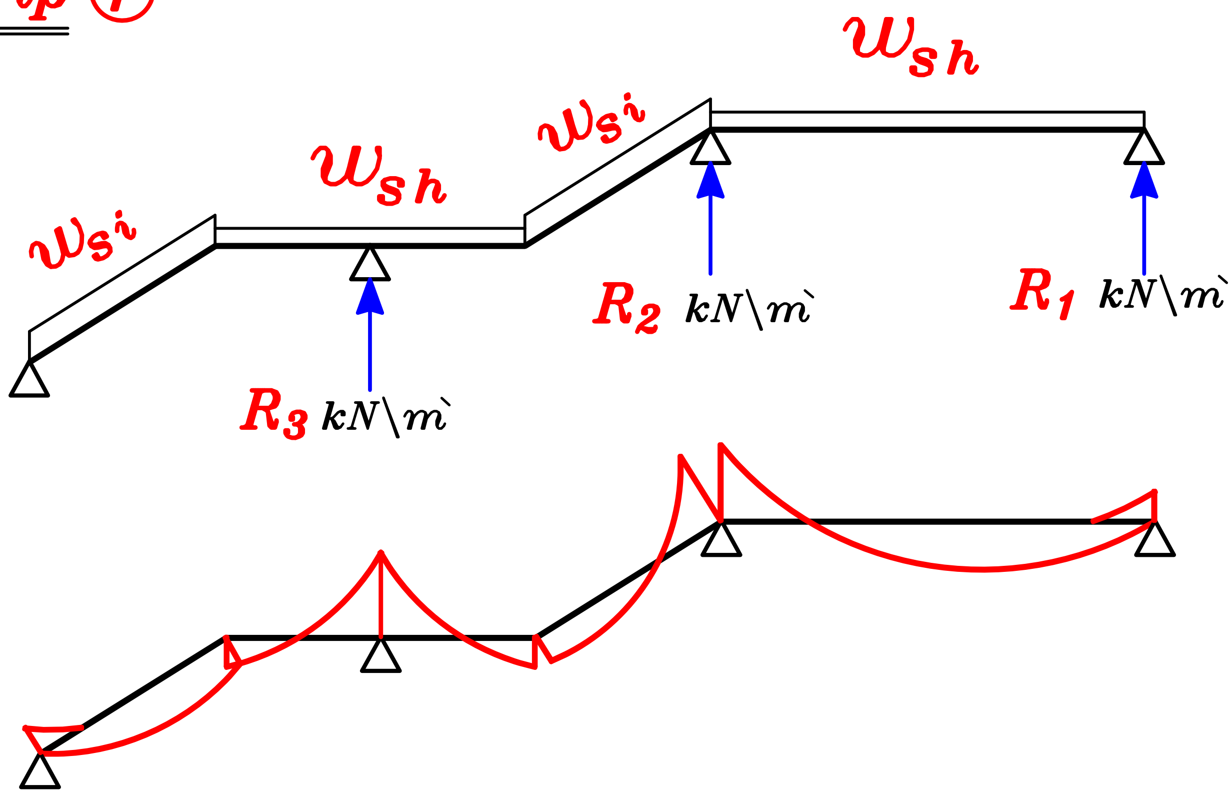




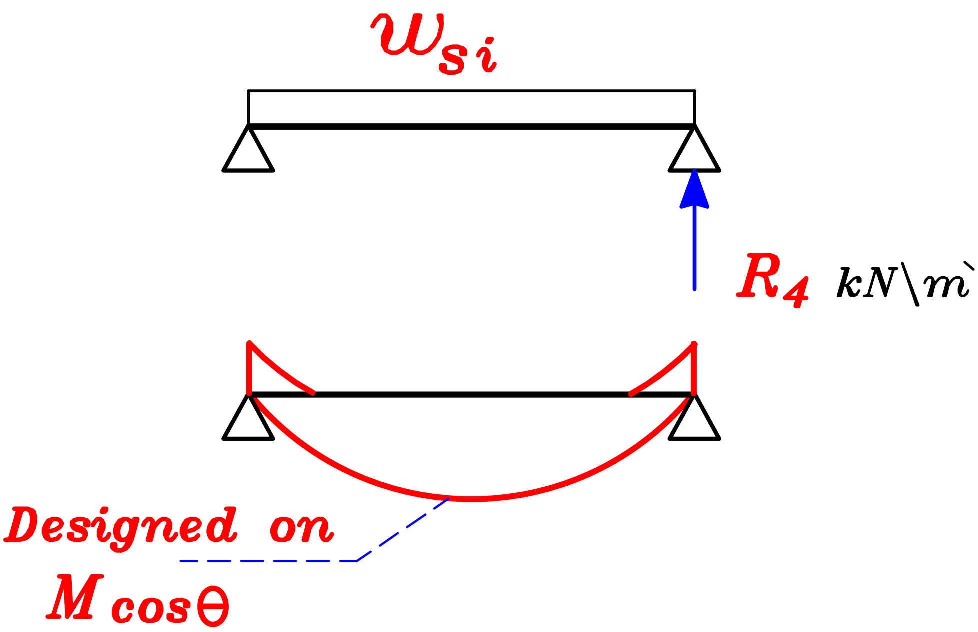
Struc.
Plan

Slabs.

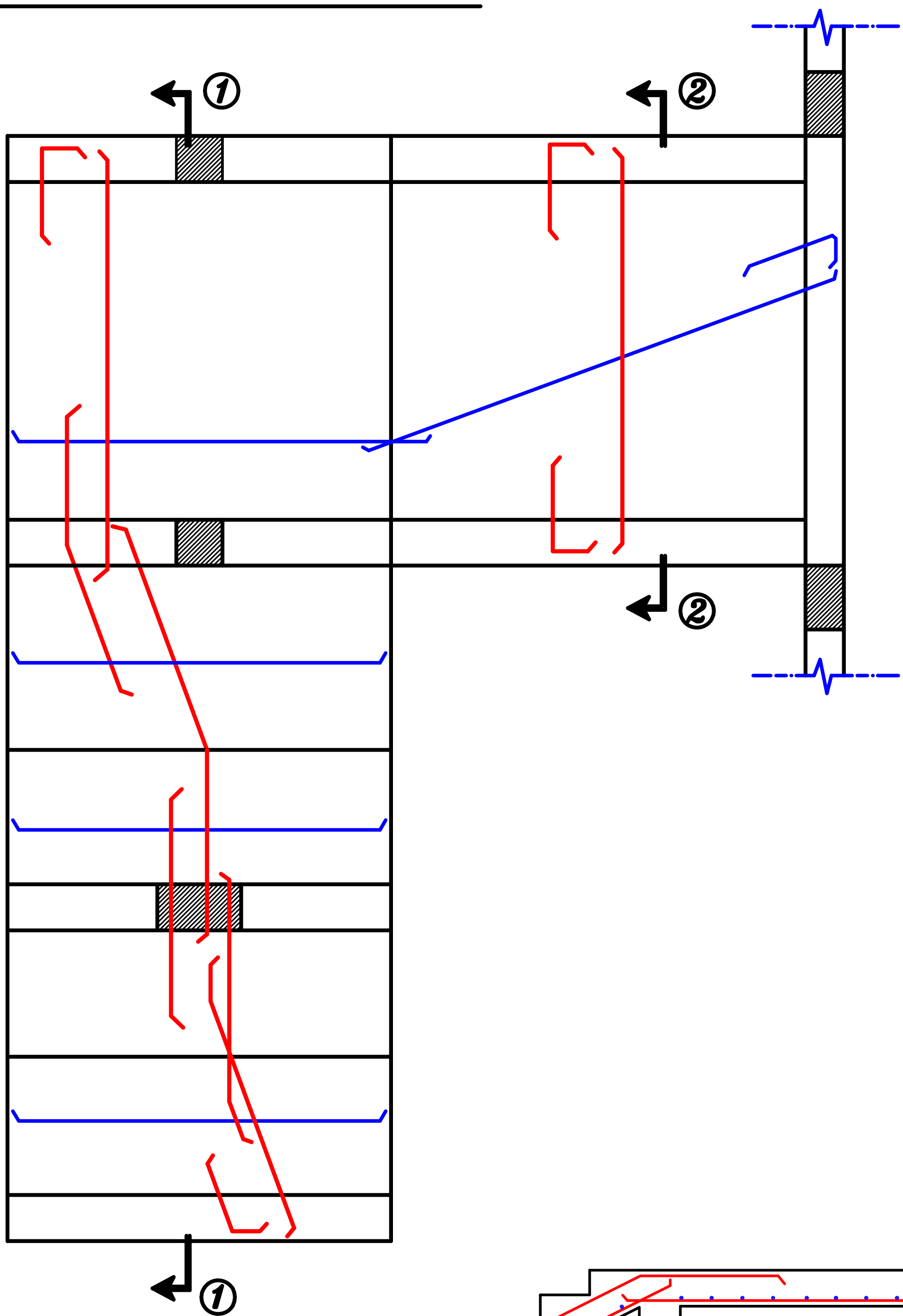
Strip ①

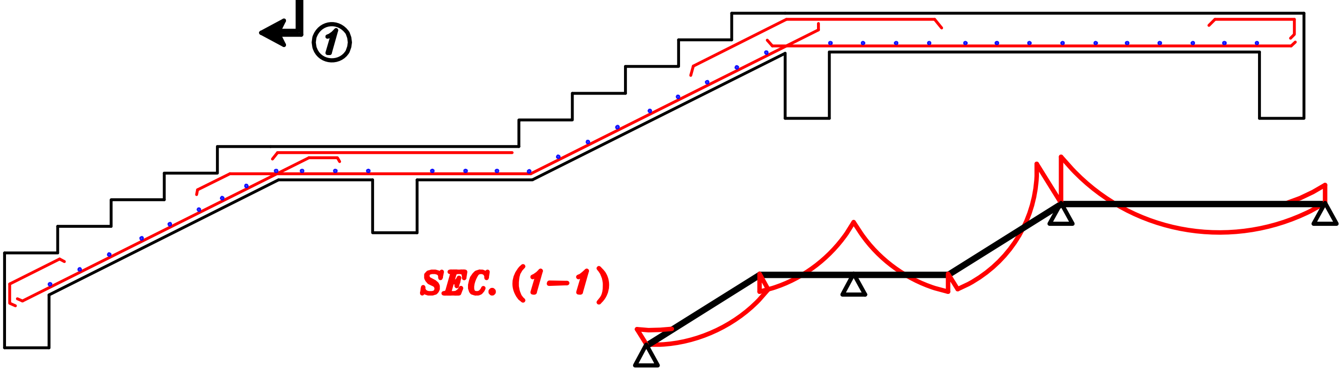


Strip ②

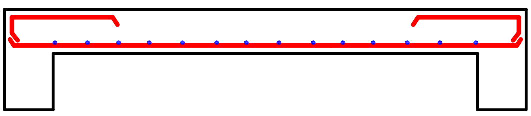


RFT. of the Slab.





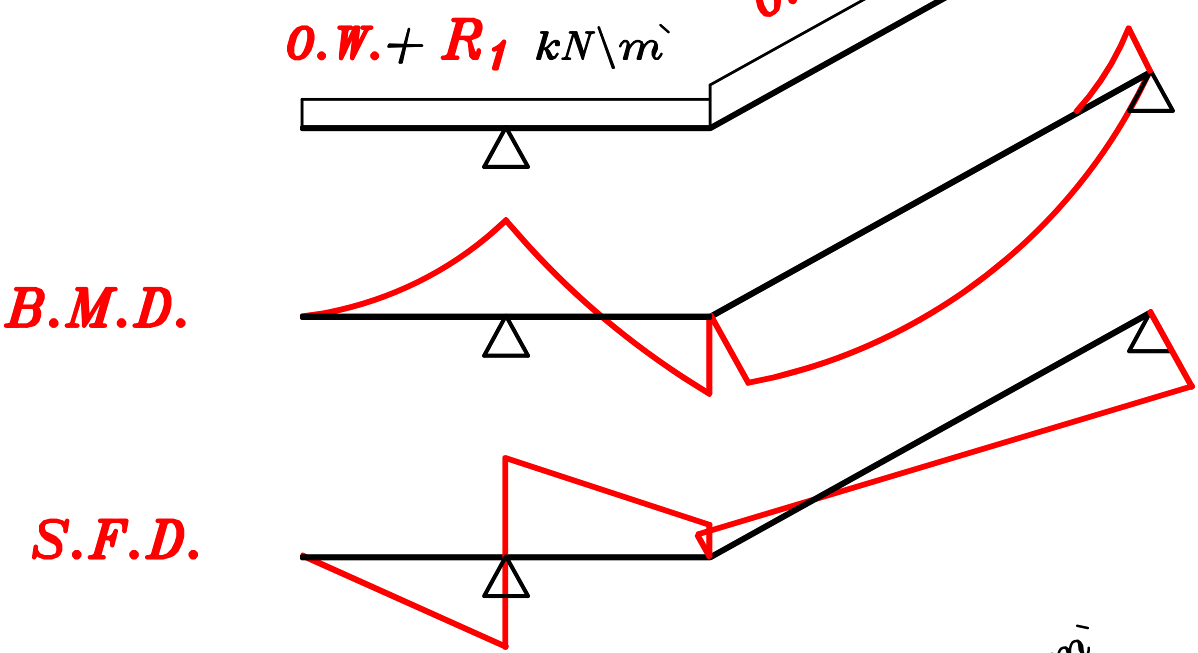
SEC. (1-1)



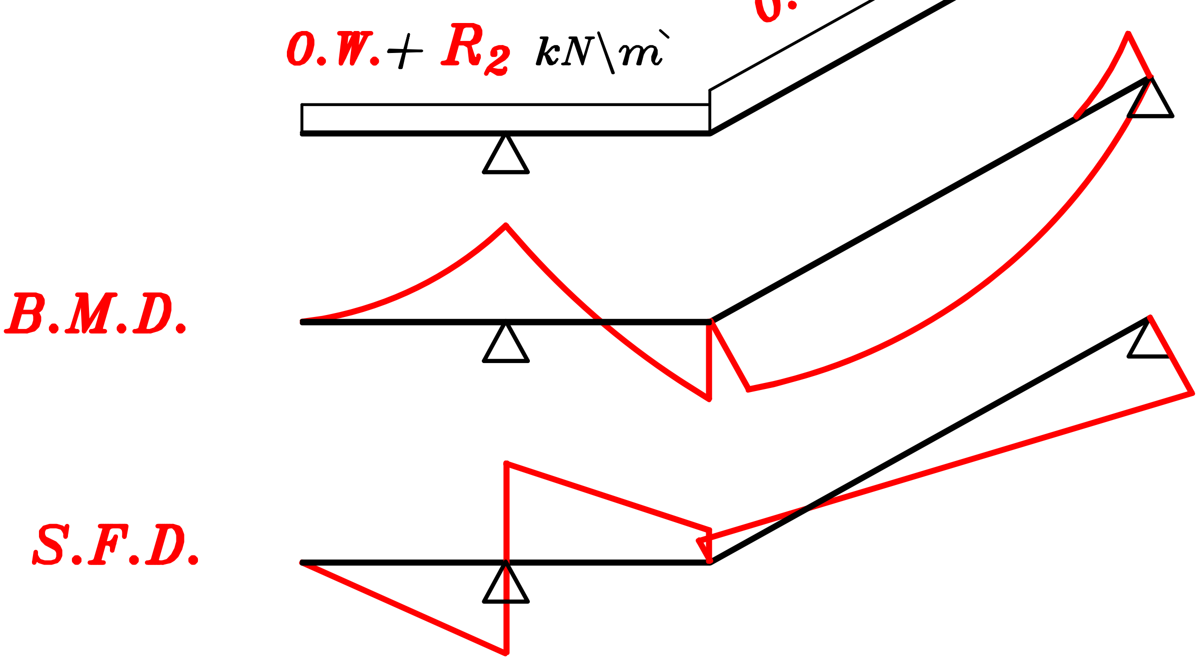
SEC. (2-2)

Beams.

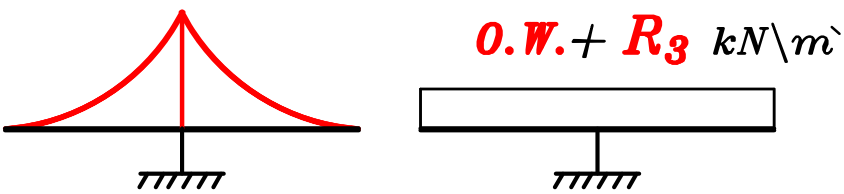
B1



B2

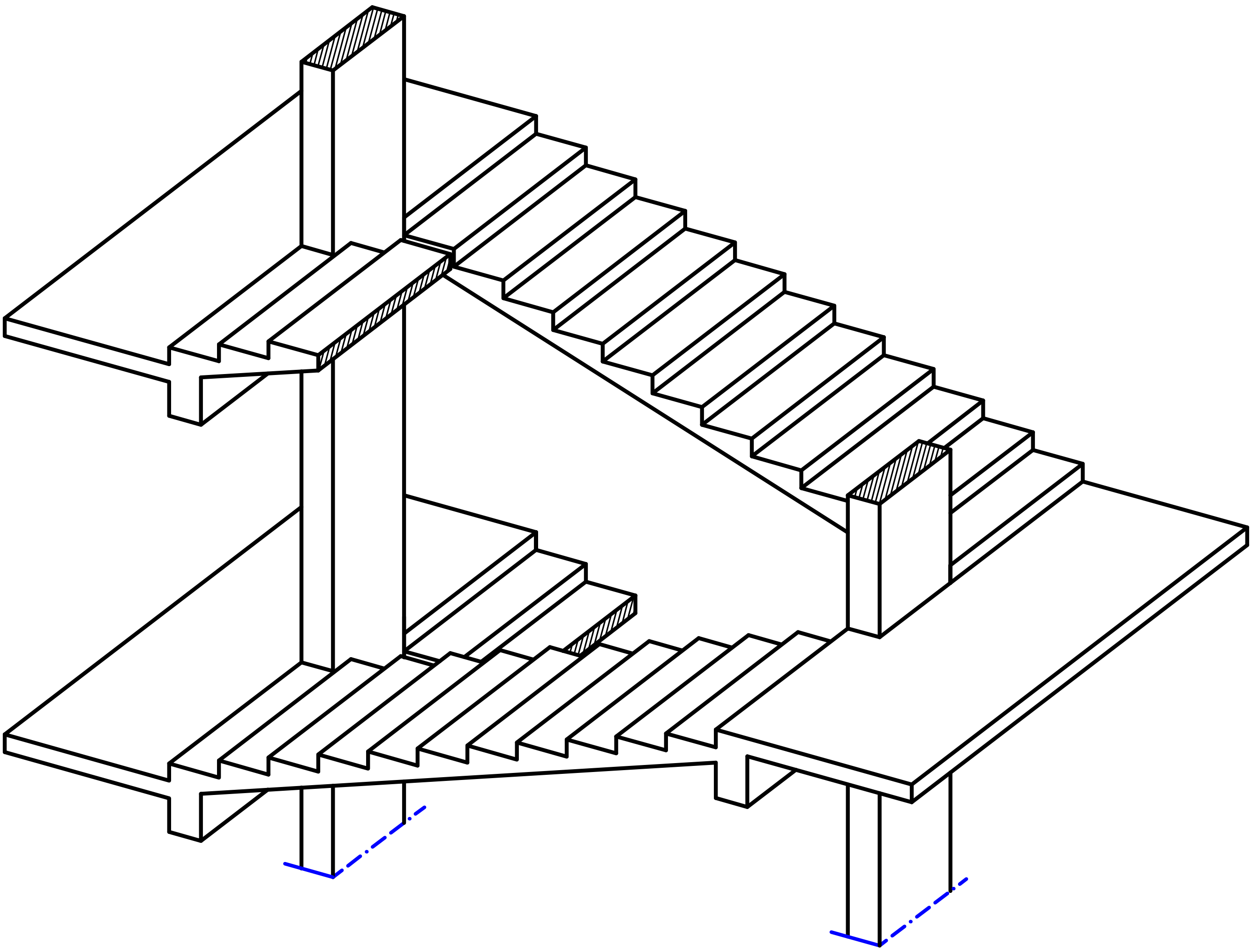


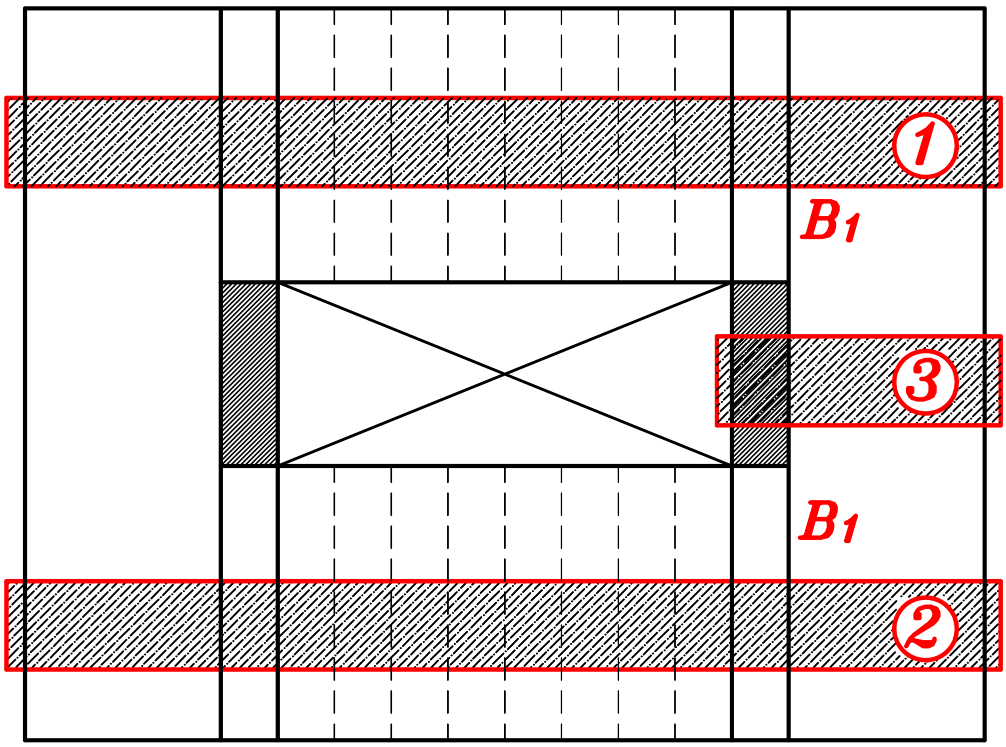
B3



Stairs on wide columns or R.C. walls

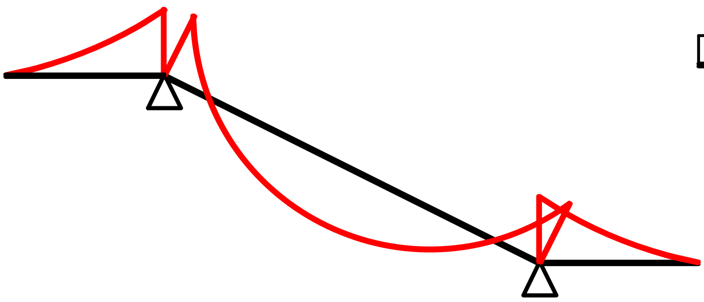
السلالم المحموله على أعمده عريضه أو حوائط خرسانيه

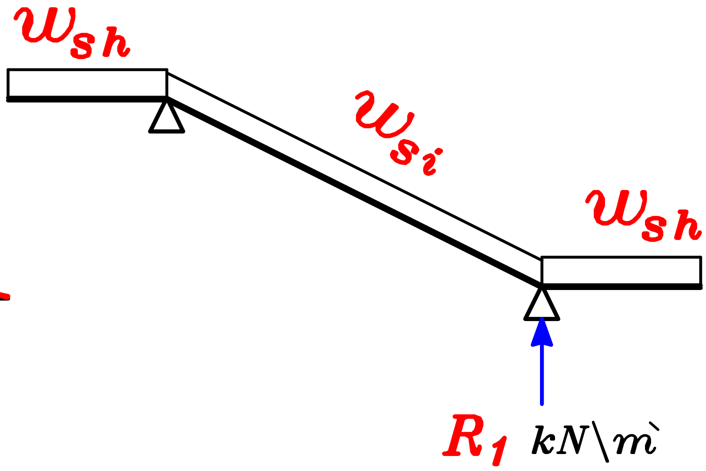




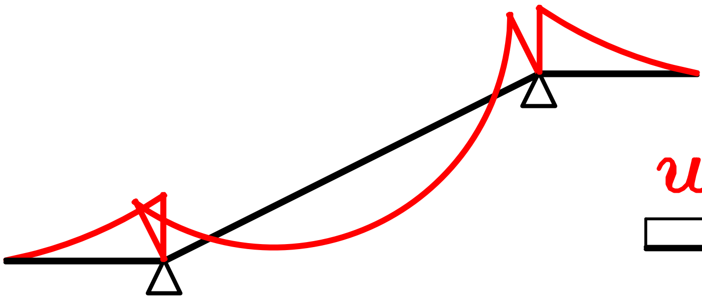
Slabs.

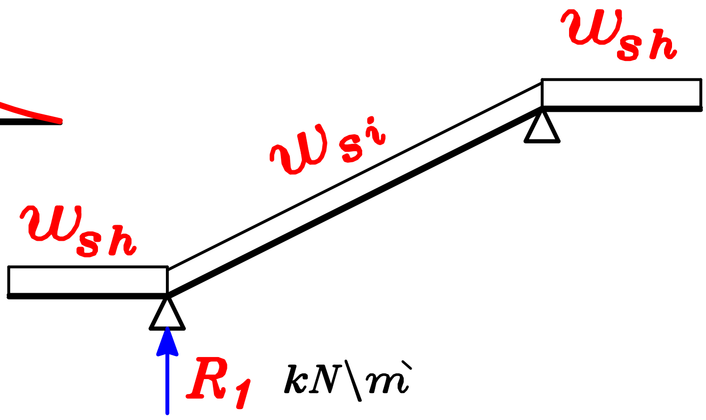
Strip ①



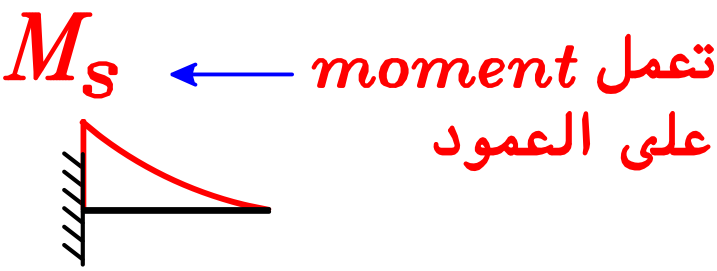


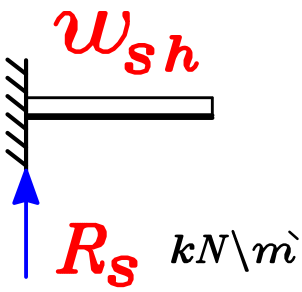
Strip ②



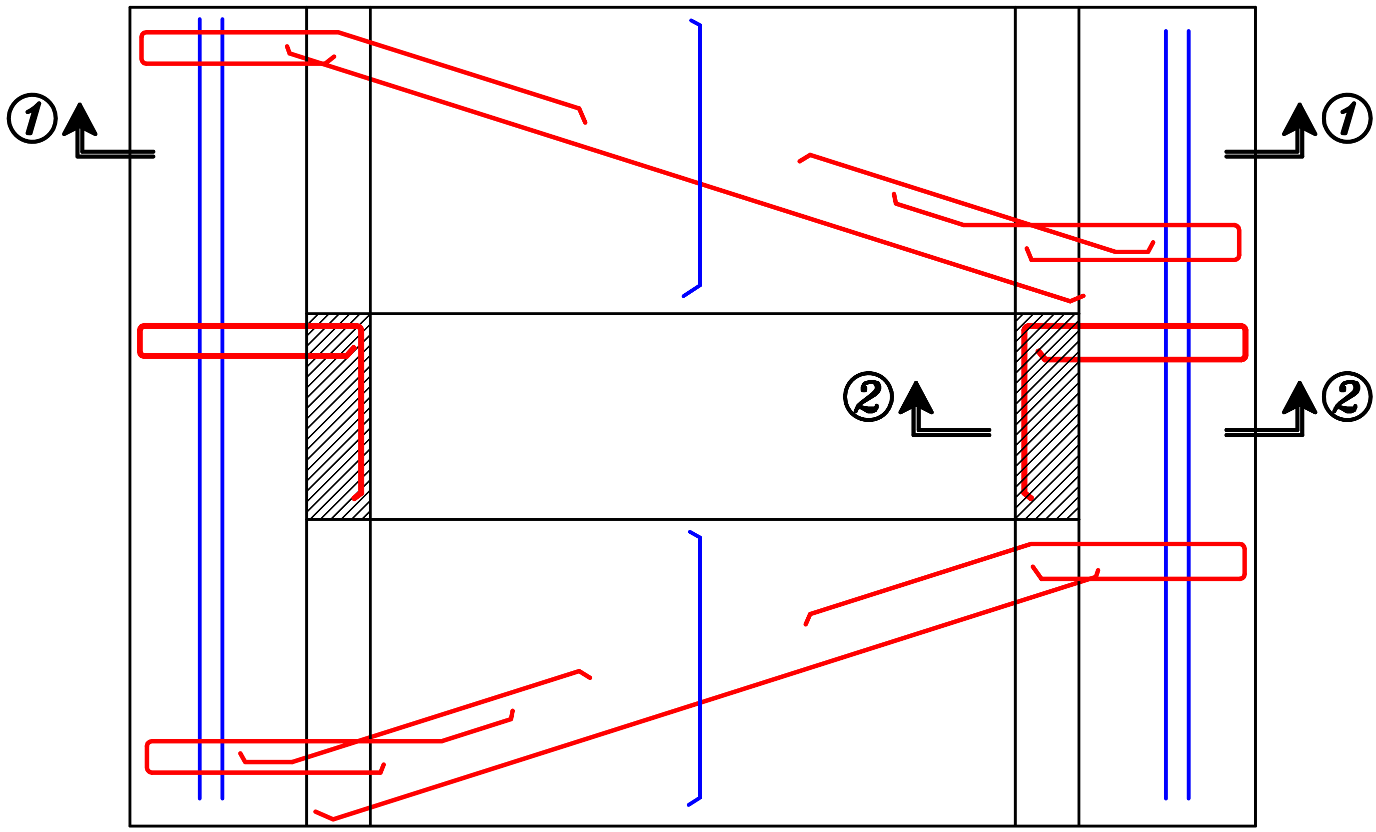


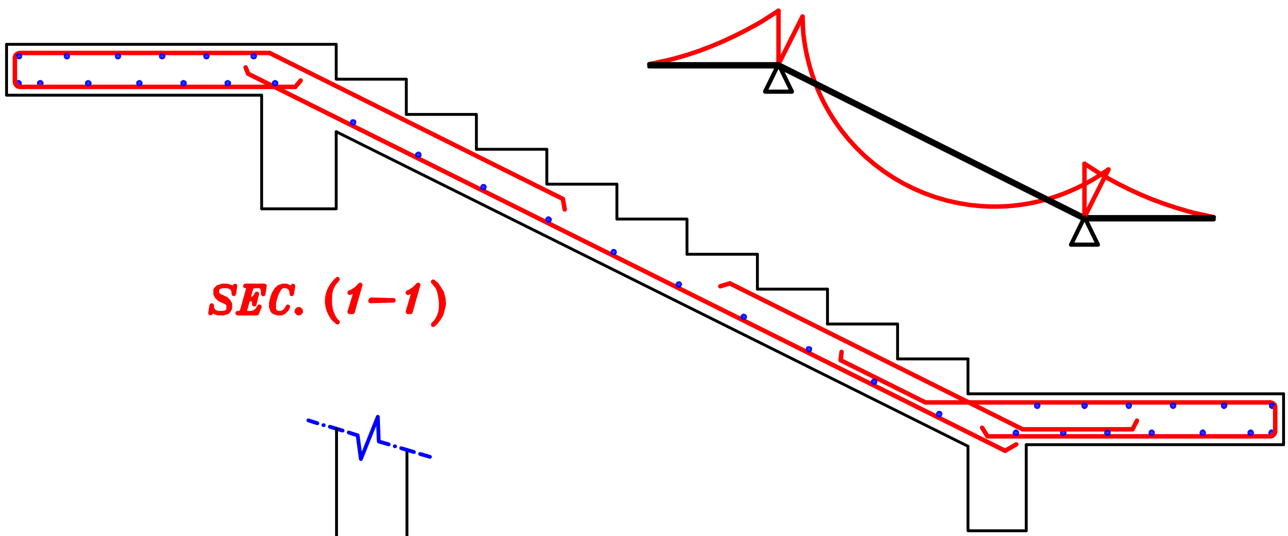
Strip ③



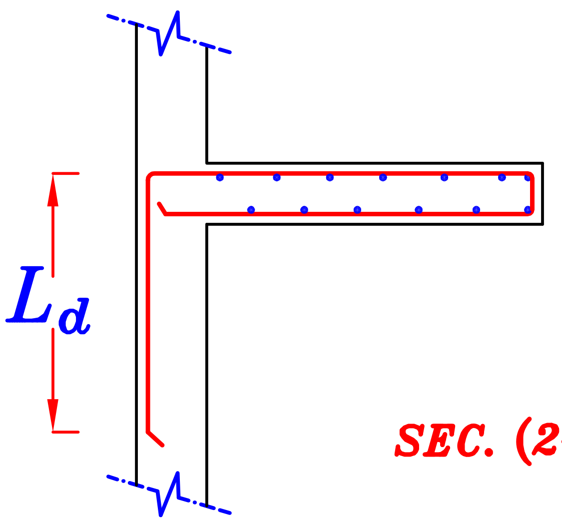


RFT. of the Slab.





SEC. (1-1)

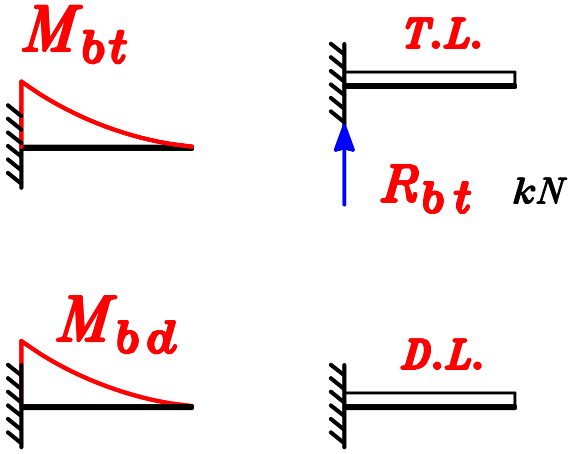


SEC. (2-2)

Beams.

B1

moment تعمل
على العمود →



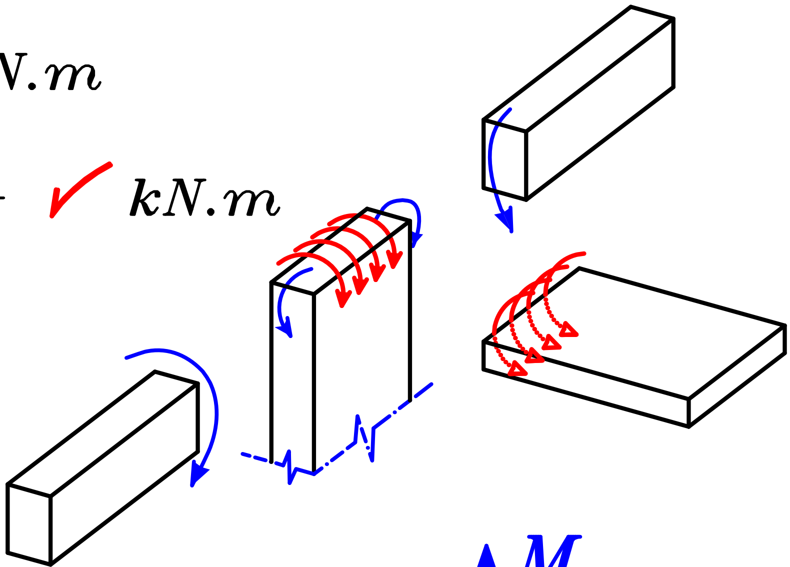
Column.

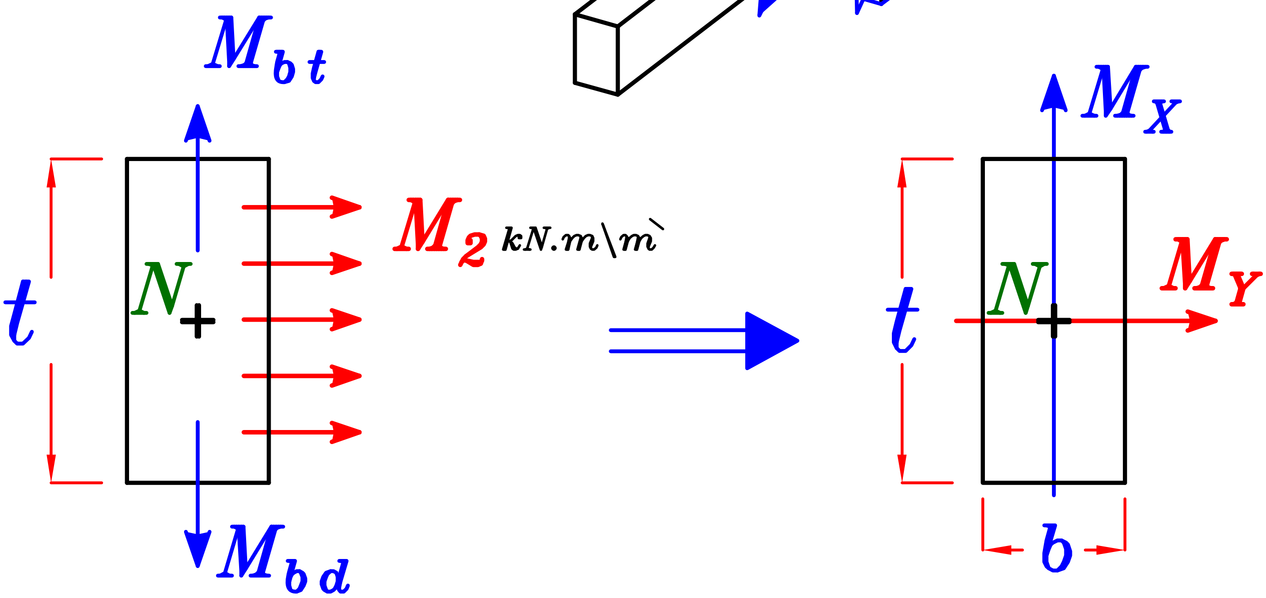
(Loads From one Floor)

$$N = R_s * t + 2(R_{bt}) = \checkmark \ kN$$

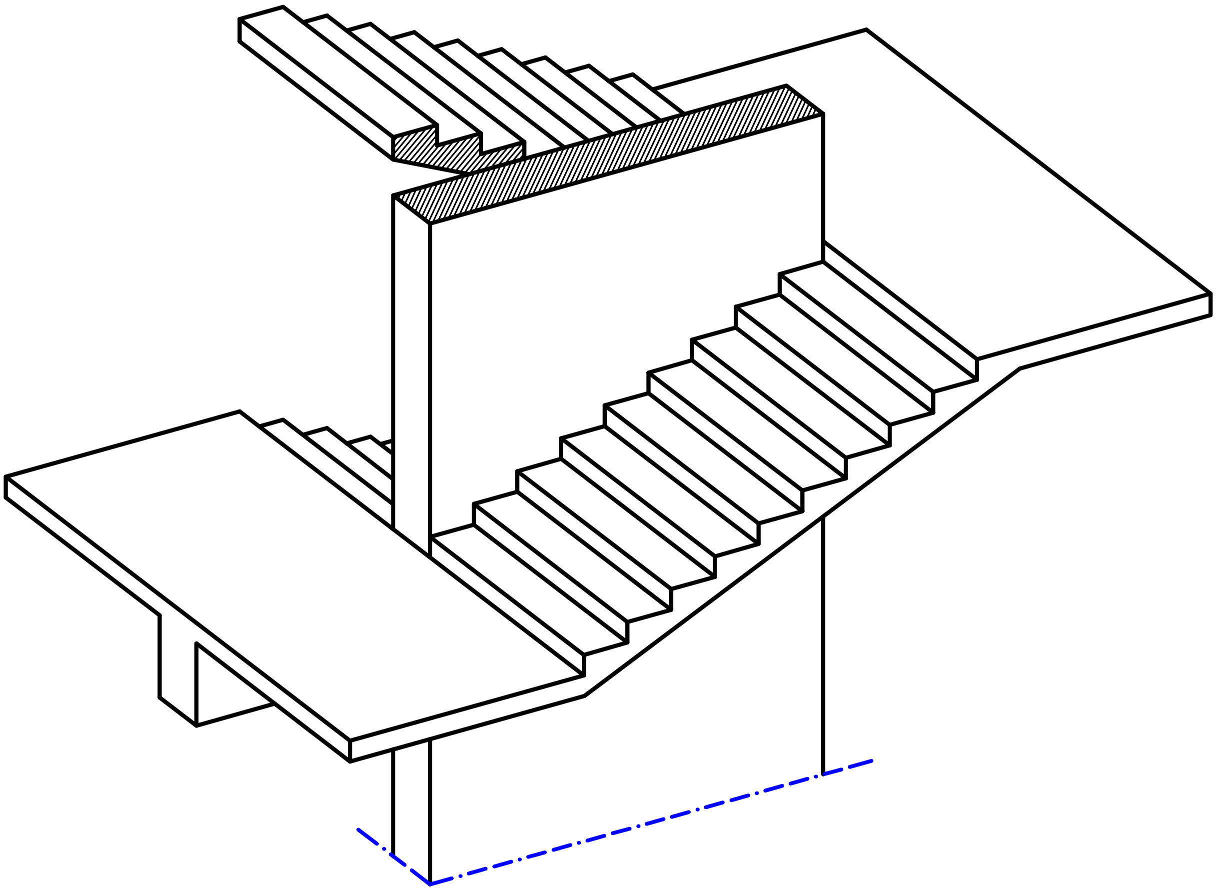
$$M_Y = M_s * t = \checkmark \ kN.m$$

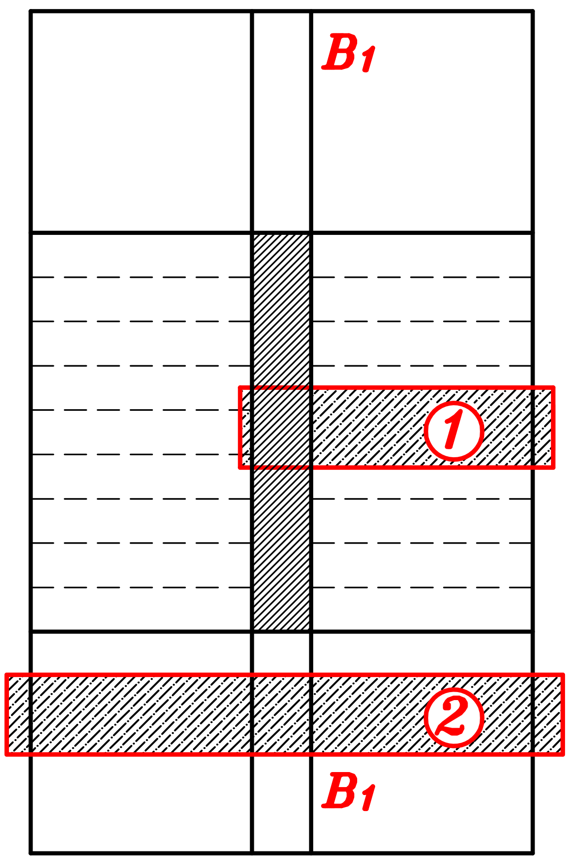
$$M_X = M_{bt}\uparrow - M_{bd}\downarrow = \checkmark \ kN.m$$





Example.





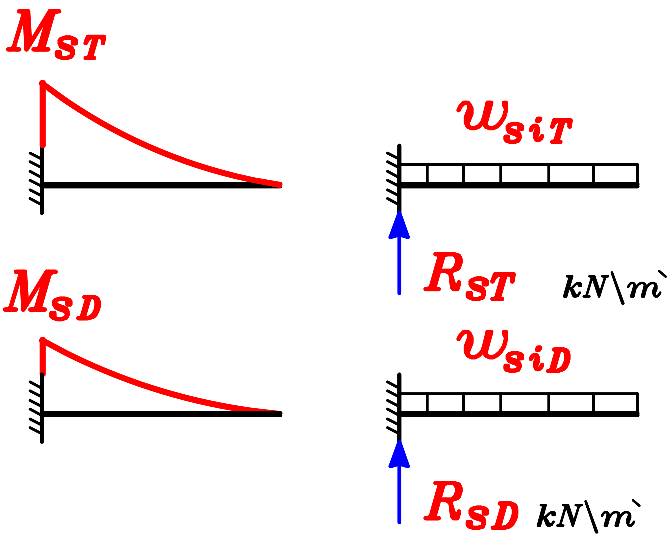
Slabs.

- $w_{shT} = 1.4\,(t_s\,\gamma_c + F.C.) + 1.4\,(L.L.)$
- $w_{shD} = 0.9\,(t_s\,\gamma_c + F.C.)$
- $w_{si\,T} = 1.4\,(t_s\,\gamma_c + F.C.) + 1.4\,(L.L.)\cos\theta$
- $w_{si\,D} = 0.9\,(t_s\,\gamma_c + F.C.)$

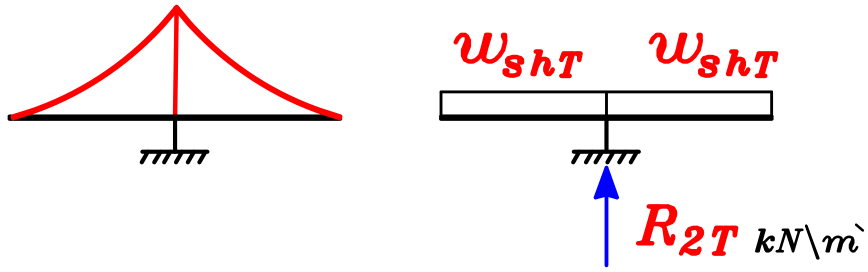
Strip ①

$\Delta M = M_{1T} - M_{1D}$

تعمل ($M_Y \longrightarrow$) على الحائط



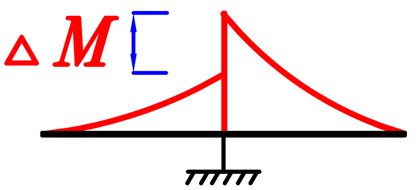
Strip ②

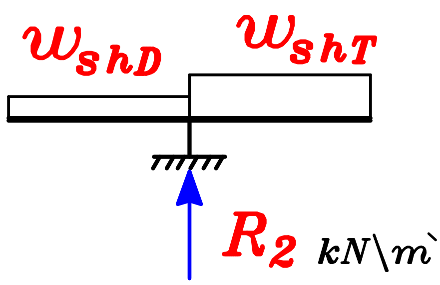


To get B.M. on B_1

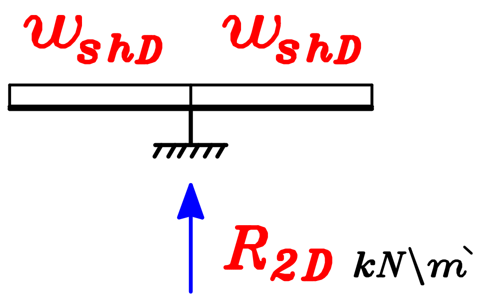
Torsion تعمل $\longrightarrow$

على B_1

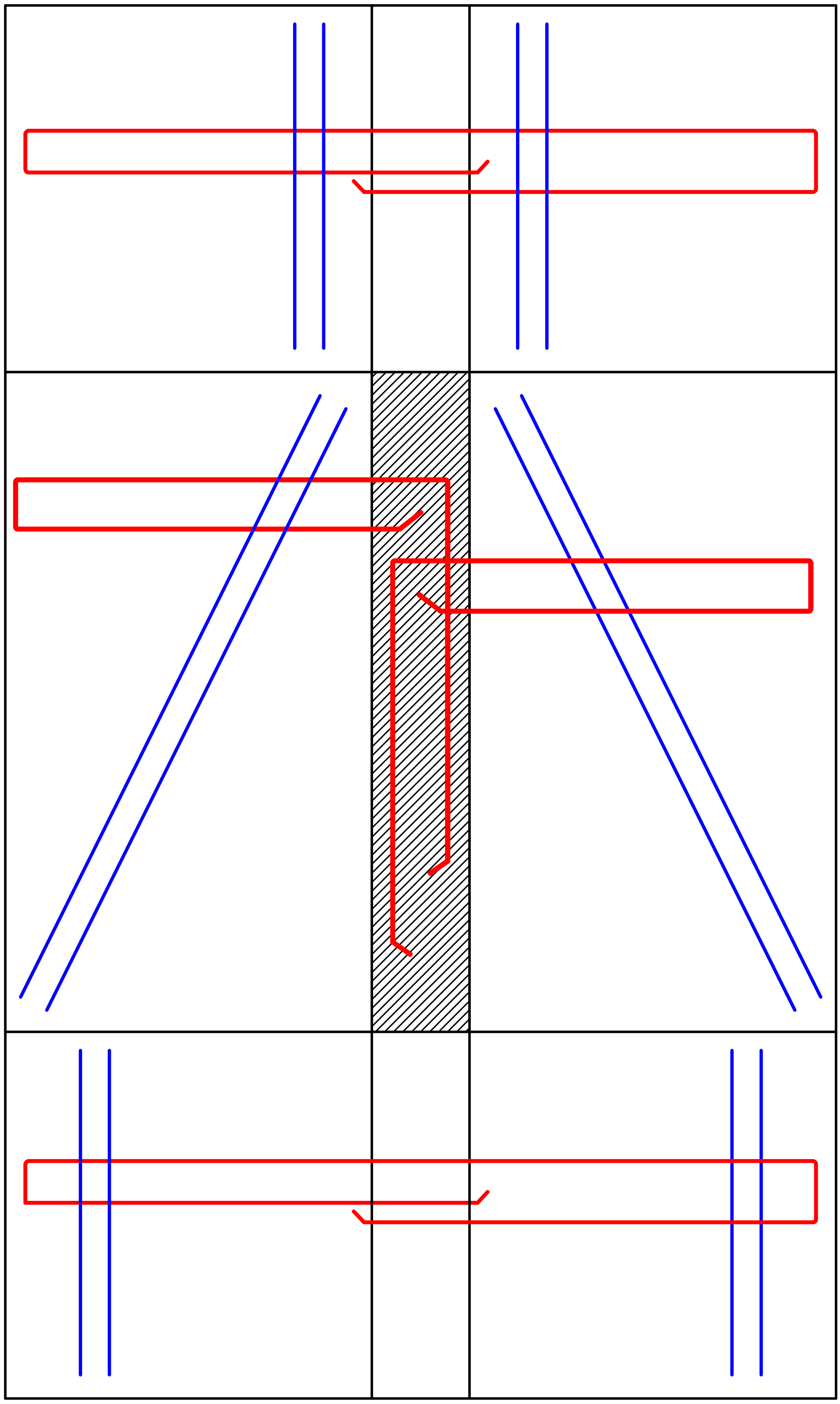




To get S.F. on B_1



RFT. of the Slab.



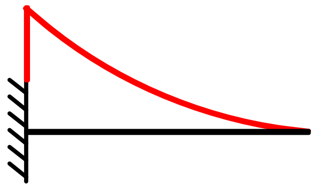
Beams.

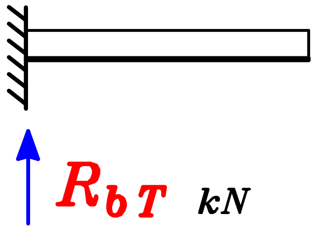
B1

M_{bT}

$o.w. + R_{2T}$ $kN \backslash m'$

B.M.D.



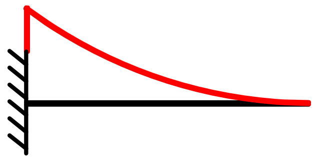


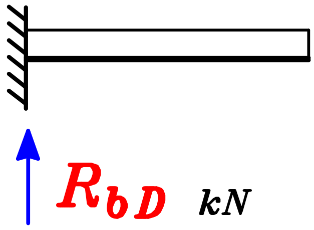
R_{bT} kN

M_{bD}

$o.w. + R_{2D}$ $kN \backslash m'$

B.M.D.





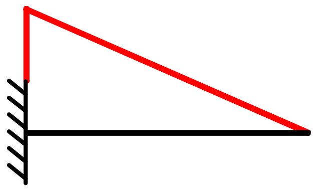
R_{bD} kN

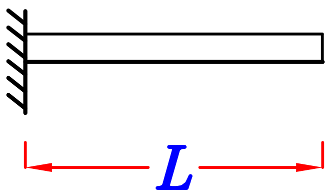
$$\Delta M = M_{bT} - M_{bD}$$

تعمل (M_Y ↑) على الحائط

$o.w. + R_2$ $kN \backslash m'$

S.F.D.

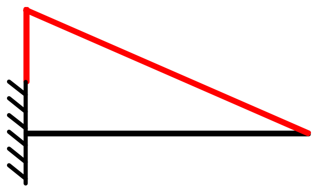


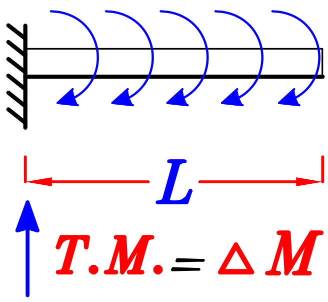


$$M_{Tor.} = \Delta M * L$$

ΔM $kN.m \backslash m'$

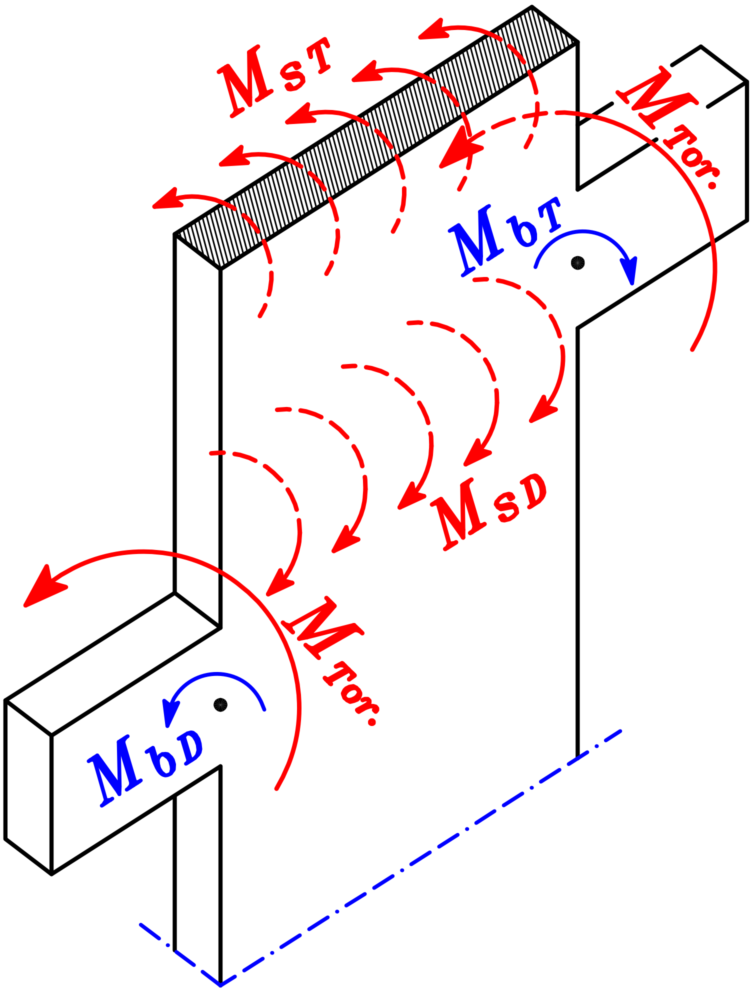
T.M.D.

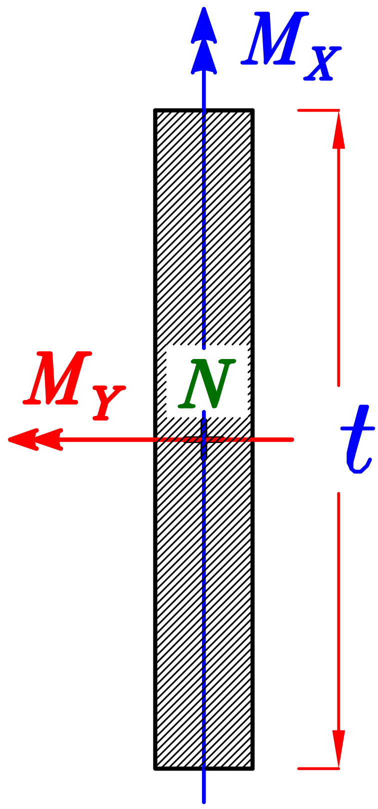




$T.M. = \Delta M * L$

R.C. Wall. (Loads From one Floor)





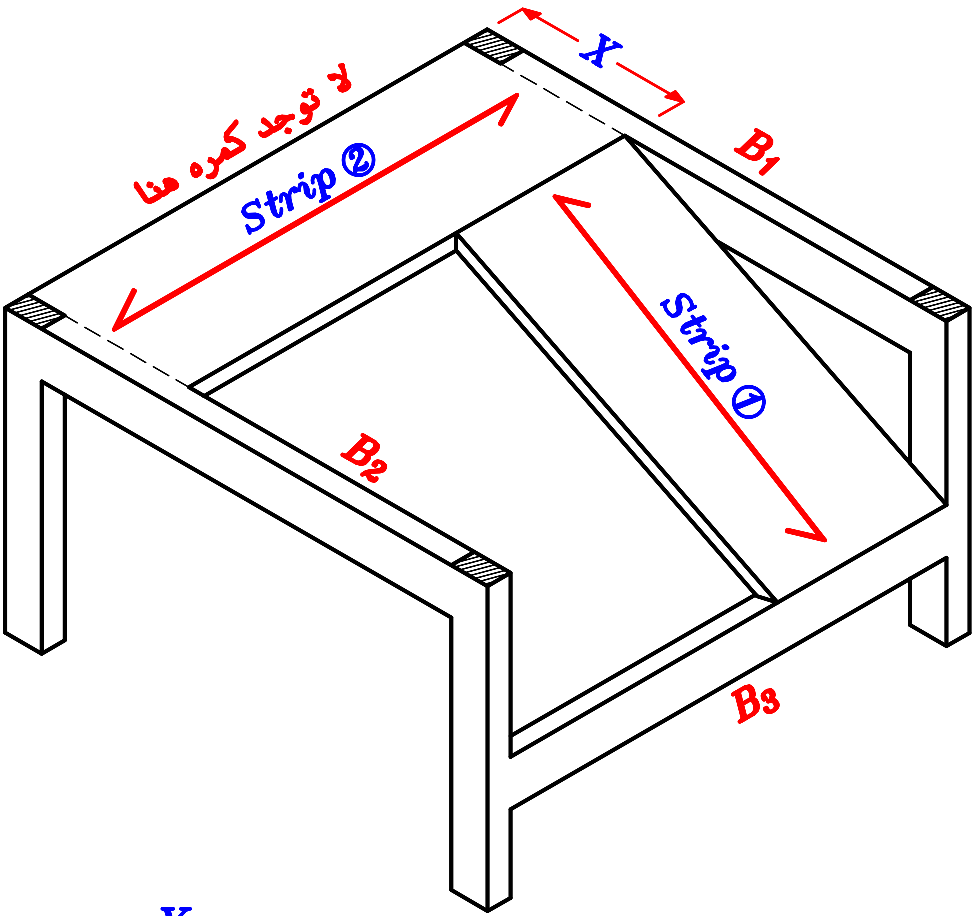
$$N = 2\,(R_{ST}) * (t) + 2\,(R_{bT})$$

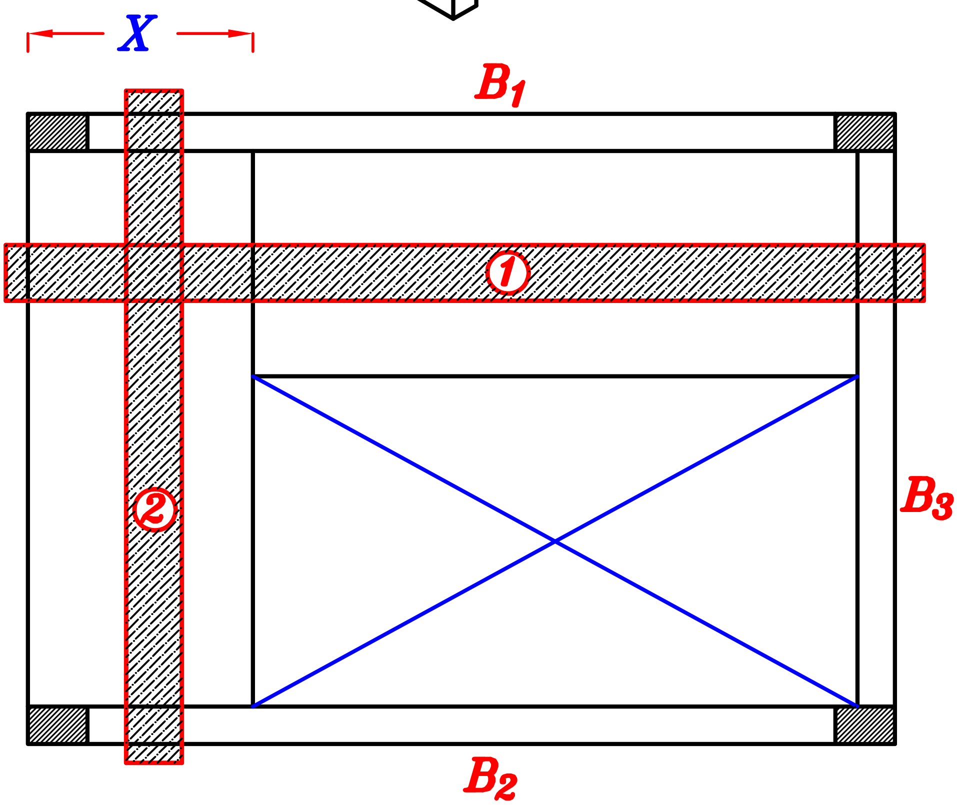
$$M_X = M_{bT} - M_{bD}$$

$$M_Y = M_{ST} * (t) - M_{SD} * (t) + 2\,M_{Tor.}$$

Spring Stairs.

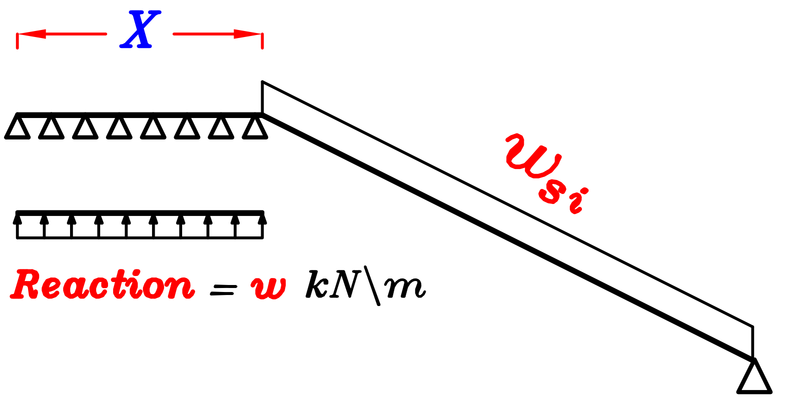
عندما يصعُب علينا وضع كمره لتحمل بلاطه السلم
ممكن أن نجعل بلاطه السلم تُحمل على بلاطه أخرى





Strip ①

يجب أن نحل الشريحه المحموله أولا



الشريحه عباره عن بلاطه لذا نعتبره support **distributed Support**

أى أن له **distributed Reaction**

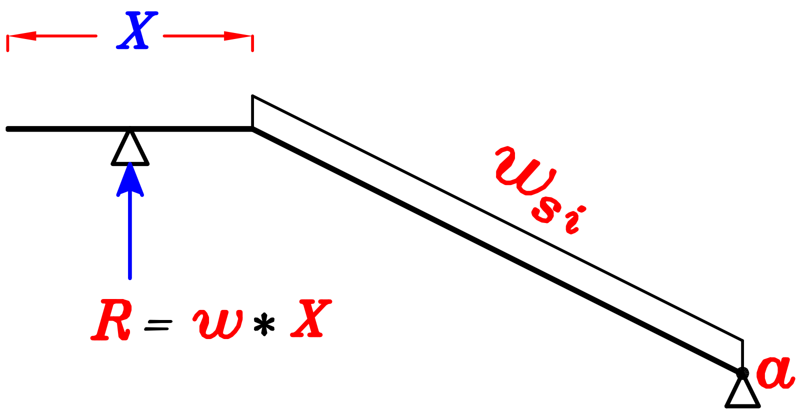
و لكى نستطيع أن نحل هذه الشريحه سوف نحسب محصله ال **Reactions**

$\because \sum M_a = Zero$

$\therefore Get \; R$

$\because \; R = w * X$

$\therefore \; w = \dfrac{R}{X}$



Strip ②

ثم نحل الشريحه الحامله و نضع عليها **Reaction** الشريحه المحموله

ملحوظه هامه

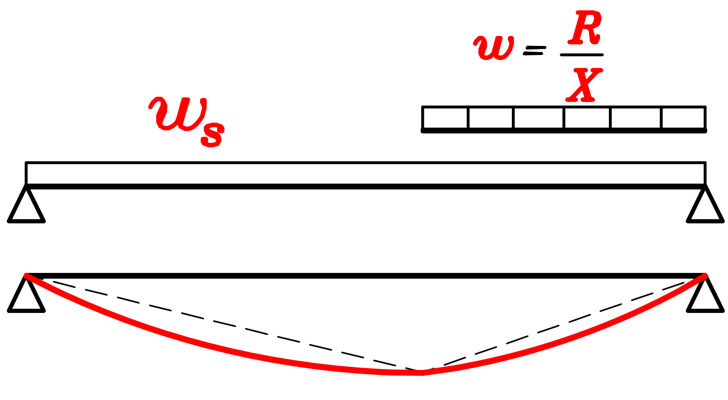
فى مساحه التقاطع بين الشريحتين

يجب أن يكون تسليح الشريحه الحامله

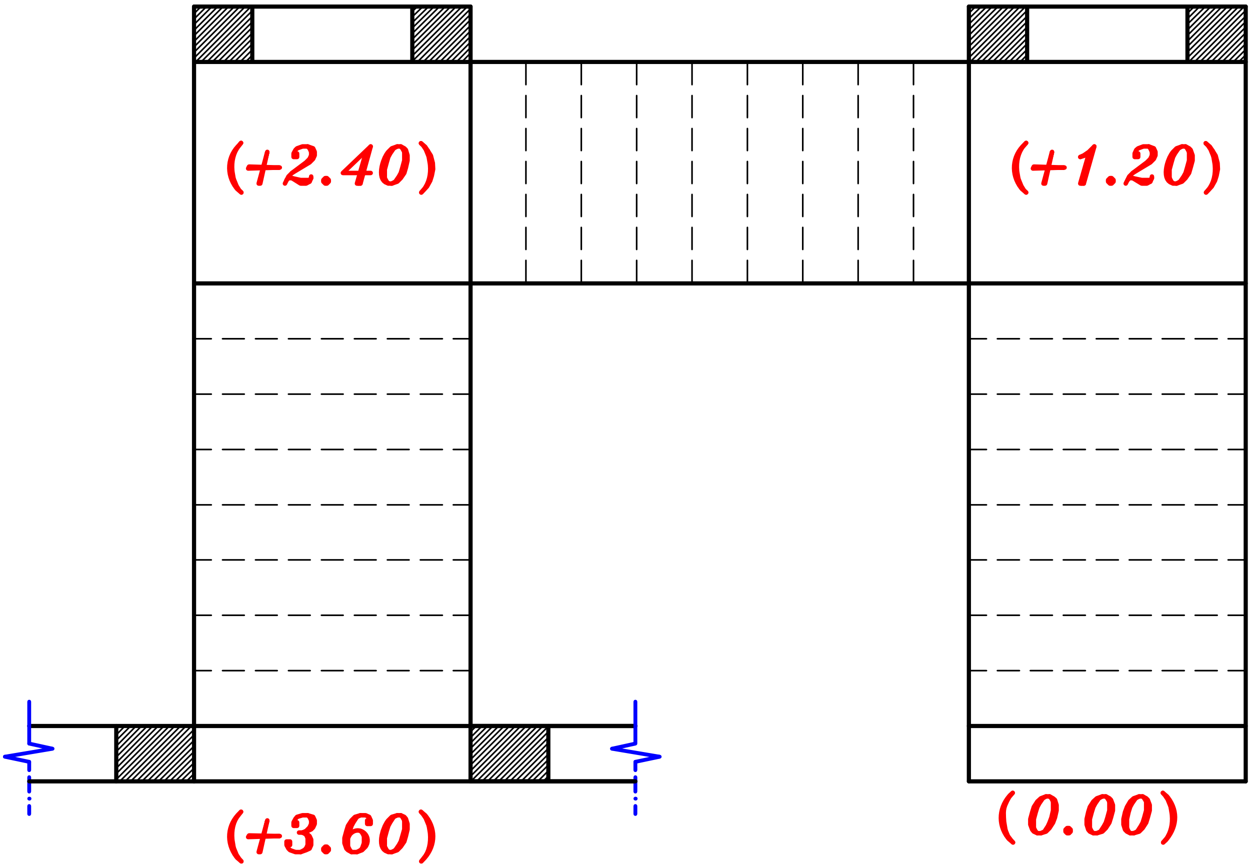
هو الحديد السفلى (الفرش)

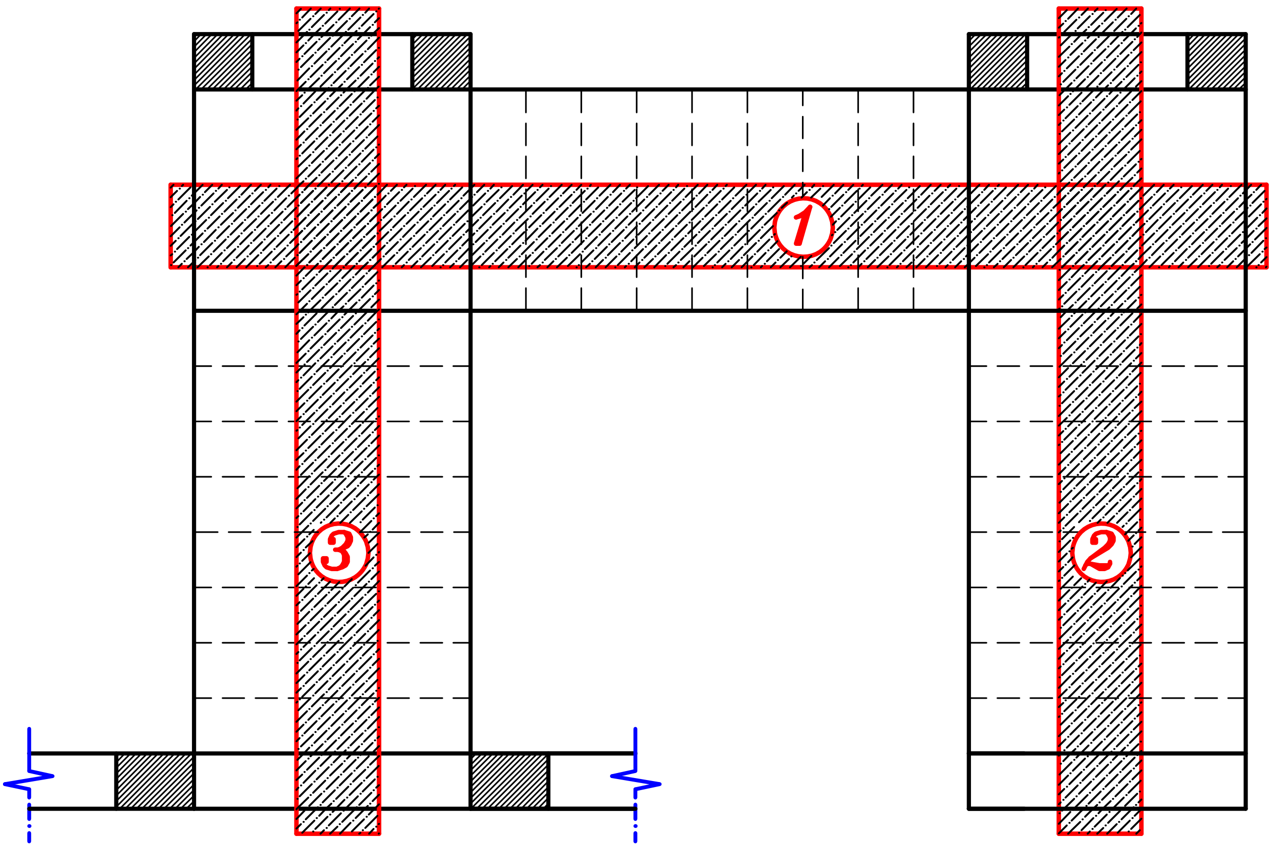
و يكون تسليح الشريحه المحموله

هو الحديد العلوى (الغطاء)



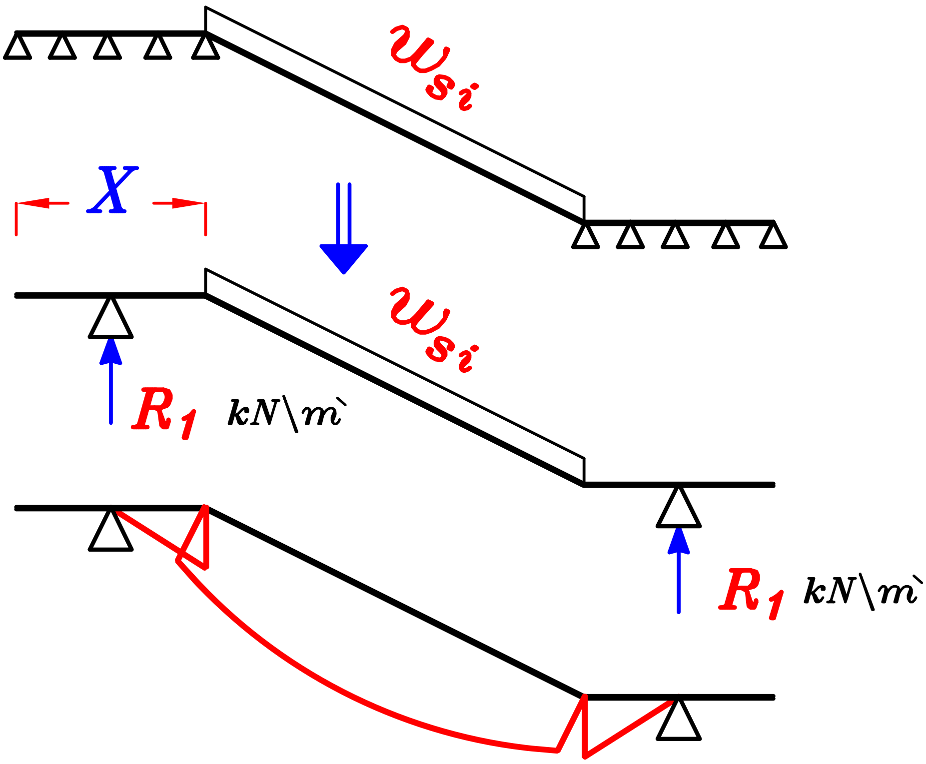
Example.





Slabs.

Strip ①

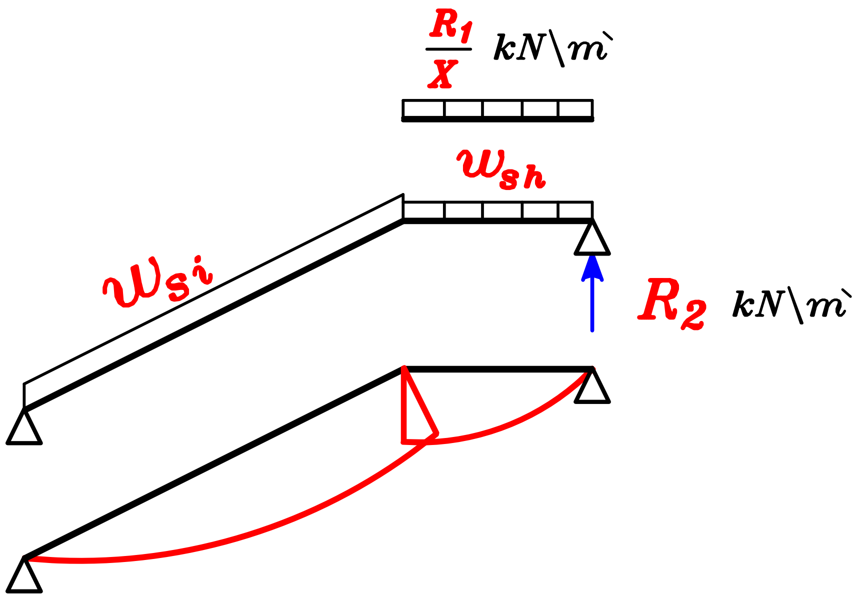


ملحوظه

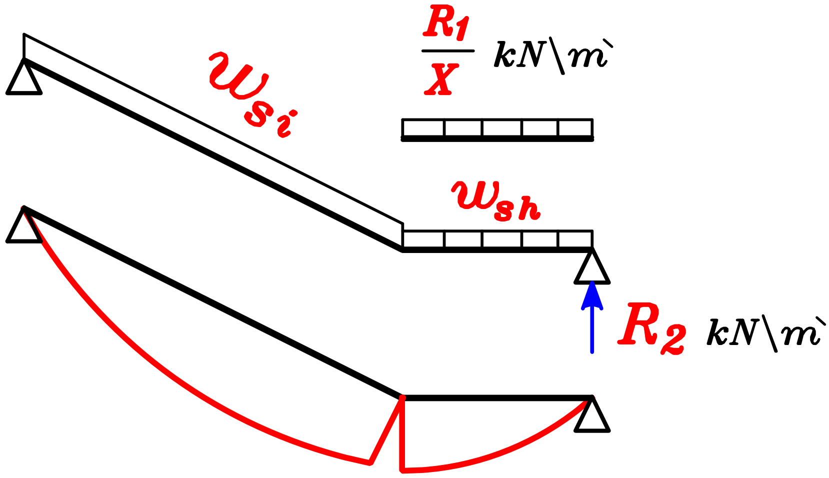
Strip ① محموله على

البلاطه لـ Strip ②

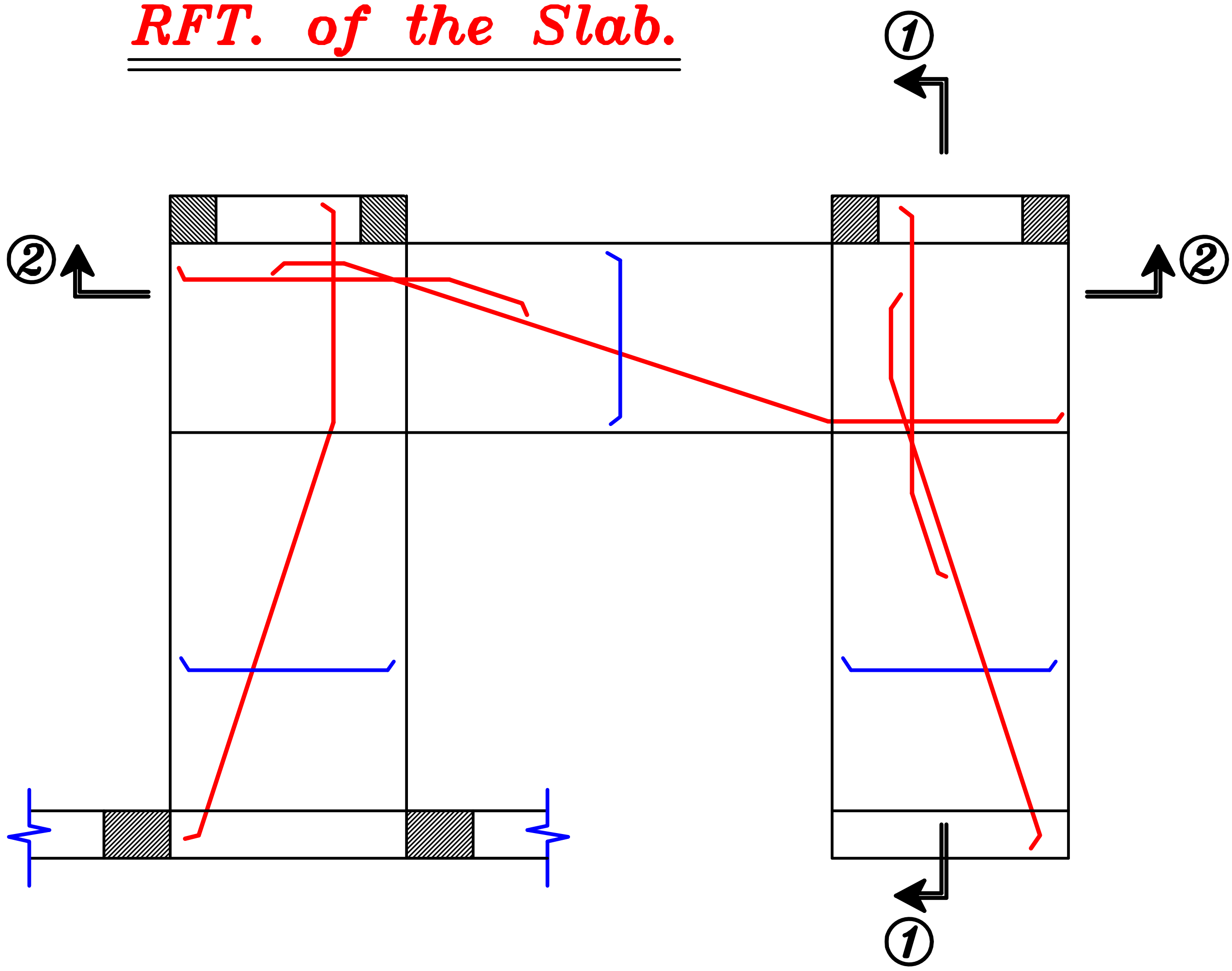
Strip ②

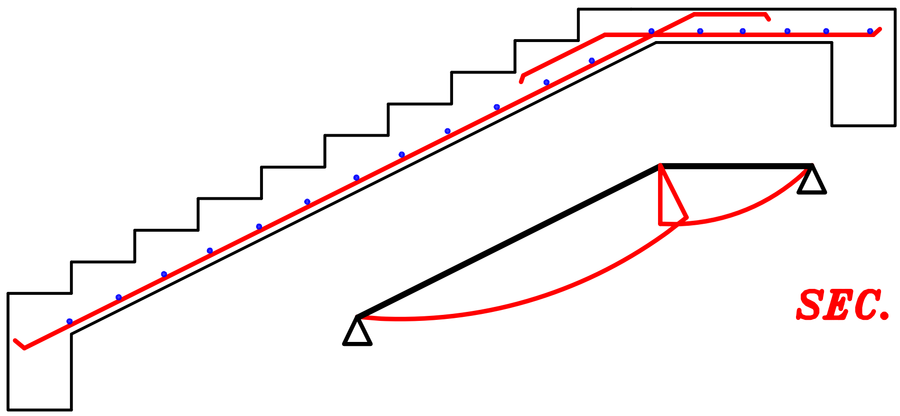


Strip ③



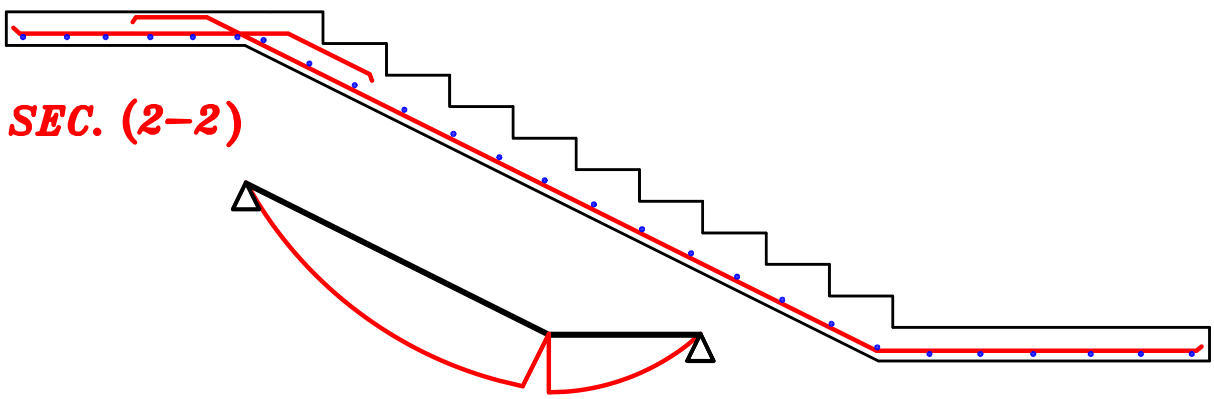
RFT. of the Slab.





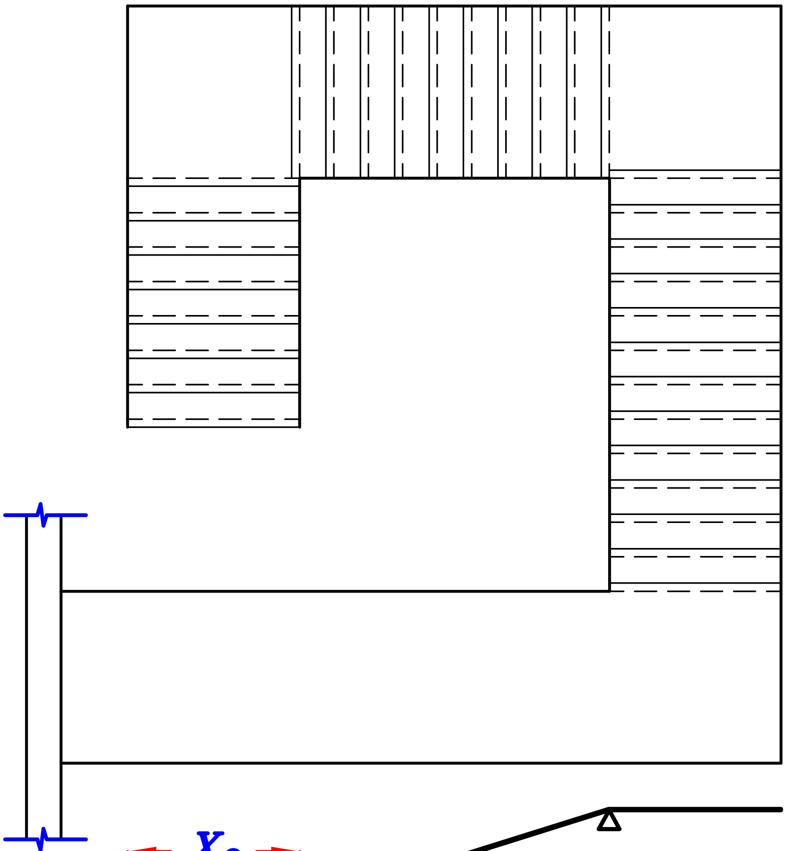
SEC. (1–1)

SEC. (2–2)

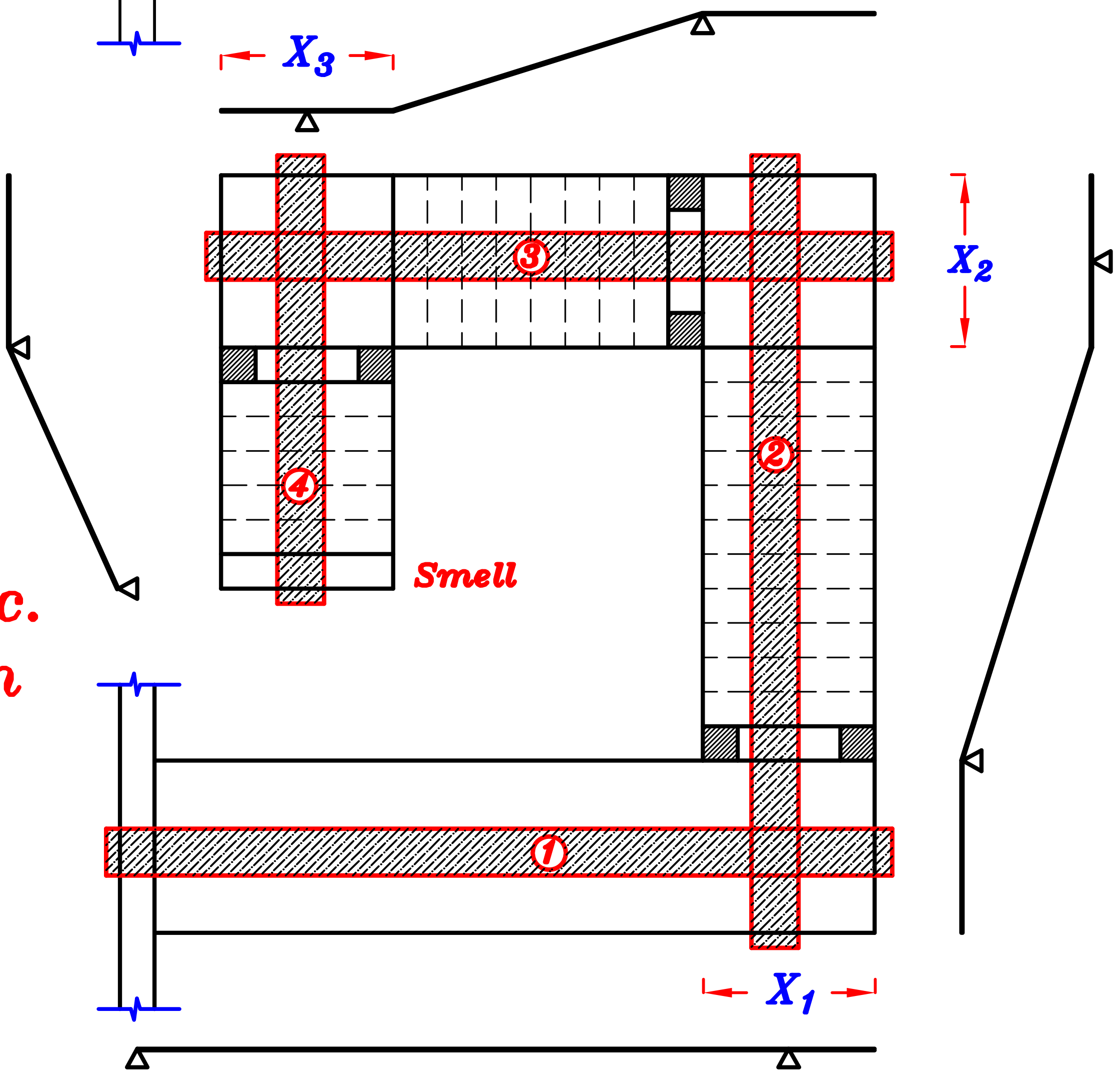


Example.

Arc.
Plan

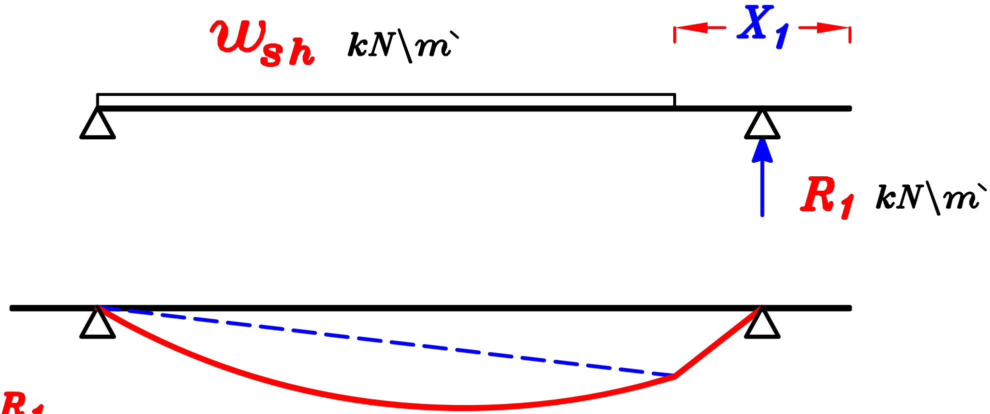


Struc.
Plan

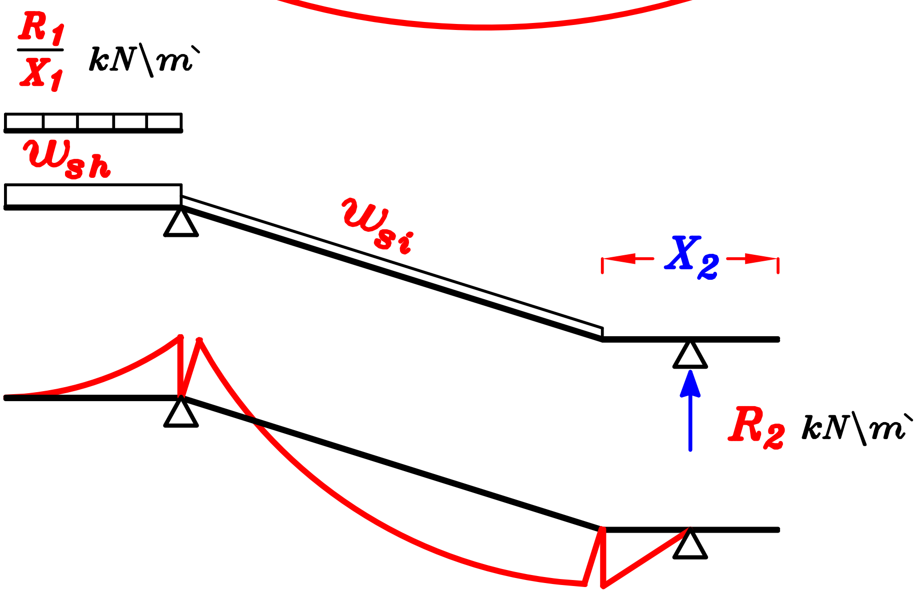


Slabs.

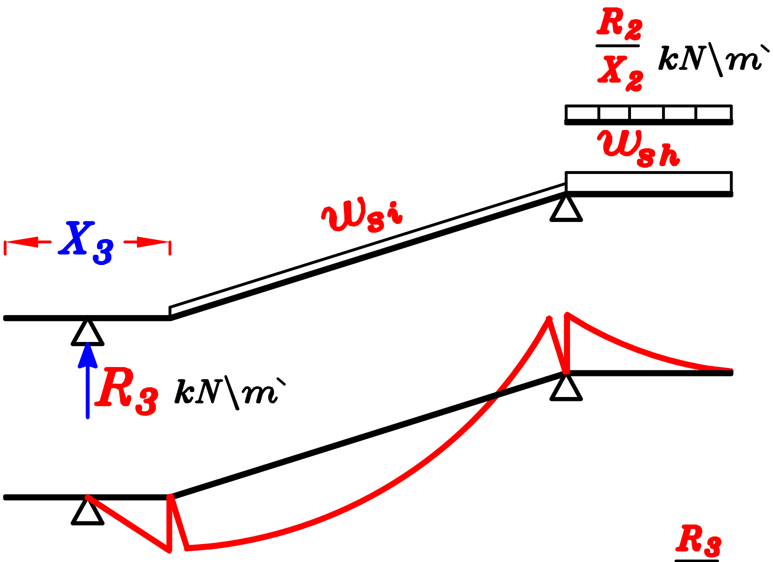
Strip ①



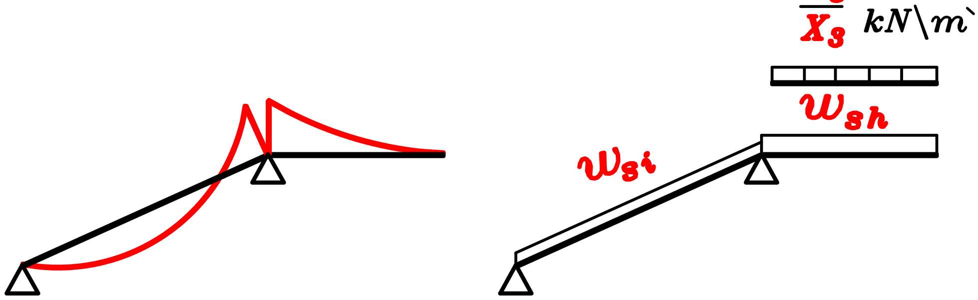
Strip ②



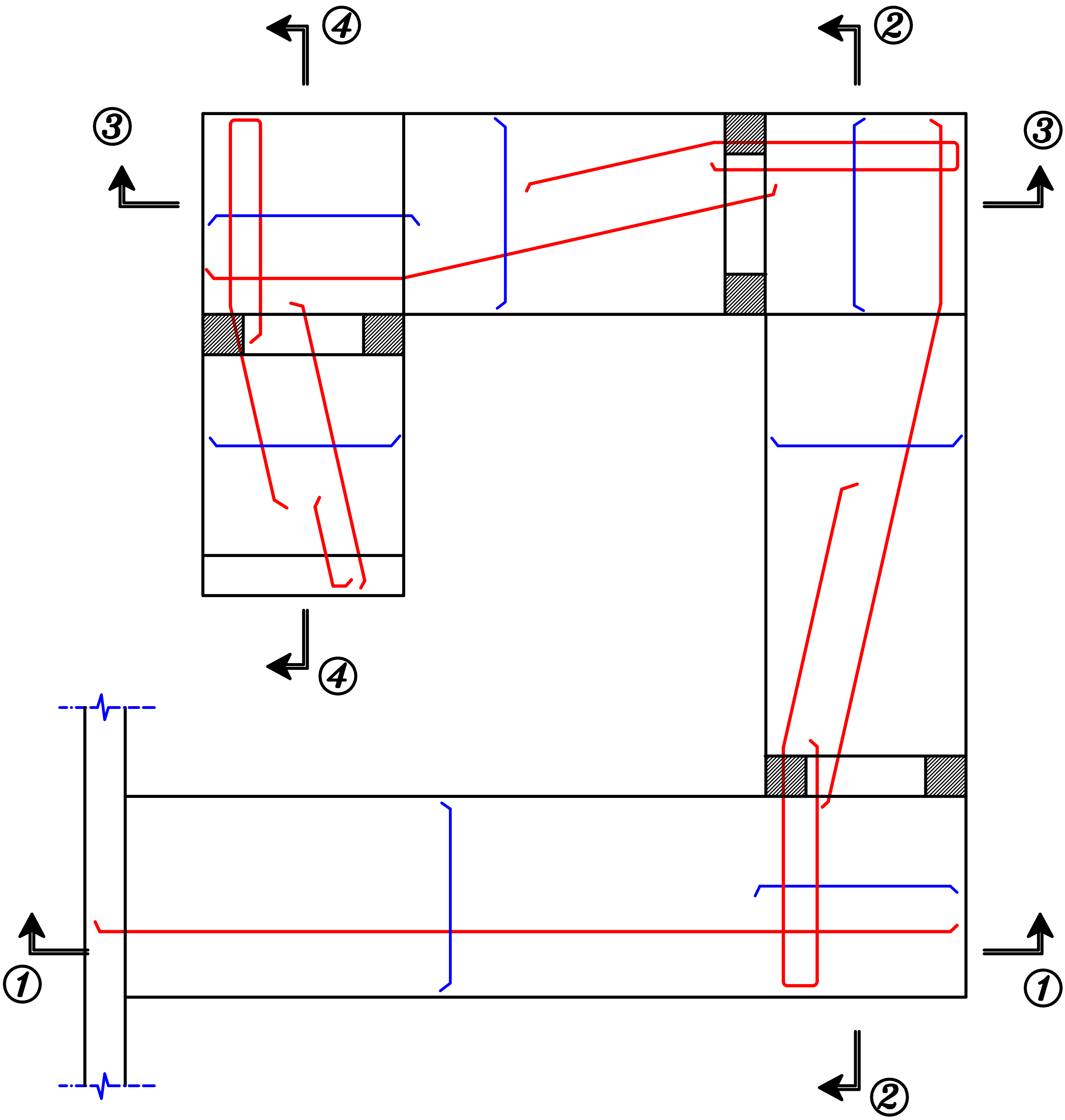
Strip ③

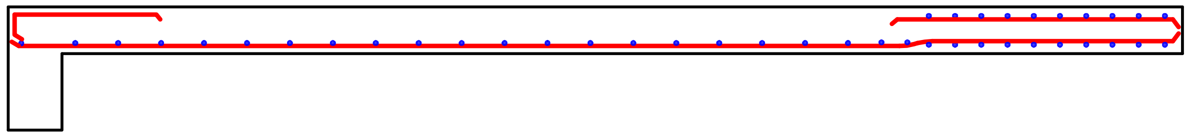


Strip ④

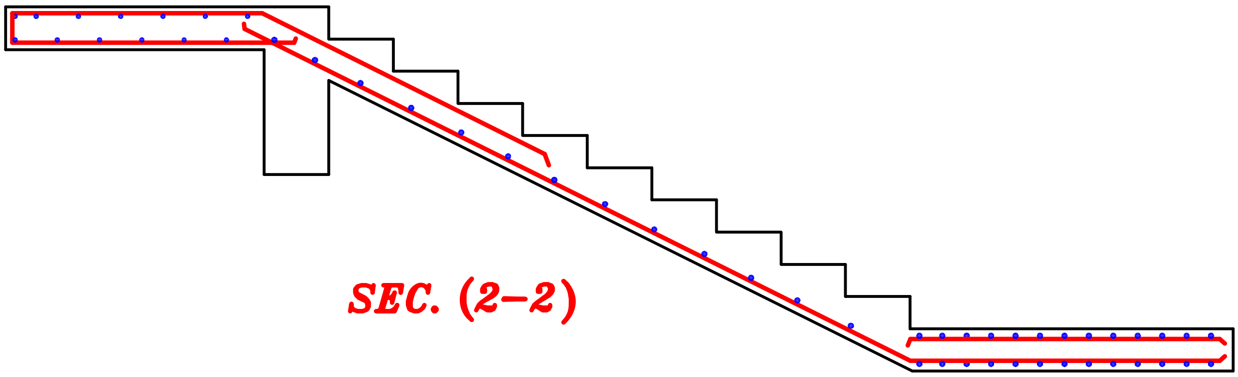


RFT. of the Slab.

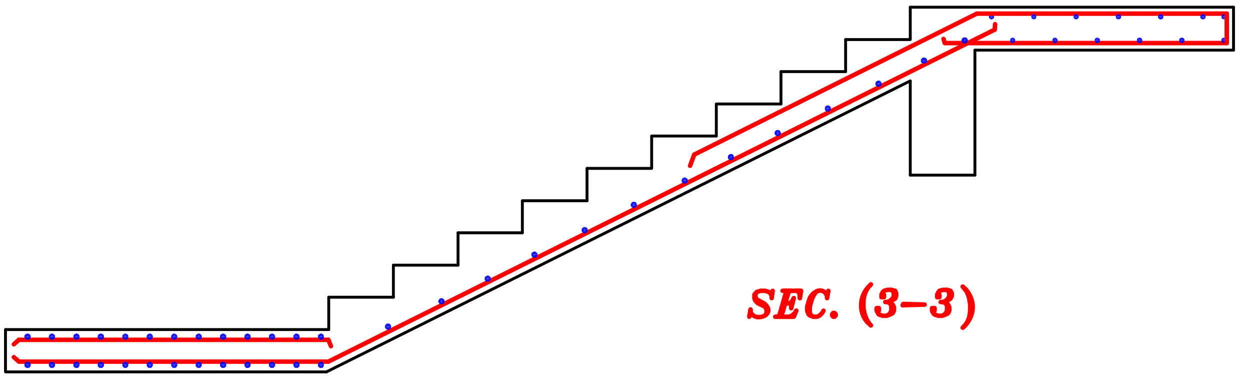




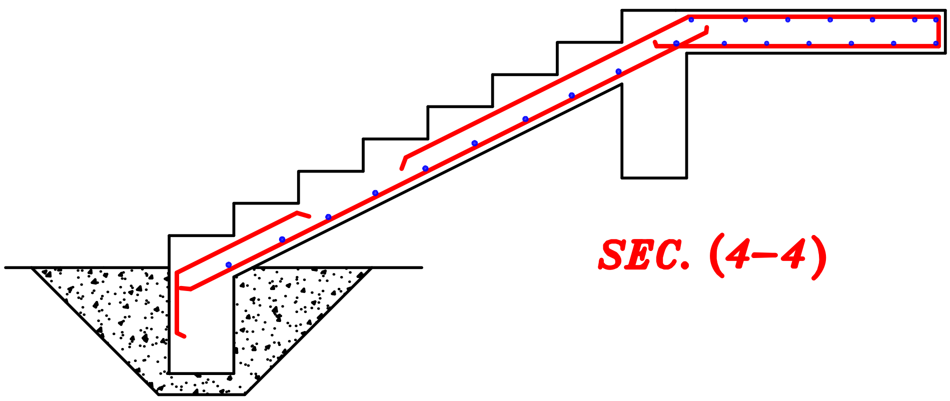
SEC. (1-1)



SEC. (2-2)

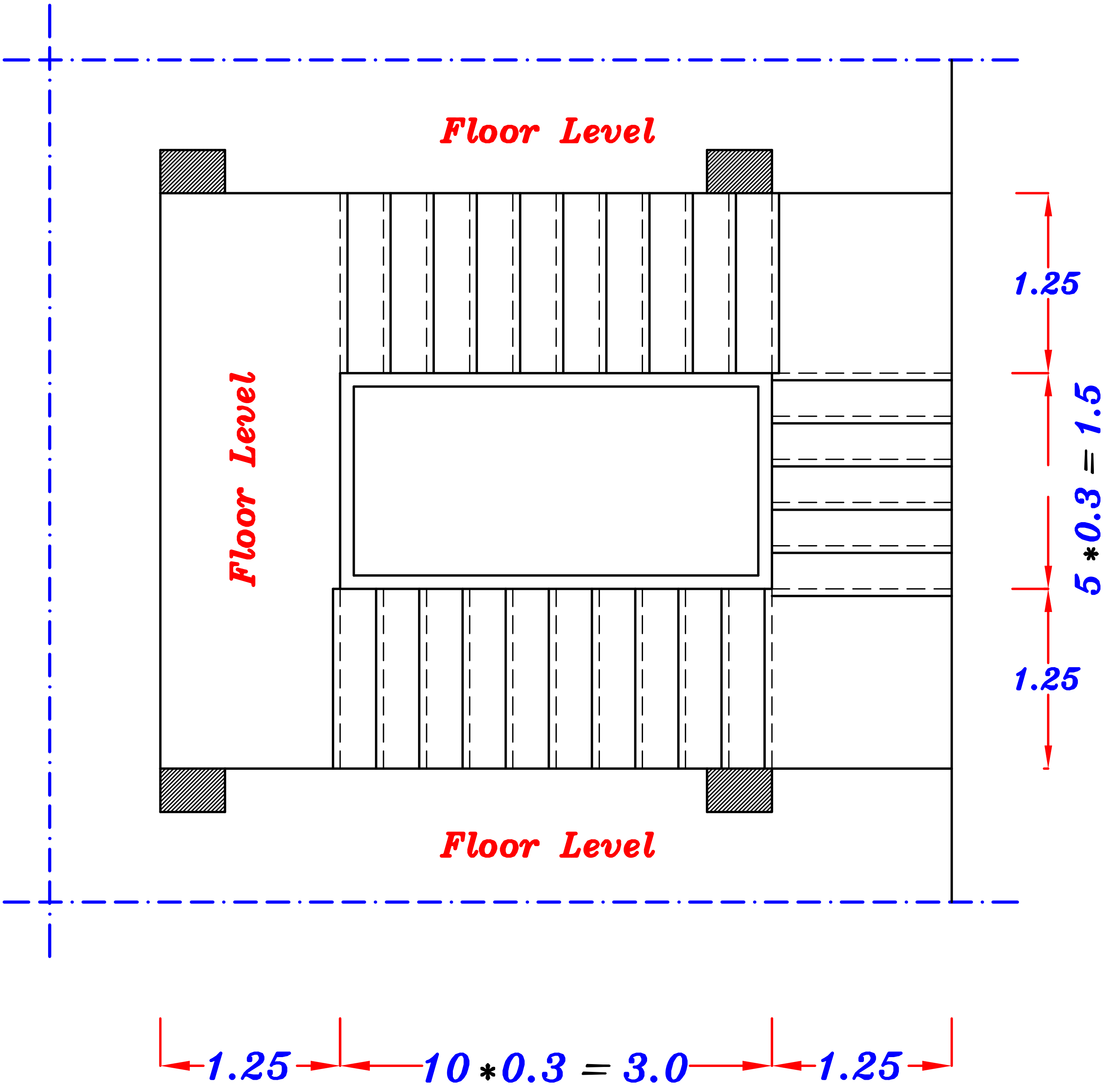


SEC. (3-3)

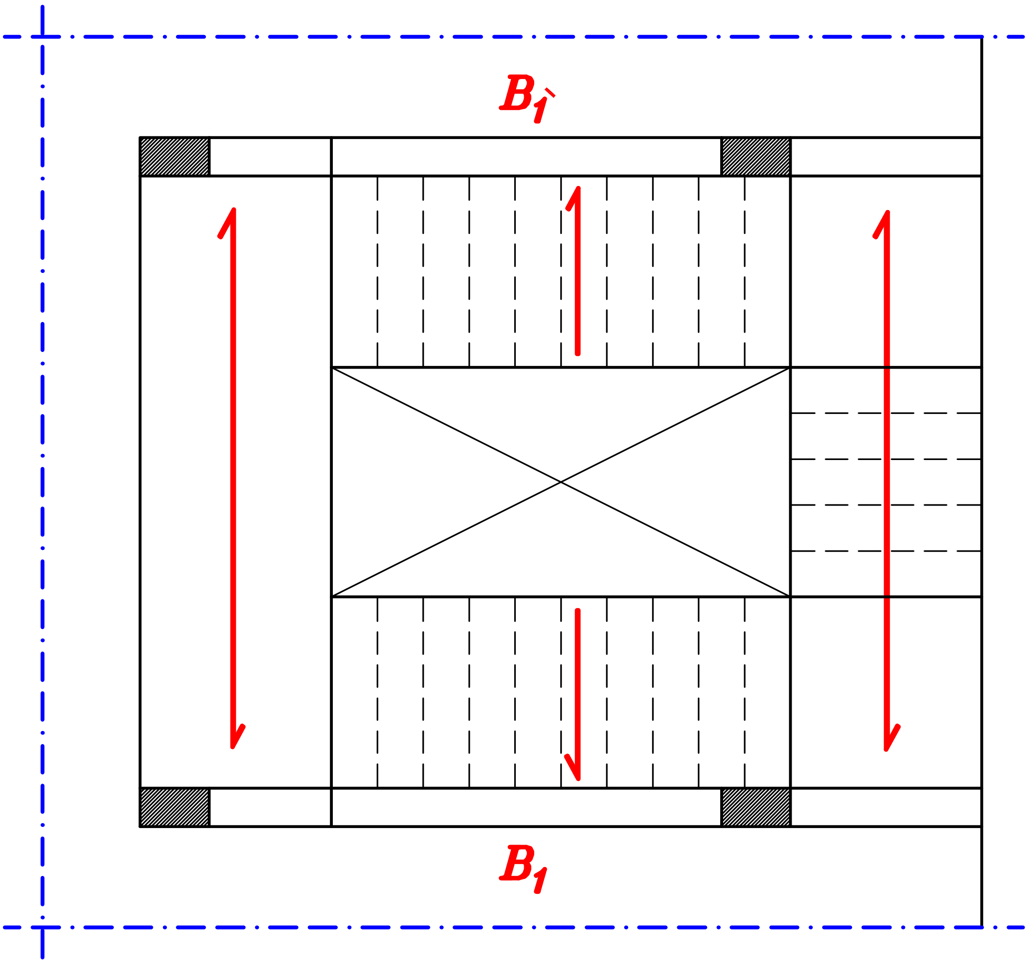


SEC. (4-4)

Example.


Floor Level
Floor Level
Floor Level
1.25
5 * 0.3 = 1.5
1.25
1.25
10 * 0.3 = 3.0
1.25

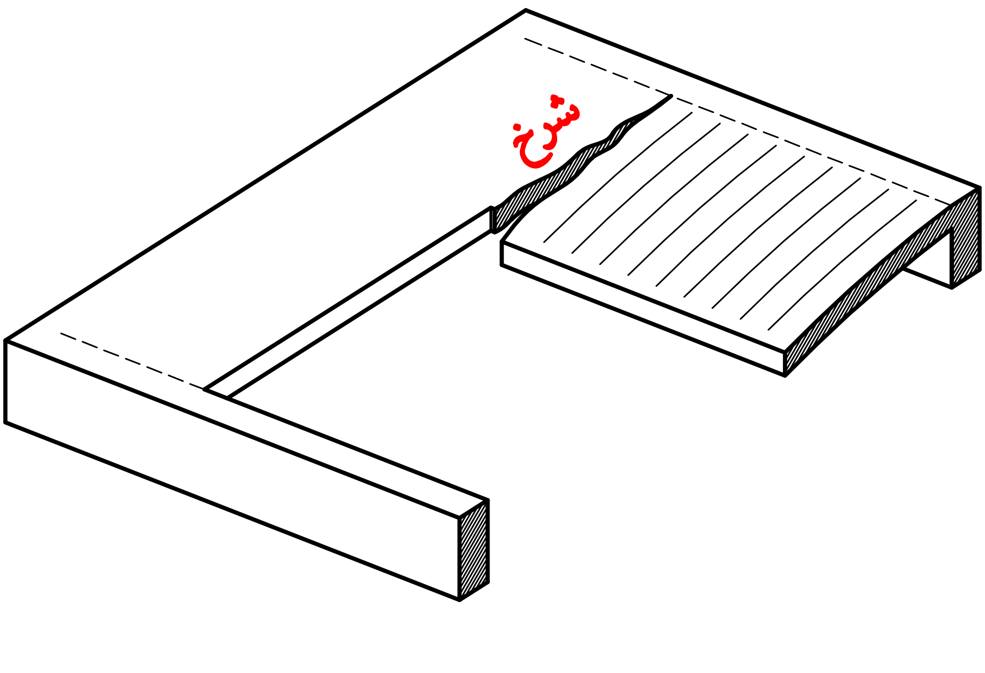
Statical action



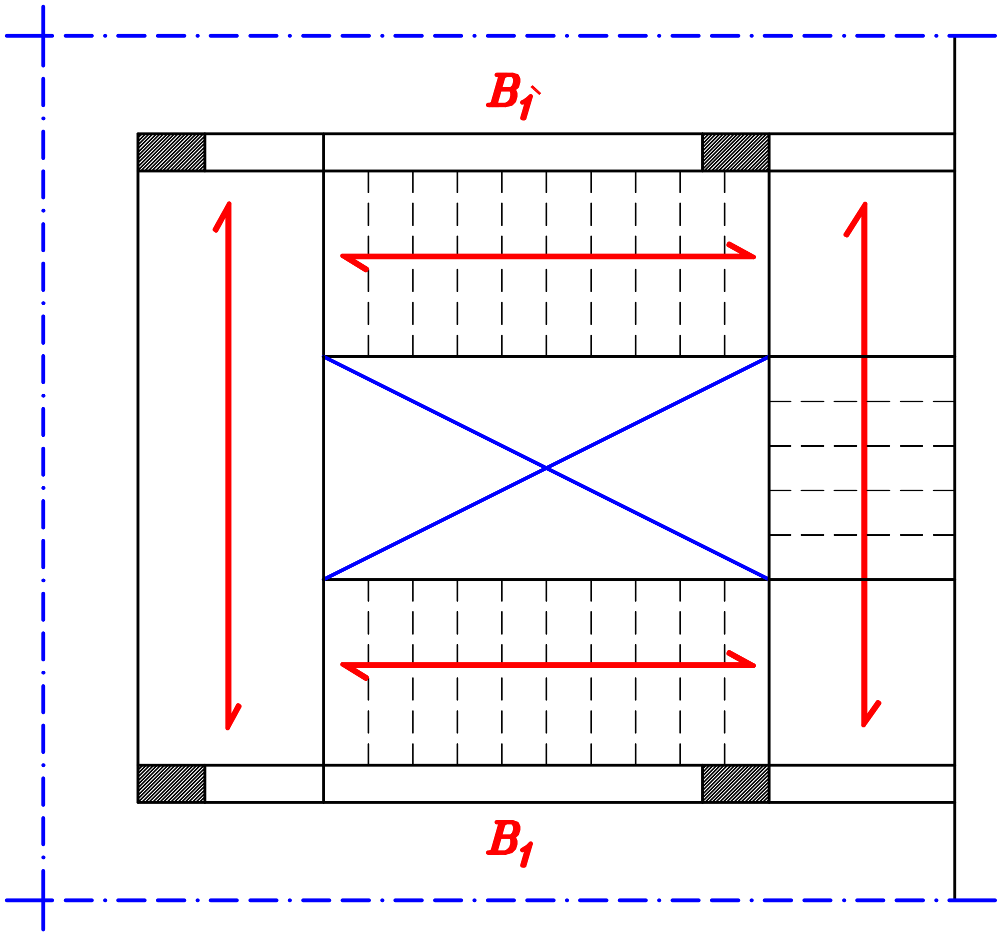
هذا الحل سيىء

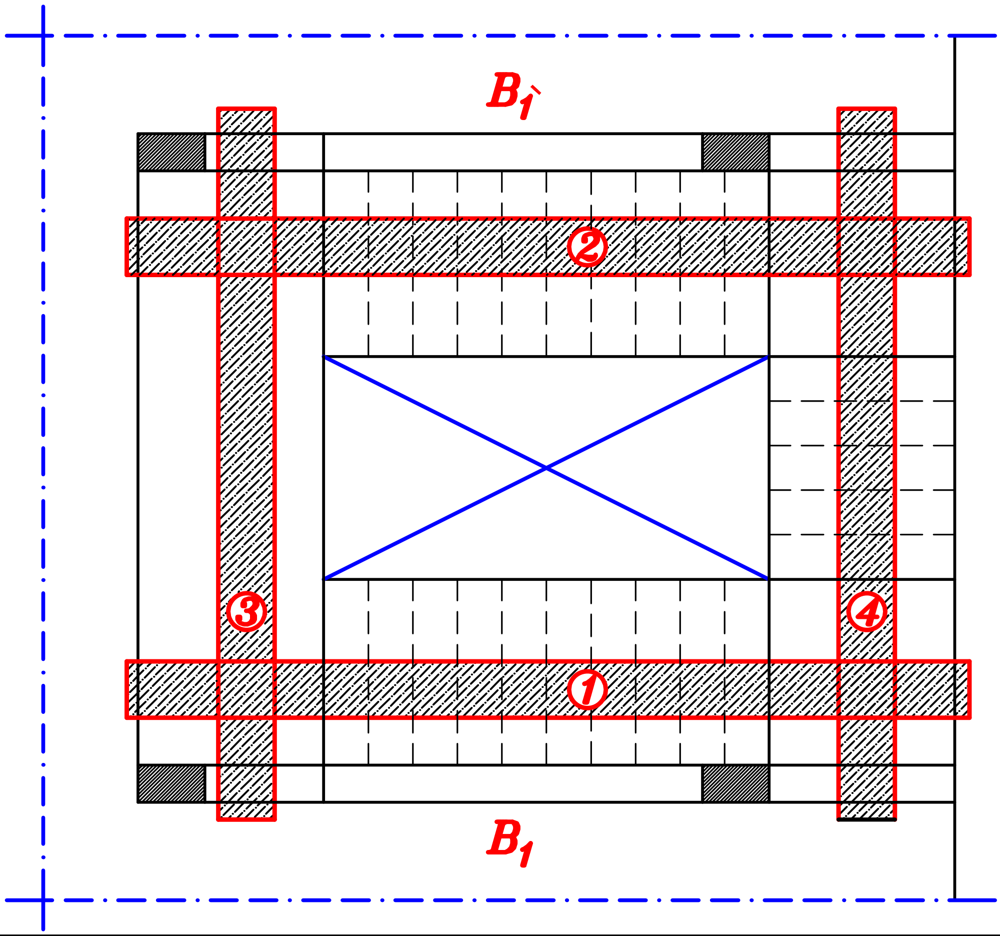
لانه توجد شريحتين ملتصقتين ببعضهما احداهما *simple* و الاخرى *cantilever*

فيحدث بينهم شرخ لعدم تساوى الـ *deflection*



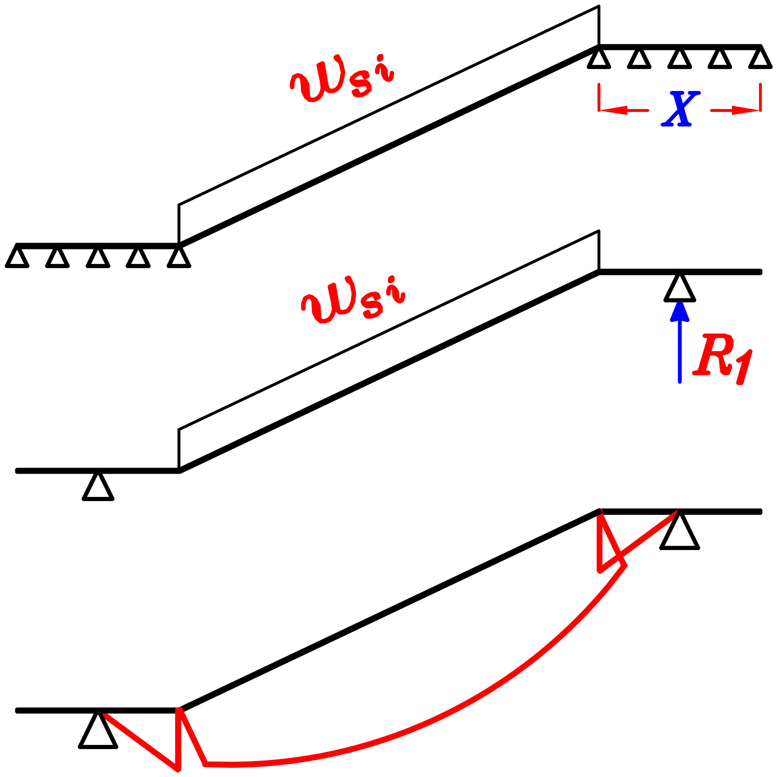
better solution



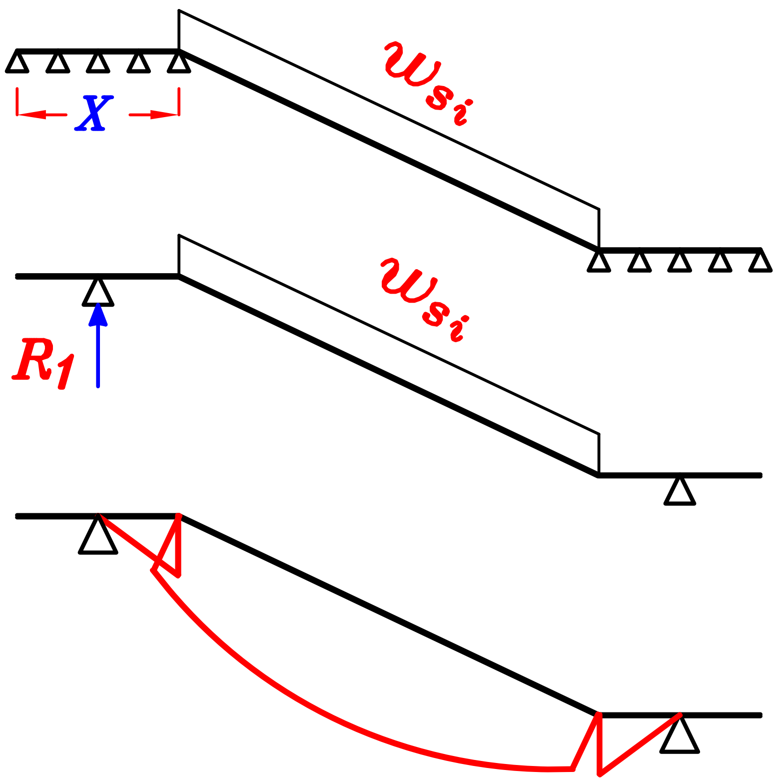


Slabs.

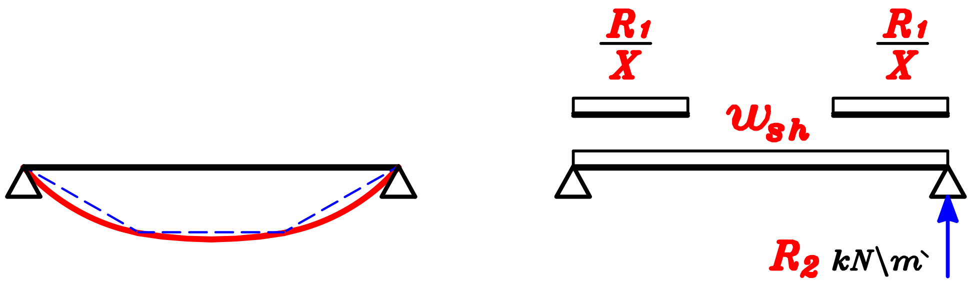
Strip ①



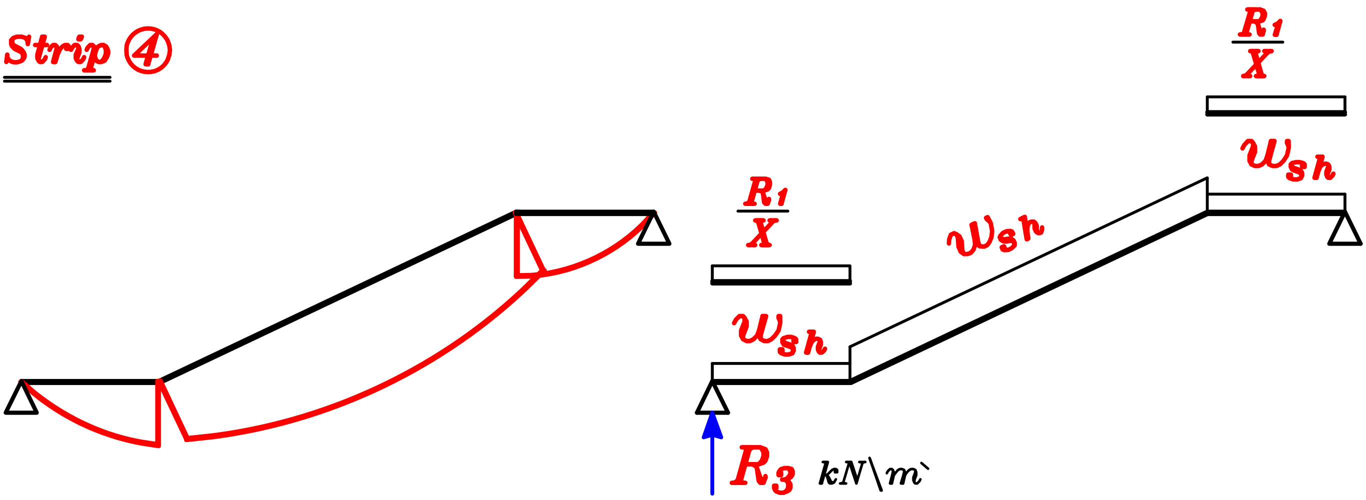
Strip ②



Strip ③



Strip ④



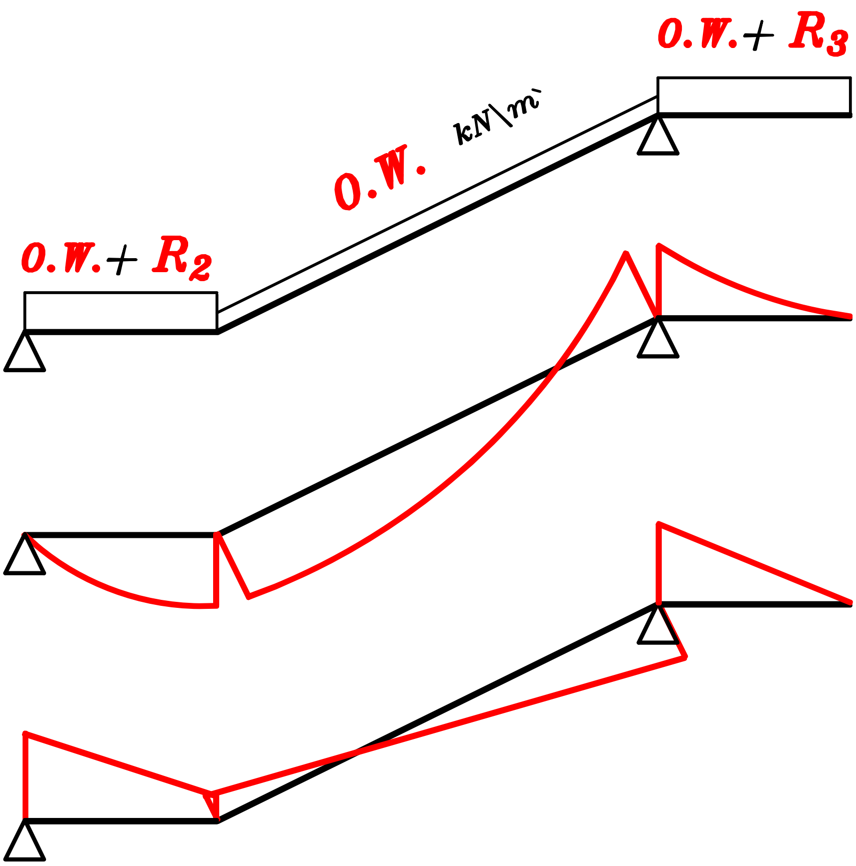
Beams.

B1

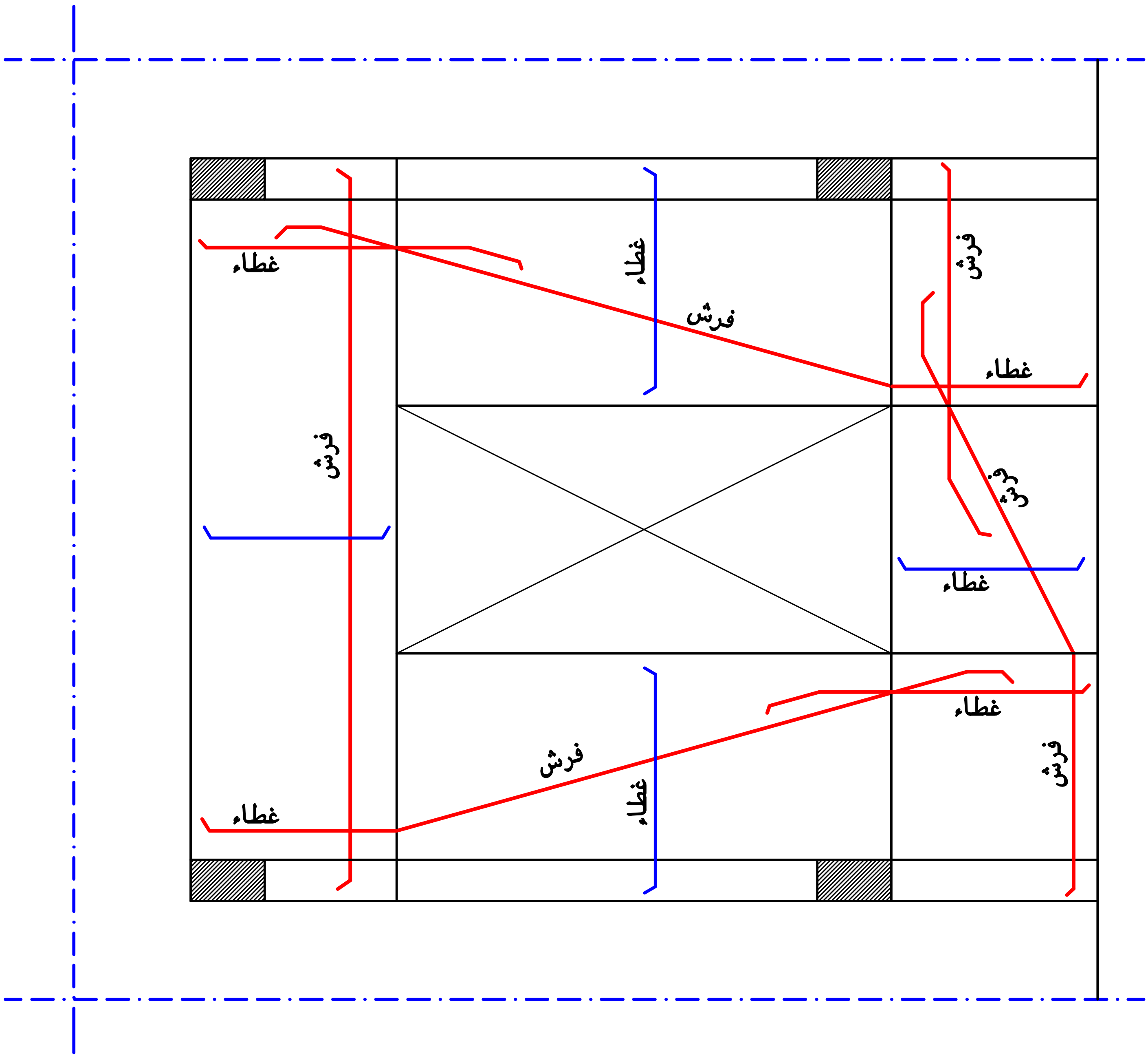
Loads

B.M.D.

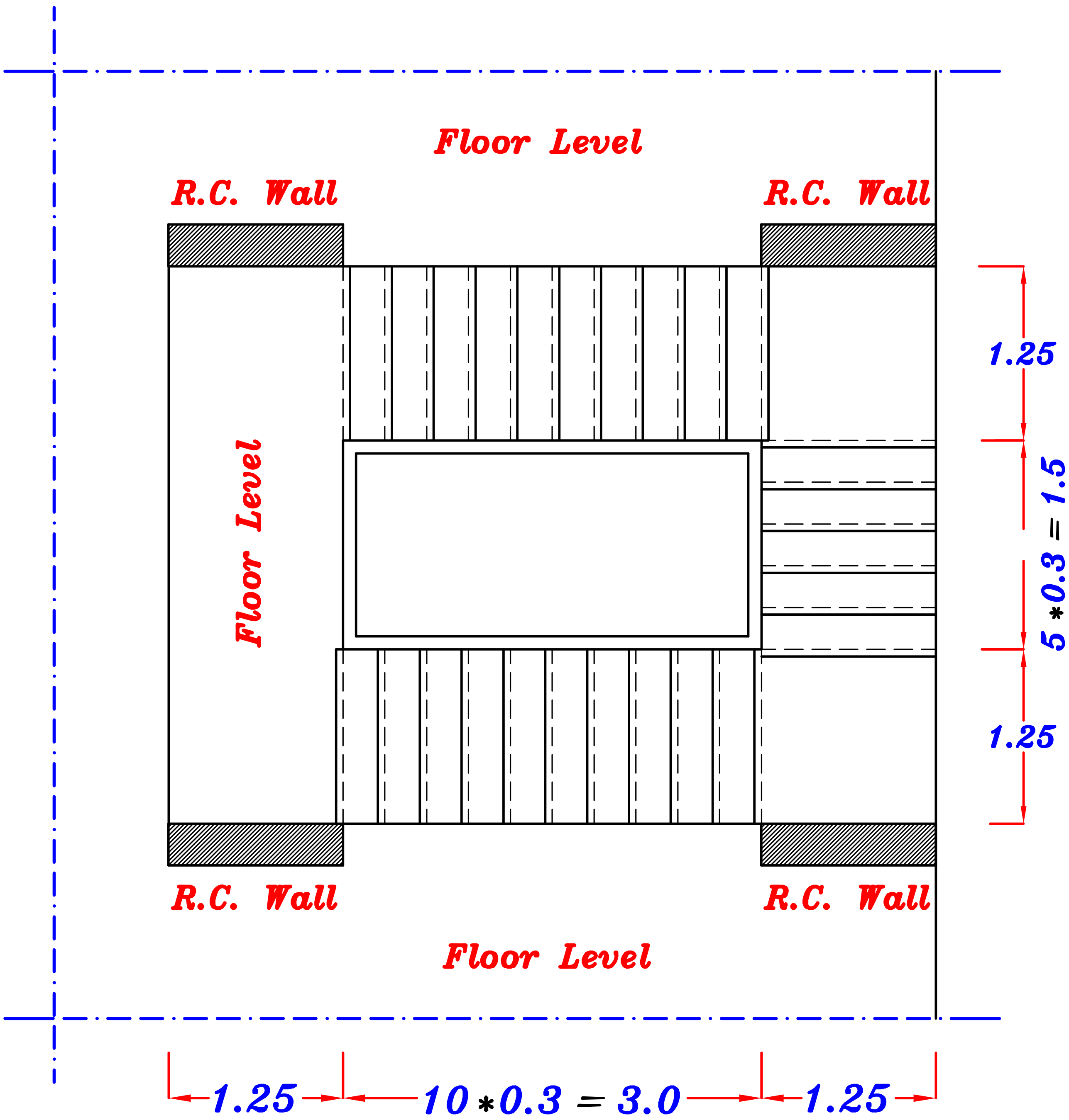
S.F.D.



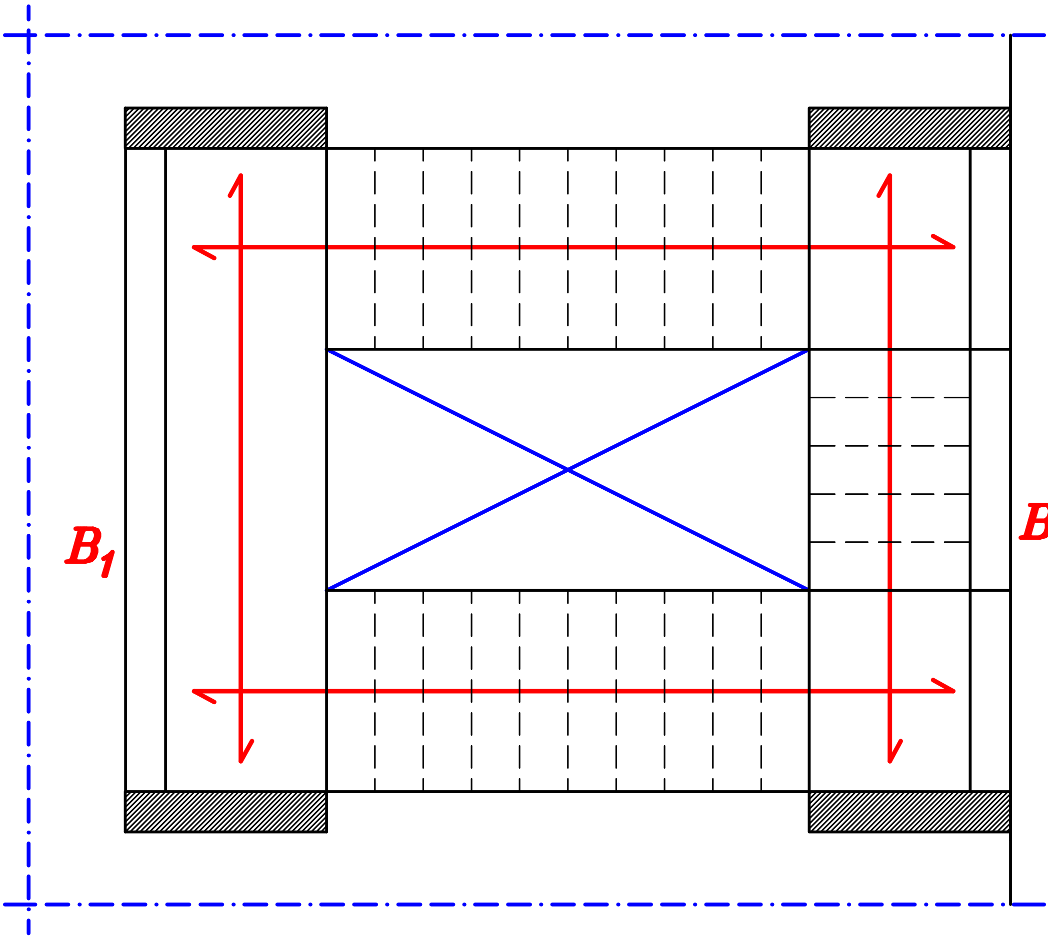
RFT. of the slabs.

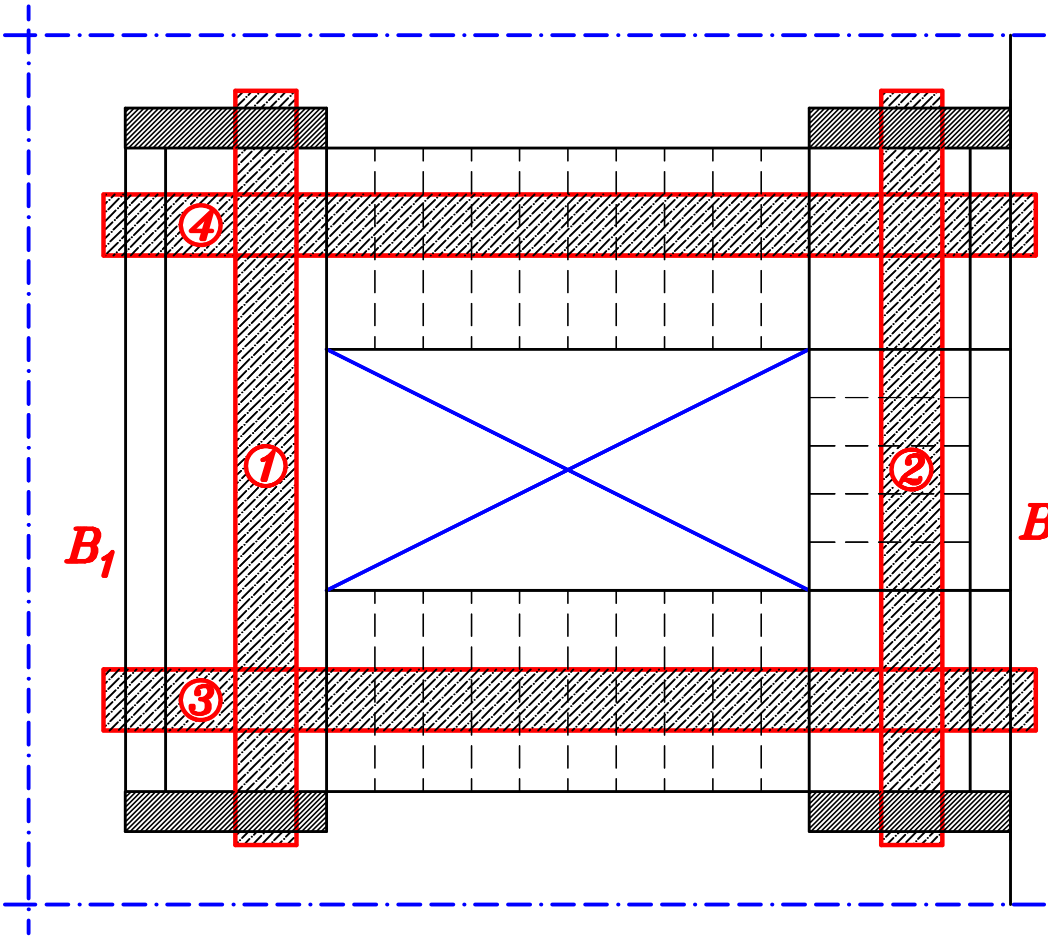


Example.



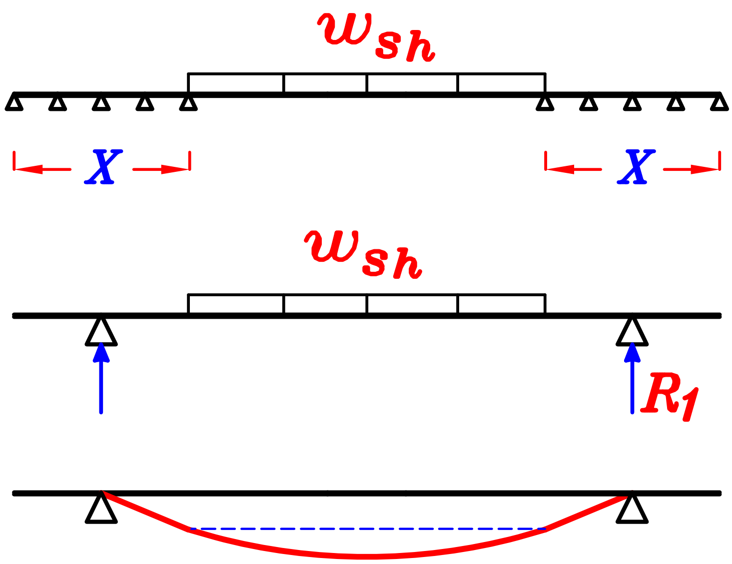
Floor Level
R.C. Wall
R.C. Wall
Floor Level
1.25
5 * 0.3 = 1.5
1.25
R.C. Wall
R.C. Wall
Floor Level
1.25
10 * 0.3 = 3.0
1.25


B1
B2

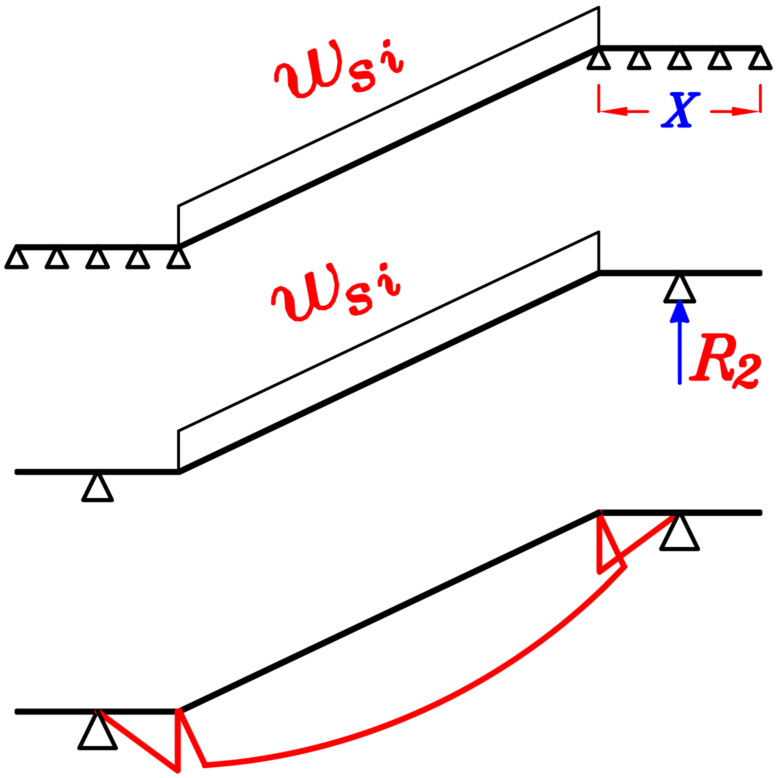

4
1
2
3
B1
B2

Slabs.

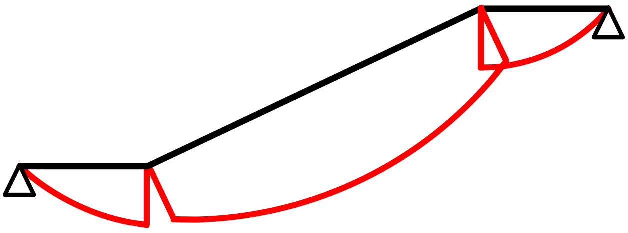
Strip ①

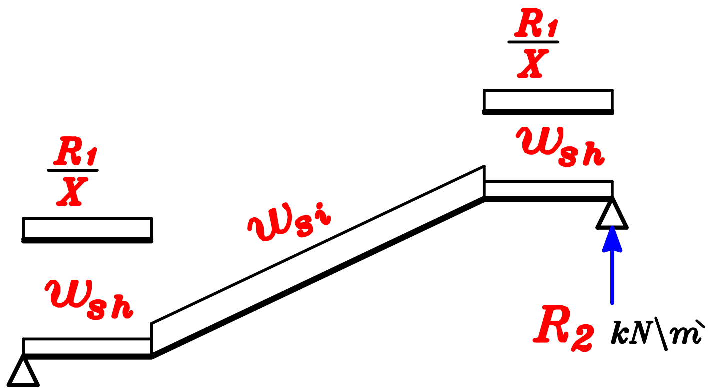


Strip ②

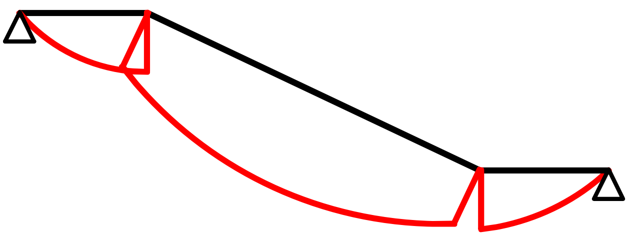


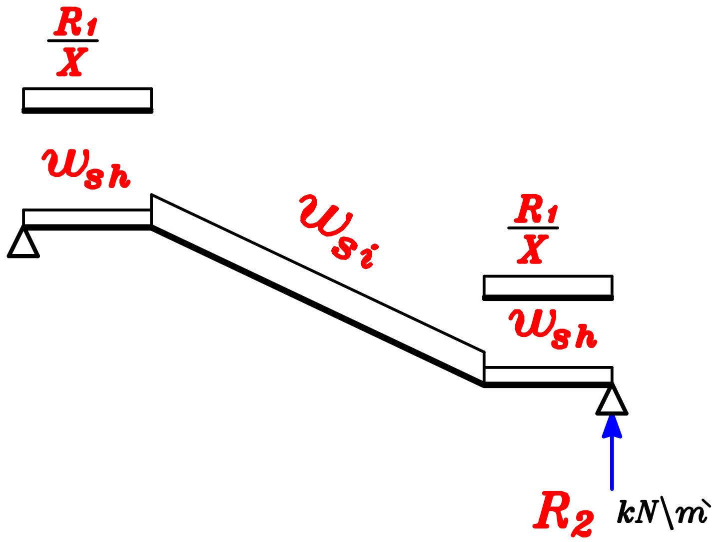
Strip ③





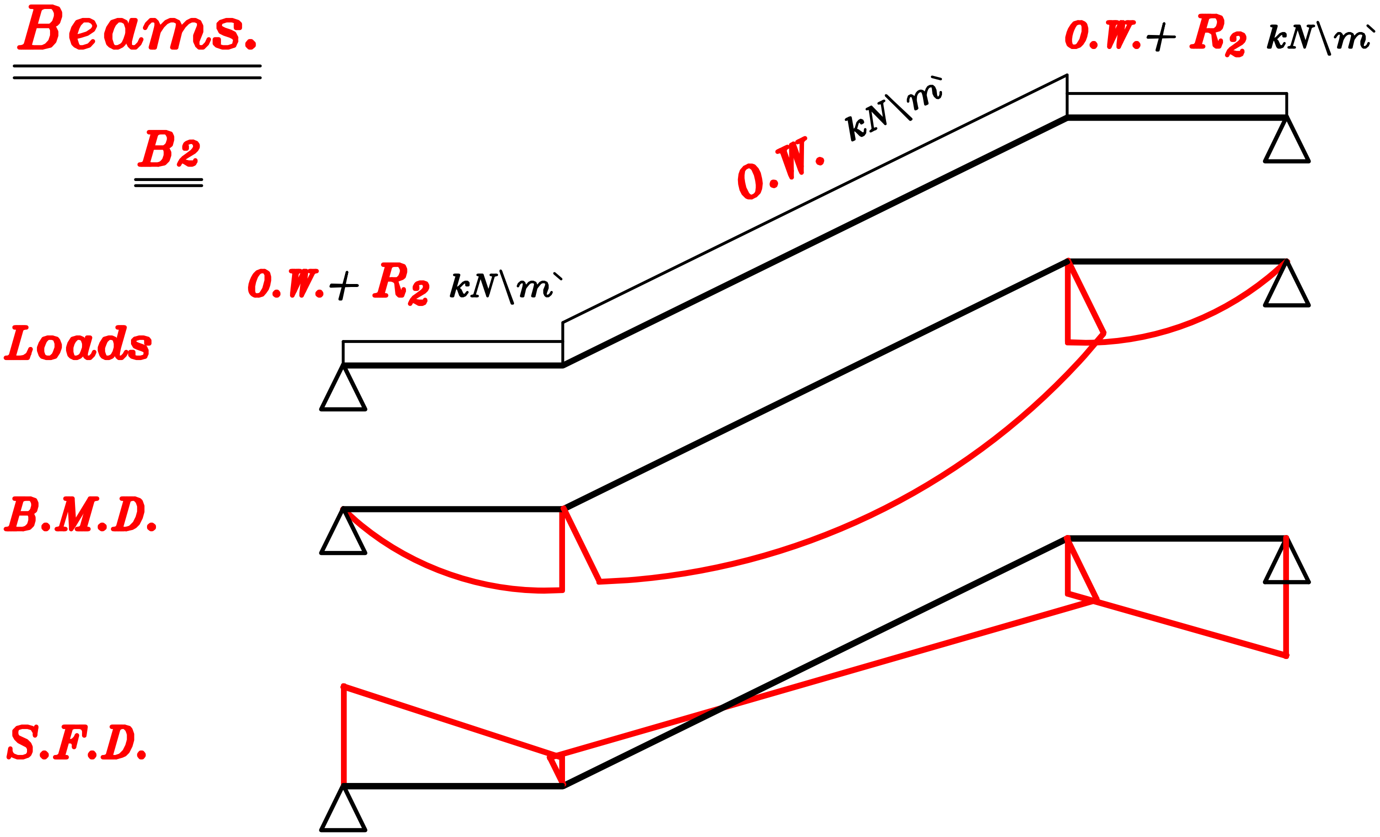
Strip ④



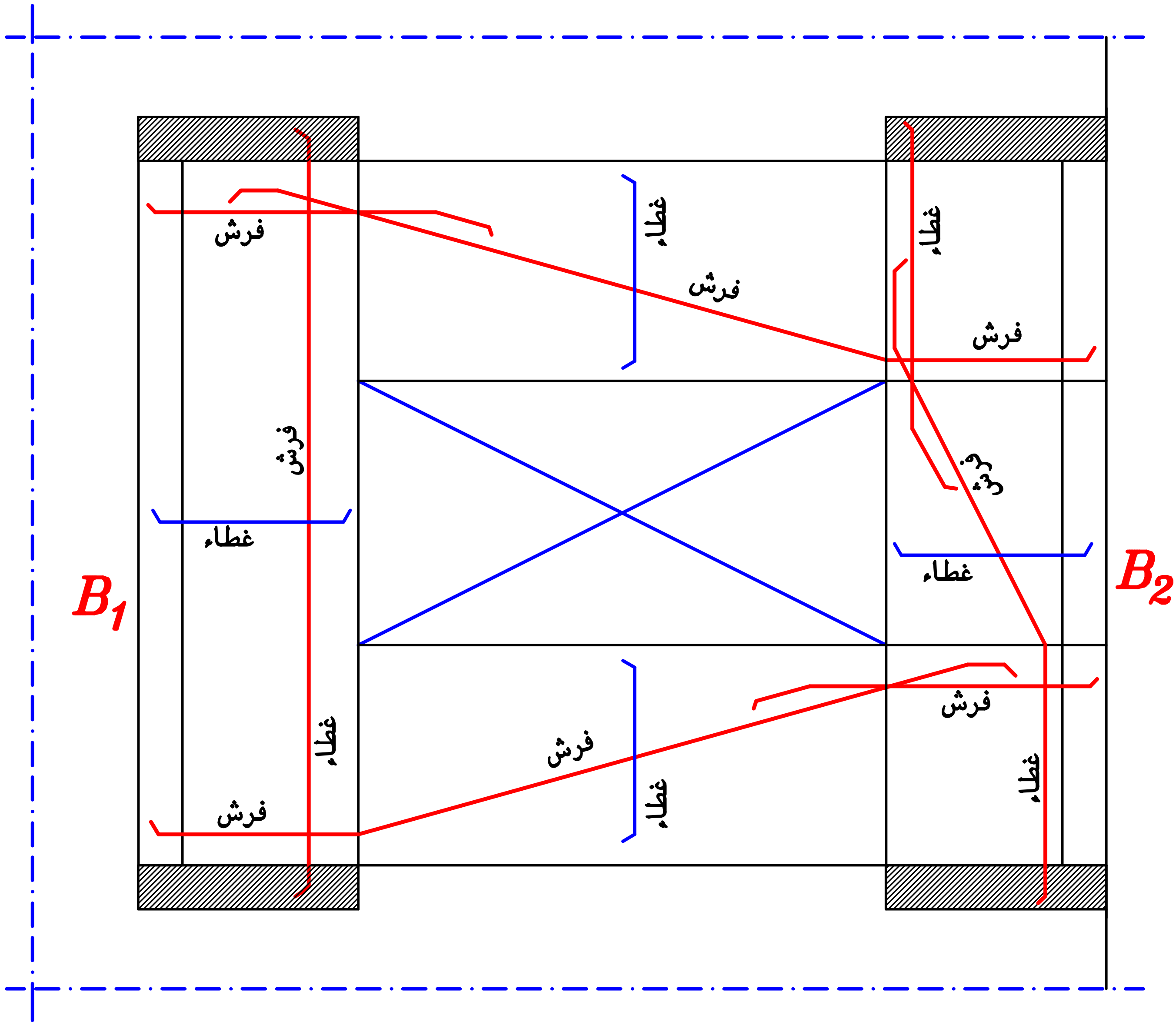


Beams.

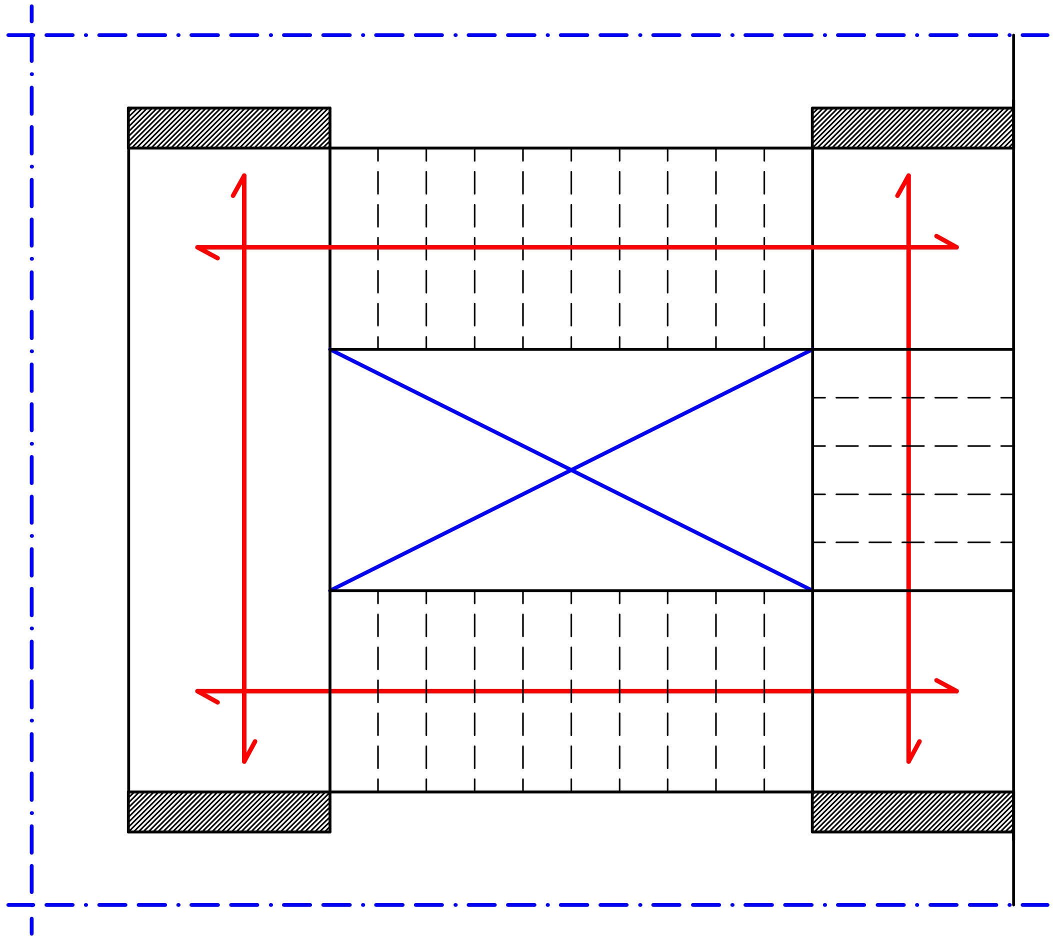
B2

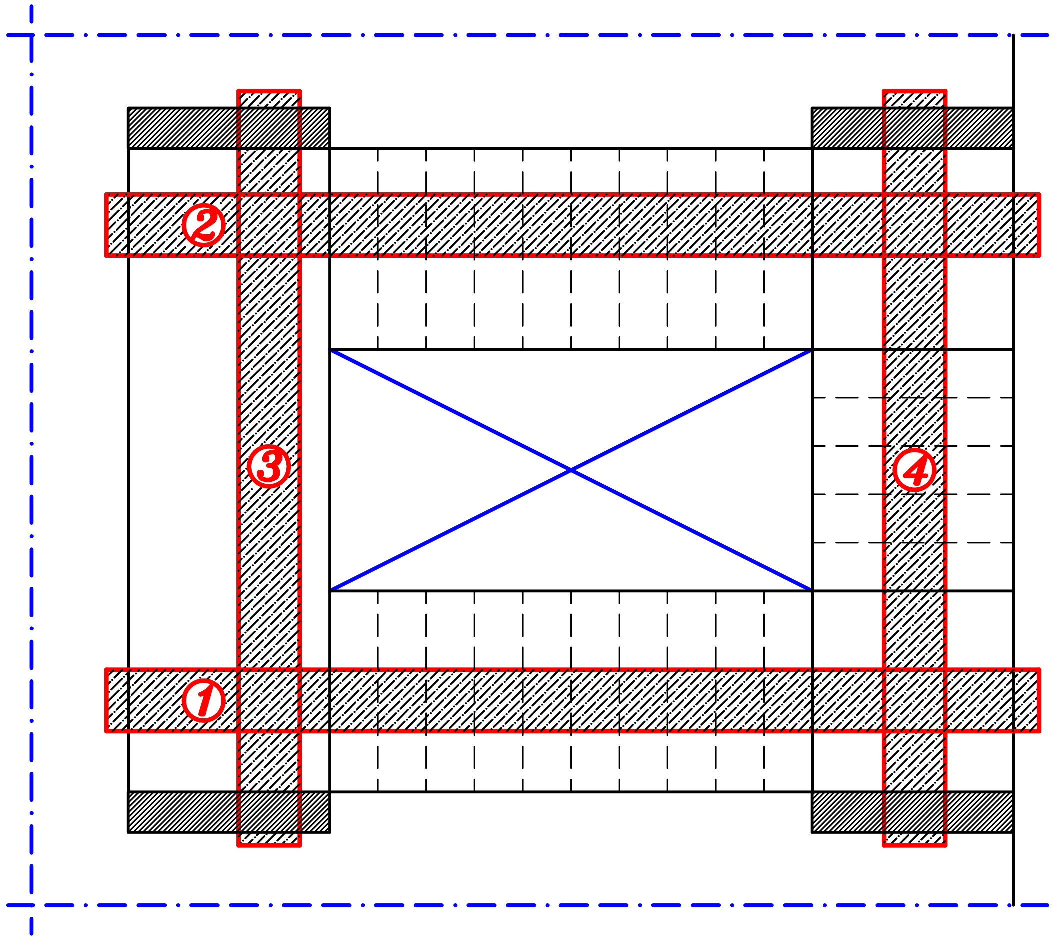


RFT. of the slabs.



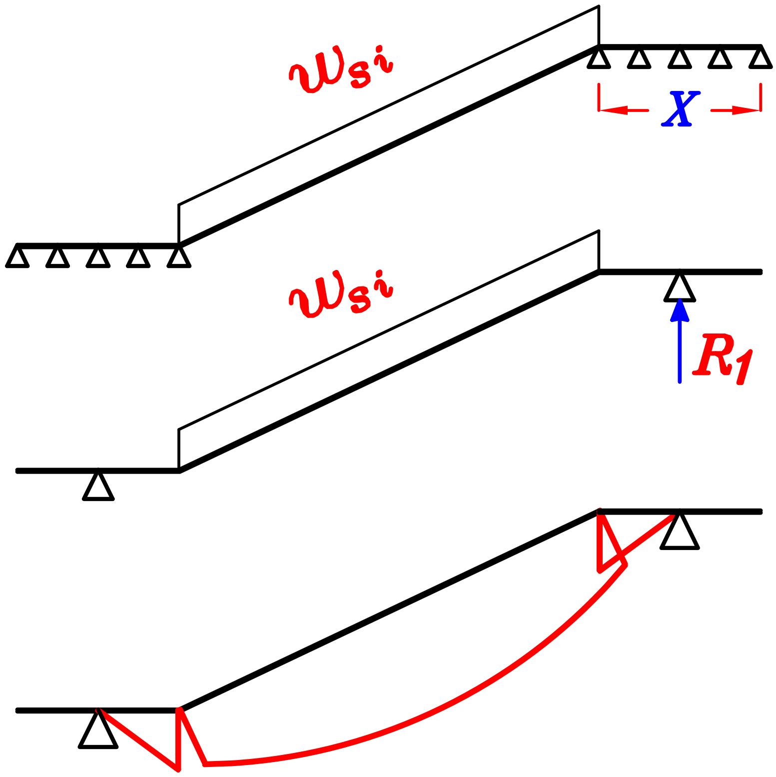
Another system



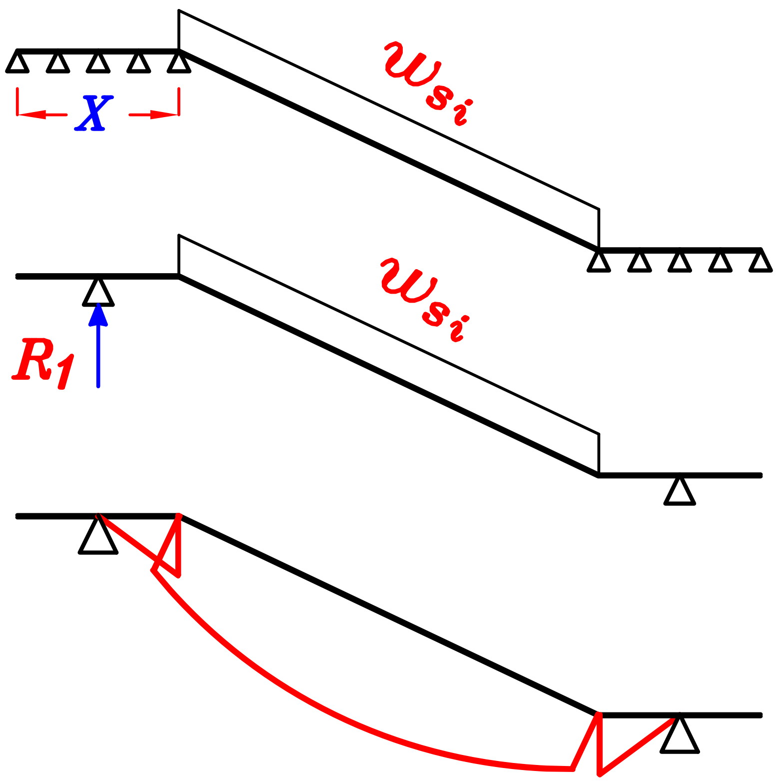


Slabs.

Strip ①

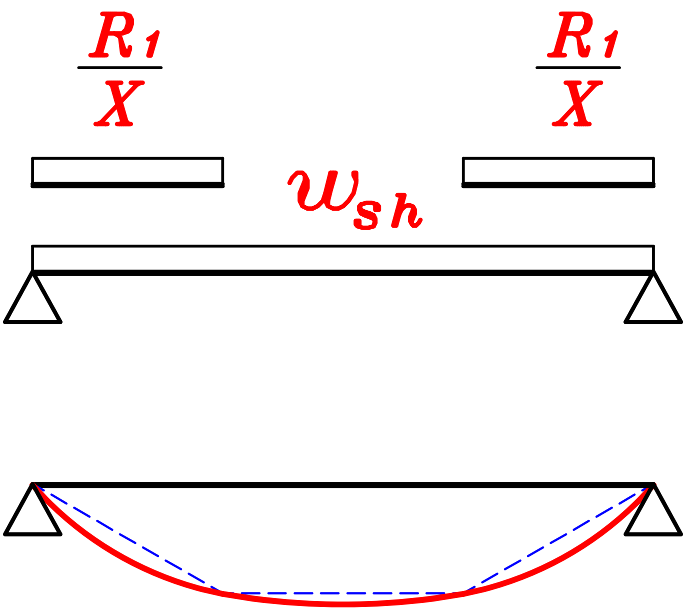


Strip ②

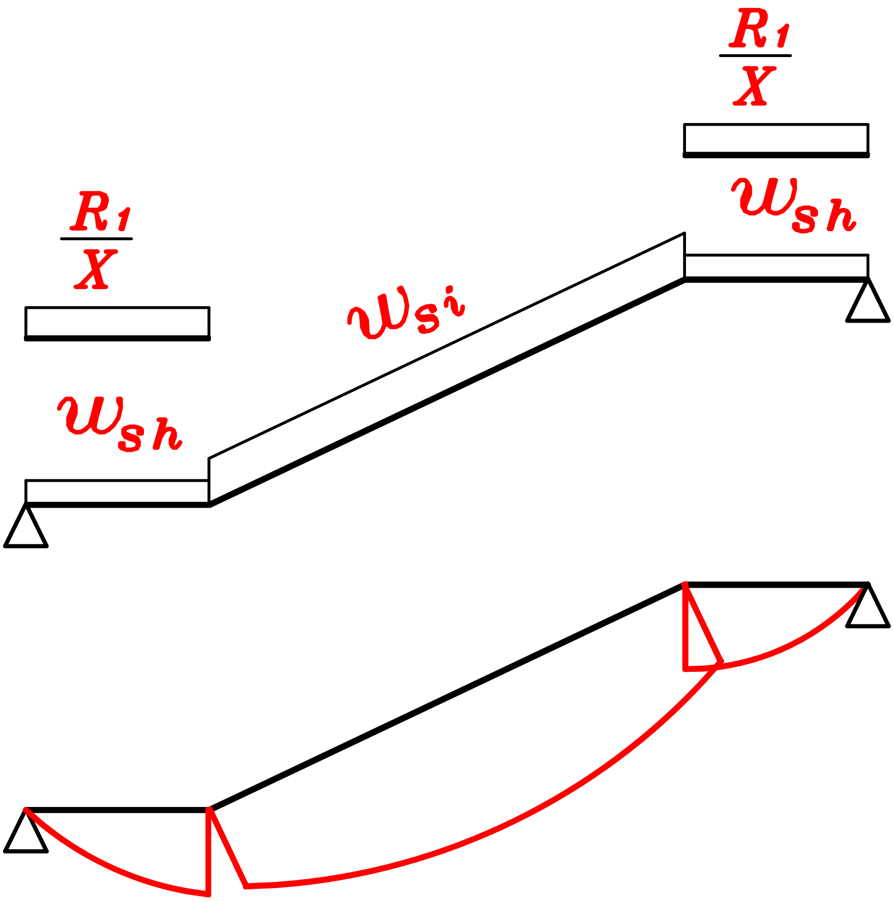


Strip ③

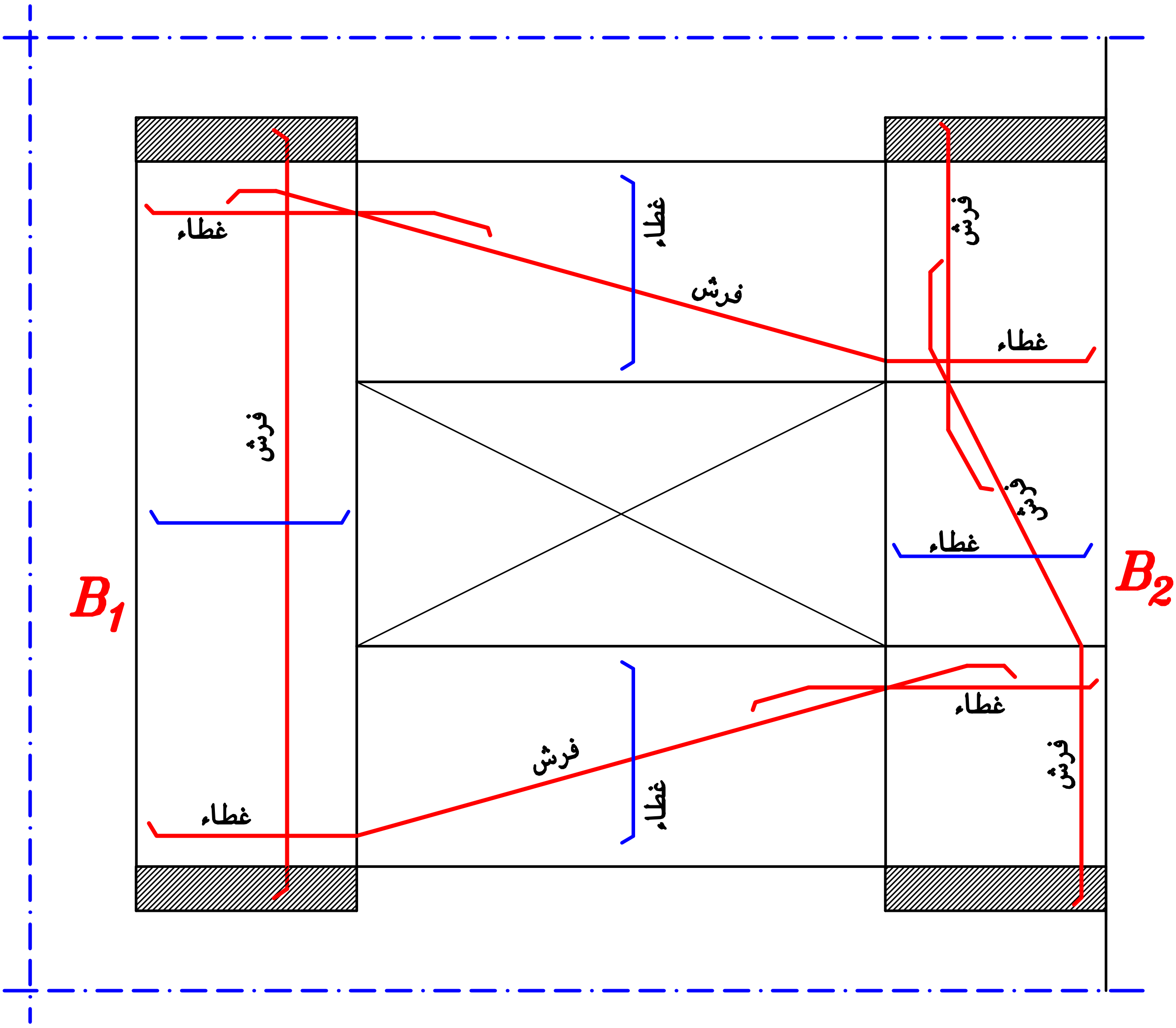
Strip ③



Strip ④

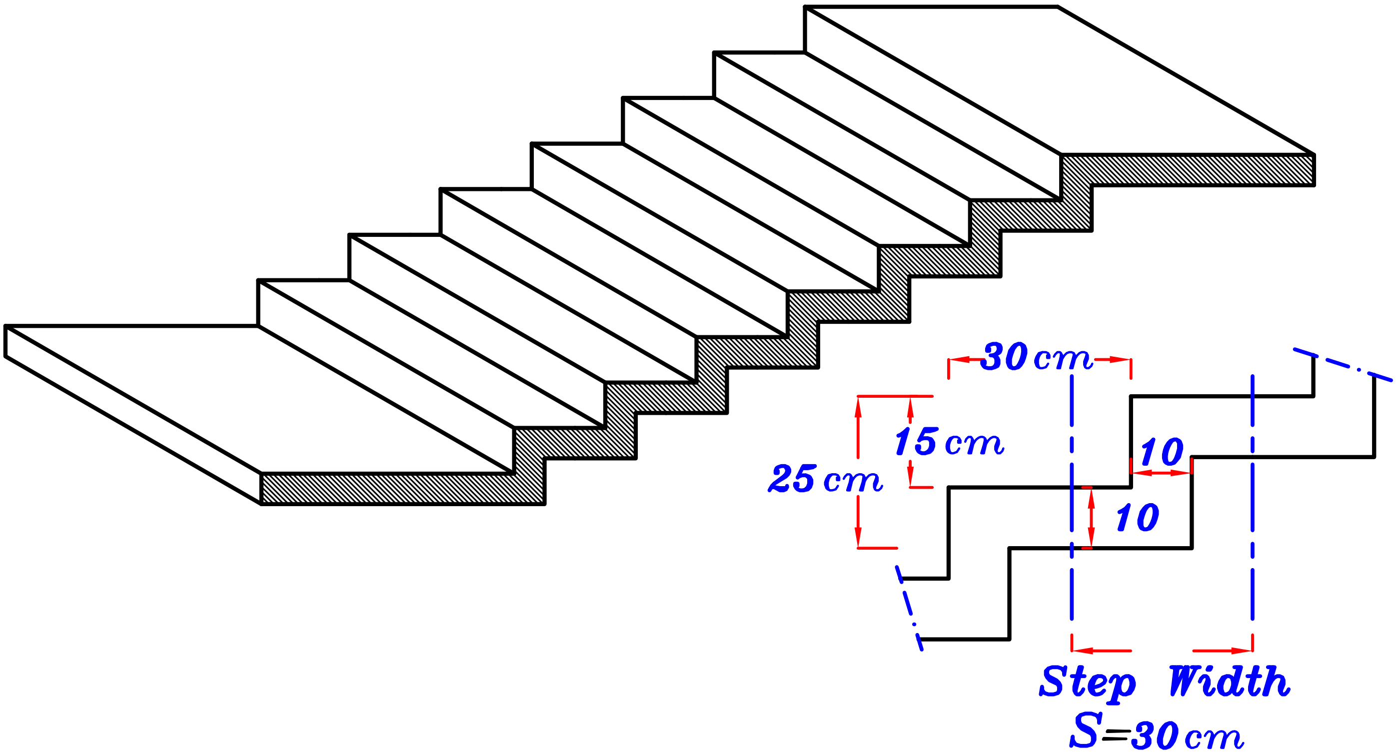


RFT. of the slabs.



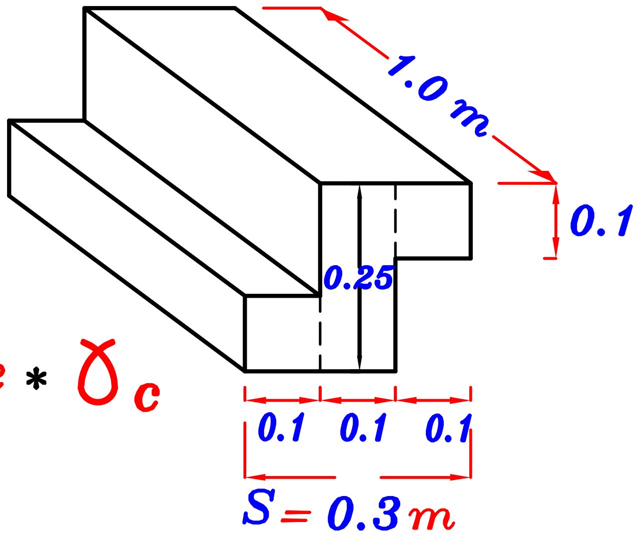
Saw Tooth Stair

هو السلم الذى يكون شكله من أسفل مثل أسنان المنشار



ملحوظة هامة جدا

في السلالم الـ Saw Tooth يجب أن يكون اتجاه الـ Load موازى لاتجاه السلمه



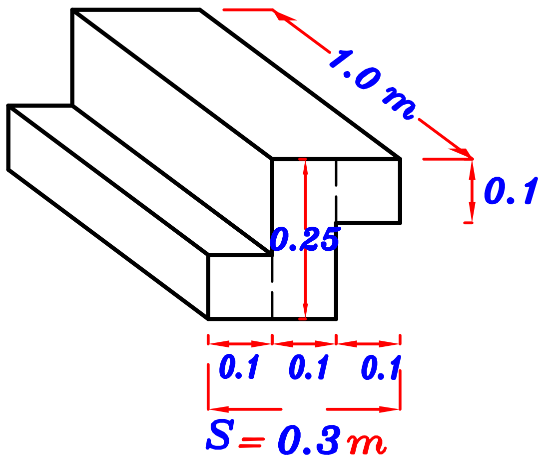
$$o.w.\ (For\ step) = Volume * \gamma_c$$

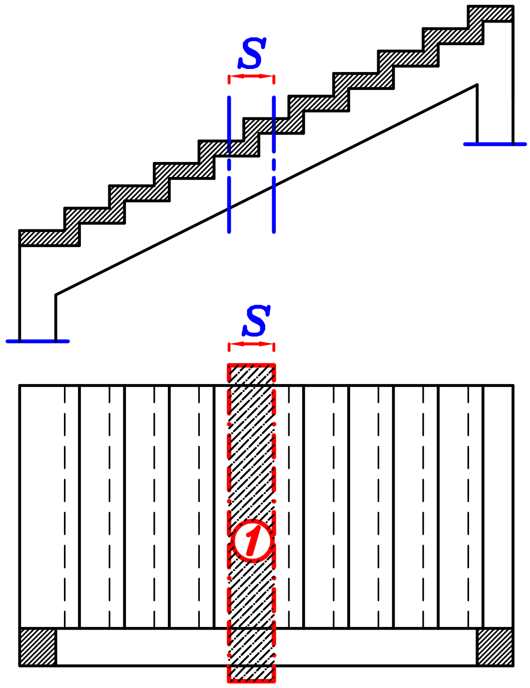
$$\left[(0.1*0.1+0.1*0.25+0.1*0.1)*1.0\,m\right]*\gamma_c = \checkmark\ kN\backslash m$$

$$w = 1.5\left[o.w. + (F.C. + L.L.)\,(S)\right] = \checkmark\ kN\backslash m$$

اذا كانت الشريحه Cantilever .

Take the strip width = step width





$- \, o.w. \, (\text{For step}) = \text{Volume} * \gamma_c$

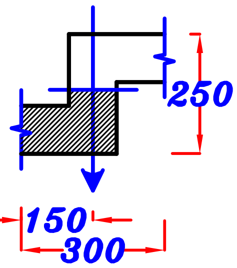
$= [(0.1*0.1+0.1*0.25+0.1*0.1)*1.0\,m] * \gamma_c$

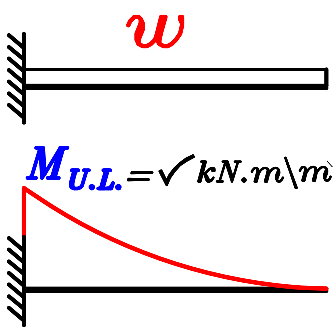
$- \, w = 1.5\,[\,o.w. + (F.C. + L.L.)\,(S)\,] = \checkmark \; kN \backslash m$

Designed as L−Sec.

with $B = 150$ mm

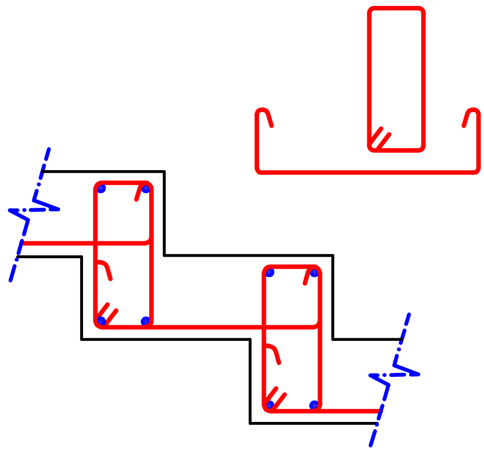
$d = 250 - 30 = 220$ mm

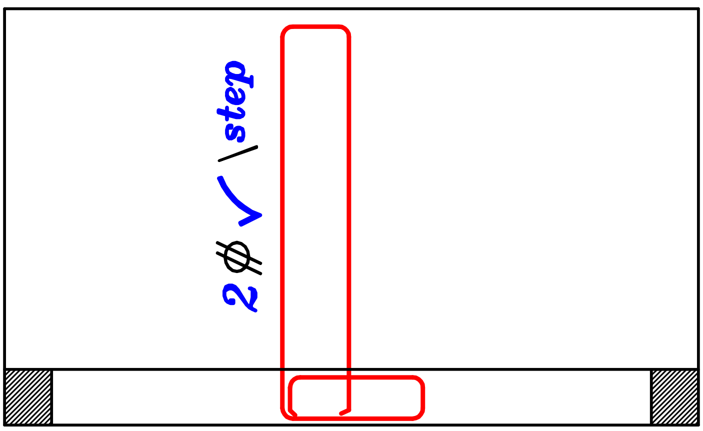




$- \, d = C_1 \sqrt{\dfrac{M_{U.L.}}{F_{cu}\,B}}$ Get $C_1 \longrightarrow J$

$- \, A_s = \dfrac{M_{U.L.}}{J\,F_y\,d} = \checkmark \; mm^2 \backslash step = 2\,\phi \checkmark \backslash step$

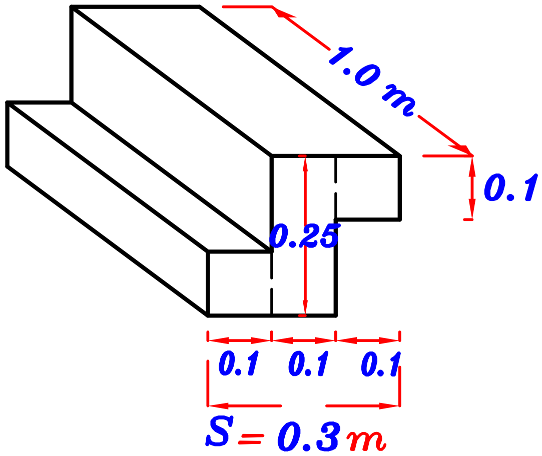


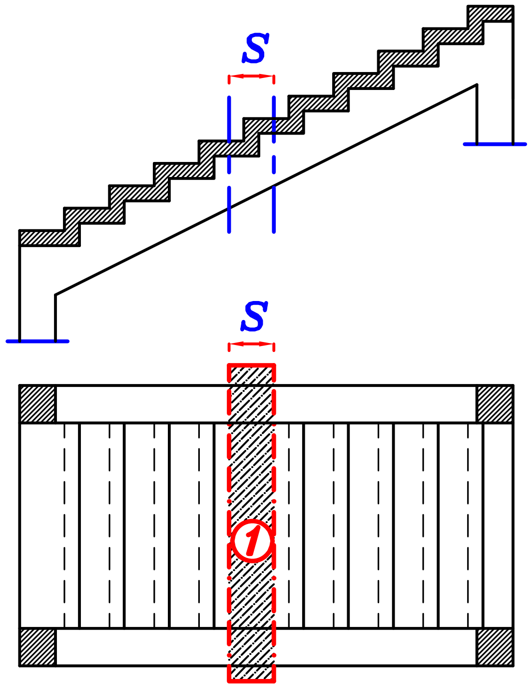


ملحوظه لا يوجد تسليح **Secondary**

اذا كانت الشريحه Simple .

Take the strip width = step width





- $o.w.$ (For step) = Volume $* \gamma_c$

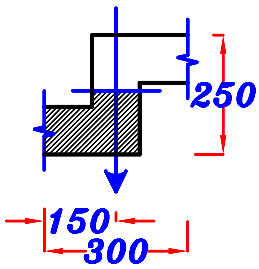
$$= \left[(0.1 * 0.1 + 0.1 * 0.25 + 0.1 * 0.1) * 1.0\, m \right] * \gamma_c$$

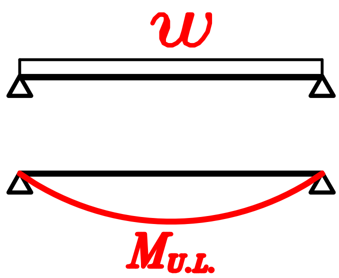
- $w = 1.5 \left[o.w. + (F.C. + L.L.)(S) \right] =$ ✓ $kN\backslash m$

Designed as L−Sec.

with $B = 150$ mm

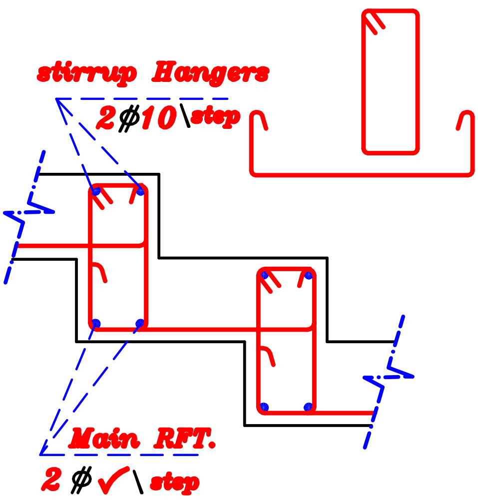
$d = 250 - 30 = 220$ mm

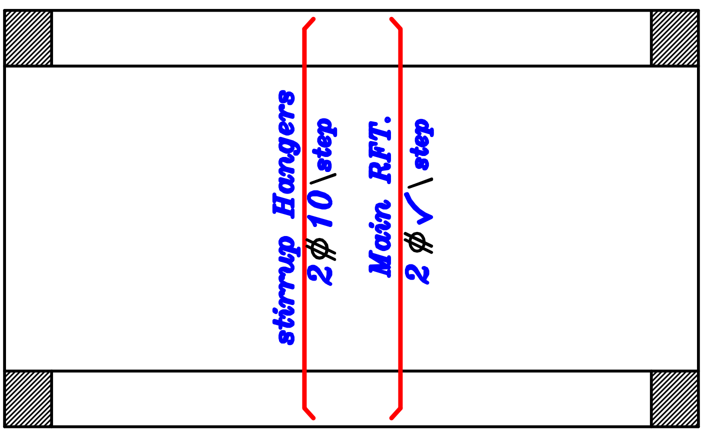




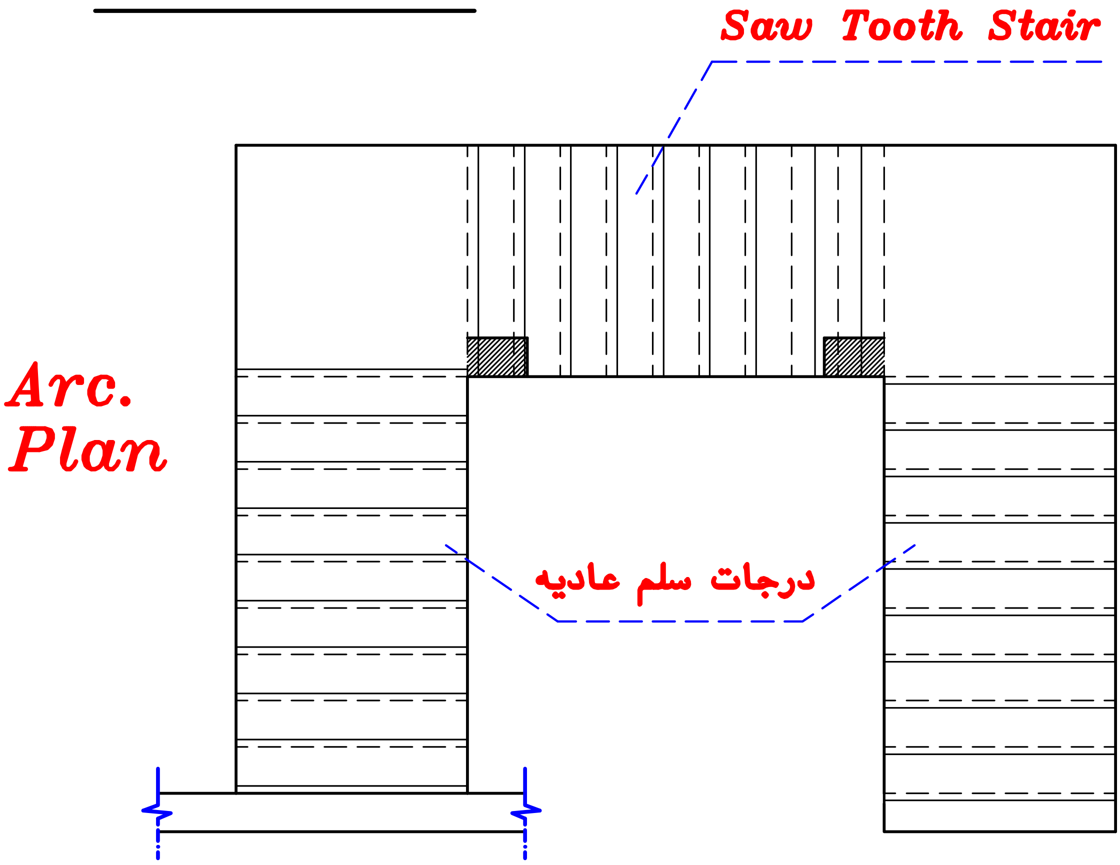
- $d = C_1 \sqrt{\dfrac{M_{U.L.}}{F_{cu}\, B}}$ Get $C_1 \longrightarrow J$

- $A_s = \dfrac{M_{U.L.}}{J\, F_y\, d} =$ ✓ $mm^2 \backslash$ step $= 2\, \phi$ ✓ $\backslash$ step

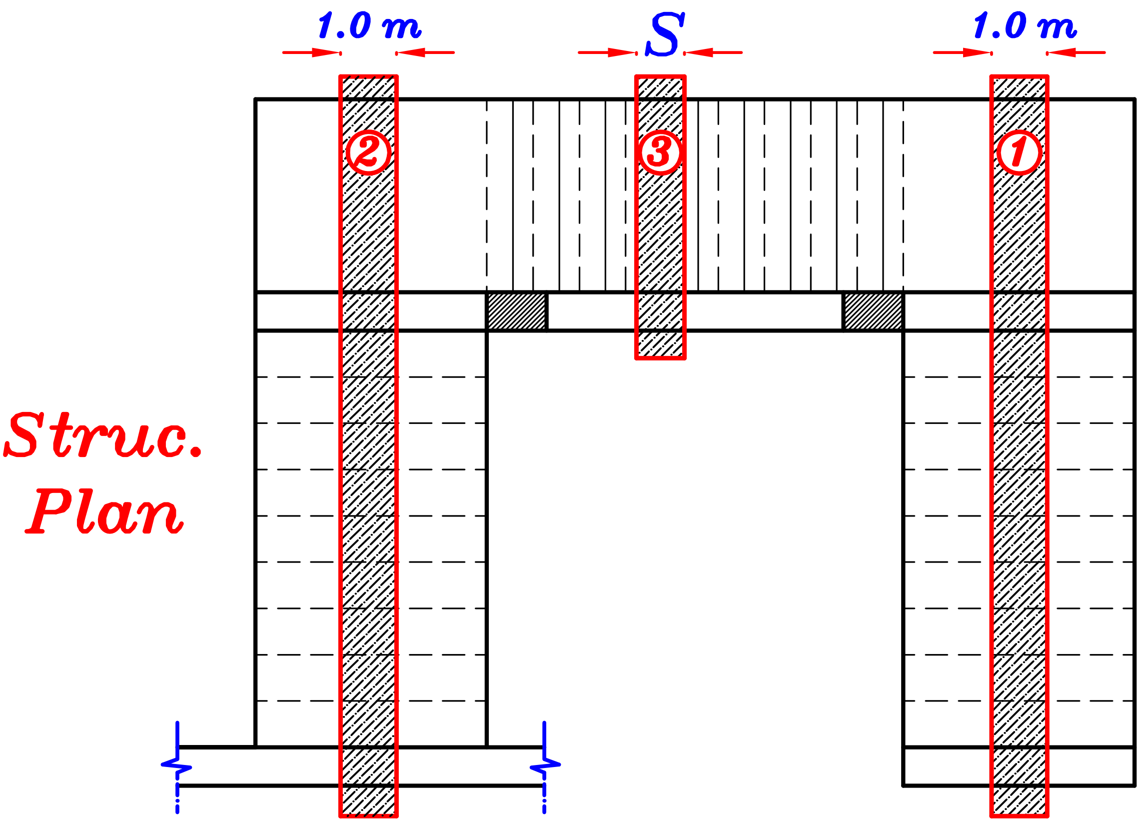




Example.



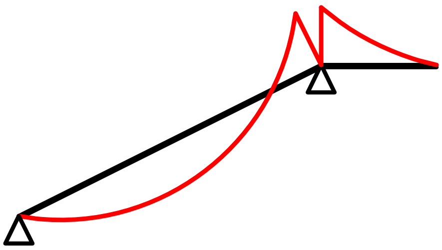
Saw Tooth Stair
Arc.
Plan
درجات سلم عاديه

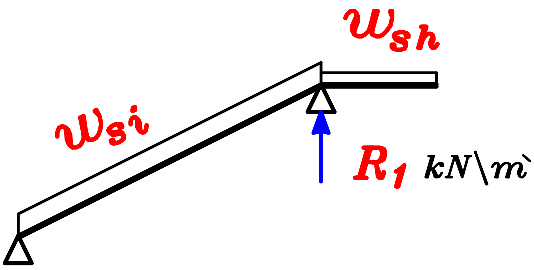


1.0 m
S
1.0 m
2
3
1
Struc.
Plan

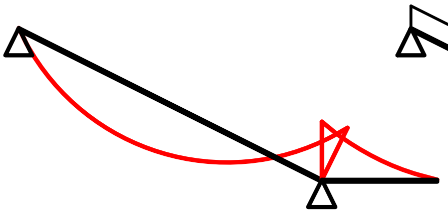
Slabs.

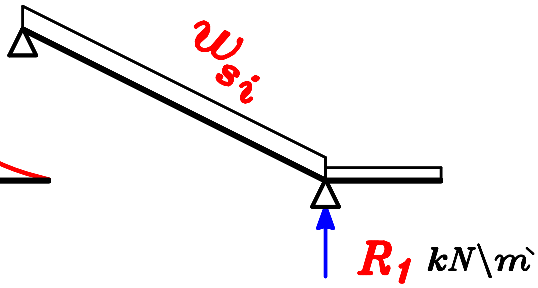
Strip ①





Strip ②





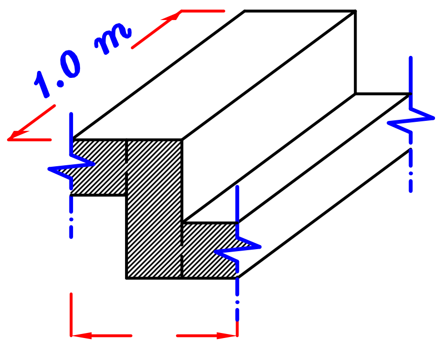
Strip ③ Strip in Saw Tooth steps

ملحوظه هامه جدا

فى السلالم ال Saw Tooth يجب أن يكون اتجاه ال Load موازى لاتجاه السلمه

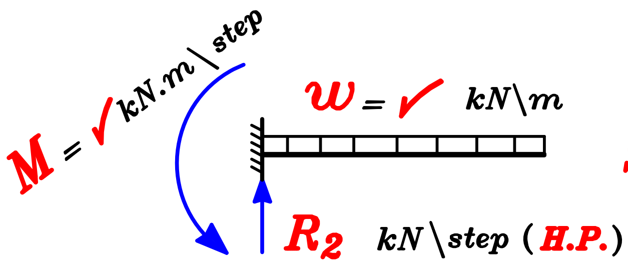
$$- o.w.\ (\text{For step}) = \text{Volume} * \gamma_c$$

$$= \left[(0.1*0.1+0.1*0.25+0.1*0.1)*1.0\,m\right]*\gamma_c$$



Step Width = S

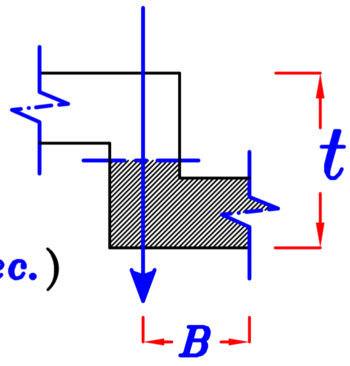
$$- w = 1.5\left[o.w. + (F.C. + L.L.)\,(S)\right] = \checkmark\ kN\backslash m$$



Strip ③

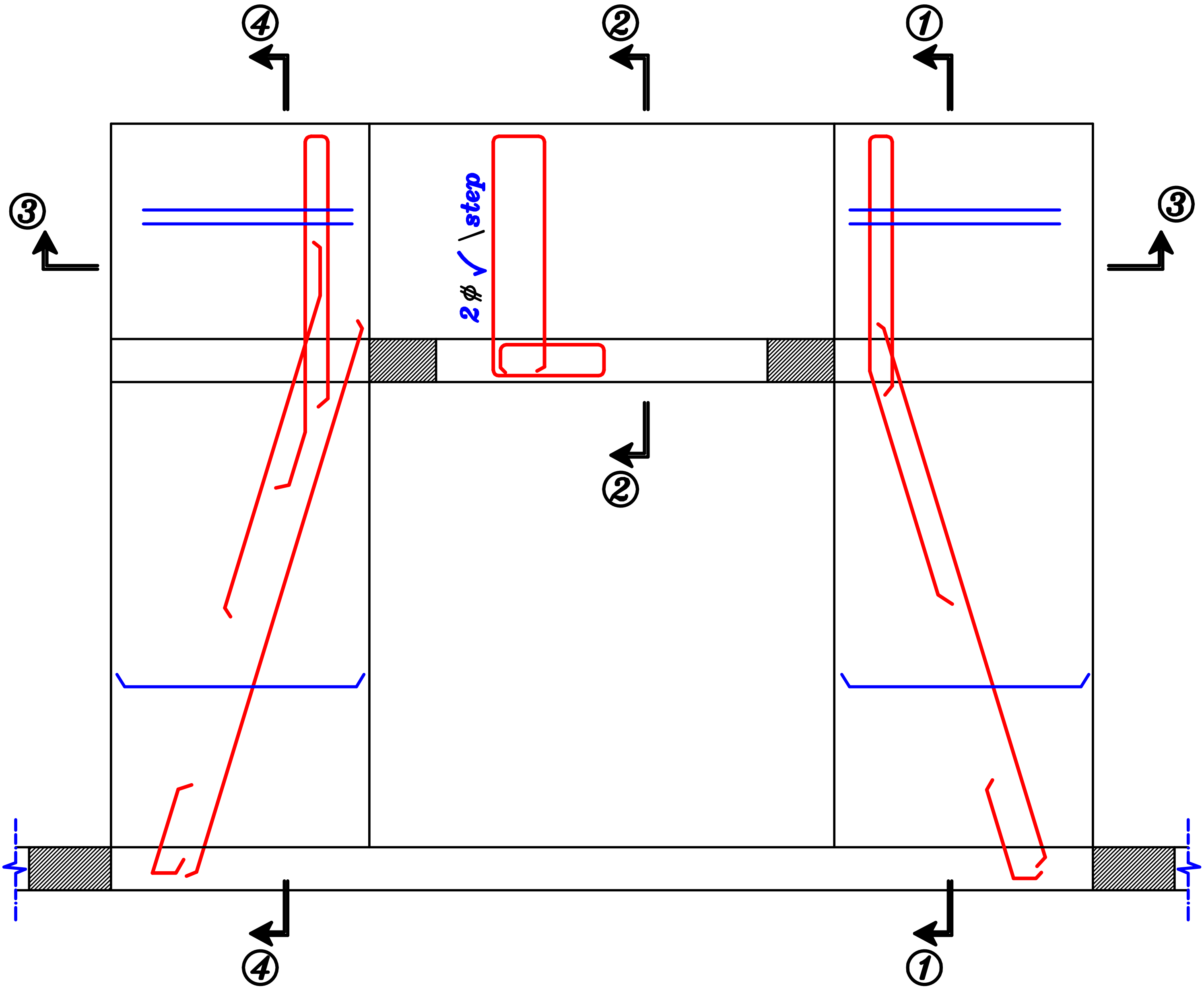
Design the strip as

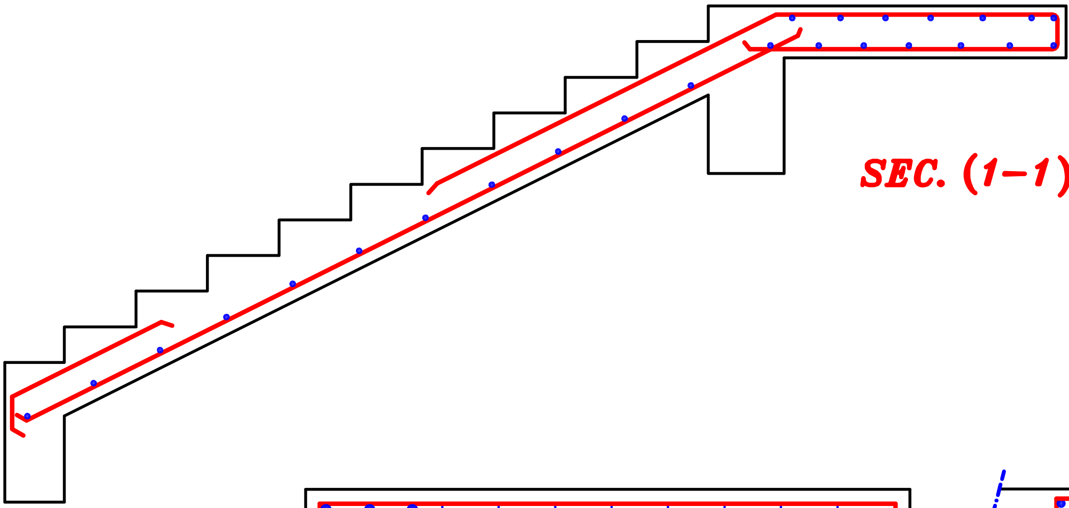
Beam (L−Sec.)



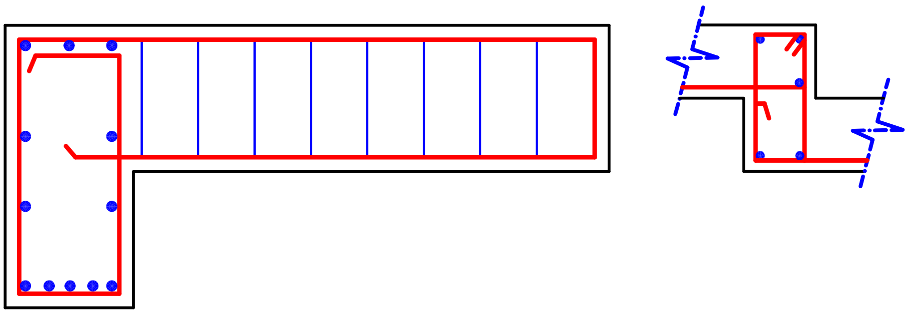
(L−Sec.)

RFT. of the Slab.

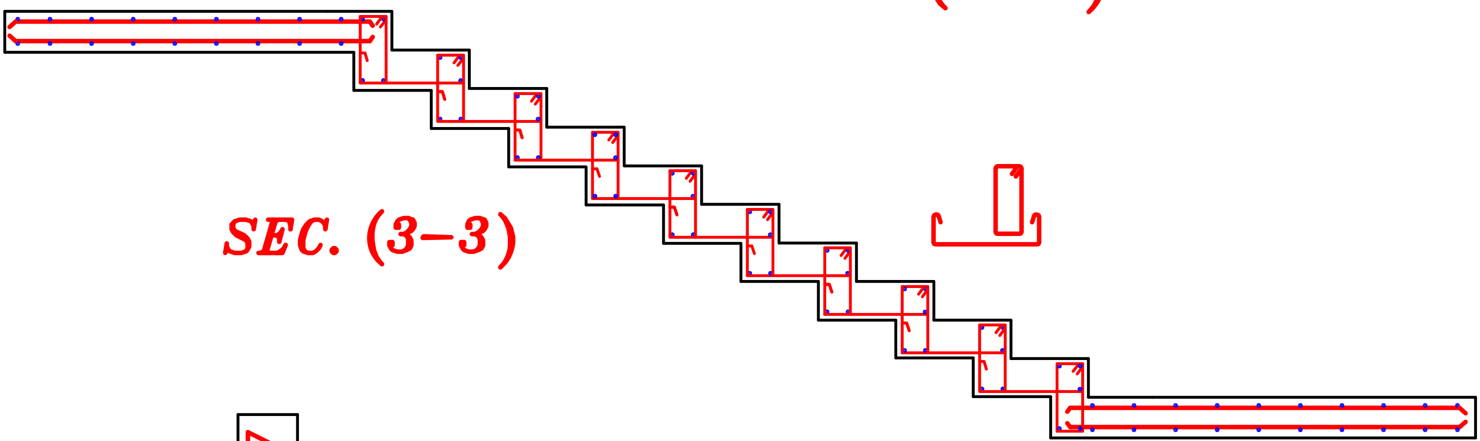




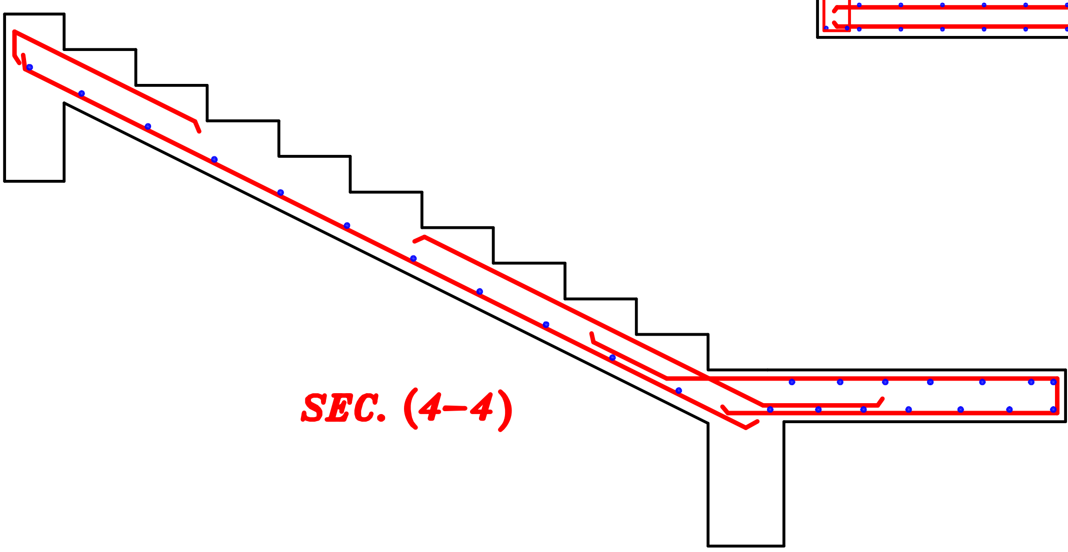
SEC. (1-1)



SEC. (2-2)



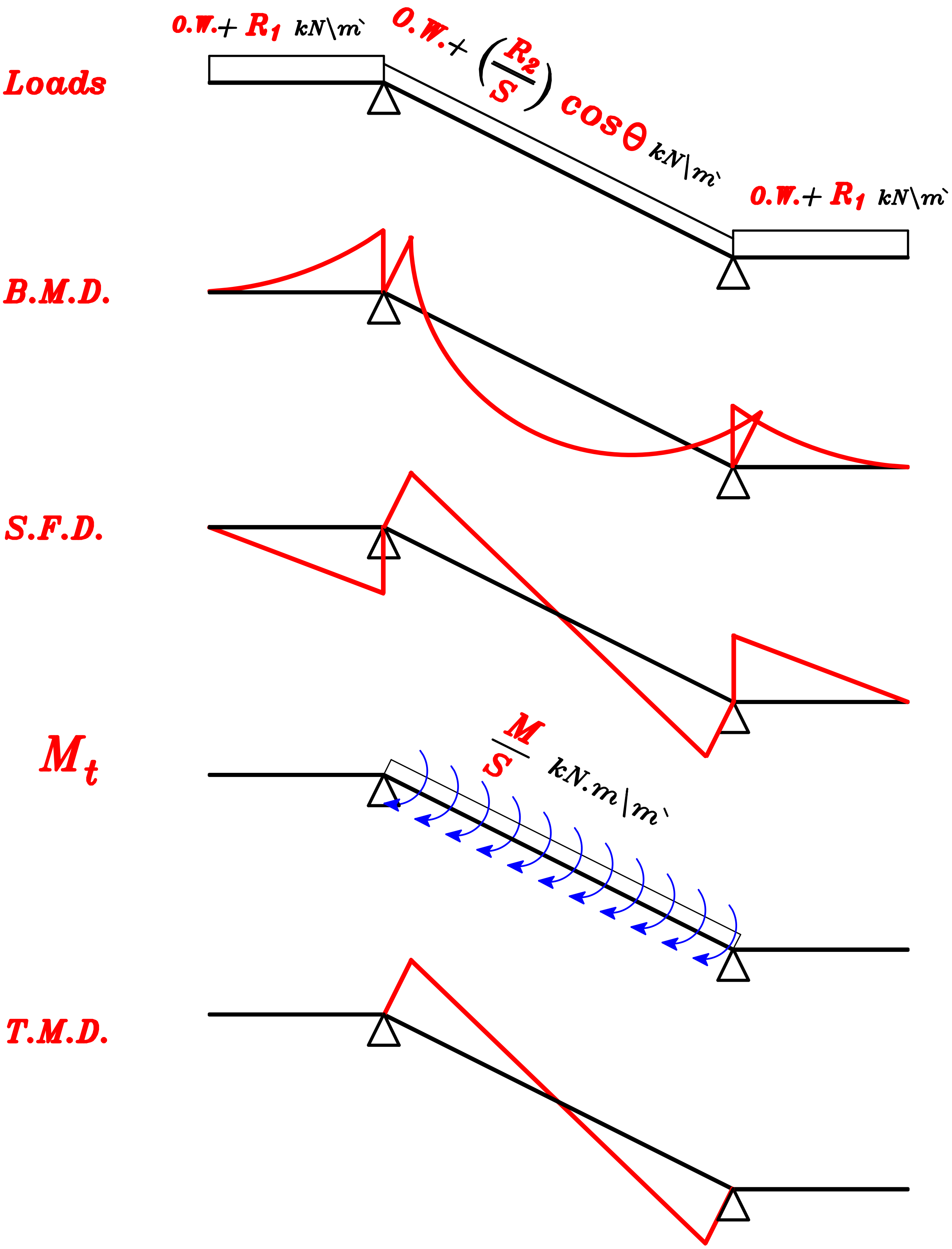
SEC. (3-3)



SEC. (4-4)

Beams.

B1

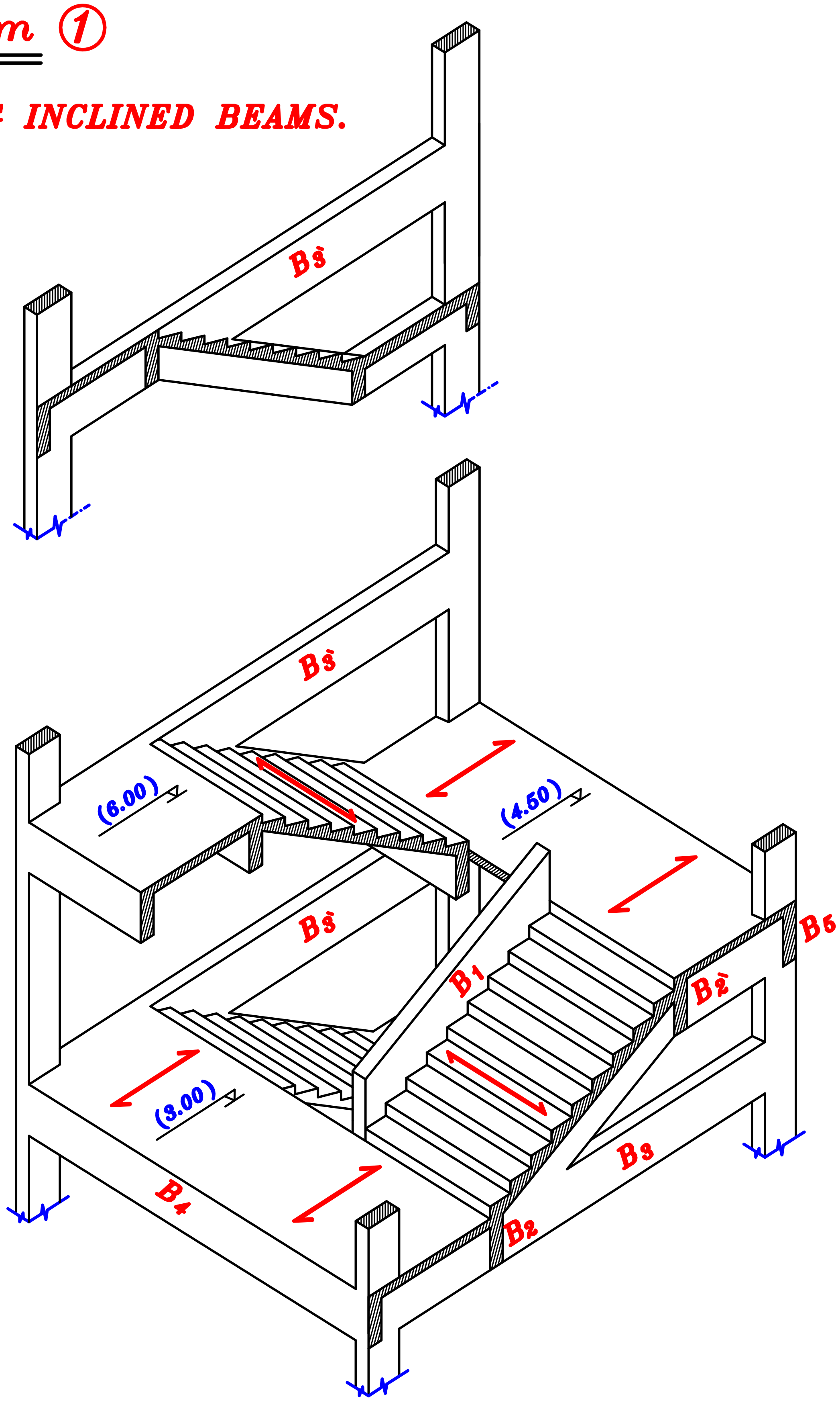


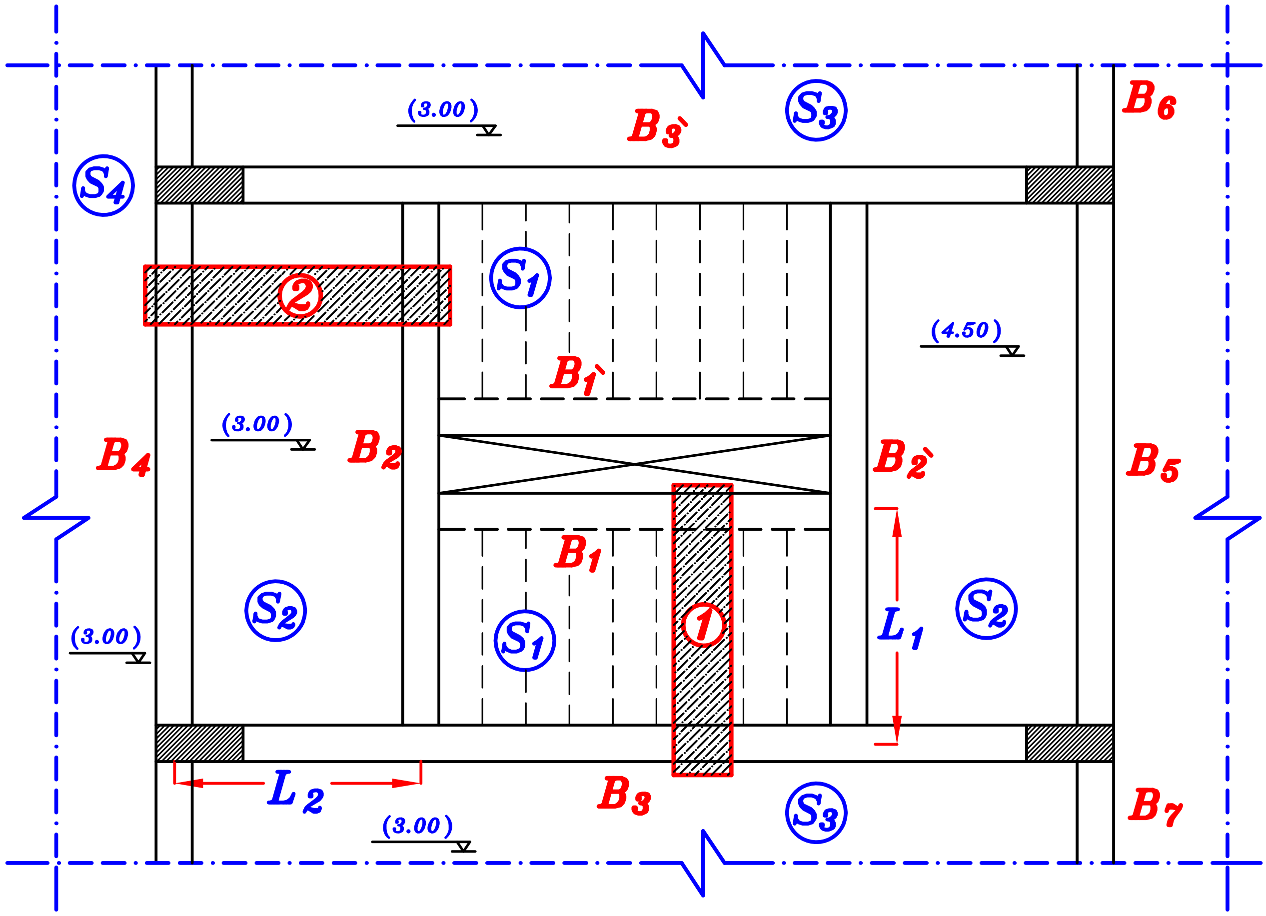
In Door Stairs.

Systems of Stairs used in ordinary buildings. (Two Flights).

System ①

USING INCLINED BEAMS.

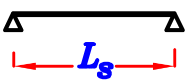




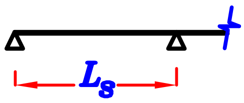
Slabs.

$$t_{s_{min}} = 120\ mm$$

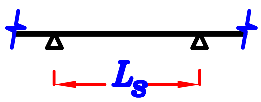
- $t_s = \frac{L_s}{25}$



$t_s = \frac{L_s}{30}$



$t_s = \frac{L_s}{36}$

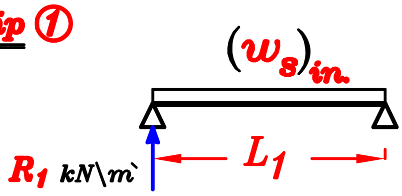


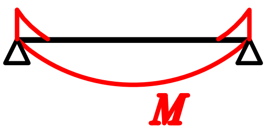
- $t_{av} = t_s + 70\ mm$

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

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

Strip ①

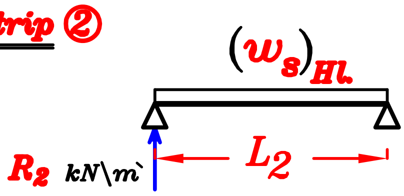


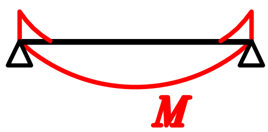


$$M_{des.} = M\cos\theta$$

$$d = t_s - 20\ mm$$

Strip ②

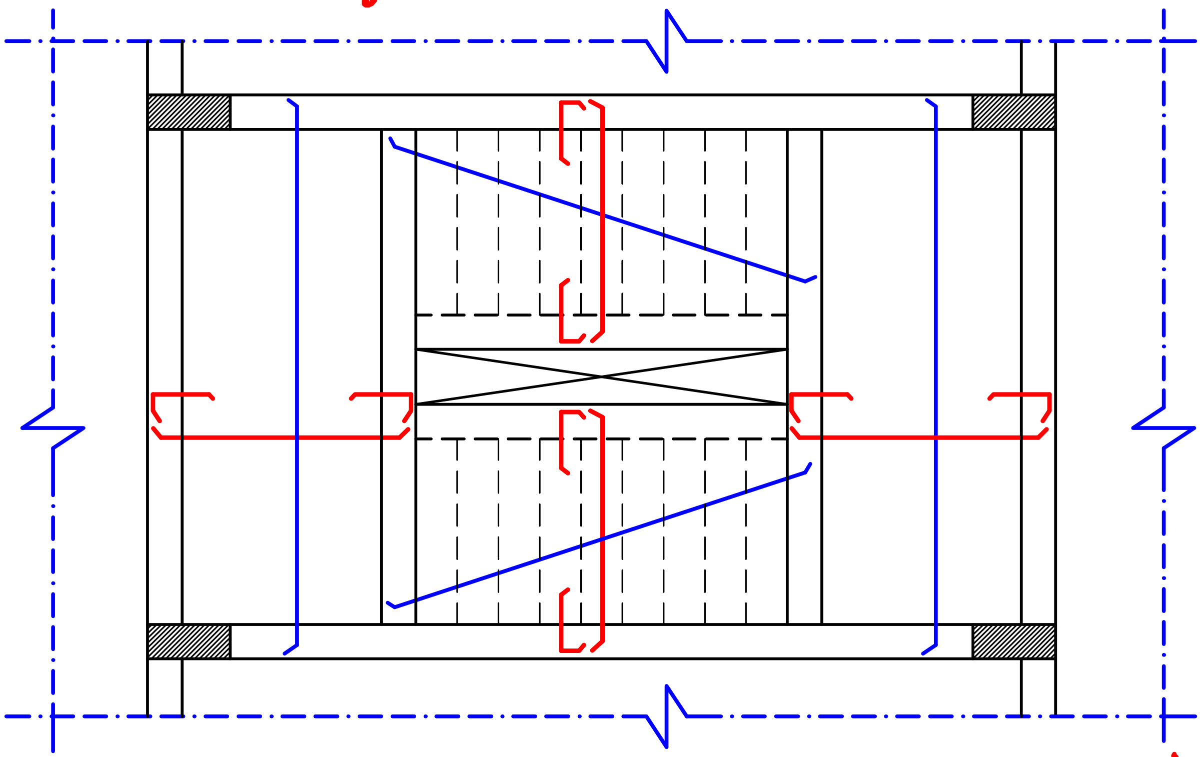




$$M_{des.} = M$$

$$d = t_s - 20\ mm$$

RFT. of the slab.



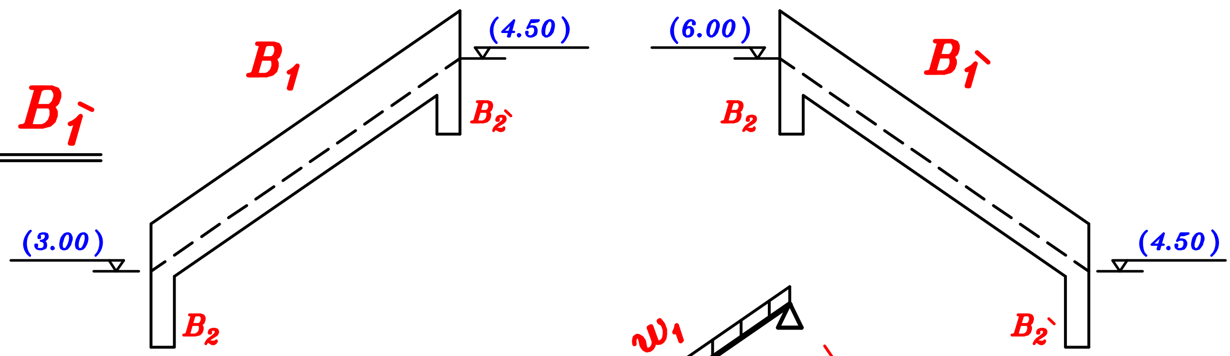
ملحوظه

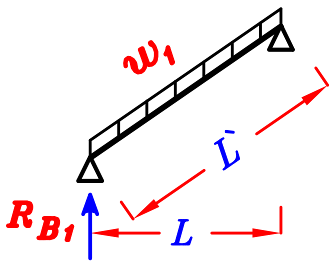
عاده تسلح بلاطه السلم بحيث تكون مفصوله عن بقيه المبنى أى تسلح على أنها *Simple Slab*

لتحديد الاحمال على الكمرات ممكن ان نأخذ ال *Reaction* من شريحه البلاطه + $o.w.$ للكمره بدلا من عمل *Load Dist.* و هذه الطريقه تكون مع الشرائح للبلاطات ال *One way & Cantilever* فقط و لكن مع البلاطات ال *Two way* فنضطر لعمل *Load Dist.* .

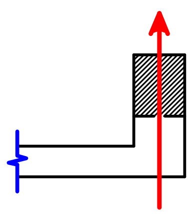
Beams.

B_1 , B_1`



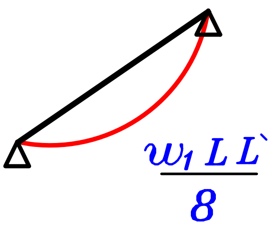


$$w_1 = o.w. + \frac{1}{2}\ S_1 = o.w. + R_1$$

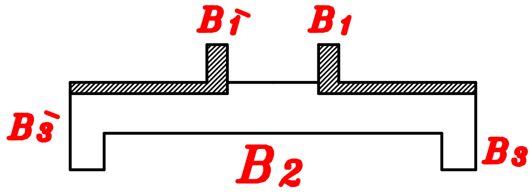


R-Sec.

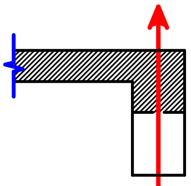
كمره مقلوبة

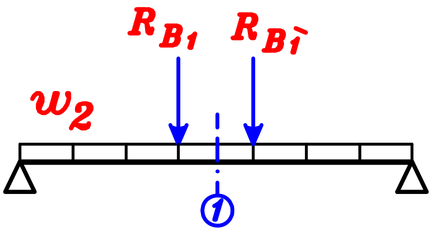


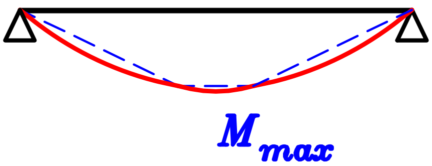
B_2 , $B_2^{`}$



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



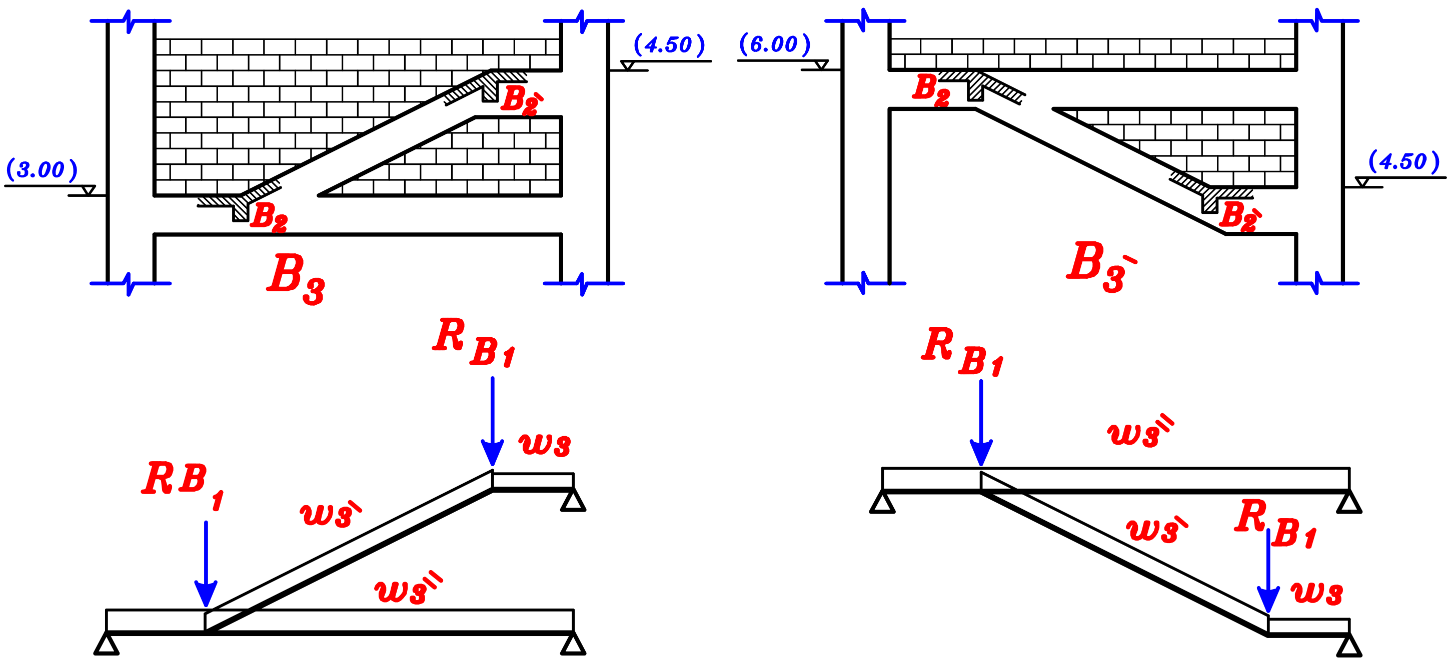




L–Sec.

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

B_3 , $B_3^{`}$



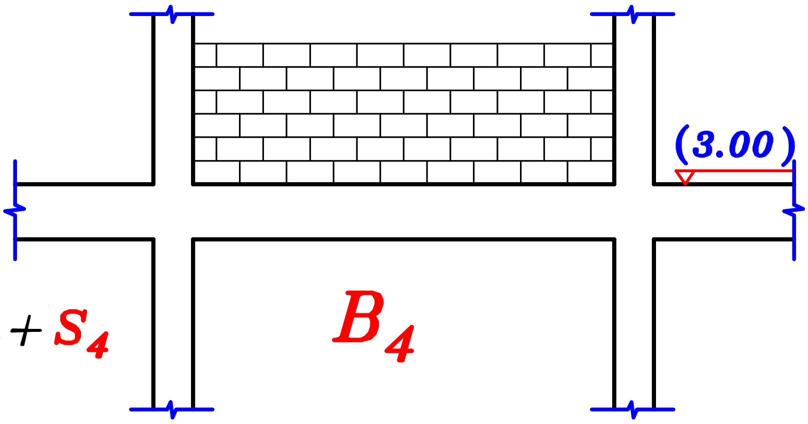
$$w_3 = o.w. + walls$$

$$w_3^{`} = o.w. + walls + R_1$$

$$w_3^{``} = o.w. + walls + S_3$$

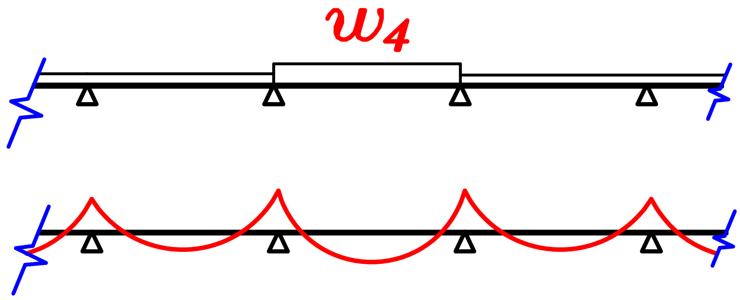
B_3 designed as a Frame

B_4

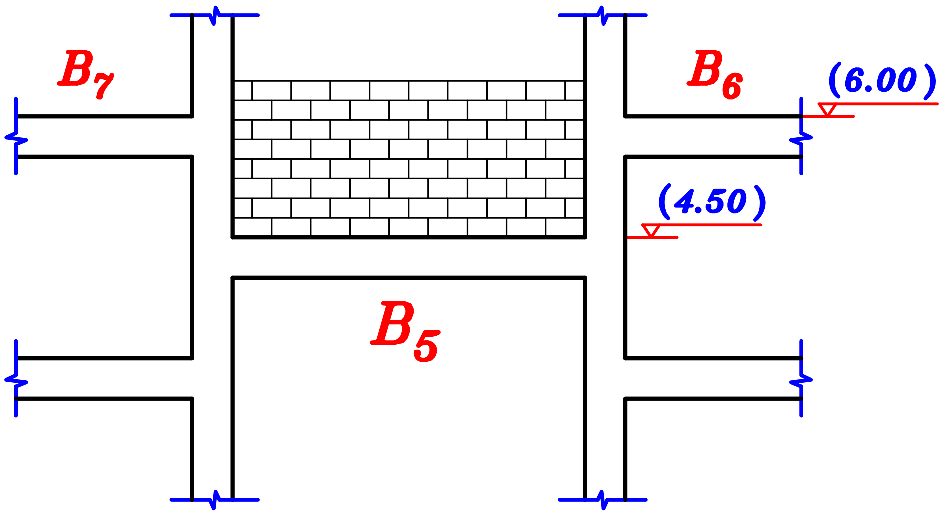


$$w_4 = o.w. + walls + R_2 + S_4$$

Continous Beam.

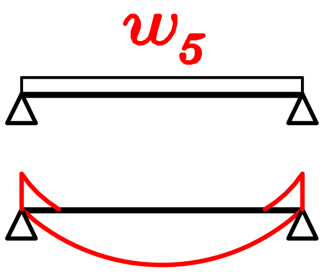


B_5



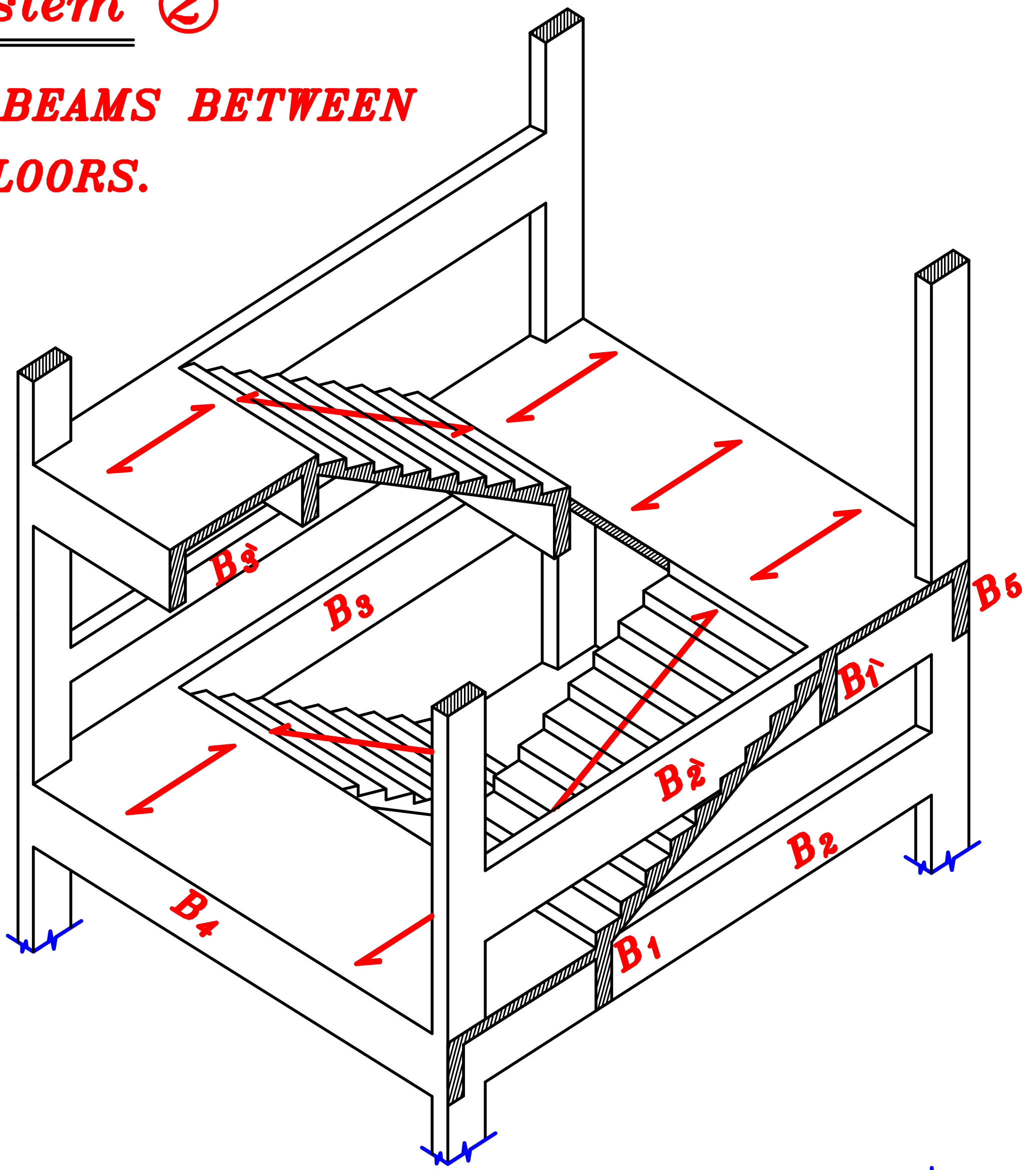
B_5 Simple Beam.

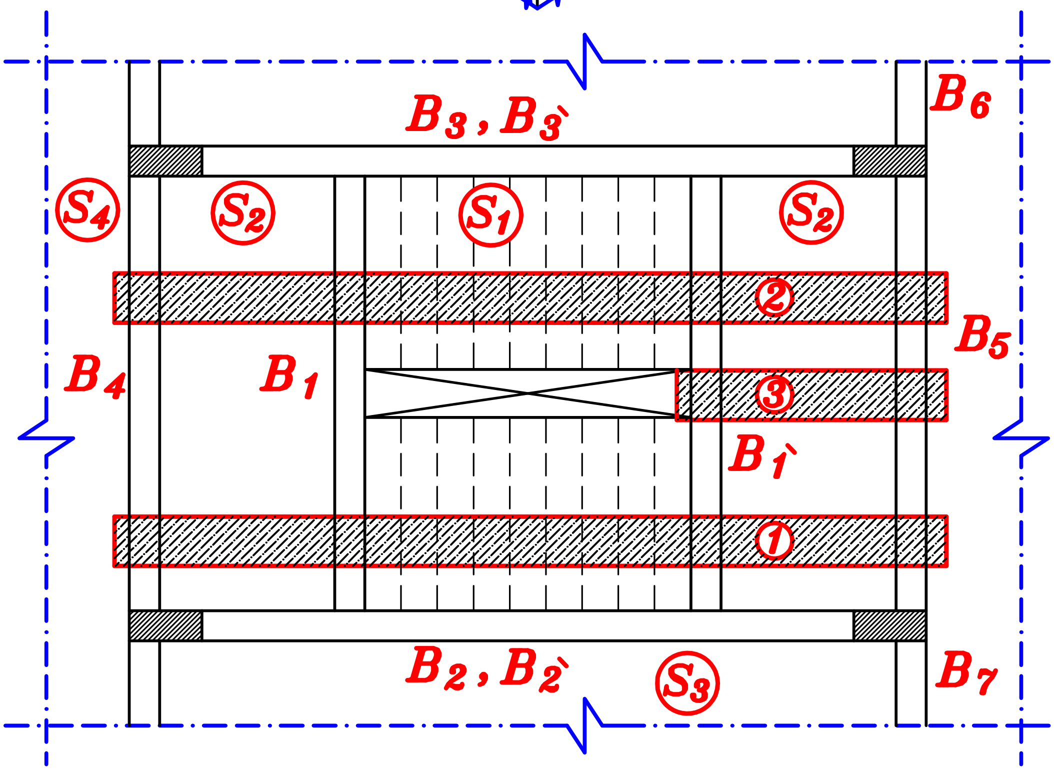
$$w_5 = o.w. + walls + R_2$$



System ②

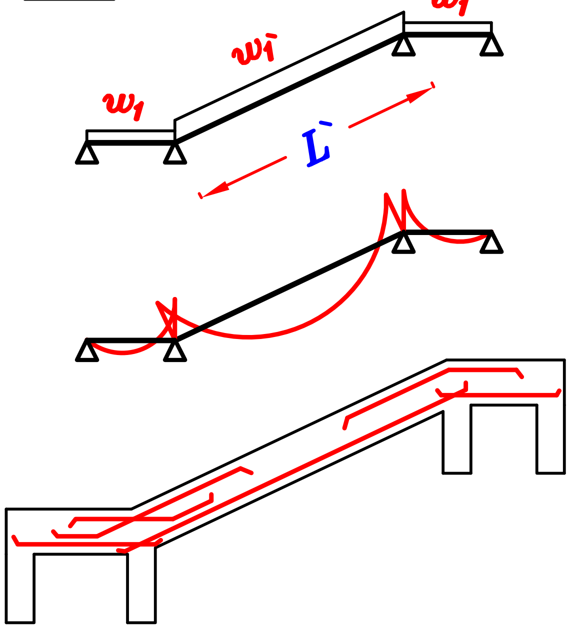
USING BEAMS BETWEEN THE FLOORS.



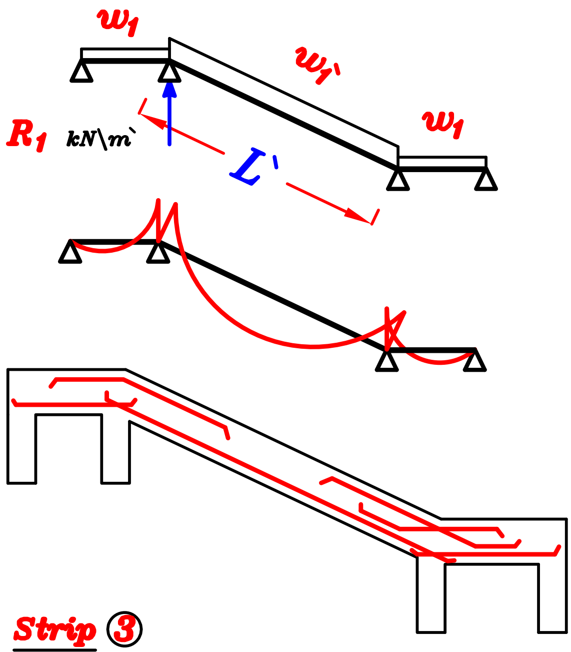


Slabs.

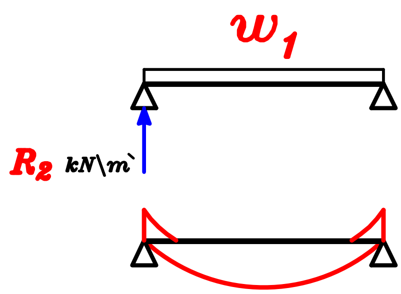
Strip ①



Strip ②



Strip ③

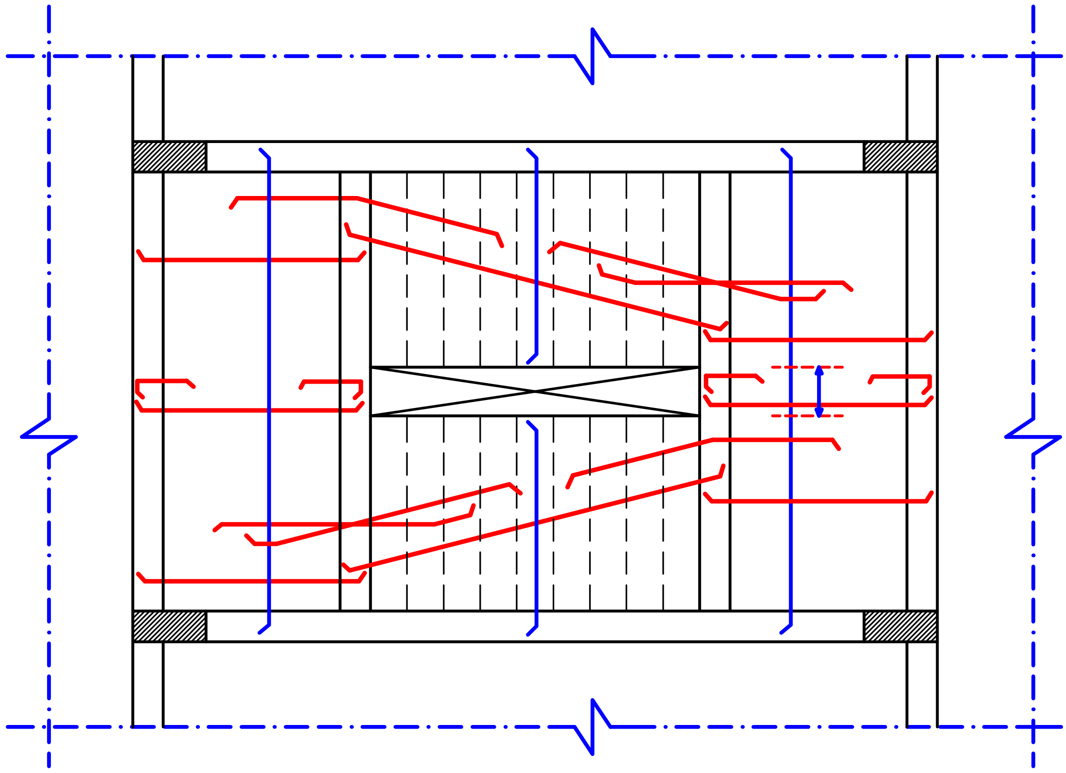


$$t_s = \frac{L'}{30}$$

$$t_{av} = t_s + 70\ mm$$

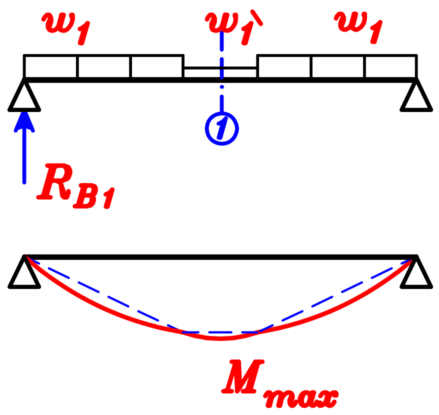
$$w_1 = t_s \gamma_c + F.C. + L.L.$$

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



Beams.

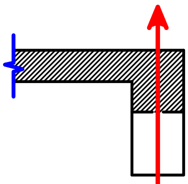
B_1 , $B_1`$



$w_1 = o.w. + R_1$ $kN\backslash m`$

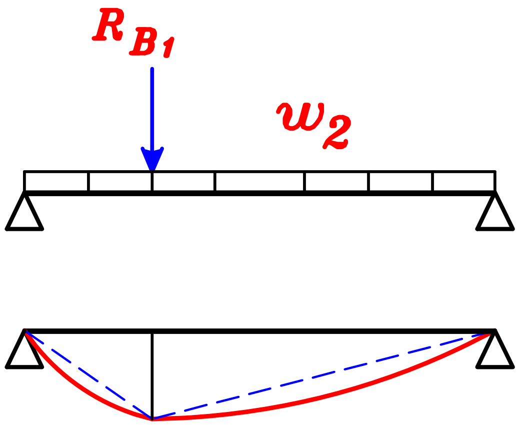
$w_1` = o.w. + R_2$ $kN\backslash m`$

Designed as L–Sec.



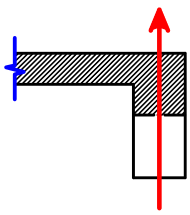
L–Sec.
Sec.(1–1)

B_2



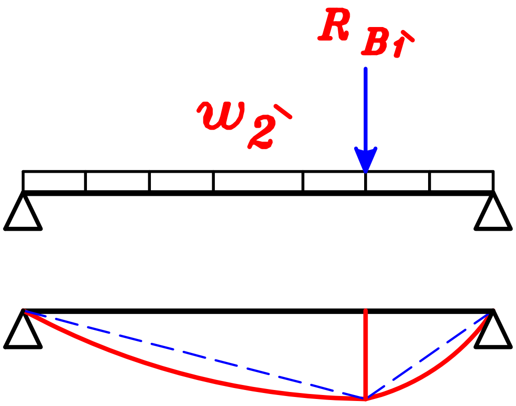
$w_2 = o.w. + walls + S_3$

Designed as L–Sec.



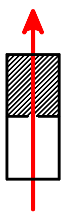
L–Sec.

$B_2`$



$w_2` = o.w. + walls$

Designed as R–Sec.



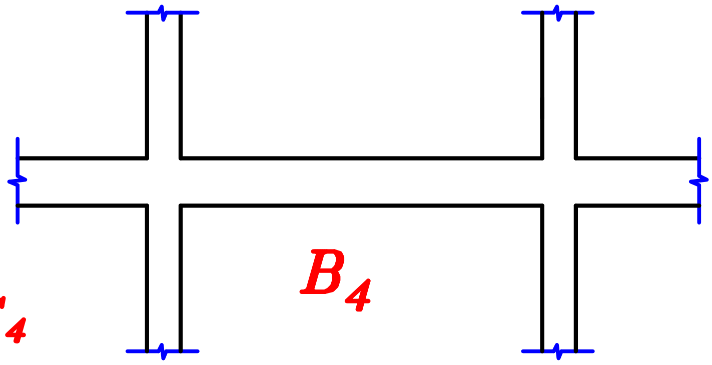
R–Sec.

B_3 the same as B_2

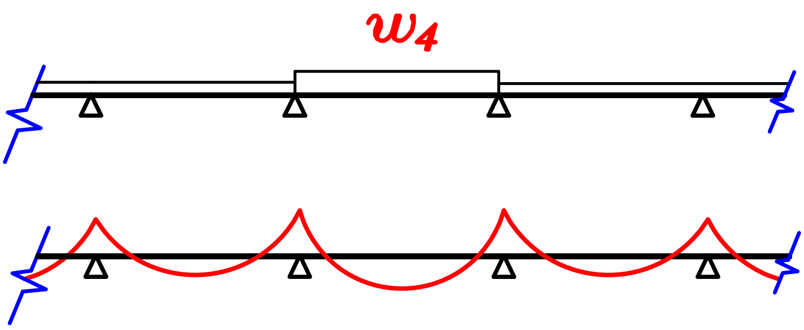
, $B_3`$ the same as $B_2`$

B_4

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

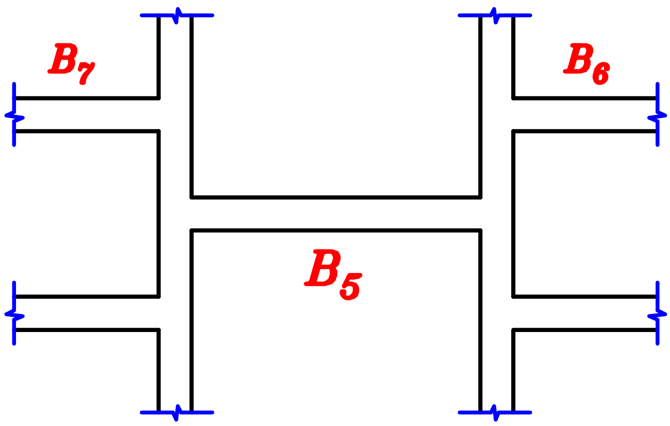


Continous Beam.

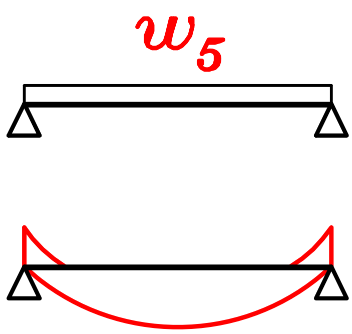


B_5

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

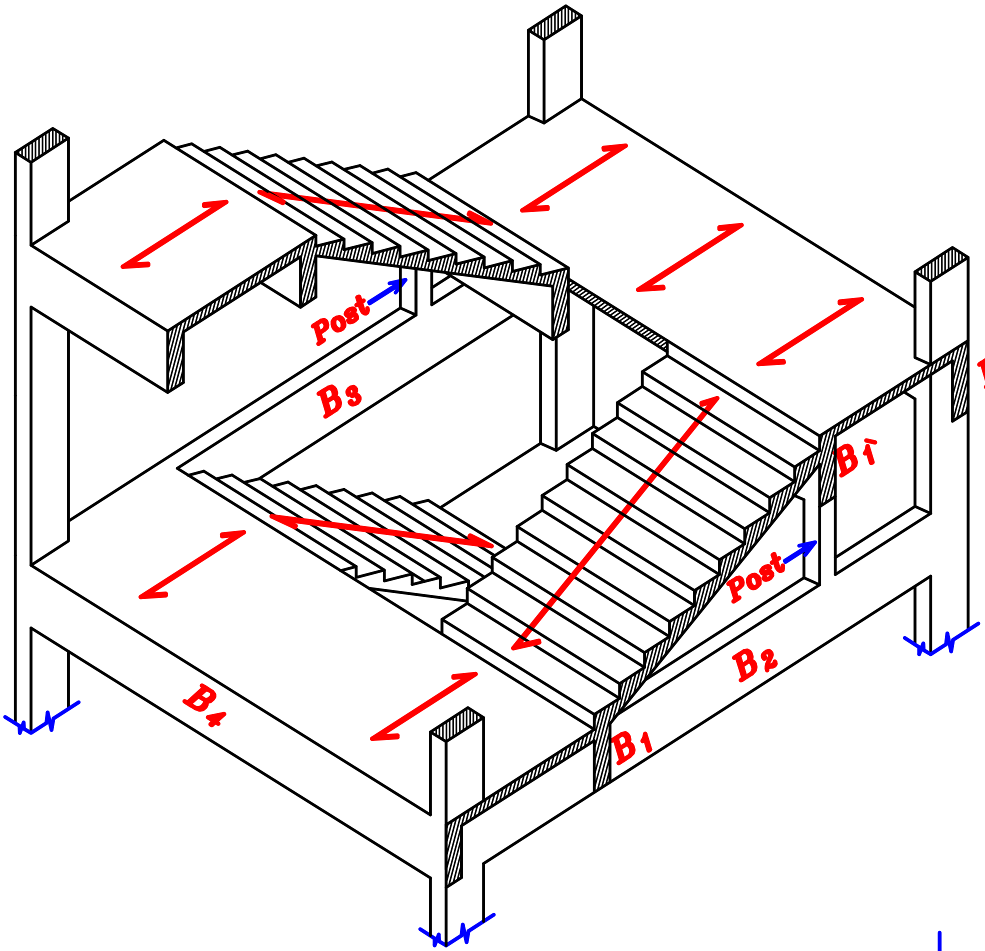


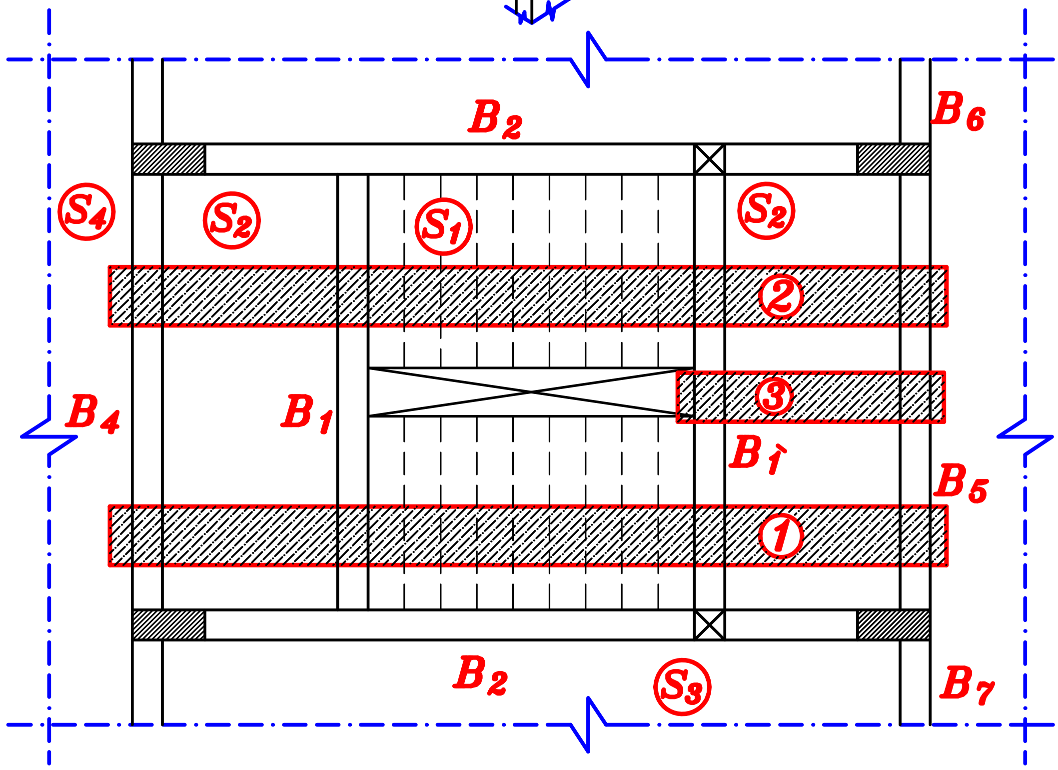
B_5 Simple Beam.



System ③

USING 2 POSTS INSTEAD OF THE BEAMS BETWEEN THE FLOORS.





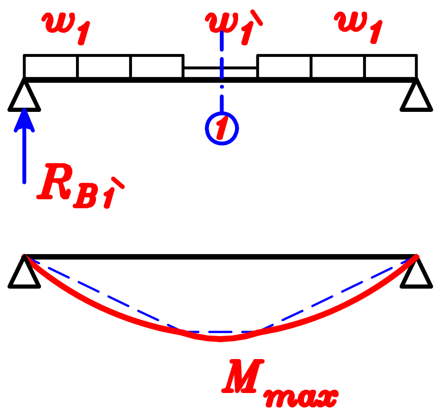
system ③ is the same as system ②
but not For Beams B_2

Beams.

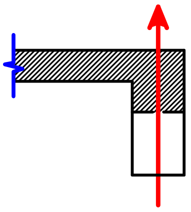
B_1`

$w_1 = o.w. + R_1 \quad kN\backslash m`$

$w_1` = o.w. + R_2 \quad kN\backslash m`$



Designed as L-Sec.

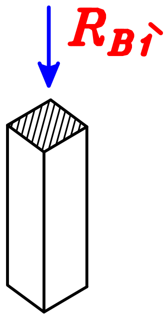


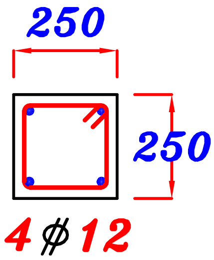
L-Sec.
Sec.(1-1)

Post.

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

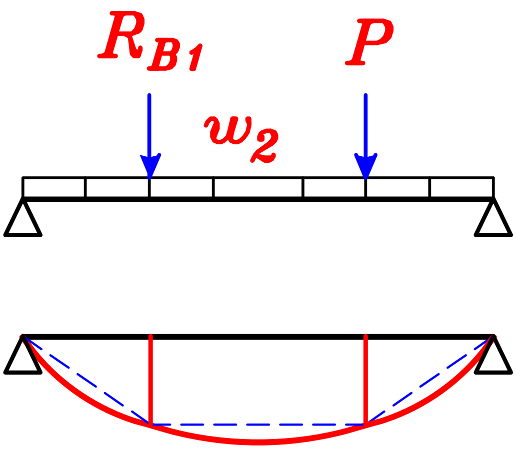
$O.W._{(Post)} \simeq 3.5 \quad kN$



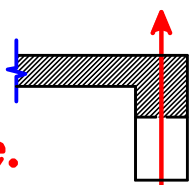


B_2

$w_2 = o.w. + walls + S_3$

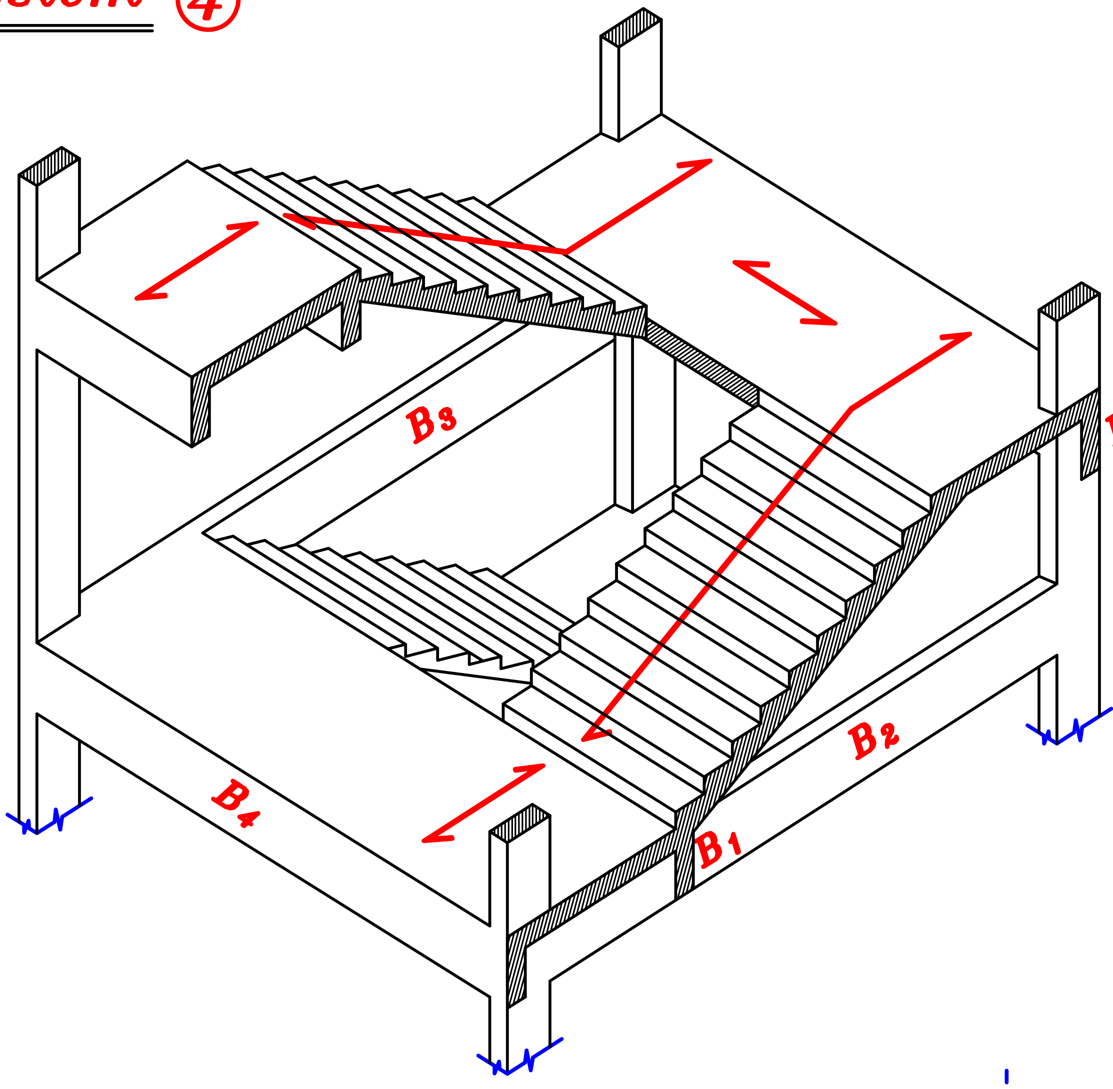


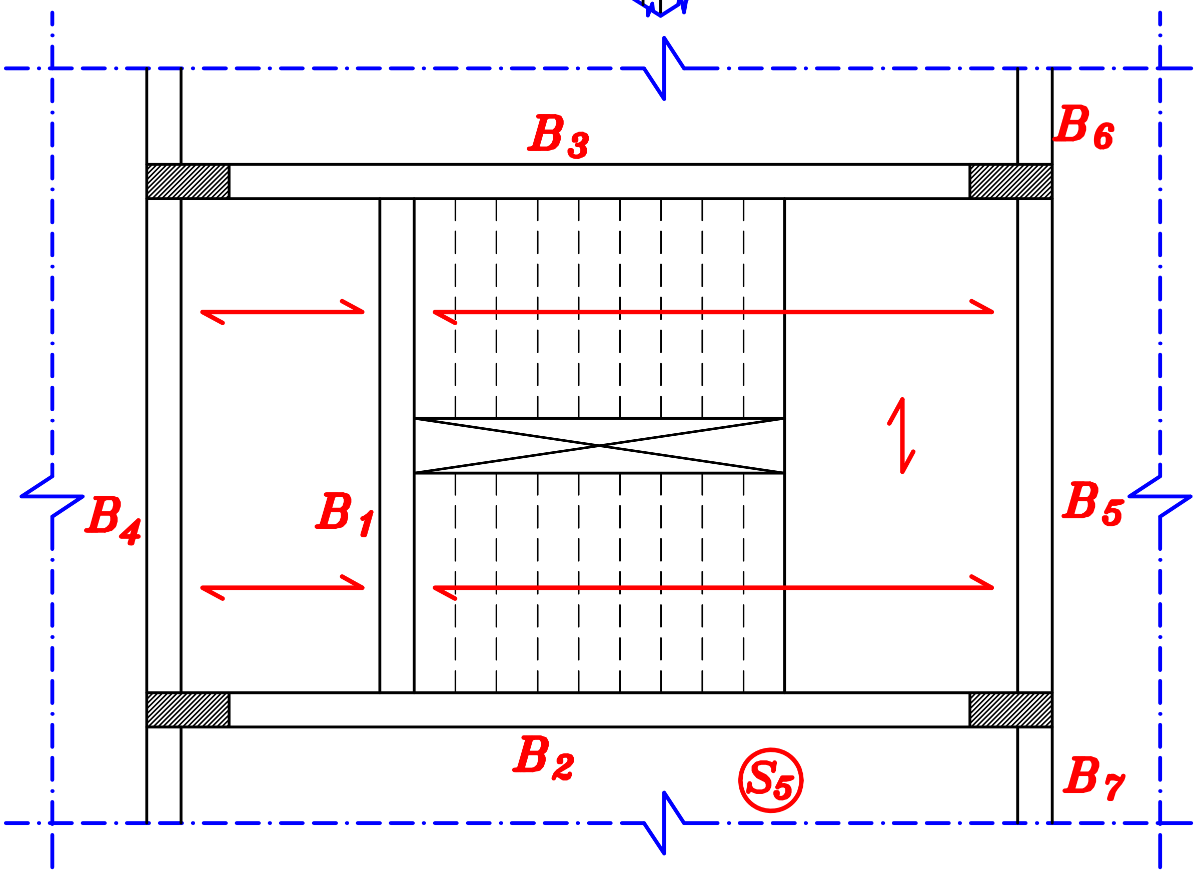
Designed as L-Sec.

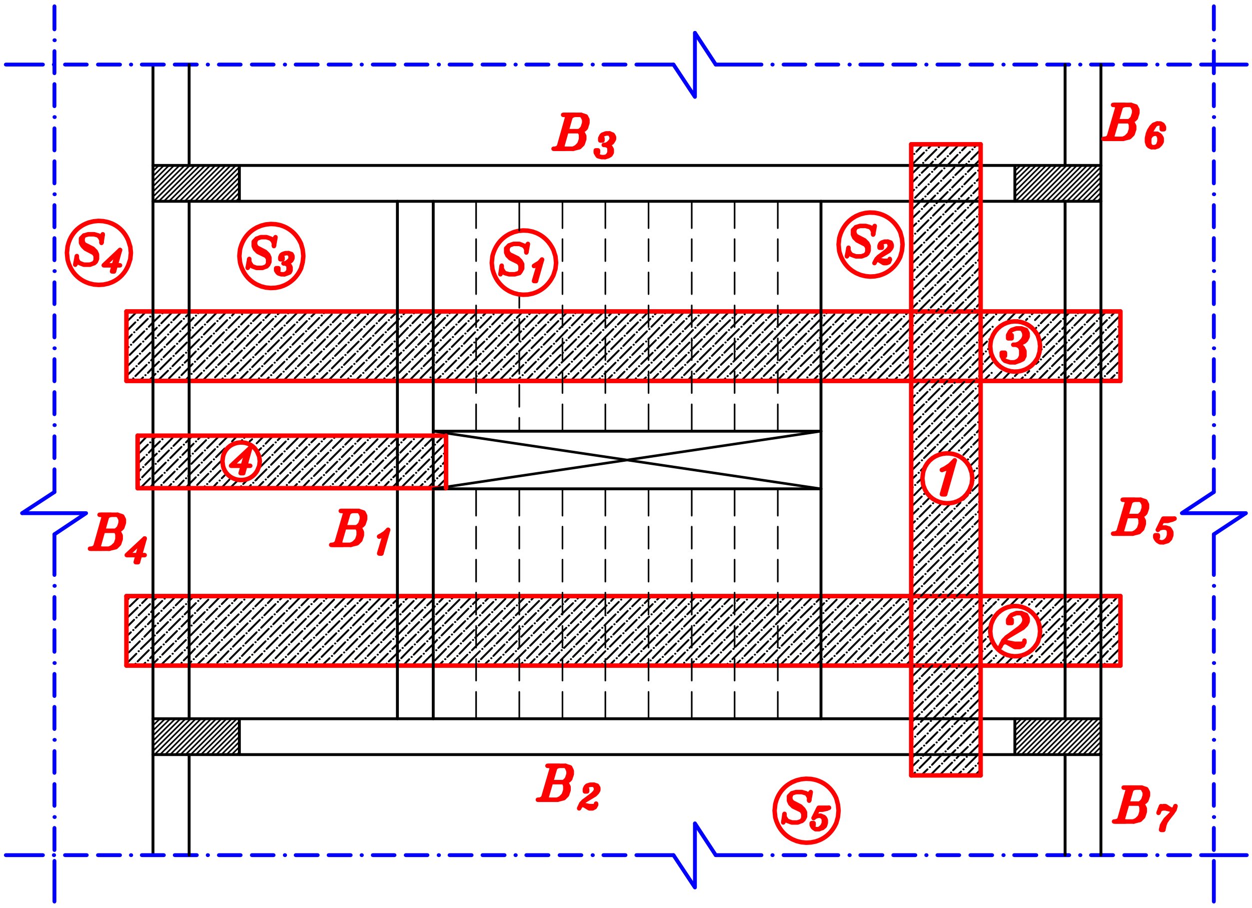


L-Sec.

System ④



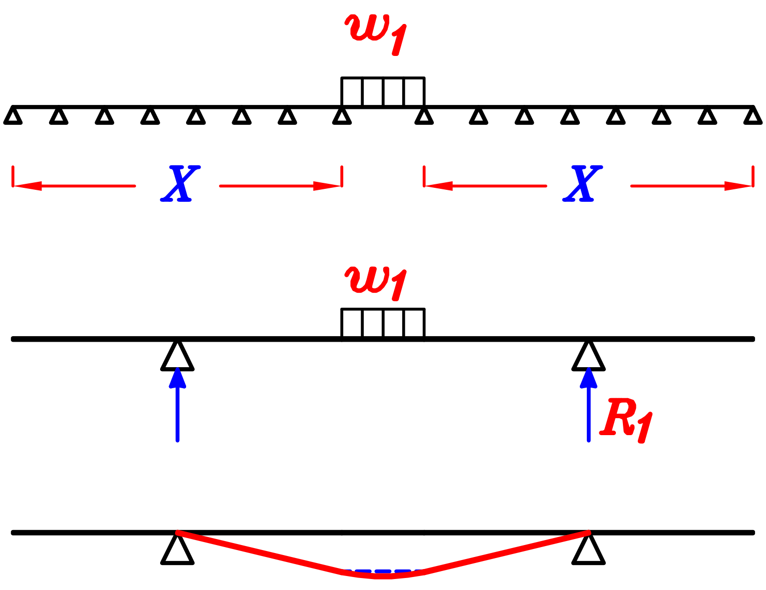




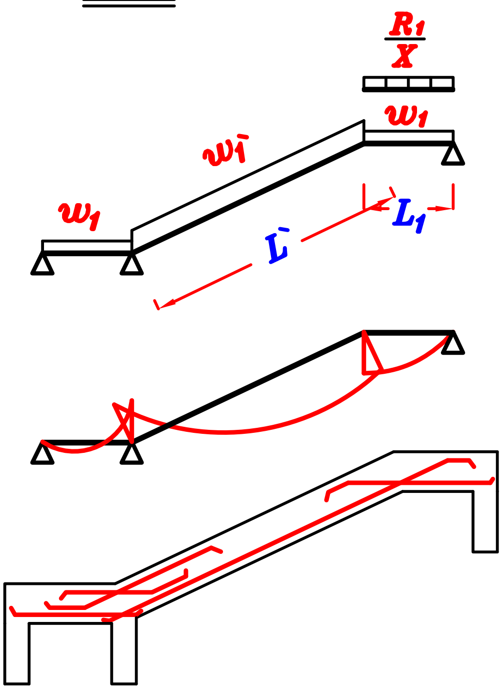
Slabs.

Strip ①

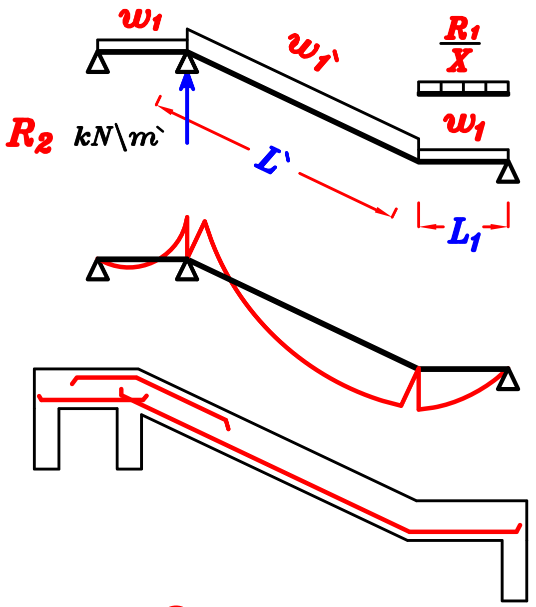
$$w_1 = t_s \gamma_c + F.C. + L.L.$$



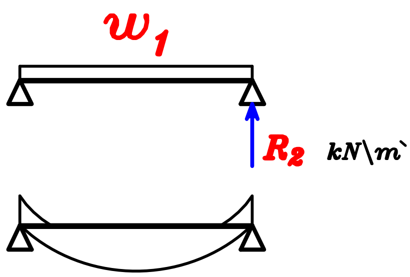
Strip ②



Strip ③



Strip ④

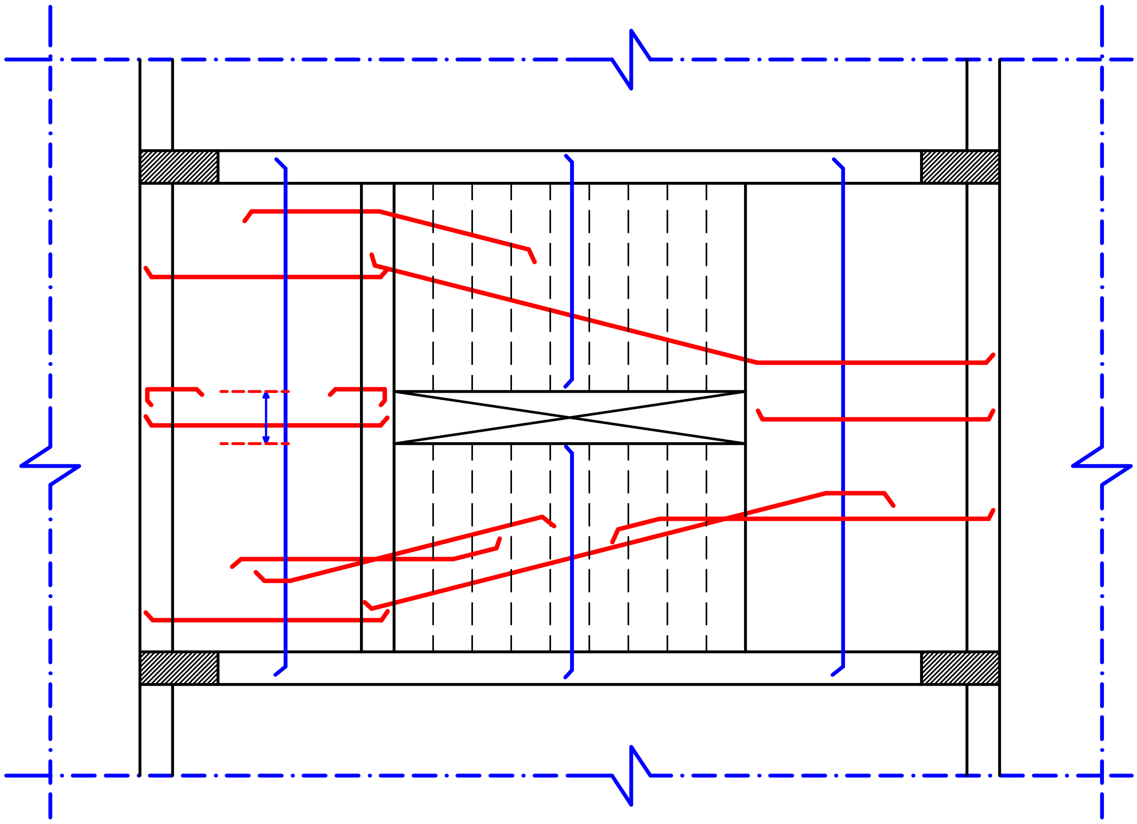


$$t_s = \frac{L_1 + L`}{24}$$

$$t_{av} = t_s + 70\ mm$$

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

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



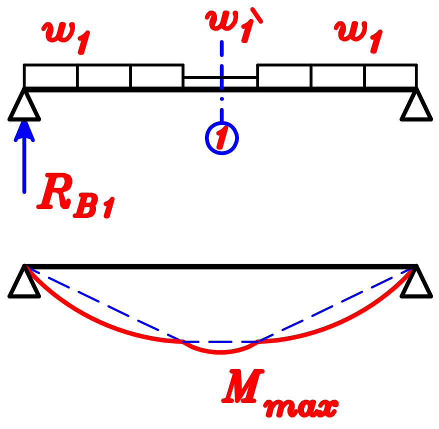
Beams.

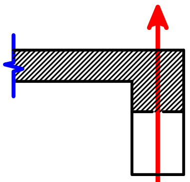
B_1

$w_1 = o.w. + R_2 \quad kN\backslash m`$

$w_1` = o.w. + R_3 \quad kN\backslash m`$

Designed as L–Sec.





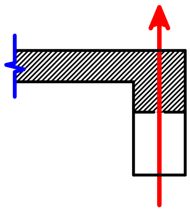
L–Sec.

Sec.(1–1)

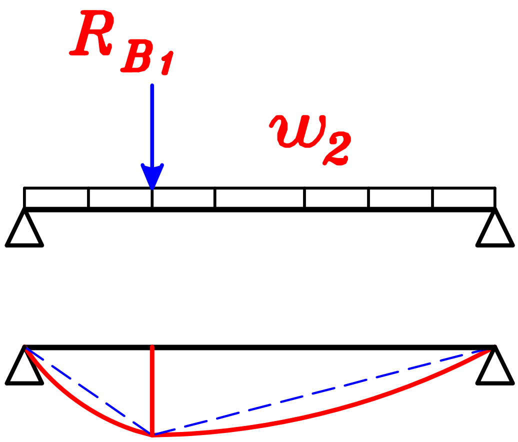
B_2 , B_3

$w_2 = o.w. + walls + S_5$

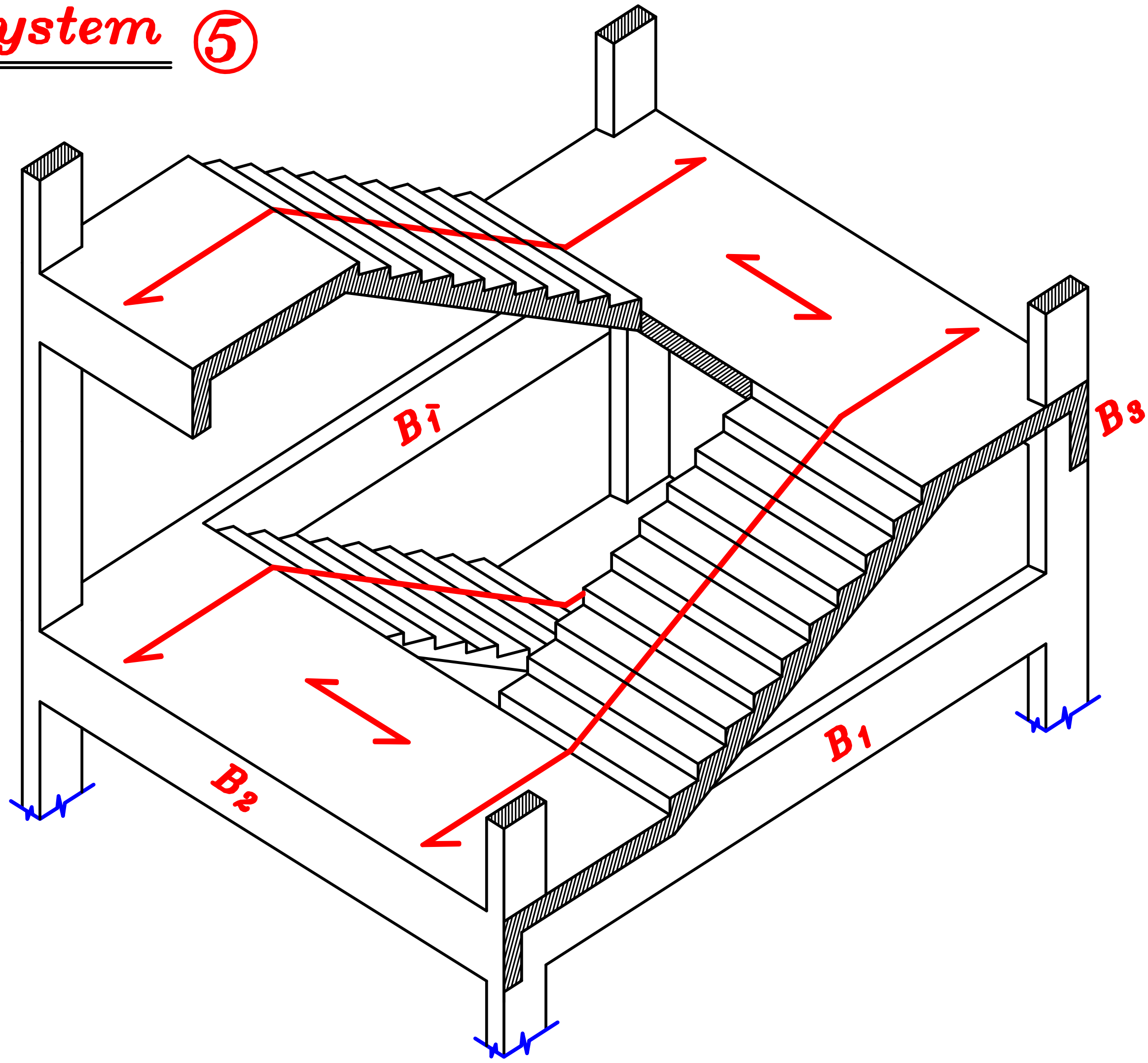
Designed as L–Sec.

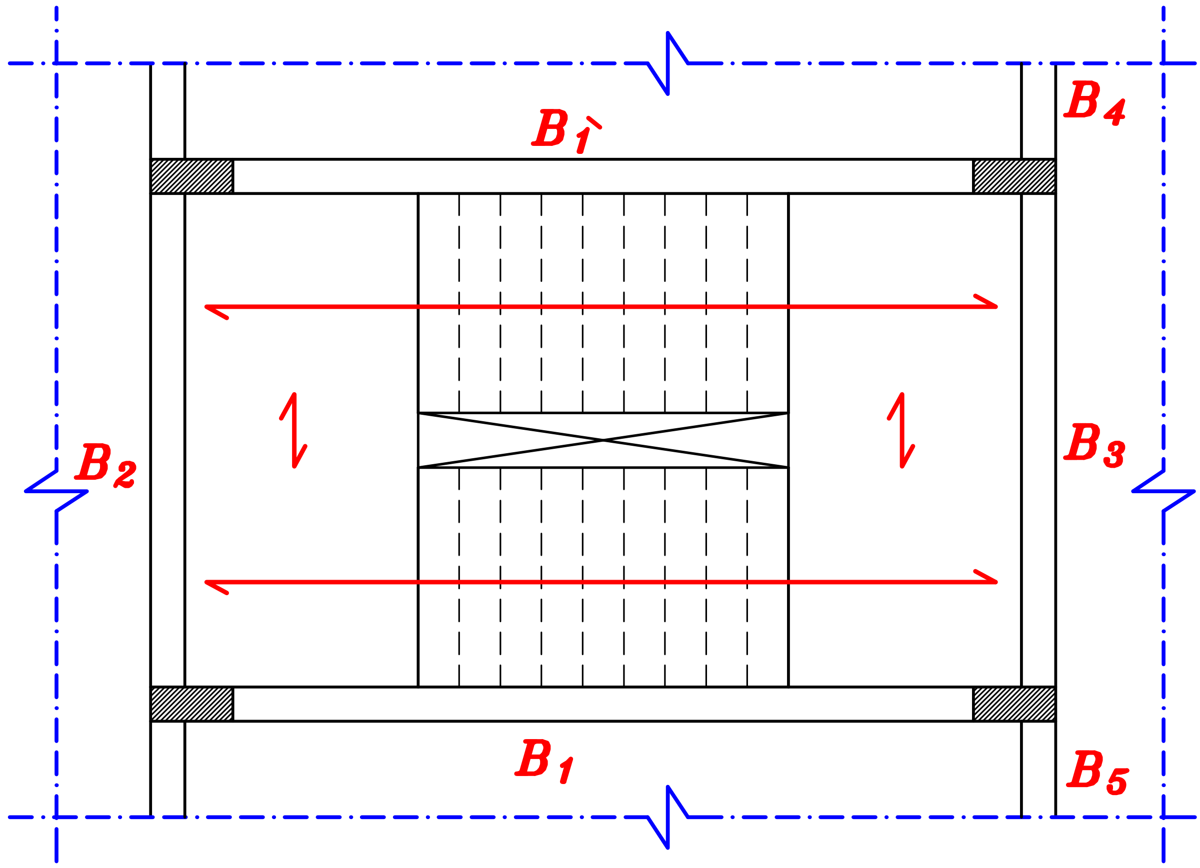


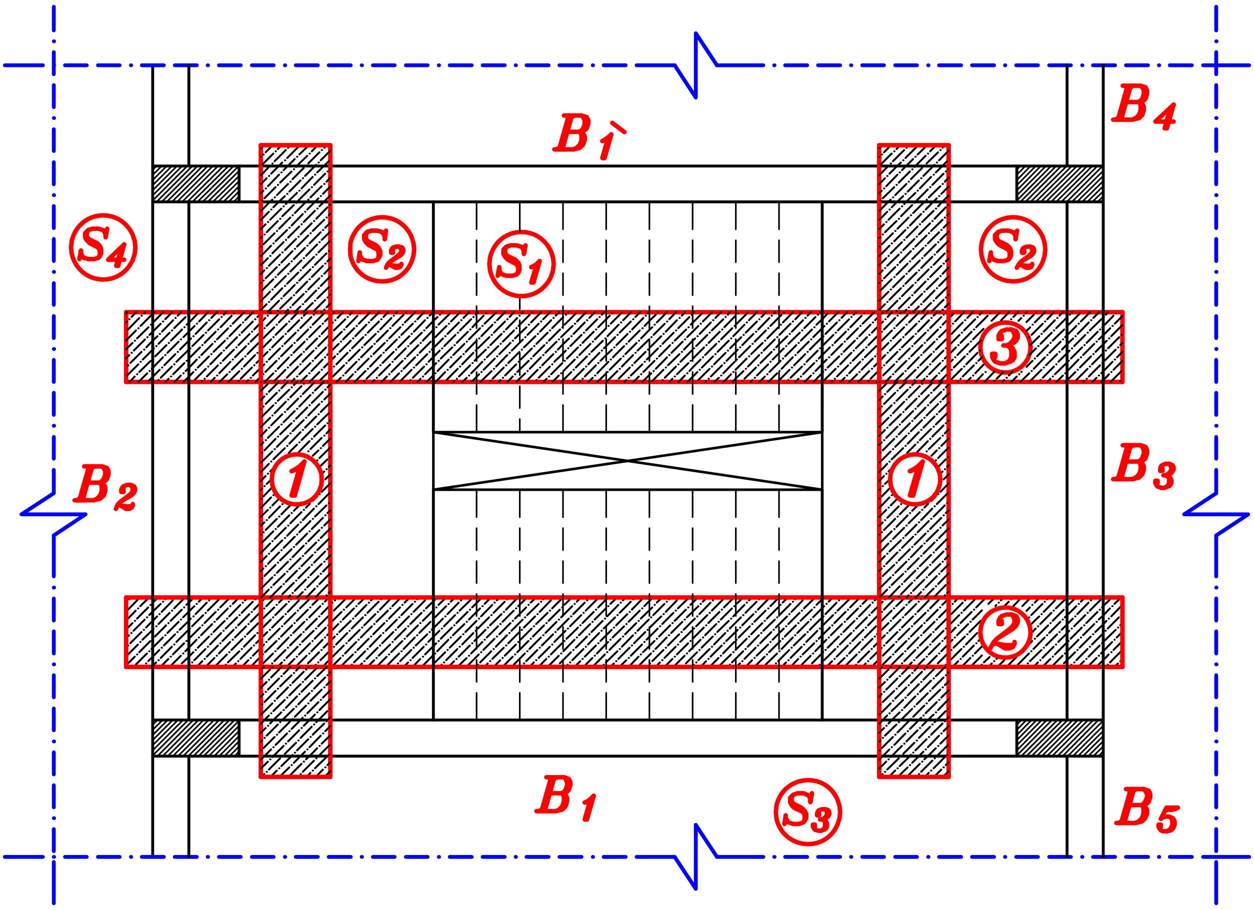
L–Sec.



System ⑤



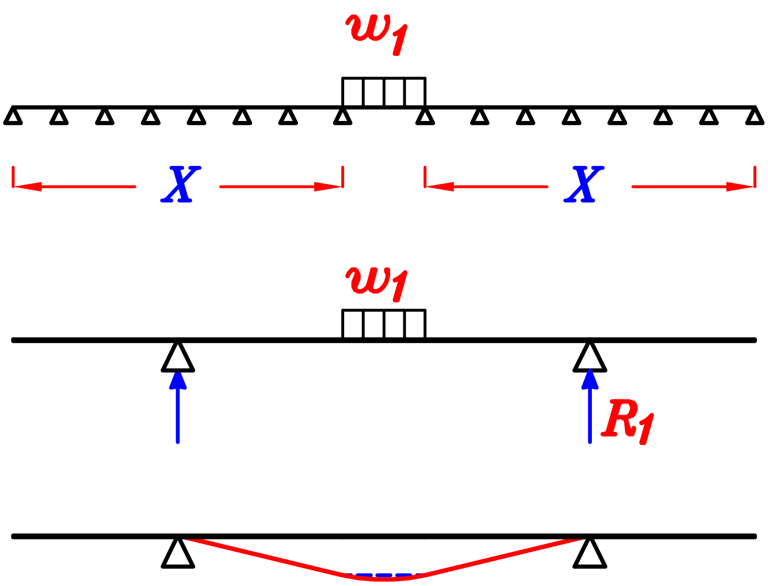




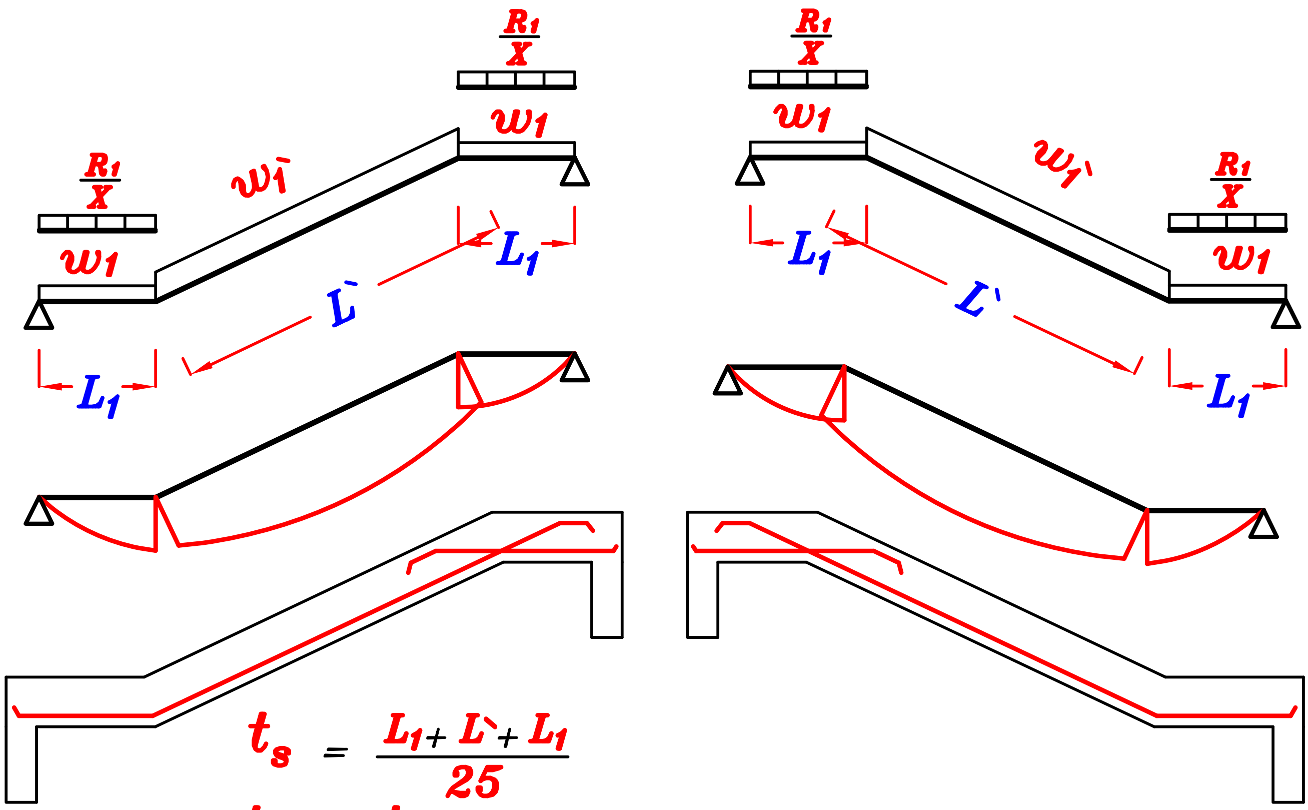
Slabs.

Strip ①

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



Strip ② Strip ③

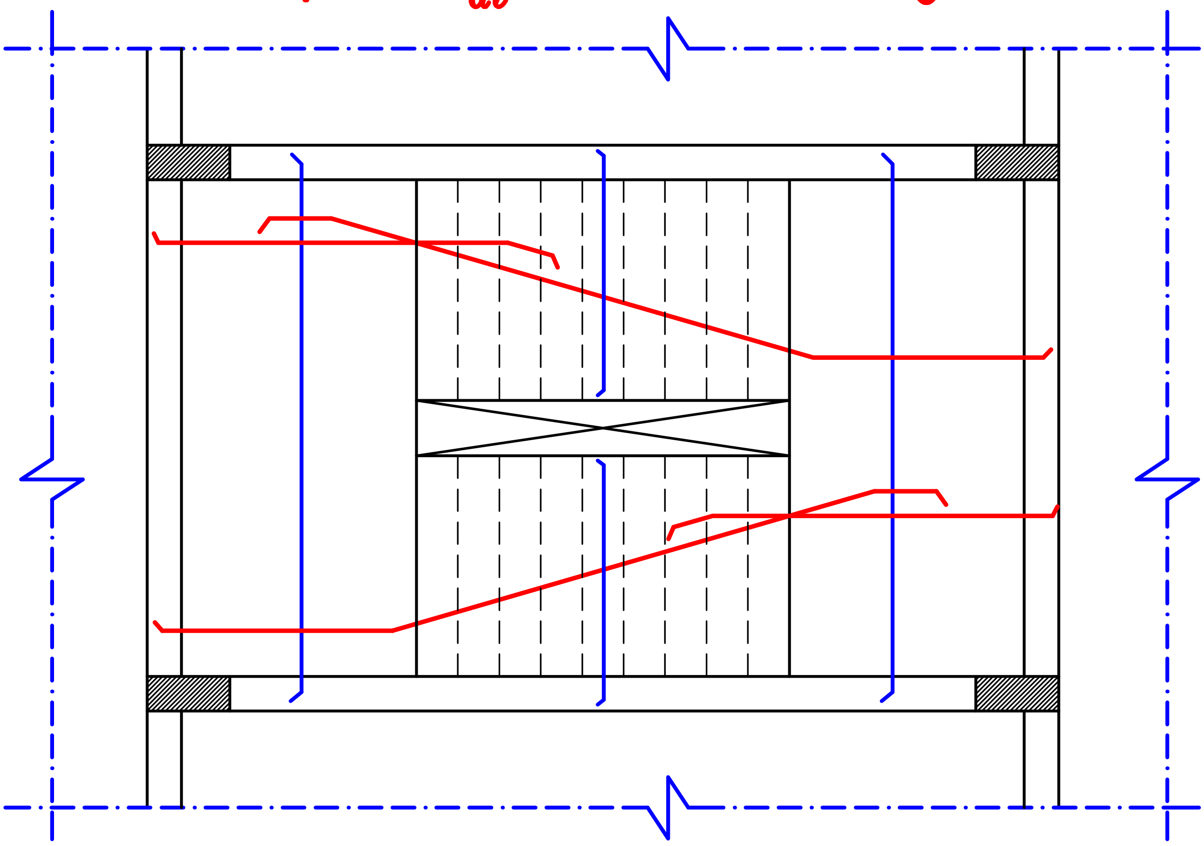


$$t_s = \frac{L_1 + L` + L_1}{25}$$

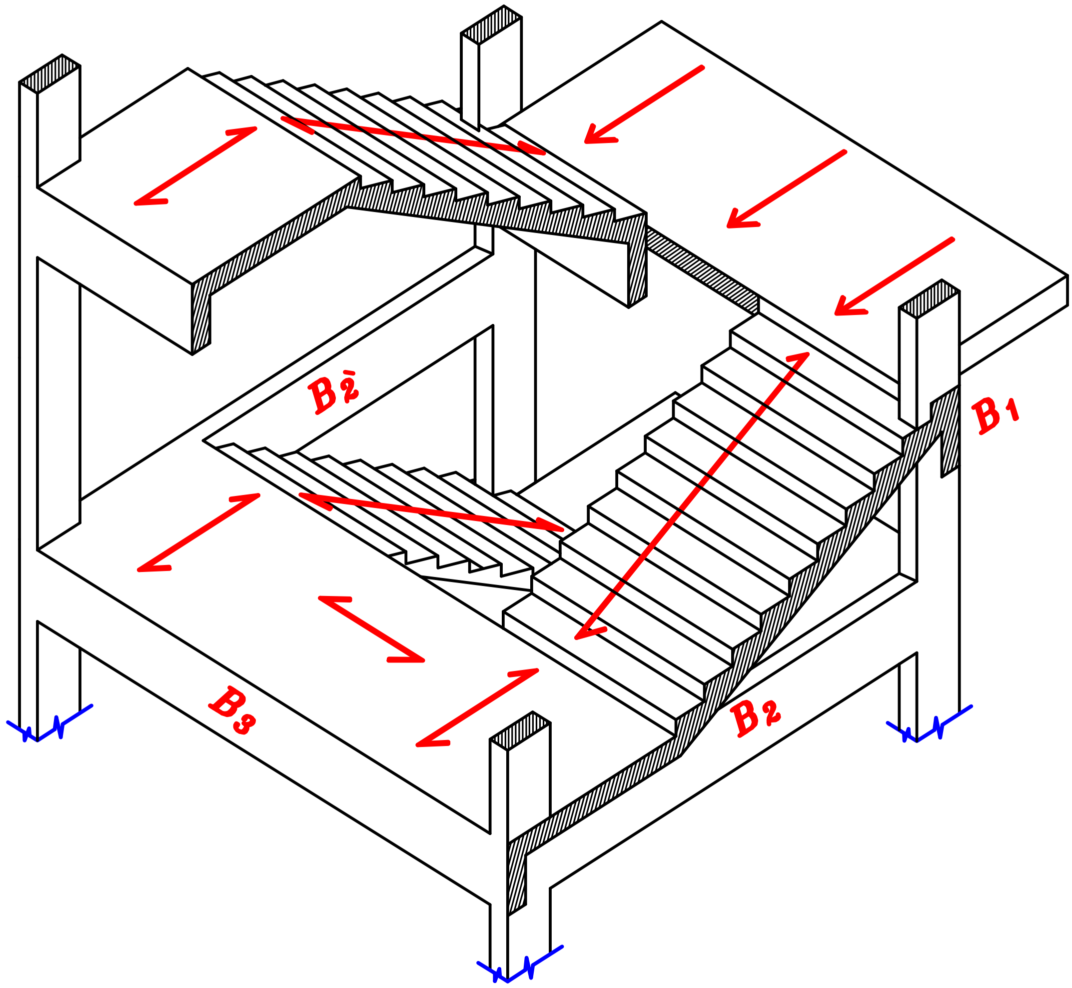
$$t_{av} = t_s + 70\,mm$$

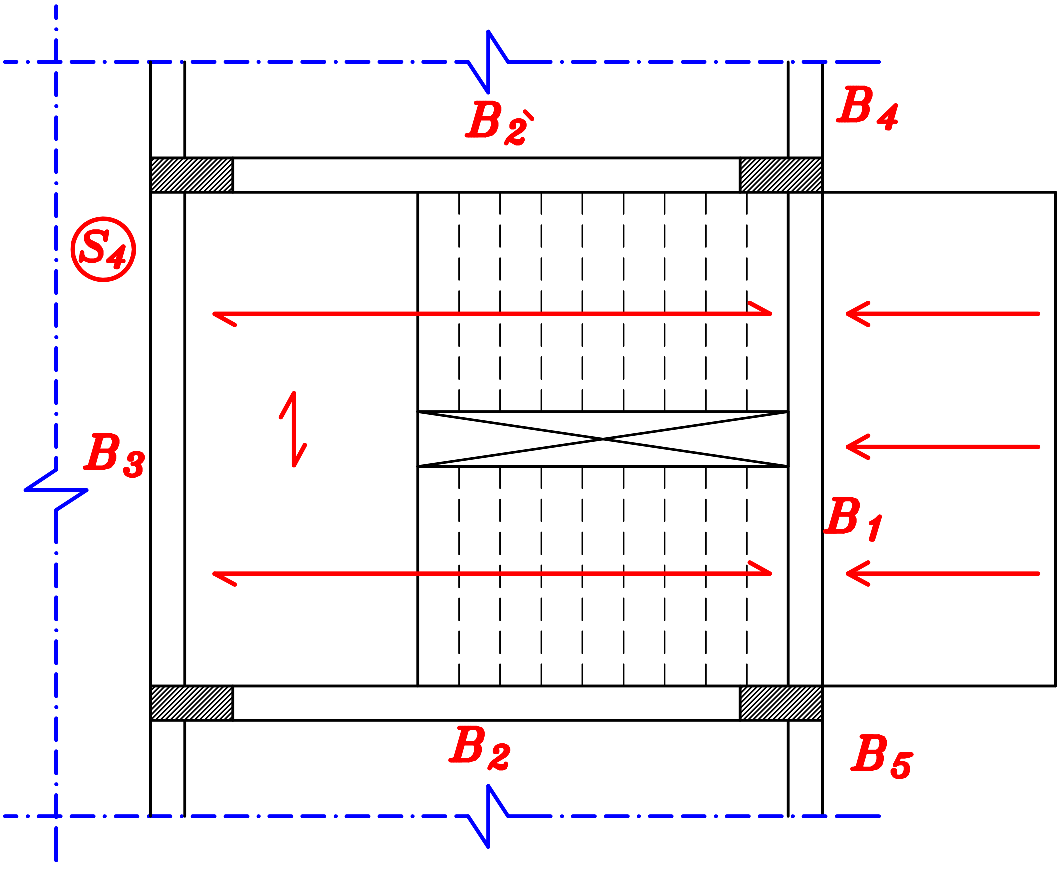
$$w_1 = t_s \gamma_c + F.C. + L.L.$$

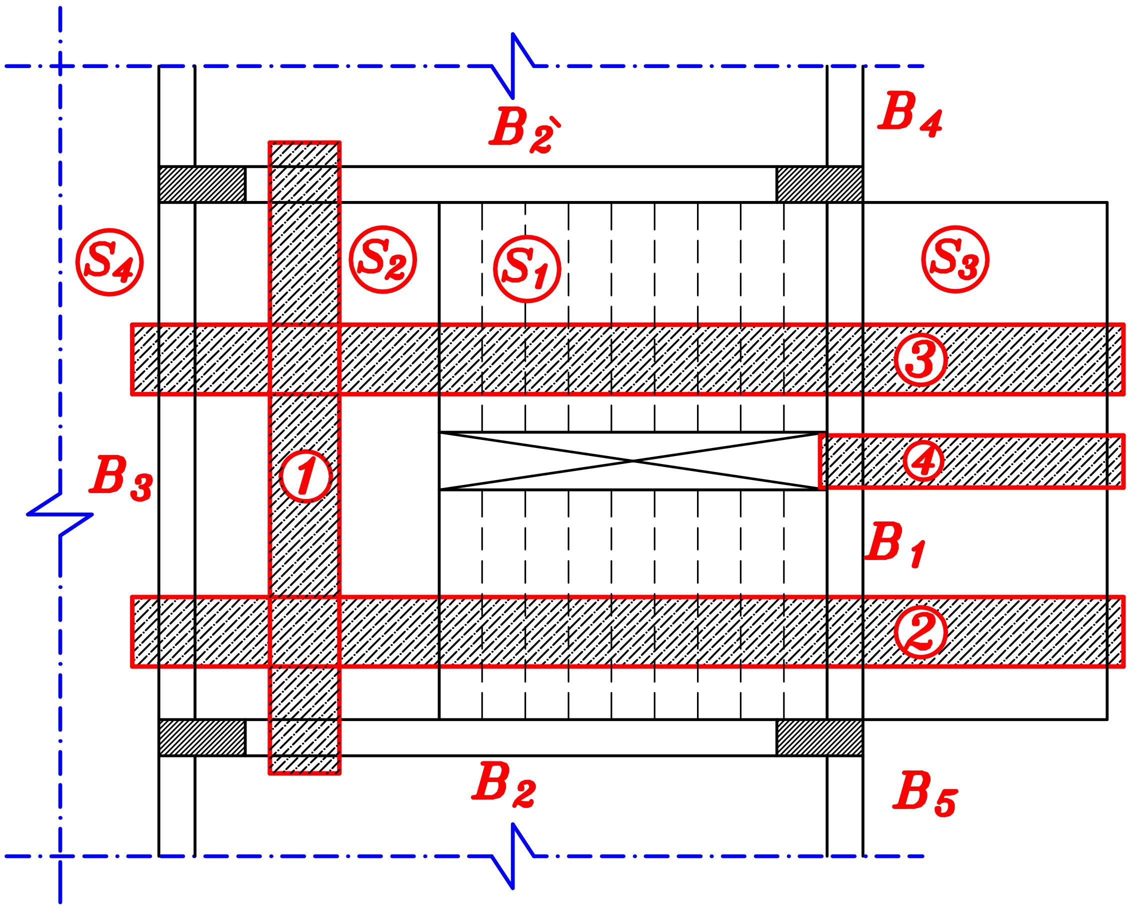
$$w_1` = t_{av} \gamma_c + F.C. + L.L. \cos\theta$$



System ⑥



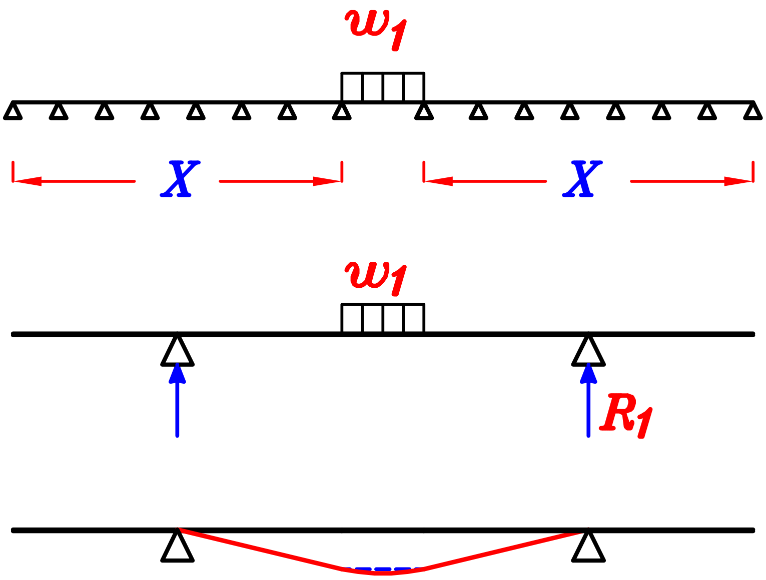




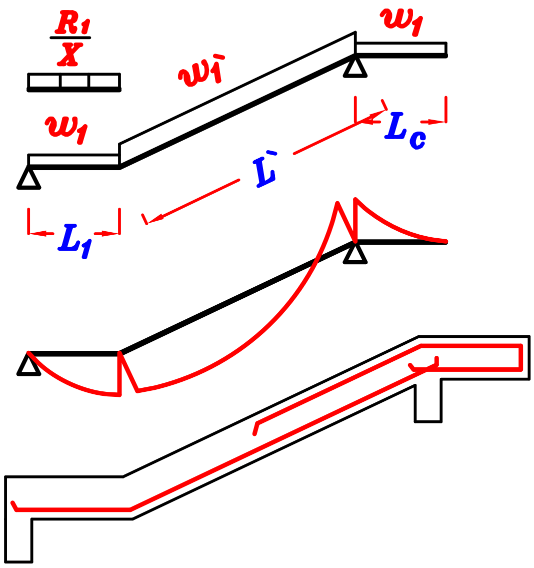
Slabs.

Strip ①

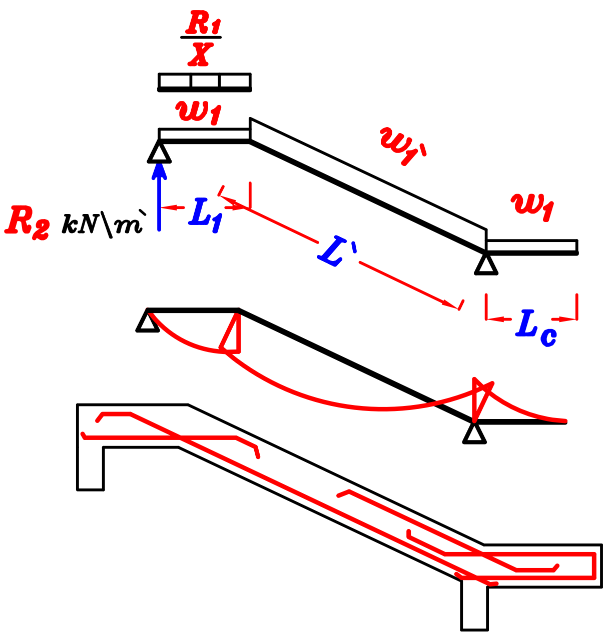
$$w_1 = t_s \gamma_c + F.C. + L.L.$$



Strip ①



Strip ②



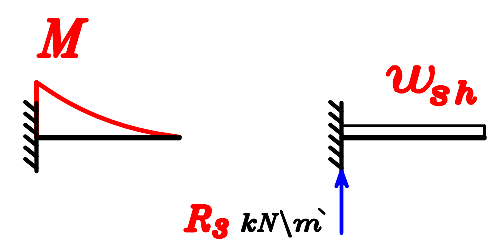
$$t_s = \frac{L_1 + L`}{24}, \quad \frac{L_c}{10} \quad \Big\} \; t_s = \text{الاكبر}$$

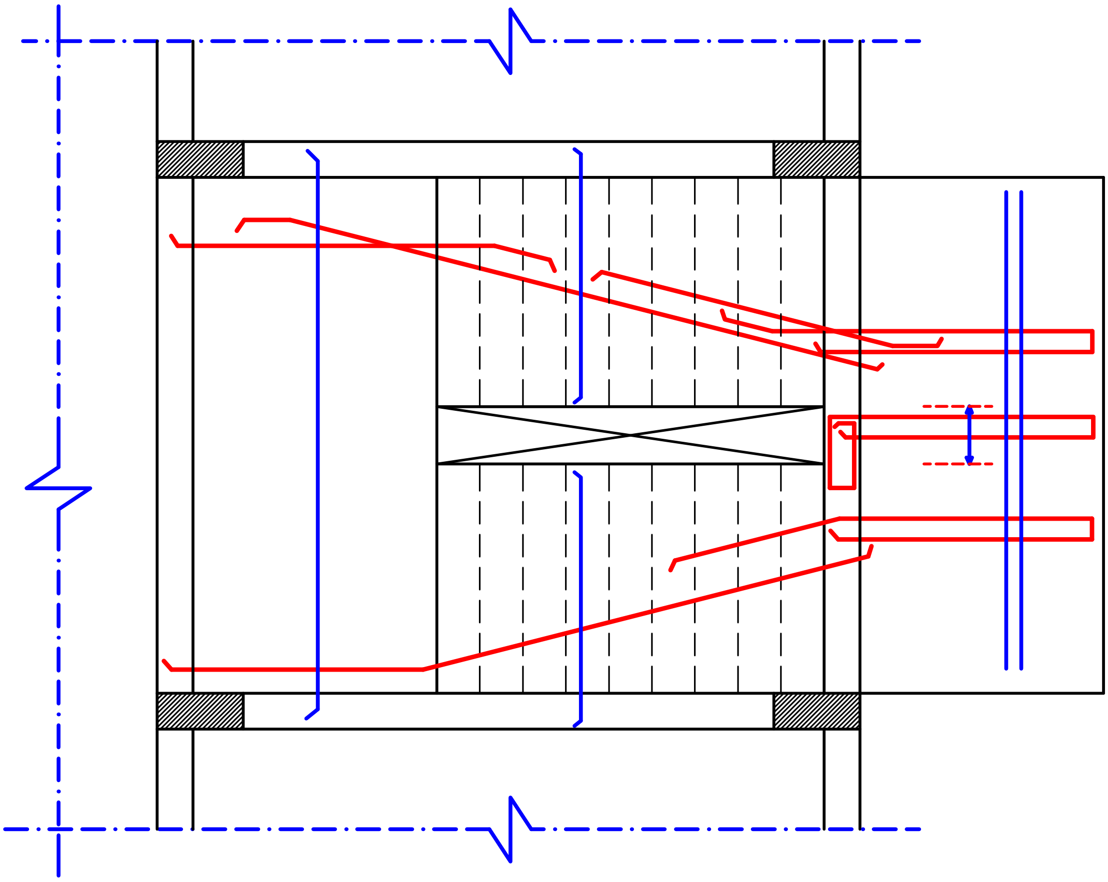
$$t_{av} = t_s + 70\,mm$$

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

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

Strip ③

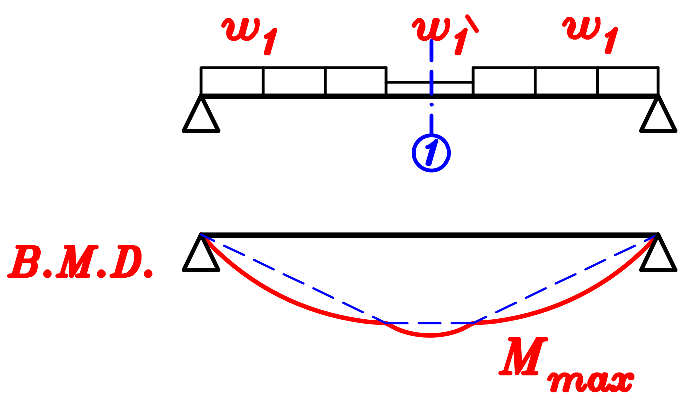




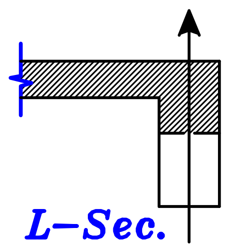
Beams. B_1

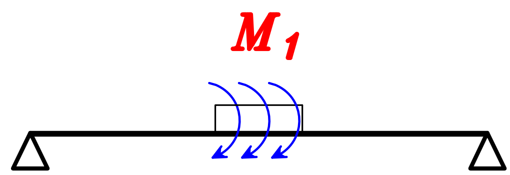
$w_1 = o.w. + R_2$ kN\m\`

$w_1\` = o.w. + R_3$ kN\m\`



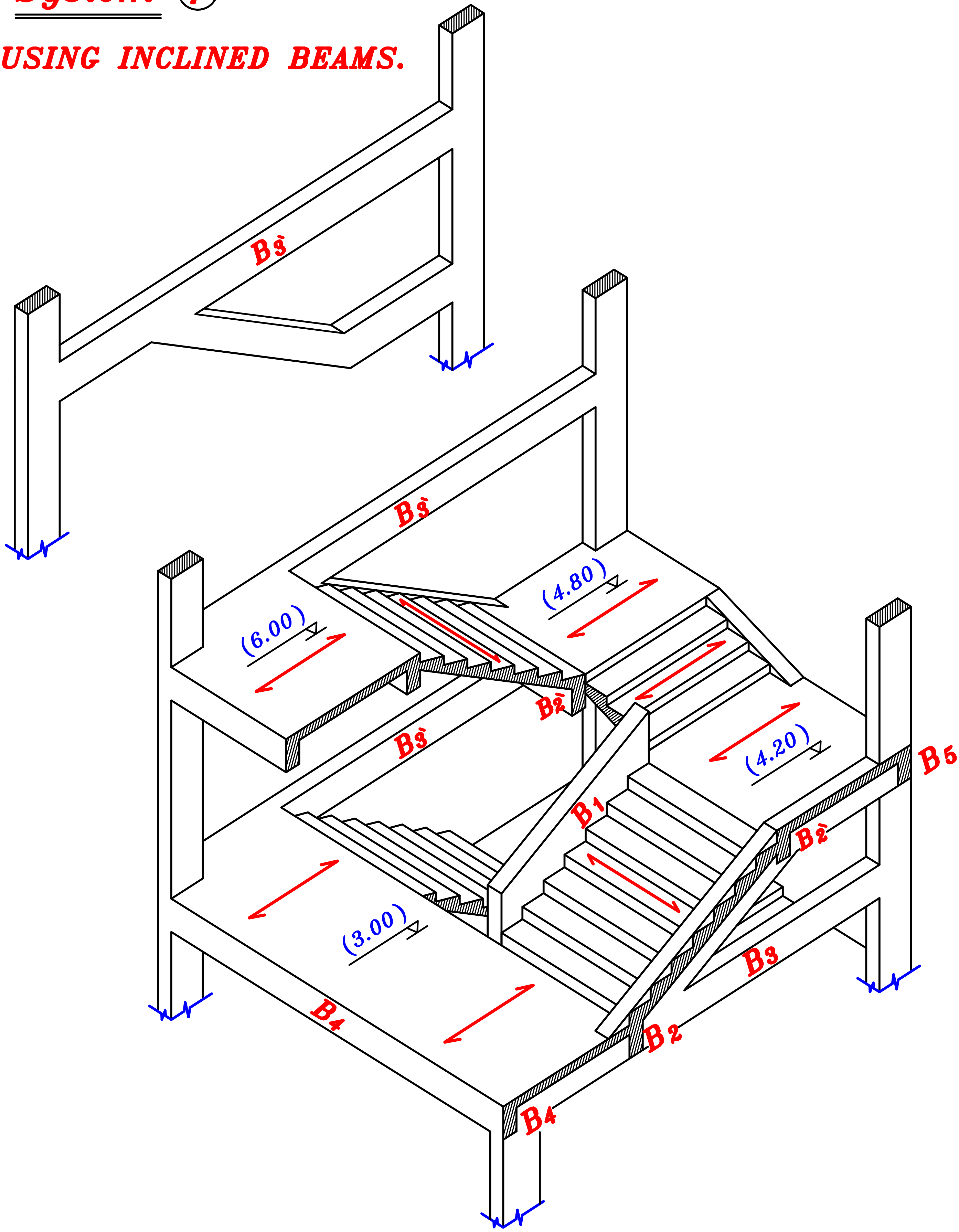
Designed as L–Sec.

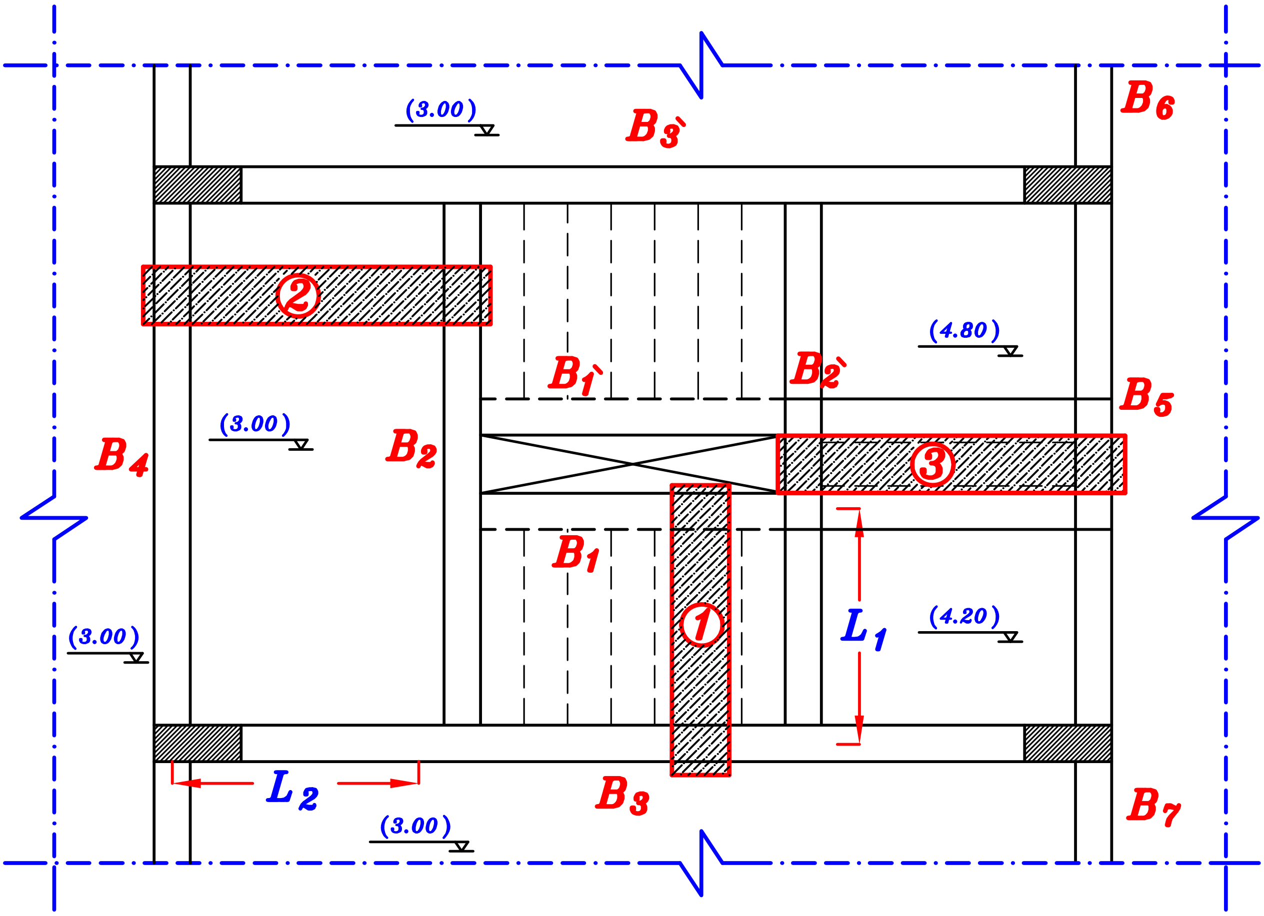




System (1)

USING INCLINED BEAMS.

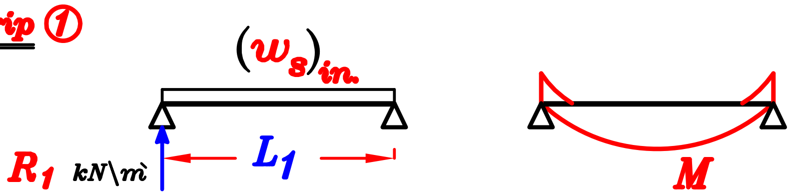




Slabs.

$t_{s_{min}} = 120\ mm$

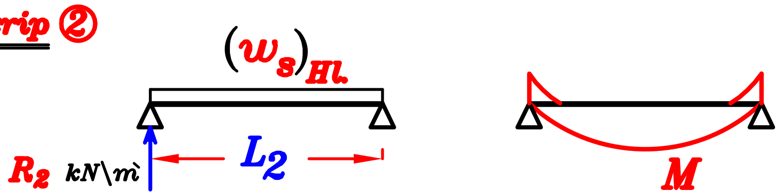
Strip 1



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

$d = t_s - 20\ mm$

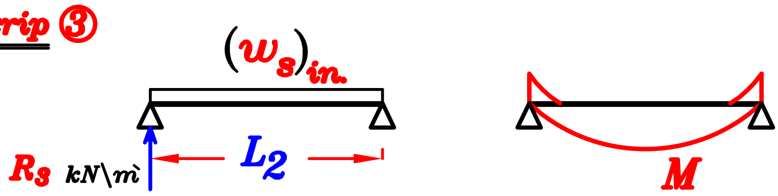
Strip 2



$M_{des.} = M$

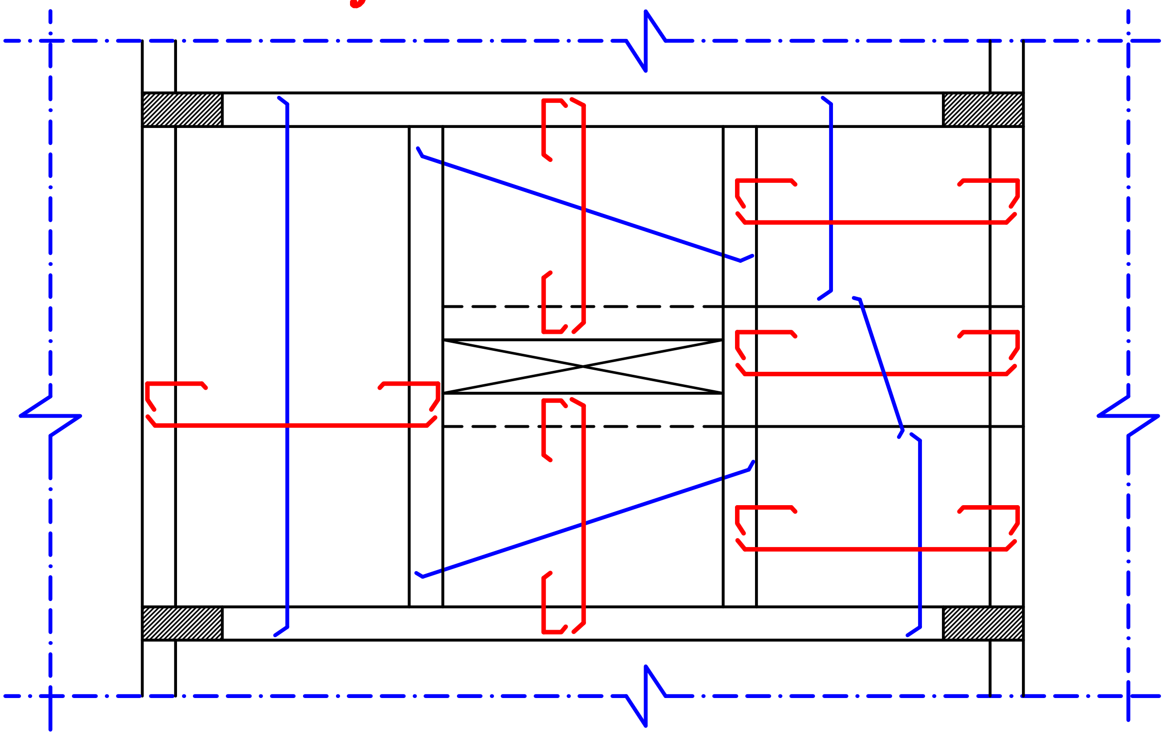
$d = t_s - 20\ mm$

Strip 3



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

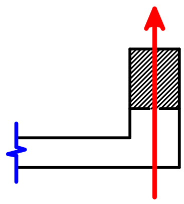
$d = t_s - 20\ mm$

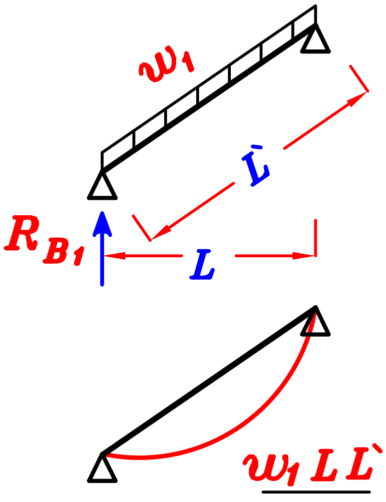


Beams.

B_1 , $B_1^{`}$

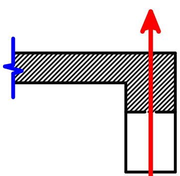
$w_1 = o.w. + R_1$

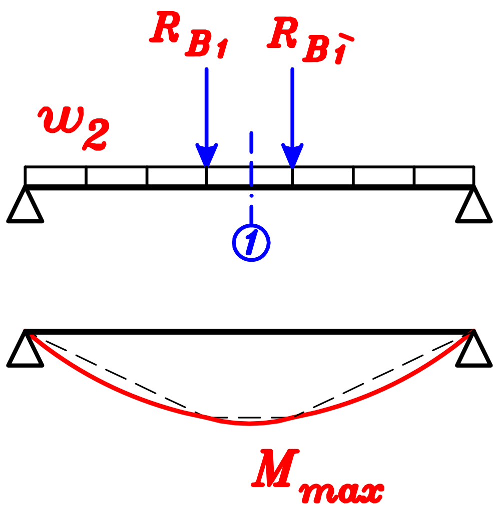




B_2

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

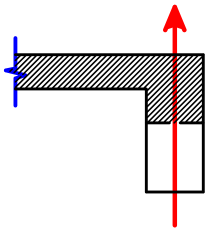


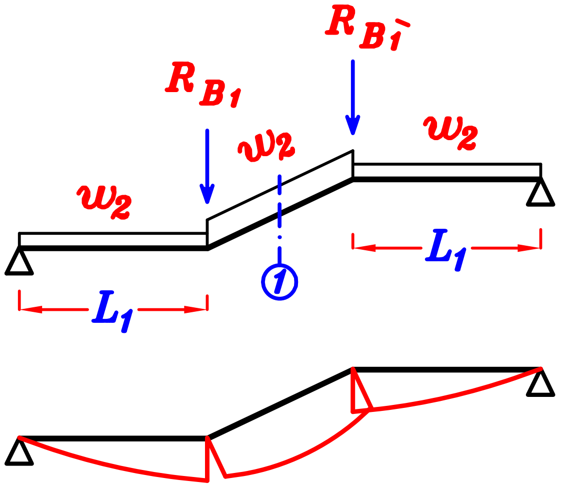


B_{2}'

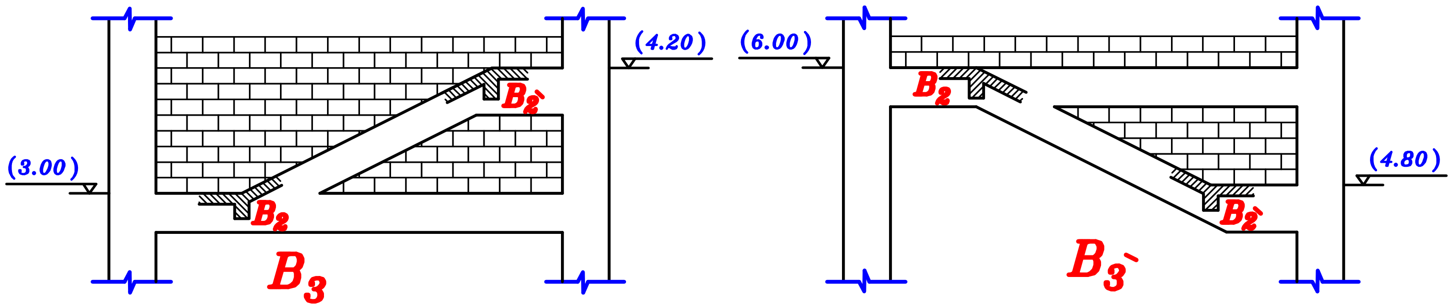
$w_2 = o.w. + R_2$

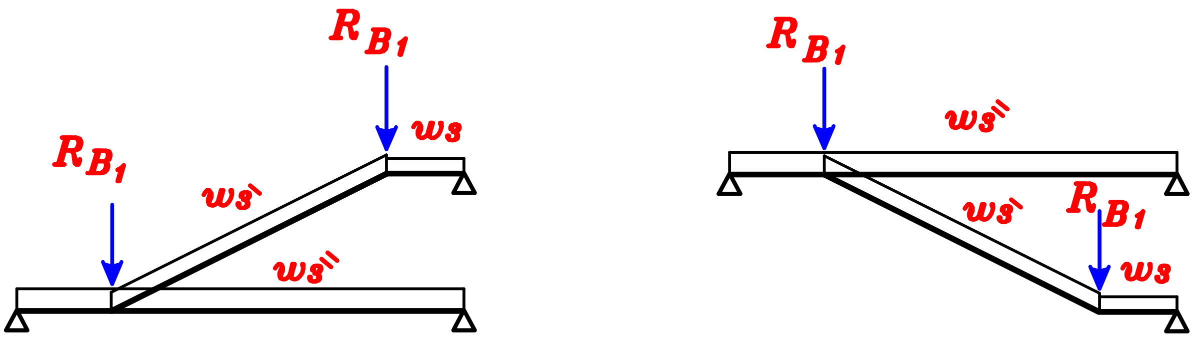
$w_3 = o.w. + R_3$





B_3 , B_3'

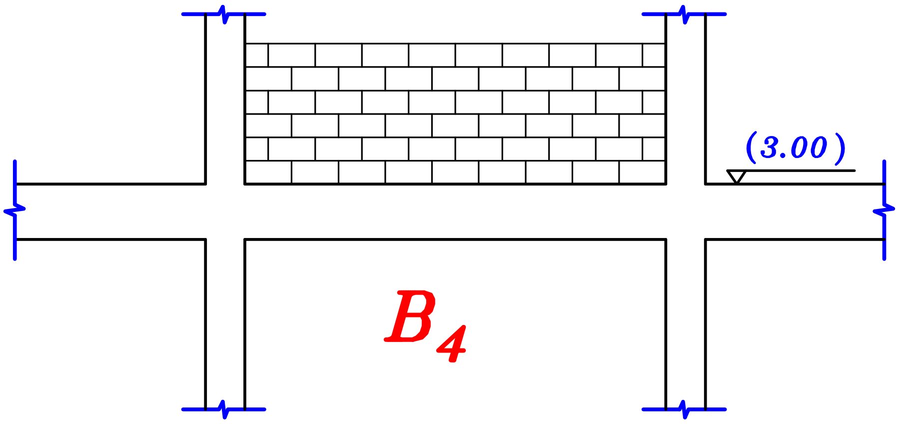




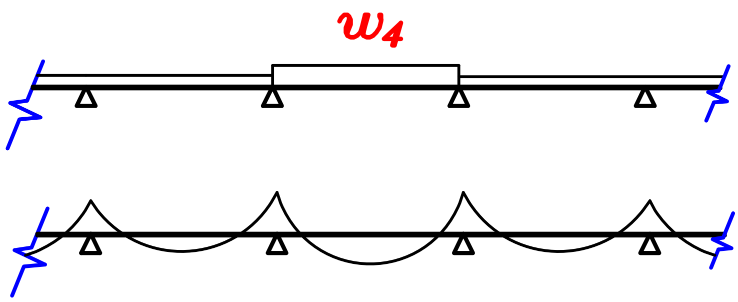
B_3 designed as a Frame

B_4

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



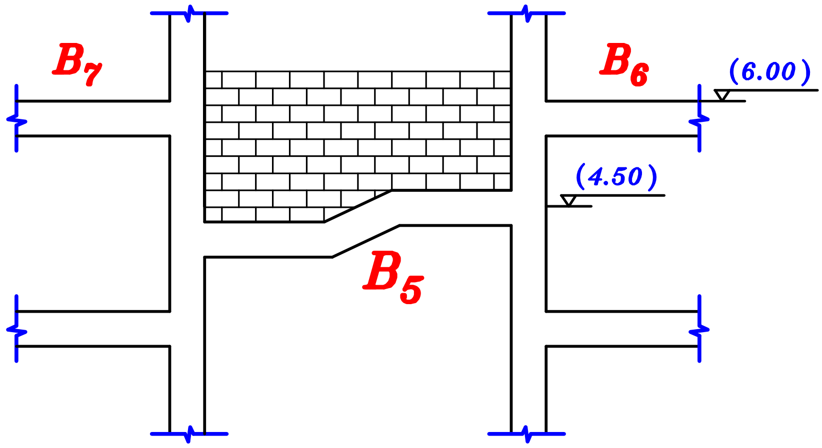
Continous Beam.



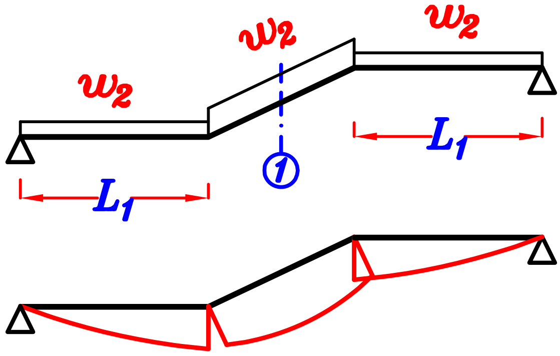
B_5

$w_2 = o.w. + R_2$

$w_3 = o.w. + R_3$

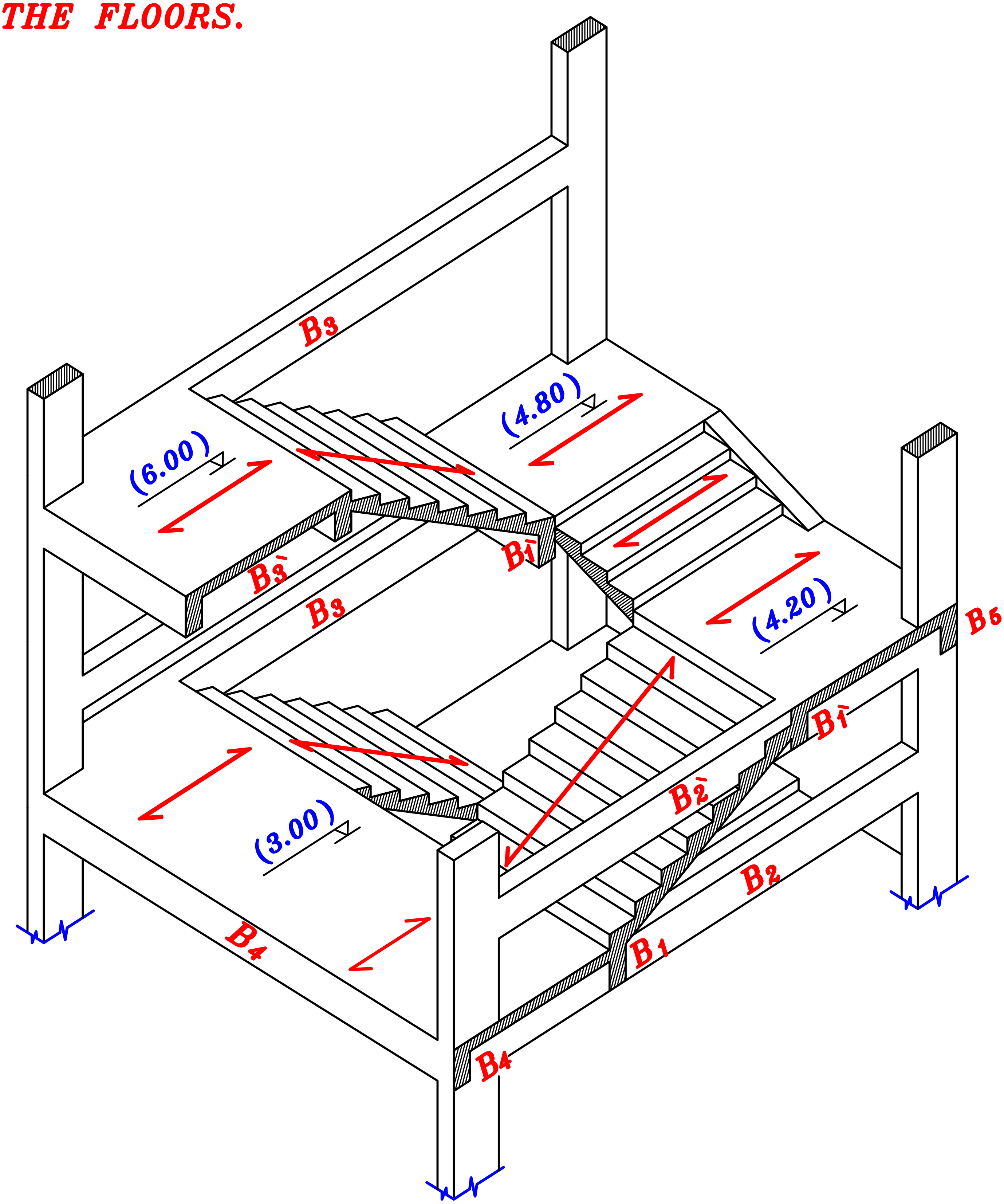


B_5 Simple Beam.



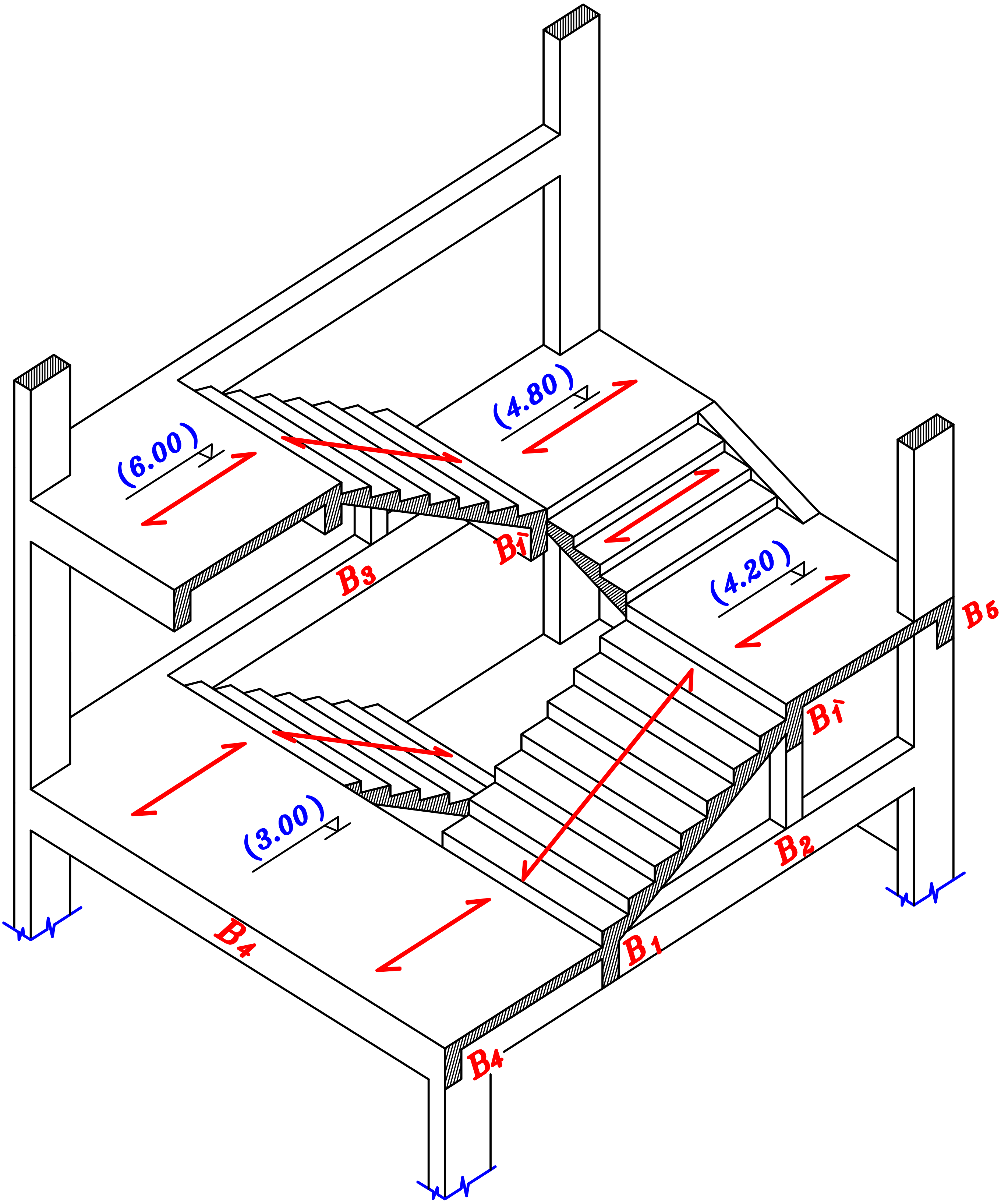
System ②

USING BEAMS BETWEEN THE FLOORS.

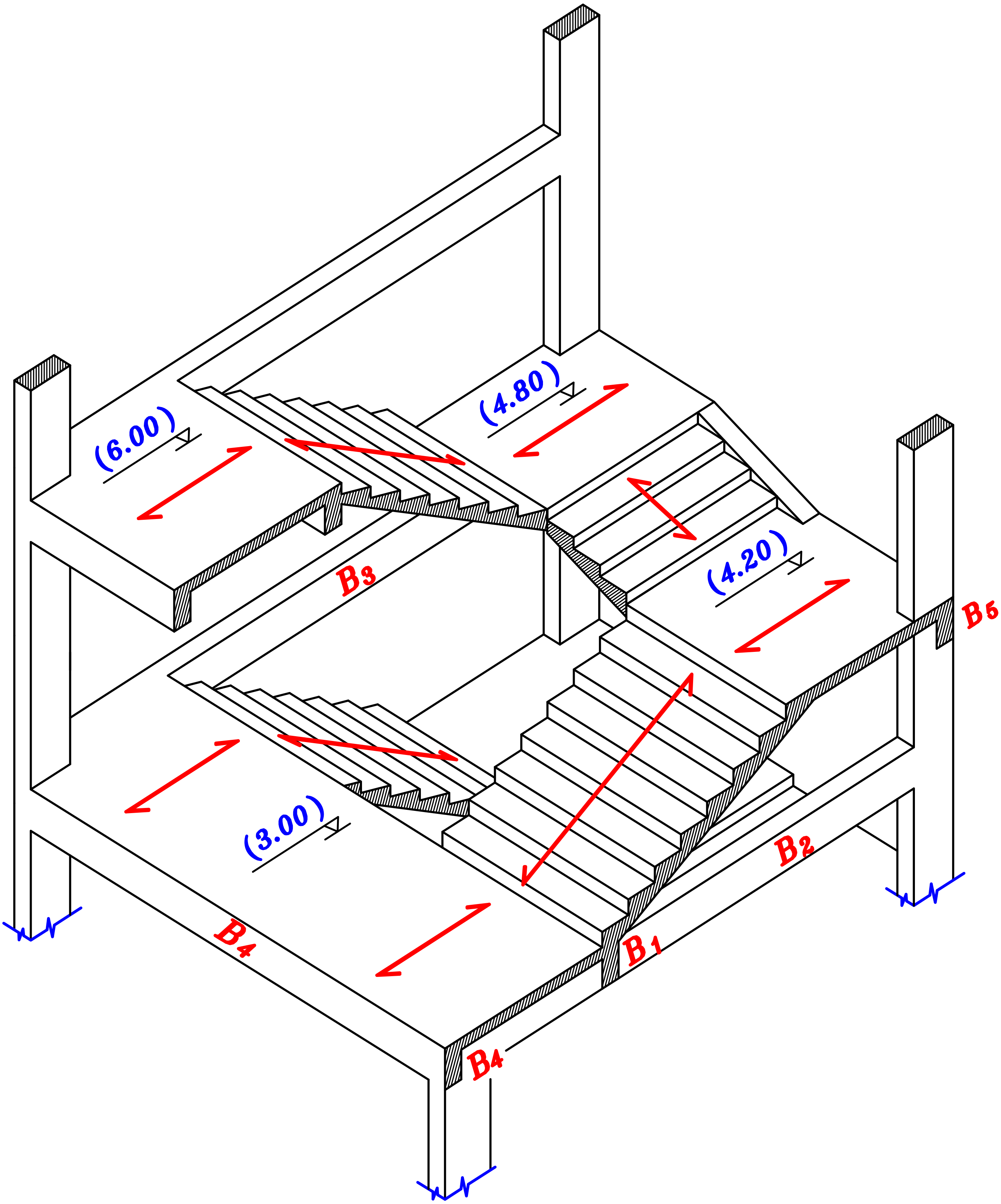


System ③

USING 2 POSTS INSTEAD OF THE BEAMS BETWEEN THE FLOORS.



System ④



System ⑤