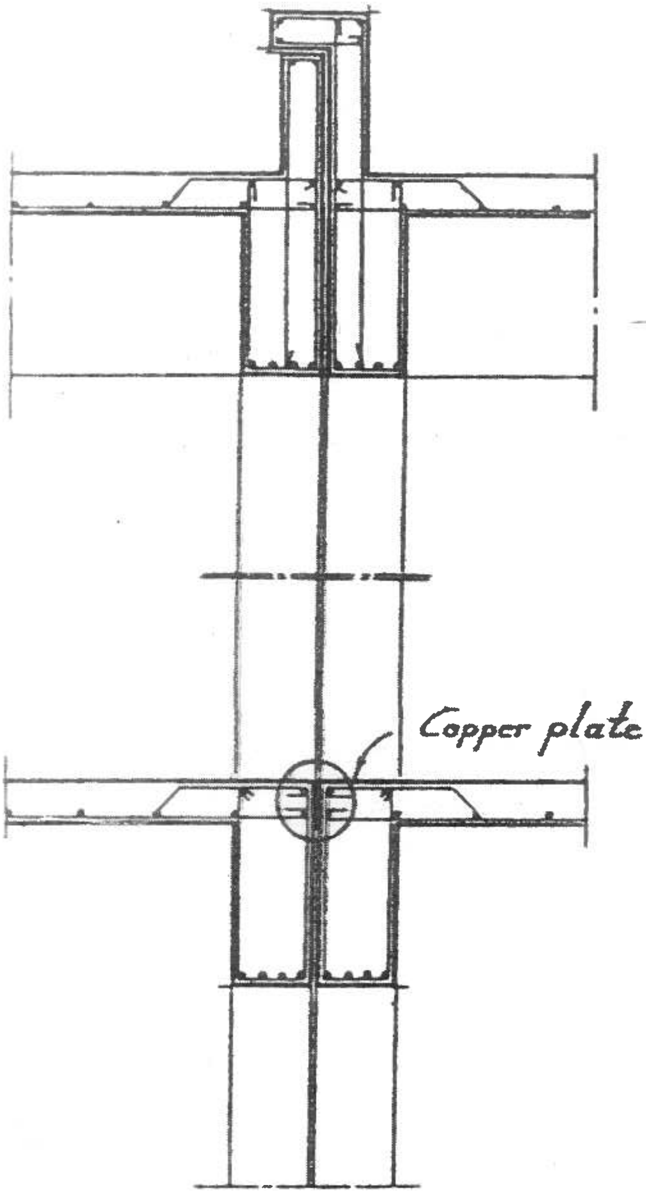
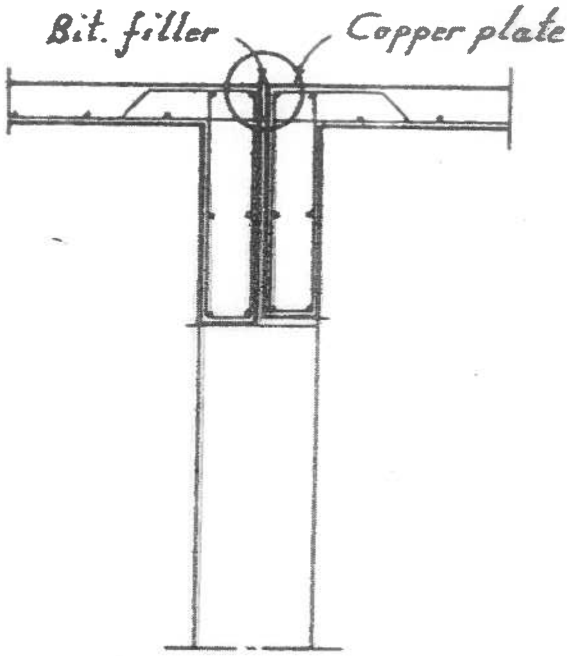
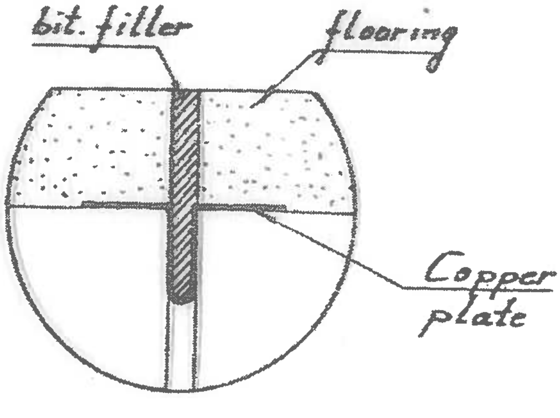
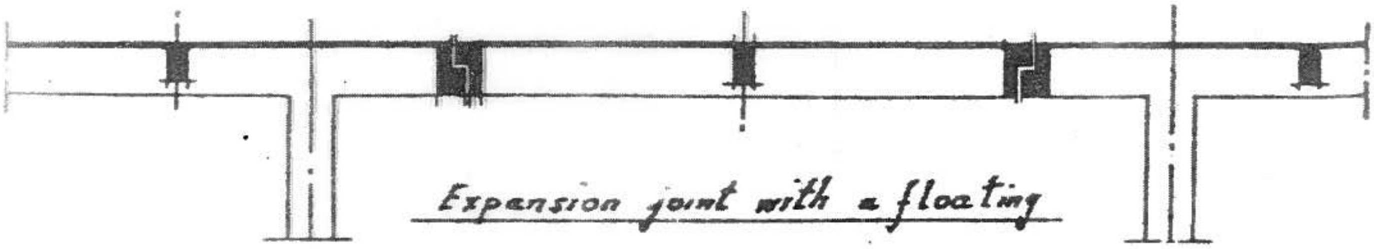


Expansion joint with double columns

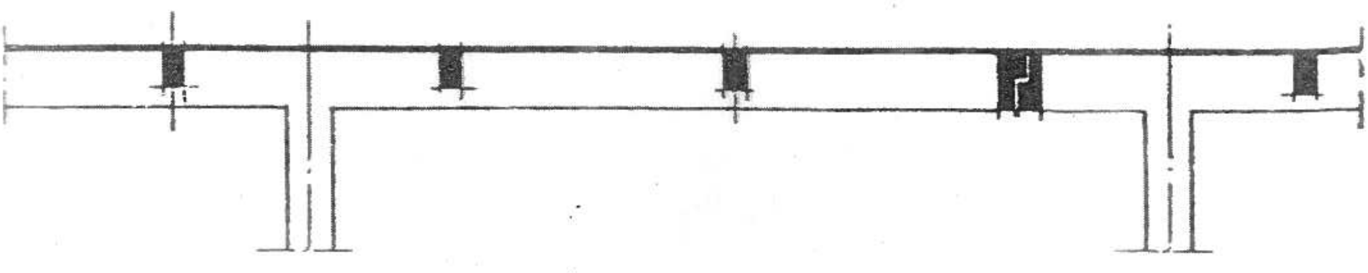


Expansion joint of a roof on one single column



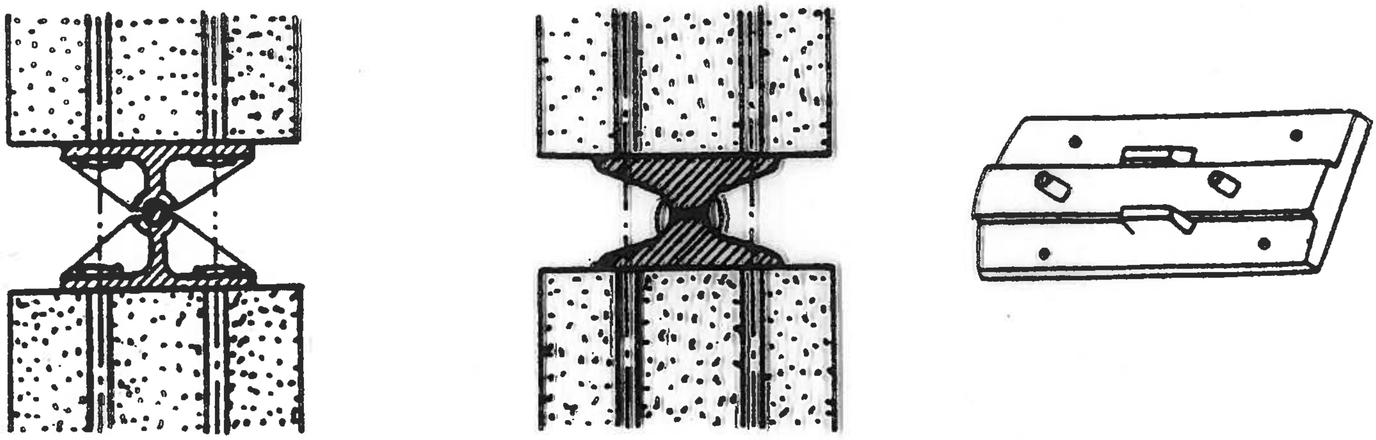


Expansion joint with a floating span



Steel Hinges

The steel hinges as shown in Fig. result in more perfect hinge action than the concrete hinges, but are considerably more expensive. Their use today, is restricted to bridges and unusually heavy concrete structure.



DETAILS OF A STEEL HINGE

Mesnager Hinges

In this type of hinge, the reaction R is transmitted through the crossing bars A_{s_1} and A_{s_2}. Their inclination with the free face of hinge lies between 30^o and 60^o. They are protected from rusting by 2.5 cm oxidized asphalt, bituminous cork or bituminous felt arranged as shown in the following figure.

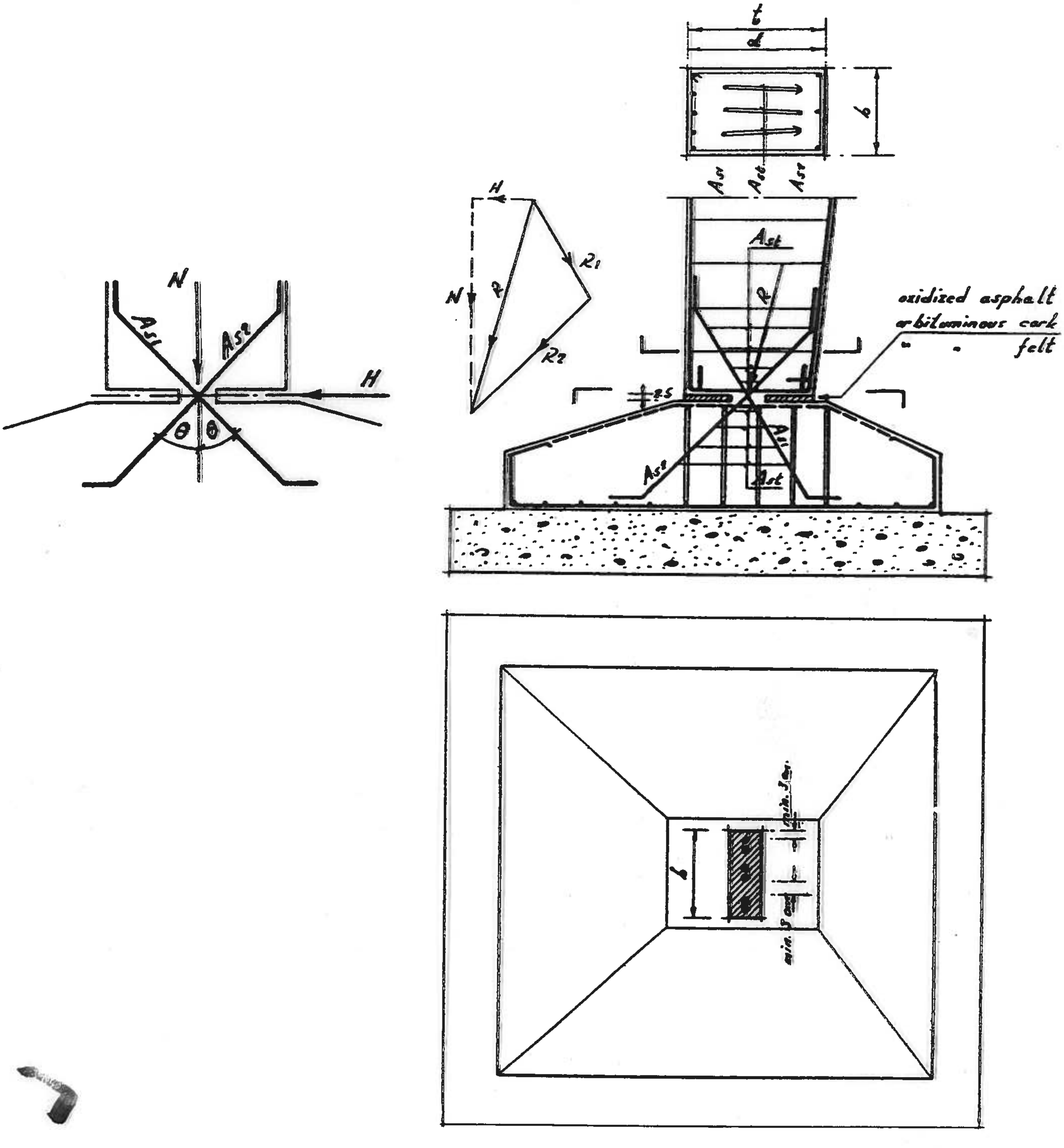
In this type of hinge, the reaction R is transmitted through the crossing bars A_{s_1} and A_{s_2}. Their inclination with the free face of hinge lies between 30^o and 60^o. They are protected from rusting by 2.5cm oxidized asphalt, bituminous cork or bituminous felt arranged as shown in the following Figure.

The crossing bars are in this manner subject to compressive stresses $\sigma_s^{'}$ which must not exceed $0.3\sigma_y$. This low stress is assumed because any rotation actually occurring at the hinge bends the bars and induces corresponding flexural stresses. Such rotations actually do take place during the lifetime of the structure and are caused primarily by changes in live load and temperature. These flexural stresses superpose on the computed compression and correspondingly increase the value of the actual maximum stresses in the bars. Rather than to attempt computing these additional stresses, it is generally satisfactory to keep the compression stress $\sigma_s^{'}$ sufficiently low so that the bars will not be overstressed by superposed bending.

The crossing bars, transmitting their force to the concrete by bond along the embedded length, exert a bursting force which must be resisted by additional ties. Only the part of the lateral reinforcement within a distance $a = 8\phi$ (ϕ being the diameter of crossing bars) from the face of the concrete is considered effective in resisting the bursting force. The tensile stress σ_{st} in the ties A_{st} can be computed according to the following Figure from the relalion

$$\sigma_{st} = \frac{(N/2)\tan\theta + H\,a/y_{ct}}{0.005\,a\,b + A_{st}} < \sigma_{s_{all.}}$$

A_{st} is the combined area of the lateral ties located within $a = 8\phi$ from the face of the hinge and $y_{ct} = 0.87\,d$



DETALIS OF A MESNAGER HINGE

Lead Hinges

The normal component N of the hinge is transmitted to the foundation by bearing through a 2.0cm thick lead plate arranged at the middle of the column foot. The horizontal component H is resisted by the shear resistance of the connecting bars A_s which are protected from rusting by 2.0cm thick bituminous cork, bituminous felt or oxidized asphalt.

The length of the lead plate *t'* must be smaller than or equal to one third of the depth of the column at the position of the hinge measured in the direction of the required rotation $\left(t' \le t/3\right)$.

$$N / bt' \; < \; \sigma_b \; = \sigma_{co} \sqrt[3]{A / A'} \le \sigma_{c28}/2$$

$$A_s = H / \tau_s \; < \; \tau_s \; = 0.8 \, \sigma_s = allow. \; shear \; stress \; of \; steel$$

$\Sigma M @ o$

$$\frac{N}{2}\left(\frac{t}{4} - \frac{t'}{4}\right) = F_{sp} \cdot \frac{t}{2}$$

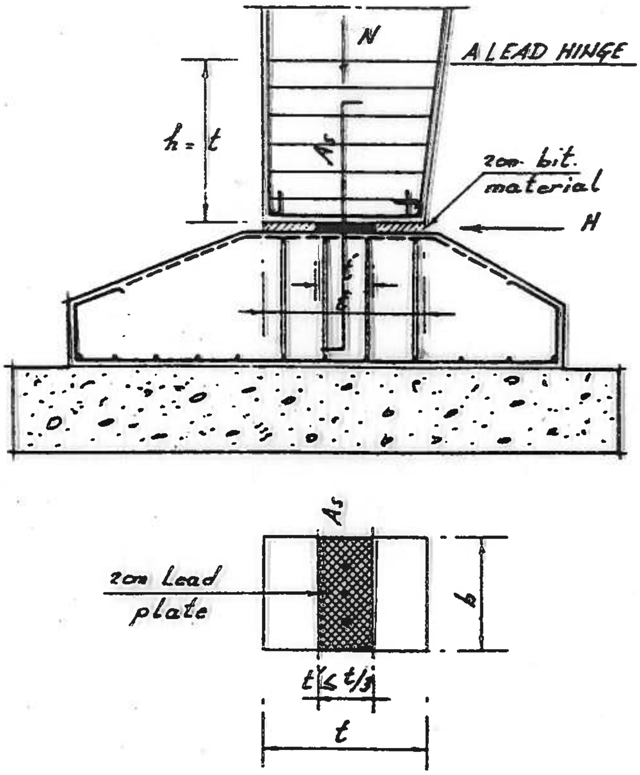
$$F_{sp} = N(t - t')/4t \simeq \frac{N}{4}$$

F_{sp} is tension and called the transverse splitting tensile force

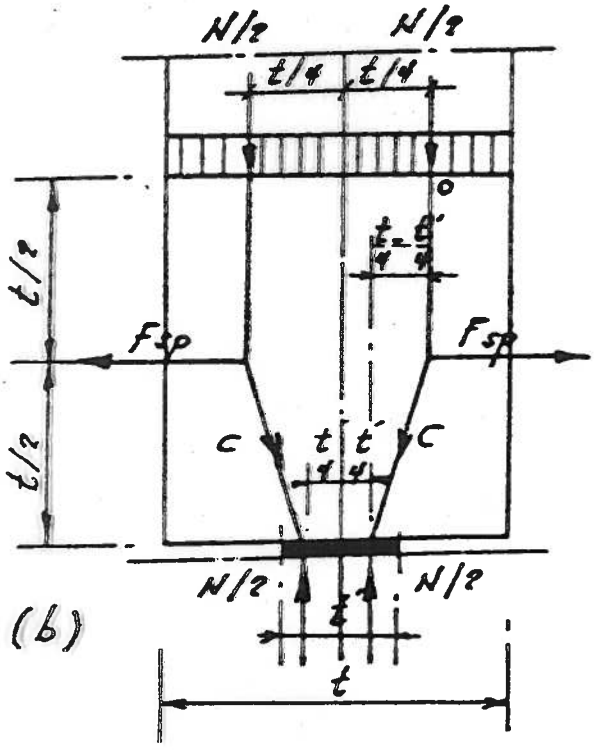
Then

$$A_{st} = \frac{F_{sp}}{\sigma_s}$$

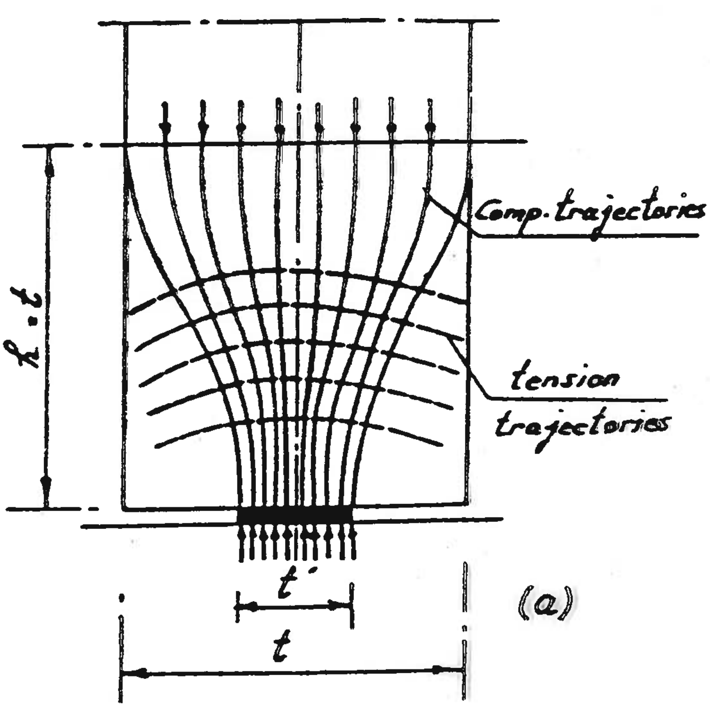
A_{st} = Horizontal stirrups arranged at the foot of the column in a height $h = t$



DETALIS OF A LEAD HINGE



(b)



(a)

Considere Hinges

The normal component N of the reaction is transmitted to the foundation by short spirally reinforced concrete column at the middle the foot of the main column. The horizontal component H is resisted by the crossing bars A_{s_1} and A_{s_2} which are protected from rusting by 2.5cm thick bituminous cork, bituminous felt or oxidized asphalt.

The length of the lead plate ***t'*** must be smaller than or equal to one third of the depth of the column at the position of the hinge measured in the direction of the required rotation $\left(t' \leq t/3\right)$.

$$N = \sigma_b\ A_k + \sigma_s'\ A_s + \sigma_s\ A_s' \leq 2\left(\sigma_b\ A_c + \sigma_s'\ A_s\right)$$

In which

A_k = *the area of the core inside the spirals (hatched area)*

$A_c = b\ t'$

A_s = *area of the cross-section of the long. Rft inside the spirals*

A_s' = *imaginary long. Rft having the same volume of the spirals with cross-sectional area* A_{sp}, *pitch* $e(\leq 8\,cm)$ *and diameter D*

$A_s' = A_{sp}\ \pi\ D/e$

$\sigma_b = \sigma_{co}\ \sqrt[3]{A/A'} \leq \sigma_{c28}/2$ *the bearing stress of partially loaded areas*

σ_{co} = *allawable compressive stress of the concrete used*

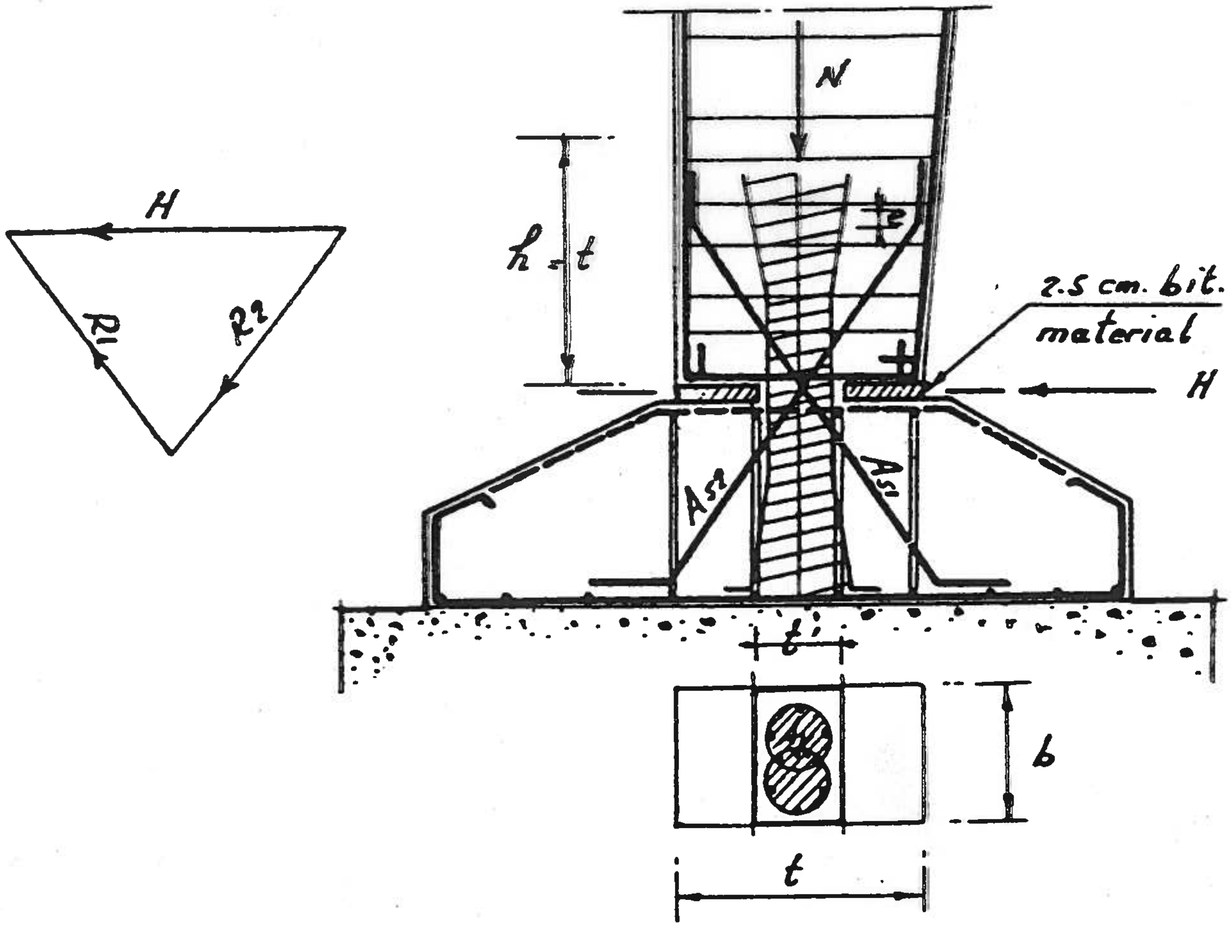
$A = b\ t$ = *area of foot of column*

$A' = A_k$ *or* A_c = *effective loaded area*

σ_s' = *allawable compressive stress of long. Rft.*

σ_s = *allawable tensil stress of spirals*

$n = 15$ = *modular ratio*



DETALIS OF A CONSIDERE HINGE