2° modello

$$\sigma_c = \frac{N}{A_{ci}} \le \overline{\sigma}_c \qquad \sigma_s = n\,\sigma_c$$

0.7

$$A_{ci} = A_c + n\,A_{s,TOT}$$

3° modello

SLU

$$N_{Rd} = A_c f_{cd} + A_{s,TOT} f_{yd} \ge N_{Ed}$$

1,2

modifiche in rosa per consentire alla sezione di portare anche un po' di M pannetto (T.A.)

$$\frac{N}{A_c + n A_{s,tot}} \leq 0.7\,\bar{\sigma}_c$$

$$\frac{A_{s,tot}}{A_c} = \rho$$

percentuale GEOMETRICA di armatura

$$\frac{N}{A_c(1+n\rho)} \leq 0.7\,\bar{\sigma}_c$$

$\rho \geq 0.3\%$ dell'area effettiva

$$A_c \geq \frac{N}{\underbrace{(1+n\rho)}\,0.7\,\bar{\sigma}_c}$$

$1 + 15 \times 0{,}008 = 1{,}12$

$\rho \geq 0{,}8\,\%$

riferito all'area necessaria di cls

C 25/30 $\qquad$ $R_{ck} = 30$ MPa

$N = 1540$ KN

$$A_c \geq \frac{1540 \times 10^3}{1.12 \times 0.7 \times 9.75} \times 10^{-2} = 2015 \text{ cm}^2$$

30x70

$$A_s \geq 0{,}008 \times 2015 = 16.1 \text{ cm}^2$$

OGGI

mio consiglio

$$N_{Rd} = A_c f_{cd} + A_{s,TOT} f_{yd} \geq 1.2 N_{Ed}$$

normativa

$\geq 0.1 N_{Ed}$

consiglio AG

$\geq N_{Ed}$

$\geq 0.2 N_{Ed}$

$$A_{s,tot}\, f_{yd} = \frac{1}{5} A_c\, f_{cd}$$

$$\frac{A_{s,tot}}{A_c} = \frac{f_{cd}}{5\, f_{yd}} = \frac{14.2}{5 \times 391.3} = 0.0073$$

progett. $\quad N_{Ed} = 2072$ KN

$$A_c \geq \frac{N_{Ed}}{f_{cd}} = \frac{2072 \times 10^3}{14.2} \times 10^{-2} = 1459 \text{ cm}^2 \quad 30 \times 50$$

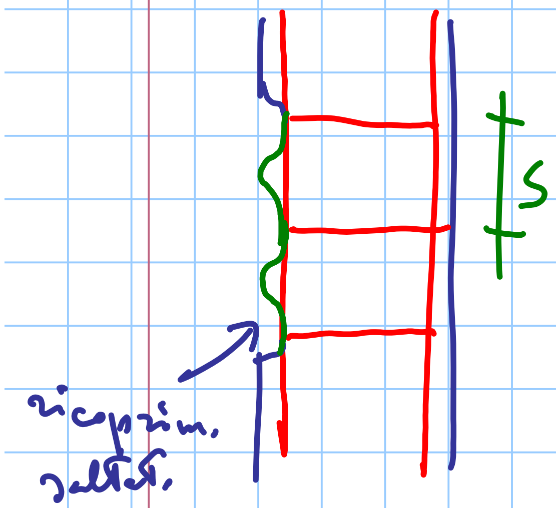
$$A_s \geq 0.2\, \frac{N_{Ed}}{f_{yd}} = 0.2 \times \frac{2072 \times 10^3}{391.3} \times 10^{-2} = 10.6 \text{ cm}^2$$

noto A_s — barre longitudinali

che diametri ? $\geq \phi 12$ rischio di instabilità

$l_0 = s/2$

quante barre ? numero pari ; 1 ogni ~ 25 cm

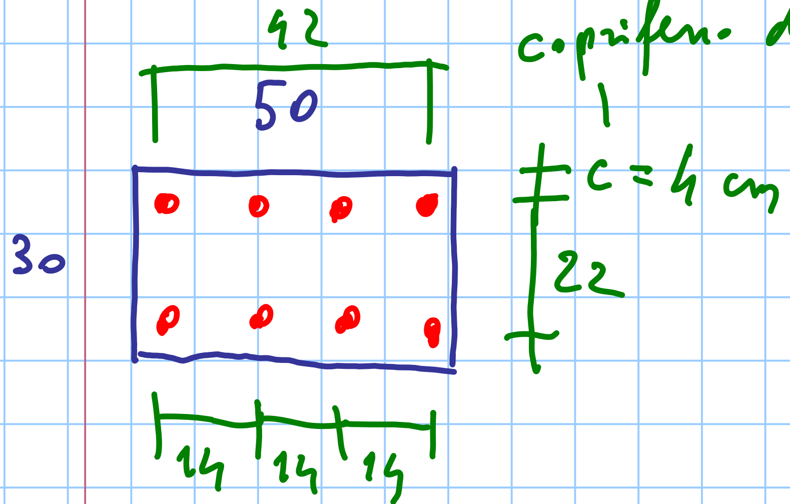


staffe ogni quanto ? $s \leq 12\, \phi_{min}$

se $\phi = 14$ mm

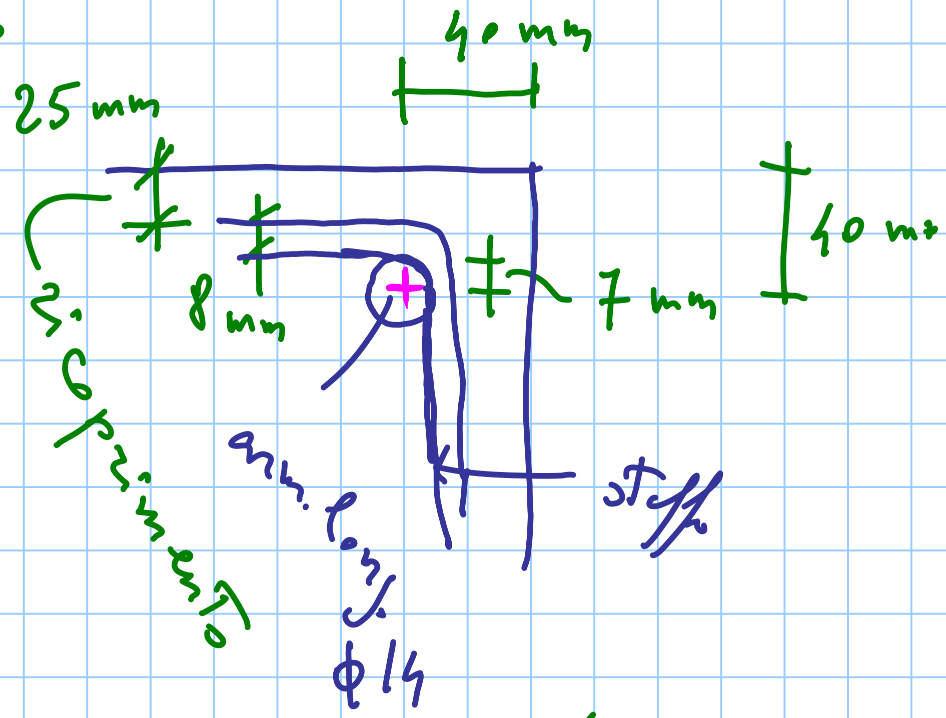
$s \leq 12 \times 14 = 168$ mm

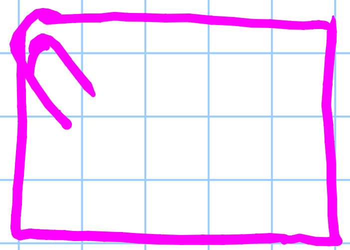
$\Downarrow$ $\phi 8/15$ → $\phi 8/10$ estremi

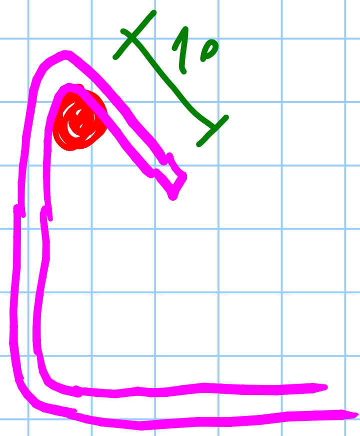


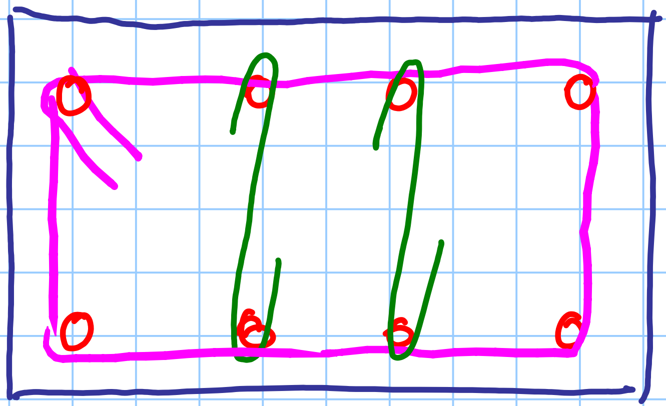
$A_s \geq 10.6\ cm^2$

$6.9\ \phi 14 \rightarrow 8\ \phi 14$



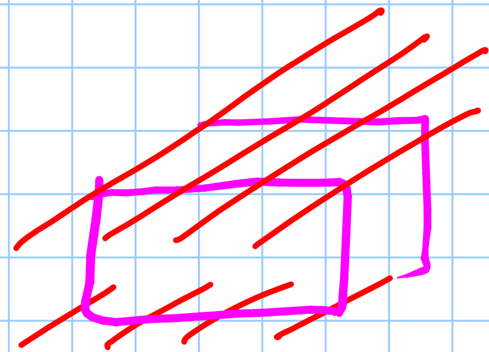


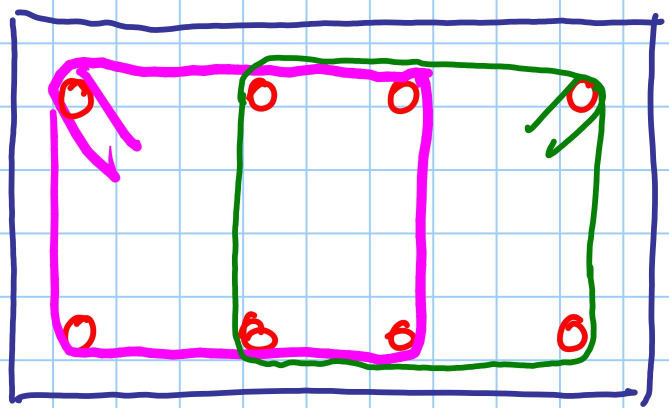




TIRANTINI

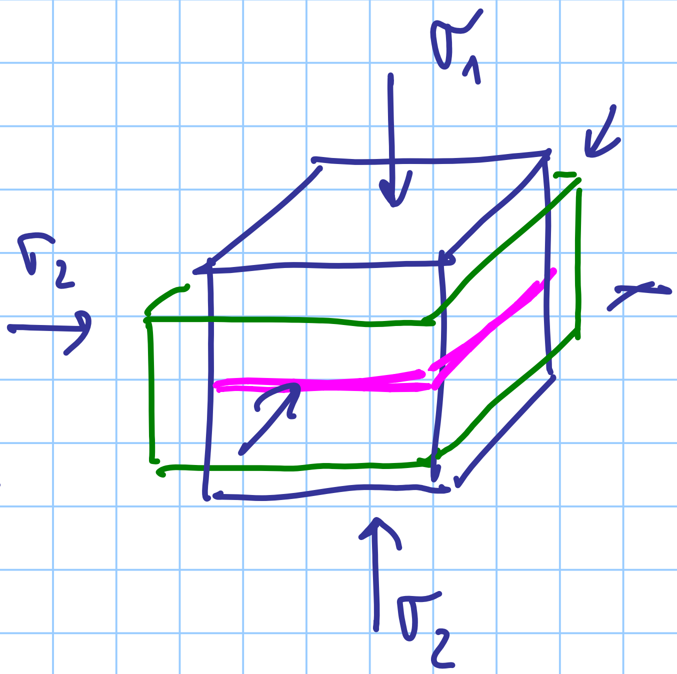
SPILLI





doppia staffa

nasce $\sigma_{trasv.} = \sigma_2$

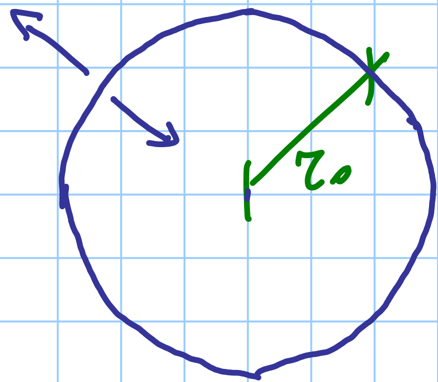


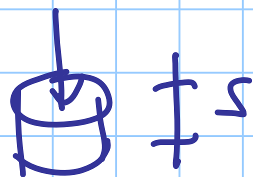
si accorcia
e si dilata

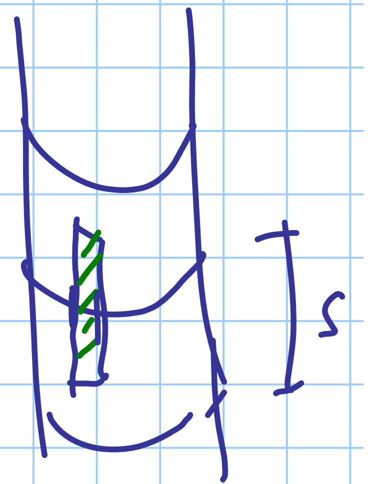
CALCESTRUZZO CONFINATO

$r_0 = r - c$

mittl. design

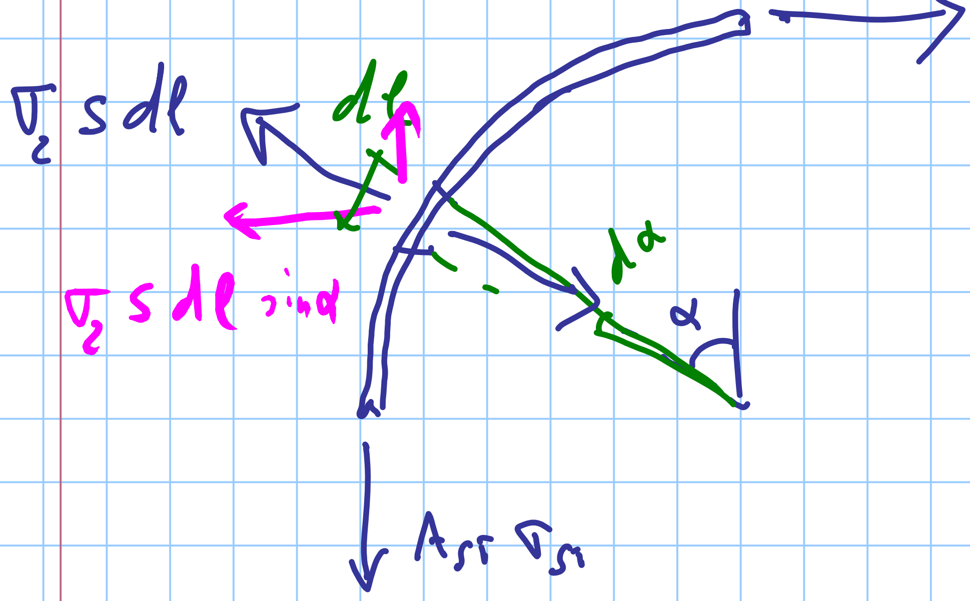






$\sigma_2 = \sigma_{c,T_{zus}}$

$dA = s\,dl$



$A_{st}\ \sigma_{st}$

$$\int_0^{\pi/2} \sigma_2\, s\, dl \sin\alpha = A_{st}\,\sigma_{st}$$

$dl = r_0\, d\alpha$

$$\int_0^{\pi/2} \sigma_2 \, s \, r_0 \sin\alpha \, d\alpha = A_{st} \, \sigma_{st}$$

$$\sigma_2 \, s \, r_0 \underbrace{\int_0^{\pi/2} \sin\alpha \, d\alpha}_{1} = A_{st} \, \sigma_{st}$$

$$\sigma_2 = \frac{A_{st} \, \sigma_{st}}{s \, r_0} \qquad x \;\; \sigma_{st} = f_{yd} \qquad \sigma_2 = \frac{A_{st}}{s \, r_0} f_{yd}$$

$$\sigma_2 = \frac{A_{st}}{s\, r_0} \frac{f_{yd}}{f_{cd}} f_{cd} \frac{2\pi r_0}{2\pi r_0} = 0.5\, \omega_{st}\, f_{cd}$$

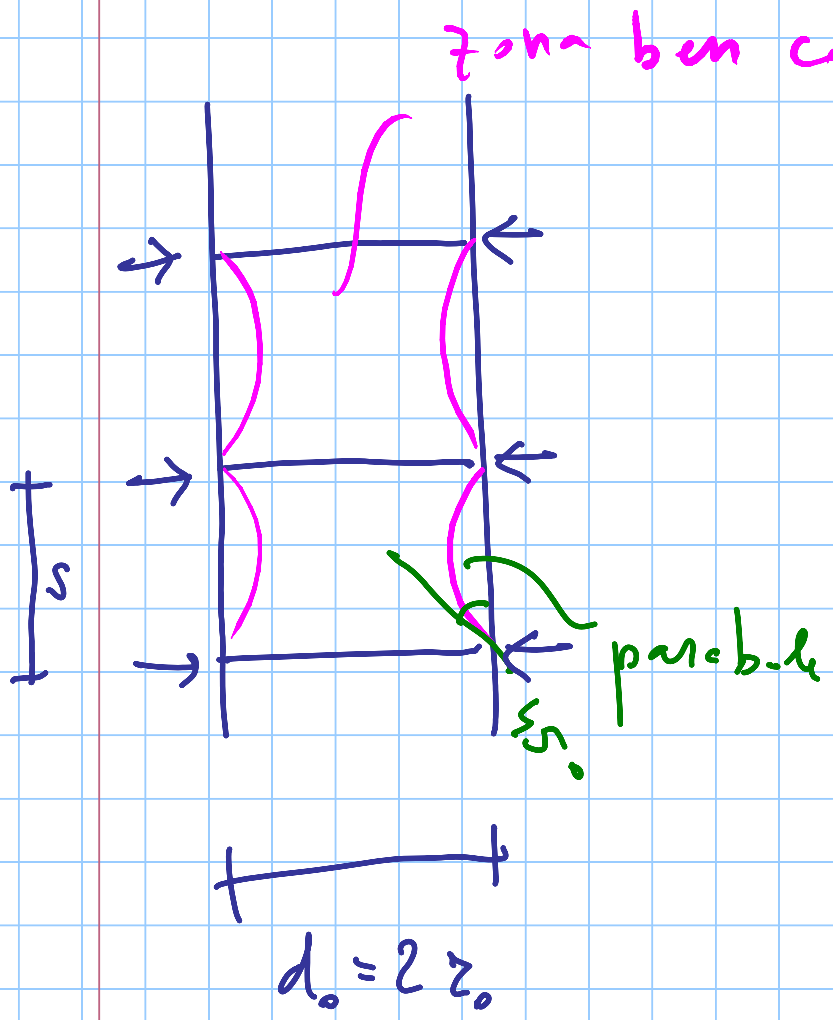
volume staffa

area cls

volume

$$\omega_{st} = \frac{A_{st} \cdot 2\pi r_0}{s\, \pi\, r_0^2} \frac{f_{yd}}{f_{cd}}$$

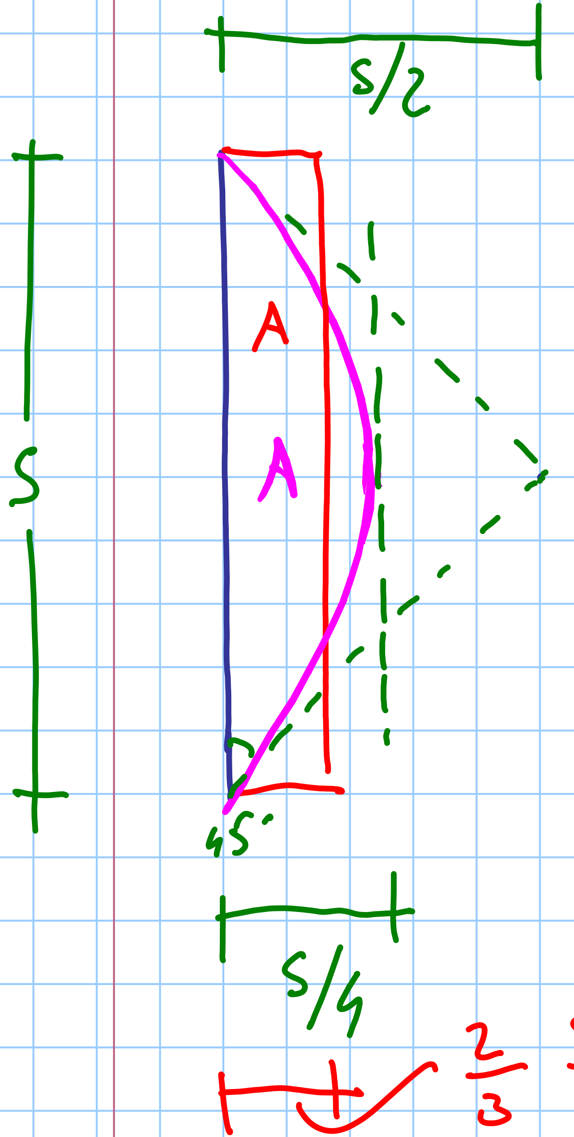
rapporto MECCANICO



efficacia del confinamento

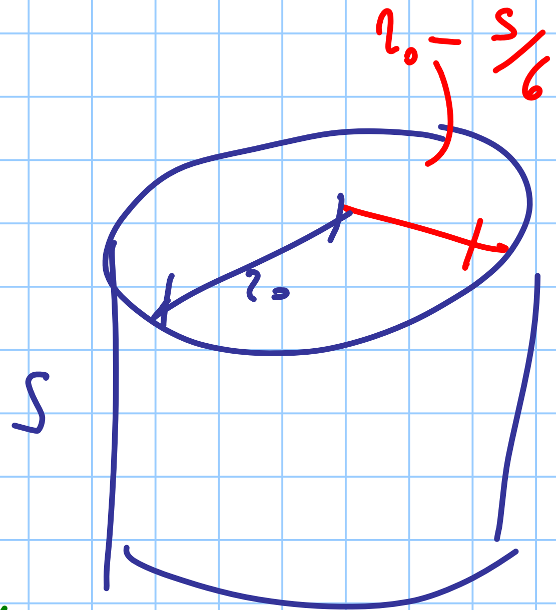
$$\alpha \leq 1$$

rapporto : $\dfrac{\text{Volume ben confinato}}{\text{Volume totale}}$



$$\frac{2}{3}\ \frac{s}{4}$$

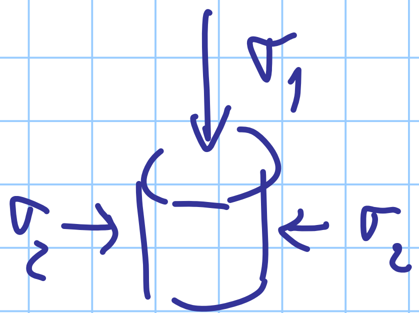
$$A = \frac{2}{3}\ s \cdot \frac{s}{4}$$



$$\alpha = \frac{\cancel{\pi}\left(r_0 - \frac{s}{6}\right)^2 \cancel{S}}{\cancel{\pi}\ r_0^{\,2}\ \cancel{S}} = \left(1 - \frac{s}{6\,r_0}\right)^2$$

$$\alpha = \left(1 - \frac{s}{3\,d_0}\right)^2$$

$$\sigma_2 = 0.5\,\alpha\,\omega_{st}\,f_{cd}$$



non succede niente

se $\sigma_1 \le t\,\sigma_2$

$t \simeq 4$

$$\sigma_1 = t\,0.5\,\alpha\,\omega_{st}\,f_{cd}$$

meglio: $\sigma_1 = t\,\dfrac{A_{st}}{s\,r_0}\,f_{yd}$

$$t \, \frac{A_{st}}{s \; r_0} \, f_{yd}$$

$$A_{st} \; 2\pi r_0 =$$

$$= A_{\ell,eq} \; s$$

$$A_{\ell,eq} = \frac{A_{st} \; 2\pi r_0}{s} \; \frac{r_0}{r_0}$$

$$\frac{A_{st}}{s \; r_0} = \frac{A_{\ell,eq}}{2\pi r_0^2} = \frac{A_{\ell,eq}}{2 A_c}$$

$$\sigma_1 = t \, \frac{A_{\ell,eq}}{2 A_c} \, f_{yd} \qquad N' = \sigma_1 A_c = \frac{t}{2} A_{\ell,eq} \, f_{yd}$$