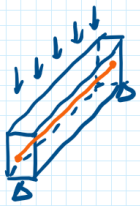
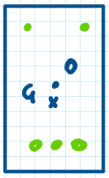
Sforzo normale centrato

lunedì 25 marzo 2024 12:04

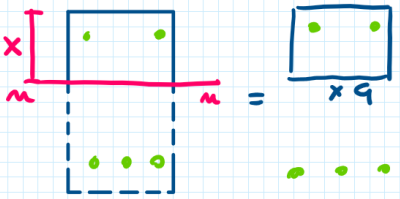
NOTA SUL MODELLO NUMERICO



IN REALTÀ → 

se le armature sono dissimetriche

$G = 0$



sez reag. omog.

$G \neq 0$

→ Ipotizzo G → X ⇒ Risolvo lo schema ⇒

⇒ caratt. della sollecitaz ⇒ asse neutro ⇒ G'

x'

Itero il procedimento

finché G finale = G iniziale

↓

NON È FATTIBILE

↓

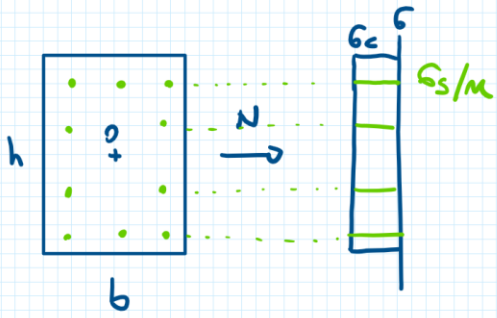
Baricentro "O" = centro geometrico

SFORZO NORMALE

N < TRAZIONE N^+
N < COMPRESSIONE N^-

N^+ TRAZIONE

I STADIO = Verifica a fessurazione



$$\sigma_{ct} \leq f_{ctk}$$

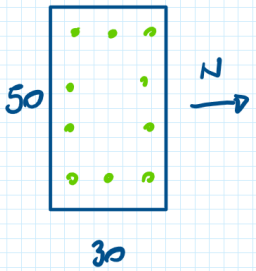
$$\sigma_{ct} = \frac{N}{A_{ci}}$$

$$A_{ci} = A_c + n A_{STOT}$$

$$n = \frac{E_s}{E_c}$$

$$\sigma_s = n \sigma_c$$

ESEMPIO



C 25/30 B 450 C

10 ϕ 14

N = 200 kN

I STADIO

$$\sigma_{ct} \leq f_{ctk}$$

$$f_{ctk} = 0.7 f_{ctm} = 0.7 \left(0.3 \sqrt[3]{f_{ck}^2}\right) = 1.79 \text{ MPa}$$

$$\sigma_{ct} = \frac{N}{A_{ci}}$$

$$A_{ci} = 30 \times 50 + 6.35 \left(10 \times 1.54\right) = 1597.8 \text{ cm}^2$$

$$\sigma_{ct} = \frac{200}{1597.8 \times 10^2} \times 10^3 = 1.25 \text{ MPa}$$

SEZ si è FESSURATA ? NO ! $1.25 < 1.79$

$\sigma_{ct} < f_{ctk}$

OSSERVA :

N_F DI FESSURAZIONE ?

$$\sigma_{ct} = \frac{N_F}{A_{ci}} \Rightarrow N_F = A_{ci} \times f_{ctk} =$$

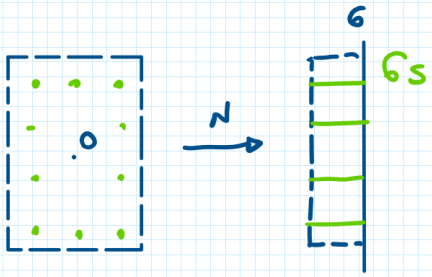
$$= 1597.8 \times 1.79 \cdot 1/10 = 286.0 \text{ kN}$$

$$\text{cm}^2 \times \frac{\text{N}}{\text{mm}^2} \times \frac{10^2}{10^3}$$

II STADIO

Verifiche sulle tensioni di esercizio

$N > N_F$

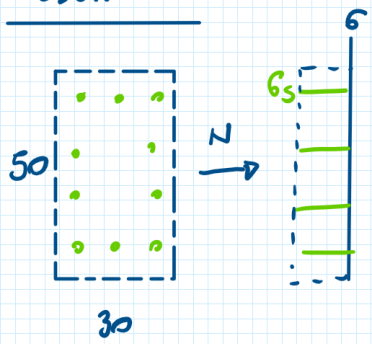


SEZ. REAG DI SOLE ARMATURE

$$\sigma_s \leq 0.8 f_{yk}$$

$$\sigma_s = \frac{N}{A_{STOT}}$$

ESEMPIO



$N = 400$ kN COMB. CARICO RARA

II STADIO

$$\sigma_s = \frac{N}{A_{STOT}} = \frac{400}{15.4} \times 10 = 259.7 \text{ MPa}$$

$A_{STOT} = 10 \times 1.54 = 15.4 \text{ cm}^2$ $\Rightarrow \sigma_s < 0.8 f_{yk}$ OK!

$0.8 f_{yk} = 0.8 \cdot 450 = 360 \text{ MPa}$

OSSERVA:

- $N = 235 \text{ kN} < N_F = 286 \text{ kN} \Rightarrow$ I STADIO

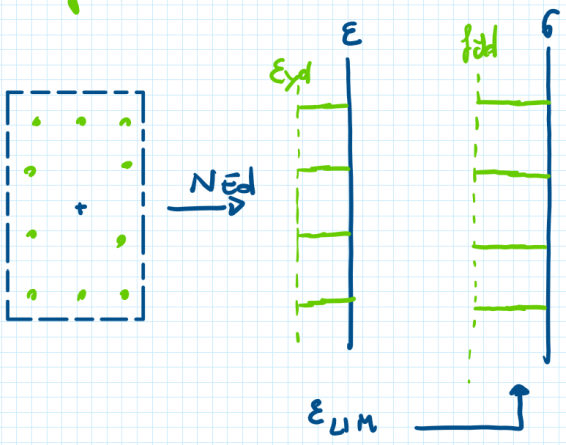
$$\sigma_s = n \sigma_c = n \frac{N}{A_{ci}} = 6.35 \times \left(\frac{235}{1597.8} \times 10 \right) = 11.33 \text{ MPa}$$

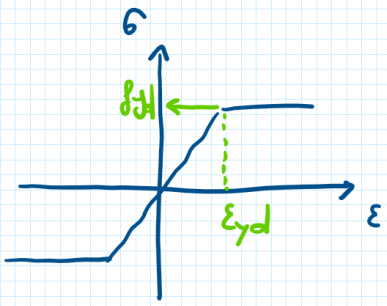
- $N = 287 \text{ kN} > N_F = 286 \text{ kN} \Rightarrow$ II STADIO

$$\sigma_s = \frac{N}{A_{STOT}} = \frac{287}{15.4} \times 10 = 186.4 \text{ MPa}$$

III STADIO

Verifiche SLU

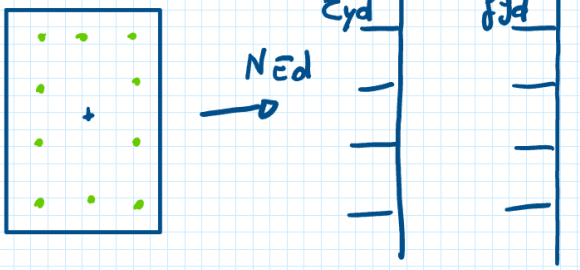




$N_{Rd} \geq N_{Ed}$

$$N_{Rd} = \int \sigma_s \, dA_s = f_{yd} A_{STOT} \qquad \left(f_{yd} = \frac{f_{yk}}{\gamma_s} \right)$$

ESEMPIO



$N_{Ed} = 560$ kN

III STADIO

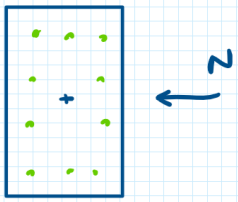
$N_{Rd} \geq N_{Ed}$

$$N_{Rd} = A_s f_{yd} = 10 \times 1.54 \times \frac{391.3}{10} = 602.6 \text{ kN}$$

Verifica ? $602.6 \geq 560$ kN sì !

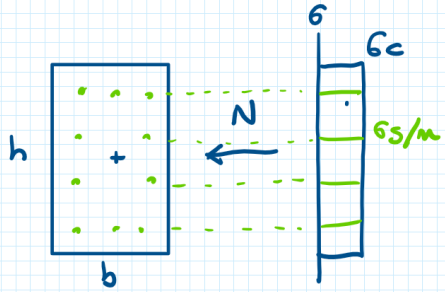
N COMPRESSIONE

I STADIO



Verif. a fessurazione non severe

II STADIO



Verifiche sulle tensioni in esercizio

$\sigma_c \leq 0.6 f_{ck}$	(COMB. RARA)
$\sigma_c \leq 0.46 f_{ck}$	(COMB. QUASI PERM)
$\sigma_s \leq 0.8 f_{yk}$	(COMB. RARA)

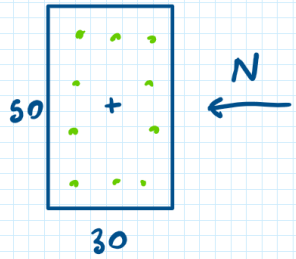
$$\sigma_c = \frac{N}{A_{ci}} \quad ; \quad \sigma_s = n \sigma_c$$

A_{ci} = sez. reag. omog. = A_c + $m A_s$

$A_c = bh$

per carichi di lunga durata $m = 15$

ESEMPIO



$N = -1000$ kN (COMB. RARA)

II STADIO di COMPORTAMENTO

$$\sigma_c \leq 0.6 f_{ck}$$

$$\sigma_c = \frac{N}{A_{ci}} = \frac{-1000}{1731} \times 10 = -5.8 \text{ MPa}$$

$$A_{ci} = 30 \times 50 + 15 (10 \times 1.54) = 1731 \text{ cm}^2$$

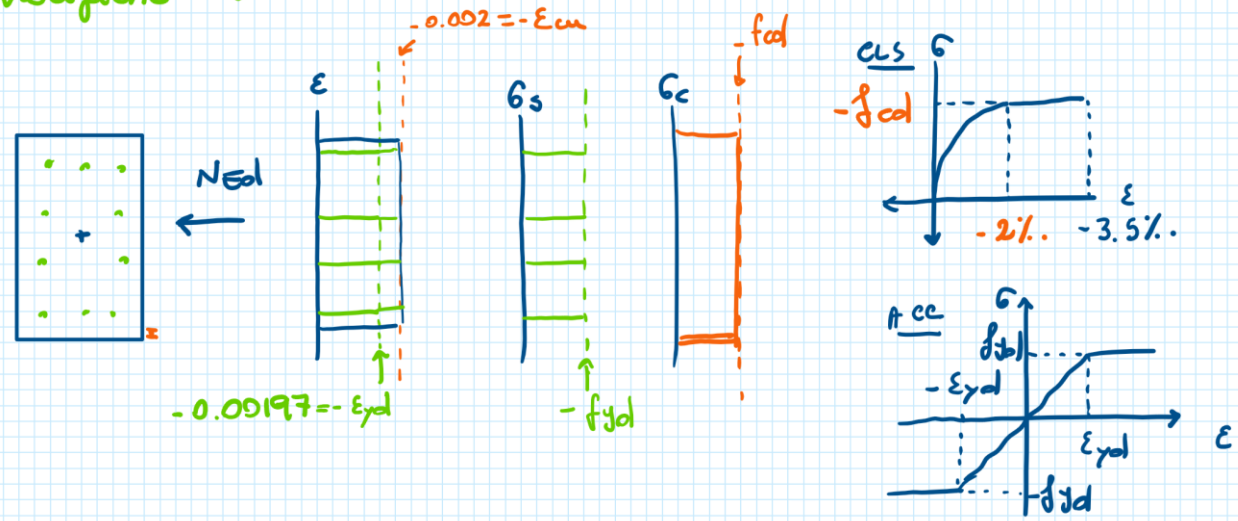
$$0.6 f_{ck} = 0.6 \times 25 = 15.0 \text{ MPa}$$

$|\sigma_c| \leq 0.6 f_{ck} \Rightarrow$ OK!

$$N_{max} = A_{ci} \cdot 0.6 f_{ck} = 1731 \times \frac{15}{10} = 2596.5 \text{ kN}$$

III STADIO

Verifiche SLU



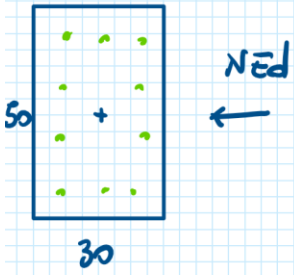
$$N_{Rd} = \int \sigma \, dA = \int \sigma_c \, dA_c + \int \sigma_s \, dA_s =$$

$$= -f_{cd} A_c + \sum \sigma_s A_s =$$

$$= -f_{cd} A_c - f_{yd} A_{STOT}$$

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

ESEMPIO



$N_{Ed} = -1400$ kN

SLU

$N_{Rd} \geq N_{Ed}$

$$N_{Rd} = \underbrace{30 \times 50 \times \frac{14.17}{10}}_{2125.5} + \underbrace{10 \times 1.54 \times \frac{391.3}{10}}_{602.6} = 2728.1 \text{ kN}$$

$2728.1 \geq |N_{Ed}| = 1400\ kN$ **OK!**

SLU è più gravoso di SLE?

SLE

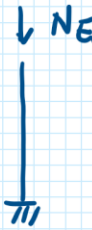
$N = -2596\ kN$

II STADIO

CAR. COMB. RARA g_k q_k

$N \leq N_{MAX\ II} = -2596\ kN$

SLU



$N_{Ed} = -2596 \times 1.4$ → $g_d = g_k \times 1.3$, $q_d = q_k \times 1.5$ } $(g_k + q_k) \times 1.4$

$N_{Ed} = -3634.4\ kN$

$N_{Rd} = 2728.1\ kN \leq |3634.4|$ SLU non è soddisfatto