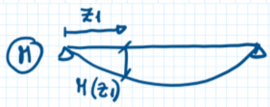
Taglio: SLU, progetto

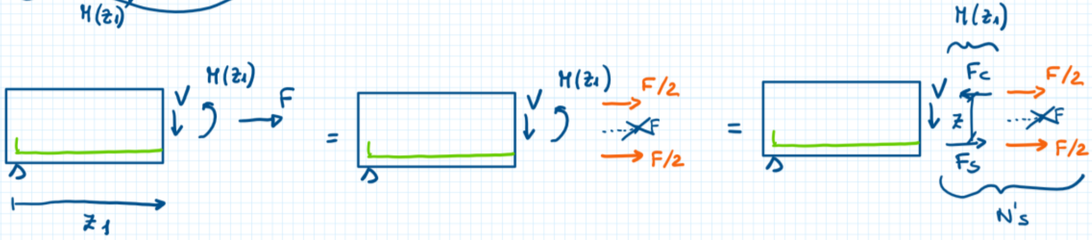
martedì 27 maggio 2025 14:02

## ARMATURA DI PARETE

$$\boxed{F = V(\cot\vartheta - \cot\alpha)}$$

IN ALTERNATIVA ALL' ARM. DI PARETE $\Rightarrow$ TRASLAZIONE DEL DIAGR. DI M



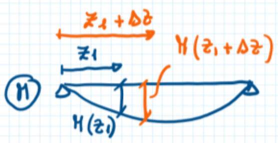




ARM. TESA DEVE PORTARE UNA TRAZIONE $N'_s = F_s + \frac{F}{2}$

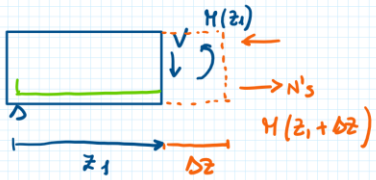
$$N'_s = \frac{M(z_1)}{z} + \frac{V(\cot\vartheta - \cot\alpha)}{2}$$

$$N'_s = \frac{M(z_1)}{z} + \frac{\Delta M}{z}$$

$$\begin{cases} \dfrac{\Delta M}{z} = \dfrac{V}{2}(\cot\vartheta - \cot\alpha) \\[2ex] \dfrac{\Delta M}{z} = \dfrac{V\,\Delta z}{z} \end{cases}$$




$$\frac{\cancel{V}\,\Delta z}{z} = \frac{\cancel{V}}{2}(\cot\vartheta - \cot\alpha)$$

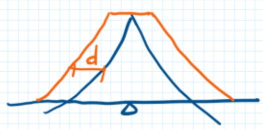



$$\boxed{\Delta z = \frac{z}{2}(\cot\vartheta - \cot\alpha)}$$

PER STAFFE $\Delta z = \frac{z}{2}\cot\vartheta$

PROGETTO IN GENERE CON $\cot\vartheta = 2$

$\hookrightarrow \Delta z = z = 0.9\,d$



# PROGETTO DI ELEMENTI ARMATI A TAGLIO

PER PORTARE V $\Rightarrow$ SEZ CLS + STAFFE + FERRI DI PARETE

OPPURE

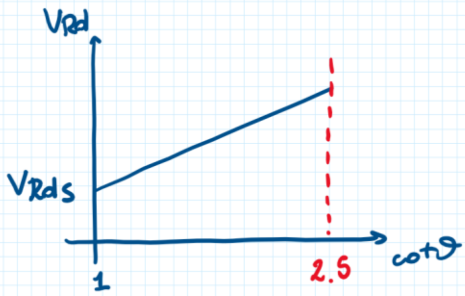
TRASLAZ. DEL DIAGR. DEL MOMENTO

PER PROG. IL NOSTRO ELEMENTO:

$\Rightarrow$ SEZ. IN CLS DA PROG. A FLESSIONE DEVE ESSERE VERIFICATA A V

$$\Rightarrow \begin{cases} V_{Rd_s} = 0.9\, d\, \dfrac{A_{sw}}{s}\, f_{yd} \cot\vartheta \\ V_{Rd_s} = V_{Ed} \end{cases} \Rightarrow \boxed{\dfrac{A_{sw}}{s} = \dfrac{V_{Ed}}{0.9\, d\, f_{yd} \cot\vartheta}}$$

CONSIGLIO $\cot\vartheta = 2.0$



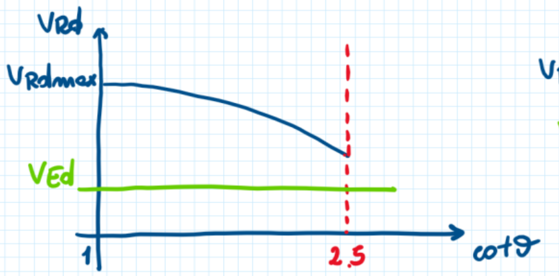

$$\Rightarrow A_{par} = \frac{V}{2}\,\frac{\cot\vartheta}{f_{yd}} \qquad \text{OPPURE} \qquad \Delta z = \frac{z}{2}\cot\vartheta$$

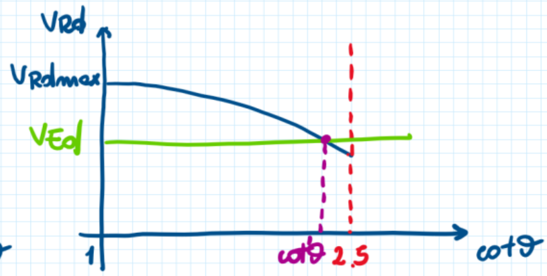
$\boxed{\text{PROCEDIMENTO DI PROGETTO:}}$

VERIFICARE LA SEZ. IN CLS : $V_{Rd\,max} \geq V_{Ed}$

$$V_{Rd_{max}} = 0.9\, d\, b\, f'_{cd}\, \alpha_c \frac{\cot\vartheta}{1+\cot^2\vartheta} \Rightarrow \text{con } \cot\vartheta = 2.5$$

1) $V_{Rd\,max}(\cot\vartheta = 2.5) \geq V_{Ed}$ $\qquad$ $V_{Rd\,max}(\cot\vartheta = 2.5) < V_{Ed}$




$\Downarrow$ $\qquad\qquad\qquad$ $\Downarrow$

$\forall \cot\vartheta$

DEVO TROVARE $\cot\vartheta$ : $V_{Rd\,max} = V_{Ed}$

$$0.9\, d\, b\, f'_{cd}\, \alpha_c \frac{\cot'\vartheta}{1+\cot'\vartheta^2} = V_{Ed}$$

$$\frac{0.9\, d\, b\, f'_{cd}\, \alpha_c \cot'\vartheta}{V_{Ed}} = 1 + \cot'\vartheta^2$$

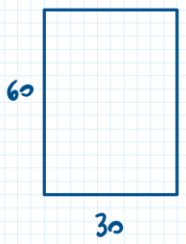
$$\cot'\vartheta^2 - \frac{0.9\, d\, b\, f'_{cd}\, \alpha_c}{V_{Ed}} \cot'\vartheta + 1 = 0$$

$\hookrightarrow \cot'\vartheta$

$\Downarrow$

PROG. LE ARMATURE CON $\cot'\vartheta$

$\boxed{\text{ESEMPIO}}$




$V_{Ed} = 300\ kN$

$c = 5\ cm$

$d = 60 - 5 = 55\ cm$

1) $V_{Rdmax}$ ( $\cot\vartheta = 2.5$ )

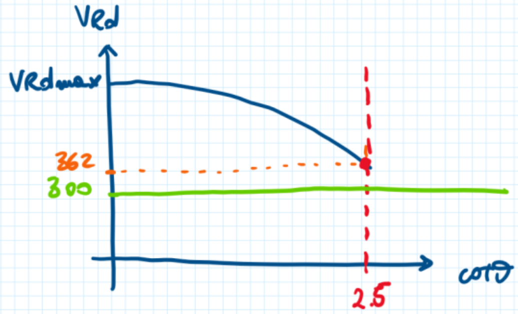
$$0.9 \times 55 \times 30 \times 0.5 \times 14.17 \times \underset{10}{1.0} \times \frac{2.5}{1+2.5^2} = 362.8 \text{ KN}$$

362.8 > 300

⇓

∀ $\cot\vartheta$

VA BENE




2) PROG. LE ARMATURE A V

$$\frac{A_{sw}}{\underset{=1\,m}{s}} = \frac{V_{Ed}}{0.9\ d\ f_{yd}\ \underbrace{\cot\vartheta}_{2.0}}$$

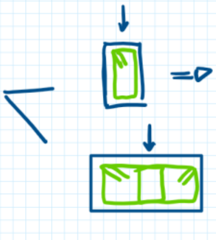
$$A_{sw} = \frac{V_{Ed}\ s}{0.9\ d\ f_{yd} \cot\vartheta} = \frac{300 \times 1.0 \times 10^3}{0.9 \times 55 \times 391.3 \times 2.0} = 7.64 \ \frac{cm^2}{1\ m}$$

$$\frac{\cancel{kN} \times \cancel{m}}{\cancel{cm}\ \frac{\cancel{N}}{mm^2}} \times 10^3 \times \frac{\cancel{10^2}}{\cancel{10^2}}$$

MI SERVONO 7.64 $cm^2$ IN 1 m DI TRAVE

PER DISPORLI => FISSO $\phi$ = 8 mm

n BRACCI



=> 2 BRACCI

=> 4 BRACCI

$$A_{1\phi8} = \underset{\substack{\downarrow \\ \text{AREA} \\ \frac{\pi 0.8^2}{4}}}{0.5} \times \underset{\substack{\downarrow \\ \text{BRACCI}}}{2} = 1.0 \ cm^2$$

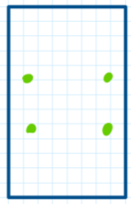
$$\frac{\text{NUM. STAFFE}}{1\ m} = \frac{7.64}{1.0} = 7.64 \text{ STAFFE IN } 1\ m$$

$$S = \frac{100}{7.64} = 13.1\ cm \Rightarrow 10\ cm$$

PER $A_{PAR} = \frac{V_{Ed}}{2} \frac{\cot\vartheta}{f_{yd}}$

$$A_{PAR} = \frac{300}{2} \frac{2.0}{391.3} \times 10 = 7.67\ cm^2$$

$4\phi 14 = 6.16\ cm^2$



VANNO BENE $4\phi 14$ COME $A_{PAR}$ ?

NEL PROG. DELLE STAFFE :

| | |
|---|---|
| $V_{Ed} = 300\ kN$ | $V_{Ed} = 300\ kN$ |
| $\cot\vartheta = 2.0$ | $\cot\vartheta < 2.0$ |
| $S = 13.10\ cm$ | $S = 10\ cm$ |

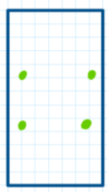
$$V_{Rds} = 0.9\ d\ \frac{A_{sw}}{S} f_{yd} \cot\vartheta$$

$$\frac{13.10}{2.0} = \frac{10}{\cot\bar{\vartheta}} \Rightarrow \cot\bar{\vartheta} = \frac{10}{13.10} \times 2.0 = 1.53$$

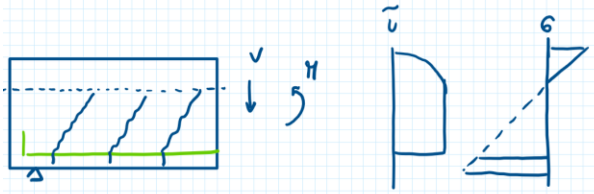
OTTIMIZZO LE $A_{PAR}$: $A_{PAR} = \frac{300}{2} \times \frac{1.53}{391.3} \times 10 = 5.87\ cm^2$

$\Downarrow$

$4\phi 14 = 6.16\ cm^2$



# TAGLIO IN ELEMENTI NON ARMATI A TAGLIO

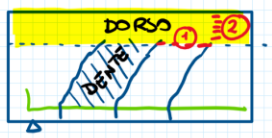



POSSO FAR CRESCERE V SENZA ARMATURE A V ? SI !

⇒ NUOVI MECCANISMI RESISTENTI

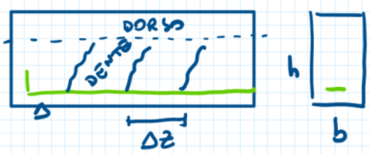
⇒ NUOVO MODELLO DI CALCOLO

SE NON HO ARMATURE A V ⇒ LA CRISI DELL'ELEMENTO
- ROTTURA DENTE 1
- 2 ROTTURA DORSO (COSTOLA)




PER STUDIARE LA RESISTENZA A V DI ELEMENTI NON ARMATI A V

⇒ MODELLO A PETTINE

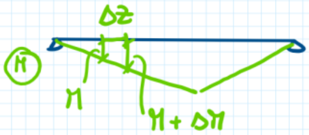


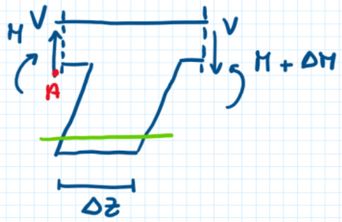

1) LESIONI A 45° E LISCE
2) LESIONI A DISTANZA Δz
3) CLS COMPRESSO TRA LESIONI È EFFICACE
4) LESIONI AL DI SOTTO DI M

DEVO RICAVARE : $V_{Rd,\,DENTE}$

$V_{Rd,\,DORSO}$

# $V_{Rd,\,DENTE}$

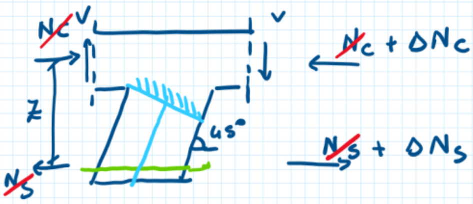


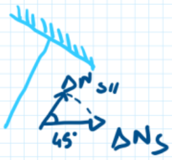

EQ. ROTAZIONE RISPETTO A :

$$\cancel{M} + V\Delta z - \cancel{M} - \Delta M = 0$$

$$V\Delta z = \Delta M$$



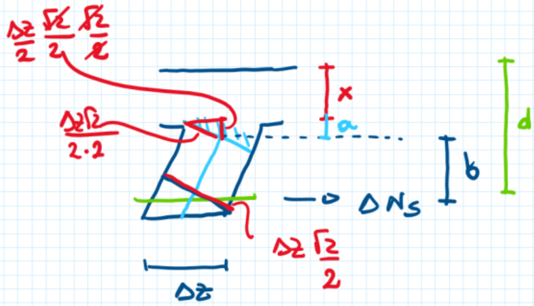

⇒

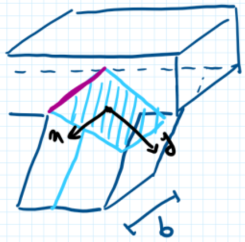


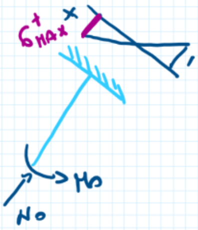

$$\Delta N_s = \frac{\Delta M}{z} = \frac{V\Delta z}{z}$$

$$\Delta N_s \begin{cases} N_0 = \Delta N_{s//} = -\Delta N_s \frac{\sqrt{2}}{2} = -\frac{V\Delta z}{z}\frac{\sqrt{2}}{2} \\ M_0 = \Delta N_s \cdot b = \frac{V\Delta z}{z}\left(d - x - \frac{\Delta z}{4}\right) \end{cases}$$

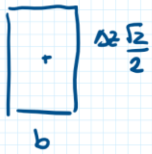
$$b = d - x - a = d - x - \frac{\Delta z}{4}$$






$$\sigma^+_{MAX} = \frac{N}{A} + \frac{M}{I} y$$




$$A = b \, \Delta z \frac{\sqrt{2}}{2}$$

$$\frac{I}{y} = \frac{\frac{b}{\cancel{12}_{3}} \, \Delta z^{\cancel{3}\,2} \, \frac{\cancel{\sqrt{2}^3}\,2}{\cancel{2^3}\,2}}{-\frac{\cancel{\Delta z}}{\cancel{2}} \frac{\cancel{\sqrt{2}}}{\cancel{2}}} = -\frac{b \, \Delta z^2}{12}$$

$$\sigma^+_{MAX} = \frac{-V \frac{\cancel{\Delta z}}{z} \cancel{\frac{\sqrt{2}}{2}}}{b \, \cancel{\Delta z} \cancel{\frac{\sqrt{2}}{2}}} + \frac{\cancel{-} V \frac{\cancel{\Delta z}}{z} \left( d - x - \frac{\Delta z}{4} \right)}{\cancel{-} \frac{b \, \Delta z^{\cancel{2}}}{12}}$$

$$\sigma^+_{MAX} = -\frac{V}{b z} + \frac{12 V}{b z \, \Delta z} \left( d - x - \frac{\Delta z}{4} \right)$$

$$\sigma^+_{MAX} = \frac{V}{b z} \left[ -1 + \frac{12}{\Delta z} \left( d - \underbrace{x}_{=0.2d} - \underbrace{\frac{\Delta z}{4}}_{=d/4} \right) \right]$$

SPERIMENTALMENTE : $x \simeq 0.2 \, d$

$\Delta z \simeq d$

$$\sigma^+_{MAX} = \frac{V}{b z} \left[ -1 + \frac{12}{d} \left( d - 0.2 d - 0.25 \, d \right) \right]$$

$$\sigma^+_{MAX} = \frac{V}{b z} \left[ -1 + \frac{12}{\cancel{d}} \, 0.55 \cancel{d} \right] = 5.6 \, \frac{V}{b z}$$

$$V_{Rd_{DENTE}} \Rightarrow \sigma^+_{MAX} = f_{cfd} = 1.2 \, f_{ctd}$$

$$V_{Rd_{DEN}} \Rightarrow 1.2 \, f_{ctd} = 5.6 \, \frac{V}{b z}$$

$$V_{Rd\,DENTE} \Rightarrow \sigma^{+}_{MAX} = f_{cfd} = 1.2\, f_{ctd}$$

$$V_{Rd\,DEN} \Rightarrow 1.2\, f_{ctd} = 5.6\, \frac{V}{bz}$$

$$V_{Rd,DENTE} = \frac{1.2}{5.6}\, b z\, f_{ctd}$$

$$V_{Rd,DENTE} = 0.214\, b \underbrace{z}_{=0.9d} f_{ctd}$$

$$\boxed{V_{Rd,DENTE} = 0.194\, b d\, f_{ctd}}$$