IPOTESI DI COMPORTAMENTO

mercoledì 1 aprile 2020 13:57

1. PERFETTA ADERENZA
2. CONSERVAZ. SEZIONI PIANE

Ⓐ $\varepsilon = \varepsilon_0 + \chi_x X + \chi_y y$

Ⓑ $\sigma = f(\varepsilon)$

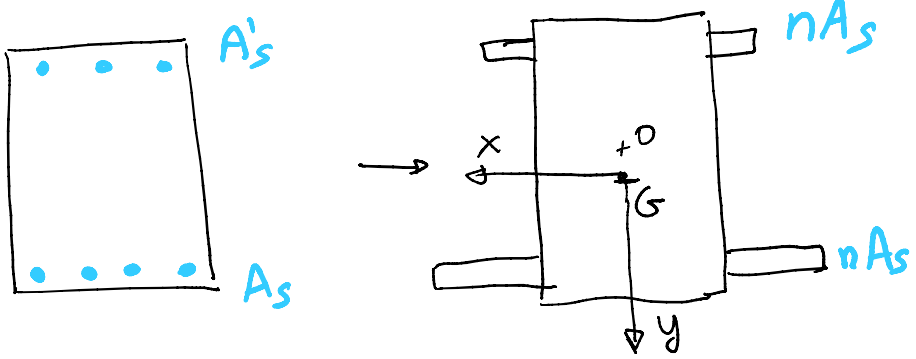
Ⓒ $N = \int \sigma \, dA \,, \quad M_x = \int \sigma y \, dA \,; \quad M_y = -\int \sigma x \, dA$

I STADIO

$\sigma_s = E_s \varepsilon_s$
$\sigma_c = E_c \varepsilon_c$

$\varepsilon_s = \varepsilon_c \Rightarrow n = \frac{E_s}{E_c}$

SEZ. OMOGENEIZZATA



G = BARICENTRO SEZ. OMOGENEIZZATA

$\varepsilon = \varepsilon_G + \chi_x X + \chi_y y$

$\sigma = E_c \cdot \varepsilon = E_c (\varepsilon_G + \chi_x X + \chi_y y)$

$$N = \int \sigma \, dA = E_c \int_A \varepsilon_G \, dA + E_c \int_A \chi_x X \, dA + E_c \int_A \chi_y y \, dA$$

X, Y BARICENTRICI $\Rightarrow$ $\int x \, dA = 0$, $\int y \, dA = 0$

$$N = E_c \varepsilon_G A \rightarrow \varepsilon_G = \frac{N}{E_c A}$$

$$M_x = \int \sigma y\,dA = \underbrace{E_c \int \varepsilon_G y\,dA}_{\downarrow 0} + \underbrace{E_c \int \chi_x xy\,dA}_{\downarrow 0} + E_c \int \chi_y y^2\,dA$$

$$= E_c \chi_y I_x \rightarrow \chi_y = \frac{M_x}{E_c I_x}$$

$$M_y = -\int \sigma x\,dA = -E_c \underbrace{\int \varepsilon_G x\,dA}_{\downarrow 0} - E_c \int \chi_x x^2\,dA - E_c \underbrace{\int \chi_y xy\,dA}_{\downarrow 0}$$

$$= -E_c \chi_x I_y \rightarrow \chi_x = -\frac{M_y}{E_c I_y}$$

SOSTITUISCO IN σ $\rightarrow$

$$\sigma = \cancel{E_c}\,\frac{N}{\cancel{E_c} A} - \cancel{E_c} \cdot x \cdot \frac{M_y}{\cancel{E_c} I_y} + \cancel{E_c}\,\frac{M_x}{\cancel{E_c} I_x} \cdot y$$

$$\boxed{\sigma = \frac{N}{A} - \frac{M_y}{I_y} x + \frac{M_x}{I_x} y}$$

σ_c

$$n = \frac{E_s}{E_c} \qquad \sigma_s = E_s \cdot \varepsilon_s \qquad \sigma_c = E_c \varepsilon_c \rightarrow \sigma_s = n \sigma_c$$

II STADIO

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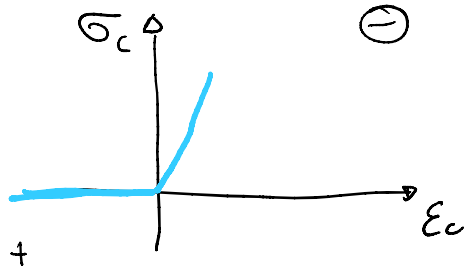
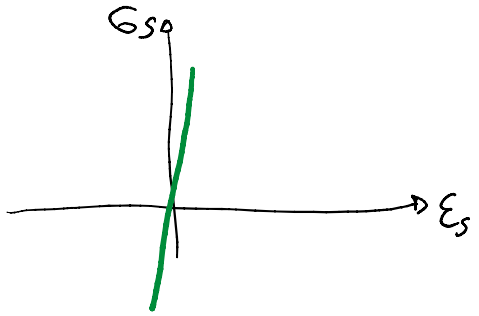
$$\varepsilon = \varepsilon_0 + \chi_x X + \chi_y y$$



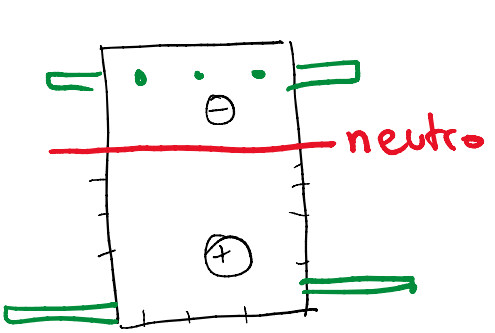
$\sigma_c = E_c \varepsilon_c \qquad \varepsilon_c < 0$

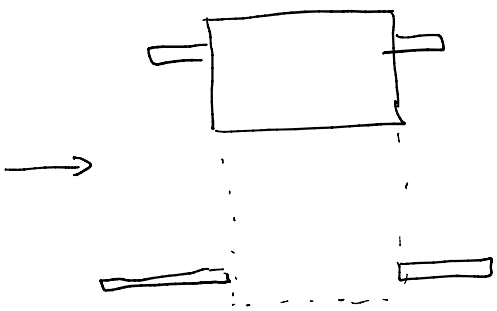
$\sigma_c = 0 \qquad \varepsilon_c > 0$



$\sigma_s = E_s \cdot \varepsilon_s$

PASSO PRELIMINARE : TROVARE POSIZIONE ASSE NEUTRO





SEZIONE REAGENTE OMOGENEIZZATA

DEFINISCO G BARICENTRO DELLA SEZIONE REAGENTE OMOGENEIZZATA

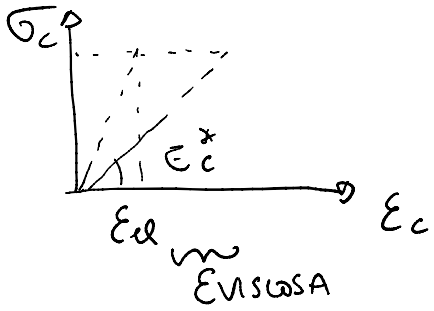
↓

APPLICO NAVIER

I STADIO $n = E_s/E_c$ C25/30 $\Rightarrow n = 6{,}35$

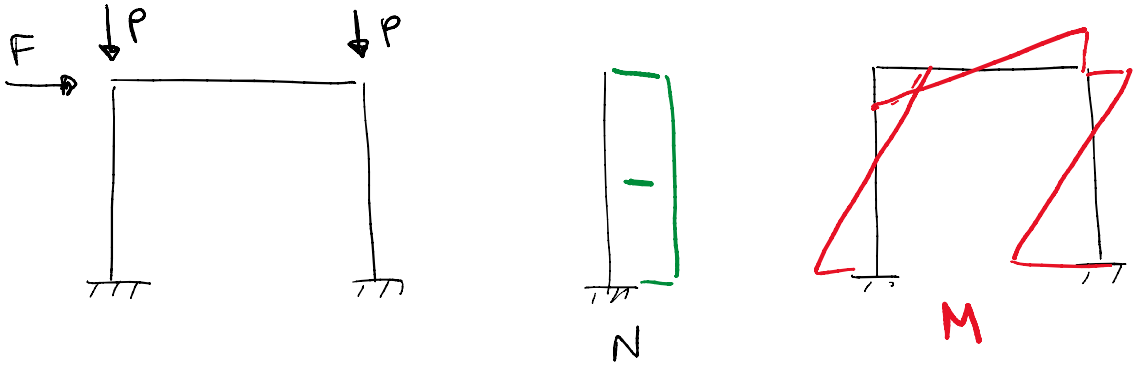
II STADIO $n = 25$

↳ CARICHI DI LUNGA DURATA



E_c^* RIDOTTO

APPROCCIO CONVENZIONALE PER RISOLVERE LE STRUTTURE



- LA SEZIONE REAGENTE OMOGENEIZZATA VARIA LUNGO LO SVILUPPO DELL'ELEMENTO
- LE ARMATURE SONO PROGETTATE DOPO CHE N, M SONO DETERMINATE

III STADIO

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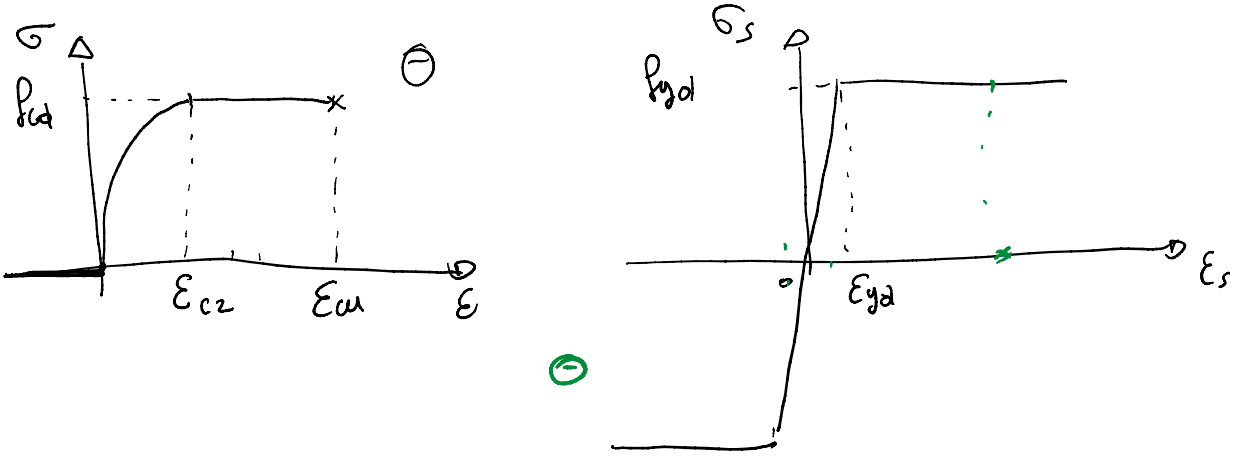
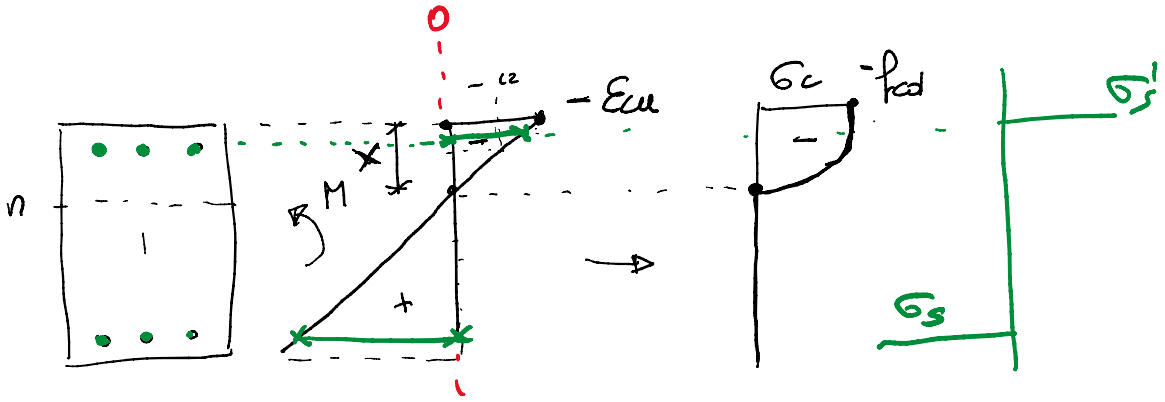


NOTA : - NON POSSO PARLARE DI COEFF. DI OMOGENEIZZAZIONE
- NON POSSO PARLARE DI BARICENTRO

CALCOLO LE CARATTERISTICHE RESISTENTI

1. FISSO DIAGRAMMA LIMITE DI DEFORMAZIONI
2. CALCOLO σ DA LEGAMI COSTITUTIVI



ESEMPIO PER FLESSIONE SEMPLICE

N=0 ⇒ TROVO ASSE NEUTRO x DA EQ. ALLA TRASLAZIONE

$$\int \sigma_c dA_c + \int \sigma_s \phi A_s = N \Rightarrow x$$

$$\int \sigma y dA_c + \int \sigma_s y dA_s = M$$

CARICHI UNITARI

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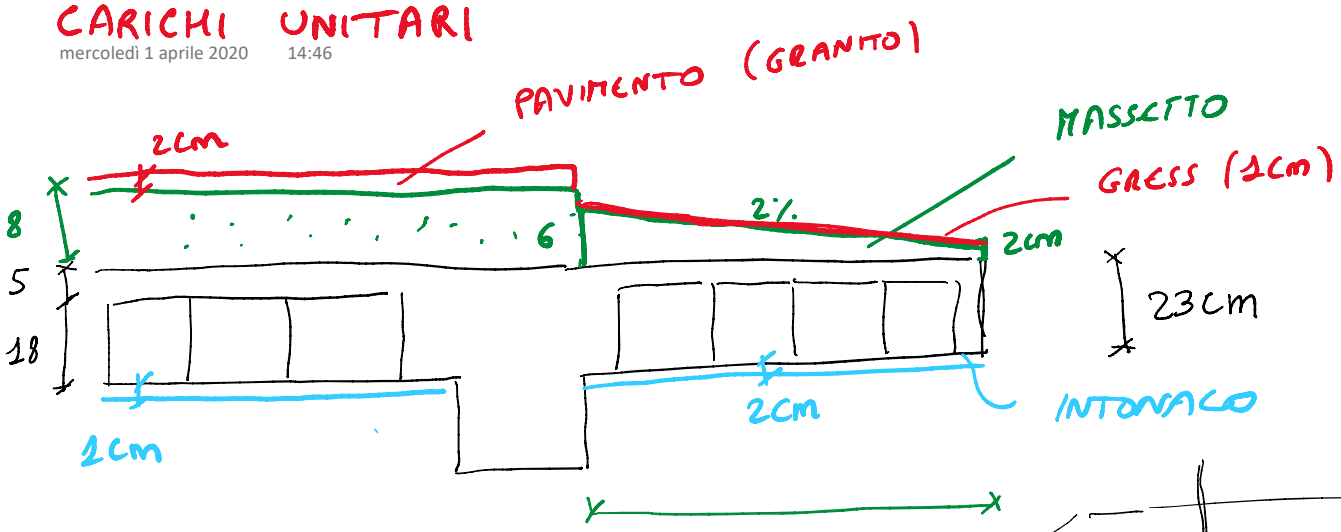
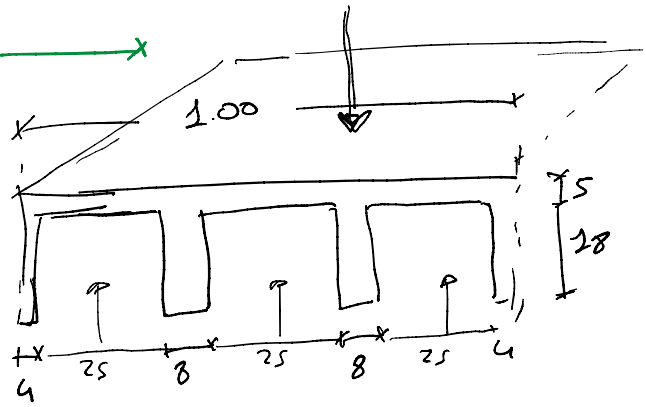




SOLAIO INTERNO (3 TRAVETTI AL m)

PESO PROPRIO

SOLETTA = $0{,}05\,m \times 25\,\frac{KN}{m^3} = 1{,}25\,\frac{KN}{m^2}$ (×1×1)

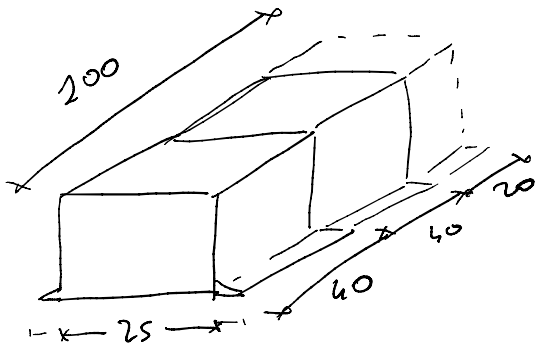
TRAVETTI = $0.18\,m \times 3\,TR \times 0.08\,m \times 25\,\frac{KN}{m^3} \times 1\,m$

$= 1{,}08\,\frac{KN}{m^2}$

PIGNATTE = $0.076\,KN \times \frac{N_{pign}}{m^2} = 0.076 \times 7{,}5 = 0{,}57\,\frac{KN}{m^2}$

NUMERO PIGNATTE

$2{,}5 \times 3 = 7{,}5\ \frac{PIGNATTE}{m^2}$



TOT PESO PROPRIO $= 1{,}25 + 1.08 + 0{,}57 = 2{,}9\ KN/m^2$

SOLAIO CON 2 TRAVETTI AL m

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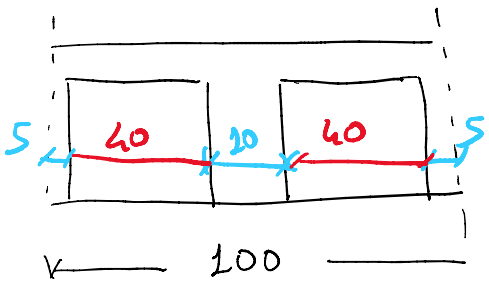
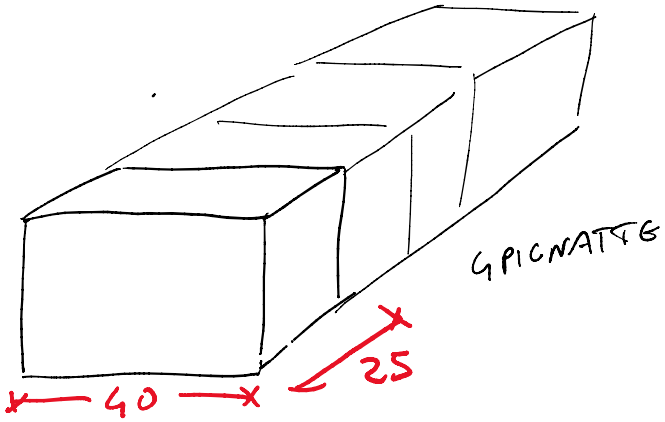
SEZ. TRASVERSALE





$4 \times 2 = 8$ PIGNATTE/m^2

PESO PIGNATTE $= 0.076 \times 8 = 0.61$ KN/m^2

PESO TRAVETTI $= 2 \times 0.10\,m \times 0.18\,m \times 25\,\frac{KN}{m^2} \times 1 = 0.9$ KN/m^2

PESO SOLETTA $= 1.25$ KN/m^2

TOT $= 2{,}76$ KN/m^2

SOVRACCARICHI PERMANENTI

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MASSETTO = $0{,}08\,m \times 1 \times 1 \times 21\,\frac{KN}{m^3} = 1{,}68\,\frac{KN}{m^2}$

INTONACO = $0{,}01\,m \times 1 \times 1 \times 18\,\frac{KN}{m^3} = 0.18\,KN/m^2$

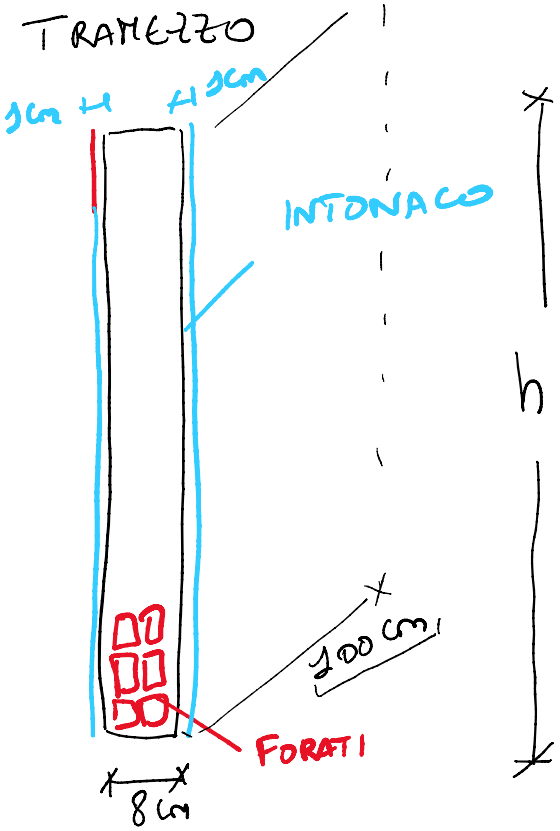
PAVIMENTO (GRANITO) = $0{,}02\,m \times 1 \times 1 \times 27\,\frac{KN}{m^3} = 0{,}54\,KN/m^2$

$2{,}40\,KN/m^2$

CARICHI COMPIUTAMENTE DEFINITI

$g_{k1} = \underbrace{2{,}90\,KN/m^2}_{\text{Peso proprio}} + \underbrace{2{,}40\,KN/m^2}_{\text{sovr. permanenti}} = 5{,}30\,KN/m^2$

CARICHI NON COMPIUTAMENTE DEFINITI



LATERIZI = $0{,}08\,m \times 3.00\,m \times 1 \times 6\,\frac{KN}{m^3}$

$= 1{,}44\,KN/m$

INTONACO = $(0{,}01+0{,}01)\,m \times 3{,}00\,m \times 1 \times 18\,\frac{KN}{m^3} = 1{,}08\,KN/m$

$\Rightarrow \underbrace{G_{k2} = 1{,}44 + 1{,}08 = 2{,}52\,KN/m}$

$g_{2k} = 1{,}2\,KN/m^2$

RIEPILOGO SOLAIO

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$g_{1k} = 2{,}90 + 2{,}40 = 5{,}30\ kN/m^2$

$g_{2k} = 1{,}2\ kN/m^2$

$q_k =$ CIVILE ABITAZIONE $= 2\ kN/m^2$

$g_{1d} = g_{1k} \cdot \gamma_{G_1} = 5{,}30 \times 1{,}30 = 6{,}89\ kN/m^2$

g_{2d} / $g_{2k} \cdot 1{,}5 = 1{,}2\ kN/m^2 \times 1{,}5 = 1{,}8\ kN/m^2$

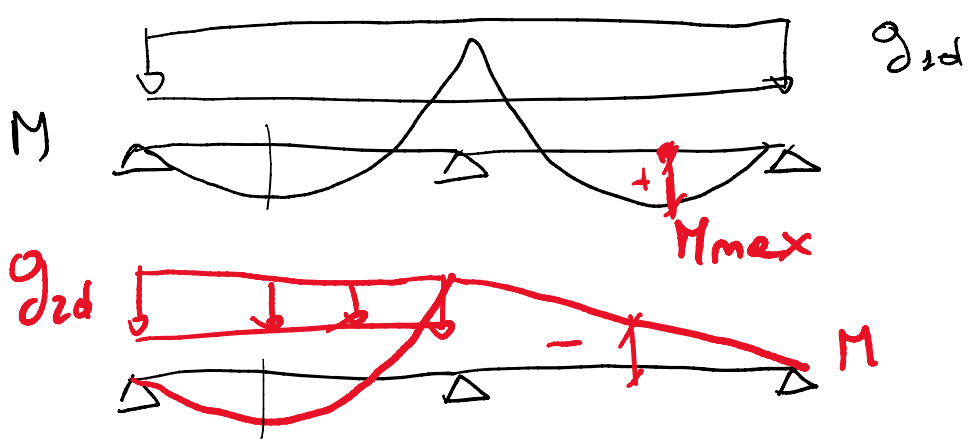
\ $g_{2k} \cdot 0{,}8 = 1{,}2 \times 0{,}8 = 0{,}96\ kN/m^2$

$q_d = q_k \times 1{,}5 = 2 \times 1{,}5 = 3\ kN/m^2$

$g_{d\,max} = 6{,}89 + 1{,}8 = 8{,}69\ kN/m^2$

$g_{d\,min} = 6{,}89 + 0{,}96 = 7{,}85\ kN/m^2$

PERCHÈ $g_{d\,min}$?



SBALZO

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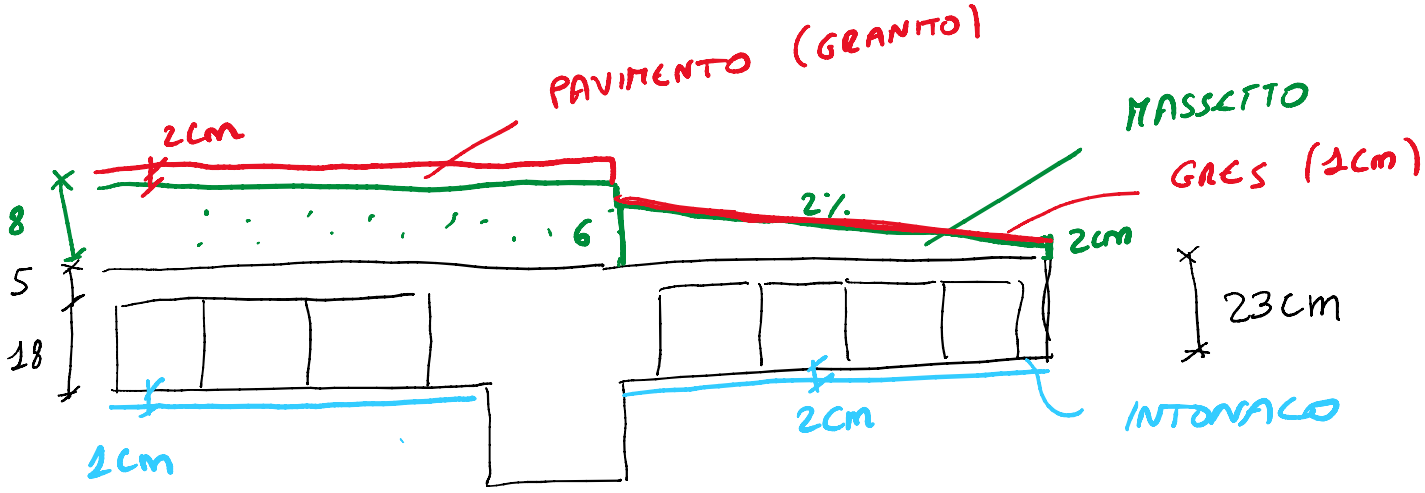
$h_{INT} = h_{SBALZO} \Rightarrow$ PESO PROPRIO $= 2{,}30\ KN/m^2$



SOVRACCARICHI PERMANENTI

MASSETTO $= m\ \frac{0{,}06+0{,}02}{2} \times 1 \times 1 \times 21\ \frac{KN}{m^3} = 0{,}84\ KN/m^2$

GRES $= 0{,}01\ m \times 1 \times 1 \times 20\ \frac{KN}{m^3} = 0{,}2\ KN/m^2$

INTONACO $= 0{,}02\ m \times 1 \times 1 \times 18\ \frac{KN}{m^3} = 0.36\ KN/m^2$

$1{,}40\ KN/m^2$

g_{1k} = PESO PROP + SOVR. PERM $= 2{,}9 + 1{,}4 = 4{,}3\ KN/m^2$

$g_{1d} = g_{1k} \times 1{,}3 = 4{,}3 \times 1{,}3 = 5{,}59\ KN/m^2$

CARICHI VARIABILI

$q_{k,A} = 4\ kN/m^2$

$q_{k,NEVE} = 0,94\ kN/m^2$

NEVE PRINCIPALE $\quad q_d = 0,94 \times 1,5 + 4 \times 1,5 \times \underbrace{\psi_0}_{0,7}$

$\leq 5,61\ kN/m^2$

CAT. A PRINCIPALE $\quad q_d = 4 \times 1,5 + 0,94 \times 1,5 \times 0,5$ ←

$= 6,71\ kN/m^2$

$q_d = 6,71\ kN/m^2$

TAMPONATURA ESTERNA

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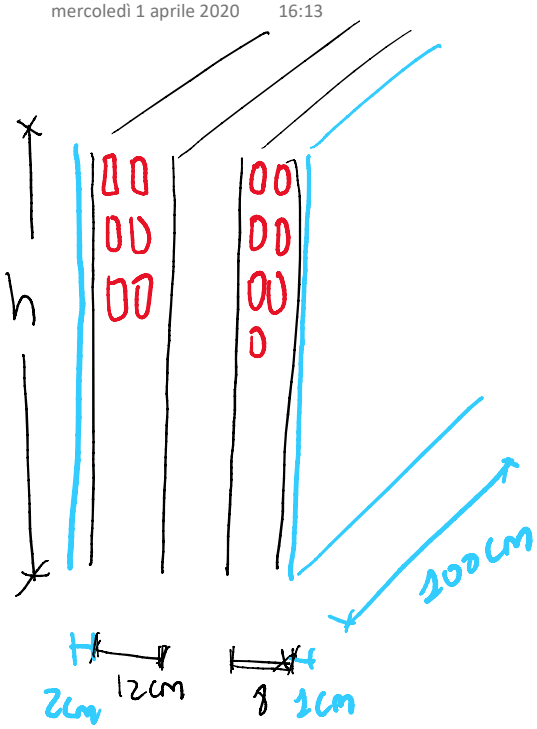

$h \simeq 2{,}90\ m$

FORATI: $(0{,}12 + 0{,}08)\,m \times 2{,}90\,m \times 1\,m \times 6\,\frac{KN}{m^2}$

$= 3{,}48\ KN/m$

INTONACO $= (0{,}02 + 0{,}01) \times 2{,}90 \times 18\,\frac{KN}{m^2}$

$= 1{,}57\ KN/m$

TOT $G_K = 3{,}48 + 1{,}57 = 5{,}05\ KN/m$

$G_d = 1{,}3 \times 5{,}05\,\frac{KN}{m} = 6{,}57\ KN/m$

PESO TRAVI

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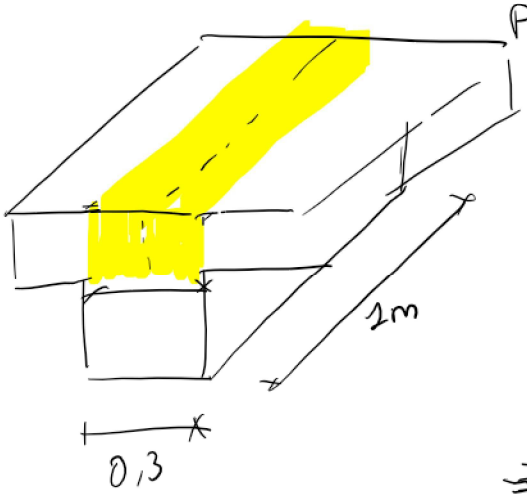
TRAVE EMERGENTE 30×60



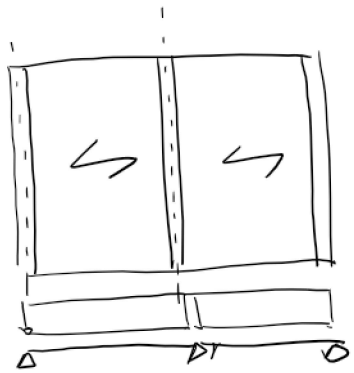
$$\text{Peso pr.} = 0{,}3\,m \times 0{,}6\,m \times 1 \times 25\,\frac{KN}{m^3}$$

$$= 4{,}5\,\frac{KN}{m}$$

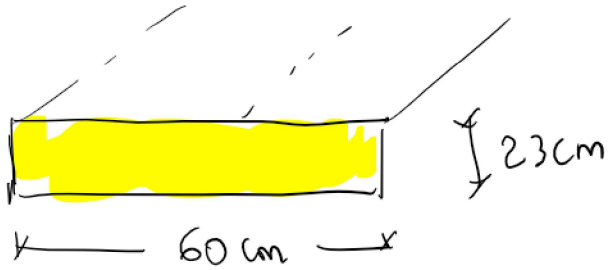
MAGGIOR PESO RISPETTO AL SOLAIO

$$- 2{,}90\,\frac{KN}{m^2} \times 0{,}30\,m$$

$$\Rightarrow 4{,}5\,\frac{KN}{m} - 2{,}9 \times 0{,}3\,\frac{KN}{m} = 3{,}63\,\frac{KN}{m}$$



TRAVE SPESSORE



$$\text{PESO} = 0{,}6\,m \times 0{,}23\,m \times 25\,\frac{KN}{m^3} -$$

$$2{,}90\,\frac{KN}{m^2} \times 0{,}6\,m$$

$$= 3{,}45 - 1{,}74 = 1{,}71\,\frac{KN}{m}$$

SCALA

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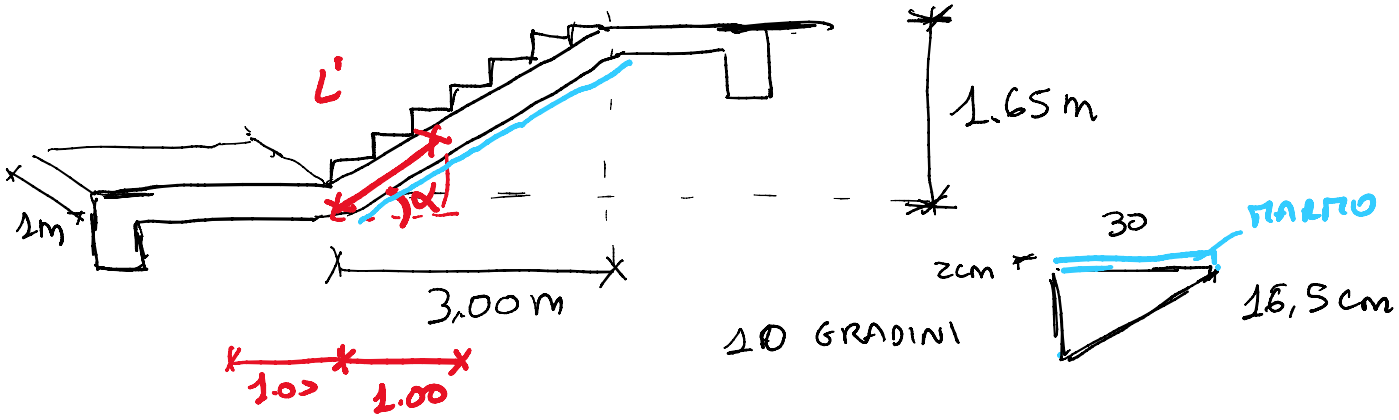
SOLETTA RAMPANTE $\quad s \simeq 15\,cm \quad$ SOLETTA PIENA



$$\alpha = \arctg \frac{1.65}{3.00} = 0.50\ rad$$

$$L' = \frac{1.00}{\cos\alpha} = 1.14\,m$$

PESO SOLETTA : $0,15\,m \times 1m \times 1.14\,m \times 25 \frac{kN}{m^3} = 4,28 \frac{kN}{m^2}$

INTONACO $\quad 0,01\,m \times 1 \times 1.14\,m \times 18 \frac{kN}{m^3} = 0,21 \frac{kN}{m^2}$

GRADINI $\quad \frac{0,3 \times 0.165}{2} \times 1m \times 24 \frac{kN}{m^3} \frac{100}{30} =$

$= 1,98\ kN/m^2$

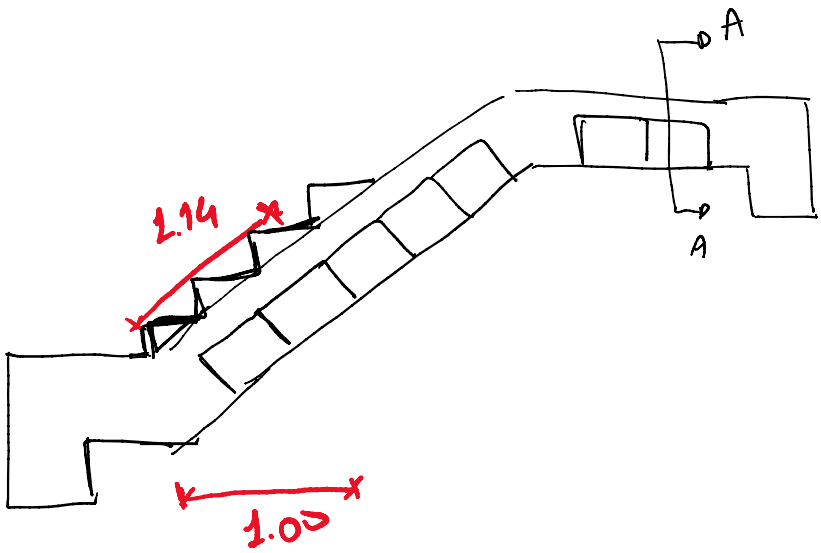
NUMERO DI GRADINI

MARMO $\quad 0,02\,m \times 27 \frac{kN}{m^3} \times 1 \times 1 = 0,54\ kN/m^2$

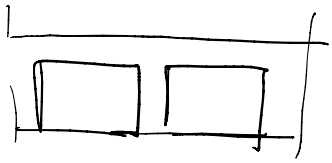
$$g_k = 7,01\ kN/m^2$$

$$q_k = 4.00\ kN/m^2$$

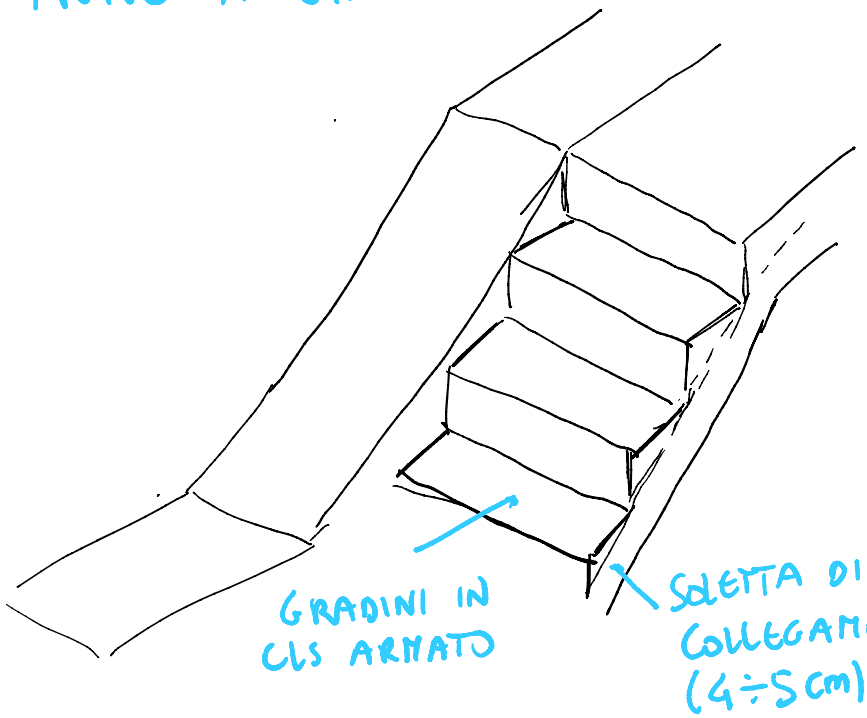
SOLETTA ALLEGGERITA



SEZ. TRASVERSALE



TRAVE A GINOCCHIO



PESO SOLETTA DA VALUTARE CON $\delta = 4 \div 5$ cm

PESO GRADINI DA VALUTARE CON $\gamma = 25\ kN/m^3$