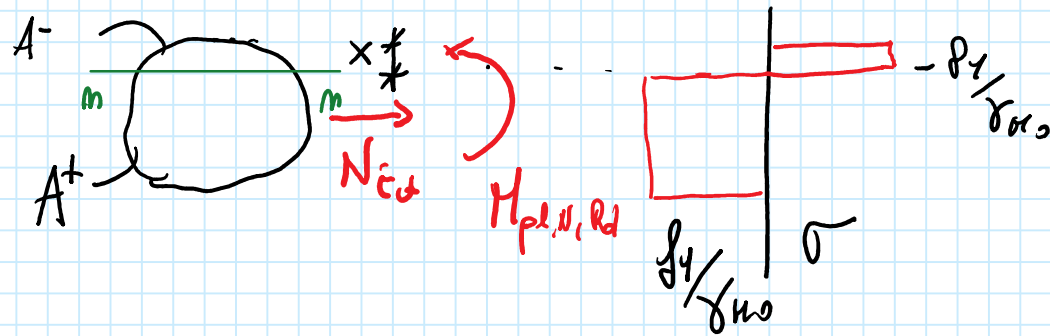
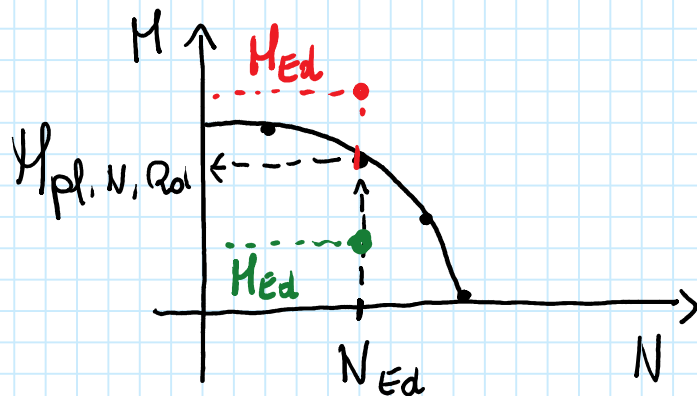


# Domini di resistenza M-N di sezioni di classe 1 o 2



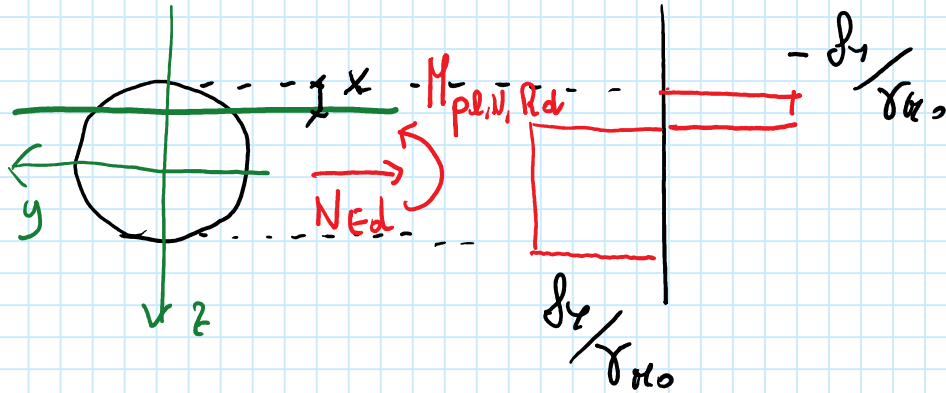
Noto  $N_{Ed} \rightarrow A^+ + A^- = A$   
 $A^+ - A^- = \frac{N_{Ed}}{f_y / \gamma_{M0}} \rightarrow$  determiniamo:  
 $X \rightarrow A^+ \text{ e } A^- \rightarrow$   
 $\rightarrow M_{pl,N,Rd} = \int_A \sigma z dA = z S^+ \frac{f_y}{\gamma_{M0}} - z S^- \frac{f_y}{\gamma_{M0}} \quad \Rightarrow \text{Ho un punto del dominio}$



Facciamo variare  $N_{Ed}$  determiniamo più punti che uniti costituiscono il dominio M-N.

Potremo usarlo per le verifiche.

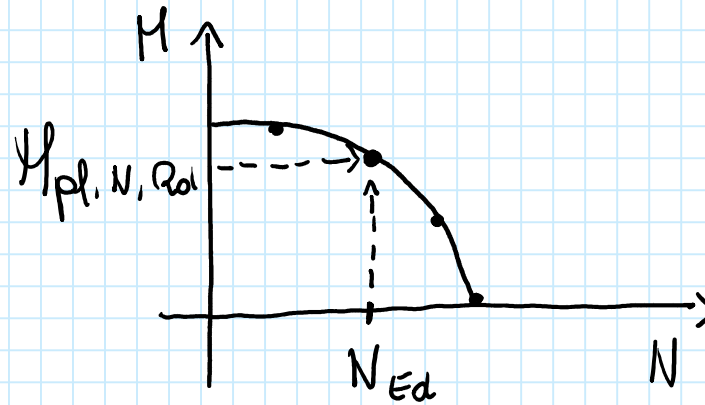
Ma esiste un procedimento più efficace...  
 ...fermò variare le posizioni dell'asse neutro.



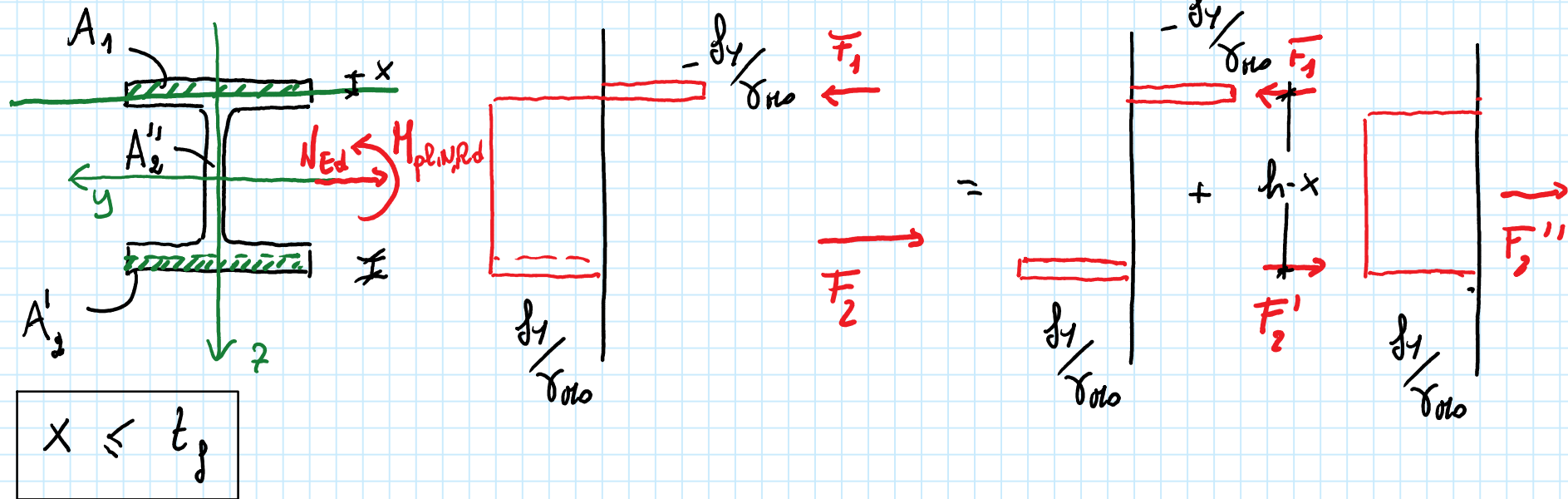
1. Fisso  $X$

$$2. N_{Ed} = \int_A \sigma dA$$

$$3. M_{pl,N,Rd} = \int_A \sigma z dA$$



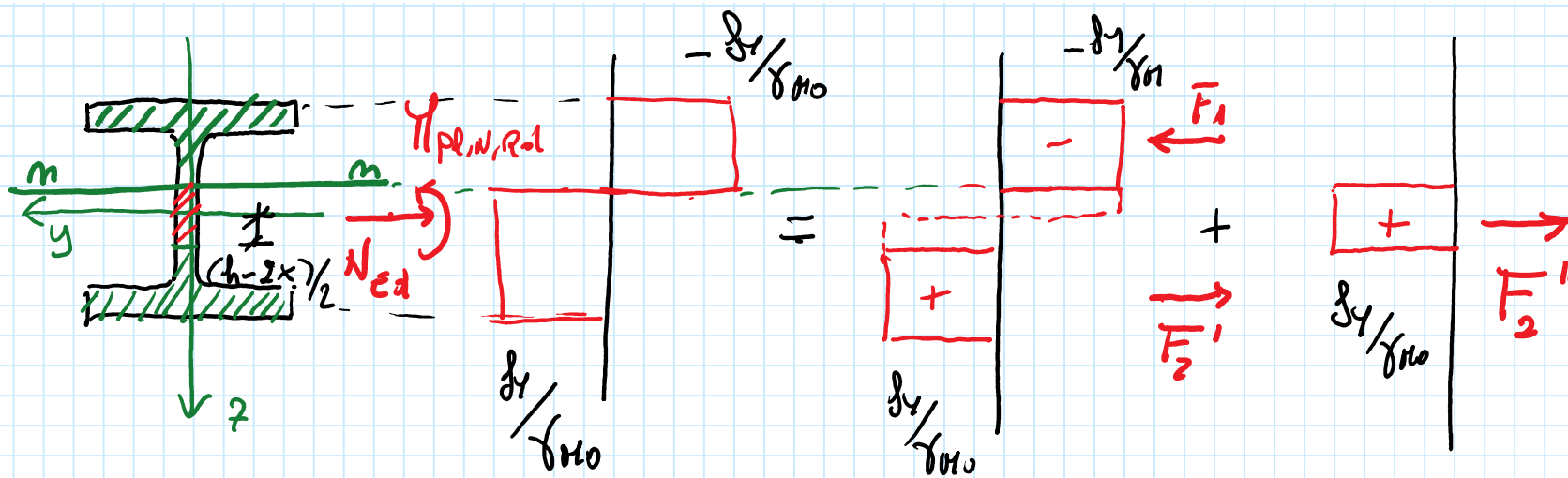
Caso delle travi a doppio T con  $N$  e  $M_y$



$$N_{Ed} = \int_A \sigma dA = \int_{A_1} \sigma dA + \int_{A_2'} \sigma dA + \int_{A_2''} \sigma dA = \cancel{-F_1} + \cancel{F_2} + F_2''$$

$$= F_2'' = A_2'' \frac{\sigma_1}{\delta_{H0}} = (A - 2bx) \frac{\sigma_1}{\delta_{H0}}$$

$$M_{pl,Ed} = \int_A \sigma z dA = F_1 (h-x) = bx \frac{\sigma_1}{\delta_{H0}} (h-x) = bx (h-x) \frac{\sigma_1}{\delta_{H0}}$$



$$X > t_f$$

$$N_{Ed} = \int_A \sigma dA = F_2'' = t_w (h - 2x) \frac{\sigma_y}{\gamma_{m0}}$$

$$M_{pl,N,Rd} = \int_A \sigma z dA = W_{pl} \frac{\sigma_y}{\gamma_{m0}} - \underbrace{t_w \frac{(h - 2x)}{2} \frac{(h - 2x)}{4}}_{W_{pl,w}} \frac{\sigma_y}{\gamma_{m0}}$$

$$= \left[ W_{pl} - \frac{t_w (h - 2x)^2}{4} \right] \frac{\sigma_y}{\gamma_{m0}}$$

## Equazioni del dominio

Per ogni valore di  $x$  ho un punto del dominio...  
... posso disegnare lo con EXCEL

$$x \leq t_f$$

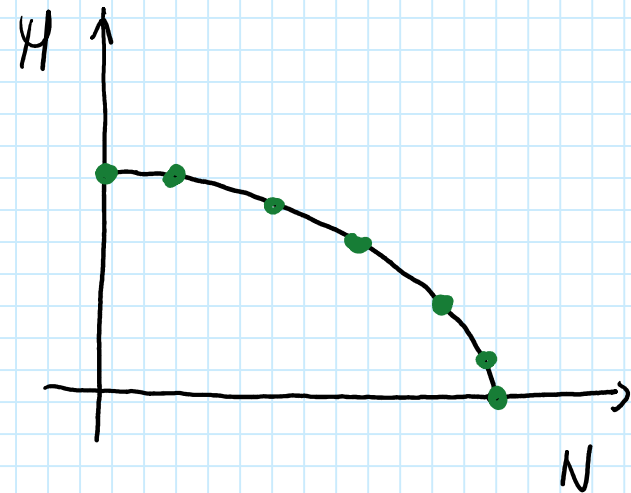
$$N_{Ed} = (A - 2bx) \frac{\delta_v}{\gamma_{H0}}$$

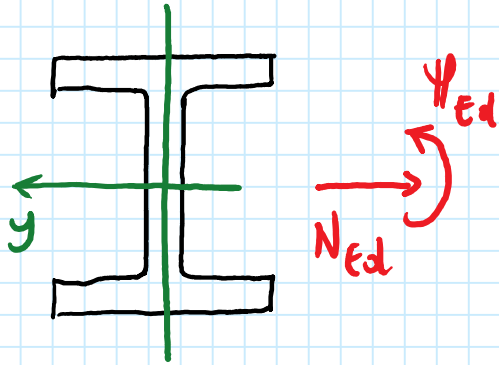
$$M_{pl,N,Rd} = b \times (h - x) \frac{\delta_1}{\gamma_{H0}}$$

$$x > t_f$$

$$N_{Ed} = t_w (h - 2x) \frac{\delta_v}{\gamma_{H0}}$$

$$M_{pl,N,Rd} = \left[ W_{pl} - t_w \frac{(h - 2x)^2}{4} \right] \frac{\delta_1}{\gamma_{H0}}$$





HEB 260

S 235

classe 3

$$N_{Ed} = 500 \text{ kN}$$

$$M_{Ed} = 50 \text{ kNm}$$

$$\frac{|N_{Ed}|}{N_{pl,Rd}} + \frac{|M_{Ed}|}{M_{el,Rd}} = \frac{500}{2649,9} + \frac{50}{256,9} = 0,1887 + 0,1946 = 0,3833 \leq 1$$

OK!

$$N_{pl,Rd} = A \frac{f_y}{\gamma_{M0}} = 118,4 \times \frac{235}{1,05} \times \frac{1}{10} = 2649,9 \text{ kN}$$

$$M_{el,Rd} = W_{el} \frac{f_y}{\gamma_{M0}} = 1148 \times \frac{235}{1,05} \times \frac{1}{10^3} = 256,9 \text{ kNm}$$

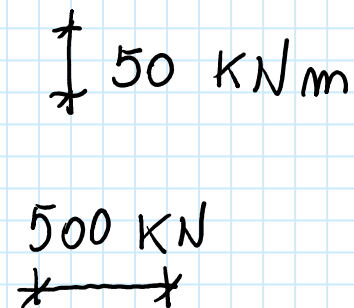
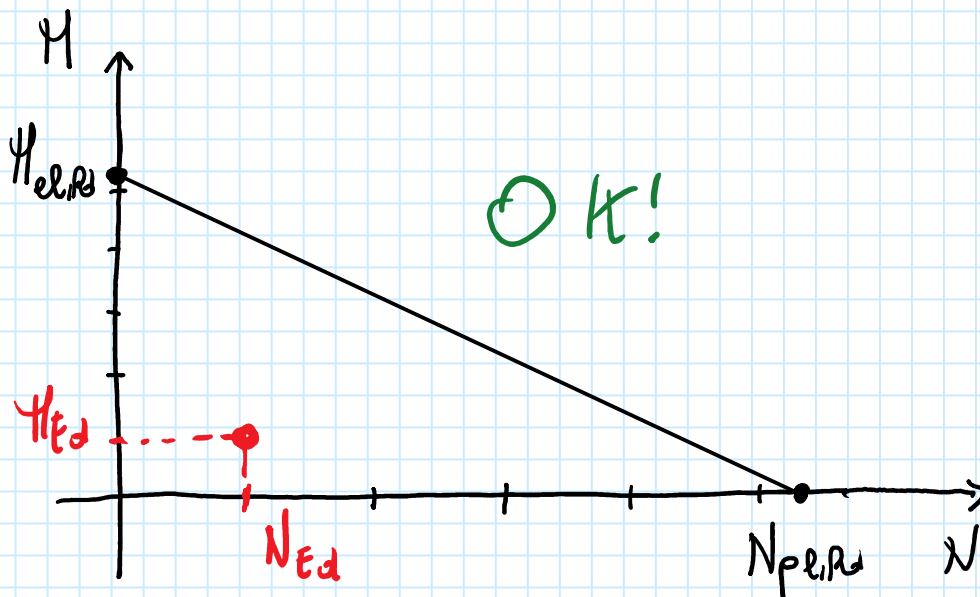
... adesso possiamo disegnare il dominio M-N e fare le verifiche attraverso il grafico.

1.  $N_{Ed} = 0$

$$M_{d,N,Rd} = M_{d,Rd} = 256,9 \text{ kNm}$$

2.  $N_{Ed} = N_{pl,Rd} = 2649,9 \text{ kN}$

$$M_{d,N,Rd} = 0$$



Per le stesse sezioni, se di classe 1 o 2 ...

