

**EDIFICI IN MURATURA  
NUOVI ED ESISTENTI**

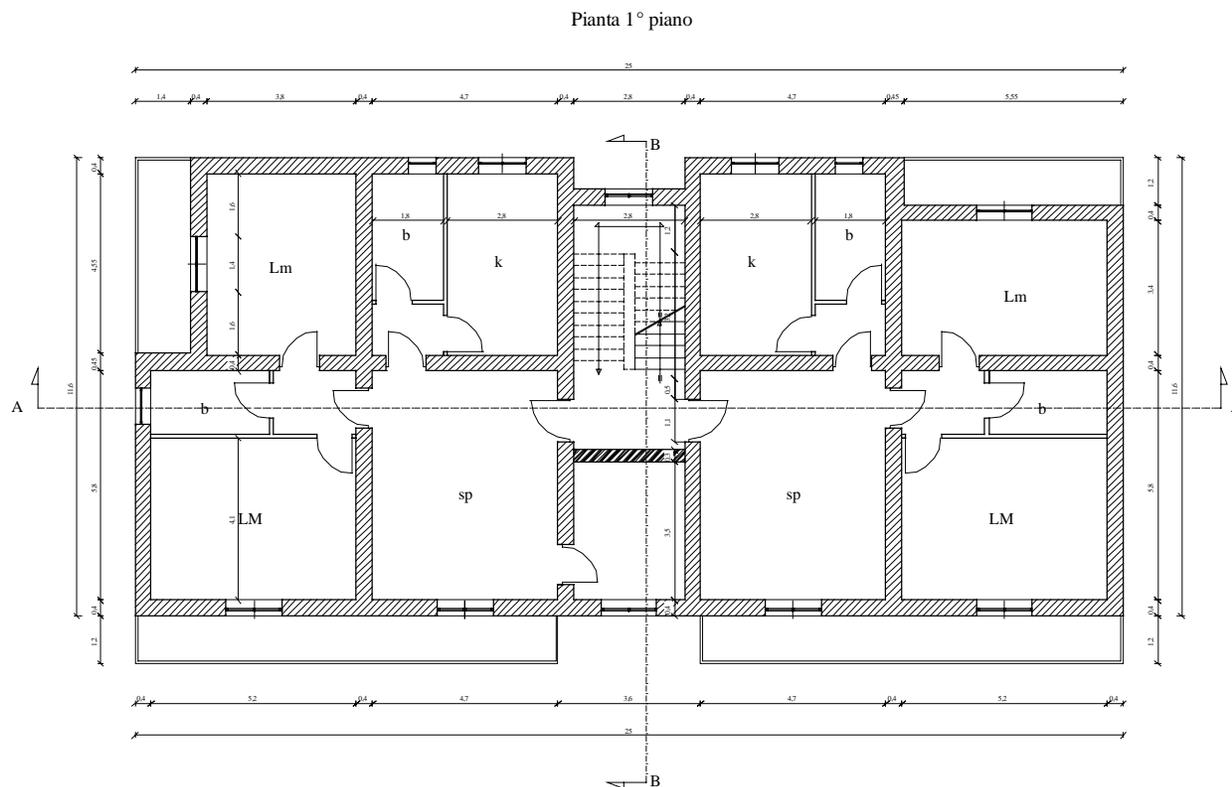
**Parte 7:**  
**IL PROGETTO DI UN EDIFICIO  
IN MURATURA NUOVO**



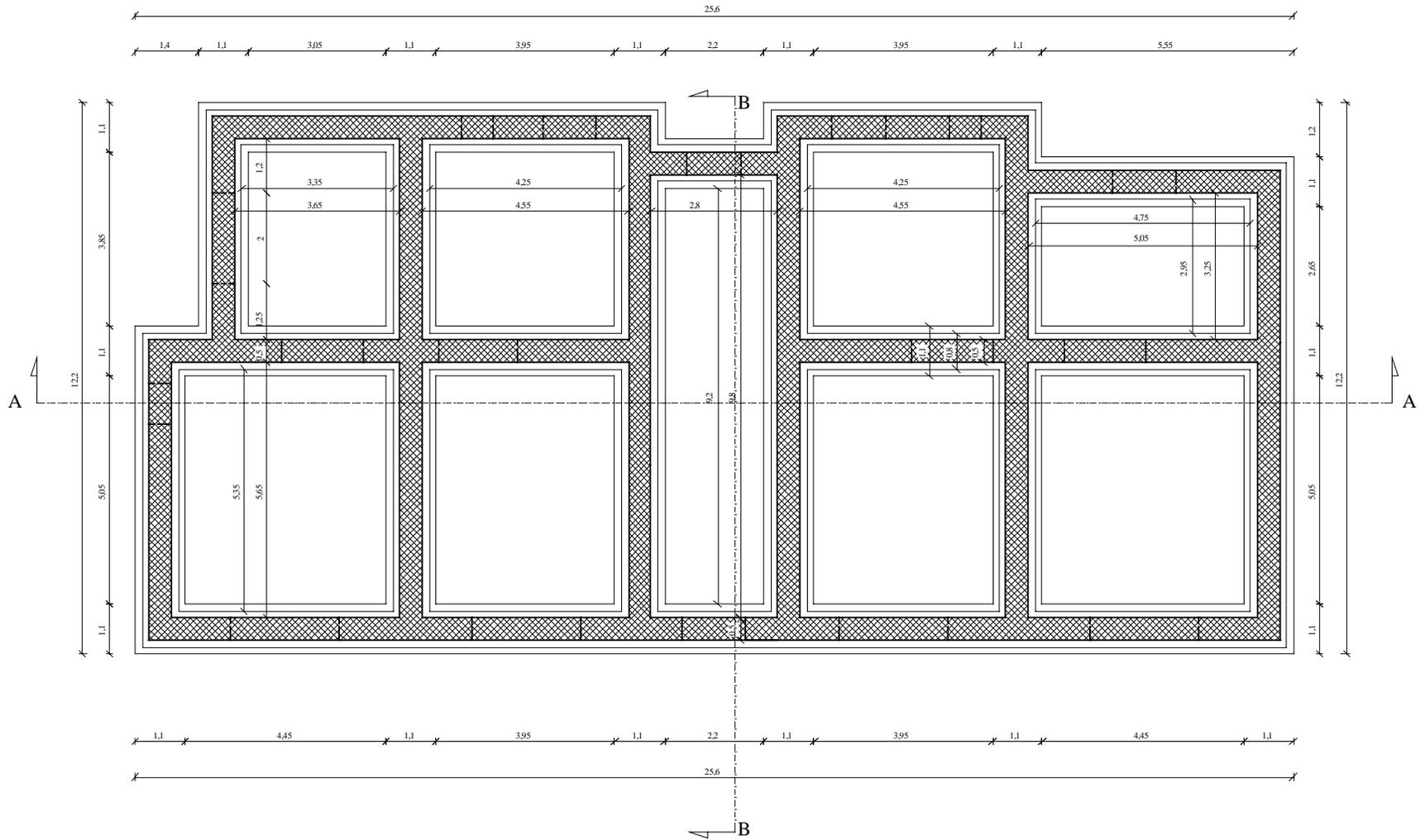
# Edificio in muratura di tufo in zona di II categoria

- Muratura di tufo      - Solai in c.a.      - Fondazioni in c.a.

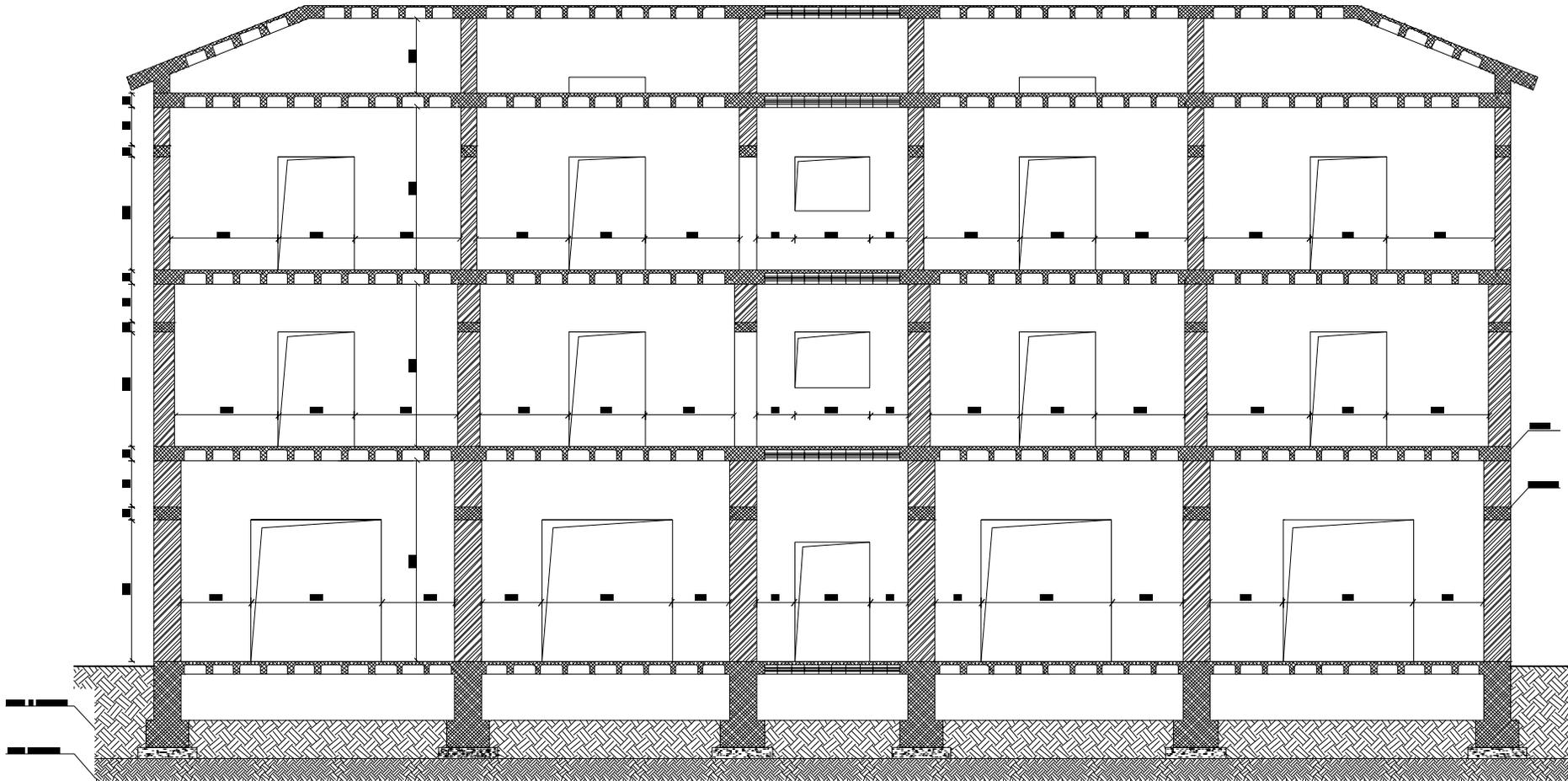
- 3 Piani + sottotetto
- Interpiano medio = 3,7 m
- 4 pareti // x
- $H_{tot} = 11 \text{ m} + 3 \text{ m}$  (sottotetto)
- Spessore muri: 30 – 50 cm
- 6 pareti // y



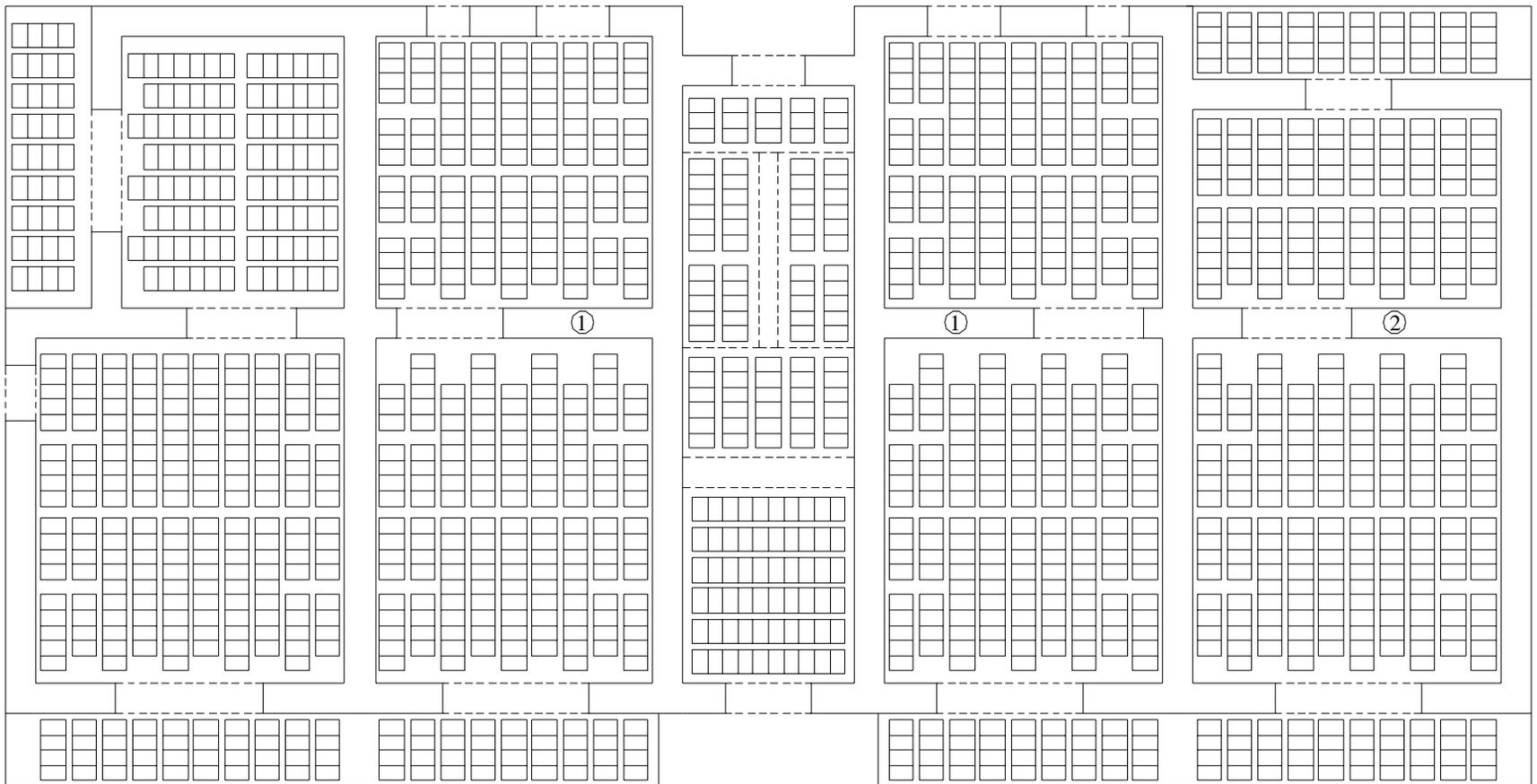
# La pianta delle fondazioni



# La sezione dell'edificio

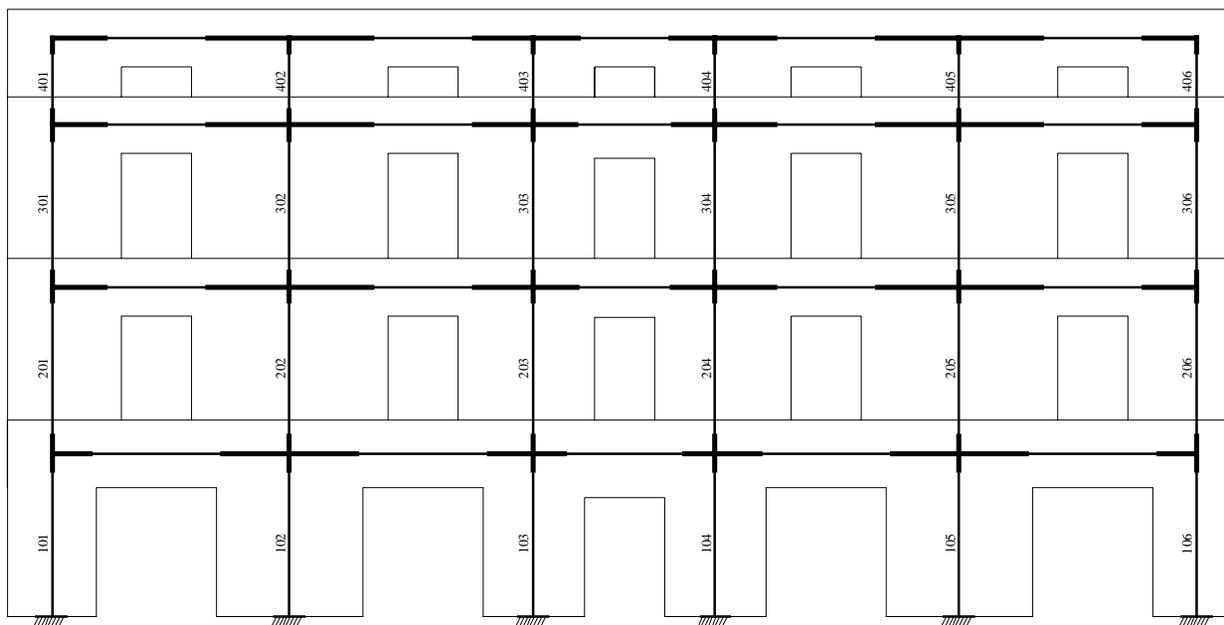


# La carpenteria dei solai

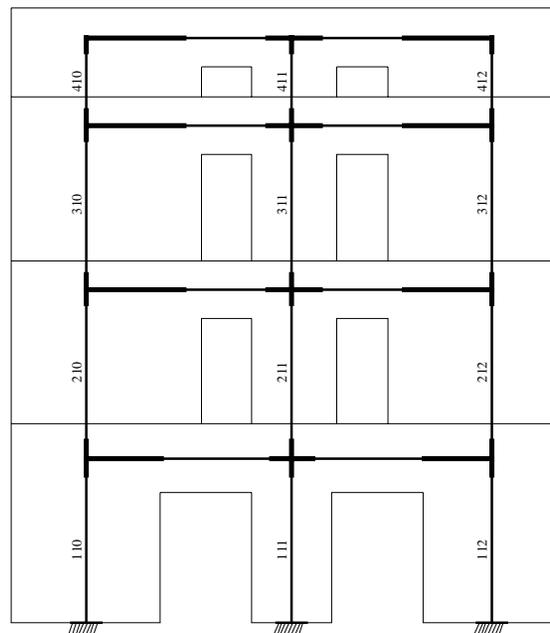
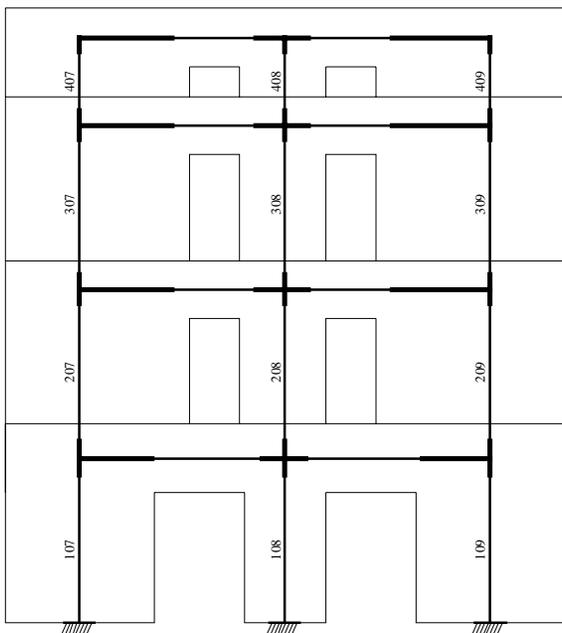


# La schematizzazione dell'edificio

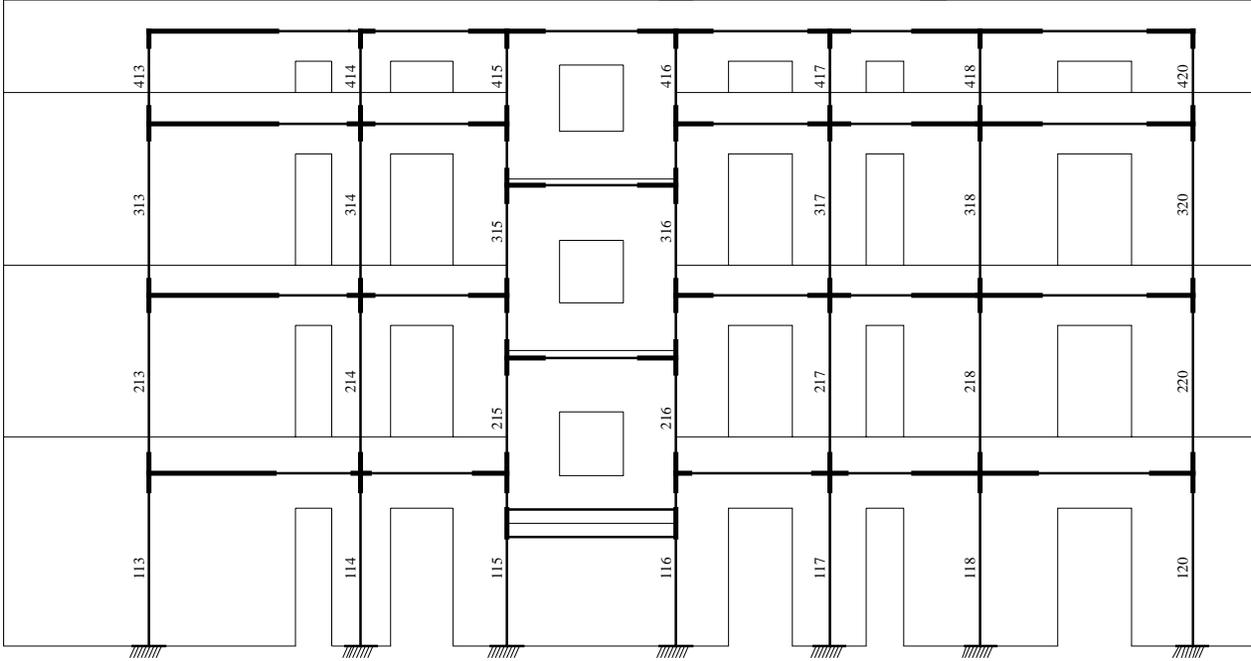
I telai in dir. x: telaio 1



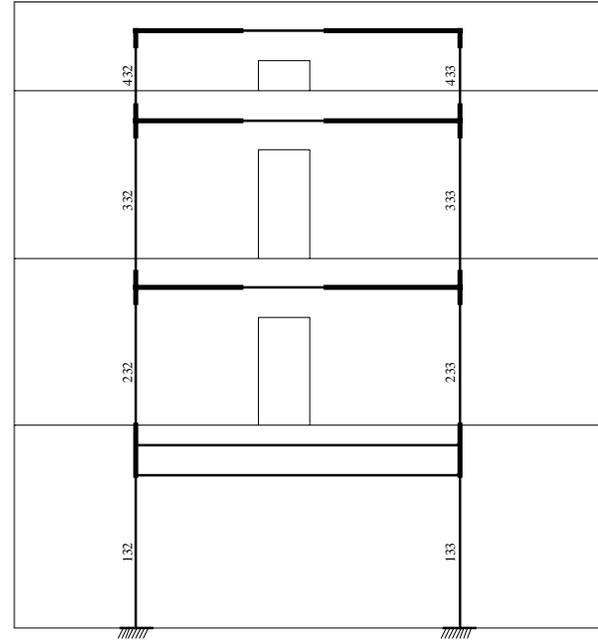
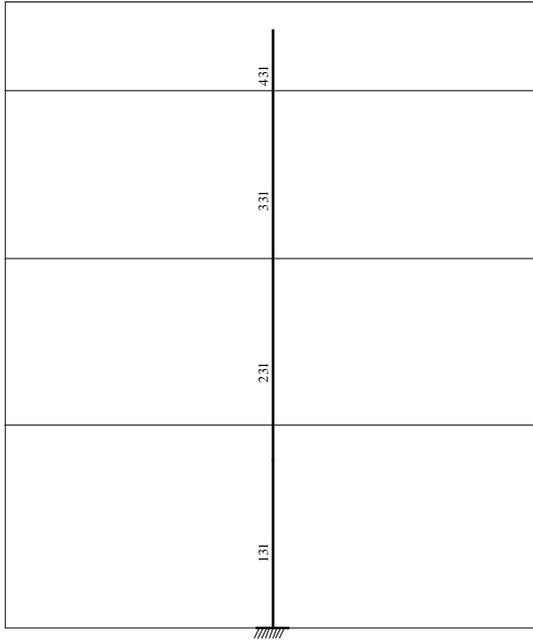
# I telai in dir. x: telai 2 e 3



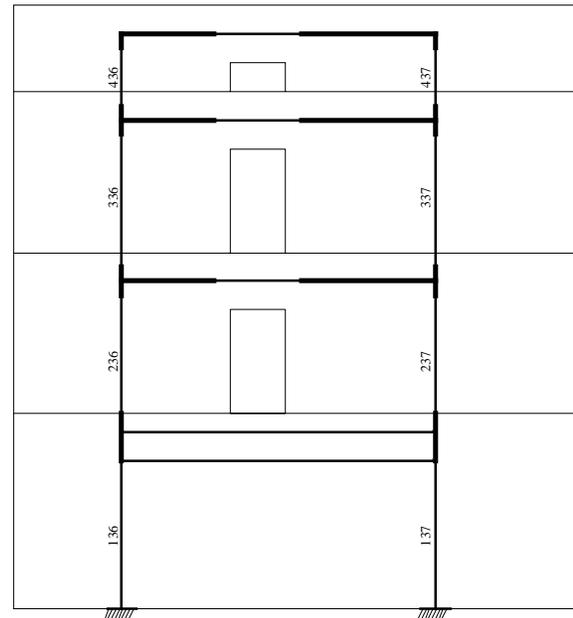
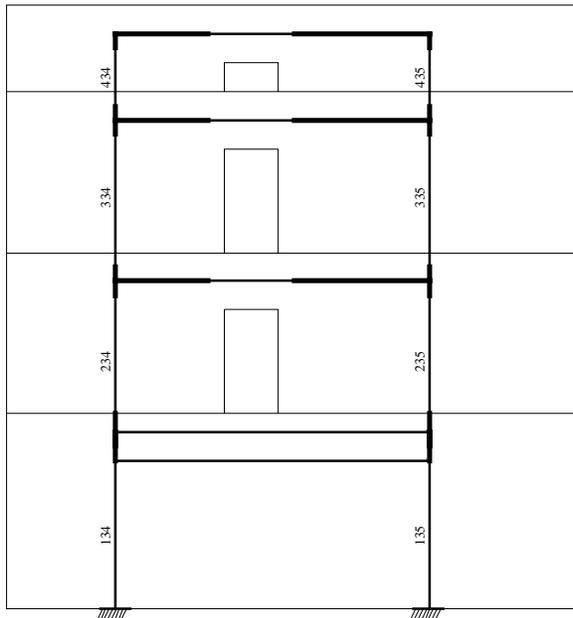
I telai in dir. x: telaio 4



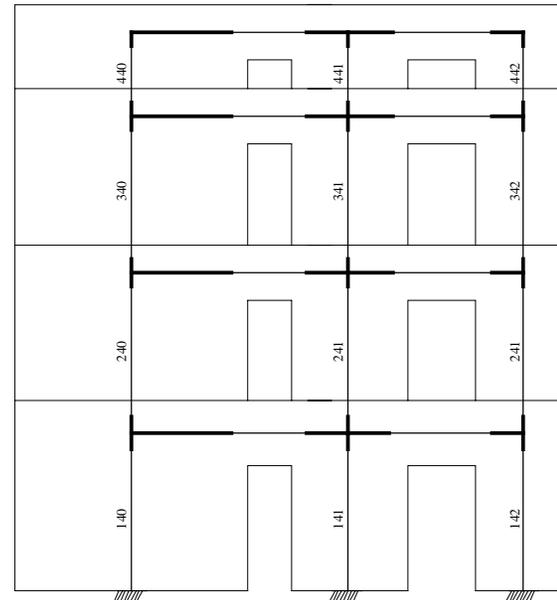
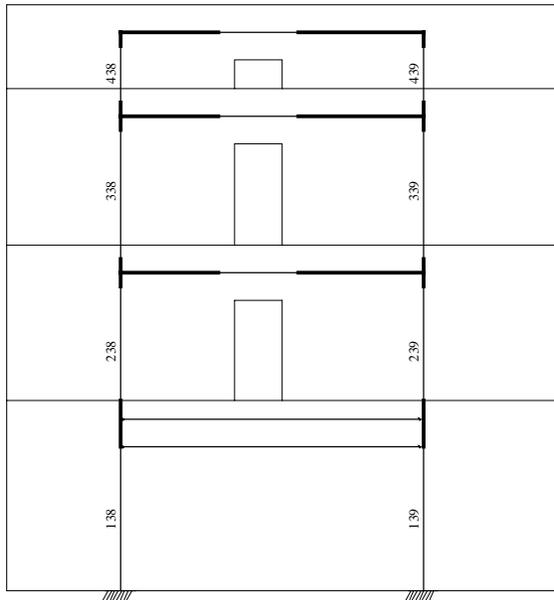
# I telai in dir. y: telai 5 e 6



# I telai in dir. y: telai 7 e 8



# I telai in dir. y: telai 9 e 10

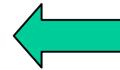


# Valutazione delle azioni sismiche

## Ordinanza - II categoria - suolo tipo B

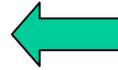
Edificio regolare in pianta e regolare in altezza.  
È applicabile l'analisi statica con  $\lambda = 0,85$

Le pareti verticali esistono a tutti i piani



$$q = 2,0 \times \alpha_u / \alpha_1 = 2,0 \times 1,8 = 3,60$$

Fattore di struttura (edificio nuovo)



$$S_d(T) = a_g S_{2.5} / q = 0,25 \times 2,5 \times 1,25 / 3,6 = 0,174g$$

$$W_{\text{tot}} = 12000 \text{ kN}$$

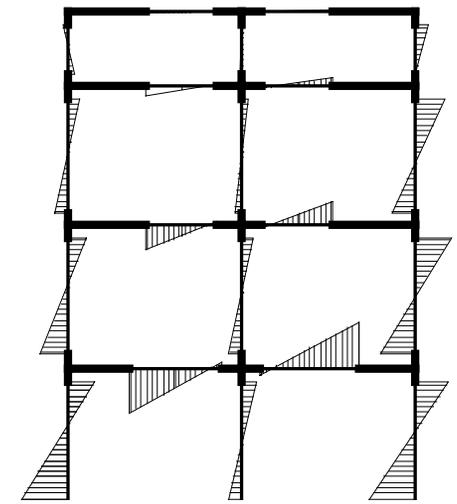
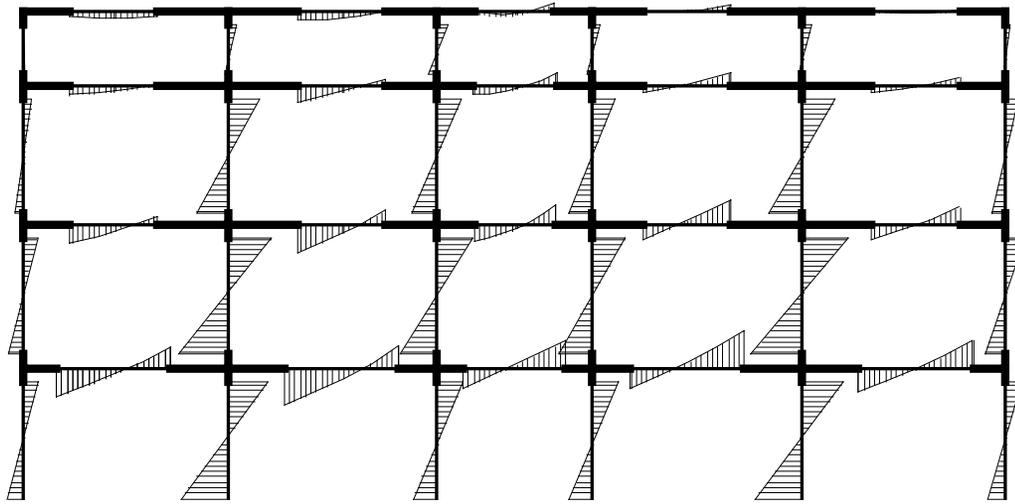
$$F_{\text{tot}} = 12000 \times 0,174 \times 0,85 = 1744 \text{ kN}$$

$$F_1 = 312 \text{ kN}$$

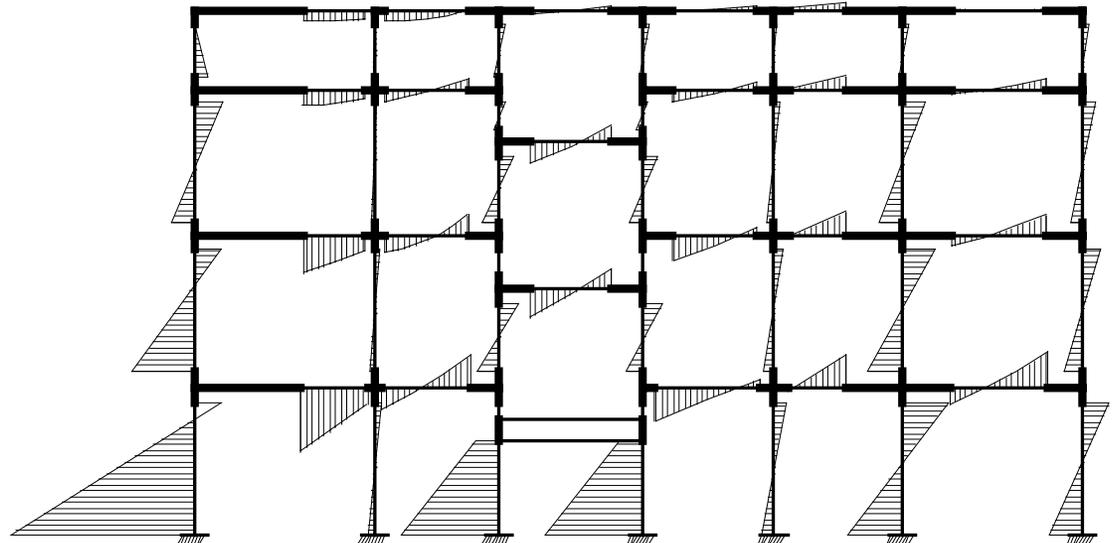
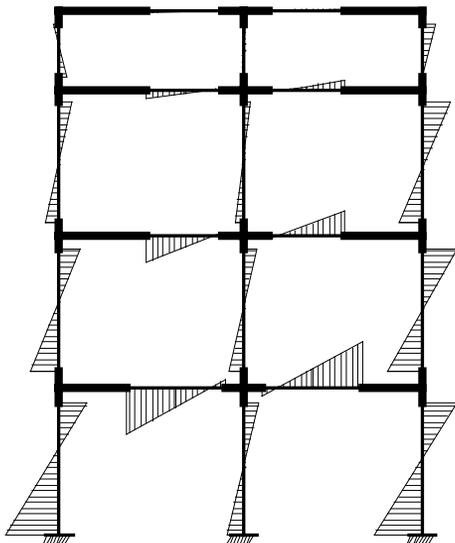
$$F_2 = 459 \text{ kN}$$

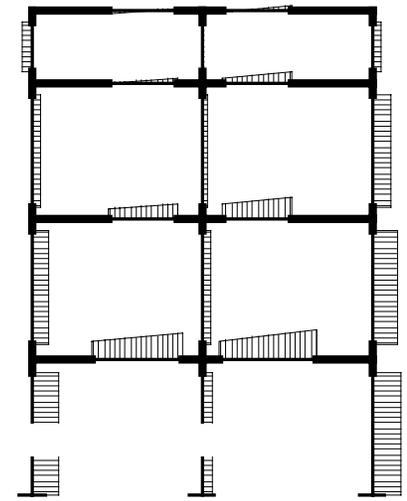
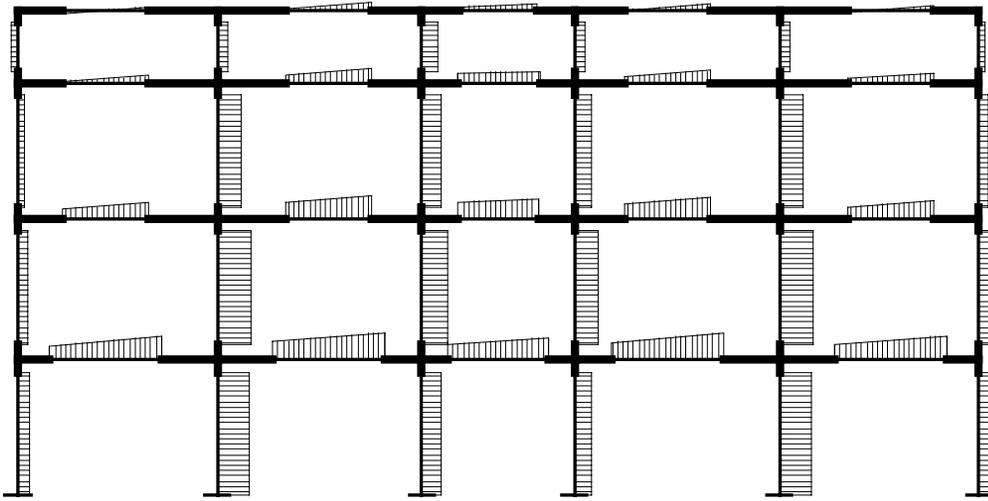
$$F_3 = 669 \text{ kN}$$

$$F_4 = 339 \text{ kN}$$

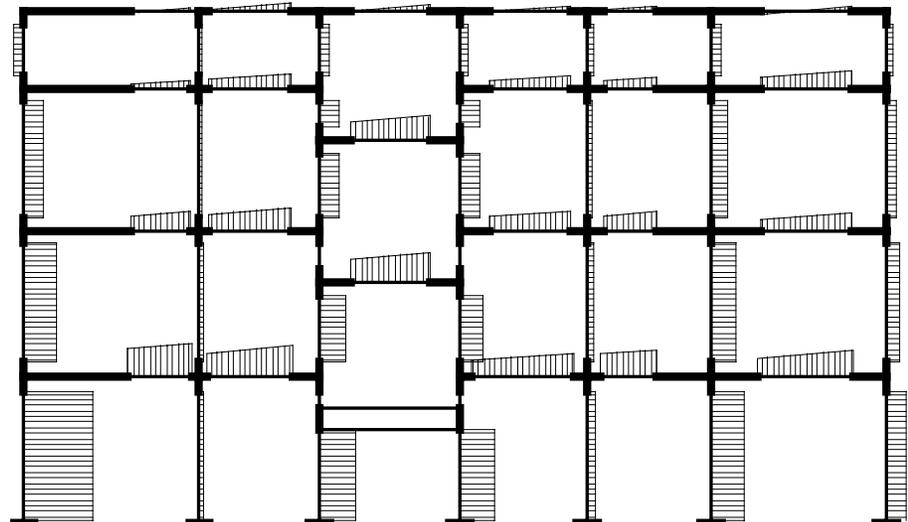
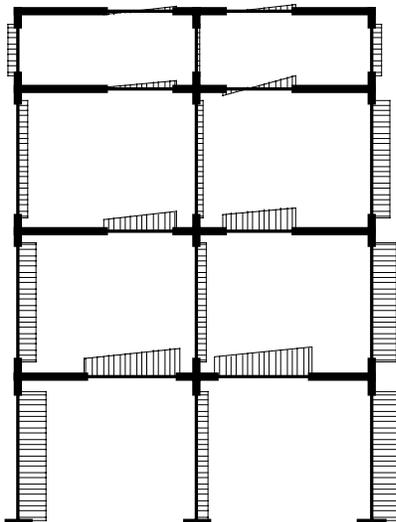


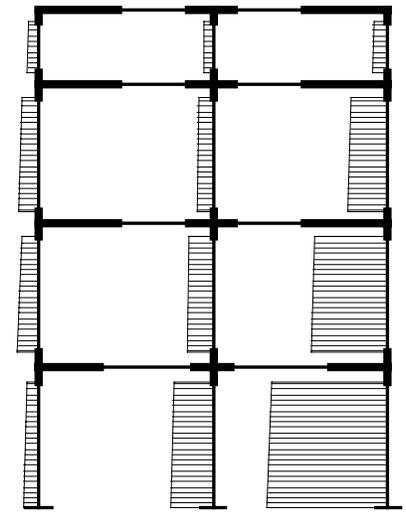
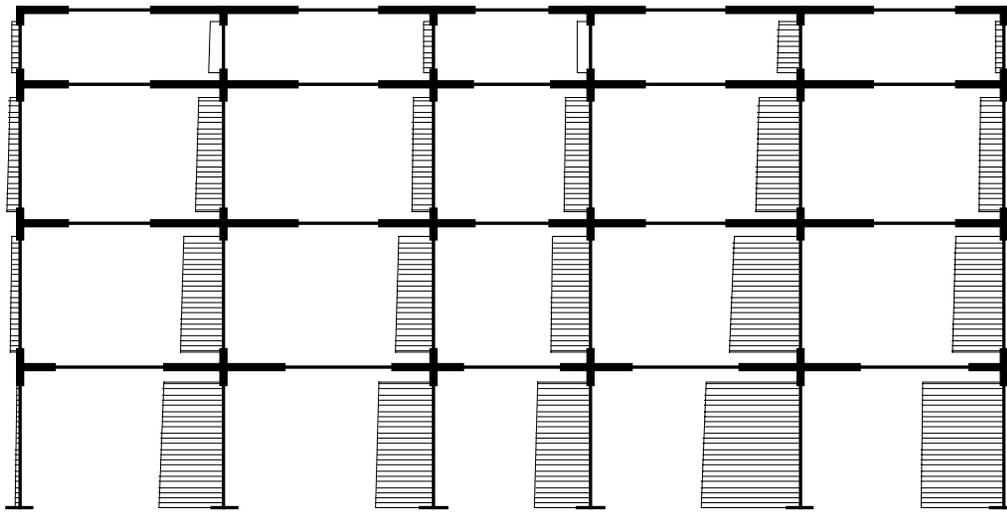
I momenti in dir. x



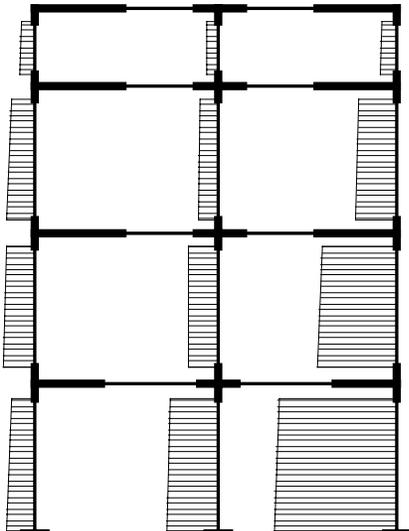


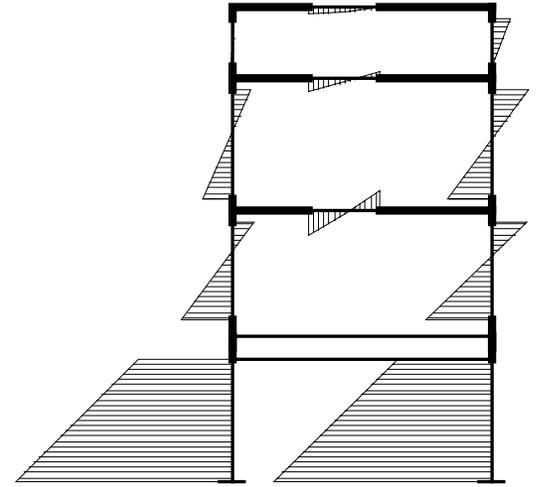
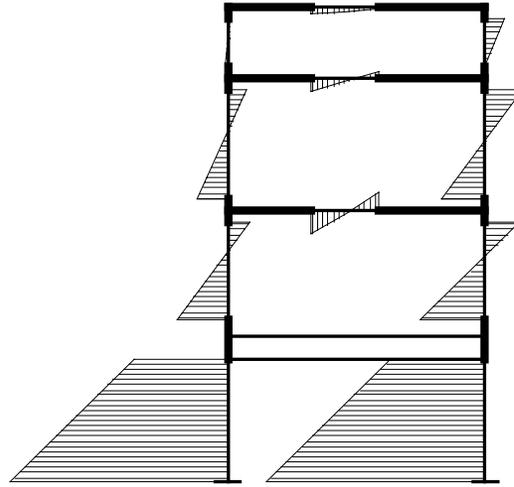
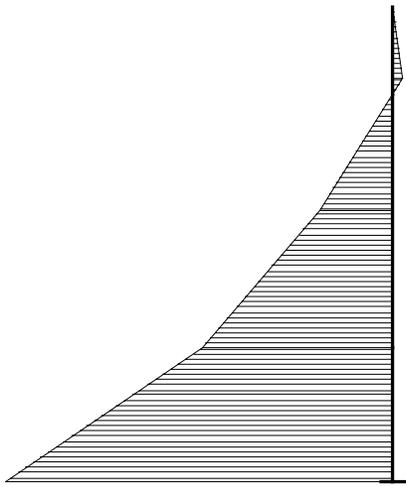
I tagli in dir. x



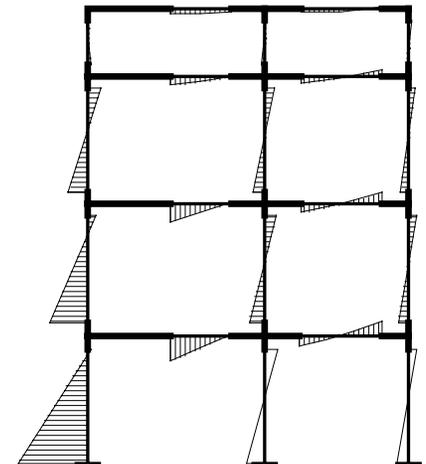
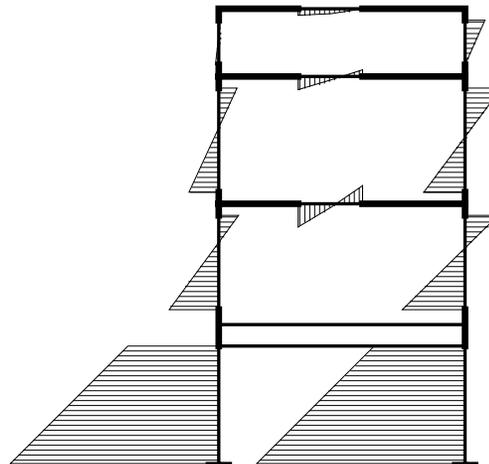
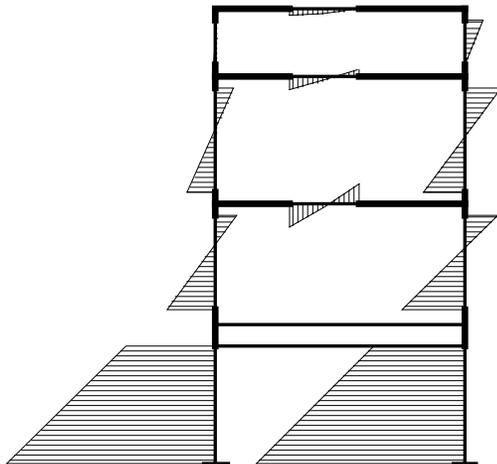


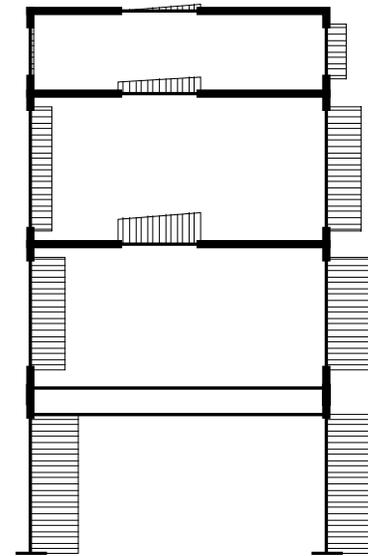
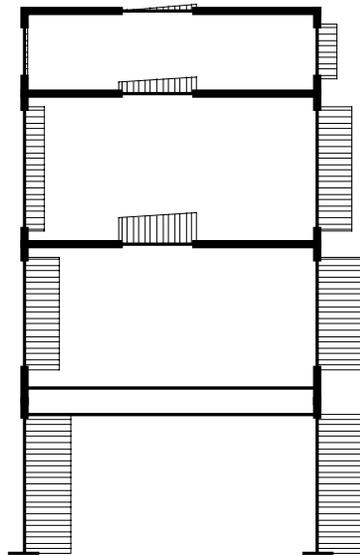
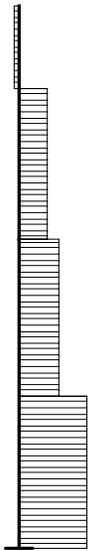
Gli sforzi normali in dir. x



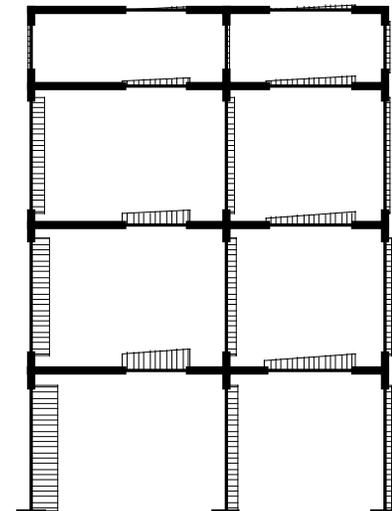
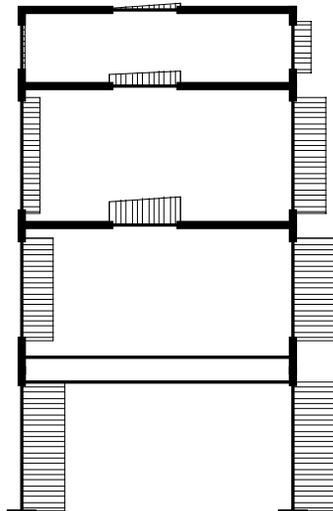
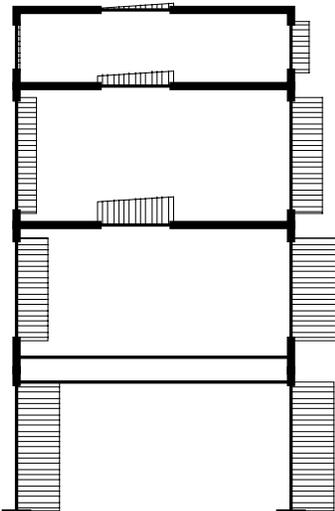


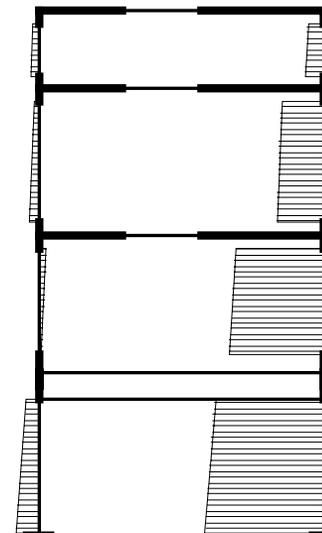
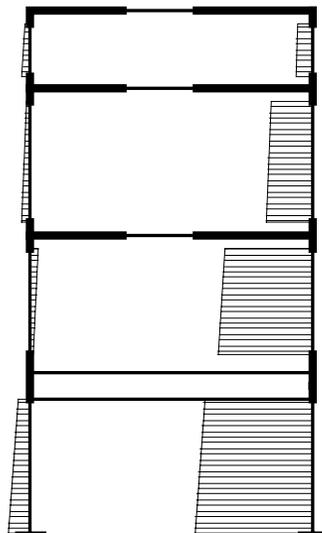
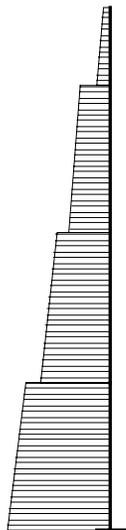
I momenti in dir. y



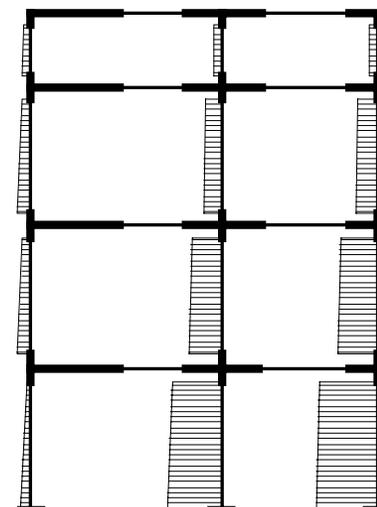
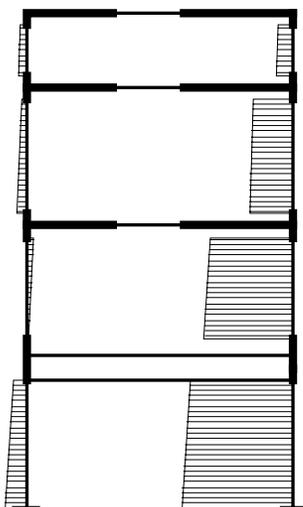
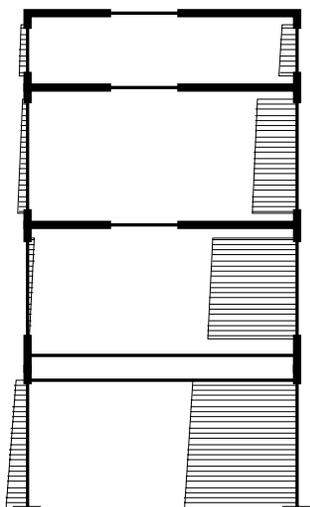


I tagli in dir. y





Gli sforzi normali in dir.  $y$



# Caratterizzazione del materiale

Tufo giallo di ottima qualità  
COMPRESSIONE

Resistenza media degli elementi:  $f_{bm} = 5 \text{ MPa} (50 \text{ kg/cm}^2)$

Resistenza caratteristica  $f_{bk} = 0,75 f_{bm} = 3,75 \text{ MPa}$

Malta tipo M1 (cementizia)

Dalle Tabelle D (D.M. 1987)

$$f_k = 2,7 \text{ MPa}$$

Resistenza di calcolo  $f_d = f_k / \gamma_m / F.C. = 2,7 / 2 = 1,35 \text{ MPa}$

TAGLIO

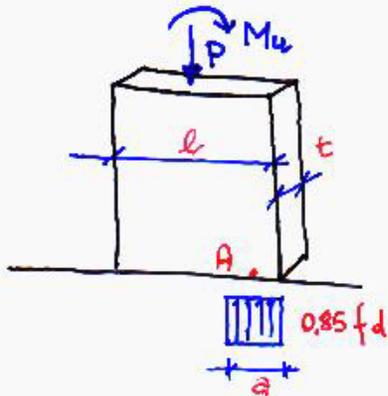
$$f_{vk} = f_{vko} + 0,4 G_0$$

Dalle Tabelle E (D.M. 1987)

$$f_{vko} = 0,2 \text{ MPa} \quad f_{vdo} = 0,2 / 2 = 0,1 \text{ MPa}$$

Modulo elastico:  $E = 2700 \text{ MPa}$

# La verifica dei maschi murari agli stati limite



Equilibrio alle tensioni verticali  
 $P = 0.85 f_d a t \Leftrightarrow a = P / (0.85 f_d t)$

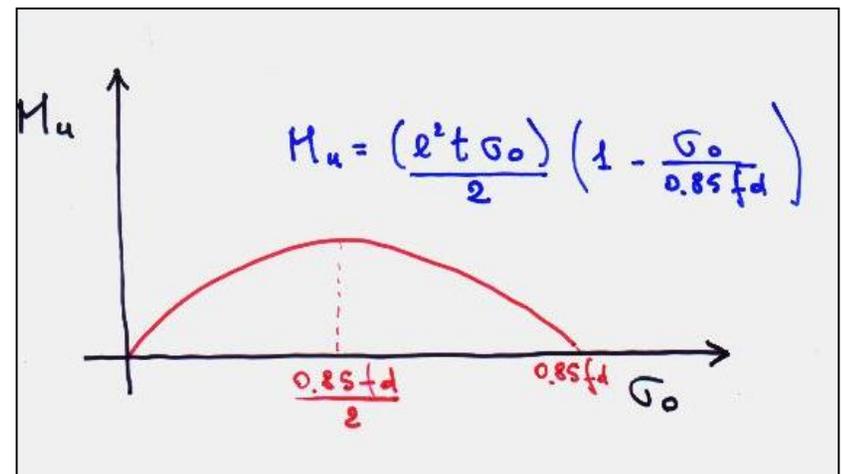
Equilibrio alla rotazione intorno al punto A

$$M_u = P(l - a) / 2$$

esprimendo  $P = \sigma_0 l t$

$$M_u = \sigma_0 l^2 t (1 - \sigma_0 / 0.85 f_d) / 2$$

## Verifica a pressoflessione

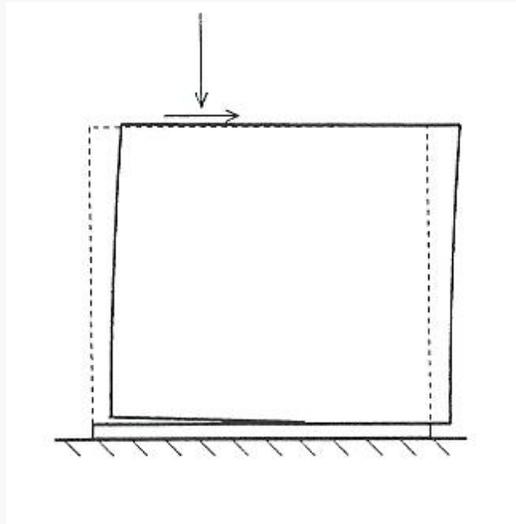


Le verifiche a pressoflessione sono soddisfatte in tutti i maschi murari

# La verifica dei maschi murari agli stati limite

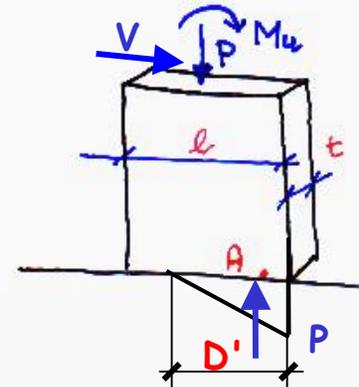
## Verifica a taglio

### Rottura per scorrimento



$$f_{vk} = f_{vk0} + 0.4 \sigma_m$$

### La formula dell'Ordinanza per edifici nuovi

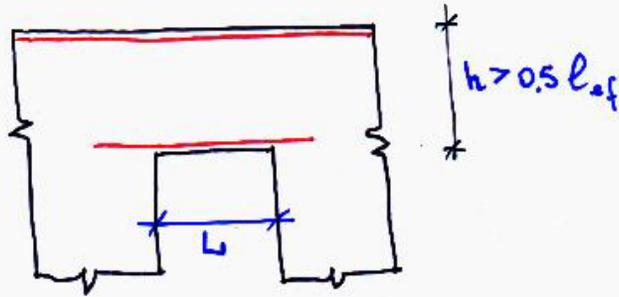


$$\begin{aligned} V_{ult} &= (f_{vk} D't) / \gamma_m = \\ &= (f_{vk0} D't) / \gamma_m + 0.4 P / \gamma_m \end{aligned}$$

Le verifiche a taglio sono soddisfatte in tutti i maschi murari

# La verifica delle fasce di piano agli stati limite per flessione e taglio

- a) in assenza di cordoli di piano, piattabande etc risulteranno strutturalmente deboli e configureranno lo schema "a fasce di piano deboli."
- b) in presenza di cordoli, piattabande etc. si può fare riferimento ai criteri del ECG



$$l_{ef} = 1.15 L$$

$$M_{Rd} = A_s \cdot f_{yk} \cdot z / \gamma_s \quad (\text{acciaio})$$

$$M_{Rd} = 0.4 \cdot f_k \cdot b d^2 / \gamma_m \quad (\text{muratura})$$

ove  $z$  "braccio della coppia interna" =

$$= \min (0.7 l_{ef}; 0.4 h + 0.2 l_{ef})$$

ove  $d$  "altezza utile efficace"  $d = 1.25 z$

## Verifica a flessione

## Verifica a taglio

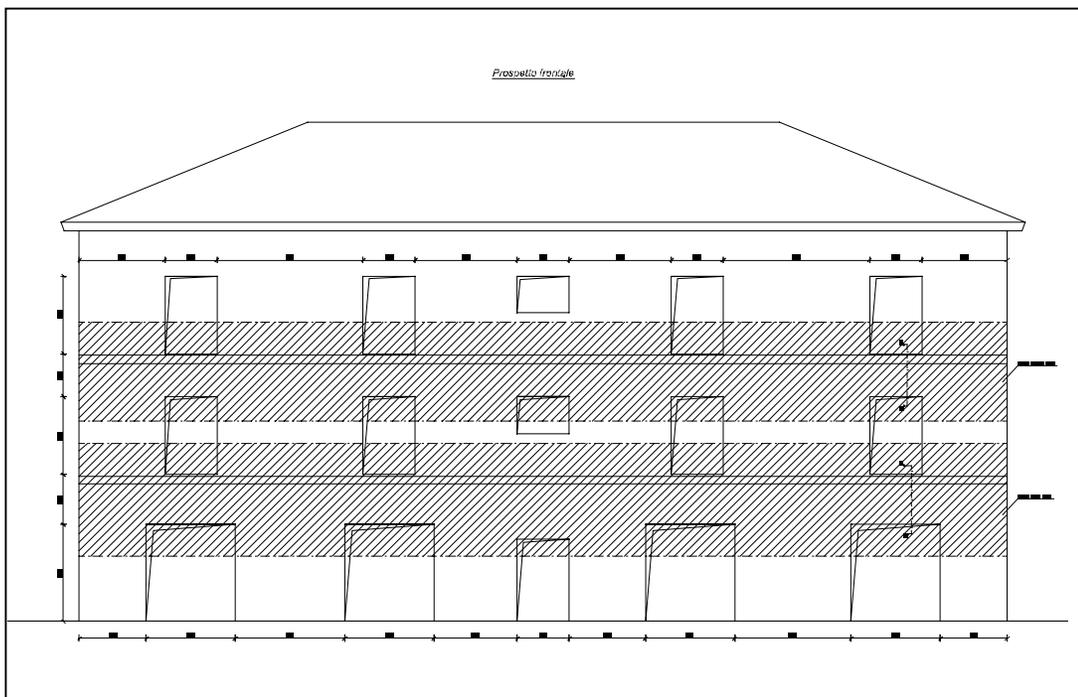
In assenza di armature a taglio:

$$V_d \leq V_{rd1}$$

$$V_{rd1} = f_{vk} b d / \gamma_m$$

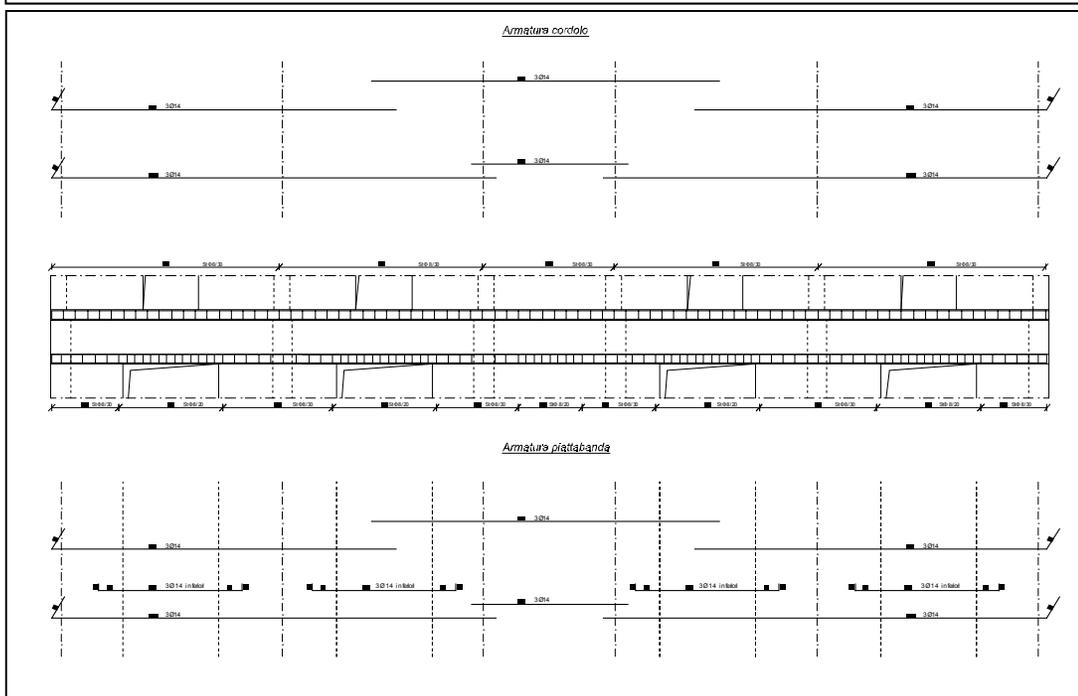
Con armature a taglio:

$$V_{rdmax} = 0.3 f_{bd} t d$$



I cordoli di piano e le piattabande (continue) sui vani

Costituiscono le armature delle fasce di piano (trasversi)



Le verifiche a flessione e taglio delle fasce sono tutte soddisfatte portando in conto anche il cls dei cordoli e delle piattabande.