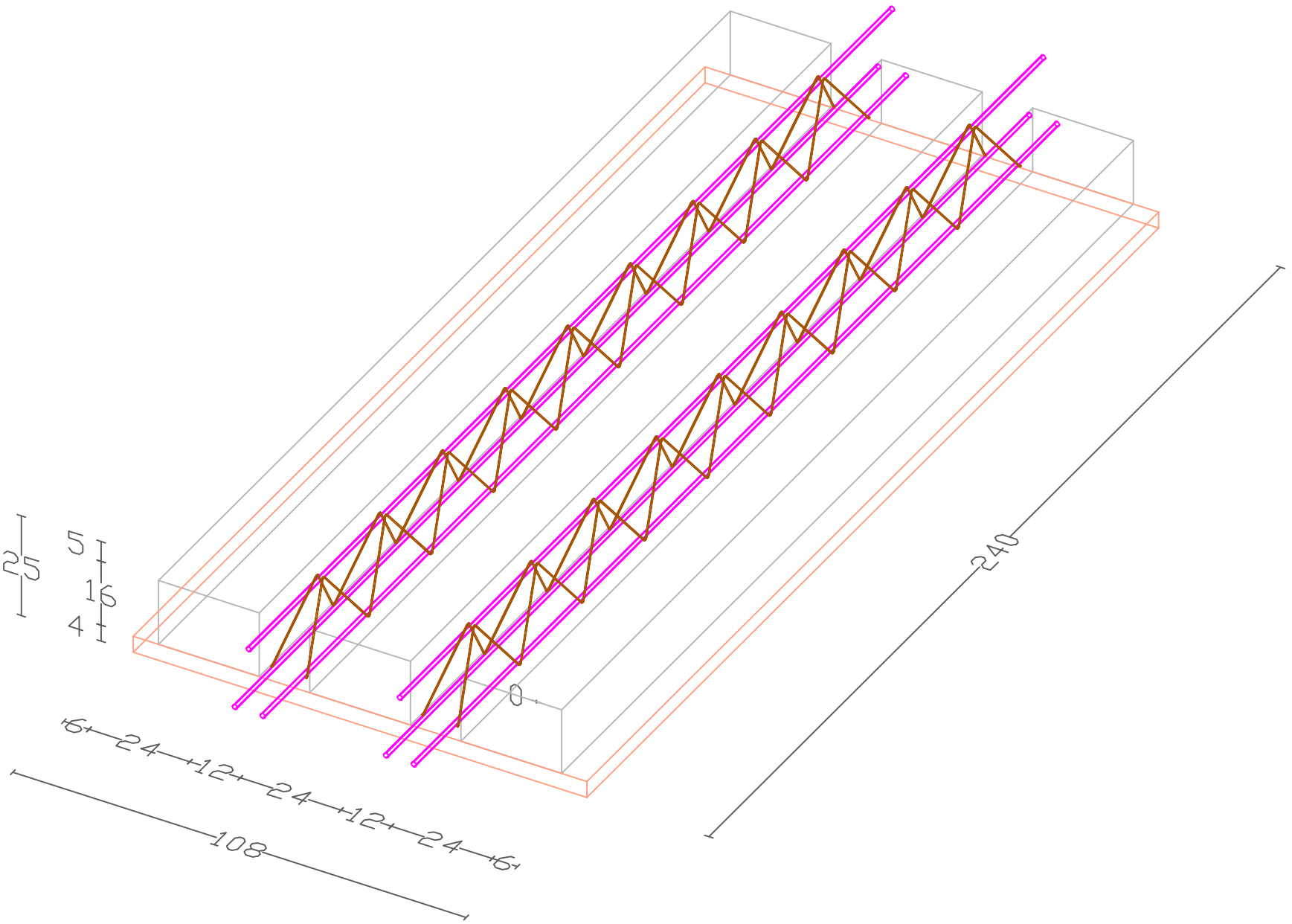
2
5
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108
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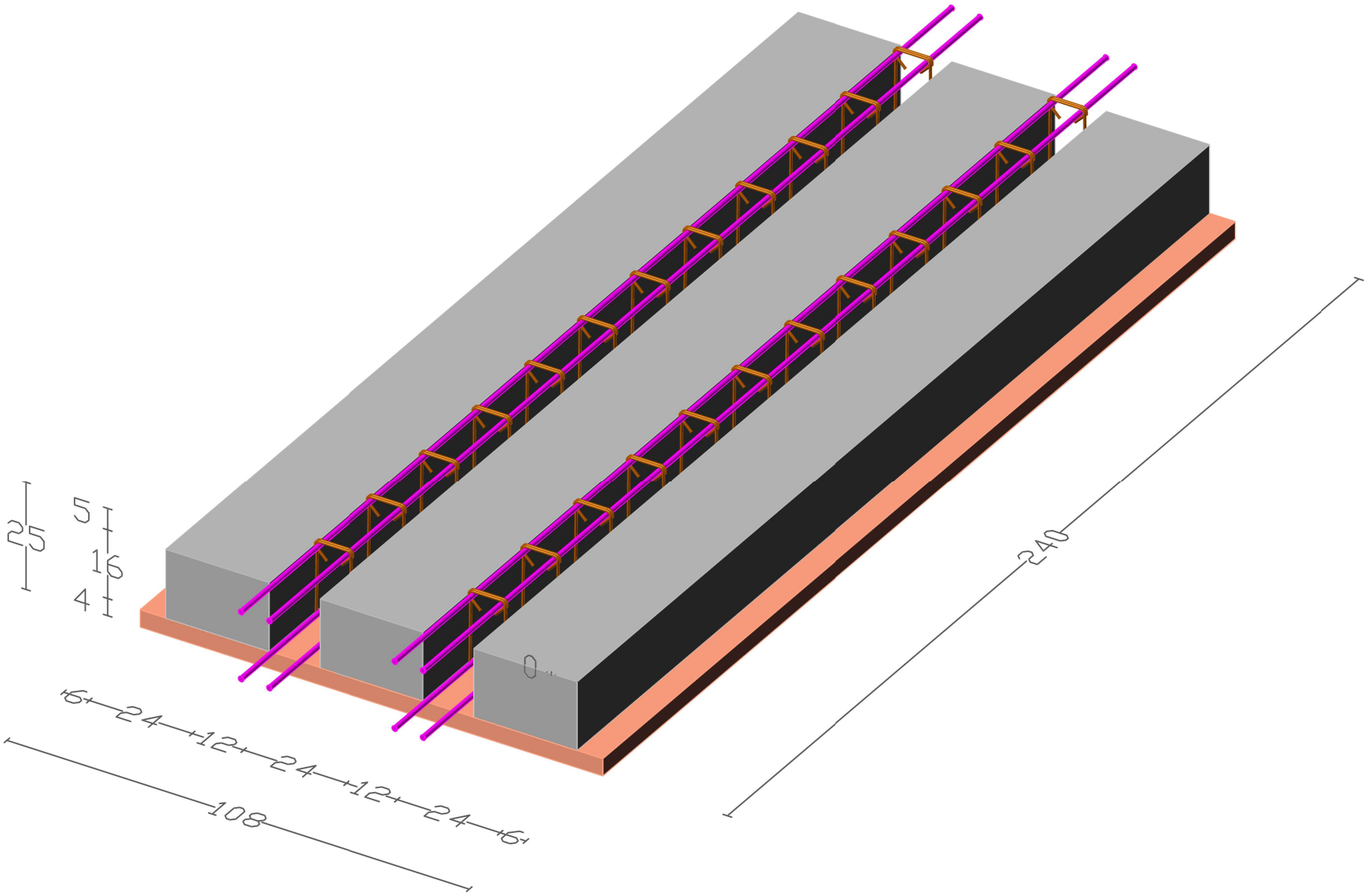
25
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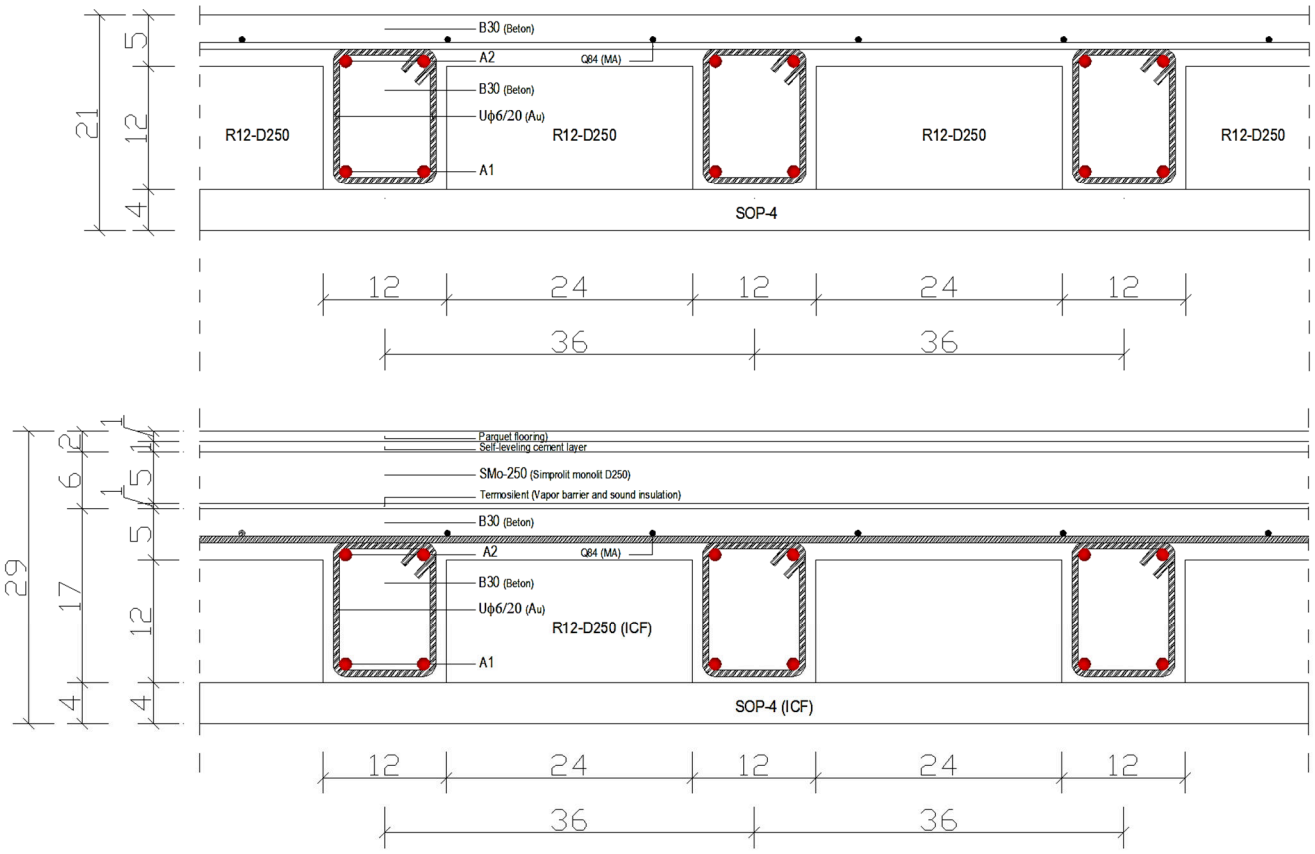
CONTROL STATIC CALCULATION

A/ INTER-STOREY (MEZZANINE) SIMPROLIT SMP CONSTRUCTIONS

Load analysis

1. CONSTANT LOAD /DEAD LOAD/



1.1. Self load /Dead load/
0,12x0,12x25/0,36 + 0,24x0,12x2,5/0,36+0,04x1,6+0,05x25=
=1,00+0,20+0,06+1,25=2,51 kN/m^2

1.2. Termosilent (Vapor barrier and sound insulation)
0,35x0,01=0,0035 kN/m^2 ~ 0,01

1.3. SMo-D250 (Simprolit monolit 250 kg/m^3)
0,05x2,5=0,125 ~ 0,13 kN/m^2

1.4. Self-leveling cement layer
0,01x14,0=0,14 kN/m^2

1.5. Parquet
0,01x8,0= 0,008 kN/m^2

1.6. Partition walls, ceiling
= 1,00 kN/m^2

TOTAL CONSTANT LOAD /DEAD LOAD/ g = 3,80 kN/m^2

2. PAYLOAD - OCCASIONAL LOAD (LIVING QUARTERS) p=2,0 kN/m^2

MAXIMUM IMPACTS:

POS 101; POS 201
L_{0max} = 5,81 m
Adopted:
* thickness of R/B pressed plate = 5cm
* rib height = 12cm
* height of ribs + plates = 17 cm
* total thickness (SOP-4 + rib + plate) = 21 cm
* assumed reinforcement of the lower rib zone: A_1= 2Rϕ14
* adopted reinforcement of the upper rib zone: A_2= 2Rϕ12
* adopted stirrups = Uϕ6/20
* B30 → f_b=2,05 kN/cm^2
* RA400/500 → σ_v = 40,0 kN/cm^2

Rib load (corresponding width B=36cm, b_0=12cm)
q_{gr}=0,36 x g = 0,36 x 3,8 = 1,368 kN/m
q_{pr}=0,36 x p = 0,36 x 2,0 = 0,72 kN/m
M_{gr}= q_{gr} x l^2/8 = 1,368 x 5,81^2/8 = 5,77 kNm
M_{pr}= q_{pr} x l^2/8 = 0,72 x 5,81^2/8 = 3,04 kNm
T_{gr}=0,5 x q_{gr} x l = 0,5 x 1,368 x 5,81 = 3,97 kN
T_{pr}=0,5 x q_{pr} x l = 0,5 x 0,72 x 5,81 = 2,09 kN

M_{ur} =1,6 x M_{gr} + 1,8 x M_{pr} = 1,6 x 5,77 + 1,8 x 3,04 = 14,70 kNm
T_{ur} =1,6 x T_{gr} + 1,8 x T_{pr} = 1,6 x 3,94 + 1,8 x 2,09 = 10,07 kN

h_r = 15,0 cm

$$k=\frac{h}{\sqrt{M_u / B \times f_b}}$$

k= h_r / (M_{ur} / B x f_b) ^{½}
k= 15 /(14,70x100/36x2,05) ^{½} = 15 / 4,463=3,361
μ=9,421
s=0,151
εa/εb=10/1,775
x=s * h =0,151 * 15,0 = 2,265 cm < d_{pl} =5,0 cm
The neutral line is in the plate, the section is dimensioned as rectangular:

$$A_p = \mu \times \frac{B \times h}{100} \times \frac{f_b}{\sigma_v}$$

A_p = 8,851*(36,0*15,0)/100 * 2,05/40 = 2,45 cm^2

Adopted: A_1=2Rϕ14 (3,08cm^2>2.45cm^2)
A_2=2Rϕ12;
Uϕ6/20;
+ in pressure plate MA 500/560: reinforcing mesh Q84 (ϕ4/15/15)
+ transverse beams for stiffening:
b/d=10/17 at a distance of max 240 cm, reinforced with: ± 2Rϕ12, Uϕ6/36

POS 102-POS105; POS 202-POS205

L_{0max} = 4,33 m

Adopted:

* thickness of R/B pressed plate = 5cm
* rib height = 12cm
* height of ribs + plates = 17 cm
* total thickness (SOP-4 + rib + plate) = 21 cm
* assumed reinforcement of the lower rib zone: A_1= 2Rϕ12
* adopted reinforcement of the upper rib zone: A_2= 2Rϕ12
* adopted stirrups = Uϕ6/20
* B30 → f_b=2,05 kN/cm^2
* RA400/500 → σ_v = 40,0 kN/cm^2

Rib load (corresponding width B=36cm, b_0=12cm)

q_{gr}=0,36 x g = 0,36 x 3,8 = 1,368 kN/m

q_{pr}=0,36 x p = 0,36 x 2,0 = 0,72 kN/m

M_{gr}= q_{gr} x l^2/8 = 1,368 x 4,33^2/8 = 3,21 kNm

M_{pr}= q_{pr} x l^2/8 = 0,72 x 4,33^2/8 = 1,69 kNm

T_{gr}=0,5 x q_{gr} x l = 0,5 x 1,368 x 4,33 = 2,96 kN

T_{pr}=0,5 x q_{pr} x l = 0,5 x 0,72 x 4,33 = 1,56 kN

M_{ur} =1,6 x M_{gr} + 1,8 x M_{pr} = 1,6 x 3,21 + 1,8 x 1,69 = 8,18 kNm

T_{ur} =1,6 x T_{gr} + 1,8 x T_{pr} = 1,6 x 2,96 + 1,8 x 1,56 = 7,54 kN

h_r = 15,0 cm

$$k=\frac{h}{\sqrt{M_u / B \times f_b}}$$

k= h_r / (M_{ur} / B x f_b) ^{½}

k= 15 /(8,18x100/36x2,05) ^{½} = 15 / 3,329=4,505

μ=5,143

s=0,107

εa/εb=10/1,2

x=s * h =0,107 * 15,0 = 1,605 cm < d_{pl} =5,0 cm

The neutral line is in the plate, the section is dimensioned as rectangular:

$$A_p = \mu \times \frac{B \times h}{100} \times \frac{f_b}{\sigma_v}$$

A_p = 5,143*(36,0*15,0)/100 * 2,05/40 = 1,42 cm^2

Adopted: A_1=2Rϕ12 (2,26cm2>1.42cm2)

A_2=2Rϕ12;

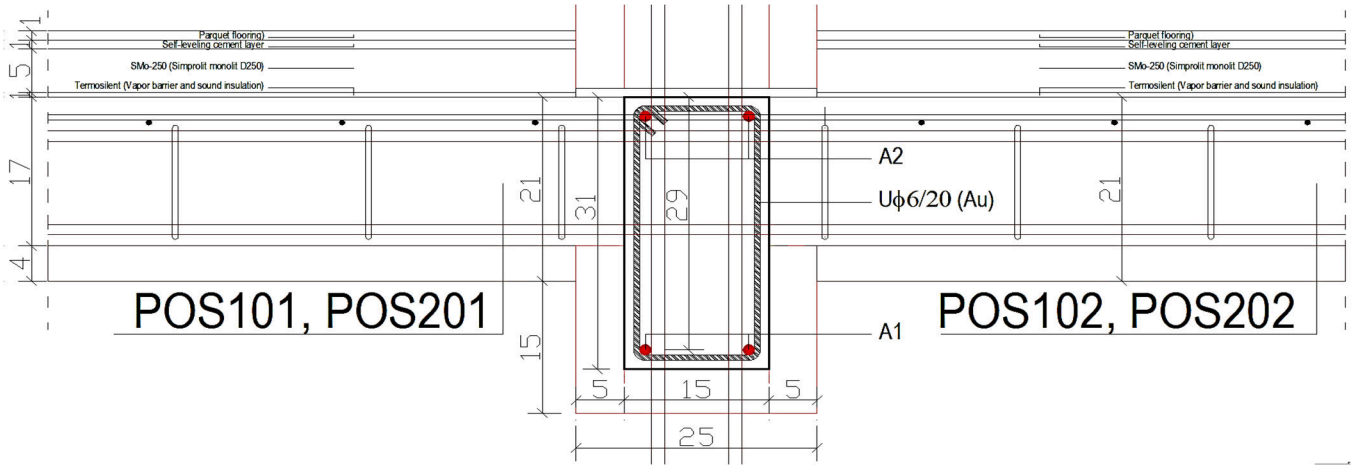
Uϕ6/20;

+ in pressure plate MA 500/560: reinforcing mesh Q84 (ϕ4/15/15)

+ transverse beams for stiffening:

b/d=10/17 at a distance of max 240 cm, reinforced with: ± 2Rϕ12, Uϕ6/36

B/ CERCLAGE BEAM ABOVE BEARING WALLS



L_{max} = 3,00 m

Adopted:

* width of R/B serclage beam b=15cm
* height of R/B cerclage beam d=31cm
* assumed reinforcement of the lower zone of the cerclage beam: A_1= 2Rϕ12
* adopted reinforcement of the upper zone of the cerclage beam: A_2= 2Rϕ12
* adopted stirrups = Uϕ6/20
* B30 → f_b=2,05 kN/cm^2
* RA400/500 → σ_v = 40,0 kN/cm^2

BEAM LOAD:

*own weight: 0,15 x 0,31 x 25,0 + 0,55 x 0,05 x 1,80 = 1,163+0,05=1,21 kN/m

*$T_{g,POS101}$ = 3,97 kN/m

*$T_{g,POS102}$ = 2,96 kN/m

T_g=1,21+3,97+2,96=8,14 kN/m

*$T_{p,POS101}$ = 2,09 kN/m

*$T_{p,POS102}$ = 1,56 kN/m

T_p=3,65 kN/m

Mg=8,14 x 3,0^2 / 10 =7,326 kNm

Mp=3,65x3,0^2 / 10 = 3,285 kNm

M_u =1,6 x M_g + 1,8 x M_p = 1,6 x 7,326 + 1,8 x 3,285 = 17,63 kNm

T_u=1,6 x 8,14 + 1,8 x 1,56 = 15,83 kN

h_g=29cm

$$k=\frac{h}{\sqrt{M_u / B \times f_b}}$$

k=29/(17,63x100/15x2,05)$^{1/2}$ = 29/7,572 = 3,830

μ=7,149

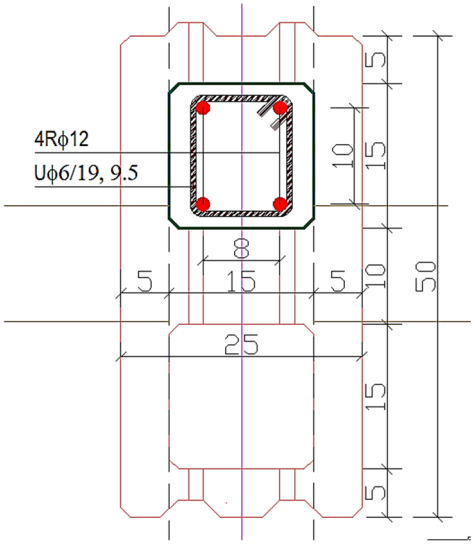
s=0,129

$$A_p = \mu \times \frac{B \times h}{100} \times \frac{f_b}{\sigma_v}$$

A = 7,149*15*29/100*2,05/40=1,60cm^2

Adopted: A_1=A_2=2Rϕ12, Uϕ6/19

COLUMN IN SIMPROLIT BLOCK:



Section of concrete inside a column in Simprolit block SBDN-25
b/d=15/15

Table: Coefficients of reduction ψ force Nu:

h/t_{ef}	0,1,2,3,4	6	8	10	12	14	16	18	20	22	24	30
ψ	0,90	0,88	0,86	0,84	0,80	0,77	0.72	0,68	0,63	0,58	0,52	0,37

* According to EUROCODE 6, the effective width of the multi-layer block (15cm concrete + 2x5cm simprolite block walls)
$t_{ef}=(15^3 + 10^3)^{1/3} = (4375)^{1/3}=16,355$
h/t_{ef} =300/16,355=18,343 => ψ=0,68
$N_0=A_b$ x f_b + A_a x σ_v = 15x15x2,05 + 4 x 1,54 x 40 = 461,25 + 246,4 = 707,65 kN
$N_{r,max}$ = 0,68 x 707,65 = 481,2 kN
T_u=1,9 x 8,14 + 2,1 x 1,56 = 18,74 kN

* For the sake of simplified calculations, the roof is counted as the third floor, so it follows:
$N_{u,max}$=3 x T_u x (3,0 + 1,75)/2 = 3 x 18,74 x (3,0+1,75)/2 = 133,52 kN <<481,2 κN = $N_{r,max}$

Adopted for R/C (Reinforced Concrete) column in the block:
* dimensions of the concrete section b/d=15/15
* reinforcement in the column:
- by column height: 4Rϕ12,
- stirrups Uϕ6/19 (thickened to 9.5 cm in 3 blocks below and above the mezzanine plate)

Important:
* In the middle walls - in the 1, 4, 7... block, horizontal reinforcement Rϕ8 on both sides (in the channel in the Simprolit block)
* In facade walls - in 1, 4, 7...block, horizontal reinforcement Rϕ8 inward (in channel in Simprolit block)