

Soil Pressure calculation

$Q_d = \gamma \cdot h \cdot K_0$		
	33,5	Kn/m
γ	20	Kn/m ³
h	3,35	mm
K_0	0,5	
P_x	Irrelevant in this situation	
W	56,1125	Kn
M_{maxq}	24,11743306	Kn/m
M_{maxq}	$1/8 \cdot 0,5 \cdot Q_d \cdot h^2$	
M_{maxq}	23,4	Kn/m

VERTICAL LOAD - BASEMENT WALL

Soil pressure : 23,4 kN

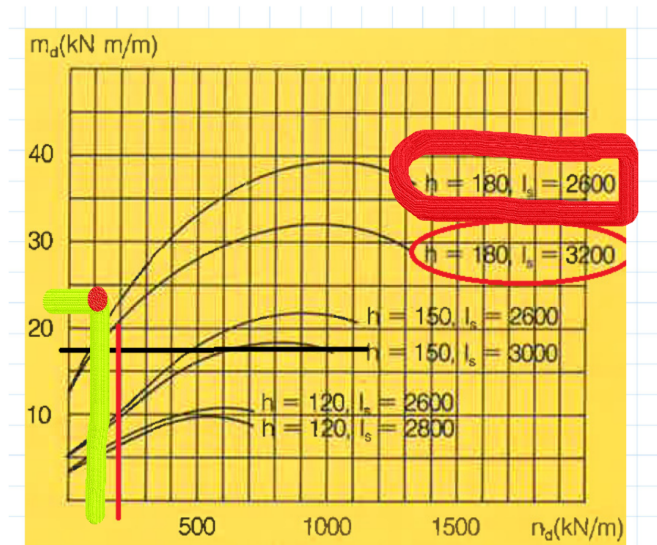
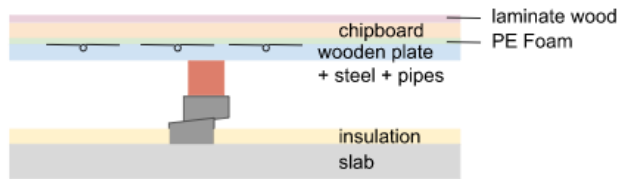


Fig 2. M-N diagram from Betonelementforeningen Bind 2

COMPONENTS

FLOOR

Component	Thickness [m]	Width [m]	Length [m]	Spacing x [m]	Spacing y [m]	Spacing %	Density kN/m3	Load kN/m2
Laminate wood	0,014	1	1	1	1	1	4,5	0,06
Chipboard	0,016	1	1	1	1	1	7,5	0,12
PE Foam	0,002	1	1	1	1	1		0,00
Wooden floor heati	0,022	1	1	1	1	1	7,5	0,17
Wooden Batten	0,075	0,038	1	0,6	1	1	7	0,03
Wedge	0,77	0,06	0,06	0,6	0,6	1	6,4	0,05
Insulation	0,07	1	1	1	1	1	1,6	0,11
Hollow core								3,10



Basement floor *(for foundations calculation)*

insulation	0,15	1	1	1	1	1	1,6	0,24
insulation	0,15	1	1	1	1	1	1,6	0,24
concrete	0,1	1	1	1	1	1	23	2,30
screed	0,15	1	1	1	1	1	23	3,45
epoxy	0,1	1	1	1	1	1	10,7	1,07
TOTAL =							7,30	

WALLS

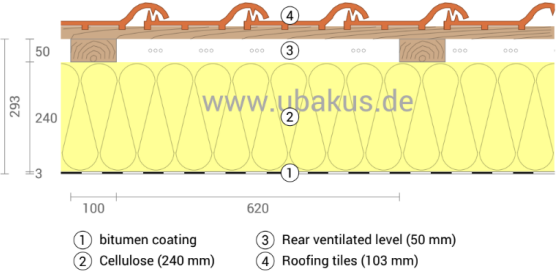
Component	Thickness [m]	Width [m]	Length [m]	Spacing x [m]	Spacing y [m]	Spacing %	Density kN/m3	Load kN/m2
External walls								
Brick	0,108	1	1	1	1	1	18	1,94
Insulation	0,24	1	1	1	1	1	5	1,20
Concrete								3,30
							TOTAL =	6,44

Basement walls *(for foundations calculation)*

concrete	0,18	1	1	1	1	1	25	4,50
insulation	0,24	1	1	1	1	1	5	1,20
TOTAL =								5,70

ROOF

Component	Weight kg/m²	Load kN/m2
bitumen coating	3,20	0,32
cellulose	14,40	1,44
tiles	51,50	5,15
TOTAL =		6,91



Vertical Load

Building component	Characteristic load				CC2		ψn	γ	Reduction factor for openings	Design load	Notes
	g [kN/m²]	q [kN/m²]	Tributary area span [m]	Load pr. meter [kN/m]	Consequeunce class factor	Category	Combination factor	Safety factor		Total load [kN/m]	
Dead load											
Roof	6,91		4,0	27,6	1,0		1	1,0	1,00	27,64	
Flooring roof	3,64		4,0	14,6	1,0		1	1,0	1,00	14,57	
Wall 4 floor	6,44		3,0	19,3	1,0		1	1,0	1,00	19,33	
Flooring 4 floor	3,64		4,0	14,6	1,0		1	1,0	1,00	14,57	
Wall 3 floor	6,44		3,0	19,3	1,0		1	1,0	1,00	19,33	
Floor 3 floor	3,64		4,0	14,6	1,0		1	1,0	1,00	14,57	
Wall 2 floor	6,44		3,0	19,3	1,0		1	1,0	1,00	19,33	
Floor 2 floor	3,64		4,0	14,6	1,0		1	1,0	1,00	14,57	
Wall 1 floor	6,44		3,0	19,3	1,0		1	1,0	1,00	19,33	
Floor 1 floor	3,64		4,0	14,6	1,0		1	1,0	1,00	14,57	
Imposed load									$\Sigma G_d =$	177,82	
Residence 1 floor		1,50	4,0	6,0	1,0	A1	1	1,5	0,667	6,00	Residence dominant for all the floors
Residence 2 floor		1,50	4,0	6,0	1,0	A1	1	1,5	0,667	6,00	
Residence 3 floor		1,50	4,0	6,0	1,0	A1	1	1,5	0,667	6,00	
Residence 4 floor		1,50	4,0	6,0	1,0	A1	1	1,5	0,667	6,00	
Climatic loads											
Snow		0,80	1,0	0,8	1,0		0,30	1,5		0,36	
Wind		-1,20	1,0	-1,2	1,0		0,30	0		0,00	Wind upward is negative, the safety facto is 0 so the wind doesn't make the building lighter.
									$\Sigma S_d =$	202,19	Total last pr. meter [kN/m]

q = variabel last (natur- og nyttelast)

Residense

Storey reduction factor

n = number of storeys of the category of load

n

Office

Storey reduction factor

ψ_0 = combination factor of thattype of load

n

Cat A	4	n	3	ψ_0	0,5	α_n	0,6666666666666666
Cat B		n	2	ψ_0	0,6	α_n	0,8

6.3.1.2 (11) Characteristic values of imposed loads – Residential, social, commercial and administrative areas – Values of actions – Reduction factor for number of storeys

The following reduction factor for the number of storeys is applied

$$\alpha_n = \frac{1 + (n-1)\psi_0}{n}$$

where

n is the number of storeys ($n > 1$) above the loaded structural element from the same category

ψ_0 is the load reduction factor, see DS/EN 1990.

FOUNDATIONS (clay - undrained conditions)

SOIL informations

Clay :

CV= 250 kN/m² from the geo-report

γ = 18 kN/m³

Sand :

Φ = 35 ° (=friction number)

γ/γ' = 18 kN/m³

Vertical Load :

$\Sigma Sd = 202,1906$ kN/m

Basement Load	g [kN/m ²]	Tributary area span [m]	Load pr. meter [kN/m]
Walls	5,7	3	17,1
Floor	7,3	4	29,2

TOTAL LOAD : R= 248,4906 kN/m

Parameters

R = 248,4906 kN/m

γ_c = 1,8 safety factor

Cd = 138,89 kN/m²

q(floor) = 7,3 kN/m²

q(soil)= 18 kN/m²

q = 7,3 kN/m²

Necessary width of foundations

B= 0,34 m

FOUNDATIONS (sand - drained conditions)

DATA

Sand :

$$\Phi = 35^\circ = 0,61 \text{ rad} \quad (= \text{friction number})$$

$$\gamma = 18 \text{ kN/m}^3$$

$$\gamma_d = 1,2 \quad \text{safety factor}$$

$$\Phi_d = 0,53 \text{ rad}$$

$$\Phi_d = 30,26^\circ$$

From eurocode :

$$N_\gamma = 20,09$$

$$N_q = 18,04$$

$$R/B = 0,5 \cdot \gamma \cdot B \cdot N_\gamma + q \cdot N_q$$

$$q = 7,3 \text{ kN/m}^2$$

$$R = 248,49 \text{ kN/m}$$

Necessary width of foundations

$$B = 0,86 \text{ m}$$

$$B = 0,86 \text{ m}$$

$$R/B = 288,94 \text{ kN/m}^2$$

$$X = 287,19 \text{ kN/m}^2$$

$$R/B > X$$

$$B = 0,87 \text{ m}$$

$$R/B = 285,62 \text{ kN/m}^2$$

$$X = 289,00 \text{ kN/m}^2$$

$$R/B < X, \text{ ok!}$$