

POS. 19.7: S.343, BINDIGER SOIL

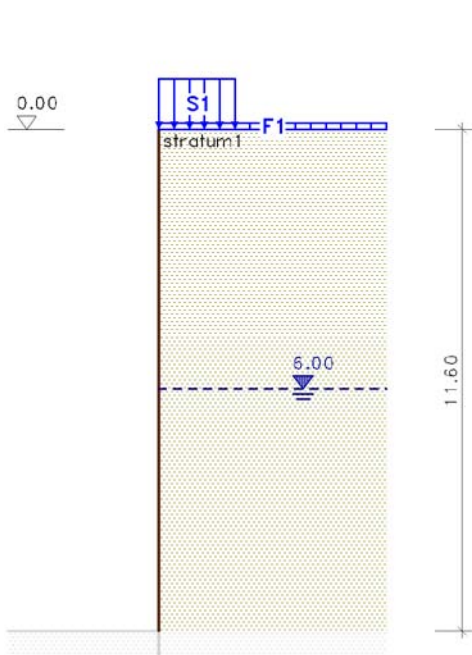
calculation of earth pressures

According to DIN 4084:2017-08 and associated standard specifications

calculation of the active earth pressure

1. system

scale 1:175



wall friction

for a rough wall surface,
angle of wall friction $\delta = 2/3 \cdot \varphi'_{ik}$

ground water

behind the wall at $z_{W,right} = 6.00$ m

cohesion

cohesion is fully taken into account
calculated tensile stress from cohesion are not applied
minimum earth pressure is checked in all cohesive strata

soil strata

stratum	notation	soil type	d m	γ kN/m ³	γ' kN/m ³	φ' °	c' kN/m ²
1	stratum1	cohesive ~	---	20,00	10,00	27,50	25,00

d - stratum thickness γ - unit weight of soil γ' - unit weight of submerged soil φ' - angle of internal friction of drained soil
c' - cohesion of the drained soil

2. loading

p - load a - distance wall head l - length \perp to the wall

2.1. distributed loads

Nr.	notation	p
F1	Flächenlast1	10.00 kN/m ²

2.2. strip loads

Nr.	notation	p'	a m	l m	introduction m	earth pressure distribution
S1	Streifenlast1	80.00 kN/m ²	0,00	1,75	surface	DIN 4085 1)

1) acc. to [1], table C.2 (shape dependent on wall movement)

2.3. load combinations

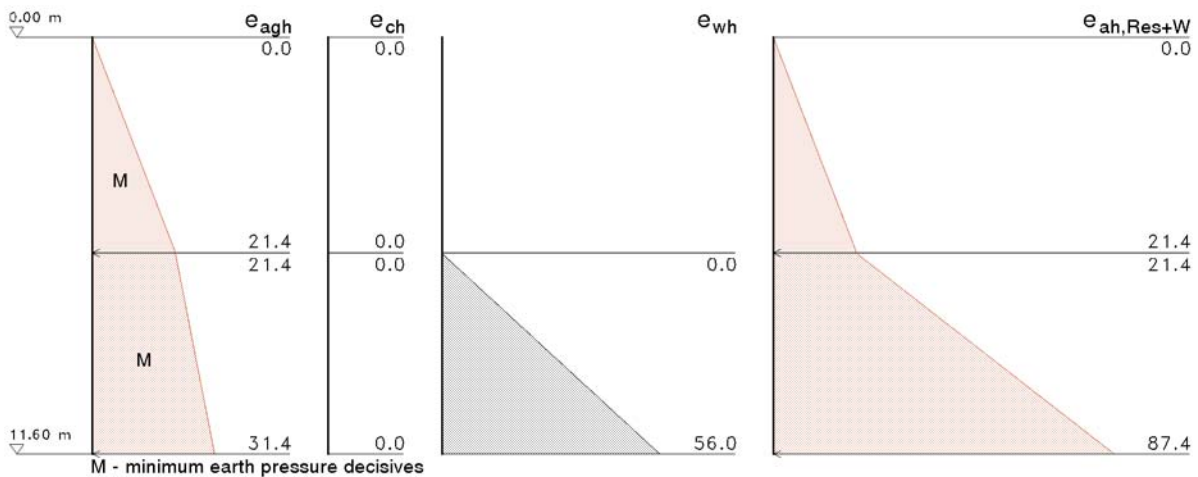
from dead load of the soil (G), water pressure (W) and the external types of loads: distributed (F), strip (S), line (L) or block (B)

LK	notation	factorization
1	load combination1	G+W

3. active earth pressure

3.1. from dead load of the soil

e_{agh} horiz. earth pressure due to soil weight
 e_{ch} horiz. relief due to cohesion
 e_{wh} horiz. water pressure
 $e_{ah,Res+W}$ resulting horiz. earth and water pressure



soil

$\Sigma(\gamma \cdot h)$ total soil weight at the depth considered
 K_{agh} coefficient of earth pressure acc. to [1] section 6.2.1, eqn.(7) (approach acc. to Müller-Breslau)
 c_{cal} computationally effective cohesion
 K_{ach} coefficient of earth pressure due to cohesion acc. to [1] section 6.2.1, eqn.(10)
 $K_{agh,min}$ coefficient of earth pressure for consideration of the minimum pressure according to [1] section 6.2.5
 e_{ah}/e_{av} horiz. and vertical ordinate of earth pressure
 e_{ares} res. ordinate of earth pressure from horizontal and vertical proportion

Z m	$\Sigma(\gamma \cdot h)$ kN/m ²	K_{agh} -	c_{cal} kN/m ²	K_{ach} -	$K_{agh,min}$ -	e_{ah} kN/m ²	e_{av} kN/m ²	e_{ares} kN/m ²
0.00	0.00	0.311	25.00	0.981	0.179	0.00*	0.00*	0.00*
6.00	240.00	0.311	25.00	0.981	0.179	21.43*	10.76*	23.98*
11.60	352.00	0.311	25.00	0.981	0.179	31.43*	15.79*	35.17*

* minimum earth pressure decisives

horizontal component of the earth pressure force $E_h = 212.31$ kN/m
 vertical component of the earth pressure force $E_v = 106.63$ kN/m
 earth pressure force $E = 237.58$ kN/m
 point of application of the earth pressure force $z_E = 7.47$ m

water pressure

e_w ordinate of water pressure

Z m	e_w kN/m ²
6.00	0.00
11.60	56.00

horizontal water pressure load $E_h = 156.80$ kN/m
 point of application der water pressure load $z_E = 8.80$ m

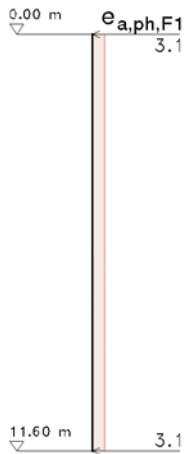
resulting earth pressure of soil including water pressure

Z m	e_{ah} kN/m ²	e_{av} kN/m ²	e_{ares} kN/m ²
0.00	0.00	0.00	0.00
6.00	21.43	10.76	23.98
11.60	87.43	15.79	88.85

horizontal component of the earth pressure force $E_h = 369.11$ kN/m
 vertical component of the earth pressure force $E_v = 106.63$ kN/m
 earth pressure force $E = 384.20$ kN/m
 point of application of the earth pressure force $z_E = 8.43$ m

3.2. from external loads

$e_{a,ph,F1}$ horiz. earth pressure from Flächenlast1
 $e_{a,ph,S1}$ horiz. earth pressure from Streifenlast1



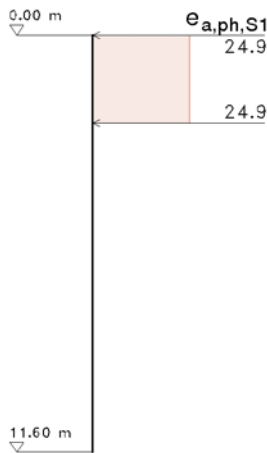
F1: Flächenlast1

earth pressure distribution: acc. to [1], table C.2

$p(z)$ effective proportion of superimposed load at the depth considered
 K_{aph} coefficient of earth pressure acc. to [1] section 6.2.1, eqn.(7) (approach acc. to Müller-Breslau)
 e_{ah}/e_{av} horiz. and vertical ordinate of earth pressure
 e_{ares} res. ordinate of earth pressure from horizontal and vertical proportion

z m	p(z) kN/m ²	K_{aph} -	e_{ah} kN/m ²	e_{av} kN/m ²	e_{ares} kN/m ²
0.00	10.00	0.311	3.11	1.03	3.28
11.60	10.00	0.311	3.11	1.03	3.28

horizontal component of the earth pressure force $E_h = 36.07$ kN/m
 vertical component of the earth pressure force $E_v = 11.95$ kN/m
 earth pressure force $E = 38.00$ kN/m
 point of application of the earth pressure force $z_E = 5.80$ m



S1: Streifenlast1

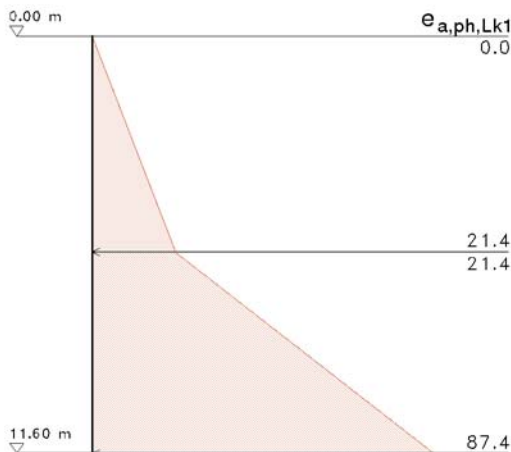
earth pressure distribution: acc. to [1], table C.2

K_{aph} coefficient of earth pressure acc. to [1] section 6.2.6, eqn.(15)

z m	p(z) kN/m ²	K_{aph} -	e_{ah} kN/m ²	e_{av} kN/m ²	e_{ares} kN/m ²
0.00	57.07	0.436	24.88	8.24	26.21
2.45	57.07	0.436	24.88	8.24	26.21

horizontal component of the earth pressure force $E_h = 61.02$ kN/m
 vertical component of the earth pressure force $E_v = 20.22$ kN/m
 earth pressure force $E = 64.29$ kN/m
 point of application of the earth pressure force $z_E = 1.23$ m

3.3. Infolge load combinations



LK 1: G+W

z m	e_{ah} kN/m ²	e_{av} kN/m ²	e_{ares} kN/m ²
0.00	0.00	0.00	0.00
6.00	21.43	10.76	23.98
11.60	87.43	15.79	88.85

horizontal component of the earth pressure force $E_h = 369.11$ kN/m
 vertical component of the earth pressure force $E_v = 106.63$ kN/m
 earth pressure force $E = 384.20$ kN/m
 point of application of the earth pressure force $z_E = 8.43$ m

4. summary

kind of earth pressure	earth pressure force				
	E_h kN/m	E_v kN/m	E kN/m	z_E m	
soil	212.31	106.63	237.58	7.47	
water pressure	156.80	0.00	156.80	8.80	
res. earth pressure from soil + water pressure		369.11	106.63	384.20	8.43
Flächenlast1	36.07	11.95	38.00	5.80	
Streifenlast1	61.02	20.22	64.29	1.23	
LK 1: G+W	369.11	106.63	384.20	8.43	

literature and standard specifications:
[1] DIN 4085: Baugrund, Berechnung des Erddrucks, August 2017

