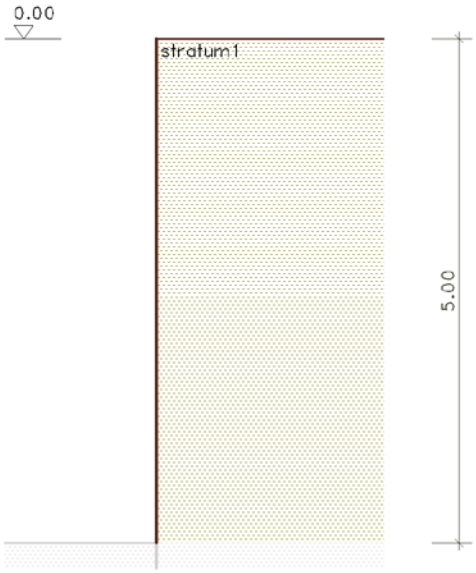
calculation of earth pressures

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

calculation of the active earth pressure

1. system

scale 1:75



wall friction
for a **rough** wall surface,
angle of wall friction $\delta = 2/3 \cdot \varphi'_k$

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

soil strata

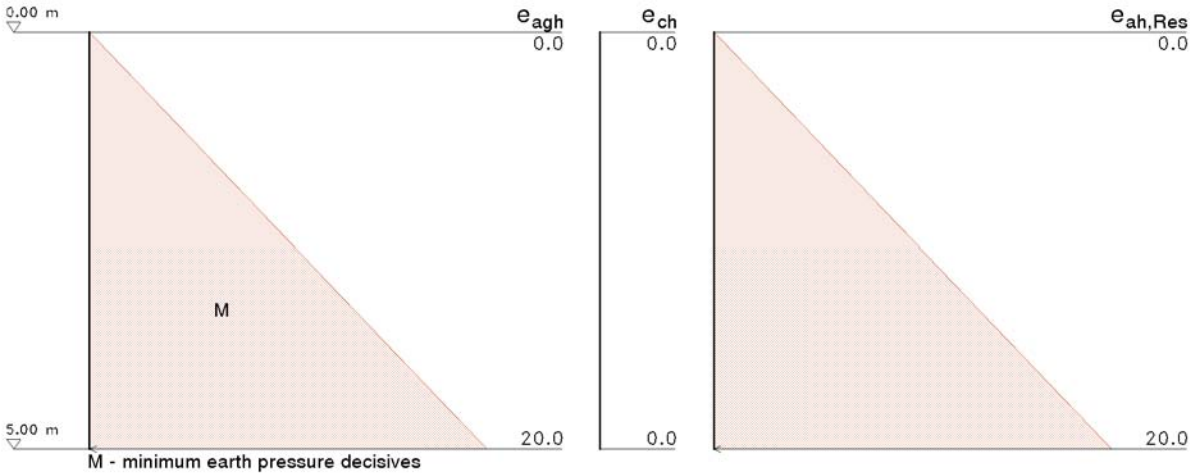
stratum	notation	soil type	d m	γ kN/m³	γ' kN/m³	φ' °	c' kN/m²
1	stratum1	cohesive ~~		---	20.00	11.00	15.00	20.00

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. active earth pressure

2.1. from dead load of the soil

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



M - minimum earth pressure decisives

soil

$\Sigma(\gamma \cdot h)$ total soil weight at the depth considered
K_{agh} coefficient of earth pressure acc. to [1] section 6.02.3, eqn.(6.02)
c_{cal} computationally effective cohesion
K_{ach} coefficient of earth pressure due to cohesion acc. to [1] section 6.02.6, eqn.(6.10)
$K_{agh,min}$ coefficient of earth pressure for consideration of the minimum pressure according to [2] 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	$\Sigma(\gamma \cdot h)$	K_{agh}	c_{cal}	K_{ach}	$K_{agh,min}$	e_{ah}	e_{av}	e_{ares}
m	kN/m²	-	kN/m²	-	-	kN/m²	kN/m²	kN/m²
0.00	0.00	0.533	20.00	1.358	0.200	0.00*	0.00*	0.00*
5.00	200.00	0.533	20.00	1.358	0.200	19.98*	10.04*	22.36*

* minimum earth pressure decisives

horizontal component of the earth pressure force E_h= 49.96 kN/m
vertical component of the earth pressure force E_v= 25.09 kN/m
earth pressure force E = 55.91 kN/m
point of application of the earth pressure force z_E= 3.33 m

resulting earth pressure from soil

z	e_{ah}	e_{av}	e_{ares}
m	kN/m²	kN/m²	kN/m²
0.00	0.00	0.00	0.00
5.00	19.98	10.04	22.36

horizontal component of the earth pressure force E_h= 49.96 kN/m
vertical component of the earth pressure force E_v= 25.09 kN/m
earth pressure force E = 55.91 kN/m
point of application of the earth pressure force z_E= 3.33 m

3. summary

kind of earth pressure	earth pressure force			
	E_h	E_v	E	z_E
	kN/m	kN/m	kN/m	m
soil	**49.96**	25.09	55.91	3.33
res. earth pressure from soil	49.96	25.09	55.91	3.33

literature and standard specifications:

[1] Dörken/Dehne/Kliesch: Grundbau in Beispielen, Teil 1, Werner Verlag, 5.Aufl., 2013
[2] DIN 4085: Baugrund, Berechnung des Erddrucks, August 2017