

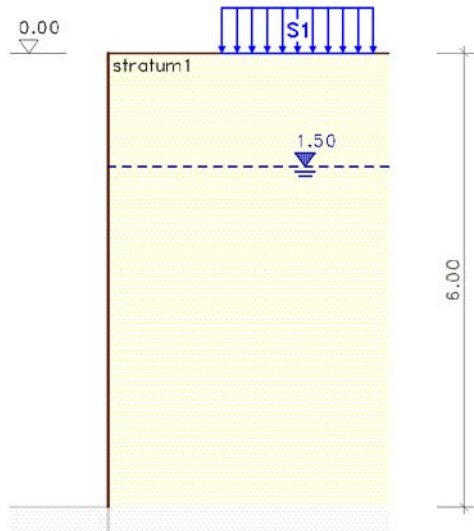
**calculation of earth pressures**

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

**calculation of the active earth pressure**

**1. system**

scale 1:100



**wall friction**

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

**ground water**

behind the wall at  $z_{W,right} = 1.50$  m

**soil strata**

stratum	notation	soil type	d m	$\gamma$ kN/m <sup>3</sup>	$\gamma'$ kN/m <sup>3</sup>	$\varphi'$ °	$c'$ kN/m <sup>2</sup>
1	stratum1	non-cohesive	---	18.00	8.00	30.00	---

d - stratum thickness     $\gamma$  - unit weight of soil     $\gamma'$  - unit weight of submerged soil     $\varphi'$  - angle of internal friction of drained soil  
 c' - cohesion of the drained soil

**2. loading**

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

**2.1. strip loads**

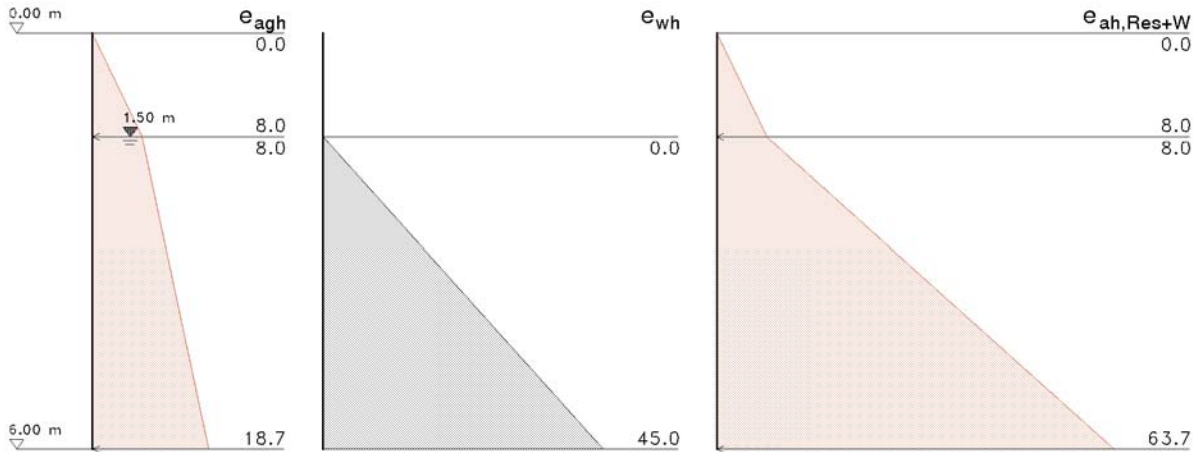
Nr.	notation	$p'$	a m	l m	introduction m	earth pressure distribution
S1	Streifenlast1	30.00 kN/m <sup>2</sup>	1.50	2.00	surface	DIN 4085    1)

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

### 3. active earth pressure

#### 3.1. from dead load of the soil

$e_{agh}$       horiz. earth pressure due to soil weight  
 $e_{wh}$         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 [2] section 6.02.3, eqn.(6.02)  
 $e_{ah}/e_{av}$      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 <sup>2</sup>	$K_{agh}$ -	$E_{ah}$ kN/m <sup>2</sup>	$E_{av}$ kN/m <sup>2</sup>	$E_{ares}$ kN/m <sup>2</sup>
0.00	0.00	0.297	0.00	0.00	0.00
1.50	27.00	0.297	8.03	2.92	8.54
6.00	63.00	0.297	18.73	6.82	19.93

horizontal component of the earth pressure force  $E_h = 66.23$  kN/m  
 vertical component of the earth pressure force  $E_v = 24.10$  kN/m  
 earth pressure force  $E = 70.48$  kN/m  
 point of application of the earth pressure force  $z_E = 3.77$  m

#### water pressure

$e_w$     ordinate of water pressure

z m	$e_w$ kN/m <sup>2</sup>
1.50	0.00
6.00	45.00

horizontal water pressure load  $E_h = 101.25$  kN/m  
 point of application der water pressure load  $z_E = 3.75$  m

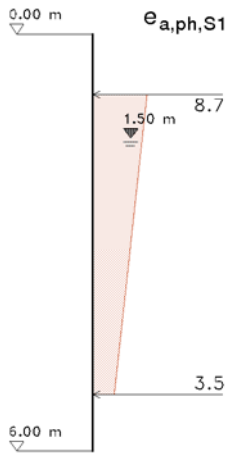
#### resulting earth pressure of soil including water pressure

z m	$E_{ah}$ kN/m <sup>2</sup>	$E_{av}$ kN/m <sup>2</sup>	$E_{ares}$ kN/m <sup>2</sup>
0.00	0.00	0.00	0.00
1.50	8.03	2.92	8.54
6.00	63.73	6.82	64.09

horizontal component of the earth pressure force  $E_h = 167.48$  kN/m  
 vertical component of the earth pressure force  $E_v = 24.10$  kN/m  
 earth pressure force  $E = 169.20$  kN/m  
 point of application of the earth pressure force  $z_E = 4.21$  m

### 3.2. from external loads

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



#### S1: Streifenlast1

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 [2] section 6.02.4.3, eqn.(6.08)  
 $e_{ah}/e_{av}$  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 <sup>2</sup>	$K_{aph}$ -	$e_{ah}$ kN/m <sup>2</sup>	$e_{av}$ kN/m <sup>2</sup>	$e_{ares}$ kN/m <sup>2</sup>
0.87	19.84	0.441	8.74	3.18	9.30
5.19	7.94	0.441	3.50	1.27	3.72

horizontal component of the earth pressure force  $E_h = 26.43$  kN/m  
 vertical component of the earth pressure force  $E_v = 9.62$  kN/m  
 earth pressure force  $E = 28.13$  kN/m  
 point of application of the earth pressure force  $z_E = 2.72$  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	66.23	24.10	70.48	3.77	
water pressure	101.25	0.00	101.25	3.75	
res. earth pressure from soil + water pressure		<b>167.48</b>	24.10	169.20	4.21
Streifenlast1	26.43	9.62	28.13	2.72	

literature and standard specifications:

[1] DIN 4085: Baugrund, Berechnung des Erddrucks, August 2017

[2] Dörken/Dehne/Kliesch: Grundbau in Beispielen, Teil 1, Werner Verlag, 5.Aufl., 2013