MŰEGYETEM 1782

Project 1.   Verifying a Reinforced Retaining wall

Earthworks

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Geometry data:

- Height of the structure (h) = 10.5 m

- Depth of underground facing panel (ht) = 1,5 m

- Horizontal distance between reinforcing elements (t) = 0,75 m

- Vertical distance between reinforcing elements (f) = 0,75 m

- Unit weight of coarse backfill (γ) = 19.5 kN/m3

- Internal friction angle of coarse backfill (φ_k) = 38°

- Cohesion of coarse backfill (c'k) = 0 KPa

- Friction angle between coarse backfill and steel reinforcing strips (μ) = 0,37
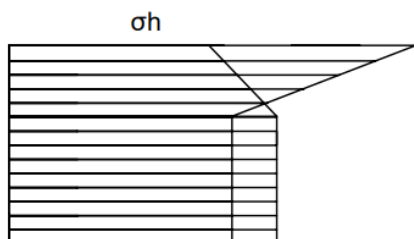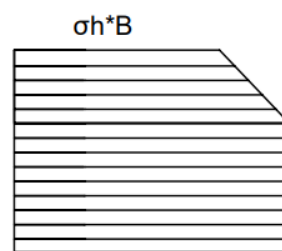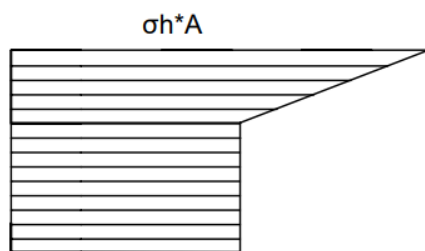
- Cohesion of subsoil (c'k,a) = 45 KPa

Loads:

- Characteristic value of fill weight (gk) = 20 kN/m2
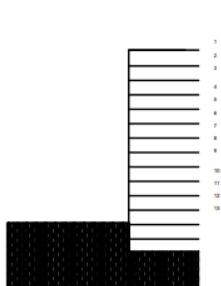
- Characteristic value of vehicle load (qk) = 24 kN/m2

Other Data:

- Steel quality = S275 (fy = 275000 kPa)

- Corrosion coefficient of steel reinforcing strips

- K1 = 0.5

- K2 = 20

- n = 0.75

- Design lifetime (tau) = 50 years

Critical Failure Surface Parameters

- Data of failure surface

- ω = 29.2°

- D/h = 0.28

- D = 2.94 m

- epsilon = 22.8°

Top of the structure

10.50

1.50

0.75

1
2
3
4
5
6
7
8
9
10
11
12
13

Ø

σh*A

σh*B

σh
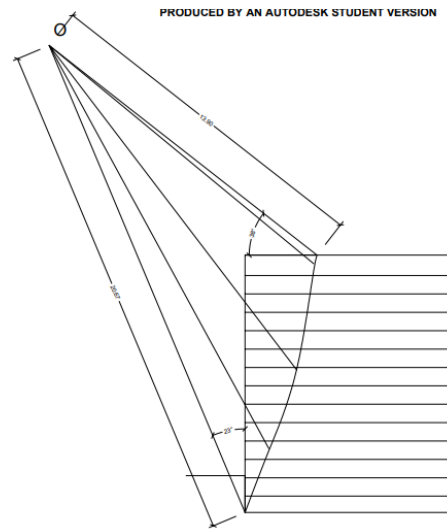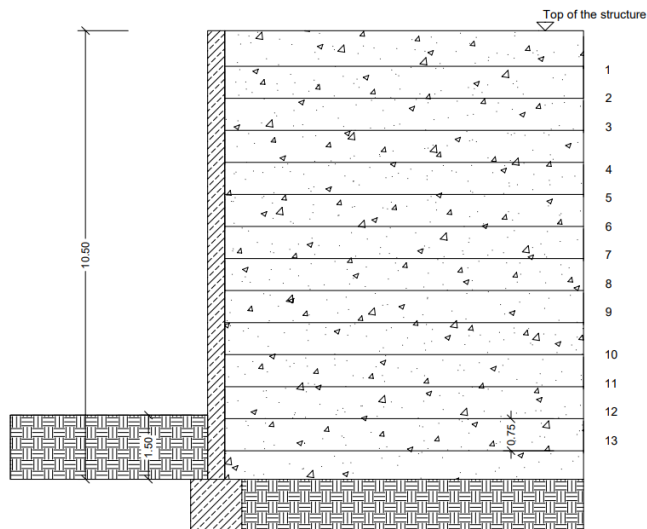
The critical failure surface is determined by the Bishop method. kN, M are the units which are commonly used in the calculations.

Analysis of Sliding:

Active Earth pressure coefficient (Ka) = 0.27475

Earth pressure due to the weight of the soil (Pa,g,h,k) =295.3390kN/m

Earth pressure due to surface load (Pa,q,h,k) = 69.2370kN/m

Design value of sliding force (Ed) =502.5632kN/m

Design value of resistance (Rd):

- If sliding on granular soil surface = 1221.5756 kN/m

- If sliding on cohesive soil surface = 343.6363 kN/m

When we take the minimum resistance from the two Rd,min = 343.6363 kN/m

From the above calculation condition didn't fulfill. $Rd \leq Ed$

Analysis of Base Failure:

Bedrock is a soft clay

Characteristic value of resistance (Rk) = 231.3717kN/m2

Design value of resistance (Rd)= 165.2655kN/m2

Design value of the combination of vertical forces acting on the base level (Vd) = 339.4125kN/m2

Since the condition is not fulfilled $Ed \leq Rd$, the maximum height of the structure need to calculate.

h_{max} = 3.8847m

ω[rad]	
0	13.8958
0.0254818	14.17522
0.0509636	14.46025
0.0764454	14.75102
0.1019272	15.04764
0.127409	15.35022
0.1528908	15.65888
0.1783726	15.97375
0.2038545	16.29495
0.2277655	16.60222
0.2548181	16.95686
0.2802999	17.29783
0.3057817	17.64565
0.3312635	18.00047
0.3567453	18.36243
0.3822271	18.73166
0.4077089	19.10832
0.4331907	19.49255
0.4586725	19.88451
0.4841543	20.28435
0.5096361	20.6702

Kcs	0.45
Ho	3.78
sigma (h,A,F)	21.7648
sigma (h,B,F)	10.704
sigma (h,A,Ho)	11.94102
sigma (h,B,Ho)	14.329224

Stirrup id	D	l_D_i	h_i	sum(l-d_i)	sigma_hi	N_i,k	sum(N_i,k)	N_i,d	sigma_vi	s_i	s_apl,l[cm]	sum(s_apl	k_i	nu_i	N_pl_Rd	n_apl,l	n_apl,l
1	2.94	5.46	0.375	5.46	21.6901	8.1337875	8.133788	10.9806	27.3125	0.0405	6	6	8.14037	0.00066549	10.9806	6.40997	7
2	2.7744	5.6256	1.125	11.0856	19.5237	7.3213875	15.45518	9.88387	41.9375	0.02304	4	10	9.53827	0.00089853	9.88387	6.4102	7
3	2.6585	5.7415	1.875	11.3671	17.6493	6.6184875	13.93988	8.93496	56.5625	0.01513	4	14	14.524	0.00081227	8.93496	6.41012	7
4	2.5429	5.8571	2.625	11.5986	15.7096	5.8911	12.50959	7.95299	71.1875	0.01049	4	18	20.9499	0.000723	7.95299	6.41003	7
5	2.4206	5.9794	3.375	11.8365	13.7509	5.1565875	11.04769	6.96139	85.8125	0.00746	4	22	29.4535	0.00063285	6.96139	6.40994	7
6	2.2854	6.1146	4.125	12.094	11.94	4.4775	9.634088	6.04463	100.438	0.00541	4	26	40.5994	0.00054951	6.04463	6.40985	7
7	2.1275	6.2725	4.875	12.3871	11.94	4.4775	8.955	6.04463	115.063	0.00461	4	30	47.7123	0.00054951	6.04463	6.40985	7
8	1.9352	6.4648	5.625	12.7373	11.94	4.4775	8.955	6.04463	129.688	0.00397	4	34	55.4255	0.00054951	6.04463	6.40985	7
9	1.7032	6.6968	6.375	13.1616	11.94	4.4775	8.955	6.04463	144.313	0.00344	4	38	63.8892	0.00054951	6.04463	6.40985	7
10	1.4313	6.9687	7.125	13.6655	11.94	4.4775	8.955	6.04463	158.938	0.003	4	42	73.2208	0.00054951	6.04463	6.40985	7
11	1.1328	7.2672	7.875	14.2359	11.94	4.4775	8.955	6.04463	173.563	0.00264	4	46	83.3833	0.00054951	6.04463	6.40985	7
12	0.8305	7.5695	8.625	14.8367	11.94	4.4775	8.955	6.04463	188.188	0.00233	4	50	94.1703	0.00054951	6.04463	6.40985	7
13	0.537	7.863	9.375	15.4325	11.94	4.4775	8.955	6.04463	202.813	0.00208	4	54	105.424	0.00054951	6.04463	6.40985	7
14	0.2501	8.1499	10.125	16.0129	11.94	4.4775	8.955	6.04463	217.438	0.00188	4	58	117.15	0.00054951	6.04463	6.40985	7