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PROJECT

Project Name: Capitol Hill Slope Stability Analysis

Face: Slope Model1

Owner of Structure:: Michael Reynolds

Project Author: Daniel Carter

Designer: Daniel Carter

STANDARDS

Excavation Support Structures: Kazı Destek Yapıları Tasarım ve Uygulama Esasları (Design and Application Principles of Excavation Support Structures)

Steel Strand Anchors: BS5896 Super Tendon

Reinforced Concrete Structures: TS500

Reinforcement Steel for Reinforced Concrete: TS-708 Betonarme İçin Donatı Çeliği (Reinforcement Steel for Reinforced Concrete)

Steel Structures: Çelik Yapıların Tasarım, Hesap ve Yapım Esaslarına Dair Yönetmelik (Regulation on Design, Calculation, and Construction Principles of Steel Structures)

Steel Material: TS EN 10025-2

ANALYSIS PROPERTIES

Limit Equilibrium Method: Bishop

Slip Surface Geometry: Circle

Type of Analysis: Calculation on a single slip surface

REGIONS

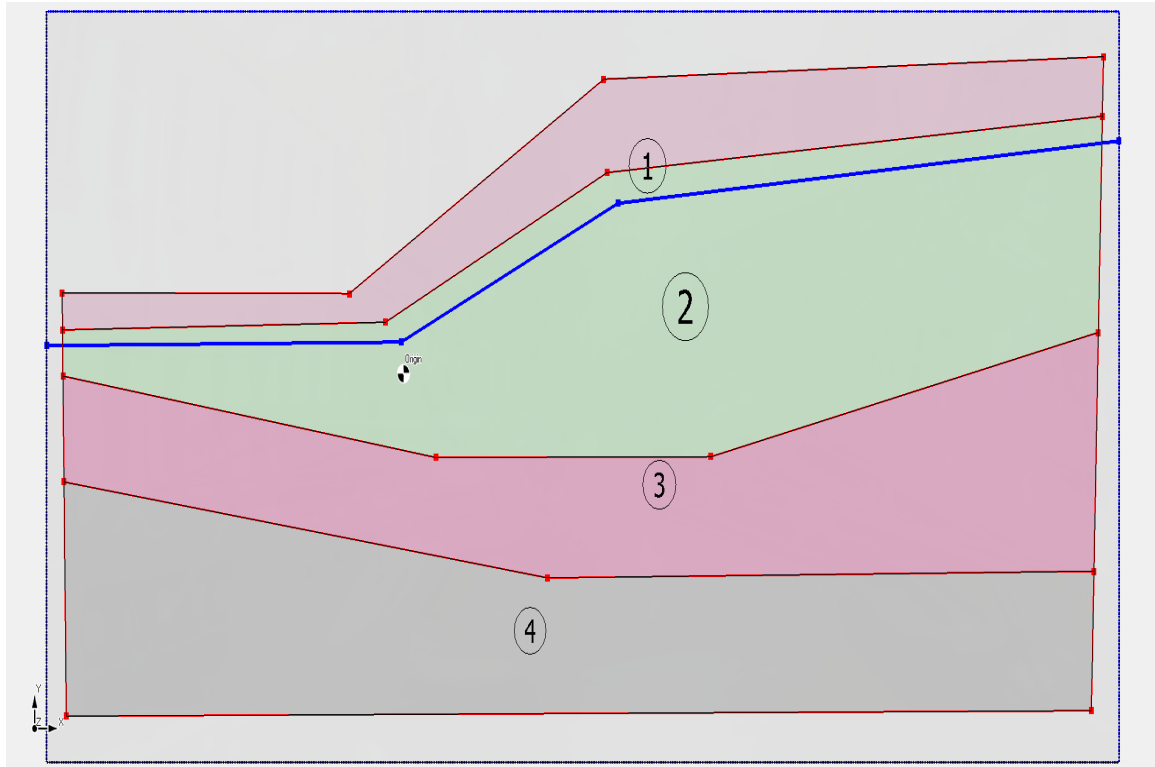


Figure 1. Terrain Model

Capitol Hill Slope Stability Analysis

Zoning Information: Seattle Province, Capitol Hill District, PL-874233 Layout, 47A Block, 112 Parcel, 5 / 8

Table 1. Contour Points

Region Number	Contour Points [m]	Drainage Condition	Material
1	{X=-110,4 Y=9,6} {X=-5,8 Y=11,3} {X=66 Y=44} {X=226,3 Y=56,4} {X=226,7 Y=69,4} {X=64,9 Y=64,5} {X=-17,6 Y=17,5} {X=-110,6 Y=17,7}	Drained	CH
2	{X=226,3 Y=56,4} {X=66 Y=44} {X=-5,8 Y=11,3} {X=-110,4 Y=9,6} {X=-110,3 Y=-0,5} {X=10,5 Y=-18,3} {X=99,5 Y=-18,2} {X=225,1 Y=9}	Drained	SM
3	{X=-110 Y=-23,7} {X=46,7 Y=-44,7} {X=223,6 Y=-43,2} {X=225,1 Y=9} {X=99,5 Y=-18,2} {X=10,5 Y=-18,3} {X=-110,3 Y=-0,5}	Drained	CH
4	{X=223,6 Y=-43,2} {X=46,7 Y=-44,7} {X=-110 Y=-23,7} {X=-109,2 Y=-74,9} {X=222,8 Y=-73,7}	Drained	SM

Table 2. Region Properties

Region Number	Drainage Condition	Material	γ_n [kN/m ³]	γ_{sat} [kN/m ³]	c [kN/m ²]	ϕ [°]
1	Drained	CH	18,4	18,8	7,6	26,4
2	Drained	SM	21	21	0	30
3	Drained	CH	18,4	18,8	7,6	26,4
4	Drained	SM	21	21	0	30

GROUND WATER TABLE

Table 3. GWT

GWT Coordinates [m]
{X=-115,6 Y=6,2} {X=-0,8 Y=6,9} {X=69,5 Y=37,3} {X=231,7 Y=50,9}

LIMIT EQUILIBRIUM ANALYSIS

B: Slice width

W: Slice weight

α : Slice base inclination angle

L: Slice base length

Uw: Pore water pressure at slice base

N: Normal force acting perpendicular to slice base

c: Cohesion at slice base

Φ : Angle of internal friction at slice base

Rs: Resisting forces

Fs: Mobilized driving forces

FS: Factor of safety

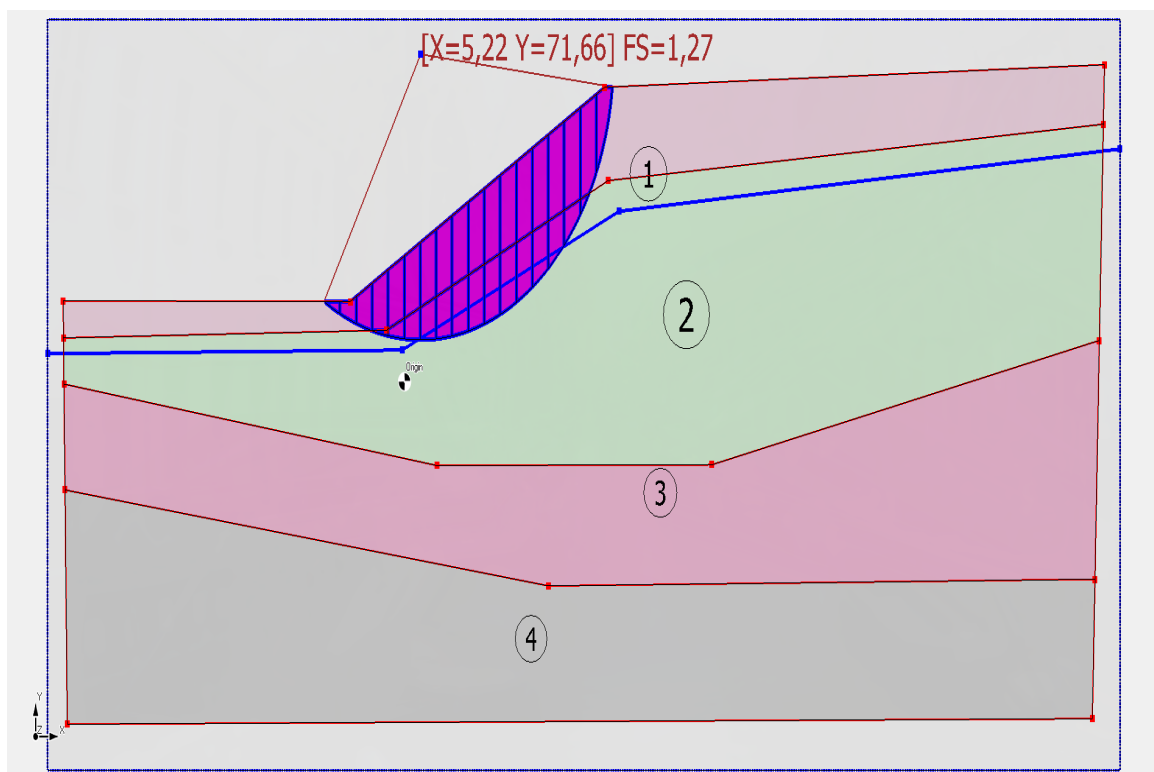


Figure 2. Sliding Surface

$$FS = \frac{\sum_i c_i L_i + N_i \tan \phi_i}{\sum_i W_i \sin \alpha_i} = \frac{\sum_i R_s}{\sum_i F_s}$$

$$m_\alpha = \cos \alpha + \frac{\sin \alpha \tan \phi}{FS}$$

$$N_i = (W_i - u_i \times L_i) \times \cos \alpha$$

Table 4. Limit Equilibrium Analysis Using the Bishop Method

Slice	B [m]	W [kN/m]	α [°]	L [m]	Uw [kN/m ²]	N [kN/m]	c [kN/m ²]	Φ [°]	Rs [kN/m]	M α	Fs [kN/m]	FS
1	5	132,474	-27,35	5,842	0	117,667	7,6	26,4	156,525	0,71	-60,858	
2	5	378,534	-22,11	5,601	0	350,698	7,6	26,4	286,267	0,78	-142,473	
3	5	779,579	-17,05	5,427	0	745,311	0	30	523,339	0,82	-228,593	
4	5	1199,415	-12,13	5,307	0	1172,626	0	30	767,803	0,88	-252,077	
5	5	1597,35	-7,3	5,231	0	1584,392	0	30	979,515	0,93	-203,048	
6	5	1959,568	-2,52	5,194	0	1957,668	0	30	1154,578	0,98	-86,279	
7	5	2274,626	2,24	5,193	12,815	2206,394	0	30	1252,484	1,02	88,886	
8	5	2542,558	7,01	5,228	30,694	2364,209	0	30	1302,235	1,05	310,284	
9	5	2762,388	11,84	5,302	44,232	2474,063	0	30	1331,998	1,07	566,988	
10	5	2932,036	16,75	5,419	53,238	2531,314	0	30	1341,892	1,09	845,241	
11	5	3048,061	21,8	5,589	57,404	2532,227	0	30	1331,549	1,1	1131,909	
12	5	3105,205	27,03	5,826	56,249	2474,088	0	30	1300,741	1,1	1411,28	
13	5	3095,544	32,52	6,155	49,045	2355,575	0	30	1249,392	1,09	1664,28	
14	5	3006,884	38,38	6,62	34,675	2177,308	0	30	1177,846	1,07	1866,728	
15	5	2819,383	44,77	7,31	11,292	1943,113	0	30	1087,756	1,03	1985,455	
16	5	2497,321	51,98	8,428	0	1538,286	0	30	910,467	0,98	1967,305	
17	5	1973,019	60,71	10,614	0	965,406	0	30	628,182	0,89	1720,697	
18	5	1029,496	74,51	19,501	0	274,997	7,6	26,4	354,414	0,65	992,09	
Σ									17136,984		13577,814	1,26

FS= 1,26 > 1,2 $\sqrt$