

SLOPE STABILITY ANALYSIS

Project: Sample Project

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1. INPUT PARAMETERS

Parameter	Symbol	Value	Unit
Analysis method	<i>Method</i>	Bishop	
Circle center x	x_c	20.00	m
Circle center y (elev.)	y_c	18.00	m
Circle radius	R	13.00	m
Number of slices	N	30	
Required FOS	FOS_{req}	1.5	

1. SLOPE GEOMETRY & SOIL PROPERTIES

Ground Surface Profile

x (m)	Elevation (m)
0.0	5.0
10.0	5.0
20.0	10.0
30.0	10.0
40.0	10.0

Soil Layer Properties

Layer	Top (m)	Bottom (m)	γ (kN/m ³)	c/c_u (kPa)	ϕ (deg)	Mode
Fill	10.0	0.0	19.0	5.0	28.0	drained

1. SLIP CIRCLE

Slip Circle Definition

$$\text{Circle : } (x - x_c)^2 + (z - y_c)^2 = R^2$$

$$(x - 20.00)^2 + (z - 18.00)^2 = 13.00^2$$

$$R = 13.00 \text{ m}$$

Slip Surface Intersection

Entry and exit points where circle intersects ground surface

$$x_{\text{entry}}, x_{\text{exit}} = 13.49 \text{ m}, 30.25 \text{ m}$$

1. ANALYSIS METHOD & FACTOR OF SAFETY

Bishop's Simplified Method

$$FOS = \Sigma[(c_i \cdot b_i + (W_i - u_i \cdot b_i) \cdot \tan(\varphi_i)) / m_{\alpha_i}] / \Sigma[W_i \times \sin(\alpha_i)]$$

$$m_{\alpha} = \cos(\alpha) + \sin(\alpha) \cdot \tan(\varphi) / FOS$$

$$FOS = 4.526$$

Bishop (1955)

Iterative solution — satisfies moment equilibrium. Assumes zero interslice shear forces.

1. SLICE DATA

Representative Slice Data

#	x_mid (m)	Width (m)	Weight (kN/m)	α (deg)	c (kPa)	φ (deg)	u (kPa)
1	13.77	0.558	3.1	-28.6	5.0	28.0	0.0
4	15.45	0.558	20.2	-20.5	5.0	28.0	0.0
7	17.12	0.558	34.4	-12.8	5.0	28.0	0.0
10	18.80	0.558	46.1	-5.3	5.0	28.0	0.0
13	20.47	0.558	53.0	2.1	5.0	28.0	0.0
16	22.15	0.558	51.2	9.5	5.0	28.0	0.0
19	23.82	0.558	47.0	17.1	5.0	28.0	0.0
22	25.50	0.558	40.1	25.0	5.0	28.0	0.0
25	27.18	0.558	30.1	33.5	5.0	28.0	0.0
28	28.85	0.558	16.1	42.9	5.0	28.0	0.0

30	29.97	0.558	3.7	50.1	5.0	28.0	0.0
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Showing 11 of 30 slices.

1. STABILITY CHECK

PASS Slope stability adequacy

$$FOS_{required} = 1.5 \leq FOS_{computed} = 4.525753512458796 \quad (D/C = 0.33)$$

1. FIGURES

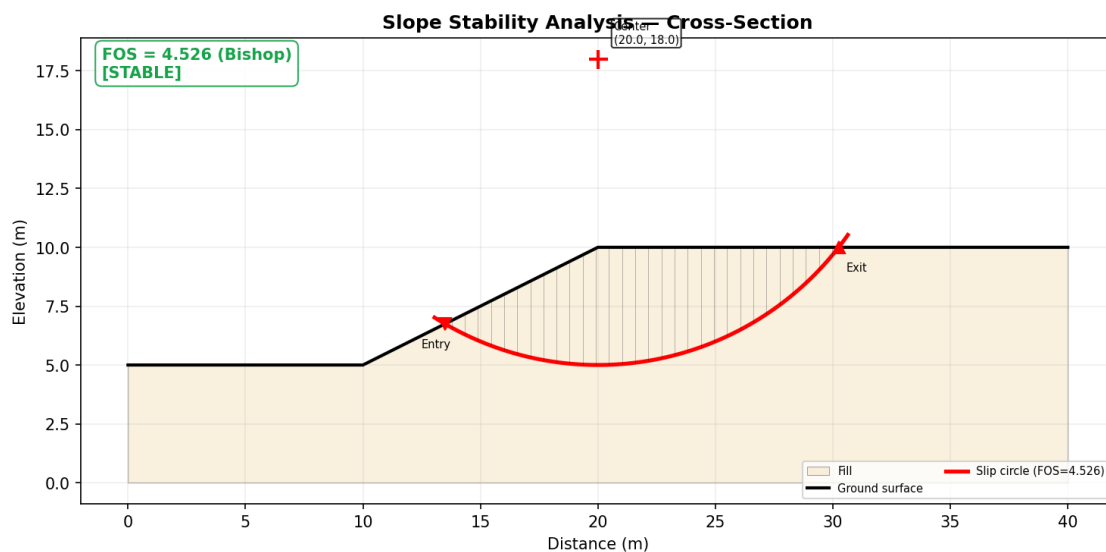


Figure 1: *
Figure 1: Slope cross-section with critical slip circle. FOS = 4.526 (Bishop method). Entry x = 13.5 m, Exit x = 30.2 m.

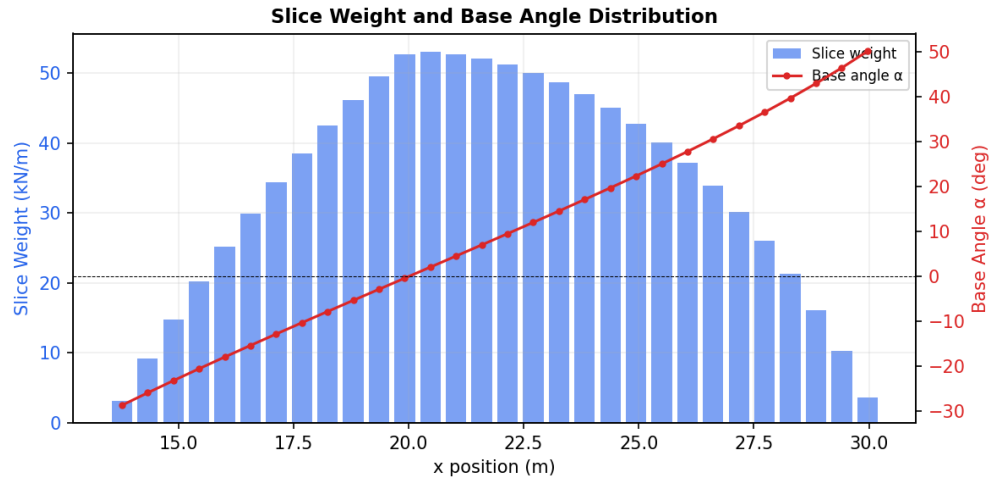


Figure 2: *

Figure 2: Slice weight and base inclination angle along the slip surface (30 slices).

1. REFERENCES

1. Duncan, J.M., Wright, S.G. & Brandon, T.L. (2014). Soil Strength and Slope Stability, 2nd Ed. Wiley.
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3. Bishop, A.W. (1955). "The Use of the Slip Circle in the Stability Analysis of Slopes." Geotechnique, 5(1), 7-17.
4. Spencer, E. (1967). "A Method of Analysis of the Stability of Embankments Assuming Parallel Interslice Forces." Geotechnique, 17(1), 11-26.
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