

## Slope stability analysis

### Input data (Construction stage 1)

#### Project

Task : Yard extension stability assessment  
 Part : Short term conditions - DA1  
 Description : Section A-A'  
 Customer : Bryn Aggregates Ltd  
 Author : JPCE Ltd  
 Date : 07/10/2023

#### Settings

Standard - safety factors (2)

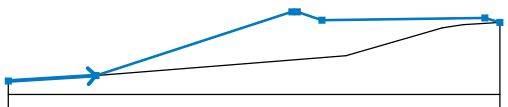
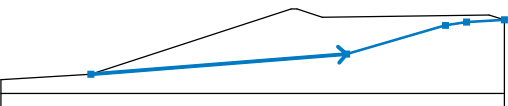

#### Stability analysis

Verification methodology : according to EN 1997  
 Earthquake analysis : Standard  
 Design approach : 1 - reduction of actions and soil parameters

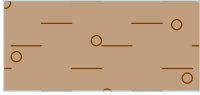
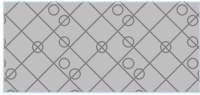

Partial factors on actions (A)					
Permanent design situation					
		Combination 1		Combination 2	
		Unfavourable	Favourable	Unfavourable	Favourable
Permanent actions :	$\gamma_G =$	1.35 [-]	1.00 [-]	1.00 [-]	1.00 [-]
Variable actions :	$\gamma_Q =$	1.50 [-]	0.00 [-]	1.30 [-]	0.00 [-]
Water load :	$\gamma_w =$	1.35 [-]		1.00 [-]	

Partial factors for soil parameters (M)					
Permanent design situation					
		Combination 1		Combination 2	
Partial factor on internal friction :	$\gamma_\phi =$	1.00 [-]		1.25 [-]	
Partial factor on effective cohesion :	$\gamma_c =$	1.00 [-]		1.25 [-]	
Partial factor on undrained shear strength :	$\gamma_{cu} =$	1.00 [-]		1.40 [-]	

#### Interface

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		0.00	0.00	32.72	2.02	105.67	25.82
		107.77	25.82	116.94	22.72	177.69	23.54
		183.30	21.85				
2		32.72	2.02	125.88	9.40	161.86	19.80
		169.57	21.03	183.30	21.85		
3		0.00	-5.00	183.30	-5.00		

## Soil parameters - total stress state

No.	Name	Pattern	$c_u$ [kPa]	$\gamma$ [kN/m <sup>3</sup> ]
1	In-situ clay soils		150.00	21.00
2	Imported mixed soils		75.00	19.00
3	Sandstone bedrock		300.00	20.00

## Soil parameters

## In-situ clay soils

Unit weight :  $\gamma = 21.00 \text{ kN/m}^3$   
 Stress-state : total  
 Shear strength : Mohr-Coulomb  
 Cohesion of soil :  $c_u = 150.00 \text{ kPa}$

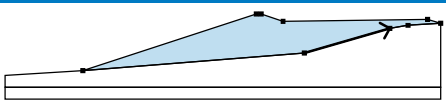

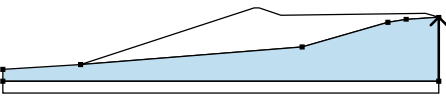
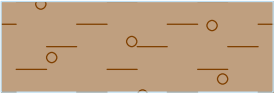
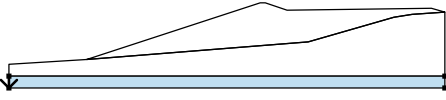

## Imported mixed soils

Unit weight :  $\gamma = 19.00 \text{ kN/m}^3$   
 Stress-state : total  
 Shear strength : Mohr-Coulomb  
 Cohesion of soil :  $c_u = 75.00 \text{ kPa}$

## Sandstone bedrock

Unit weight :  $\gamma = 20.00 \text{ kN/m}^3$   
 Stress-state : total  
 Shear strength : Mohr-Coulomb  
 Cohesion of soil :  $c_u = 300.00 \text{ kPa}$

## Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		125.88	9.40	161.86	19.80	Imported mixed soils 
		169.57	21.03	183.30	21.85	
		177.69	23.54	116.94	22.72	
		107.77	25.82	105.67	25.82	
		32.72	2.02			
2		183.30	-5.00	183.30	21.85	In-situ clay soils 
		169.57	21.03	161.86	19.80	
		125.88	9.40	32.72	2.02	
		0.00	0.00	0.00	-5.00	
3		0.00	-5.00	0.00	-10.00	Sandstone bedrock 
		183.30	-10.00	183.30	-5.00	

**Surcharge**

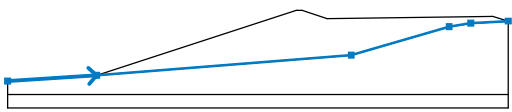
No.	Type	Type of action	Location z [m]	Origin x [m]	Length l [m]	Width b [m]	Slope $\alpha$ [°]	Magnitude		
1	strip	permanent	on terrain	x = 117.00	l = 60.00		0.00	q, q <sub>1</sub> , f, F, x	q <sub>2</sub> , z	unit
								100.00		kN/m <sup>2</sup>

**Surcharges**

No.	Name
1	Working loads

**Water**

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		0.00	-0.14	32.63	1.97	125.80	9.40
		161.68	19.84	169.58	21.11	183.30	21.84

**Tensile crack**

Tensile crack not input.

**Earthquake**

Earthquake not included.

**Settings of the stage of construction**

Design situation : permanent

**Results (Construction stage 1)****Analysis 1****Circular slip surface**

Slip surface parameters					
Center :	x =	74.57 [m]	Angles :	$\alpha_1$ =	-13.55 [°]
	z =	101.93 [m]		$\alpha_2$ =	34.84 [°]
Radius :	R =	96.30 [m]			
Slip surface after grid search.					

Total weight of soil above the slip surface: 13654.09 kN/m

**Slope stability verification (Bishop)****Combination 1**Sum of active forces :  $F_a$  = 4337.57 kN/mSum of passive forces :  $F_p$  = 6073.29 kN/mSliding moment :  $M_a$  = 413370.10 kNm/mResisting moment :  $M_p$  = 578784.18 kNm/m

Utilization : 71.4 %

**Slope stability ACCEPTABLE****Combination 2**Sum of active forces :  $F_a$  = 3176.66 kN/mSum of passive forces :  $F_p$  = 4356.83 kN/m

Sliding moment :  $M_a = 305912.04 \text{ kNm/m}$   
Resisting moment :  $M_p = 419562.80 \text{ kNm/m}$   
Utilization : 72.9 %

Slope stability **ACCEPTABLE**

Name : Analysis

Stage - analysis : 1 - 1

