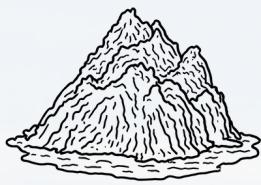


Rocks Mechanics

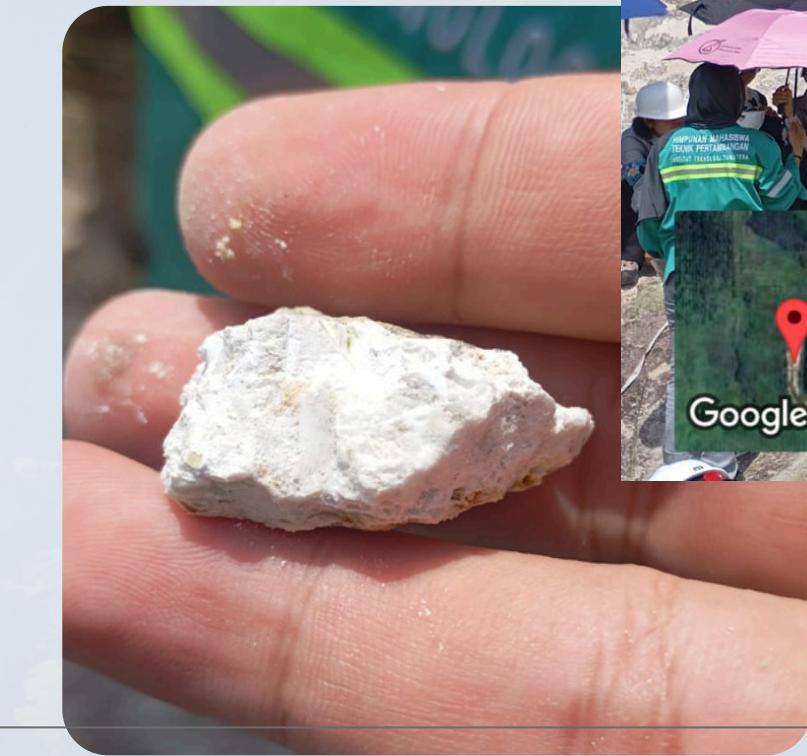
Final report of rock mechanics practicum

Testing rock and slope strength at Lake E using RMR and field data



Introduction to pyroclastic rocks

Batuhan piroklastik terbentuk dari material vulkanik seperti abu, lapilli, dan bom yang dilontarkan secara eksplosif saat erupsi gunung berapi akibat dekompreksi magma kaya gas. Material tersebut terendapkan melalui jatuhnya udara atau awan panas, kemudian mengalami litifikasi melalui proses kompaksi, sementasi, dan devitrifikasi yang mengubahnya menjadi batuan padat. Seiring waktu, melalui proses pengangkatan tektonik dan erosi lapisan penutup, batuan piroklastik yang telah terlitifikasi ini akhirnya tersingkap di permukaan sebagai singkapan dengan ciri khas berlapis dan mengandung fragmen vulkanik.





Characteristic of tuff stone



Warna Segar : Putih ke abu-abuan
Warna Lapuk : Coklat terang



Ukuran Butir = Fine sand (1/4-1/8 mm)
Kebundaran = well rounded



Struktur = Masif
Kemas = tertutup
Sortasi = Very well sorted

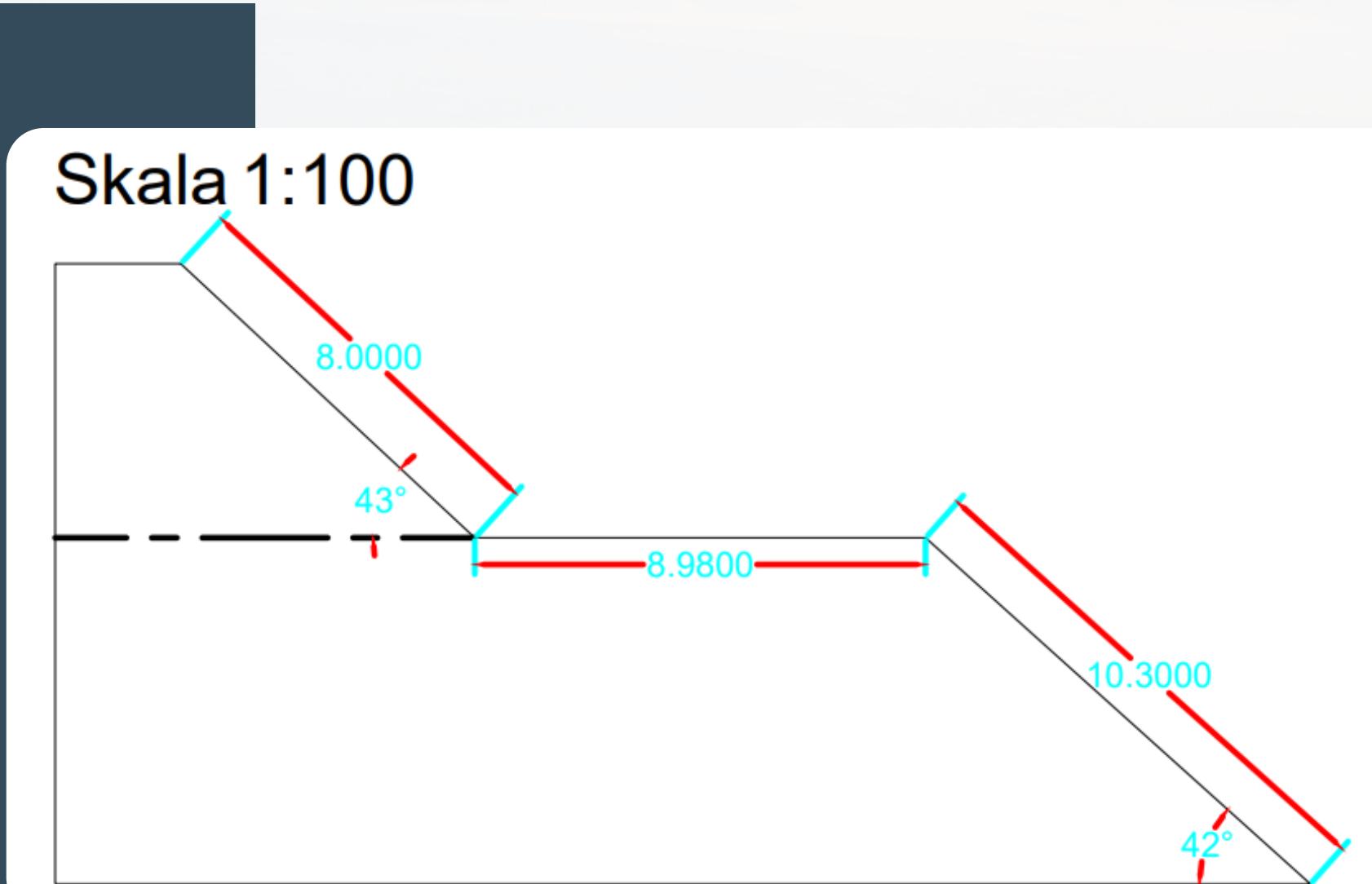


Tanjung Bintang, Lampung, Indo
J8p7+h2v, Sabah Balau, Tanjung Bintang, Lampung
Lat -5.365022° Long 105.313372°
29/09/2025 09:40 AM GMT +07:00

Tekstur = Ash halus (< 1 mm)
Density = 1.5-2.1 g/cm³



Geometri Lereng



Strike/Dip Lereng : N 252° E/ 43°

Panjang Slope 1: 8 m

Lebar Bench : 8,98 m

Panjang Slope 2 : 10,3 m

Strike/Dip Lereng 2 : N 252° E/42°

Tipe Lereng : Mechanical excavation

Geotechnical Parametric

UCS : 1-25 MPa

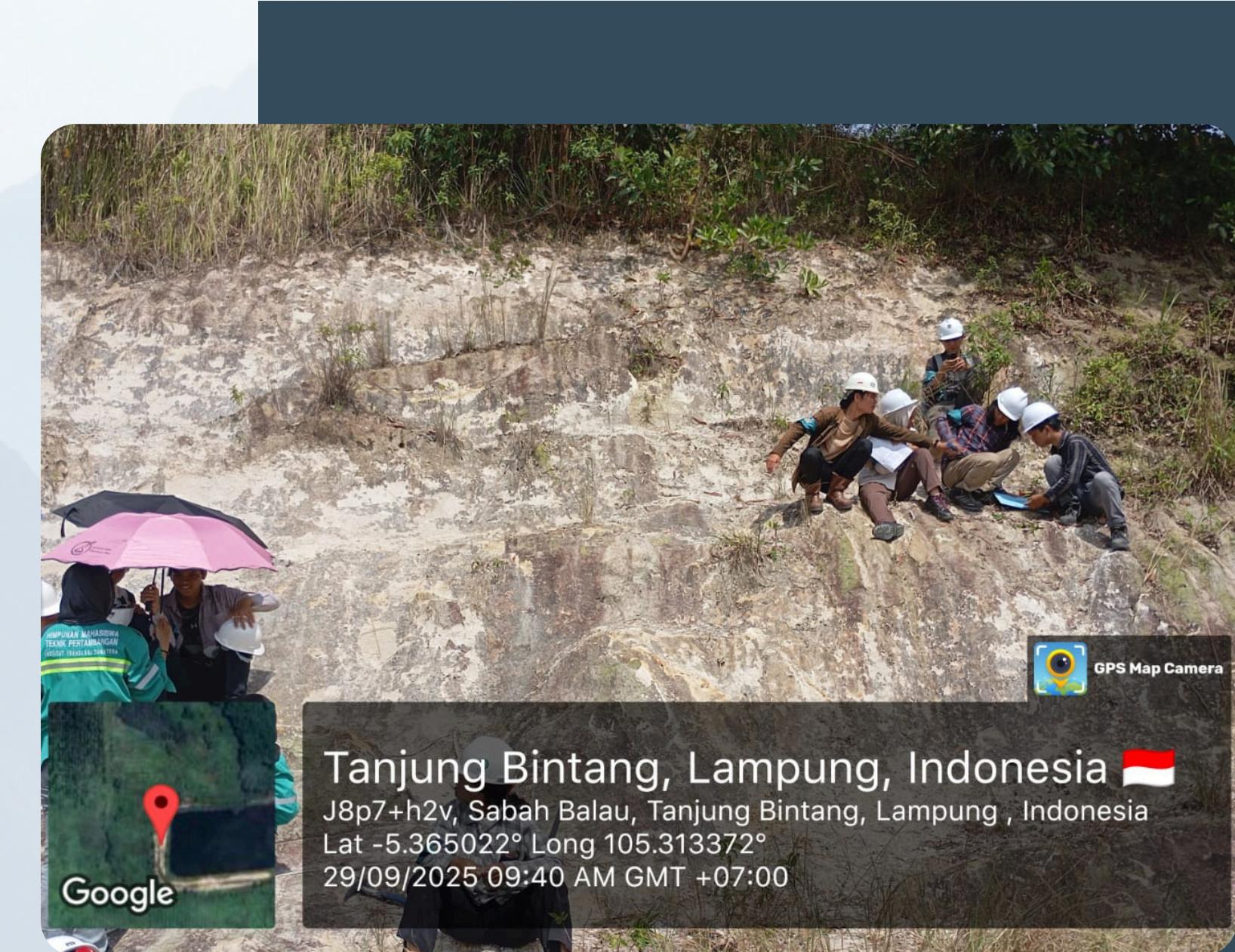
RQD : 75-90%



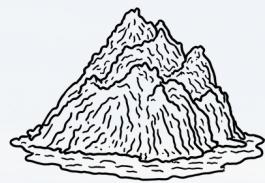
Strike/Dip Plane



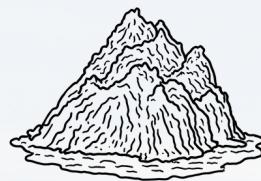
Strike	Dip	Dip Direction
350	15	260
270	75	180
255	25	165
203	72	113
206	46	116
200	72	110



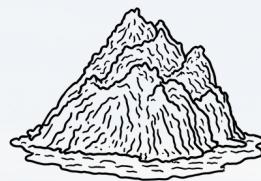
Tanjung Bintang, Lampung, Indonesia
J8p7+h2v, Sabah Balau, Tanjung Bintang, Lampung , Indonesia
Lat -5.365022° Long 105.313372°
29/09/2025 09:40 AM GMT +07:00



PARAMETER			Range of values // ratings					
1	Strength of intact rock material	Joint-rock strength	> 10 MPa	4 - 10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range	
		Uniaxial compressive strength	> 250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5 - 25 MPa	1 - 5 MPa < 1 MPa
RATING			15	12	7	4	2	1 0
2	RQD		90 - 100%	75 - 90%	50 - 75%	25 - 50%	< 25%	
RATING			20	17	13	8	3	
3	Spacing of discontinuities		> 2 m	0.6 - 2 m	200 - 600 mm	60 - 200 mm	< 60 mm	
	RATING		20	16	10	8	5	
4	Condition of discontinuities	Length, persistence	< 1 m	1 - 3 m	3 - 10 m	10 - 20 m	> 20 m	
		Rating	6	4	2	1	0	
		Separation	none	< 0.1 mm	0.1 - 1 mm	1 - 5 mm	> 5 mm	
		Rating	6	5	4	1	0	
		Roughness	very rough	rough	slightly rough	smooth	slickensided	
		Rating	6	5	3	1	0	
		Infilling (gouge)	none -	Hard Filling mm	<5 >5mm	Soft filling		< 5 mm > 5 mm
		Rating	6	4	2	2	0	
		Weathering	unweathered	slightly w.	moderately w.	highly w.	decomposed	
		Rating	6	5	3	1	0	
5	Ground water	Inflow per 10 m tunnel length	none	< 10 litres/min	10 - 25 litres/min	25 - 125 litres/min	> 125 litres /min	
		P_w / σ_l	0	0 - 0.1	0.1 - 0.2	0.2 - 0.5	> 0.5	
		General conditions	completely dry	damp	wet	dripping	flowing	
		RATING	15	10	7	4	0	
P_w = joint water pressure; σ_l = major principal stress								



PARAMETER			Range of values // ratings					
1	Strength of intact rock material	Point-load strength index	> 10 MPa	4 - 10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range uniaxial compr. strength is preferred	
		Uniaxial compressive strength	> 250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5 - 25 MPa	1 - 5 MPa
	RATING	15	12	7	4	2	1	0
2	X	90 - 100%	75 - 90%	50 - 75%	25 - 50%	< 25%		
	RATING	20	17	13	8	3		
3	Spacing of discontinuities	> 2 m	0.6 - 2 m	200 - 600 mm	60 - 200 mm	< 60 mm		
	RATING	20	16	10	8	5		
4	Condition of discontinuities	Length, persistence	< 1 m	1 - 3 m	3 - 10 m	10 - 20 m	> 20 m	
		Rating	6	4	2	1	0	
		Separation	none	< 0.1 mm	0.1 - 1 mm	1 - 5 mm	> 5 mm	
		Rating	6	5	4	1	0	
		Roughness	very rough	rough	slightly rough	smooth	slickensided	
		Rating	6	5	3	1	0	
		Infilling (gouge)	none	Hard Filling		< 5 mm	Soft filling	
			-	> 5 mm		< 5 mm	> 5 mm	
		Rating	6	4	2	2	0	
		Weathering	unweathered	slightly w.	moderately w.	highly w.	decomposed	
5	Ground water	Rating	6	5	3	1	0	
		Inflow per 10 m tunnel length	none	< 10 litres/min	10 - 25 litres/min	25 - 125 litres/min	> 125 litres /min	
		p_w/σ_1	0	0 - 0.1	0.1 - 0.2	0.2 - 0.5	> 0.5	
		General conditions	completely dry	damp	wet	dripping	flowing	
		RATING	15	10	7	4	0	
<p>p_w = joint water pressure; σ_1 = major principal stress</p>								



PARAMETER			Range of values // ratings					
1	Strength of intact rock material	Point-load strength index	> 10 MPa	4 - 10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range uniaxial compr. strength is preferred	
		Uniaxial compressive strength	> 250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5 - 25 MPa	1 - 5 MPa
	RATING		15	12	7	4	2	1
2	X		90 - 100%	75 - 90%	50 - 75%	25 - 50%	< 25%	
	RATING		20	17	13	8	3	
3	Spacing of discontinuities		> 2 m	0.6 - 2 m	200 - 600 mm	60 - 200 mm	< 60 mm	
	RATING		20	16	10	8	5	
4	Condition of discontinuities	Length, persistence	< 1 m	1 - 3 m	3 - 10 m	10 - 20 m	> 20 m	
		Rating	6	4	2	1	0	
		Separation	none	< 0.1 mm	0.1 - 1 mm	1 - 5 mm	> 5 mm	
		Rating	6	5	4	1	0	
		Roughness	very rough	rough	slightly rough	smooth	slickensided	
		Rating	6	5	3	1	0	
		Infilling (gouge)	none	Hard Filling ->5mm	<5 mm	Soft filling < 5 mm		> 5 mm
		Rating	6	4	2	2	0	
		Weathering	unweathered	slightly w.	moderately w.	highly w.	decomposed	
		Rating	6	5	3	1	0	
5	Ground water	Inflow per 10 m tunnel length	none	< 10 litres/min	10 - 25 litres/min	25 - 125 litres/min	> 125 litres /min	
		p_w / σ_1	0	0 - 0.1	0.1 - 0.2	0.2 - 0.5	> 0.5	
		General conditions	completely dry	damp	wet	dripping	flowing	
		RATING	15	10	7	4	0	
<p>p_w = joint water pressure; σ_1 = major principal stress</p>								



Total Pembobotan RMR

B. RATING ADJUSTMENT FOR DISCONTINUITY ORIENTATIONS

		Very favourable	Favourable	Fair	Unfavourable	Very unfavourable
RATINGS	Tunnels	0	-2	-5	-10	-12
	Foundations	0	-2	-7	-15	-25
	Slopes	0	-2	-25	-50	-60

Rating	81-100	61-80	41-60	21-40	<21
Class No.	I	II	III	IV	V
Description	VERY GOOD	GOOD	FAIR	POOR	VERY POOR



Kasus	Kriteria Faktor Koreksi	Sangat menguntungkan	Menguntungkan	Sedang	Tidak Menguntungkan	Sangat Tidak Menguntungkan
P	$ aj - as $	>30°	30° - 20°	20° - 10°	10° - 5°	<5°
T	$ aj - as - 180 $					
P/T	F1	0,015	0,4	0,7	0,85	1,00
P	$ \beta_j $	< 20°	20°-30°	30° - 35°	35° - 45°	>45°
P	F2	0,015	0,4	0,7	0,85	1,00
T	F2	1	1	1	1	1
P	$\beta_j - \beta_s$	>10°	10° - 0°	0°	0° - (-10°)	<(-10°)
T	$\beta_j + \beta_s$	<100°	100° - 120°	>120°	-	-
P/T	F3	0	-6	-25	-50	-60

$$SMR = RMR + (F1 \times F2 \times F3) + F4$$

$$SMR = 52 + (0.015 \times 0.015 \times (-50)) + 0$$

$$SMR = 51.9$$



Calculate SMR



Profil Massa Batuan	Deskripsi				
	I	II	III	IV	V
Nomor Kelas					
SMR Rating	81-100	61-80	41-60	21-40	0-20
Kestabilan	Sangat Baik	Baik	Sedang	jelek	Sangat jelek
Kelas Massa batuan	Sangat Stabil	Stabil	Stabil Sebagian	Tidak Stabil	Sangat Tidak Stabil
Longsoran	Tidak ada	Beberapa Blok	Beberapa kekar/ banyak baji	Bidang/Baji besar	Bidang Besar atau Seperti tanah
Penyangga	Tidak ada	Sewaktu-waktu	Sistematis	Sangat Perlu Perbaikan	Reexcavation



THANK YOU!

