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Lampiran 1 Lembar Deskripsi Batuan

Warna	Segar	: Putih keabuan
	Lapuk	: Putih keabuan
Jenis Batuan		: Batuan sedimen klastik
Struktur		: Perlapisan sedang
Tekstur		: Berbutir kasar
Nama Batuan		: Batupasir

Warna

	Segar	: Coklat
	Lapuk	: Coklat
Jenis Batuan		: Batuan sedimen klastik
Struktur		: Laminasi dan masif
Tekstur		: Berbutir halus
Nama Batuan		: Batulempung

Warna

Segar : Coklat kehitaman

Lapuk : Coklat kehitaman

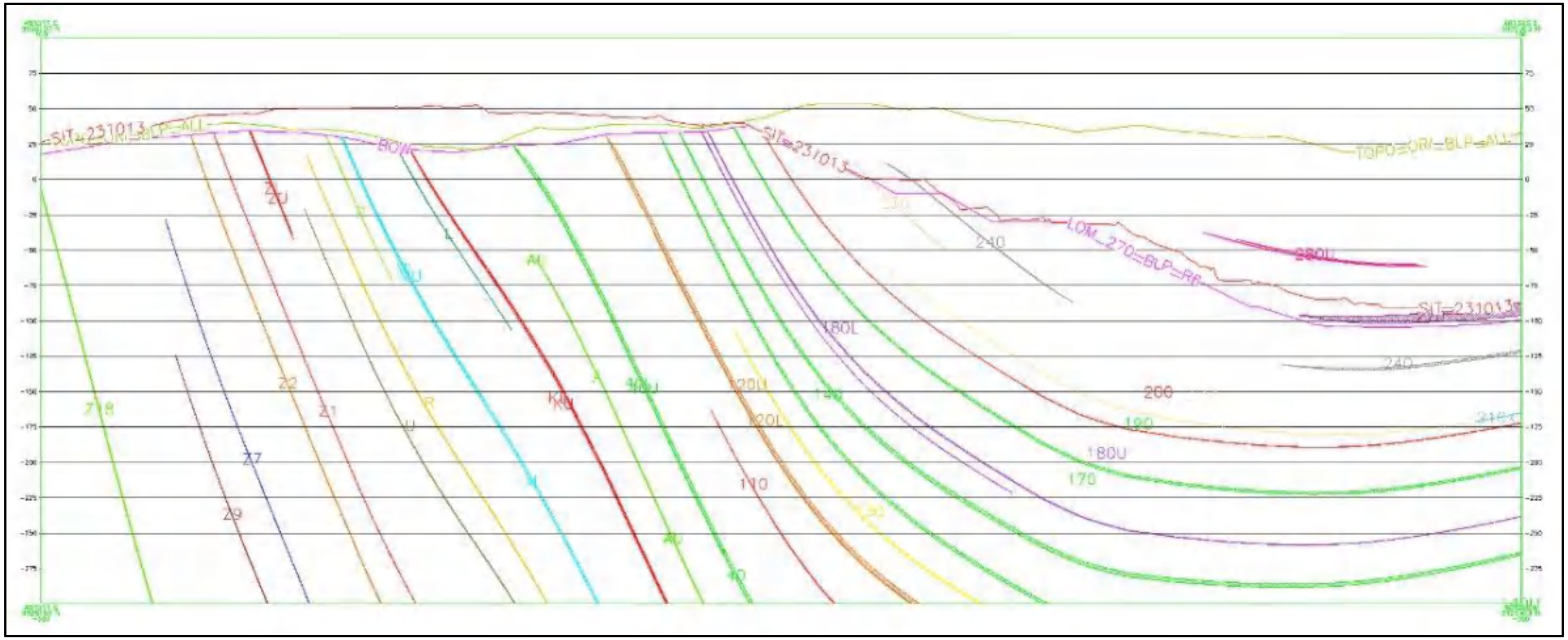
Jenis Batuan : Batuan sedimen klastik

Struktur : Laminasi

Tekstur : Berbutir halus

Nama Batuan : Serpih

Lampiran 2 Penampang 2 Dimensi *Seam* Batubara



Lampiran 3 Data Pengukuran Orientasi Kekar

Lokasi 1

No	***Dip*** **(….°)**	***Dip Direction*** **(N...°E)**	***Strike*** **(N...°E)**
1	84	318	228
2	85	200	110
3	72	201	111
4	80	390	300
5	79	405	315
6	82	410	320
7	88	415	325
8	70	210	120
9	65	224	134
10	63	215	125
11	67	214	124
12	65	205	115
13	72	215	125
14	72	215	125
15	80	415	325
16	85	416	326
17	76	415	325

Lokasi 2

No	***Dip*** **(….°)**	***Dip Direction*** **(N...°E)**	***Strike*** **(N...°E)**
1	38	350	260
2	65	225	135
3	72	220	130
4	38	348	258
5	40	350	260
6	30	347	257
7	35	344	254

Lampiran 4 Data Pengamatan Kekar

1. Spasi dan bukaan kekar

a. *Seam* 190 lokasi 1

No	Spasi Kekar (m)	Bukaan Kekar (mm)
1	0,16	0
2	0,2	0
3	0,4	0,1
4	0,83	0,1
5	1,12	0
6	1,3	0
7	1,75	0,2
8	2,2	0
9	2,8	0
10	3,17	0
11	3,38	0,1
12	3,48	0
13	3,6	0
14	3,88	0,1
15	3,98	0,1
16	4,05	0,2
17	4,63	0

b. *Seam* 190 lokasi 2

No	Spasi Kekar (m)	Bukaan Kekar (mm)
1	0,22	0,1
2	0,75	0
3	0,93	0
4	0,4	0,2
5	0,53	0
6	0,6	0
7	0,7	0,1

2. *Persistence*, *Roughness*, dan *Ground Water Condition*

a. *Seam* 190 lokasi 1

No	*Persistence* (m)	*Roughness*	*Ground Water Condition*
1	0,3	Sangat kasar	Kering
2	0,47	Sangat kasar	Kering
3	0,08	Sangat kasar	Kering
4	0,37	Sangat kasar	Kering
5	0,83	Sangat kasar	Kering
6	0,47	kasar	Kering
7	0,38	Sangat kasar	Kering
8	0,26	Sangat kasar	Kering
9	0,28	Sangat kasar	Kering
10	0,4	Sangat kasar	Kering
11	0,6	Sangat kasar	Kering
12	0,6	Sangat kasar	Kering
13	0,48	Sangat kasar	Kering
14	0,18	Sangat kasar	Kering
15	0,23	Sangat kasar	Kering
16	0,58	kasar	Kering
17	1,2	Sangat kasar	Kering

b. *Seam* 190 lokasi 2

No	*Persistence* (m)	*Roughness*	*Ground Water Condition*
1	0,37	Sangat kasar	Kering
2	0,5	Sangat kasar	Kering
3	0,15	Sangat kasar	Kering
4	0,35	kasar	Kering
5	0,78	Sangat kasar	Kering
6	0,4	Sangat kasar	Kering
7	0,38	Sangat kasar	Kering

Lampiran 5 Perhitungan Nilai Kuat Tekan Batuan (UCS)

Nilai UCS pada penelitian ini dihitung menggunakan rumus standar pengujian ISRM 1981 pada persamaan berikut.

$$\sigma_C = \frac{F}{A}$$

Dimana:

σ_C = Kuat tekan (MPa)

F = Beban (kN)

A = Luas Permukaan Sampel (mm^2)

Nilai Kuat Tekan Batuan

1. F = 3 kN

   A = 1358,75 mm^2

   Kuat Tekan = $\frac{F}{A}$

   $= \frac{3 \text{ kN}}{1358{,}75 \text{ mm}^2} \times 1000$

   = 2, 207 MPa

   F = 3 kN = 3 x 10^3 N

   A = 1358,75 mm^2 = 1,358 x 10^{-3} m^2

   Kuat Tekan = $\frac{F}{A}$

   $= \frac{3 \times 10^3 \text{ N}}{1{,}358 \times 10^{-3} \text{ m}^2}$

   = 2, 207 x 10^6 Pa

   = 2, 207 MPa

2. F = 9 kN

   A = 1435,27 mm^2

   Kuat Tekan = $\frac{F}{A}$

   $= \frac{9 \text{ kN}}{1435{,}27 \text{ mm}^2} \times 1000$

   = 6, 270 MPa

3. F = 10 kN

   A = 1425,88 mm^2

   Kuat Tekan = $\frac{F}{A}$

   $= \frac{10 \text{ kN}}{1425{,}88 \text{ mm}^2} \times 1000$

   = 7, 013 MPa

13 kN

= 1421,42 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{13\text{ kN}}{1421{,}42\text{ mm}^2}$ x 1000

= 9, 145 MPa

5. F = 2 kN

   A = 1409,20 mm^2

   Kuat Tekan $= \frac{F}{A}$

   $= \frac{2\text{ kN}}{1409{,}20\text{ mm}^2}$ x 1000

   = 1,419 MPa

6. F = 1 kN

   A = 1423,21 mm^2

   Kuat Tekan $= \frac{F}{A}$

   $= \frac{1\text{ kN}}{1423{,}21\text{ mm}^2}$ x 1000

   = 0,702 MPa

7. F = 2 kN

   A = 1400,45 mm^2

   Kuat Tekan $= \frac{F}{A}$

   $= \frac{2\text{ kN}}{1400{,}45\text{ mm}^2}$ x 1000

   = 1,428 MPa

8. F = 2 kN

   A = 1421,42 mm^2

   Kuat Tekan $= \frac{F}{A}$

   $= \frac{2\text{ kN}}{1421{,}42\text{ mm}^2}$ x 1000

   = 1,407 MPa

10 kN

1419,20 mm^2

at Tekan $= \frac{F}{A}$

$$= \frac{10\ \text{kN}}{1419{,}20\ \text{mm}^2} \text{ x } 1000$$

$$= 7{,}046 \text{ MPa}$$

10. F = 9 kN

A = 1412,53 mm^2

Kuat Tekan $= \frac{F}{A}$

$$= \frac{9\ \text{kN}}{1412{,}53\ \text{mm}^2} \text{ x } 1000$$

$$= 6{,}371 \text{ MPa}$$

11. F = 2 kN

A = 1390,40 mm^2

Kuat Tekan $= \frac{F}{A}$

$$= \frac{2\ \text{kN}}{1390{,}40\ \text{mm}^2} \text{ x } 1000$$

$$= 1{,}438 \text{ MPa}$$

12. F = 2 kN

A = 1392,61 mm^2

Kuat Tekan $= \frac{F}{A}$

$$= \frac{2\ \text{kN}}{1392{,}61\ \text{mm}^2} \text{ x } 1000$$

$$= 1{,}436 \text{ MPa}$$

13. F = 15 kN

A = 1419,20 mm^2

Kuat Tekan $= \frac{F}{A}$

$$= \frac{15\ \text{kN}}{1419{,}20\ \text{mm}^2} \text{ x } 1000$$

$$= 10{,}569 \text{ MPa}$$

14. F = 3 kN

A = 1380,62 mm^2

at Tekan $= \frac{F}{A}$

$$= \frac{3\ \text{kN}}{1380{,}62\ \text{mm}^2} \text{ x } 1000$$

$= 2{,}172$ MPa

15. F = 7 kN

    A = 1412,53 mm^2

    Kuat Tekan $= \frac{F}{A}$

    $= \frac{7 \text{ kN}}{1412{,}53 \text{ mm}^2}$ x 1000

    $= 4{,}955$ MPa

16. F = 2 kN

    A = 1421,42 mm^2

    Kuat Tekan $= \frac{F}{A}$

    $= \frac{2 \text{ kN}}{1421{,}42 \text{ mm}^2}$ x 1000

    $= 1{,}407$ MPa

17. F = 2 kN

    A = 1421,42 mm^2

    Kuat Tekan $= \frac{F}{A}$

    $= \frac{2 \text{ kN}}{1421{,}42 \text{ mm}^2}$ x 1000

    $= 1{,}407$ MPa

18. F = 11 kN

    A = 1441,43 mm^2

    Kuat Tekan $= \frac{F}{A}$

    $= \frac{11 \text{ kN}}{1441{,}43 \text{ mm}^2}$ x 1000

    $= 7{,}631$ MPa

19. F = 3 kN

    A = 1422,65 mm^2

    at Tekan $= \frac{F}{A}$

    $= \frac{3 \text{ kN}}{1422{,}65 \text{ mm}^2}$ x 1000

= 2,108 MPa

20. F = 3 kN

A = 1421,42 mm^2

Kuat Tekan = $\frac{F}{A}$

= $\frac{3\text{ kN}}{1421{,}42\text{ mm}^2}$ x 1000

= 2,110 MPa

21. F = 4 kN

A = 1421,42 mm2

Kuat Tekan = $\frac{F}{A}$

= $\frac{4\text{ kN}}{1421{,}42\text{ mm}^2}$ x 1000

= 2,814 MPa

22. F = 8 kN

A = 1395,15 mm^2

Kuat Tekan = $\frac{F}{A}$

= $\frac{8\text{ kN}}{1395{,}15\text{ mm}^2}$ x 1000

= 5,734 MPa

23. F = 2 kN

A = 1443,79 mm^2

Kuat Tekan = $\frac{F}{A}$

= $\frac{2\text{ kN}}{1443{,}79\text{ mm}^2}$ x 1000

= 1,385 MPa

24. F = 4 kN

A = 1378,15 mm^2

Kuat Tekan = $\frac{F}{A}$

= $\frac{4\text{ kN}}{1378{,}15\text{ mm}^2}$ x 1000

= 2,901 MPa

25. F = 3 kN

A = 1473,13 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{3 \text{ kN}}{1473{,}13 \text{ mm}^2} \times 1000$

= 2,036 MPa

26. F = 4 kN

A = 1434,71 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{4 \text{ kN}}{1434{,}71 \text{ mm}^2} \times 1000$

= 2,788 MPa

27. F = 2 kN

A = 1421,43 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{2 \text{ kN}}{1421{,}43 \text{ mm}^2} \times 1000$

= 1,407 MPa

28. F = 9 kN

A = 1439,30 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{4 \text{ kN}}{1439{,}30 \text{ mm}^2} \times 1000$

= 6,253 MPa

29. F = 3 kN

A = 1400,45 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{3 \text{ kN}}{1400{,}45 \text{ mm}^2} \times 1000$

= 2,142 MPa

3 kN

A = 1422,65 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{3 \text{ kN}}{1422,65 \text{ mm}^2}$ x 1000

= 2,108 MPa

31. F = 2 kN

A = 1421,42 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{2 \text{ kN}}{1421,42 \text{ mm}^2}$ x 1000

= 1,407 MPa

32. F = 2 kN

A = 1422,65 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{2 \text{ kN}}{1422,65 \text{ mm}^2}$ x 1000

= 1,405 MPa

33. F = 3 kN

A = 1355,37 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{3 \text{ kN}}{1335,37 \text{ mm}^2}$ x 1000

= 2,213 MPa

34. F = 10 kN

A = 1439,30 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{10 \text{ kN}}{1439,30 \text{ mm}^2}$ x 1000

= 6,947 MPa

5 kN

1421,42 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{5 \text{ kN}}{1421{,}42 \text{ mm}^2} \text{ x } 1000$

$= 3{,}517$ MPa

36. F = 3 kN

A = 1423,65 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{3 \text{ kN}}{1423{,}65 \text{ mm}^2} \text{ x } 1000$

$= 2{,}107$ MPa

37. F = 9 kN

A = 1439,30 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{9 \text{ kN}}{1439{,}30 \text{ mm}^2} \text{ x } 1000$

$= 6{,}253$ MPa

38. F = 3 kN

A = 1422,65 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{3 \text{ kN}}{1422{,}65 \text{ mm}^2} \text{ x } 1000$

$= 2{,}108$ MPa

39. F = 3 kN

A = 1421,42 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{3 \text{ kN}}{1421{,}42 \text{ mm}^2} \text{ x } 1000$

$= 2{,}110$ MPa

11 kN

= 1439,30 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{11\ \text{kN}}{1439{,}30\ \text{mm}^2}$ x 1000

= 7,642 MPa

41. F = 4 kN

A = 1421,42 mm^2

Kuat Tekan $= \frac{F}{A}$

$= \frac{4\ \text{kN}}{1421{,}42\ \text{mm}^2}$ x 1000

= 2,814 MPa

Nilai UCS Batuan

No	*Seam*	Lapisan	Litologi	*Length* (mm)				Diameter (mm)				L/D	Luas penampang (mm2)	*Force*	UCS
				1	2	3	Rata-rata	1	2	3	Rata-rata			(KN)	MPa
1	190		Batubara												
		1	Serpih	100,1	99,18	99,5	99,59	41,7	41,5	41,6	41,59	2,39	1358,75	3	2,208
		2	Batupasir	94,11	94,04	94,1	94,08	42,7	42,7	42,9	42,74	2,20	1435,27	9	6,271
		3	Batupasir	97,1	97,07	97,15	97,11	42,8	42,5	42,5	42,60	2,28	1425,88	10	7,013
		4	Batupasir	91,7	92,4	92,8	92,30	42,7	42,1	42,8	42,53	2,17	1421,42	13	9,146
		5	Batulempung	87	85,5	86,05	86,18	42,4	42,1	42,6	42,35	2,04	1409,20	2	1,419
		6	Serpih	87,57	87,97	87,76	87,77	42,6	42,6	42,6	42,56	2,06	1423,21	1	0,703
2	210		Batubara												**5,75**
		1	Serpih	96,66	97,11	96,82	96,86	41,5	42,6	42,6	42,22	2,29	1400,45	2	1,428
		2	Batulempung	94,5	93,6	93,5	93,87	42,5	42,6	42,5	42,53	2,21	1421,42	2	1,407
		3	Batupasir	93,9	93,8	93,5	93,73	42,8	42,6	42,1	42,50	2,21	1419,20	10	7,046
3	220		Batubara												**5,75**
		1	Batupasir	95,2	95,2	95,2	95,20	42,1	42,5	42,6	42,40	2,25	1412,53	15	6,372
		2	Batulempung	90,7	90,1	90,6	90,47	41,4	42,2	42,6	42,07	2,15	1390,40	2	1,438
	240		Batubara												**5,75**
		1	Batulempung	95,5	94,7	95,9	95,37	41,9	41,5	42,9	42,10	2,27	1392,61	2	1,436
		2	Batupasir	93,9	93,8	93,5	93,73	42,8	42,6	42,1	42,50	2,21	1419,20	15	10,569
		3	Serpih	98,1	99,18	98,5	98,59	41,7	42,5	41,6	41,92	2,35	1380,62	3	2,173
		4	Batupasir	92,9	92,7	92	92,53	42,5	42,4	42,3	42,40	2,18	1412,53	7	4,956
		5	Batulempung	94,5	93,6	93,5	93,87	42,5	42,6	42,5	42,53	2,21	1421,42	2	1,407

No	***Seam***	**Lapisan**	**Litologi**	***Length* (mm)**				**Diameter**				**L/D**	**Luas Penampang**	**Force**	**UCS**
				1	**2**	**3**	**Rata-rata**	**1**	**2**	**3**	**Rata-rata**		**(mm^2)**	**(KN)**	**(MPa)**
5	270		Batubara												**5,75**
		1	Batulempung	94,5	93,6	93,5	93,87	42,5	42,6	42,5	42,53	2,21	1421,42	2	1,407
		2	Batupasir	95,1	96,2	95,5	95,60	43,1	42,3	43,1	42,83	2,23	1441,43	11	7,631
		3	Serpih	97,66	97,11	97,12	97,30	42,5	42,6	42,6	42,55	2,29	1422,65	2	2,109
		4	Batulempung	94,5	93,6	93,5	93,87	42,5	42,6	42,5	42,53	2,21	1421,42	3	2,111
		5	Serpih	93,5	93,6	93,5	93,53	42,5	42,6	42,5	42,53	2,20	1421,42	4	2,814
		6	Batupasir	95,21	96,01	97	96,07	42,1	42,3	42	42,14	2,28	1395,15	8	5,734
		7	Batulempung	92,5	93,6	92,5	92,87	43,5	42,6	42,5	42,87	2,17	1443,79	2	1,385
6	280		Batubara												**5,75**
		1	Serpih	96,66	97,11	96,12	96,63	41,5	42,6	42,6	42,22	2,29	1400,45	4	2,902
		2	Batulempung	94,5	93,6	93,8	93,97	43,5	42,9	43,5	43,30	2,17	1473,13	3	2,036
		3	Serpih	96,66	97,11	96,12	96,63	42,5	43,1	42,6	42,73	2,26	1434,71	4	2,788
		4	Batulempung	94,5	93,6	93,5	93,87	42,5	42,6	42,5	42,53	2,21	1421,42	2	1,407
		5	Batupasir	94	94	94	94,00	42,8	42,8	42,8	42,80	2,20	1439,30	9	6,253
		6	Serpih	95,66	97,11	95,12	95,96	42,5	42,6	41,6	42,22	2,27	1400,45	3	2,142
7	290		Batubara												**5,75**
		1	Serpih	100,1	99,2	98,8	99,37	42,5	42,6	42,6	42,55	2,34	1422,65	3	2,109
		2	Batulempung	94,5	93,6	93,5	93,87	42,5	42,6	42,5	42,53	2,21	1421,42	2	1,407
		3	Serpih	97,66	97,11	97,12	97,30	42,5	42,6	42,6	42,55	2,29	1422,65	2	1,406
			Batubara												**5,75**
		1	Batulempung	94,5	93,6	93,5	93,87	41,5	41,6	41,5	41,53	2,26	1355,37	3	2,213
		2	Batupasir	94,5	94	95	94,50	42,8	42,8	42,8	42,80	2,21	1439,30	10	6,948

No	*Seam*	Lapisan	Litologi	*Length* (mm)				Diameter				L/D	Luas Penampang	Force	UCS
				1	2	3	Rata-rata	1	2	3	Rata-rata		(mm^2)	(KN)	(MPa)
	300	3	Batulempung	94,5	93,6	93,5	93,87	42,5	42,6	42,5	42,53	2,21	1421,42	5	3,518
			Batubara												**5,75**
9	310	1	Batulempung	94,5	93,6	93,5	93,87	42,5	42,6	42,5	42,53	2,21	1421,42	3	2,107
		2	Batupasir	94	94	94	94,00	42,8	42,8	42,8	42,80	2,20	1439,30	9	6,253
		3	Serpih	97,66	97,11	97,12	97,30	42,5	42,6	42,6	42,55	2,29	1422,65	3	2,109
		4	Batulempung	94,5	93,6	93,5	93,87	42,5	42,6	42,5	42,53	2,21	1421,42	3	2,111
		5	Batupasir	94	94	94	94,00	42,8	42,8	42,8	42,80	2,20	1439,30	11	7,643
		6	Batulempung	94,5	93,6	93,5	93,87	42,5	42,6	42,5	42,53	2,21	1421,42	4	2,814

Lampiran 6 Perhitungan Nilai Berat Volume

Nilai Berat Volume pada penelitian ini dihitung menggunakan rumus pada persamaan berikut.

$$\gamma = \frac{m}{V}\,g$$

Dimana:

γ = Berat Volume (kN/m^3)

m = Massa (kg)

V = Volume (m^3)

g = Percepatan Gravitasi (10 m/s^2)

Nilai Berat Volume

1. m = 0,21 kg

   V = 0,000135 m^3

   Berat Volume $= \frac{m}{V}$ x g

   $= \frac{0{,}21\text{ kg}}{0{,}000135\text{ m}^3}$ x 10 m/s^2

   = 15.801,05 N/m^3

   = 15,80 kN/m^3

2. m = 0,25 kg

   V = 0,000135 m^3

   Berat Volume $= \frac{m}{V}$ x g

   $= \frac{0{,}25\text{ kg}}{0{,}000135\text{ m}^3}$ x 10 m/s^2

   = 18.510,15 N/m^3

   = 18,51 kN/m^3

3. m = 0,28 kg

   V = 0,000138 m^3

   Berat Volume $= \frac{m}{V}$ x g

   $= \frac{0{,}28\text{ kg}}{0{,}000138\text{ m}^3}$ x 10 m/s^2

   = 19.922,31 N/m^3

   = 19,92 kN/m^3

4. m = 0,26 kg

   V = 0,000131 m^3

   Berat Volume $= \frac{m}{V}$ x g

   $= \frac{0,26 \text{ kg}}{0,000131 \text{ m}^3}$ x 10 m/s^2

   = 20.103,74 N/m^3

   = 20,10 kN/m^3

5. m = 0,27 kg

   V = 0,000121 m^3

   Berat Volume $= \frac{m}{V}$ x g

   $= \frac{0,27 \text{ kg}}{0,000121 \text{ m}^3}$ x 10 m/s^2

   = 22.052,00 N/m^3

   = 22,05 kN/m^3

6. m = 0,18 kg

   V = 0,000125 m^3

   Berat Volume $= \frac{m}{V}$ x g

   $= \frac{0,18 \text{ kg}}{0,000125 \text{ m}^3}$ x 10 m/s^2

   = 14.517,18 N/m^3

   = 14,51 kN/m^3

7. m = 0,18 kg

   V = 0,000136 m^3

   Berat Volume $= \frac{m}{V}$ x g

   $= \frac{0,18 \text{ kg}}{0,000136 \text{ m}^3}$ x 10 m/s^2

   = 13.201,33 N/m^3

   = 13,20 kN/m^3

: 0,32 kg

0,000133 m^3

at Volume $= \frac{m}{V}$ x g

$= \frac{0{,}32 \text{ kg}}{0{,}000133 \text{ m}^3}$ x 10 m/s^2

= 23.763,60 N/m^3

= 23,76 kN/m^3

9. m = 0,28 kg

   V = 0,000133 m^3

   Berat Volume $= \frac{m}{V}$ x g

   $= \frac{0{,}28 \text{ kg}}{0{,}000133 \text{ m}^3}$ x 10 m/s^2

   = 21.014,36 N/m^3

   = 21,01 kN/m^3

10. m = 0,29 kg

    V = 0,000134 m^3

    Berat Volume $= \frac{m}{V}$ x g

    $= \frac{0{,}29 \text{ kg}}{0{,}000134 \text{ m}^3}$ x 10 m/s^2

    = 21.885,29 N/m^3

    = 21,88 kN/m^3

11. m = 0,27 kg

    V = 0,000126 m^3

    Berat Volume $= \frac{m}{V}$ x g

    $= \frac{0{,}27 \text{ kg}}{0{,}000126 \text{ m}^3}$ x 10 m/s^2

    = 11.215,16 N/m^3

    = 21,22 kN/m^3

12. m = 0,30 kg

    V = 0,000133 m^3

    Berat Volume $= \frac{m}{V}$ x g

    $= \frac{0{,}30 \text{ kg}}{0{,}000133 \text{ m}^3}$ x 10 m/s^2

    = 22.780,96 N/m^3

$= 22,78\ kN/m^3$

13. m = 0,27 kg

    V = 0,000133 m^3

    Berat Volume $= \frac{m}{V} \times g$

    $= \frac{0,27\ kg}{0,000133\ m^3} \times 10\ m/s^2$

    $= 20.733,43\ N/m^3$

    $= 20,73\ kN/m^3$

14. m = 0,23 kg

    V = 0,000136 m^3

    Berat Volume $= \frac{m}{V} \times g$

    $= \frac{0,23\ kg}{0,000136\ m^3} \times 10\ m/s^2$

    $= 16.664,64\ N/m^3$

    $= 16,66\ kN/m^3$

15. m = 0,26 kg

    V = 0,000131 m^3

    Berat Volume $= \frac{m}{V} \times g$

    $= \frac{0,26\ kg}{0,000131\ m^3} \times 10\ m/s^2$

    $= 20.134,94\ N/m^3$

    $= 20,13\ kN/m^3$

16. m = 0,31 kg

    V = 0,000133 m^3

    Berat Volume $= \frac{m}{V} \times g$

    $= \frac{0,31\ kg}{0,000133\ m^3} \times 10\ m/s^2$

    $= 23.572,21\ N/m^3$

    $= 23,57\ kN/m^3$

= 0,28 kg

V = 0,000133 m^3

Berat Volume $= \frac{m}{V}$ x g

$= \frac{0{,}28 \text{ kg}}{0{,}000133 \text{ m}^3}$ x 10 m/s^2

= 20.934,85 N/m^3

= 20,93 kN/m^3

18. m = 0,30 kg

V = 0,000138 m^3

Berat Volume $= \frac{m}{V}$ x g

$= \frac{0{,}30 \text{ kg}}{0{,}000138 \text{ m}^3}$ x 10 m/s^2

= 21.885,29 N/m^3

= 21,88 kN/m^3

19. m = 0,25 kg

V = 0,000138 m^3

Berat Volume $= \frac{m}{V}$ x g

$= \frac{0{,}25 \text{ kg}}{0{,}000138 \text{ m}^3}$ x 10 m/s^2

= 17.946,26 N/m^3

= 17,94 kN/m^3

20. m = 0,27 kg

V = 0,000133 m^3

Berat Volume $= \frac{m}{V}$ x g

$= \frac{0{,}27 \text{ kg}}{0{,}000133 \text{ m}^3}$ x 10 m/s^2

= 19.972,98 N/m^3

= 19,97 kN/m^3

21. m = 0,22 kg

0,000133 m^3

at Volume $= \frac{m}{V}$ x g

$= \frac{0{,}22 \text{ kg}}{0{,}000133 \text{ m}^3} \text{ x } 10 \text{ m/s}^2$

$= 16.843{,}42 \text{ N/m}^3$

$= 16{,}84 \text{ kN/m}^3$

22. m = 0,29 kg

V = 0,000134 m^3

Berat Volume $= \frac{m}{V} \text{ x g}$

$= \frac{0{,}29 \text{ kg}}{0{,}000134 \text{ m}^3} \text{ x } 10 \text{ m/s}^2$

$= 21.885{,}29 \text{ N/m}^3$

$= 21{,}89 \text{ kN/m}^3$

23. m = 0,32 kg

V = 0,000134 m^3

Berat Volume $= \frac{m}{V} \text{ x g}$

$= \frac{0{,}32 \text{ kg}}{0{,}000134 \text{ m}^3} \text{ x } 10 \text{ m/s}^2$

$= 24.227{,}45 \text{ N/m}^3$

$= 24{,}23 \text{ kN/m}^3$

24. m = 0,20 kg

V = 0,000135 m^3

Berat Volume $= \frac{m}{V} \text{ x g}$

$= \frac{0{,}20 \text{ kg}}{0{,}000135 \text{ m}^3} \text{ x } 10 \text{ m/s}^2$

$= 14.822{,}83 \text{ N/m}^3$

$= 14{,}82 \text{ kN/m}^3$

25. m = 0,32 kg

V = 0,000138 m^3

Berat Volume $= \frac{m}{V} \text{ x g}$

$= \frac{0{,}32 \text{ kg}}{0{,}000138 \text{ m}^3} \text{ x } 10 \text{ m/s}^2$

$= 23.350{,}84 \text{ N/m}^3$

= 23,35 kN/m^3

26. m = 0,25 kg

    V = 0,000139 m^3

    Berat Volume $= \frac{m}{V}$ x g

    $= \frac{0{,}25 \text{ kg}}{0{,}000139 \text{ m}^3}$ x 10 m/s^2

    = 18.256,81 N/m^3

    = 18,26 kN/m^3

27. m = 0,34 kg

    V = 0,000133 m^3

    Berat Volume $= \frac{m}{V}$ x g

    $= \frac{0{,}34 \text{ kg}}{0{,}000133 \text{ m}^3}$ x 10 m/s^2

    = 25.323,57 N/m^3

    = 25,32 kN/m^3

28. m = 0,27 kg

    V = 0,000135 m^3

    Berat Volume $= \frac{m}{V}$ x g

    $= \frac{0{,}27 \text{ kg}}{0{,}000135 \text{ m}^3}$ x 10 m/s^2

    = 19.680,09 N/m^3

    = 19,68 kN/m^3

29. m = 0,17 kg

    V = 0,000134 m^3

    Berat Volume $= \frac{m}{V}$ x g

    $= \frac{0{,}17 \text{ kg}}{0{,}000134 \text{ m}^3}$ x 10 m/s^2

    = 12.970,27 N/m^3

    = 12,97 kN/m^3

0,19 kg

0,000141 m^3

Berat Volume $= \frac{m}{V}$ x g

$= \frac{0{,}19 \text{ kg}}{0{,}000141 \text{ m}^3}$ x 10 m/s^2

= 13.604,75 N/m^3

= 13,60 kN/m^3

31. m = 0,27 kg

V = 0,000133 m^3

Berat Volume $= \frac{m}{V}$ x g

$= \frac{0{,}27 \text{ kg}}{0{,}000133 \text{ m}^3}$ x 10 m/s^2

= 20.608,08 N/m^3

= 20,61 kN/m^3

32. m = 0,21 kg

V = 0,000138 m^3

Berat Volume $= \frac{m}{V}$ x g

$= \frac{0{,}21 \text{ kg}}{0{,}000138 \text{ m}^3}$ x 10 m/s^2

= 15.203,65 N/m^3

= 15,20 kN/m^3

33. m = 0,31 kg

V = 0,000127 m^3

Berat Volume $= \frac{m}{V}$ x g

$= \frac{0{,}31 \text{ kg}}{0{,}000127 \text{ m}^3}$ x 10 m/s^2

=24.180,52 N/m^3

= 24,18 kN/m^3

34. m = 0,29 kg

V = 0,000136 m^3

at Volume $= \frac{m}{V}$ x g

$= \frac{0{,}29 \text{ kg}}{0{,}000136 \text{ m}^3}$ x 10 m/s^2

$= 21.677{,}71\ N/m^3$

$= 21{,}68\ kN/m^3$

35. m = 0,29 kg

V = 0,000133 m^3

Berat Volume $= \frac{m}{V}$ x g

$= \frac{0{,}29\ kg}{0{,}000133\ m^3}$ x 10 m/s^2

$= 21.836{,}25\ N/m^3$

$= 21{,}83\ kN/m^3$

36. m = 0,16 kg

V = 0,000133 m^3

Berat Volume $= \frac{m}{V}$ x g

$= \frac{0{,}16\ kg}{0{,}000131\ m^3}$ x 10 m/s^2

$= 11.687{,}13\ N/m^3$

$= 11{,}69\ kN/m^3$

37. m = 0,29 kg

V = 0,000135 m^3

Berat Volume $= \frac{m}{V}$ x g

$= \frac{0{,}29\ kg}{0{,}000135\ m^3}$ x 10 m/s^2

$= 21.69732\ N/m^3$

$= 21{,}70\ kN/m^3$

38. m = 0,21 kg

V = 0,000138 m^3

Berat Volume $= \frac{m}{V}$ x g

$= \frac{0{,}21\ kg}{0{,}000138\ m^3}$ x 10 m/s^2

$= 15.406{,}95\ N/m^3$

$= 15{,}41\ kN/m^3$

39. m = 0,28 kg

V = 0,000133 m^3

Berat Volume $= \frac{m}{V}$ x g

$= \frac{0{,}28\ \text{kg}}{0{,}000133\ \text{m}^3}$ x 10 m/s^2

=21.280,54 N/m^3

= 21,28 kN/m^3

40. m = 0,31 kg

V = 0,000135 m^3

Berat Volume $= \frac{m}{V}$ x g

$= \frac{0{,}31\ \text{kg}}{0{,}000135\ \text{m}^3}$ x 10 m/s^2

= 23.107,04 N/m^3

= 23,11 kN/m^3

41. m = 0,28 kg

V = 0,000133 m^3

Berat Volume $= \frac{m}{V}$ x g

$= \frac{0{,}28\ \text{kg}}{0{,}000133\ \text{m}^3}$ x 10 m/s^2

= 21.280,54 N/m^3

= 21,28 kN/m^3

Nilai Berat Volume

No	*Seam*	Lapisan	Litologi	Tinggi	Diameter	Volume	Massa	Percepatan Gravitasi	Berat Volume
				(m)	(m)	(m^3)	(Kg)	m/s^2	(KN/m^3)
	190		Batubara					10	
		1	Serpih	0,0996	0,0416	0,000135	0,21	10	15,80
		2	Batupasir	0,0941	0,0427	0,000135	0,25	10	18,51
1		3	Batupasir	0,0971	0,0426	0,000138	0,28	10	19,92
		4	Batupasir	0,0923	0,0425	0,000131	0,26	10	20,10
		5	Batulempung	0,0862	0,0424	0,000121	0,27	10	22,05
		6	Serpih	0,0878	0,0426	0,000125	0,18	10	14,52
	210		Batubara						**12,07**
2		1	Serpih	0,0969	0,0422	0,000136	0,18	10	13,20
		2	Batulempung	0,0939	0,0425	0,000133	0,32	10	23,76
		3	Batupasir	0,0937	0,0425	0,000133	0,28	10	21,01
	220		Batubara						12,07
3		1	Batupasir	0,0952	0,0424	0,000134	0,29	10	21,89
		2	Batulempung	0,0905	0,0421	0,000126	0,27	10	21,22
	240		Batubara						**12,07**
		1	Batulempung	0,0954	0,0421	0,000133	0,30	10	22,78
4		2	Batupasir	0,0937	0,0425	0,000133	0,28	10	20,73
		3	Serpih	0,0986	0,0419	0,000136	0,23	10	16,64
		4	Batupasir	0,0925	0,0424	0,000131	0,26	10	20,13
		5	Batulempung	0,0939	0,0425	0,000133	0,31	10	23,57
			Batubara						

No	*Seam*	Lapisan	Litologi	Tinggi	Diameter	Volume	Massa	Percepatan Gravitasi	Berat Volume
				(m)	(m)	(m^3)	(Kg)	m/s^2	(KN/m^3)
5	270	1	Batulempung	0,0939	0,0425	0,000133	0,28	10	20,93
		2	Batupasir	0,0956	0,0428	0,000138	0,30	10	21,89
		3	Serpih	0,0973	0,0426	0,000138	0,25	10	17,95
		4	Batulempung	0,0939	0,0425	0,000133	0,27	10	19,97
		5	Serpih	0,0935	0,0425	0,000133	0,22	10	16,84
		6	Batupasir	0,0961	0,0421	0,000134	0,29	10	21,89
		7	Batulempung	0,0929	0,0429	0,000134	0,32	10	24,23
6	280		Batubara						**12,07**
		1	Serpih	0,0966	0,0422	0,000135	0,20	10	14,82
		2	Batulempung	0,0940	0,0433	0,000138	0,32	10	23,35
		3	Serpih	0,0966	0,0427	0,000139	0,25	10	18,26
		4	Batulempung	0,0939	0,0425	0,000133	0,34	10	25,32
		5	Batupasir	0,0940	0,0428	0,000135	0,27	10	19,68
		6	Serpih	0,0960	0,0422	0,000134	0,17	10	12,97
7	290		Batubara						**12,07**
		1	Serpih	0,0994	0,0426	0,000141	0,19	10	13,60
		2	Batulempung	0,0939	0,0425	0,000133	0,27	10	20,61
		3	Serpih	0,0973	0,0426	0,000138	0,21	10	15,20
	300		Batubara						**12,07**
		1	Batulempung	0,0939	0,0415	0,000127	0,31	10	24,18
		2	Batupasir	0,0945	0,0428	0,000136	0,29	10	21,68
		3	Batulempung	0,0939	0,0425	0,000133	0,29	10	21,84
			Batubara						**12,07**

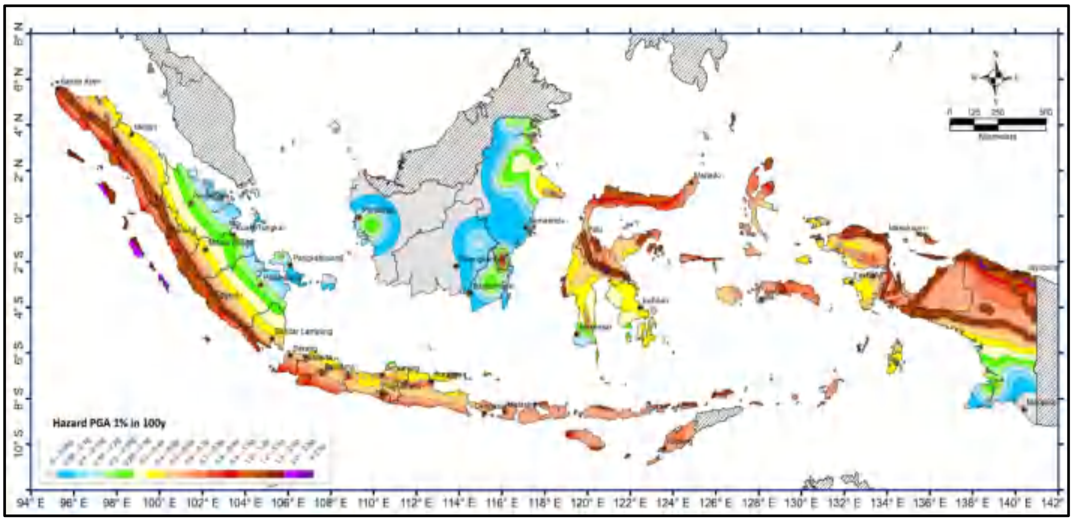
No	***Seam***	**Lapisan**	**Litologi**	**Tinggi**	**Diameter**	**Volume**	**Massa**	**Percepatan Gravitasi**	**Bobot Isi**
				(m)	**(m)**	**(m^3)**	**(Kg)**	**m/s^2**	**(KN/m^3)**
9	310	1	Batulempung	0,0939	0,0425	0,000133	0,16	10	11,69
		2	Batupasir	0,0940	0,0428	0,000135	0,29	10	21,70
		3	Serpih	0,0973	0,0426	0,000138	0,21	10	15,41
		4	Batulempung	0,0939	0,0425	0,000133	0,28	10	21,28
		5	Batupasir	0,0940	0,0428	0,000135	0,31	10	23,11
		6	Batulempung	0,0939	11,69	0,000133	0,28	10	21,28
10	320		Batubara						**12,07**

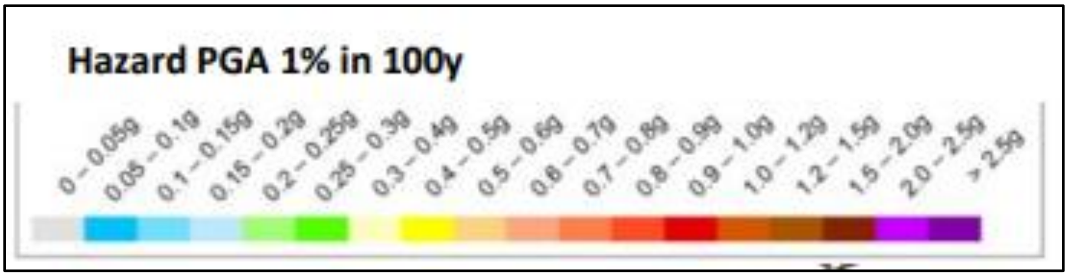
Lampiran 7 Hasil Pemetaan Geoteknik Lapangan

FORM PENGAMATAN DAN PEMETAAN GEOTEKNIK PERMUKAAN			Rock Type.					Tanggal: 14/2/2023	
				Lokasi Pit	: 270 (Lokasi 1)				
			Bench No.	Diisi Oleh	: Yuliati Pasande'				
				Diperiksa Oleh	: Grinus Halilintar				
	PARAMETER	CODE/VALUE	RATING	PARAMETER			CODE/VALUE	RATING	GSI (1)
1.	Strength of intact rock	R2	2	2. RQD			E	20	63
3.	Spacing of discontinuity	M	10	5. Ground water condition			CD	15	
A.	RATING (1+2+3+5)	**47**		B. RATING (1+2+3)+15			**47**		
4.	Conditon of Discontinuity								
	Joint Set	SET 1*)		SET 2		SET 3		SET 4	
Parameter		CODE/VALUE	RATING	CODE/VALUE	RATING	CODE/VALUE	RATING	CODE/VALUE	RATING
	a) Length (persistence)	VL	6	VL	6				
	b) Separation (aperture)	VT	5	VT	5				
	c) Roughness	SR	3	SR	3				
	d) Infilling (gouge)	N	6	N	6				
	e) Weathering	SW	5	SW	5				
	Joint Orientation (D/DD)								
C.	RATING (a+b+c+d+e) =	**25**							
PERHITUNGAN RMR DAN NILAI GSI									
D.	Basic RMR' 89 = (A+C)	**72**							
E.	Basic RMR'89 (Dry) = (B+C)	**72**							
F.	GSI (2) = E (-5)	**67**							
*) Set 1 adalah joint dengan nilai frekuensi fracture terbesar									
Foto									

FORM PENGAMATAN DAN PEMETAAN GEOTEKNIK PERMUKAAN			Rock Type.					Tanggal: 2/3/2023	
				Lokasi Pit	: 270 (Lokasi 2)				
			Bench No.	Diisi Oleh	: Yuliati Pasande'				
				Diperiksa Oleh	: Grinus Halilintar				
	PARAMETER	CODE/VALUE	RATING	PARAMETER		CODE/VALUE		RATING	GSI (1)
1.	Strength of intact rock	R2	2	2. RQD		P		8	52
3.	Spacing of discontinuity	C	8	5. Ground water condition		CD		15	
A.	RATING (1+2+3+5)	33		B. RATING (1+2+3)+15		33			
4.	Conditon of Discontinuity								
	Joint Set	SET 1*)		SET 2		SET 3		SET 4	
Parameter		CODE/VALUE	RATING	CODE/VALUE	RATING	CODE/VALUE	RATING	CODE/VALUE	RATING
	a) Length (persistence)	VL	6	VL	6				
	b) Separation (aperture)	N	6	N	6				
	c) Roughness	SR	3	SR	3				
	d) Infilling (gouge)	N	6	N	6				
	e) Weathering	UW	6	UW	6				
	Joint Orientation (D/DD)								
C.	RATING (a+b+c+d+e) =	**27**							
PERHITUNGAN RMR DAN NILAI GSI									
D.	Basic RMR' 89 = (A+C)	**60**							
E.	Basic RMR'89 (Dry) = (B+C)	**60**							
F.	GSI (2) = E (-5)	**55**							
*) Set 1 adalah joint dengan nilai frekuensi fracture terbesar									
Foto									

Lampiran 8 Peta Zonasi Gempa di Indonesia





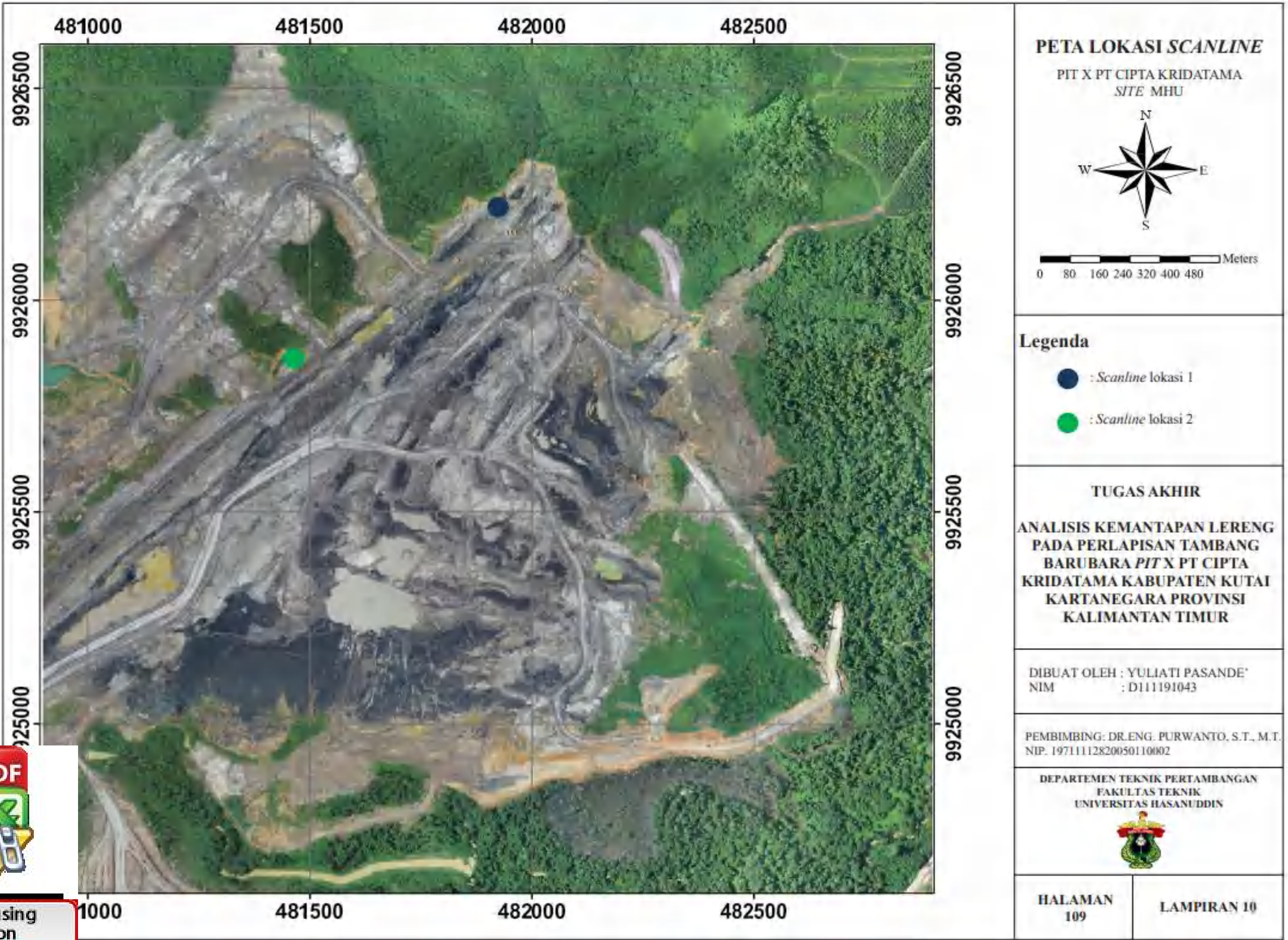
TIM PEMUTAKHIRAN PETA SUMBER DAN BAHAYA GEMPA INDONESIA 2017

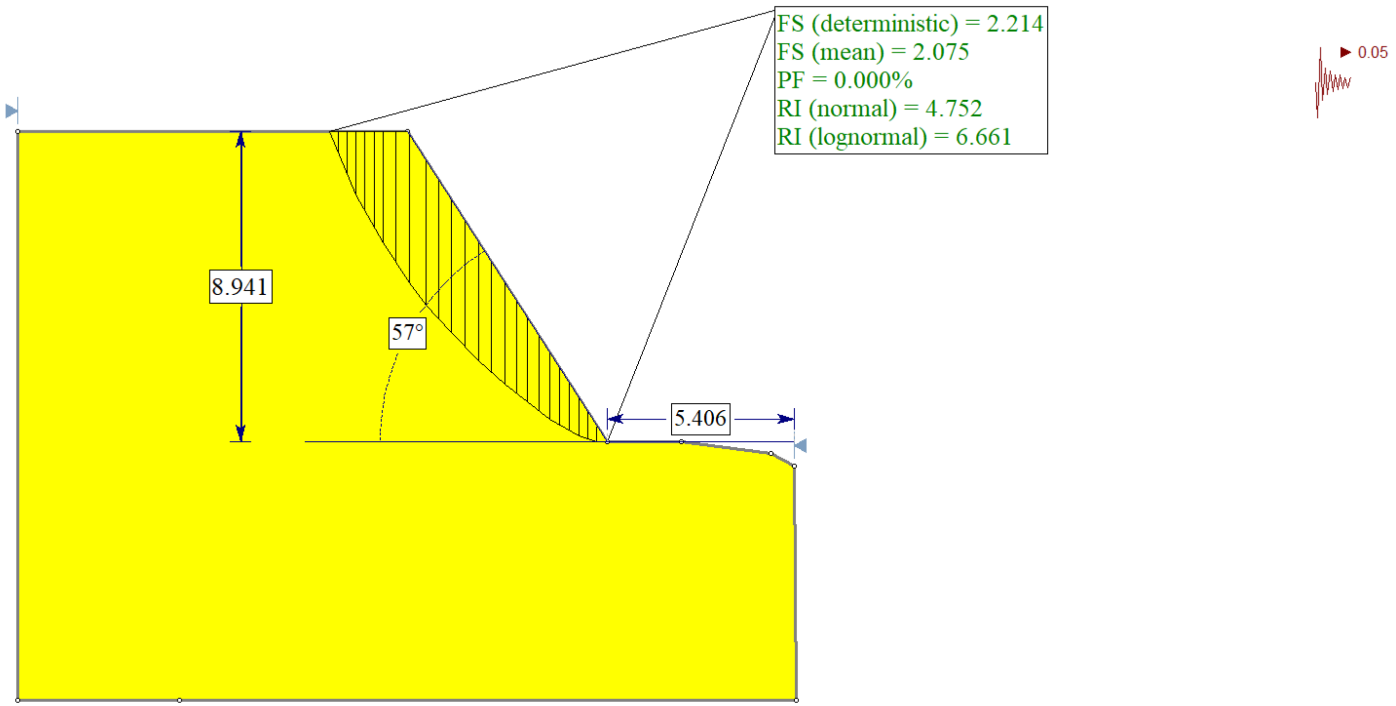
- **Prof. Dr. Masyhur Irsyam (Ketua)**
- **Ir. Lutfi Faizal (Wakil Ketua)**
- **Dr. Danny Hilman Natawidjaja (Ketua Pokja Geologi)**
- **Dr. Irwan Meilano (Ketua Pokja Geodesi)**
- **Prof. Dr. Sri Widiyantoro (Ketua Pokja Seismologi)**
- **Dr. Wahyu Triyoso (Ketua Pokja Katalog)**
- **Ariska Rudyanto, M.Phil. (Ketua Pokja GMPE)**
- **Dr. Sri Hidayati (Ketua Pokja SHA)**
- **Dr. M. Asrurifak**
- **Dr. M. Ridwan**
- **Prof. Dr. Phil Cummins**

Lampiran 9 Panduan Pengisian Formulir Kegiatan Pengamatan dan Pemetaan Geoteknik Permukaan

NO.	PARAMETER		RANGE OF VALUE						
1	Strength of intact rock	Term	Extremely Strong	Very Strong	Strong	Medium Strong	Weak	Very Weak	Extremely Weak
		Code	R6	R5	R4	R3	R2	R1	R0
		Value	>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	Term	Excellent Quality	Good Quality	Fair Quality	Poor Quality	Very Poor Quality		
		Code	E	G	F	P	VP		
		Value	90% - 100%	75% - 90%	50% - 75%	25% - 50%	< 25%		
		Rating	20	17	13	8	3		
3	Spacing of Discontinuities	Term	Very Wide	Wide	Moderate	Close	Very Close		
		Code	VW	W	M	C	VC		
		Value	> 2 m	0.6 - 2 m	200 - 600 mm	60 - 200 mm	< 60 mm		
		Rating	20	15	10	8	5		
4a	Condition of discontinuities (detailed)								
	a) Discontinuity length (persistence)	Term	Very Low	Low	Medium	High	Very High		
		Code	VL	L	M	H	VH		
		Value	< 1 m	1-3 m	3-10 m	10-20 m	> 20m		
		Rating	6	4	2	1	0		
	b) Separation (aperture)	Term	None	Very tight joint	Tight joint	Moderately Open Joint	Open Joint		
		Code	N	VT	T	M	O		
		Value	-	< 0.1 mm	0.1-1.0 mm	1-5 mm	> 5 mm		
		Rating	6	5	4	1	0		
	c) Roughness	Term	Very Rough	Rough	Slightly Rough	Smooth	Slickensided		
		Code	VR	R	SR	SM	SL		
		Roughness							
		Rating	6	5	3	1	0		
	d) Infilling (gouge)	Code	N	H1	H2	S1	S2		
		Term	None	Hard filling < 5mm	Hard filling > 5 mm	Soft filling < 5mm	Soft filling > 5mm		
		Rating	6	4	2	2	0		
	e) Weathering	Code	UW	SW	MW	HW	D		
		Term	Unweathered	Slightly Weathered	Moderately Weathered	Highly weathered	Decomposed		
		Rating	6	5	3	1	0		
4b	Condition of discontinuities (mutually exclusive condition)								
		Condition	Very rough Not continuous No separation Unweathered	Slightly rough Separation<1mm Slightly weathered	Slightly rough Separation<1mm Highly weathered	Slickensided or Gouge<5mm or Separation 1-5mm Continuous	Soft gouge > 5mm or Separation > 5mm Coninuous		
		Code	C1	C2	C3	C4	C5		
		Rating	30	25	20	10	0		
5	Ground Water	Code	CD	DM	WT	DR	FL		
		Term	Completely Dry	Damp	Wet	Dripping	Flowing		
		Rating	15	10	7	4	0		

Panduan pengisian formulir kegiatan pengamatan dan pemetaan geoteknik permukaan RMR 1989 (PT Cipta Kridatama)


481000
481500
482000
482500
9926500
9926000
9925500
9925000
PETA LOKASI *SCANLINE*
PIT X PT CIPTA KRIDATAMA
SITE MHU
N
W
E
S
Meters
0 80 160 240 320 400 480
Legenda
: *Scanline* lokasi 1
: *Scanline* lokasi 2
TUGAS AKHIR
ANALISIS KEMANTAPAN LERENG PADA PERLAPISAN TAMBANG BARUBARA *PIT* X PT CIPTA KRIDATAMA KABUPATEN KUTAI KARTANEGARA PROVINSI KALIMANTAN TIMUR
DIBUAT OLEH : YULIATI PASANDE'
NIM : D111191043
PEMBIMBING: DR.ENG. PURWANTO, S.T., M.T.
NIP. 19711112820050110002
DEPARTEMEN TEKNIK PERTAMBANGAN
FAKULTAS TEKNIK
UNIVERSITAS HASANUDDIN
HALAMAN 109
LAMPIRAN 10



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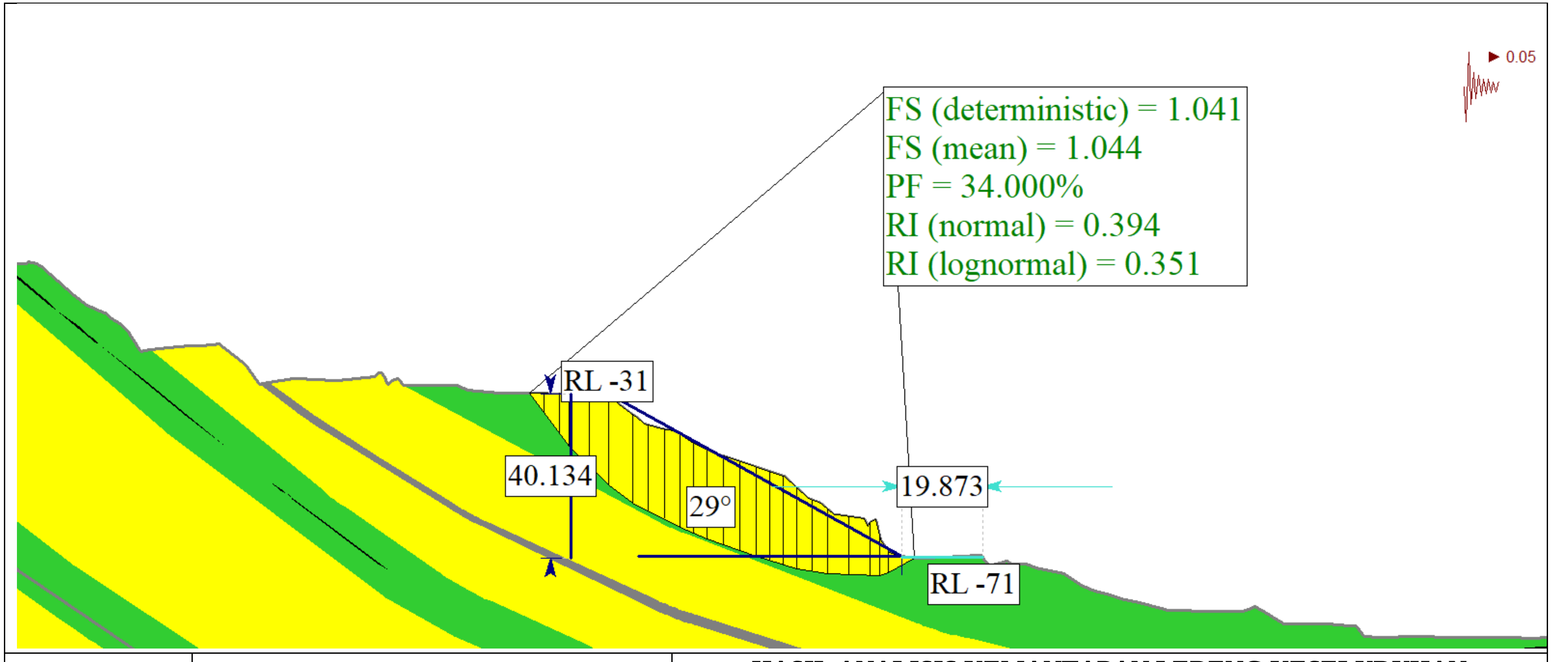
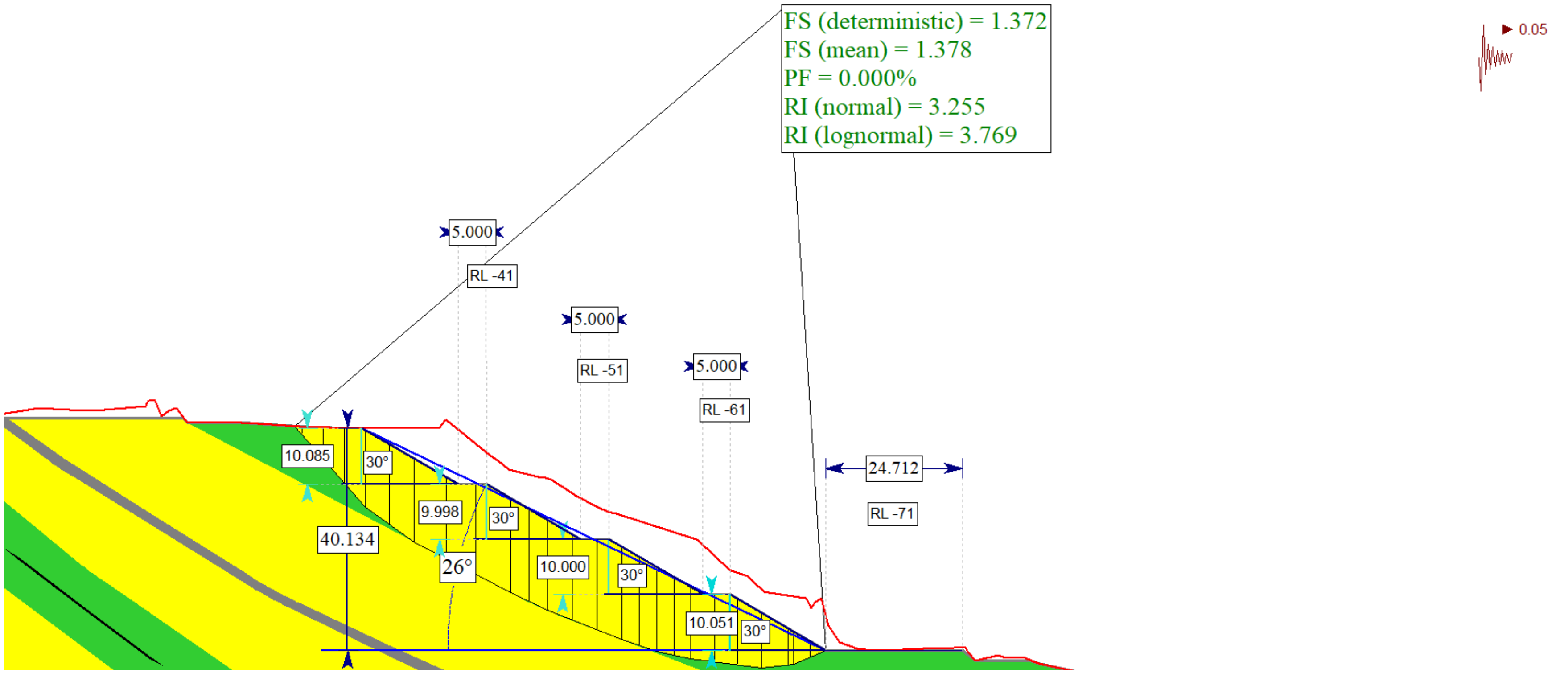
HASIL ANALISIS KEMANTAPAN LERENG *SEAM* 190			
	BATUPASIR		SERPIH
	BATULEMPUNG		BATUBARA
LAMPIRAN 11			
DIGAMBAR OLEH:	YULIATI PASANDE' D111 19 1043	GOWA 2023	
DIPERIKSA OLEH:	Dr.Eng. PURWANTO, S.T., M.T.		



PROGRAM STUDI SARJANA TEKNIK PERTAMBANGAN FAKULTAS TEKNIK UNIVERSITAS HASANUDDIN	**HASIL ANALISIS KEMANTAPAN LERENG KESELURUHAN**			
		BATUPASIR		SERPIH
		BATULEMPUNG		BATUBARA
	LAMPIRAN 12			
	DIGAMBAR OLEH:	YULIATI PASANDE' D111 19 1043	GOWA 2023	
	DIPERIKSA OLEH:	Dr.Eng. PURWANTO, S.T., M.T.		



HASIL ANALISIS REKOMENDASI LERENG KESELURUHAN

	BATUPASIR	SITUASI
	BATULEMPUNG	
	SERPIH	LAMPIRAN 13
	BATUBARA	

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DIGAMBAR OLEH:	YULIATI PASANDE' D111 19 1043	GOWA 2023
DIPERIKSA OLEH:	Dr.Eng. PURWANTO, S.T., M.T.	

Lampiran 14 Dokumentasi Longsoran di *Pit* X

Lampiran 15 Kartu Konsultasi Tugas Akhir

Lampiran B 10

Kartu Konsultasi Tugas Akhir

JUDUL: Analisis Kemantapan Lereng pada Perlapisan Tambang Pit X PT Cipta Kridatama Kabupaten Kutaikartanegara Provinsi Kalimantan Timur

(Konsultasi minimal 8 kali)

TANGGAL	MATERI KONSULTASI	PARAF DOSEN
25 Oktober 2023	- Perbaikan Abstrak BAB I Pendahuluan - Latar Belakang - Tujuan Penelitian	
6 November 2023	- Perbaikan BAB II - Penambahan tinjauan pustaka - Catatan (penambahan daftar pustaka yang berkaitan dengan penelitian	
17 November 2023	- Perbaikan BAB III - Bagan Alir - Perbaikan lokasi penelitian	
30 November 2023	- Perbaikan BAB IV - Penambahan analisis kinematika - Perbaikan penggunaan kata	
14 Desember 2023	- Perbaikan BAB IV - Penambahan geometri lereng pada pembahasan dan kesimpulan - Poster -	

TANGGAL	MATERI KONSULTASI	PARAF DOSEN
8 Januari 2024	- Perbaikan BAB IV * Perbaikan ESI * Orientasi Kekar	
12 Januari 2024	- Perbaikan pembahasan pada BAB IV - Penambahan section A-A' pada lampiran	
15 Januari 2024	- Perbaikan BAB III - Perbaikan BAB IV	
16 Januari 2024	- Perbaikan diagram alir	
17 Januari 2024	- Perbaikan Peta - Perbaikan Kesimpulan - Perbaikan BAB III - Perbaikan Pembahasan	