

[illegible]

1

1.1		1
1.2		2

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2.1		8
2.2		13
2.3		14
2.4		29

3

3.1		54
3.2		61
3.3		70
3.4		93
3.5		96
3.6		103
3.7		114
		117

4

4.1		118
4.2		127

5

5.1		128
5.2		128

5.3		130
6		
6.1		131
6.2		131

[illegible]

	2015	2016	2017	2018	2019
1	2015	13	2015	2	13
2	2015	75	2015	7	1
3	2015	5	29	80	2006
3	2015	5	29	80	2006
	2015	7	1		

2024 1 16

14

10	GB 50052-2009
11	GB50057-2010
12	(GB50057-2010[2016])
13	GB50068-2010
14	GB 50068-2011
15	GB 50068-2012
16	GB50187-2012
17	GB50029-2014
18	GB50201-2014
19	GB 51016-2014
20	2018 GB50016-2014
21	GB55037-2022
22	GB 18306-2015
23	GB50150-2016
24	< 1 GB 6722-2014/XG1-2016
25	GB/T13869-2017
26	GB/T10595-2017
27	
28	GB/T8196-2018
29	GB18218-2018
30	GB51119-2015
31	GB 2811-2019
32	GB/T 38304-2019
33	GB/T 38509-2020
	5
	GB/T 2893.5-2020
	GB50070-2020

37	4	GB 39800.4-2020
38	GB16423-2020	
39		GB/T29639-2020
40		GB/T12265-2021
41		GB/T12719-2021
42		GB/T 20645-2021
43		GB/T23821-2022
44		GB/T13861-2022
1.2.5.2		
1		AQ2005-2005
2	AQ8001-2007	
3	AQ8002-2007	
4	AQ1043-2007	
5		
AQ2027-2010		
6		AQ/T 2063-2018
7		
AQ/T2073-2019		
8		AQ/T 1009-2021
9		AQ/T 1118-2021
1		
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[illegible][illegible]

		2023	10				
5							
		2023	42			2023	12 27
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2023	43					2023	12 26
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				2024	4		
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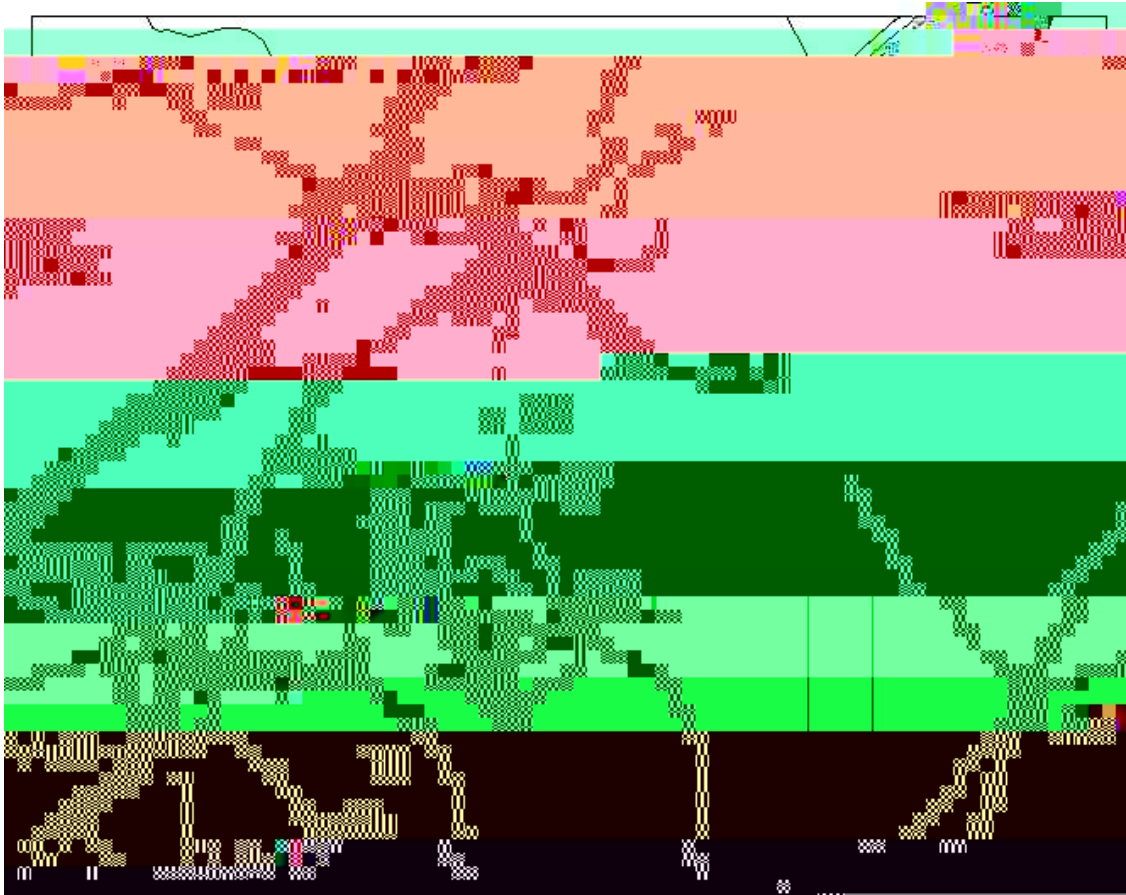
[illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible]

2												
2.1												
1												
				13	32			9		8		
2				2								
12km												
				4650m				-1300m				
-300m				2016		2	29					
-1300m				1981795.46		t	TFe	31.42%		2023		
6	30	-450m		685286.32		t	TFe	31.15%				
				5100	t/a	1700		t/a	3400	t/a		
				60	3400		-270m		12m			
15m -30m												
								900		t/a		
1440				/								
						2300	t	1700		t/a		
2												
								12km				
1.3km				6km								

2-1

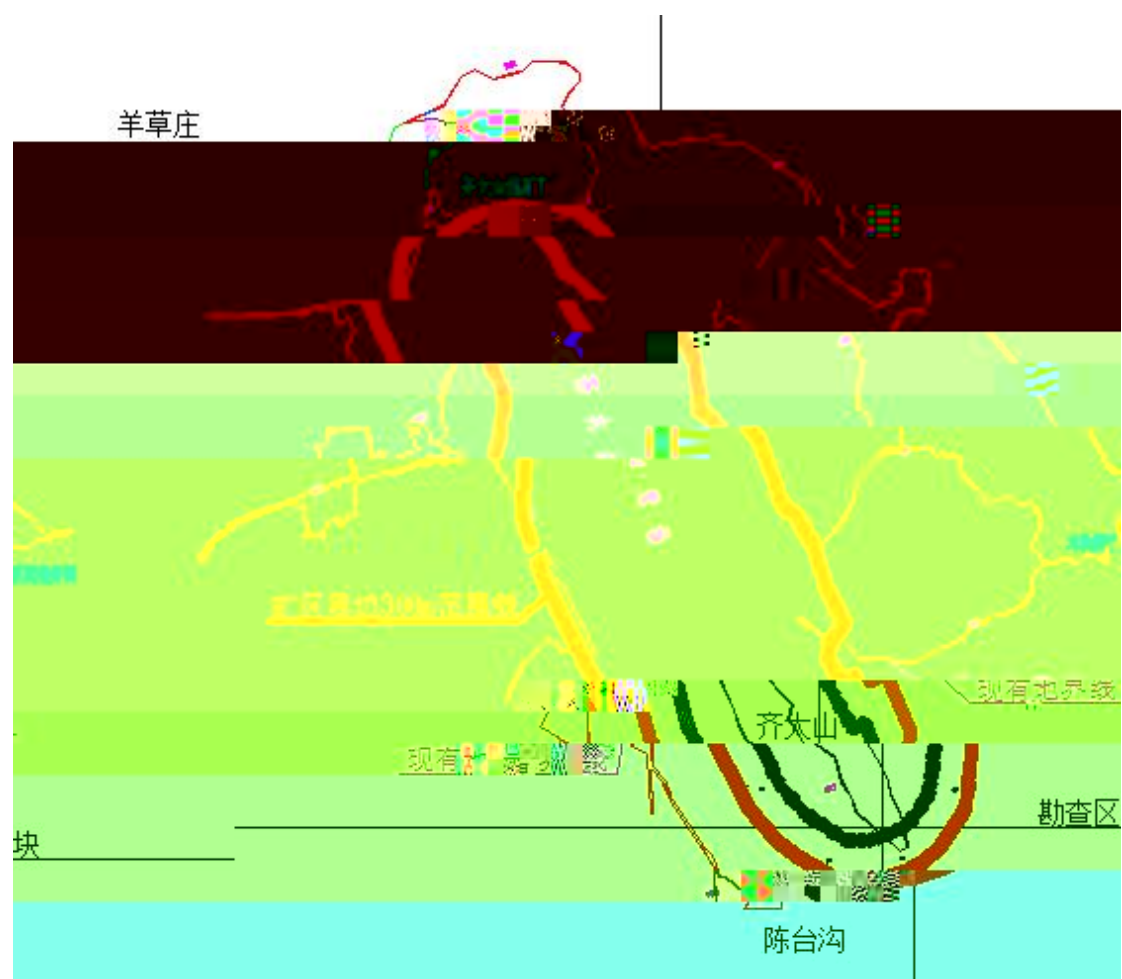
123 ° 05 ' 07 '

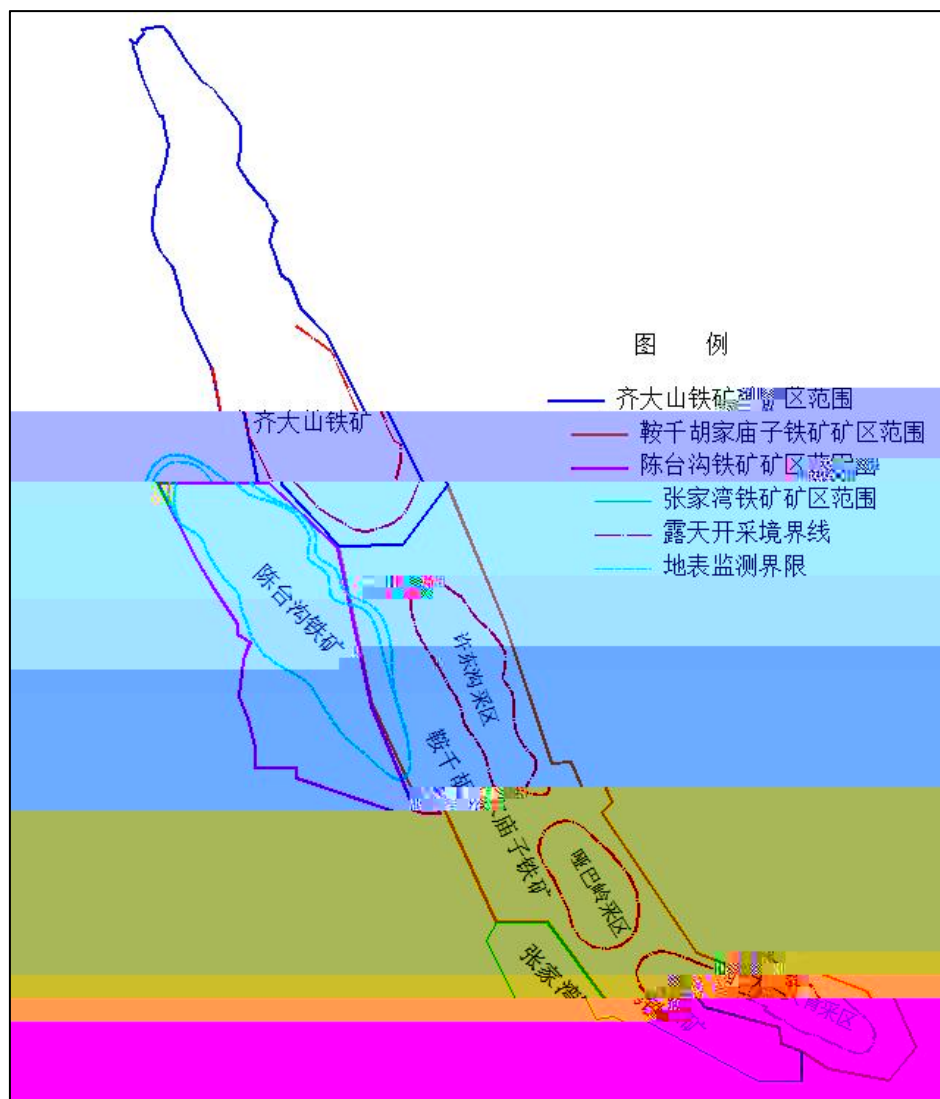
41 ° 07 ' 09 '



2







3

1 3m

50

2.3.1.2

1

		1480	3420m
310°	335°		86°

2-3

2.3.1.3

1

γ_1^2

1680

4500

-1200m

2

a. δ

b. μ

REPORT

1

4900 60

173 100 200m

3400m 1410m

133.72 -1385m 0m 1230m

305 335° 70 90° TFe

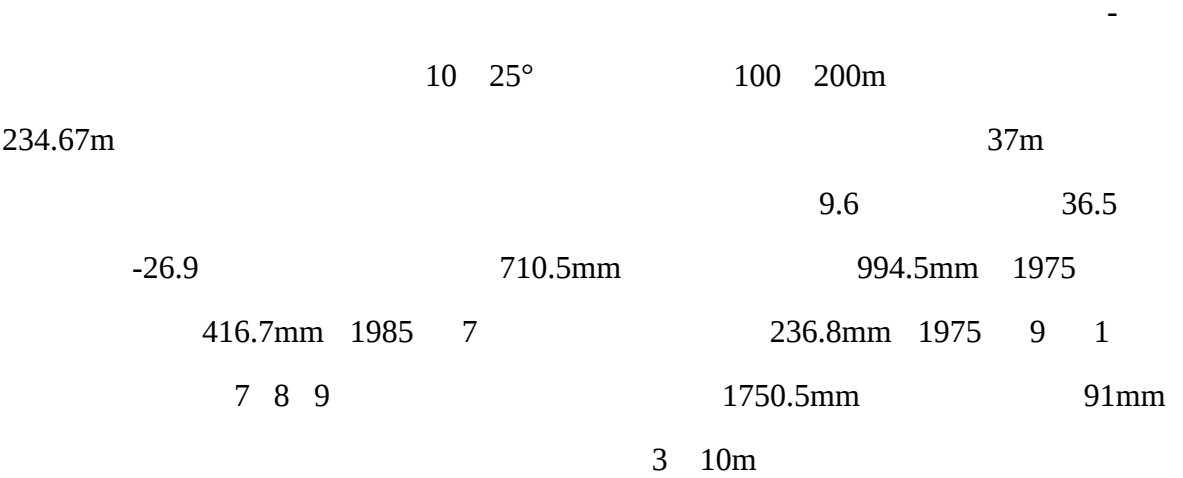
31.20% 9.23% 36.3 267.5m 152.58m

42.92%

60 1060 t

2.3.3

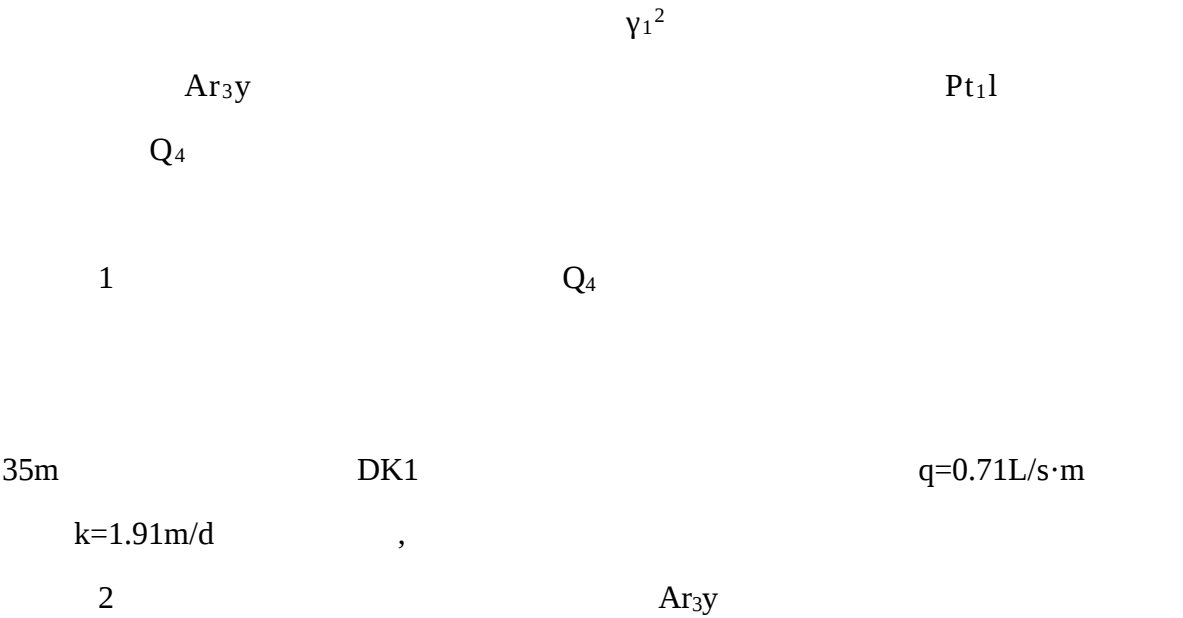
2.3.3.1



0.16m³/s

34.5m³/s

2.3.3.2



[illegible]

1

1-4m

1-2

1m

2-3

2

,

0.0006L/s·m

0.00027m/d

-48m

-69m

2.3.3.4

3P k : b@B@ k

1260 1880

30m 50m

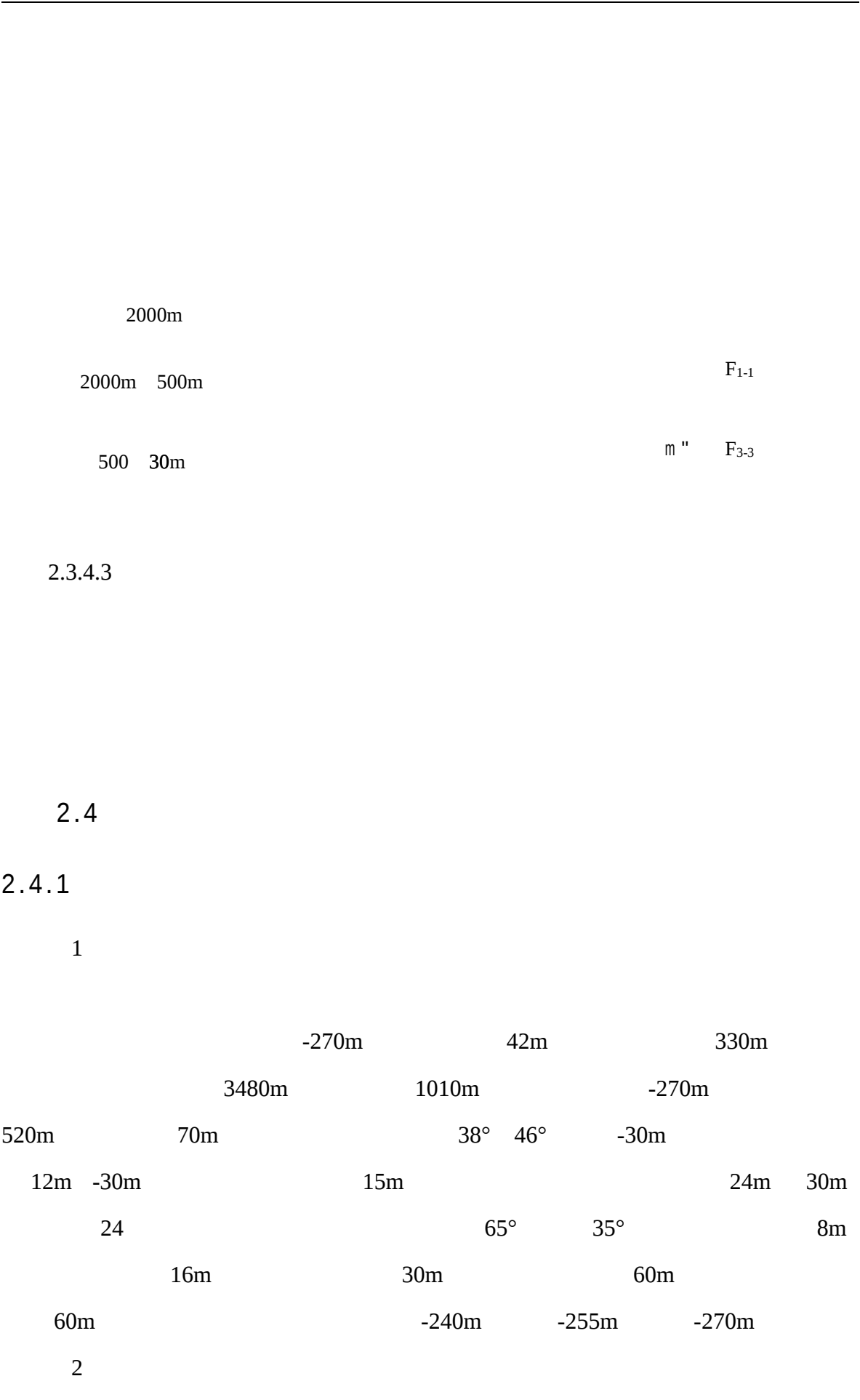
2cm 5cm

240 250°

32° 38°

	RQD		RQD
	90.63%		91.06%
	82.54%		94.36%

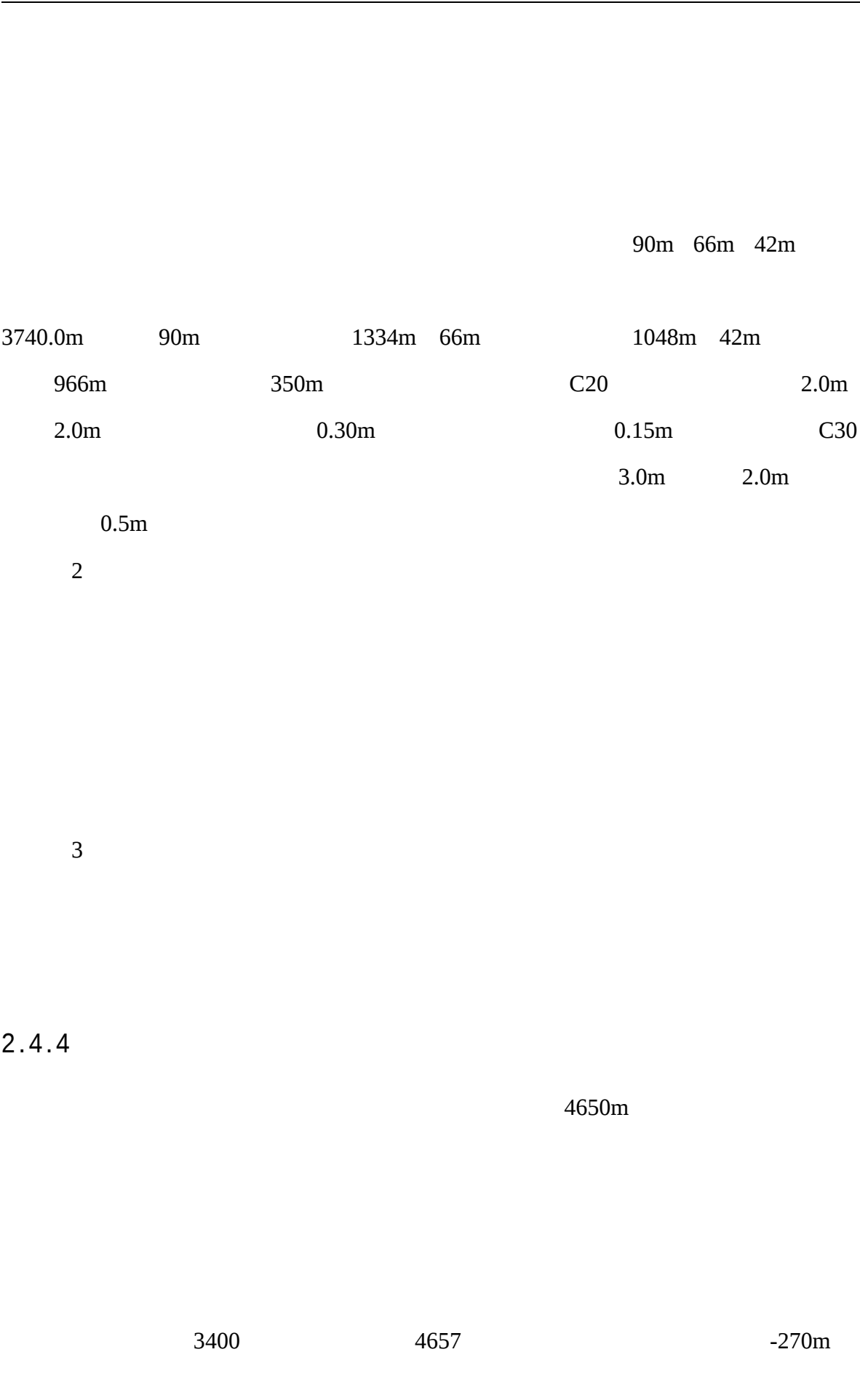
3



[illegible]

2-11

1



-450m

2.4.5

42m

-6m

50m

-330m

154 190t

30m

22m

1m

0.4m × 0.4m

4m

2m

8%

60m

30m

1

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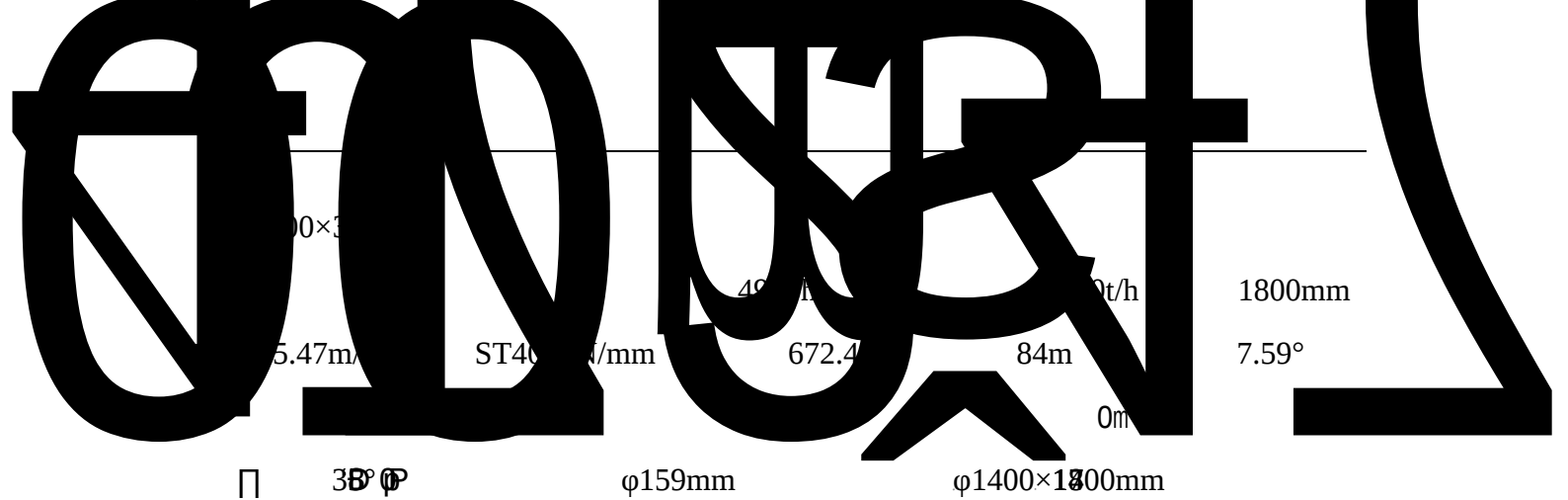
1

1997

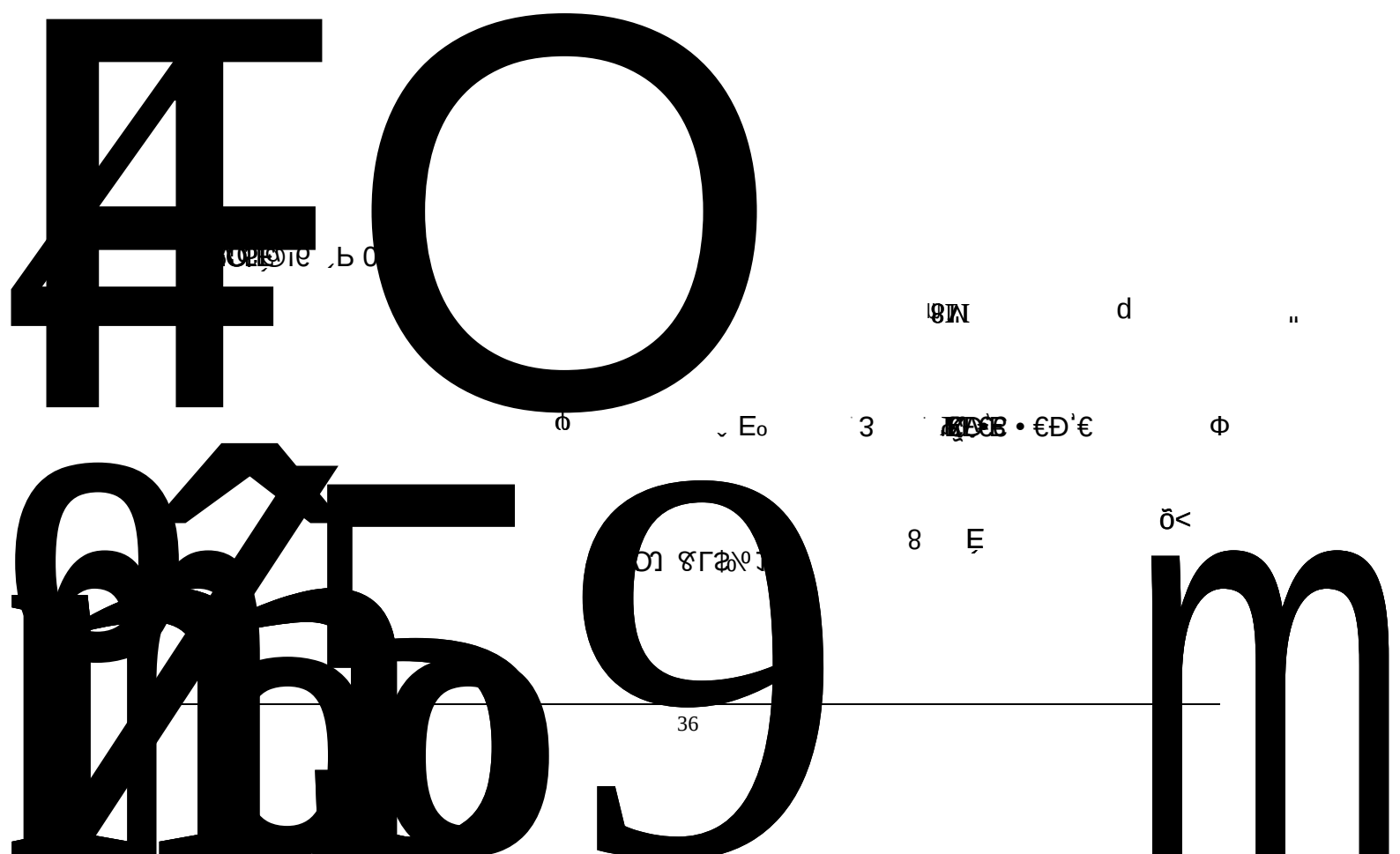
-135m

-108.5m

1700



2# 4950h 8150t/h 1800mm
5.47m/s



				3 [#]	2 [#]
b					
1 [#]			1 [#]		4950h
1150t/h	1200mm	2.5m/s	ST1000N/mm		472.485m
28.3m	12.718°		400kW		
	35°		φ133mm		φ1000×1400mm
2 [#]				4950h	1150t/h
1200mm	2.5m/s	ST3150N/mm		693.523m	173.5m
14°		2×630kW			
35°		φ133mm		φ1400×1400mm	
3 [#]			4950h		1150t/h
2.5m/s	ST1000N/mm		178m	0m	0°
160kW					35°
φ133mm		φ1000×1400mm			
4					
					500 t/a
		→	→	→	1 [#] → 2 [#]
⊕					
	:500 t/a		330	3	8
	1000mm				
⊙					
a					
			+52.15m		

14.15m

1200mm×1600mm

1000mm

300mm 0mm

1050t/h

400 t/a

200 t/a

500 t

200 t/a

2.4.6

1

-30m 12m -30m 15m 24m 30m

-210m 60 ° -210m 65 °

65 ° 35 °

8m

14m

30m

-30m -120m -210m 30m

35m

 $\leq 8\%$

9 $\geq 60m$

2

2-12

2-12

1			m	12 15 24 30
2				35
				60

						65
						14.57
						41.59
3						44.68
						41.98
				m	8	8 14
4				m	8	8 14
5	-30	-120	-210	m		30
6				m		30
1				m	4849 × 1568	850
2				m	2549 × 110	35
3				m		-450
4				m		596
5				m		42
				t		36704.88
6				t		79682.45

				φ 250	310mm		14.5
17.5m	2.5m	250mm			7m × 6m	310mm	
8m × 8m			550	t/	•	3%	110t/m
	7300	t/a					
		3	7		4	6	
				200m			
2							
	10m ³	3	16.8m ³	5			13.5m
16.8m							
	2				1		1
3							
					2300	t	
				6400	t/a	1900	t
						5500	t
						2800	t
			6200	t/a	2100	t	

										PE	
1											
2.4.8											
2.4.8.1											
1											

[illegible]

8369 m³

50m 20m 10m

2.4.9.3

78859 t 38084 m³
31729 m³ 6355 m³
8369 m³ 2-14

2-14

			m ³	
1		320	16176	
2		320	15553	
3		330	8369	
			40098	
			38084	
			2014	

2.4.9.4

850m 320m 16176 m³

1200m 320m 15553 m³

-

2.4.9.5

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2 2% 5%

118m -5.5m 49 2
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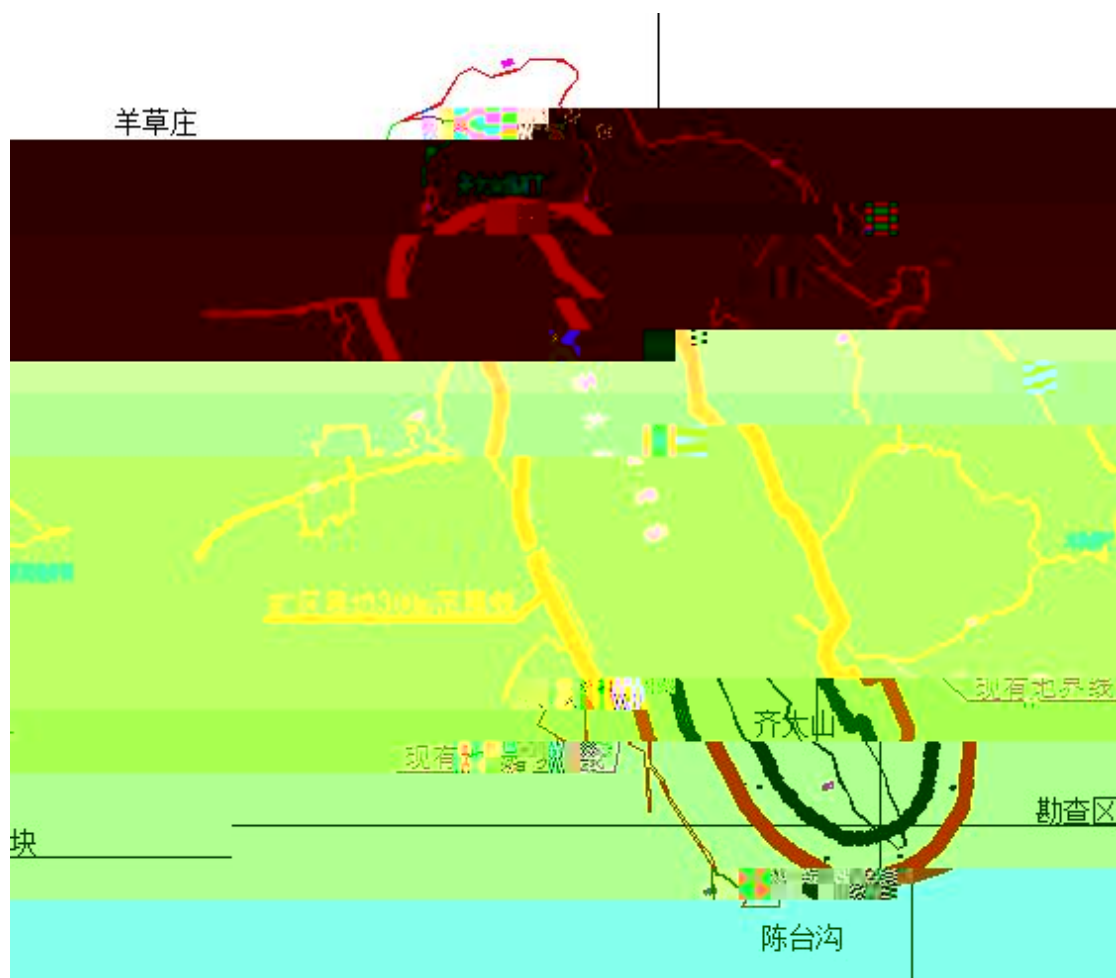
3.

3.0.10

4

3.1.2

1



1		220m	
2		820m	
3		1300m	
4		500m	
5		20m	
6		600m	
7			
8		500m	

9		320m	
10		550m	
11		500m	
12			

1		220	
2		20	
3			
4			

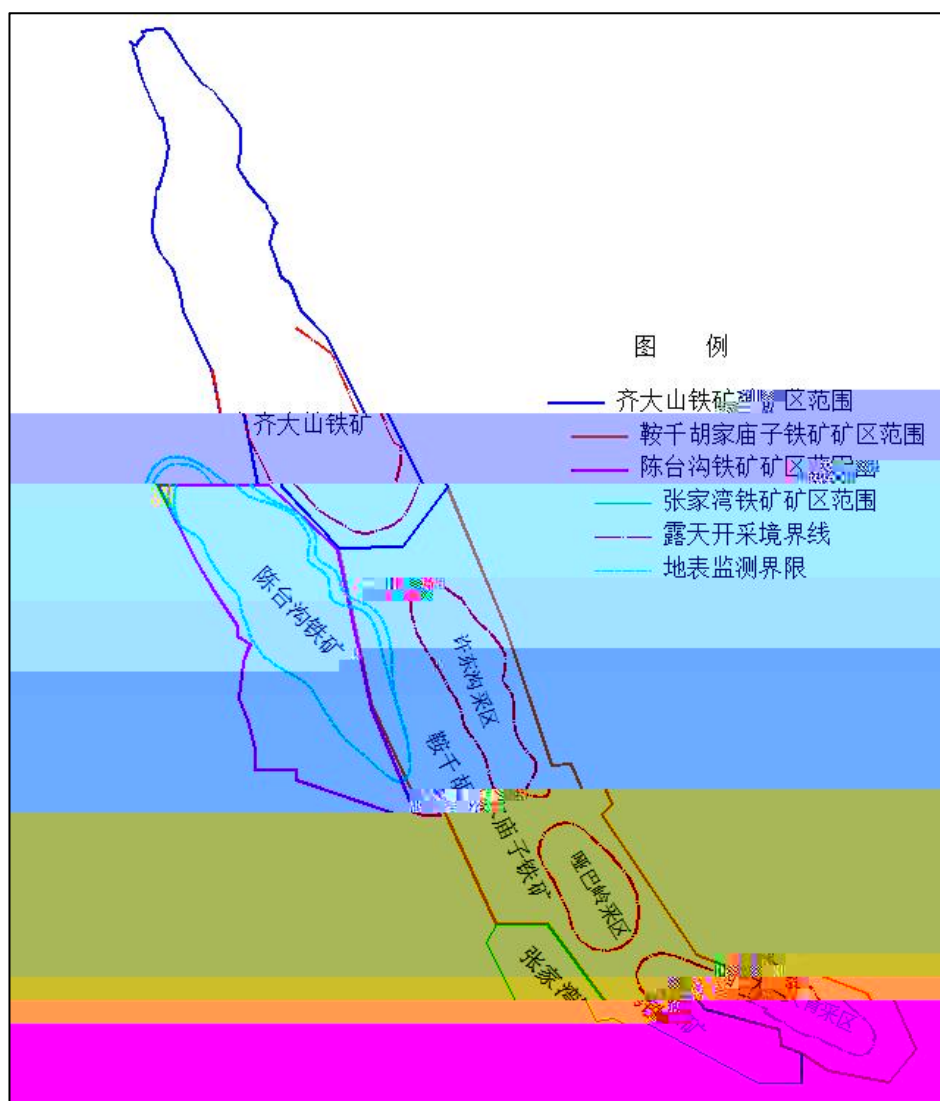
2

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500m

30m Å



3.2

3.2.1

154 190t

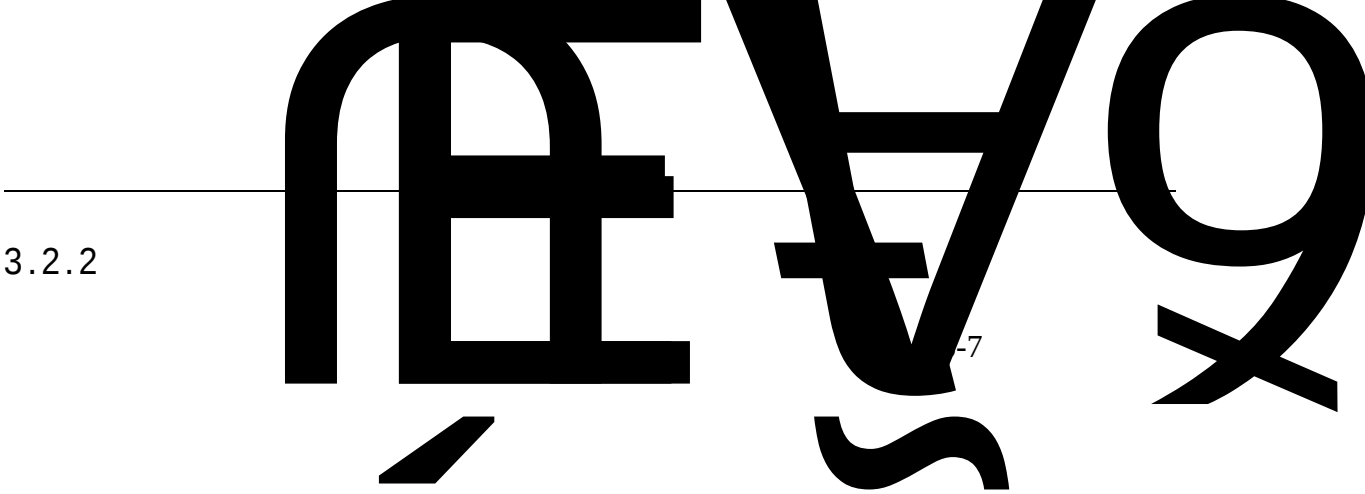
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3.2.2

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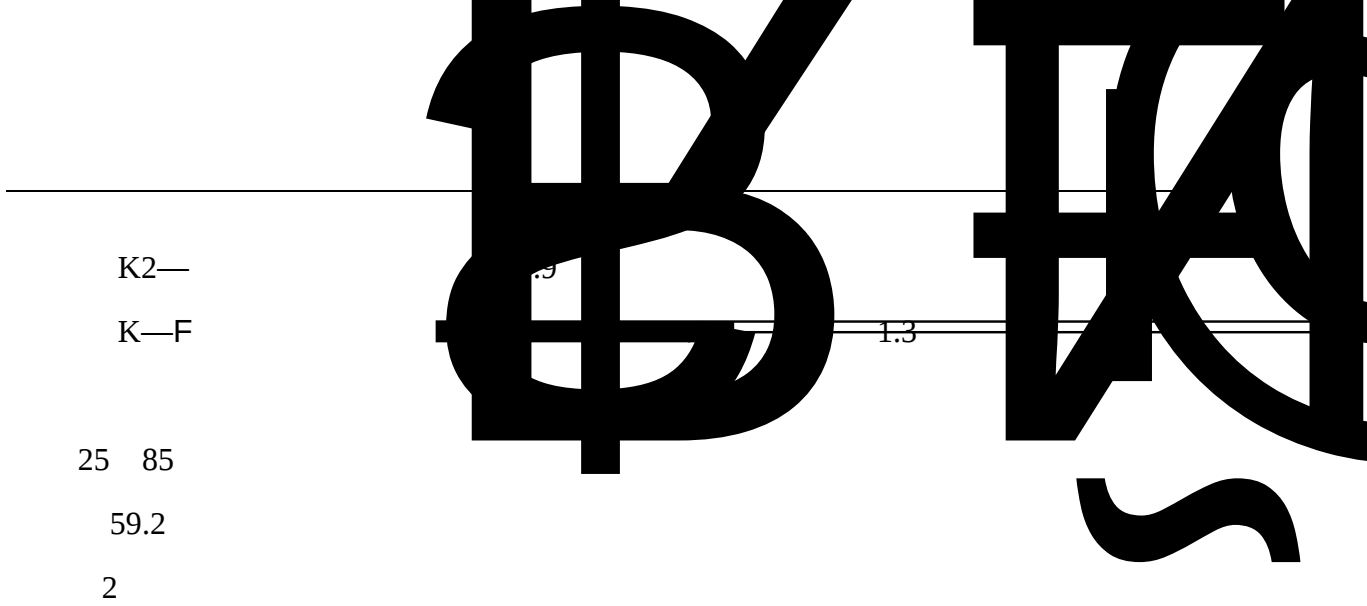
3.

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			1. 2. 3. 4.		1. 2.
			1. 2. 3. 4. 5. 6. 7. 8. 9. 10.		1. 2. 3. 4. 5. 6. 7. 8. 9. 10.
			1. 2.		1. 2.
2			1. 2.		1. 2. 3.
			1. 2. 40		
3			1. 2.		1. 2.
			1. 2. 3.		
4			1. 2.		1. 2.

					3.
			1. 2.		
			1. 2.		1. 2.
5					
6			1. 2.		
7			1. 2. 30% 3. 10 20	10%	
8					

8

	Sf	Sd	S		
1	10			RPN= Sf×Sd×S	RPN
	Sf	Sd	S	5	
3-9					

	Sf	Sd	S	RPN		
	8	3	5	120	2	2
	4	3	4	48		

	4	4	4	16		
	7	4	6	168	1	1
	3	2	3	18		
	5	3	6	90	4	4
	4	4	6	96	3	3
	5	3	5	75	5	5
	3	5	3	45		

3-9

3

FMEA

3.2.5

3-10

3-10

	1. — — — —	GB18152-2000 7.1.1		
	2.	GB18152-2000 7.1.2		

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“ GB18152-2000
7.1.3
”

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GB18152-2000
9.2.4

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GB18152-2000
9.2.8

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	— — — — — —			
	8. 7 8 10	GB16423-2020 5.4.3.3		
	9. 3	GB16423-2020 5.4.3.4		
	10. — — — — — — — — — — — — — — — — — —	GB16423-2020 5.4.3.5	— — — — — —	
	11.	GB16423-2020 5.4.3.6		

12.

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1.0m

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1.0m

0.6m

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3.3.1.2

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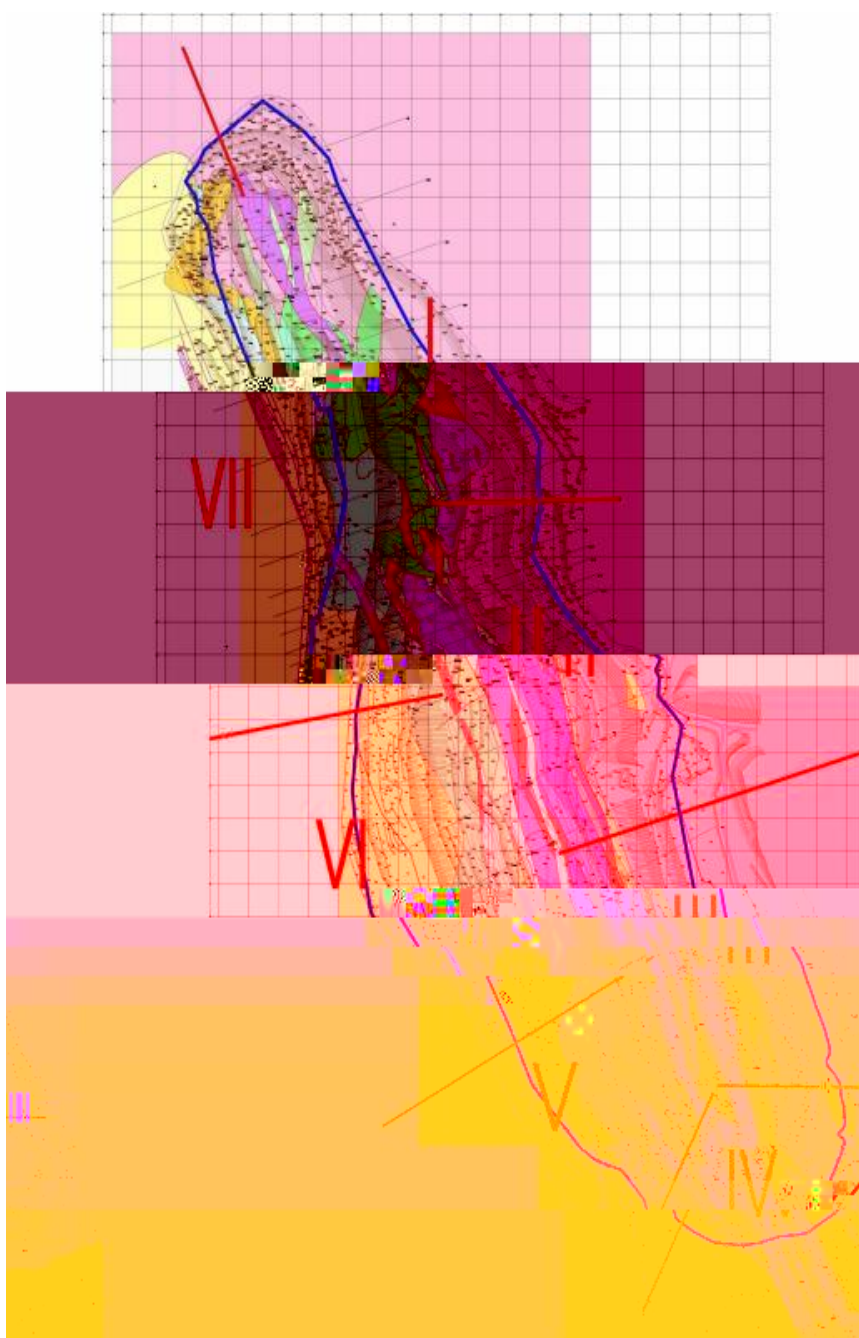
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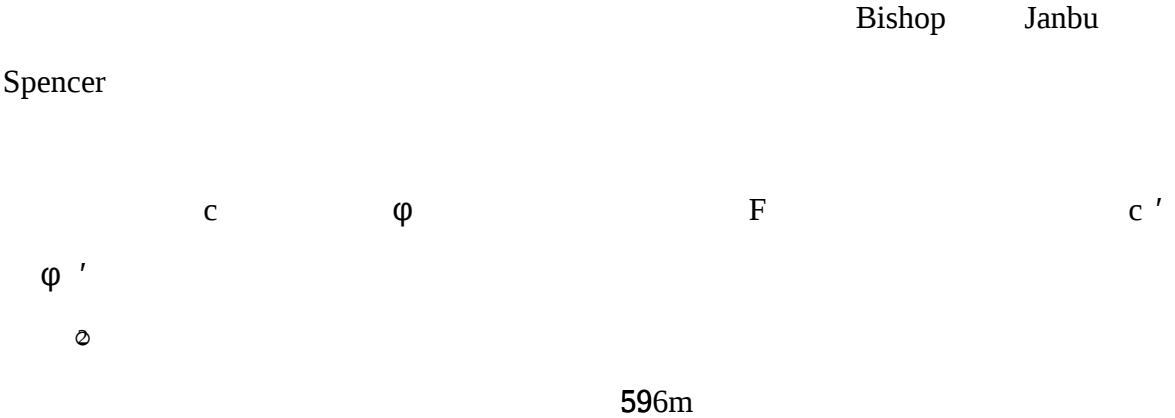
1.

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2023 6

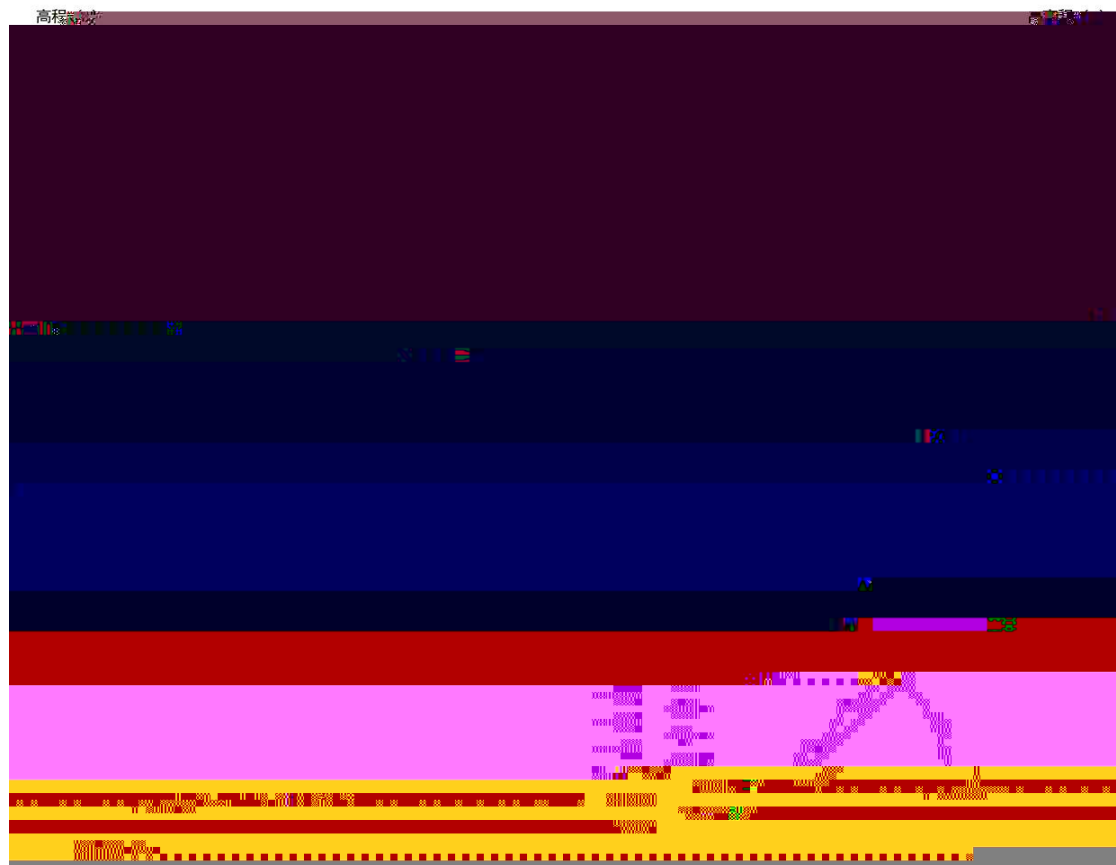


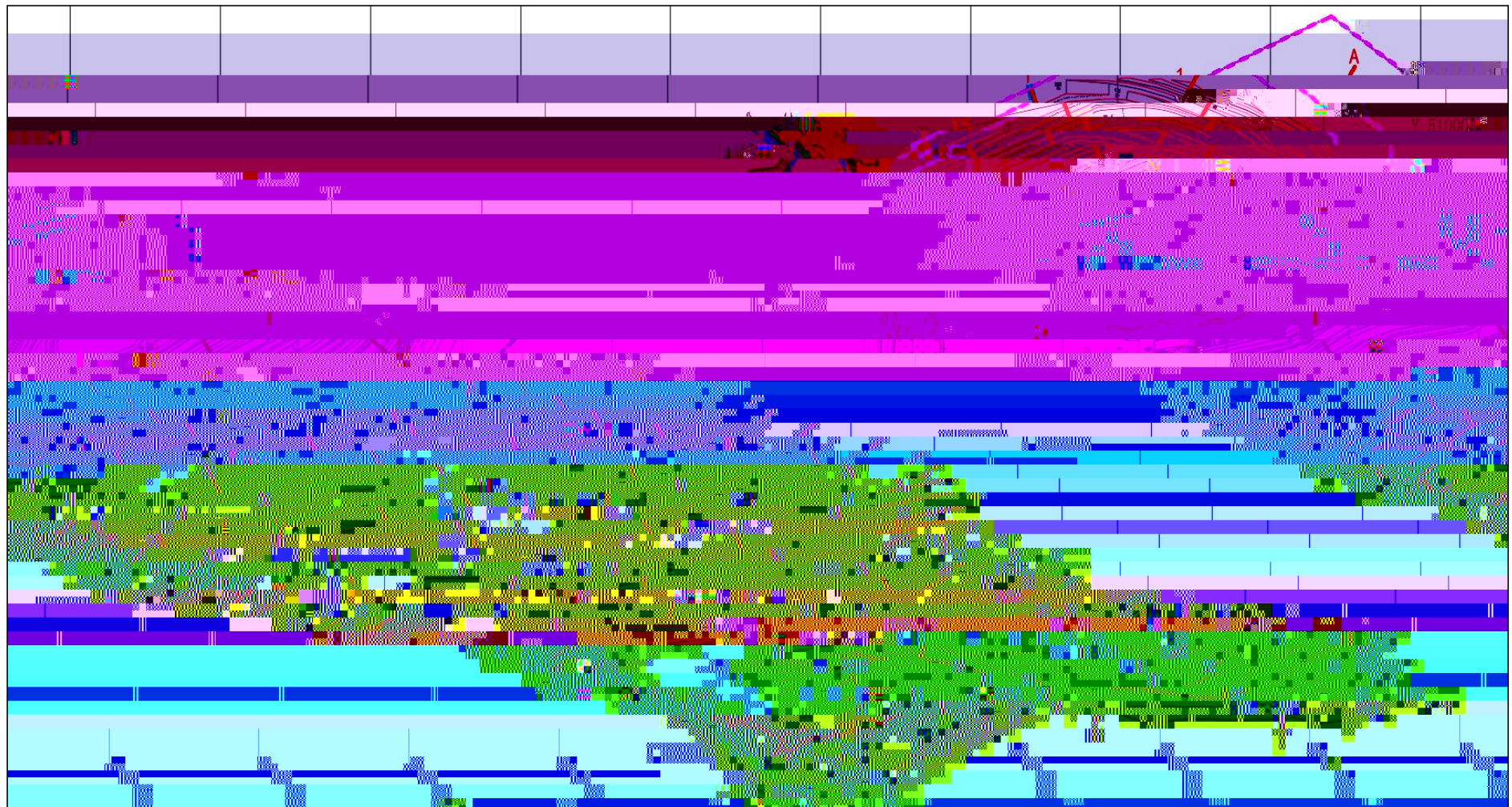




Fs= 1.25 Fs= 1.23 Fs= 1.20 I +
II + III + +
Fs ≥ 1.25 Fs ≥
1.23 Fs ≥ 1. 20
⊗

1 15 1-1' 2-2' 3-3'
4-4' 5-5' 6-6' 7-7' 8-8' 9-9' 10-10'
11-11' 12-12' 13-13' 14-14' 15-15' A-A'
3-6 A-A'
3-7





1994 Hoek GSI RMR Hoek-Brown

$$\sigma_1 = \sigma_3 + \sigma_{ci} \left(m_b \frac{\sigma_3}{\sigma_{ci}} + S \right)^a$$

2002 Hoek 94

D

Hoek-Brown

S a

GSI=25

mb S a

$$= \cdot \left(\frac{\sigma_3}{\sigma_{ci}} \right)$$

$$= \left(\frac{\sigma_3}{\sigma_{ci}} \right)$$

$$= - + - \left[\left(\frac{\sigma_3}{\sigma_{ci}} \right) - \left(\frac{-20}{3} \right) \right]$$

	kN/m ³		/GPa				/MPa		/°		/MPa	
1	24.00	28.00	8.00	33.30	0.25	0.40	4.00	11.00	30.00	42.00	3.40	4.20
2	24.00	28.00	8.00	33.00	0.25	0.40	4.00	11.00	30.00	42.00	3.40	4.20
3	32.00	35.00	69.00	143.00	0.25	0.40	15.00	28.00	40.00	51.00	9.10	15.30
4	32.00	35.00	68.00	84.00	0.25	0.40	11.00	24.00	39.00	45.00	8.30	13.60
5	32.00	35.00	61.00	74.00	0.25	0.40	9.00	23.00	38.00	42.00	6.90	11.80
6	24.00	28.00	25.00	38.00	0.20	0.40	5.00	14.00	35.00	47.00	4.40	10.70
7	24.00	28.00	16.00	31.00	0.20	0.40	8.00	17.00	32.00	38.00	4.70	9.20
8	28.00	31.00	34.00	69.00	.	Ů						

/					
		Bishop	Janbu	M-P	
1-1'-	1	1.35	1.3373	1.3306	1.3301
1-1'-	2	1.29	1.2831	1.2765	1.2760
1-1'-	3	1.24	1.2534	1.2453	1.2546
2-2'-	1	1.35	1.3328	1.3270	1.3268
2-2'-	2	1.29	1.2793	1.2740	1.2735
2-2'-	3	1.24	1.2436	1.2475	1.2485
3-3'-	1	1.36	1.3494	1.3447	1.3441
3-3'-	2	1.29	1.2806	1.2761	1.2758
3-3'-	3	1.25	1.2554	1.2585	1.25784
4-4'-	1	1.38	1.3557	1.3519	1.3519
4-4'-	2	1.32	1.2963	1.2939	1.2934
4-4'-	3	1.26	1.2678	1.2637	1.2696
5-5'-	1	1.37	1.3462	1.3425	1.3420
5-5'-	2	1.31	1.2913	1.2881	1.2874
5-5'-	3	1.27	1.2731	1.2737	1.2796
6-6'-	1	1.37	1.3515	1.3445	1.3440
6-6'-	2	1.30	1.2880	1.2812	1.2808
6-6'-	3	1.25	1.2567	1.2534	1.2512
7-7'-	1	1.39	1.3767	1.3750	1.3748
7-7'-	2	1.32	1.3101	1.3086	1.3082
7-7'-	3	1.26	1.2675	1.2685	1.2634
8-8'-	1	1.42	1.4078	1.4007	1.4006
8-8'-	2	1.34	1.3344	1.3247	1.3246

/			Bishop	Janbu	M-P
8-8'-	3	1.29	1.2944	1.2946	1.2935
9-9'-	1	1.43	1.4133	1.4066	1.4055
9-9'-	2	1.35	1.3268	1.3246	1.3240
9-9'-	3	1.28	1.2867	1.2858	1.2896
10-10'-	1	1.40	1.3805	1.3763	1.3744
10-10'-	2	1.33	1.3123	1.3086	1.3078
10-10'-	3	1.27	1.2788	1.2785	1.2795
11-11'-	1	1.38	1.3576	1.3503	1.3498
11-11'-	2	1.31	1.2952	1.2885	1.2880
11-11					

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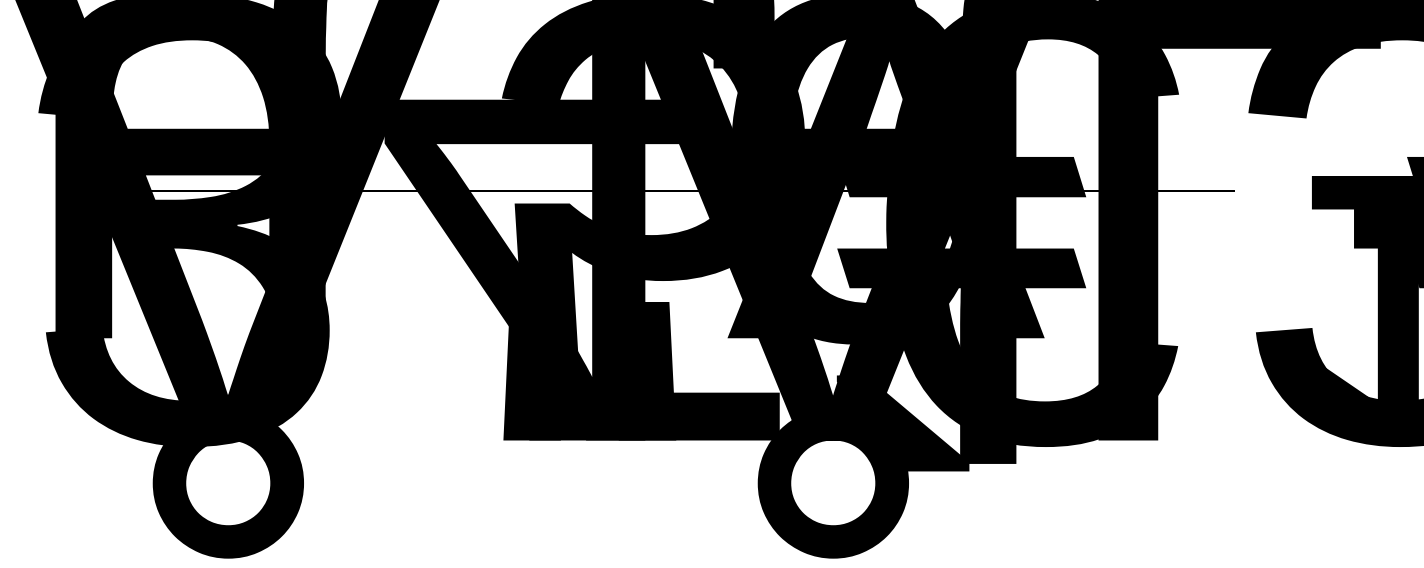
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GB51016-2014



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3.3.2.1

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3.3.2.2

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3-17

	1. 2. 3.	1. 2.		1. 2.
	1. 2.			1. 2.
	1. 2. 3. 4. 5. 6. 7. 8	1. 2. 3.		1. 2. 3. 4. 5. 6. 7

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GB6722-2014

3.3.3

3.3.3.1

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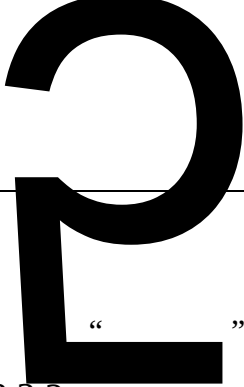
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3.3.3.2

“ ” “ ” “ ”

3-18

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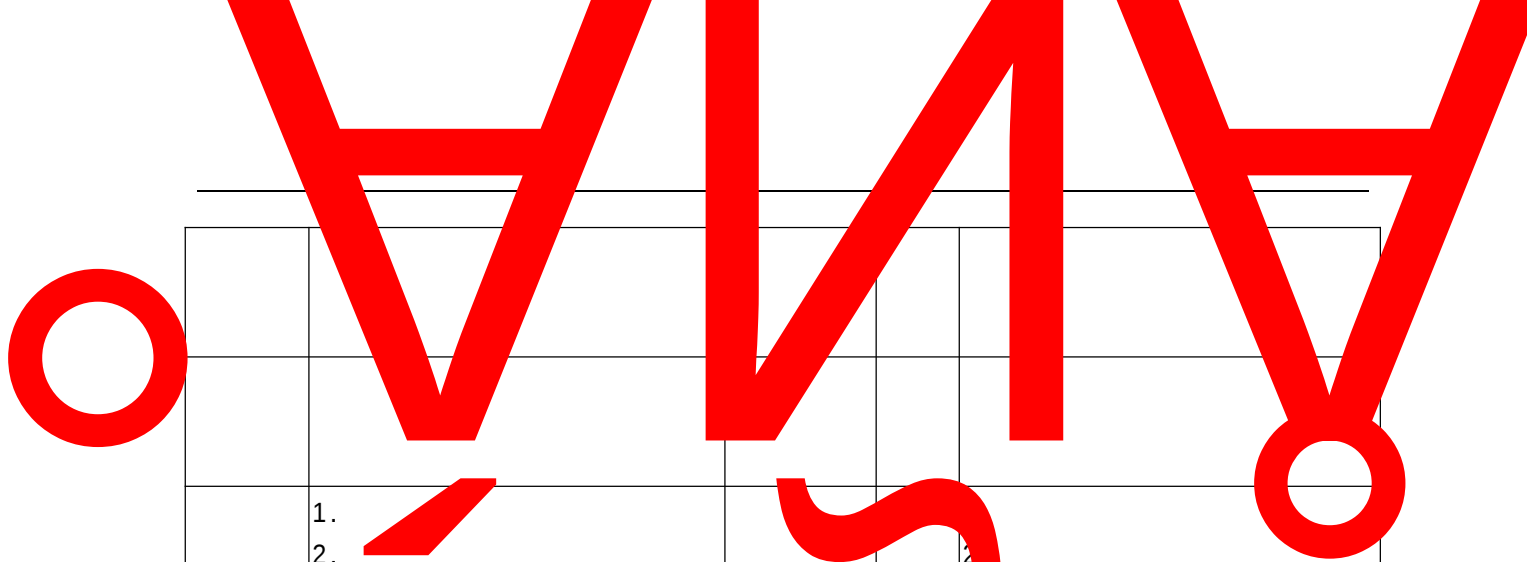
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	6			7.	
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3.3.3.3

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3.4

3.4.1

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“ ” “ ”

3.4.2

3-19

	1.	1.		1.
	2. ()			2.

	3. 4. 5. 6. 7. 8. 9 10 11	2.		3. 4. 5. 6. 7. 8. 9 10 11.
	1. 2. 3. 4. 5.			1. 2. 3. 4. 5.

3.4.3

3.5

3.5.1

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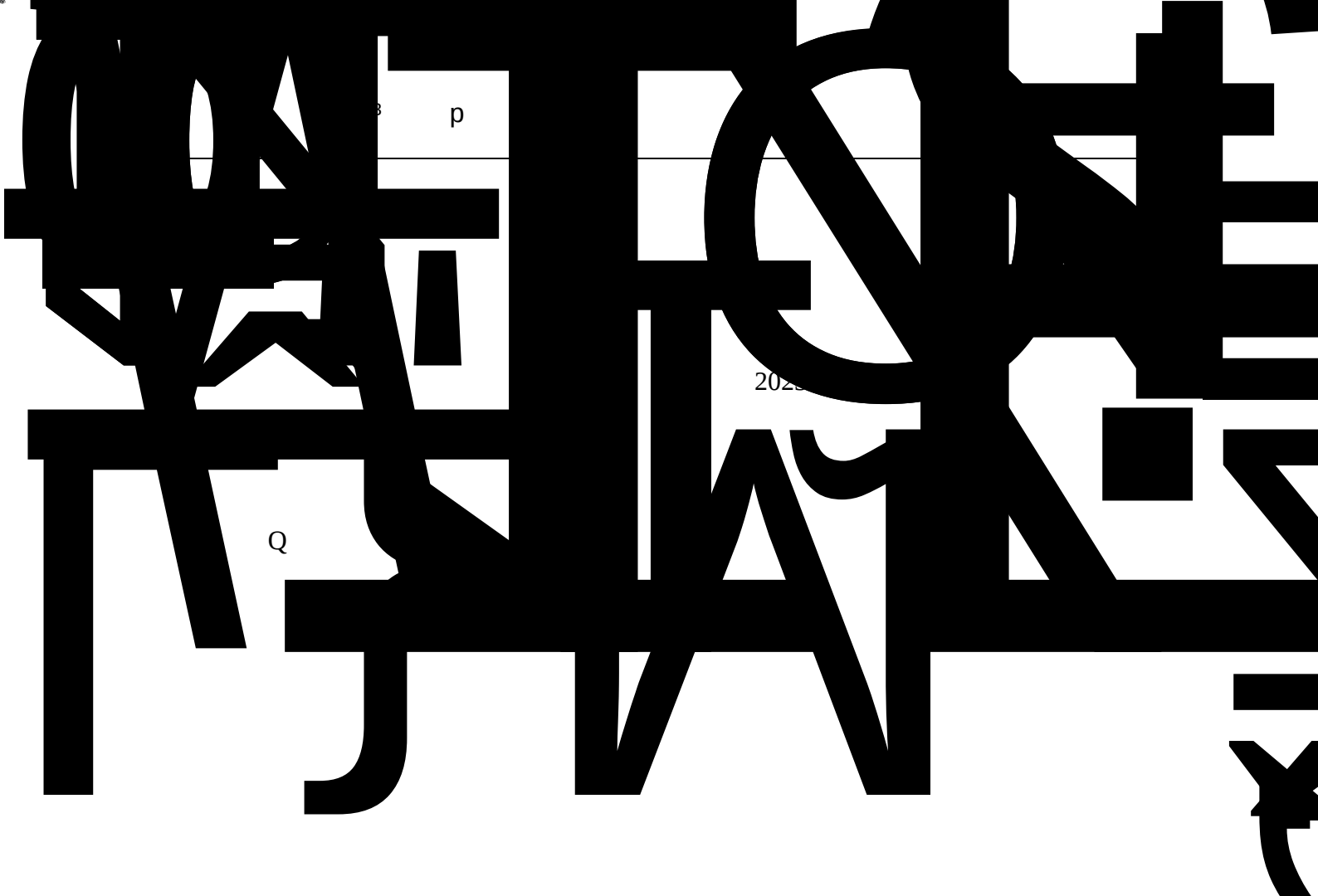
3.5.2

1

3-20

	1.	1.		1.
	2.	2.		2.
	3.			3.
				4.

				90m	66m	42m	
3740.0m	90m		1334m	66m		1048m	42m
966m		350m			C20		2.0m
2.0m		0.30m			0.15m		C30



50830-2013

20

P=5%

$$Q_2 = F \cdot H \cdot \Phi$$

$$Q_2 = F \cdot H_p \cdot \Phi$$

$$Q_2 = \frac{F \cdot H \cdot \Phi}{P} \quad \text{m}^3/\text{d}$$

$$Q_2 = \frac{F \cdot H_p \cdot \Phi}{P} \quad \text{m}^3/\text{d}$$

$$F = \frac{Q_2}{H \cdot \Phi} \quad \text{m}^2$$

$$H = \frac{Q_2}{F \cdot \Phi} \quad \text{m/d}$$

$$H_p = \frac{Q_2}{F \cdot \Phi} \cdot P \quad \text{m/d}$$

$$\Phi = \frac{Q_2}{F \cdot H}$$

$$5237145 \text{ m}^2$$

$$35.2 \text{ mm}$$

24h 48h 72h 120h 168h

P=5%

h	P=5% mm
24	189.00
48	209.42
72	252.00
120	275.67
168	304.95

		F m ²	H m/d	φ	Q ₂ m ³ /d	
		5237145	0.0352	0.4	73739	
	24h	5237145	0.189	0.6	593892	P=5%
	48h	5237145	0.20942	0.6	658058	P=5%

	72h	5237145	0.252	0.6	791856	P=5%
	120h	5237145	0.27567	0.6	866234	P=5%
	168h	5237145	0.30495	0.6	958240	P=5%

3.

= +

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——Qr m³/d

——Q m³/h

20

7

$H_{-450m} = 1.15 \times (180 + 5) = 212.75m$

m

$$H_{-120\text{m}} = 1.15 \times (162 + 5) = 192.1\text{m} \qquad +42\text{m}$$

3.5.3

3-25				
	1.	1.		1.
		2.		2.
	“			
	”	3.		3.
	2.			4.
	3.			
	4.			5.
	5.			

“ ”

3.5.4

“ ”

3.6

1

9

2

5.

1.

2.

3.

4.

1.

2.

3.

4.

		320m 15553 m ³ -300m 30m 330m 30m 36~37 ° 30m 22.57 °	
2.	5.5		
3.	5.6		

3.6.3.1

2020 10

2022 2

280m “

”

320m “

$$\begin{array}{ccccccc} & & c & & \varphi & & F \\ & & | & & | & & \\ c' & & \varphi' & & & & \end{array}$$

GB51119-2015

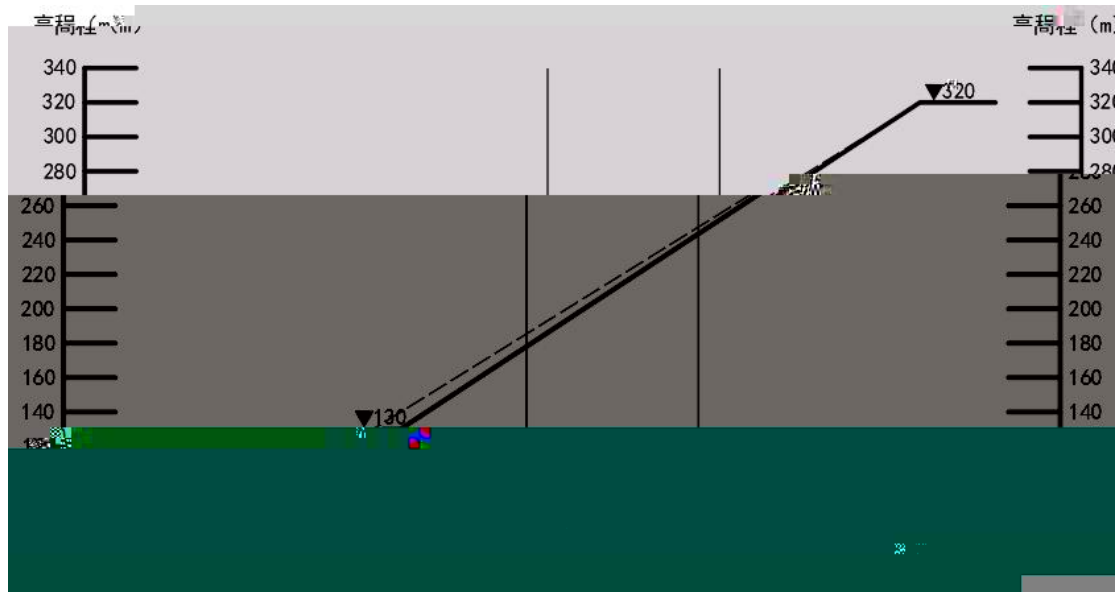
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GB51119-2015

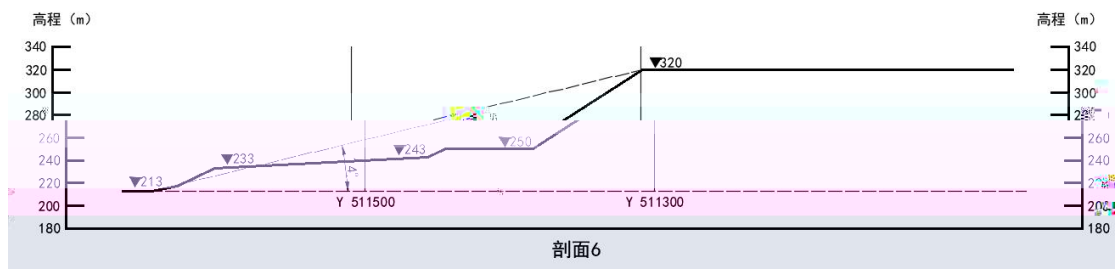
1.25

	1.25 1.30
	1.20 1.25
	1.15 1.20
	1.10 1.20

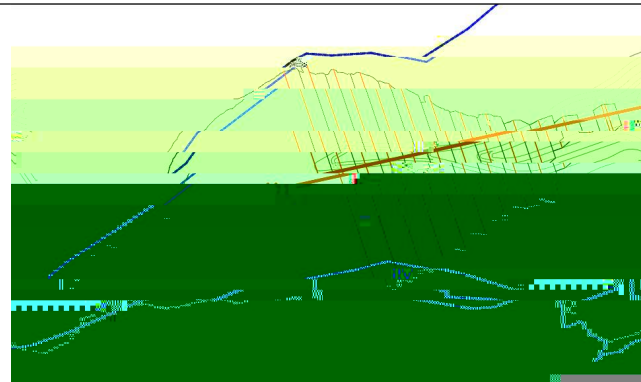
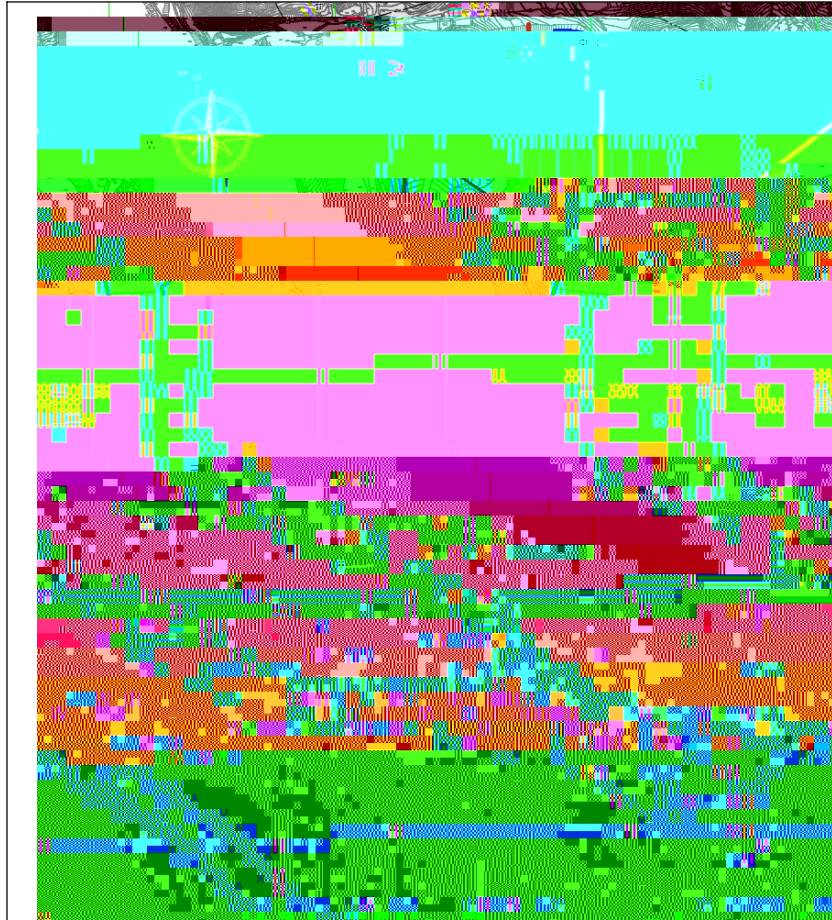
[illegible]



3-8 2-2



3-9 6-6



3-10

4

Hoek-Brown

3-30

3-30										
	/	kN/m ³	kN/m ²	°	°	10 ⁴ MPa		10 ⁴ MPa	10 ⁴ MPa	MPa
1		21	5	34	4	1.2	0.2	0.667	0.500	0.01
2	0	19.5	33	16	0	0.004	0.31	0.004	0.002	0.15
3		19.5	30	16	0	0.004	0.31	0.004	0.002	0.15
4		19.5	8	26	0	0.23	0.25	0.135	0.150	

5 0-0,-	I	I'30	I'34I0	I'3302	I'3304
8-8,-	3	I'53	I'53I4	I'5325	I'5325
8-8,-	5	I'50	I'54ΔI	I'544I	I'5445
8-8,- 3-31	I	I'32	I'3323	I'3352	I'3350
Δ-Δ,-	3	I'54	I'540Δ	I'545I	I'540I
Δ-Δ,-	3-31 5	I'58	I'5080	I'5023	I'5022
Δ-Δ,- /	I	I'32	I'334I Bishop	I'3303 Janbu	I'3302 M-P
0-0,-	3	I'50	I'5082	I'5032	I'5005
1-1'-	1	1.35	1.3299	1.3269	1.3270
0-0,-	5	I'35	I'3008	I'50ΔΔ	I'50Δ0
1-1'-	2	1.28	1.2648	1.2617	1.2618
0-0,-	I	I'4I	I'3802	I'3833	I'383I
1-1'-	3	1.25	1.2467	1.2486	1.2478
2-2,-	3	I'50	I'520Δ	I'52Δ8	I'5230
2-2'-	1	1.34	1.3248	1.3216	1.3217
2-2'-	2	1.28	1.2593	1.2561	1.2562
2-2'-	3	1.24	1.2467	1.2424	1.2413
3-3'-	1	1.36	1.3370	1.3337	1.3338
3-3'-	2	1.29	1.2715	1.2684	1.2684
3-3'-	3	1.25	1.2546	1.2574	1.2574
4-4'-	1	1.34	1.3143	1.3107	1.3108
4-4'-	2	1.27	1.2493	1.2458	1.2459
4-4'-	3	1.23	1.2355	1.2352	1.2371
5-5'-	1	1.40	1.3853	1.3817	1.3818
5-5'-	2	1.31	1.2918	1.2884	1.2885

/						
			Bishop	Janbu	M-P	
9-9'-	2	1.30	1.2770	1.2747	1.2745	
9-9'-	3	1.24	1.2464	1.2463	1.2425	
10-10'-	1	1.35	1.3256	1.3221	1.3220	
10-10'-	2	1.28	1.2622	1.2589	1.2587	
10-10'-	3	1.24	1.2412	1.2462	1.2424	
11-11'-	1	1.43	1.4120	1.4093	1.4092	
11-11'-	2	1.34	1.3273	1.3247	1.3247	
11-11'-	3	1.27	1.2747	1.2746	1.2790	

GB51119-2015

3.6.3.2

2

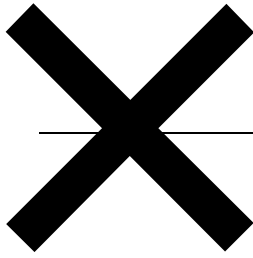
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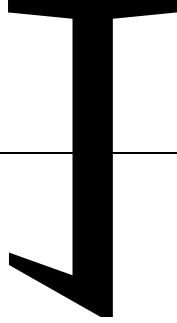
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2017 45

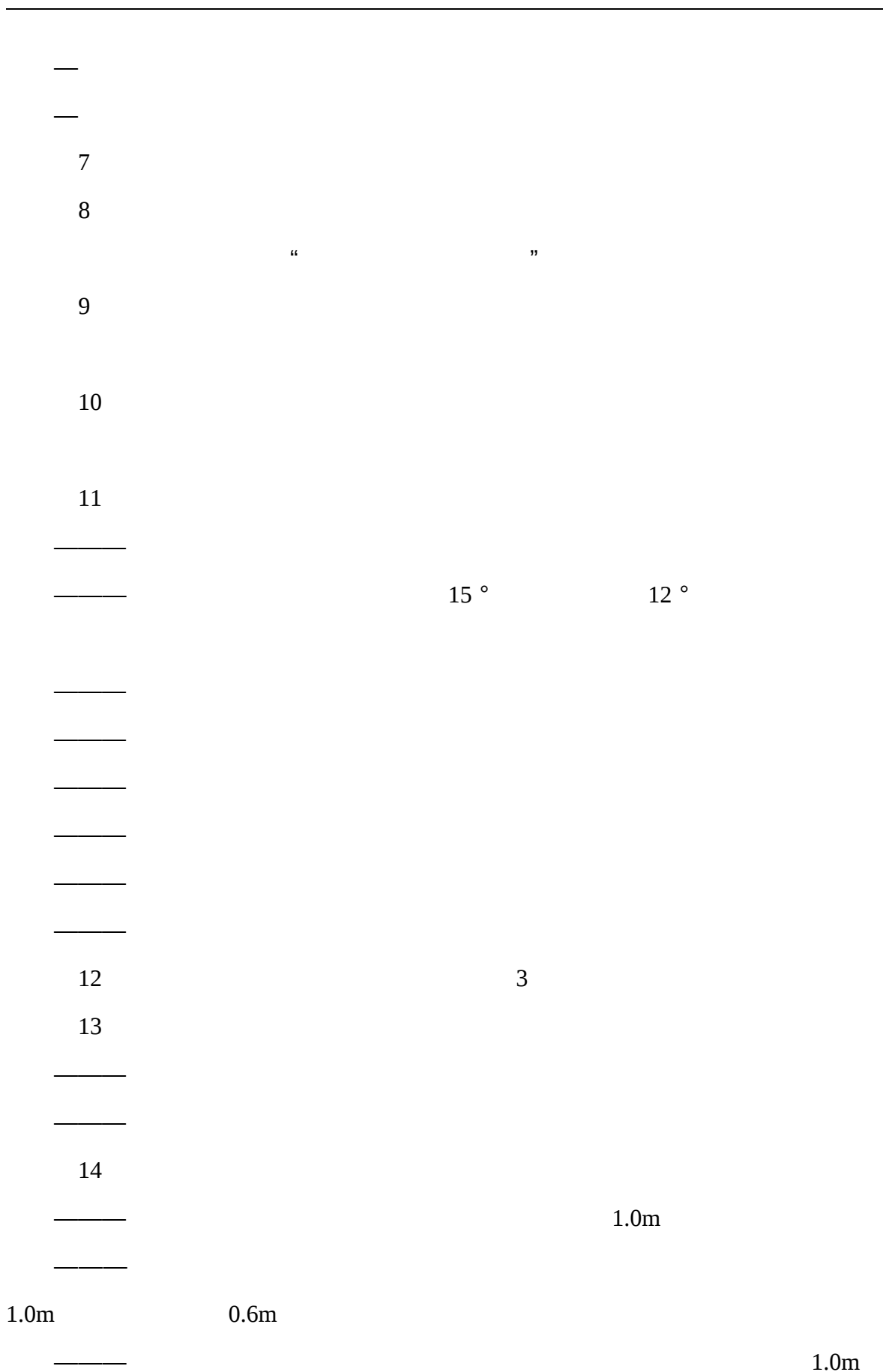
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	7.				
	8.				



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4.1.3

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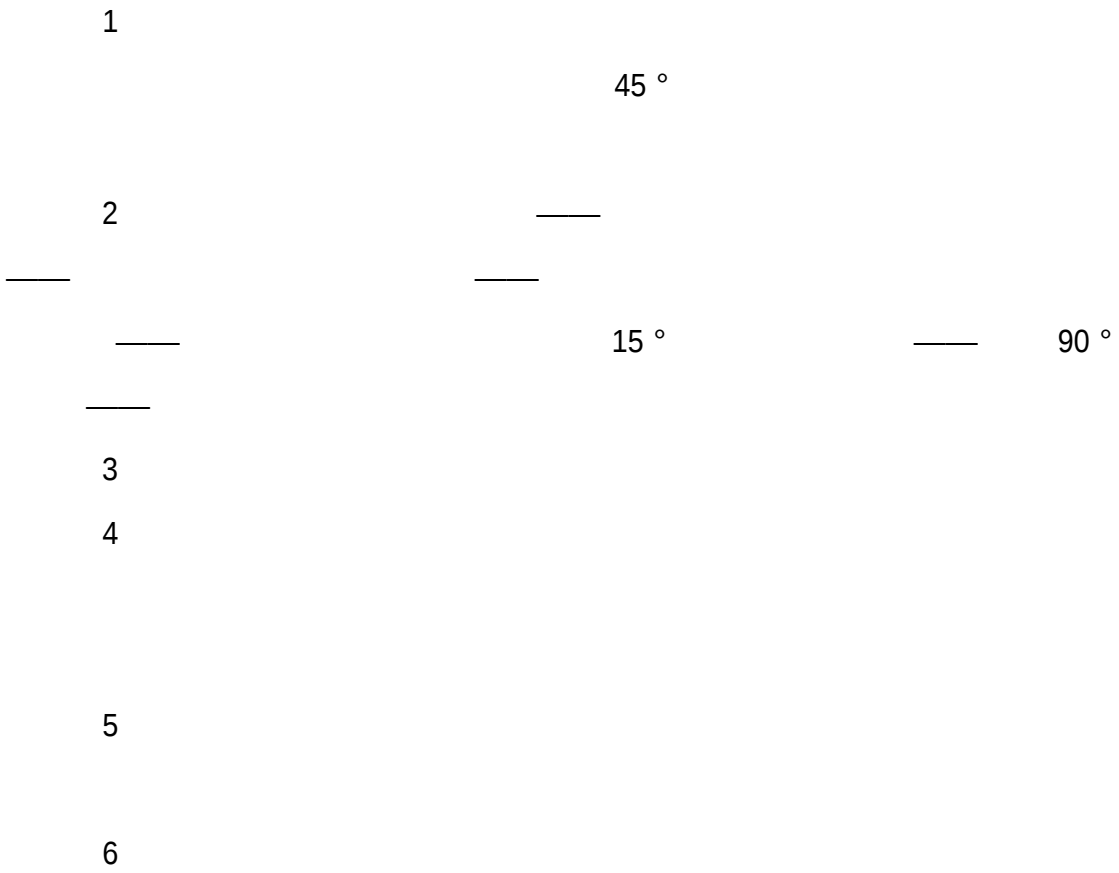
5

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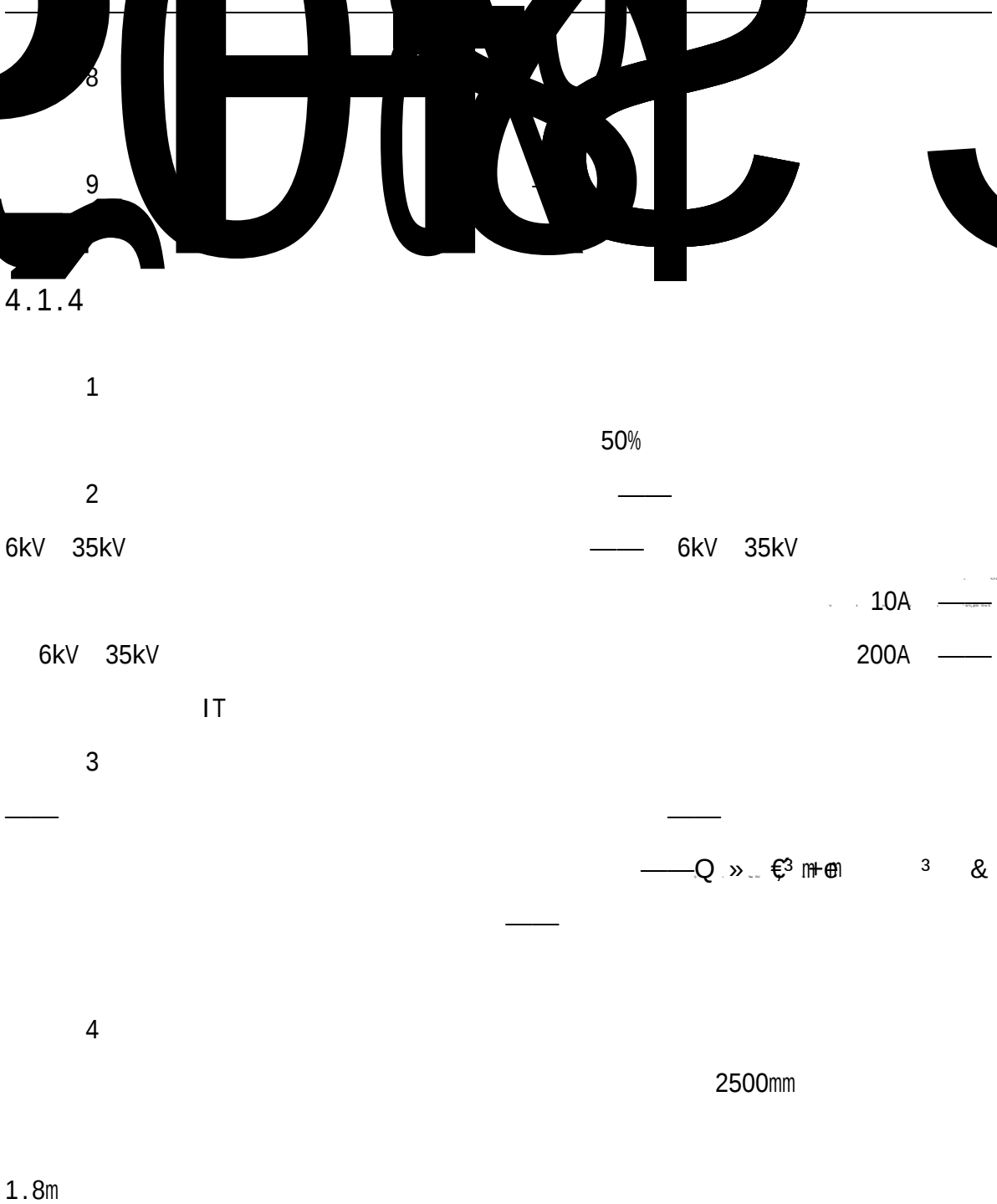
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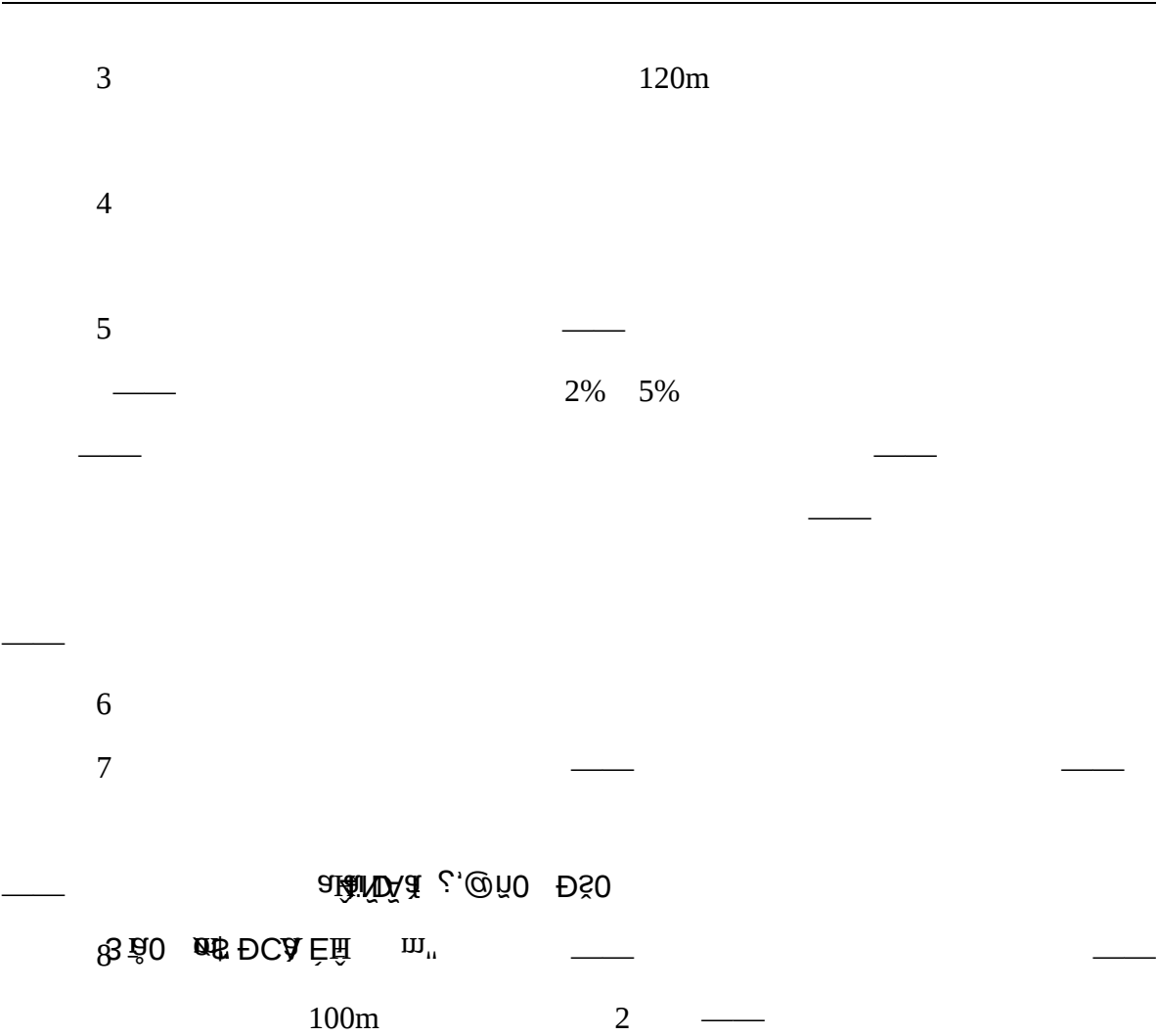
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ē ē Đ Ē ē q Ē Ě
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đ Đ Ē 4Ω — mĐ q
l m " ē Ě Ω m"
kV Ē 0.5Ω —kV mĐ p Ē đ m "m "
4Ω m "

4.1.5

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4.1.6

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5.2.2

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6.1

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1

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3 42m

4 -120m

5 -300m

6 -450m

7 3250

8 3850

