

## INTERVENTI DI MIGLIORAMENTO DELLA DIGA DROVE DI CEPPARELLO



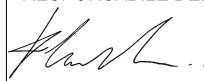
Tavola / Elaborato	Nome Elaborato:	Scala:
<b>ET.06.06</b>	<b>VERIFICHE DI STABILITA' LUNGO I VERSANTI PROSPICIENTI L'INVASO E IL CORPO DIGA</b>	
		Data: 18/04/2019

Settore:	
 <b>INGEGNERIE TOSCANI</b>	Sede Firenze Via de Sanctis, 49 Cod. Fiscale e P.I. 06111950488
	<small>Organizzazione dotata di Sistema di Gestione Integrato certificato in conformità alla normativa ISO9001 - ISO14001 - OHSAS18001 - SA8000</small>

<b>PROGETTAZIONE :</b>	<b>COLLABORATORI :</b>
<b>PROGETTISTA - PROJECT MANAGER :</b> <b>ING MARIO CHIARUGI</b>	<b>DOTT. GEOL. CARLO FERRI</b>
	<b>DOTT. GEOL. ALESSANDRO AGNELLI</b>
<b>GEOLOGO:</b> <b>DOTT. GEOL. NICOLA CEMPINI</b>	<b>PER. AGR. DAVIDE MORETTI</b>
<b>ESPROPRI:</b> <b>GEOM. ANDREA PATRIARCHI</b>	<b>GEOM. ANDREA BERNARDINI</b>

<b>CONSULENTI TECNICI :</b>	<b>COMMESSA I.T. :</b>
 <b>WEST Systems</b>	<b>INGT-TPLPD-ACQAC159</b>
<b>PROGETTISTA OPERE IDRAULICHE E STRUTTURALI :</b> <b>ING. DAVID SETTESOLDI</b>	

	<b>RESPONSABILE COMMITTENTE :</b> <b>GEOM. ALESSANDRO PIOLI</b>
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<b>DIRETTORE TECNICO INGEGNERIE TOSCANI :</b>	<b>RESPONSABILE DEL PROCEDIMENTO :</b>
<b>ING. MARIO CHIARUGI</b>	 <b>ING. ROBERTO CECCHINI</b>

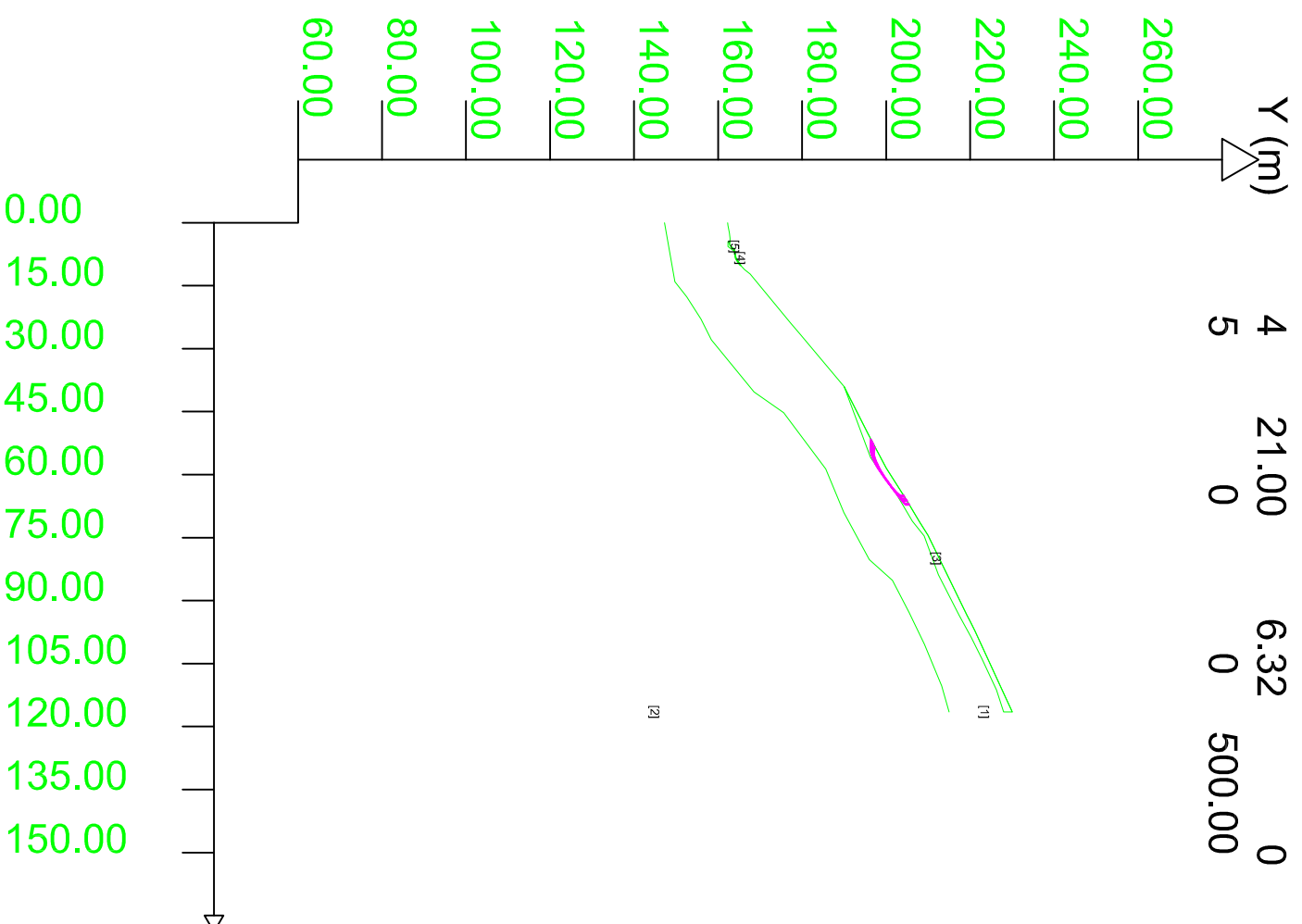
Rev.	Data	Descrizione / Motivo della revisione	Redatto	Controllato / Approvato
00	18/04/2019	Emissione	Soc. IdroGeo Service Srl	

PROGETTO DEFINITIVO

Data : 18/04/2019  
 Localita' : Loc. Cepparello  
 Descrizione : Sez.1 - Stato attuale  
 [n] = N. strato o lente

# Parametri Geotecnici degli strati # -----

N.	phi` deg	C` KPa	Cu KPa	Gamm KN/m3	GammSat KN/m3	sgci MPa	GSI	mi	D
1	0	0	0	24.00	24.50	50.00	50.00	17.00	1.00
2	0	0	0	24.00	24.50	100.00	65.00	17.00	1.00
3	21.00	6.32	0	17.50	18.50	0	0	0	0
4	21.00	6.32	0	17.50	18.50	0	0	0	0
5	0	0	500.00	25.00	25.00	0	0	0	0



**DATI 10 SUP. CON MINOR Fs**

Fs minimo : 1.2117      1.2246  
 Range Fs : 1.2117  
 Differenza % Range Fs : 1.06  
 Coefficiente Sismico orizzontale - Kh: 0.0510

**GENERAZIONE SUPERFICI RANDOM**

Campione Superfici - N.: 20000  
 Lunghezza media segmenti (m) : 1.0  
 Range X inizio generazione : 2.3 - 107.2  
 Range X termine generazione : 14.0 - 114.2  
 Livello Y minimo considerato : 72.8

# Report elaborazioni #

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SSAP 4.9.9 - Slope Stability Analysis Program (1991,2018)

WWW.SSAP.EU

Build No. 10784

BY

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\*\* Gia' Ricercatore CNR-IRPI fino a Luglio 2011

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Ultima Revisione struttura tabelle del report: 29 dicembre 2018  
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File report: C:\SSAP2010\Verifiche\Risultati\Sez1\_Stato\_Attuale.txt

Data: 18/4/2019

Localita' :

Descrizione:

Modello pendio: Sez1-stato\_attuale\_V1.mod

----- PARAMETRI DEL MODELLO DEL PENDIO -----

\_\_\_ PARAMETRI GEOMETRICI - Coordinate X Y (in m) \_\_\_

SUP T.		SUP 2		SUP 3		SUP 4	
X	Y	X	Y	X	Y	X	Y
0.00	162.27	0.00	147.27	39.08	190.00	6.36	163.89
0.67	162.34	14.07	149.75	55.91	196.32	6.86	163.89
2.50	162.70	17.64	152.51	59.95	199.01	8.45	164.14
3.69	162.85	22.94	155.93	64.25	202.23	8.90	164.42
4.57	162.84	27.93	158.39	71.10	206.26	9.91	165.09
4.93	162.73	40.35	168.59	74.59	209.08	10.22	165.41
5.45	162.81	45.23	175.60	83.87	212.44	8.55	164.29
6.09	163.61	58.64	185.65	93.54	217.41	8.47	164.28
6.36	163.89	69.00	189.92	98.65	220.23	8.04	164.18
7.60	164.11	80.28	196.01	103.89	222.79	7.60	164.11
8.04	164.18	85.16	201.50	111.28	226.28	6.36	163.89
8.47	164.28	92.78	205.46	116.53	228.00	-	-
8.55	164.29	100.40	209.11	116.53	230.00	-	-
10.22	165.41	110.29	213.23	116.02	229.77	-	-
11.19	166.32	116.53	215.00	113.13	228.48	-	-
12.23	167.64	-	-	97.21	221.11	-	-
23.88	177.21	-	-	94.96	220.00	-	-
26.80	179.68	-	-	93.47	219.22	-	-
39.08	190.00	-	-	74.44	210.00	-	-
50.30	195.70	-	-	71.23	207.95	-	-
58.44	200.00	-	-	65.97	204.86	-	-
65.97	204.86	-	-	58.44	200.00	-	-
71.23	207.95	-	-	50.30	195.70	-	-
74.44	210.00	-	-	39.08	190.00	-	-

93.47	219.22	-	-	-	-	-	-
94.96	220.00	-	-	-	-	-	-
97.21	221.11	-	-	-	-	-	-
113.13	228.48	-	-	-	-	-	-
116.02	229.77	-	-	-	-	-	-
116.53	230.00	-	-	-	-	-	-

SUP 5		SUP 6		SUP 7		SUP 8	
X	Y	X	Y	X	Y	X	Y
4.49	162.84	-	-	-	-	-	-
4.49	162.34	-	-	-	-	-	-
5.64	162.34	-	-	-	-	-	-
6.86	163.89	-	-	-	-	-	-
6.36	163.89	-	-	-	-	-	-
6.09	163.61	-	-	-	-	-	-
5.45	162.81	-	-	-	-	-	-
4.93	162.73	-	-	-	-	-	-
4.57	162.84	-	-	-	-	-	-
4.49	162.84	-	-	-	-	-	-

## ASSENZA DI FALDA ##

----- PARAMETRI GEOMECCANICI -----

STR_IDX	sgci	fi` GSI	mi	C` D	Cu	Gamm	Gamm_sat
STRATO 1	1	0.00		0.00	0.00	24.00	24.50
8.587	50.00	50.00	17.00	1.00			
STRATO 2	2	0.00		0.00	0.00	24.00	24.50
12.882	100.00	65.00	17.00	1.00			
STRATO 3	3	21.00		6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00			
STRATO 4	4	21.00		6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00			
STRATO 5	5	0.00		0.00	500.00	25.00	25.00
1000.000	0.00	0.00	0.00	0.00			

LEGENDA: fi` \_\_\_\_\_ Angolo di attrito interno efficace(in gradi)  
C` \_\_\_\_\_ Coesione efficace (in Kpa)  
Cu \_\_\_\_\_ Resistenza al taglio Non drenata (in Kpa)  
Gamm \_\_\_\_\_ Peso di volume terreno fuori falda (in KN/m^3)  
Gamm\_sat \_\_\_\_\_ Peso di volume terreno immerso (in KN/m^3)  
STR\_IDX \_\_\_\_\_ Indice di resistenza (usato in solo in 'SNIFF SEARCH')

(adimensionale)

---- SOLO Per AMMASSI ROCCIOSI FRATTURATI - Parametri Criterio di Rottura di Hoek (2002)-

sigci \_\_\_\_\_ Resistenza Compressione Uniassiale Roccia Intatta (in MPa)

GSI \_\_\_\_\_ Geological Strenght Index ammasso(adimensionale)

mi \_\_\_\_\_ Indice litologico ammasso(adimensionale)

D \_\_\_\_\_ Fattore di disturbo ammasso(adimensionale)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 -

ATTIVATO (solo per ROCCE)  
 Uso CRITERIO DI ROTTURA Hoek et al.(2002,2006) - non-lineare - Generalizzato  
 secondo Lei et al.(2016)

----- INFORMAZIONI GENERAZIONE SUPERFICI RANDOM -----

\*\*\* PARAMETRI PER LA GENERAZIONE DELLE SUPERFICI

METODO DI RICERCA: CONVEX RANDOM - Chen (1992)  
 FILTRAGGIO SUPERFICI : ATTIVATO  
 COORDINATE X1,X2,Y OSTACOLO : 0.00 0.00 0.00  
 LUNGHEZZA MEDIA SEGMENTI (m): 1.0 (+/-) 50%  
 INTERVALLO ASCISSE RANDOM STARTING POINT (Xmin .. Xmax): 2.33

107.21

LIVELLO MINIMO CONSIDERATO (Ymin): 72.81  
 INTERVALLO ASCISSE AMMESSO PER LA TERMINAZIONE (Xmin .. Xmax): 13.98

114.20

\*\*\* TOTALE SUPERFICI GENERATE : 20000

----- INFORMAZIONI PARAMETRI DI CALCOLO -----

METODO DI CALCOLO : BORSELLI (Borselli, 2016)  
 COEFFICIENTE SISMICO UTILIZZATO Kh : 0.0510  
 COEFFICIENTE SISMICO UTILIZZATO Kv (assunto Positivo): 0.0255  
 COEFFICIENTE c=Kv/Kh UTILIZZATO : 0.5000  
 FORZA ORIZZONTALE ADDIZIONALE IN TESTA (kN/m): 0.00  
 FORZA ORIZZONTALE ADDIZIONALE ALLA BASE (kN/m): 0.00

N.B. Le forze orizzontali addizionali in testa e alla base sono poste uguali a 0

durante le tutte le verifiche globali.

I valori >0 impostati dall'utente sono utilizzati solo in caso di verifica singola

----- RISULTATO FINALE ELABORAZIONI -----

\* DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR Fs \*

Fattore di sicurezza (FS)	1.2117	- Min. -	X	Y	Lambda=
0.4078			52.35	196.78	
			53.22	196.65	
			53.61	196.60	
			53.87	196.59	
			54.08	196.59	
			54.29	196.62	
			54.47	196.66	
			54.68	196.72	
			54.90	196.80	
			55.17	196.91	
			55.42	197.02	
			55.66	197.12	
			55.90	197.22	
			56.13	197.32	
			56.35	197.41	

56.58	197.51
56.81	197.61
57.04	197.71
57.27	197.81
57.50	197.91
57.73	198.02
57.96	198.12
58.18	198.22
58.42	198.33
58.65	198.44
58.89	198.55
59.12	198.66
59.34	198.77
59.56	198.89
59.78	199.02
60.00	199.15
60.22	199.29
60.45	199.44
60.70	199.61
60.93	199.77
61.16	199.93
61.39	200.09
61.61	200.26
61.84	200.43
62.06	200.60
62.29	200.78
62.52	200.96
62.75	201.14
62.99	201.32
63.22	201.50
63.44	201.68
63.67	201.86
63.90	202.04
64.13	202.22
64.36	202.40
64.59	202.58
64.82	202.76
65.04	202.94
65.27	203.12
65.50	203.30
65.74	203.48
65.97	203.67
66.22	203.86
66.44	204.04
66.66	204.24
66.87	204.43
66.87	205.39

Fattore di sicurezza (FS)    1.2122    - N.2    --    X    Y    Lambda=  
0.3931

52.01	196.61
53.10	196.56
53.60	196.56

53.95	196.57
54.23	196.60
54.51	196.64
54.77	196.70
55.04	196.78
55.33	196.88
55.68	197.02
55.99	197.14
56.29	197.27
56.58	197.39
56.87	197.53
57.16	197.66
57.45	197.80
57.75	197.96
58.06	198.12
58.36	198.29
58.65	198.45
58.94	198.62
59.23	198.79
59.51	198.97
59.80	199.15
60.10	199.34
60.40	199.55
60.70	199.75
61.00	199.95
61.29	200.15
61.59	200.36
61.88	200.56
62.17	200.76
62.47	200.97
62.77	201.18
63.06	201.39
63.36	201.60
63.65	201.81
63.94	202.02
64.24	202.24
64.54	202.46
64.84	202.68
65.16	202.92
65.45	203.15
65.73	203.38
66.01	203.63
66.29	203.90
66.60	204.21
66.81	204.44
66.81	205.36

Fattore di sicurezza (FS)    1.2152    - N.3    --    X    Y    Lambda=  
0.3946

52.74	196.99
53.65	196.99
54.09	197.00
54.40	197.01

54.67	197.03
54.93	197.06
55.17	197.09
55.42	197.13
55.69	197.18
55.99	197.24
56.25	197.30
56.50	197.37
56.73	197.45
56.98	197.54
57.21	197.64
57.46	197.75
57.71	197.88
58.00	198.03
58.27	198.18
58.53	198.32
58.78	198.47
59.04	198.62
59.29	198.77
59.54	198.93
59.80	199.09
60.07	199.26
60.33	199.43
60.59	199.60
60.84	199.78
61.10	199.95
61.35	200.13
61.60	200.31
61.86	200.49
62.12	200.68
62.38	200.87
62.64	201.06
62.90	201.25
63.15	201.44
63.41	201.63
63.67	201.82
63.92	202.01
64.18	202.20
64.44	202.40
64.70	202.59
64.95	202.78
65.21	202.98
65.47	203.18
65.73	203.37
65.99	203.58
66.27	203.79
66.52	203.99
66.77	204.21
67.01	204.42
67.22	204.62
67.22	205.59

Fattore di sicurezza (FS)    1.2200    - N.4 --    X    Y    Lambda=



0.3928

52.78	197.01
53.43	196.60
53.72	196.44
53.89	196.35
54.02	196.31
54.17	196.29
54.28	196.29
54.42	196.31
54.57	196.35
54.79	196.42
54.98	196.49
55.16	196.55
55.33	196.60
55.49	196.66
55.66	196.72
55.82	196.78
55.99	196.85
56.16	196.91
56.32	196.98
56.49	197.05
56.65	197.12
56.81	197.19
56.97	197.26
57.14	197.34
57.30	197.42
57.48	197.51
57.65	197.59
57.81	197.68
57.97	197.77
58.13	197.86
58.29	197.96
58.45	198.06
58.61	198.16
58.79	198.28
58.95	198.39
59.12	198.50
59.28	198.62
59.45	198.73
59.61	198.84
59.78	198.96
59.94	199.08
60.11	199.20
60.27	199.32
60.44	199.44
60.60	199.55
60.77	199.67
60.93	199.79
61.10	199.91
61.26	200.04
61.43	200.16
61.59	200.28
61.76	200.40
61.92	200.52

62.08	200.65
62.25	200.77
62.41	200.90
62.58	201.02
62.75	201.15
62.91	201.28
63.07	201.40
63.24	201.53
63.40	201.66
63.57	201.79
63.73	201.92
63.90	202.06
64.07	202.19
64.24	202.33
64.40	202.47
64.56	202.61
64.72	202.75
64.88	202.90
65.05	203.05
65.21	203.21
65.39	203.39
65.56	203.55
65.72	203.72
65.72	204.70

Fattore di sicurezza (FS)      1.2233   - N.5   --      X      Y      Lambda=  
0.3954

52.49	196.86
53.58	196.78
54.08	196.75
54.41	196.76
54.69	196.78
54.96	196.83
55.21	196.89
55.48	196.98
55.77	197.08
56.11	197.23
56.43	197.37
56.73	197.50
57.02	197.63
57.31	197.77
57.60	197.90
57.90	198.04
58.19	198.19
58.51	198.35
58.80	198.50
59.09	198.66
59.37	198.82
59.65	198.99
59.94	199.16
60.22	199.35
60.52	199.54
60.83	199.75

61.13	199.96
61.42	200.17
61.71	200.38
62.00	200.59
62.29	200.80
62.58	201.02
62.87	201.25
63.17	201.48
63.46	201.72
63.76	201.95
64.05	202.18
64.34	202.42
64.63	202.66
64.92	202.90
65.22	203.14
65.52	203.40
65.82	203.65
66.10	203.90
66.31	204.09
66.31	205.06

Fattore di sicurezza (FS)    1.2233   - N.6 --    X            Y            Lambda=  
0.3829

51.59	196.38
53.02	196.32
53.68	196.30
54.13	196.32
54.49	196.36
54.86	196.42
55.19	196.51
55.55	196.62
55.94	196.77
56.41	196.97
56.83	197.15
57.21	197.34
57.58	197.53
57.96	197.74
58.32	197.96
58.69	198.19
59.08	198.45
59.49	198.73
59.89	199.02
60.28	199.29
60.67	199.57
61.05	199.85
61.44	200.14
61.83	200.43
62.22	200.73
62.64	201.05
63.02	201.36
63.40	201.68
63.76	202.00
64.14	202.36

64.55 202.77  
65.02 203.26  
65.02 204.25

Fattore di sicurezza (FS) 1.2234 - N.7 -- X Y Lambda=  
0.3965

52.38 196.80  
53.53 196.81  
54.08 196.83  
54.45 196.86  
54.77 196.90  
55.07 196.96  
55.35 197.02  
55.65 197.11  
55.97 197.22  
56.34 197.36  
56.67 197.49  
56.99 197.62  
57.30 197.75  
57.61 197.89  
57.92 198.04  
58.24 198.19  
58.56 198.35  
58.91 198.54  
59.23 198.71  
59.54 198.89  
59.84 199.08  
60.15 199.27  
60.45 199.47  
60.76 199.68  
61.08 199.91  
61.41 200.15  
61.74 200.40  
62.06 200.63  
62.38 200.87  
62.69 201.11  
63.01 201.35  
63.34 201.59  
63.67 201.83  
64.01 202.09  
64.32 202.34  
64.62 202.59  
64.92 202.86  
65.23 203.15  
65.56 203.49  
65.94 203.91  
65.94 204.84

Fattore di sicurezza (FS) 1.2239 - N.8 -- X Y Lambda=  
0.3806

52.23 196.72  
53.38 196.55

53.91	196.48
54.26	196.46
54.54	196.47
54.82	196.50
55.08	196.55
55.35	196.63
55.66	196.74
56.04	196.88
56.37	197.02
56.68	197.16
56.98	197.30
57.28	197.45
57.57	197.60
57.87	197.77
58.18	197.95
58.51	198.14
58.82	198.34
59.13	198.53
59.43	198.72
59.73	198.92
60.03	199.13
60.33	199.34
60.64	199.56
60.95	199.78
61.26	200.01
61.57	200.24
61.88	200.46
62.18	200.69
62.49	200.92
62.80	201.16
63.12	201.40
63.45	201.65
63.75	201.90
64.05	202.15
64.33	202.42
64.63	202.71
64.95	203.06
65.32	203.47
65.32	204.44

Fattore di sicurezza (FS)      1.2245   - N.9 --      X      Y      Lambda=  
0.3835

51.60	196.39
53.01	196.33
53.66	196.31
54.10	196.33
54.46	196.37
54.83	196.43
55.15	196.51
55.51	196.63
55.90	196.77
56.36	196.96
56.77	197.14

57.15	197.32
57.51	197.50
57.88	197.70
58.23	197.91
58.60	198.14
58.98	198.39
59.39	198.68
59.78	198.95
60.17	199.23
60.55	199.50
60.93	199.77
61.31	200.05
61.69	200.33
62.09	200.63
62.50	200.93
62.88	201.23
63.24	201.54
63.60	201.86
63.97	202.21
64.37	202.61
64.83	203.10
65.03	203.32
65.03	204.25

Fattore di sicurezza (FS)    1.2246   - N.10   --    X            Y            Lambda=  
0.3973

53.43	197.35
54.15	197.20
54.49	197.14
54.71	197.11
54.89	197.11
55.07	197.11
55.24	197.13
55.42	197.17
55.61	197.22
55.85	197.29
56.06	197.35
56.26	197.42
56.44	197.49
56.64	197.56
56.82	197.63
57.01	197.71
57.21	197.80
57.41	197.89
57.61	197.99
57.81	198.08
58.00	198.17
58.19	198.27
58.39	198.36
58.58	198.46
58.78	198.56
58.98	198.67
59.18	198.77

59.37	198.87
59.56	198.98
59.75	199.09
59.94	199.21
60.13	199.32
60.33	199.45
60.53	199.58
60.73	199.71
60.92	199.83
61.12	199.96
61.31	200.10
61.50	200.23
61.70	200.36
61.89	200.50
62.09	200.65
62.29	200.79
62.48	200.93
62.67	201.07
62.87	201.22
63.06	201.36
63.25	201.51
63.45	201.67
63.64	201.82
63.84	201.98
64.04	202.13
64.23	202.29
64.42	202.44
64.62	202.60
64.82	202.76
65.02	202.93
65.23	203.10
65.43	203.27
65.61	203.44
65.79	203.62
65.98	203.83
66.17	204.05
66.17	204.98

----- ANALISI DEFICIT DI RESISTENZA -----

# DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR  $F_s$  \*

# Analisi Deficit in riferimento a  $F_s(\text{progetto}) = 1.200$

Sup N.	$F_s$	FTR(kN/m)	FTA(kN/m)	Bilancio(kN/m)	ESITO
1	1.212	235.1	194.0	2.3	Surplus
2	1.212	238.3	196.6	2.4	Surplus
3	1.215	233.9	192.5	2.9	Surplus
4	1.220	234.5	192.2	3.8	Surplus
5	1.223	224.2	183.3	4.3	Surplus
6	1.223	233.6	191.0	4.5	Surplus
7	1.223	219.1	179.1	4.2	Surplus
8	1.224	229.3	187.3	4.5	Surplus
9	1.225	232.7	190.1	4.7	Surplus
10	1.225	207.8	169.7	4.2	Surplus

Esito analisi: SURPLUS di RESISTENZA!

Valore minimo di SURPLUS di RESISTENZA (kN/m): 2.3

Note: FTR --> Forza totale Resistente lungo la superficie di scivolamento

FTA --> Forza totale Agente lungo la superficie di scivolamento

IMPORTANTE! : Il Deficit o il Surplus di resistenza viene espresso in kN per metro di LARGHEZZA rispetto al fronte della scarpata

TABELLA PARAMETRI CONCI DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

phi'	X	dx	alpha	W	ru	U
(°)	(m)	(m)	(°)	(kN/m)	(-)	(kPa)
21.00	52.354	0.210	-8.68	0.27	0.00	0.00
21.00	52.563	0.210	-8.68	0.81	0.00	0.00
21.00	52.773	0.210	-8.68	1.34	0.00	0.00
21.00	52.983	0.210	-8.68	1.88	0.00	0.00
21.00	53.192	0.024	-8.68	0.25	0.00	0.00
21.00	53.217	0.210	-7.09	2.47	0.00	0.00
21.00	53.426	0.184	-7.09	2.59	0.00	0.00
21.00	53.610	0.210	-3.36	3.41	0.00	0.00
21.00	53.820	0.048	-3.36	0.85	0.00	0.00
21.00	53.868	0.207	1.51	3.89	0.00	0.00
21.00	54.075	0.210	7.44	4.30	0.00	0.00
21.00	54.285	0.003	7.44	0.07	0.00	0.00
21.00	54.288	0.082	11.98	1.76	0.00	0.00
21.00	54.370	0.105	11.98	2.30	0.00	0.00
21.00	54.475	0.205	16.46	4.67	0.00	0.00
21.00	54.680	0.210	19.98	4.92	0.00	0.00



21.00	54.889	0.012	19.98	0.29	0.00	0.00
	6.32					
21.00	54.902	0.210	22.48	5.04	0.00	0.00
	6.32					
21.00	55.111	0.061	22.48	1.47	0.00	0.00
	6.32					
21.00	55.172	0.210	22.61	5.16	0.00	0.00
	6.32					
21.00	55.382	0.043	22.61	1.07	0.00	0.00
	6.32					
21.00	55.425	0.210	22.75	5.26	0.00	0.00
	6.32					
21.00	55.634	0.030	22.75	0.76	0.00	0.00
	6.32					
21.00	55.664	0.210	22.89	5.36	0.00	0.00
	6.32					
21.00	55.874	0.024	22.89	0.62	0.00	0.00
	6.32					
21.00	55.898	0.012	23.04	0.30	0.00	0.00
	6.32					
21.00	55.910	0.210	23.04	5.46	0.00	0.00
	6.32					
21.00	56.120	0.006	23.04	0.16	0.00	0.00
	6.32					
21.00	56.126	0.210	23.18	5.54	0.00	0.00
	6.32					
21.00	56.336	0.019	23.18	0.49	0.00	0.00
	6.32					
21.00	56.354	0.210	23.32	5.62	0.00	0.00
	6.32					
21.00	56.564	0.019	23.32	0.50	0.00	0.00
	6.32					
21.00	56.582	0.210	23.46	5.71	0.00	0.00
	6.32					
21.00	56.792	0.020	23.46	0.54	0.00	0.00
	6.32					
21.00	56.812	0.210	23.60	5.79	0.00	0.00
	6.32					
21.00	57.021	0.020	23.60	0.57	0.00	0.00
	6.32					
21.00	57.042	0.210	23.75	5.86	0.00	0.00
	6.32					
21.00	57.252	0.020	23.75	0.55	0.00	0.00
	6.32					
21.00	57.271	0.210	23.89	5.94	0.00	0.00
	6.32					
21.00	57.481	0.019	23.89	0.53	0.00	0.00
	6.32					
21.00	57.499	0.210	24.04	6.01	0.00	0.00
	6.32					
21.00	57.709	0.018	24.04	0.53	0.00	0.00
	6.32					
21.00	57.728	0.210	24.18	6.08	0.00	0.00
	6.32					

21.00	57.937	0.018	24.18	0.52	0.00	0.00
	6.32					
21.00	57.955	0.210	24.33	6.15	0.00	0.00
	6.32					
21.00	58.165	0.020	24.33	0.59	0.00	0.00
	6.32					
21.00	58.185	0.210	24.48	6.21	0.00	0.00
	6.32					
21.00	58.395	0.022	24.48	0.65	0.00	0.00
	6.32					
21.00	58.416	0.024	24.62	0.70	0.00	0.00
	6.32					
21.00	58.440	0.200	24.62	6.03	0.00	0.00
	6.32					
21.00	58.640	0.012	24.62	0.38	0.00	0.00
	6.32					
21.00	58.652	0.210	24.76	6.47	0.00	0.00
	6.32					
21.00	58.862	0.032	24.76	1.00	0.00	0.00
	6.32					
21.00	58.894	0.210	25.94	6.63	0.00	0.00
	6.32					
21.00	59.104	0.016	25.94	0.52	0.00	0.00
	6.32					
21.00	59.120	0.210	27.20	6.76	0.00	0.00
	6.32					
21.00	59.330	0.012	27.20	0.39	0.00	0.00
	6.32					
21.00	59.342	0.210	28.51	6.85	0.00	0.00
	6.32					
21.00	59.552	0.007	28.51	0.22	0.00	0.00
	6.32					
21.00	59.558	0.210	29.78	6.93	0.00	0.00
	6.32					
21.00	59.768	0.014	29.78	0.48	0.00	0.00
	6.32					
21.00	59.782	0.168	31.02	5.57	0.00	0.00
	6.32					
21.00	59.950	0.050	31.02	1.66	0.00	0.00
	6.32					
21.00	60.000	0.210	32.23	7.00	0.00	0.00
	6.32					
21.00	60.209	0.013	32.23	0.44	0.00	0.00
	6.32					
21.00	60.223	0.210	33.35	7.00	0.00	0.00
	6.32					
21.00	60.432	0.019	33.35	0.64	0.00	0.00
	6.32					
21.00	60.452	0.210	34.34	6.98	0.00	0.00
	6.32					
21.00	60.661	0.035	34.34	1.17	0.00	0.00
	6.32					
21.00	60.696	0.210	34.80	6.94	0.00	0.00
	6.32					

21.00	60.906	0.025	34.80	0.83	0.00	0.00
	6.32					
21.00	60.931	0.210	35.29	6.89	0.00	0.00
	6.32					
21.00	61.141	0.020	35.29	0.64	0.00	0.00
	6.32					
21.00	61.160	0.210	35.78	6.84	0.00	0.00
	6.32					
21.00	61.370	0.016	35.78	0.53	0.00	0.00
	6.32					
21.00	61.387	0.210	36.28	6.77	0.00	0.00
	6.32					
21.00	61.596	0.017	36.28	0.54	0.00	0.00
	6.32					
21.00	61.613	0.210	36.76	6.69	0.00	0.00
	6.32					
21.00	61.823	0.015	36.76	0.47	0.00	0.00
	6.32					
21.00	61.838	0.210	37.23	6.59	0.00	0.00
	6.32					
21.00	62.047	0.016	37.23	0.50	0.00	0.00
	6.32					
21.00	62.063	0.142	37.69	4.39	0.00	0.00
	6.32					
21.00	62.205	0.086	37.69	2.65	0.00	0.00
	6.32					
21.00	62.291	0.210	38.13	6.38	0.00	0.00
	6.32					
21.00	62.501	0.022	38.13	0.67	0.00	0.00
	6.32					
21.00	62.523	0.210	38.13	6.26	0.00	0.00
	6.32					
21.00	62.733	0.022	38.13	0.65	0.00	0.00
	6.32					
21.00	62.755	0.210	38.13	6.13	0.00	0.00
	6.32					
21.00	62.965	0.020	38.13	0.59	0.00	0.00
	6.32					
21.00	62.985	0.210	38.14	6.01	0.00	0.00
	6.32					
21.00	63.195	0.020	38.14	0.58	0.00	0.00
	6.32					
21.00	63.215	0.210	38.14	5.89	0.00	0.00
	6.32					
21.00	63.425	0.018	38.14	0.51	0.00	0.00
	6.32					
21.00	63.443	0.210	38.14	5.77	0.00	0.00
	6.32					
21.00	63.653	0.020	38.14	0.54	0.00	0.00
	6.32					
21.00	63.673	0.210	38.14	5.65	0.00	0.00
	6.32					
21.00	63.882	0.019	38.14	0.51	0.00	0.00
	6.32					

21.00	63.901	0.210	38.15	5.53	0.00	0.00
	6.32					
21.00	64.111	0.019	38.15	0.50	0.00	0.00
	6.32					
21.00	64.130	0.120	38.15	3.10	0.00	0.00
	6.32					
21.00	64.250	0.107	38.15	2.75	0.00	0.00
	6.32					
21.00	64.357	0.210	38.15	5.29	0.00	0.00
	6.32					
21.00	64.567	0.019	38.15	0.48	0.00	0.00
	6.32					
21.00	64.586	0.210	38.16	5.17	0.00	0.00
	6.32					
21.00	64.796	0.019	38.16	0.46	0.00	0.00
	6.32					
21.00	64.815	0.210	38.16	5.05	0.00	0.00
	6.32					
21.00	65.025	0.020	38.16	0.47	0.00	0.00
	6.32					
21.00	65.045	0.210	38.16	4.93	0.00	0.00
	6.32					
21.00	65.254	0.018	38.16	0.43	0.00	0.00
	6.32					
21.00	65.273	0.210	38.16	4.81	0.00	0.00
	6.32					
21.00	65.482	0.022	38.16	0.49	0.00	0.00
	6.32					
21.00	65.504	0.210	38.17	4.69	0.00	0.00
	6.32					
21.00	65.714	0.023	38.17	0.50	0.00	0.00
	6.32					
21.00	65.737	0.210	38.17	4.56	0.00	0.00
	6.32					
21.00	65.946	0.024	38.17	0.51	0.00	0.00
	6.32					
21.00	65.970	0.004	38.17	0.08	0.00	0.00
	6.32					
21.00	65.974	0.210	38.17	4.41	0.00	0.00
	6.32					
21.00	66.183	0.032	38.17	0.66	0.00	0.00
	6.32					
21.00	66.215	0.210	39.52	4.22	0.00	0.00
	6.32					
21.00	66.425	0.015	39.52	0.29	0.00	0.00
	6.32					
21.00	66.440	0.210	40.95	4.00	0.00	0.00
	6.32					
21.00	66.650	0.011	40.95	0.20	0.00	0.00
	6.32					
21.00	66.660	0.210	42.40	3.75	0.00	0.00
	6.32					

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LEGENDA SIMBOLI

- X(m) : Ascissa sinistra concio
- dx(m) : Larghezza concio
- alpha(°) : Angolo pendenza base concio
- W(kN/m) : Forza peso concio
- ru(-) : Coefficiente locale pressione interstiziale
- U(kPa) : Pressione totale dei pori base concio
- phi'(°) : Angolo di attrito efficace base concio
- c'/Cu (kPa) : Coesione efficace o Resistenza al taglio in condizioni non drenate

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TABELLA DIAGRAMMA DELLE FORZE DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

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T(x)	X (m)	ht E' (m) (kN)	yt rho(x) (m) (--)	yt' FS_FEM (--) (--)	E(x) FS_p-qFEM (kN/m) (--)
	52.354	0.000	196.785	0.022	0.0000000000E+000
0.0000000000E+000		4.2914233417E+000		0.124	20.208 1.580
	52.563	0.036	196.789	0.022	1.1995289368E+000
1.3904663408E-001		7.1499220946E+000		0.124	20.208 1.580
	52.773	0.073	196.794	0.044	2.9984370268E+000
4.5398233742E-001		1.0638618018E+001		0.186	14.626 1.198
	52.983	0.118	196.807	0.077	5.6610077833E+000
1.1886729356E+000		1.2251834095E+001		0.295	4.180 1.162
	53.192	0.170	196.826	0.092	8.1364444779E+000
2.1223108515E+000		1.0609583667E+001		0.382	2.539 1.178
	53.217	0.176	196.829	0.118	8.3906653721E+000
2.2282333858E+000		1.0591387984E+001		0.389	2.445 1.181
	53.426	0.227	196.854	0.152	1.0829335121E+001
3.2828656042E+000		1.2716018253E+001		0.455	1.901 1.196
	53.610	0.284	196.888	0.194	1.3344133403E+001
4.4981928686E+000		1.2914783034E+001		0.521	1.604 1.217
	53.820	0.339	196.930	0.203	1.5871980460E+001
5.8132767180E+000		1.1391293754E+001		0.577	1.435 1.237
	53.868	0.352	196.941	0.242	1.6413075121E+001
6.1082755927E+000		1.1057207763E+001		0.588	1.410 1.241
	54.075	0.398	196.992	0.257	1.8541413141E+001
7.3537070706E+000		8.9376515385E+000		0.633	1.364 1.249
	54.285	0.426	197.048	0.267	2.0131349313E+001
8.3981292696E+000		6.9709832413E+000		0.669	1.379 1.247
	54.288	0.427	197.049	0.309	2.0153386168E+001
8.4137779287E+000		6.9348982324E+000		0.670	1.379 1.247
	54.370	0.435	197.074	0.303	2.0665167485E+001
8.7879787146E+000		5.7714534377E+000		0.683	1.399 1.244
	54.475	0.444	197.106	0.362	2.1206077827E+001
9.2063553543E+000		5.1234626986E+000		0.697	1.431 1.239
	54.680	0.464	197.186	0.415	2.2236665606E+001

1.0090006857E+001	4.4736772668E+000	0.732	1.497	1.225
54.889	0.479 197.278	0.434	2.3057522046E+001	
1.0877677954E+001	3.1228340292E+000	0.765	1.544	1.209
54.902	0.480 197.283	0.507	2.3095067100E+001	
1.0916121393E+001	3.0801753857E+000	0.766	1.546	1.208
55.111	0.500 197.390	0.519	2.3753278898E+001	
1.1605932038E+001	3.0300144327E+000	0.796	1.556	1.191
55.172	0.508 197.423	0.508	2.3934943130E+001	
1.1796462898E+001	2.8228043653E+000	0.804	1.555	1.186
55.382	0.525 197.527	0.479	2.4399332355E+001	
1.2277754155E+001	1.6035292105E+000	0.822	1.520	1.174
55.425	0.524 197.544	0.438	2.4462949704E+001	
1.2340781725E+001	1.5035968480E+000	0.824	1.513	1.172
55.634	0.530 197.638	0.443	2.4804301713E+001	
1.2664573929E+001	1.4406929190E+000	0.833	1.475	1.164
55.664	0.529 197.650	0.435	2.4846716016E+001	
1.2703380779E+001	1.4226915485E+000	0.833	1.471	1.163
55.874	0.533 197.742	0.434	2.5157909444E+001	
1.2987243420E+001	1.2728580308E+000	0.840	1.440	1.158
55.898	0.532 197.751	0.405	2.5188149387E+001	
1.3014529159E+001	1.3543330802E+000	0.841	1.437	1.157
55.910	0.532 197.757	0.426	2.5204686323E+001	
1.3029970385E+001	1.4012122966E+000	0.841	1.435	1.157
56.120	0.532 197.846	0.424	2.5481520125E+001	
1.3292228945E+001	1.1811786624E+000	0.847	1.410	1.154
56.126	0.532 197.848	0.454	2.5488876133E+001	
1.3299573103E+001	1.1807254720E+000	0.847	1.409	1.154
56.336	0.538 197.944	0.453	2.5762426642E+001	
1.3582283154E+001	1.1590411399E+000	0.855	1.383	1.153
56.354	0.538 197.952	0.481	2.5783660081E+001	
1.3605776171E+001	1.1558916764E+000	0.855	1.381	1.153
56.564	0.549 198.054	0.485	2.6049075443E+001	
1.3907412868E+001	1.2052687467E+000	0.864	1.352	1.153
56.582	0.550 198.063	0.516	2.6071355284E+001	
1.3933607316E+001	1.2021802765E+000	0.865	1.350	1.153
56.792	0.568 198.171	0.520	2.6328809853E+001	
1.4244812301E+001	1.1980225669E+000	0.874	1.317	1.155
56.812	0.570 198.182	0.490	2.6352378555E+001	
1.4273708916E+001	1.1795089575E+000	0.875	1.314	1.155
57.021	0.580 198.284	0.489	2.6564672010E+001	
1.4541444102E+001	1.0175280156E+000	0.882	1.283	1.157
57.042	0.582 198.294	0.489	2.6585418439E+001	
1.4567935210E+001	1.0065987731E+000	0.883	1.281	1.157
57.252	0.592 198.396	0.486	2.6771840912E+001	
1.4811030280E+001	8.1818428994E-001	0.889	1.250	1.160
57.271	0.592 198.406	0.487	2.6787799281E+001	
1.4832600037E+001	8.0771240905E-001	0.890	1.248	1.160
57.481	0.602 198.508	0.487	2.6948612190E+001	
1.5058611704E+001	6.9450465117E-001	0.896	1.219	1.161
57.499	0.602 198.517	0.526	2.6961355133E+001	
1.5078015946E+001	6.8727874148E-001	0.896	1.217	1.161
57.709	0.620 198.628	0.525	2.7103497263E+001	
1.5322762733E+001	5.6726918157E-001	0.903	1.188	1.162
57.728	0.620 198.637	0.509	2.7113788689E+001	

1.5341849607E+001	5.5486906068E-001	0.904	1.186	1.162
57.937	0.634 198.744	0.509	2.7223795066E+001	
1.5592371785E+001	4.4120030842E-001	0.912	1.159	1.161
57.955	0.634 198.753	0.490	2.7231603899E+001	
1.5612733074E+001	4.2916683318E-001	0.913	1.158	1.161
58.165	0.643 198.856	0.487	2.7309679171E+001	
1.5875346571E+001	3.0227046236E-001	0.922	1.134	1.160
58.185	0.642 198.864	0.477	2.7315611582E+001	
1.5898168651E+001	2.8730842359E-001	0.923	1.133	1.160
58.395	0.647 198.965	0.475	2.7357775080E+001	
1.6164952723E+001	1.3764792183E-001	0.934	1.113	1.160
58.416	0.647 198.974	0.439	2.7360625231E+001	
1.6189292165E+001	6.8301263962E-002	0.934	1.112	1.160
58.440	0.647 198.985	0.495	2.7360629906E+001	
1.6216680828E+001	-4.3601038807E-003	0.936	1.110	1.160
58.640	0.655 199.085	0.501	2.7352029937E+001	
1.6462910797E+001	-2.8080689962E-001	0.939	1.094	1.160
58.652	0.656 199.091	0.541	2.7348372551E+001	
1.6475989002E+001	-2.9987587513E-001	0.939	1.093	1.160
58.862	0.673 199.205	0.547	2.7270027458E+001	
1.6695148999E+001	-6.9216958667E-001	0.942	1.079	1.162
58.894	0.676 199.224	0.599	2.7246254191E+001	
1.6718447014E+001	-7.6605063251E-001	0.943	1.078	1.162
59.104	0.701 199.350	0.603	2.7051180661E+001	
1.6841378969E+001	-1.2763054241E+000	0.944	1.067	1.164
59.120	0.703 199.360	0.613	2.7029776030E+001	
1.6844018545E+001	-1.3154937347E+000	0.943	1.067	1.164
59.330	0.724 199.489	0.611	2.6721566282E+001	
1.6855713002E+001	-1.9112918910E+000	0.942	1.059	1.166
59.342	0.724 199.496	0.583	2.6698547864E+001	
1.6850688884E+001	-1.9390971066E+000	0.941	1.059	1.166
59.552	0.733 199.618	0.584	2.6281669618E+001	
1.6724228177E+001	-2.5916707834E+000	0.935	1.057	1.168
59.558	0.733 199.622	0.597	2.6264035313E+001	
1.6717257744E+001	-2.6076975233E+000	0.935	1.057	1.169
59.768	0.738 199.747	0.598	2.5739459313E+001	
1.6481023462E+001	-2.8192828463E+000	0.926	1.057	1.171
59.782	0.739 199.756	0.597	2.5698463512E+001	
1.6461119686E+001	-2.8561284699E+000	0.925	1.057	1.171
59.950	0.738 199.856	0.598	2.5190493569E+001	
1.6192129167E+001	-3.1189942690E+000	0.917	1.058	1.174
60.000	0.738 199.886	0.629	2.5033862027E+001	
1.6107401264E+001	-3.2392364126E+000	0.914	1.058	1.174
60.209	0.739 200.019	0.634	2.4271742349E+001	
1.5660537958E+001	-3.6342504158E+000	0.900	1.059	1.178
60.223	0.739 200.027	0.660	2.4223626898E+001	
1.5631935016E+001	-3.6629965155E+000	0.899	1.060	1.179
60.432	0.740 200.166	0.662	2.3360016961E+001	
1.5088148927E+001	-4.1303005791E+000	0.882	1.060	1.183
60.452	0.740 200.179	0.682	2.3280980037E+001	
1.5037869424E+001	-4.1624593181E+000	0.881	1.060	1.184
60.661	0.740 200.322	0.684	2.2336719245E+001	
1.4411170349E+001	-4.5736982581E+000	0.861	1.058	1.189
60.696	0.740 200.346	0.676	2.2175596061E+001	

1.4303011213E+001	-4.5932256778E+000	0.858	1.058	1.190
60.906	0.736 200.488	0.675	2.1202806351E+001	
1.3634725133E+001	-4.5328374468E+000	0.836	1.056	1.195
60.931	0.735 200.505	0.682	2.1089520166E+001	
1.3555989156E+001	-4.5491022136E+000	0.833	1.055	1.196
61.141	0.730 200.648	0.683	2.0084787035E+001	
1.2855061515E+001	-4.6139513846E+000	0.809	1.054	1.202
61.160	0.730 200.661	0.690	1.9994311443E+001	
1.2791730414E+001	-4.6306515385E+000	0.807	1.054	1.202
61.370	0.723 200.806	0.691	1.8948767330E+001	
1.2060738294E+001	-4.5419947981E+000	0.781	1.053	1.209
61.387	0.723 200.817	0.681	1.8874711154E+001	
1.2009215999E+001	-4.5234483906E+000	0.780	1.053	1.210
61.596	0.712 200.960	0.680	1.7882684344E+001	
1.1321338952E+001	-4.8007607234E+000	0.755	1.054	1.217
61.613	0.711 200.971	0.670	1.7801207294E+001	
1.1265064379E+001	-4.8040272292E+000	0.753	1.054	1.217
61.823	0.694 201.112	0.670	1.6800023379E+001	
1.0575760260E+001	-4.7695152116E+000	0.728	1.056	1.224
61.838	0.693 201.122	0.677	1.6729621865E+001	
1.0527363351E+001	-4.7712450652E+000	0.726	1.057	1.224
62.047	0.676 201.264	0.679	1.5722922999E+001	
9.8363207636E+000	-4.9362796586E+000	0.700	1.058	1.231
62.063	0.675 201.275	0.690	1.5643144657E+001	
9.7814879412E+000	-4.9322186044E+000	0.697	1.059	1.231
62.205	0.663 201.373	0.695	1.4963049577E+001	
9.3137480021E+000	-4.8666672737E+000	0.679	1.059	1.235
62.291	0.657 201.433	0.719	1.4540901216E+001	
9.0229294041E+000	-4.9127121056E+000	0.667	1.059	1.237
62.501	0.645 201.585	0.724	1.3506333844E+001	
8.3083100460E+000	-4.9002735524E+000	0.637	1.058	1.240
62.523	0.643 201.601	0.732	1.3396799237E+001	
8.2326010062E+000	-4.8905747267E+000	0.634	1.058	1.240
62.733	0.632 201.755	0.731	1.2383328789E+001	
7.5317882027E+000	-4.6642855349E+000	0.602	1.054	1.240
62.755	0.631 201.771	0.732	1.2280482262E+001	
7.4608814031E+000	-4.6487851840E+000	0.598	1.054	1.240
62.965	0.620 201.925	0.730	1.1301051252E+001	
6.7889624792E+000	-4.3204459598E+000	0.565	1.049	1.238
62.985	0.618 201.939	0.700	1.1213579666E+001	
6.7294706628E+000	-4.2855191806E+000	0.562	1.049	1.238
63.195	0.600 202.086	0.698	1.0316721822E+001	
6.1256693996E+000	-4.0138789264E+000	0.531	1.044	1.233
63.215	0.598 202.099	0.744	1.0234975003E+001	
6.0712239748E+000	-4.0231471816E+000	0.529	1.044	1.233
63.425	0.591 202.257	0.745	9.3162933893E+000	
5.4658746060E+000	-3.8992400544E+000	0.495	1.039	1.227
63.443	0.589 202.269	0.697	9.2452503264E+000	
5.4196493948E+000	-3.8629212845E+000	0.492	1.039	1.226
63.653	0.571 202.416	0.698	8.4208752411E+000	
4.8897590652E+000	-3.7783759009E+000	0.462	1.036	1.220
63.673	0.569 202.430	0.699	8.3464451612E+000	
4.8424901349E+000	-3.7627890383E+000	0.459	1.036	1.220
63.882	0.551 202.576	0.699	7.5599944506E+000	



4.3480663435E+000	-3.6239671359E+000	0.428	1.036	1.215
63.901	0.549 202.589	0.699	7.4914727120E+000	
4.3053384303E+000	-3.6082792945E+000	0.426	1.036	1.214
64.111	0.531 202.736	0.699	6.7446753978E+000	
3.8430771678E+000	-3.4522953965E+000	0.395	1.038	1.212
64.130	0.529 202.749	0.700	6.6783736217E+000	
3.8022904441E+000	-3.4324276480E+000	0.392	1.039	1.212
64.250	0.519 202.833	0.709	6.2750897900E+000	
3.5557125777E+000	-3.3996476517E+000	0.375	1.043	1.213
64.357	0.512 202.910	0.730	5.9070318182E+000	
3.3305576927E+000	-3.3945654595E+000	0.359	1.047	1.214
64.567	0.501 203.065	0.735	5.2077221814E+000	
2.9043277904E+000	-3.2276157825E+000	0.326	1.059	1.220
64.586	0.500 203.079	0.736	5.1457399228E+000	
2.8666625435E+000	-3.2108045342E+000	0.323	1.060	1.221
64.796	0.490 203.233	0.735	4.4883270433E+000	
2.4686920219E+000	-3.0051294652E+000	0.290	1.077	1.233
64.815	0.489 203.247	0.737	4.4315447432E+000	
2.4344987665E+000	-2.9890880876E+000	0.287	1.079	1.234
65.025	0.479 203.402	0.735	3.8146758954E+000	
2.0658193721E+000	-2.7704302036E+000	0.254	1.101	1.250
65.045	0.477 203.416	0.757	3.7602061021E+000	
2.0335241647E+000	-2.7577185461E+000	0.251	1.102	1.251
65.254	0.472 203.575	0.757	3.1742630658E+000	
1.6933268304E+000	-2.5397929404E+000	0.218	1.129	1.272
65.273	0.471 203.588	0.743	3.1278913487E+000	
1.6666479241E+000	-2.5216378125E+000	0.216	1.131	1.274
65.482	0.462 203.745	0.736	2.5890892412E+000	
1.3625884337E+000	-2.1925305041E+000	0.184	1.159	1.296
65.504	0.459 203.759	0.703	2.5422515009E+000	
1.3364962159E+000	-2.1643493801E+000	0.181	1.162	1.298
65.714	0.443 203.907	0.698	2.0663247698E+000	
1.0754642866E+000	-1.8962427265E+000	0.152	1.190	1.322
65.737	0.439 203.921	0.670	2.0238370889E+000	
1.0524672794E+000	-1.8697986144E+000	0.149	1.192	1.324
65.946	0.416 204.063	0.665	1.6042294846E+000	
8.2821210143E-001	-1.6510625339E+000	0.123	1.220	1.348
65.970	0.411 204.076	0.548	1.5660702803E+000	
8.0800038473E-001	-1.5537554826E+000	0.120	1.224	1.350
65.974	0.410 204.078	0.660	1.5603637779E+000	
8.0498395880E-001	-1.5503976442E+000	0.120	1.224	1.351
66.183	0.384 204.217	0.646	1.1679633319E+000	
5.9845835456E-001	-1.4696698046E+000	0.094	1.249	1.376
66.215	0.376 204.234	0.781	1.1231219381E+000	
5.7486132591E-001	-1.4942382841E+000	0.091	1.253	1.380
66.425	0.374 204.406	0.791	6.9163552190E-001	
3.4240766519E-001	-1.0312213964E+000	0.058	1.286	1.423
66.440	0.368 204.412	0.729	6.7727415018E-001	
3.3459641088E-001	-1.0077573351E+000	0.057	1.287	1.425
66.650	0.344 204.570	0.734	3.1951201633E-001	
1.5116632251E-001	-8.9398565672E-001	0.040	1.331	1.473
66.660	0.339 204.574	0.734	3.1037425182E-001	
1.4673242384E-001	-8.8299430511E-001	0.040	1.313	1.475

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 ht(m) : Altezza linea di thrust da nodo sinistro base concio  
 yt(m) : coordinata Y linea di trust  
 yt'(-) : gradiente pendenza locale linea di trust  
 E(x)(kN/m) : Forza Normale interconcio  
 T(x)(kN/m) : Forza Tangenziale interconcio  
 E' (kN) : derivata Forza normale interconcio  
 Rho(x) (-) : fattore mobilizzazione resistenza al taglio verticale interconcio  
 ZhU et al.(2003)  
 FS\_FEM(x) (-) : fattore di sicurezza locale stimato (locale in X) by qFEM  
 FS\_SRM(x) (-) : fattore di sicurezza locale stimato (locale in X) by SRM  
 Procedure

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TABELLA SFORZI DI TAGLIO DISTRIBUITI LUNGO SUPERFICIE INDIVIDUATA CON MINOR FS

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X (m)	dx (m)	dl (m)	alpha (°)	TauStress (kPa)	TauF (kN/m)
52.354	0.210	0.212	-8.678	-0.127	-0.027
7.173	1.521				
52.563	0.210	0.212	-8.678	-0.382	-0.081
8.608	1.826				
52.773	0.210	0.212	-8.678	-0.636	-0.135
10.689	2.267				
52.983	0.210	0.212	-8.678	-0.891	-0.189
12.185	2.585				
53.192	0.024	0.025	-8.678	-1.033	-0.025
12.676	0.311				
53.217	0.210	0.211	-7.089	-0.851	-0.180
13.446	2.841				
53.426	0.184	0.185	-7.089	-1.017	-0.189
15.153	2.809				
53.610	0.210	0.210	-3.364	-0.126	-0.027
15.403	3.235				
53.820	0.048	0.048	-3.364	-0.137	-0.007
15.859	0.765				
53.868	0.207	0.207	1.507	1.453	0.301
15.639	3.240				
54.075	0.210	0.211	7.440	3.658	0.773
15.106	3.194				
54.285	0.003	0.003	7.440	3.793	0.012
15.382	0.049				
54.288	0.082	0.084	11.976	5.411	0.454
14.682	1.231				
54.370	0.105	0.107	11.976	5.544	0.592

14.807	1.582					
54.475	0.205	0.214	16.457	7.246	1.551	
14.332	3.067					
54.680	0.210	0.223	19.977	8.598	1.918	
13.947	3.112					
54.889	0.012	0.013	19.977	8.718	0.113	
14.086	0.183					
54.902	0.210	0.227	22.480	9.542	2.165	
13.704	3.110					
55.111	0.061	0.066	22.480	9.652	0.633	
13.808	0.905					
55.172	0.210	0.227	22.607	9.797	2.225	
13.959	3.171					
55.382	0.043	0.047	22.607	9.898	0.461	
14.126	0.659					
55.425	0.210	0.227	22.747	10.038	2.282	
14.175	3.223					
55.634	0.030	0.033	22.747	10.132	0.330	
14.276	0.464					
55.664	0.210	0.228	22.891	10.266	2.337	
14.321	3.260					
55.874	0.024	0.026	22.891	10.355	0.272	
14.416	0.379					
55.898	0.012	0.013	23.042	10.414	0.133	
14.383	0.184					
55.910	0.210	0.228	23.042	10.496	2.392	
14.455	3.294					
56.120	0.006	0.007	23.042	10.576	0.072	
14.527	0.099					
56.126	0.210	0.228	23.183	10.697	2.440	
14.547	3.318					
56.336	0.019	0.020	23.183	10.780	0.217	
14.621	0.295					
56.354	0.210	0.228	23.323	10.904	2.490	
14.642	3.343					
56.564	0.019	0.020	23.323	10.984	0.222	
14.708	0.297					
56.582	0.210	0.229	23.463	11.106	2.539	
14.737	3.369					
56.792	0.020	0.021	23.463	11.185	0.240	
14.801	0.318					
56.812	0.210	0.229	23.600	11.305	2.587	
14.860	3.400					
57.021	0.020	0.022	23.600	11.382	0.253	
14.917	0.332					
57.042	0.210	0.229	23.745	11.502	2.635	
14.967	3.429					
57.252	0.020	0.021	23.745	11.577	0.249	
15.032	0.323					
57.271	0.210	0.229	23.891	11.695	2.682	
15.066	3.455					
57.481	0.019	0.020	23.891	11.767	0.238	
15.124	0.306					
57.499	0.210	0.230	24.037	11.883	2.728	

15.137	3.475					
57.709	0.018	0.020	24.037	11.953	0.242	
15.207	0.307					
57.728	0.210	0.230	24.183	12.067	2.774	
15.212	3.496					
57.937	0.018	0.020	24.183	12.134	0.239	
15.270	0.301					
57.955	0.210	0.230	24.332	12.247	2.818	
15.277	3.516					
58.165	0.020	0.022	24.332	12.312	0.271	
15.341	0.338					
58.185	0.210	0.230	24.478	12.422	2.862	
15.343	3.535					
58.395	0.022	0.024	24.478	12.486	0.298	
15.412	0.368					
58.416	0.024	0.026	24.622	12.544	0.326	
15.389	0.399					
58.440	0.200	0.220	24.622	12.692	2.792	
15.488	3.407					
58.640	0.012	0.014	24.622	12.842	0.175	
15.623	0.213					
58.652	0.210	0.231	24.760	13.042	3.012	
15.713	3.628					
58.862	0.032	0.035	24.760	13.211	0.467	
15.883	0.561					
58.894	0.210	0.233	25.937	13.745	3.205	
15.798	3.684					
59.104	0.016	0.018	25.937	13.886	0.254	
15.966	0.292					
59.120	0.210	0.236	27.204	14.402	3.395	
15.837	3.734					
59.330	0.012	0.013	27.204	14.518	0.194	
16.005	0.214					
59.342	0.210	0.239	28.513	15.000	3.579	
15.869	3.787					
59.552	0.007	0.008	28.513	15.091	0.116	
16.017	0.123					
59.558	0.210	0.242	29.776	15.508	3.746	
15.857	3.831					
59.768	0.014	0.017	29.776	15.577	0.259	
15.957	0.265					
59.782	0.168	0.196	31.017	15.932	3.116	
15.815	3.093					
59.950	0.050	0.058	31.017	15.974	0.928	
15.863	0.922					
60.000	0.210	0.248	32.232	16.283	4.036	
15.776	3.911					
60.209	0.013	0.016	32.232	16.297	0.255	
15.792	0.247					
60.223	0.210	0.251	33.348	16.525	4.148	
15.714	3.944					
60.432	0.019	0.023	33.348	16.513	0.378	
15.717	0.360					
60.452	0.210	0.254	34.336	16.667	4.232	

15.637	3.971					
60.661	0.035	0.043	34.336	16.626	0.707	
15.643	0.666					
60.696	0.210	0.255	34.799	16.656	4.253	
15.571	3.976					
60.906	0.025	0.031	34.799	16.603	0.507	
15.531	0.474					
60.931	0.210	0.257	35.287	16.621	4.270	
15.481	3.977					
61.141	0.020	0.024	35.287	16.556	0.399	
15.410	0.372					
61.160	0.210	0.258	35.782	16.556	4.279	
15.375	3.974					
61.370	0.016	0.020	35.782	16.479	0.334	
15.225	0.308					
61.387	0.210	0.260	36.277	16.461	4.281	
15.146	3.940					
61.596	0.017	0.021	36.277	16.369	0.344	
15.116	0.318					
61.613	0.210	0.262	36.755	16.329	4.274	
14.977	3.920					
61.823	0.015	0.018	36.755	16.225	0.299	
14.925	0.275					
61.838	0.210	0.263	37.229	16.167	4.257	
14.799	3.897					
62.047	0.016	0.020	37.229	16.047	0.325	
14.780	0.299					
62.063	0.142	0.179	37.688	16.008	2.863	
14.631	2.617					
62.205	0.086	0.109	37.688	15.874	1.727	
14.596	1.588					
62.291	0.210	0.267	38.127	15.734	4.194	
14.453	3.852					
62.501	0.022	0.028	38.127	15.584	0.443	
14.378	0.409					
62.523	0.210	0.267	38.130	15.434	4.114	
14.297	3.811					
62.733	0.022	0.028	38.130	15.284	0.430	
14.182	0.399					
62.755	0.210	0.267	38.133	15.134	4.034	
14.115	3.763					
62.965	0.020	0.026	38.133	14.985	0.389	
13.948	0.362					
62.985	0.210	0.267	38.136	14.836	3.955	
13.869	3.697					
63.195	0.020	0.026	38.136	14.687	0.383	
13.725	0.358					
63.215	0.210	0.267	38.139	14.538	3.876	
13.740	3.663					
63.425	0.018	0.023	38.139	14.390	0.337	
13.542	0.317					
63.443	0.210	0.267	38.142	14.242	3.797	
13.483	3.595					
63.653	0.020	0.025	38.142	14.093	0.354	

13.369	0.336					
63.673	0.210	0.267	38.145	13.944	3.718	
13.292	3.544					
63.882	0.019	0.024	38.145	13.795	0.333	
13.189	0.318					
63.901	0.210	0.267	38.148	13.647	3.639	
13.106	3.495					
64.111	0.019	0.024	38.148	13.498	0.331	
13.010	0.319					
64.130	0.120	0.152	38.151	13.408	2.040	
12.950	1.970					
64.250	0.107	0.137	38.151	13.261	1.812	
12.897	1.762					
64.357	0.210	0.267	38.154	13.054	3.481	
12.784	3.409					
64.567	0.019	0.024	38.154	12.905	0.316	
12.691	0.311					
64.586	0.210	0.267	38.156	12.757	3.402	
12.605	3.361					
64.796	0.019	0.024	38.156	12.608	0.304	
12.506	0.302					
64.815	0.210	0.267	38.159	12.459	3.322	
12.424	3.313					
65.025	0.020	0.025	38.159	12.309	0.310	
12.314	0.310					
65.045	0.210	0.267	38.162	12.160	3.243	
12.244	3.265					
65.254	0.018	0.023	38.162	12.011	0.281	
12.118	0.284					
65.273	0.210	0.267	38.165	11.863	3.164	
12.052	3.214					
65.482	0.022	0.028	38.165	11.712	0.324	
11.898	0.329					
65.504	0.210	0.267	38.168	11.561	3.083	
11.847	3.160					
65.714	0.023	0.029	38.168	11.409	0.332	
11.696	0.341					
65.737	0.210	0.267	38.170	11.257	3.003	
11.651	3.108					
65.946	0.024	0.030	38.170	11.105	0.334	
11.508	0.347					
65.970	0.004	0.005	38.170	11.086	0.052	
11.487	0.054					
65.974	0.210	0.267	38.173	10.890	2.904	
11.459	3.056					
66.183	0.032	0.040	38.173	10.667	0.432	
11.275	0.457					
66.215	0.210	0.272	39.520	10.483	2.850	
11.127	3.025					
66.425	0.015	0.019	39.520	10.234	0.199	
10.807	0.210					
66.440	0.210	0.278	40.950	9.997	2.775	
10.645	2.955					
66.650	0.011	0.014	40.950	9.707	0.138	



1300.00	1460.58	31.47	372.79
1400.00	1536.19	30.83	393.39
1500.00	1614.69	30.20	418.74
2000.00	1960.39	27.76	515.66

Strato 2 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso

stimati secondo criterio di rottura non lineare Hoek et

al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

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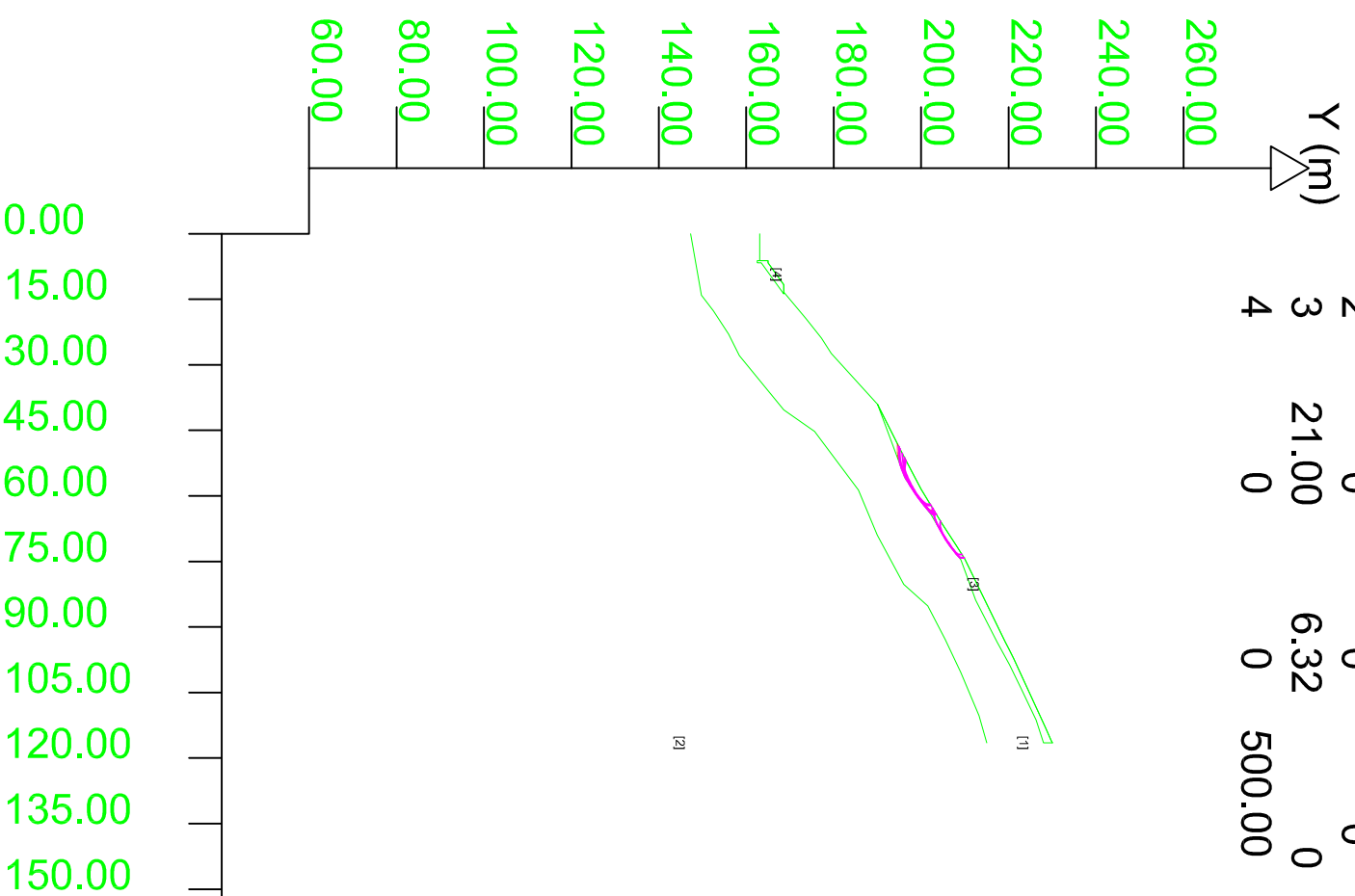
SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	696.24	60.38	513.03
50.00	756.64	59.62	520.01
75.00	806.42	59.04	520.13
100.00	857.50	58.47	523.03
125.00	909.85	57.91	528.58
150.00	949.97	57.49	524.59
175.00	1004.57	56.95	534.68
200.00	1046.36	56.55	534.32
225.00	1103.20	56.03	548.62
250.00	1146.67	55.64	551.63
275.00	1190.86	55.26	556.09
300.00	1235.77	54.89	561.97
325.00	1281.40	54.52	569.22
350.00	1327.76	54.15	577.81
375.00	1359.06	53.91	572.83
400.00	1406.61	53.55	583.74
425.00	1454.89	53.20	595.90
450.00	1487.48	52.96	593.65
475.00	1536.97	52.61	607.98
500.00	1570.37	52.38	607.39
600.00	1724.68	51.37	628.85
700.00	1885.62	50.39	662.51
800.00	2034.30	49.55	689.13
900.00	2188.33	48.73	725.29
1000.00	2327.55	48.02	750.56
1100.00	2450.22	47.43	762.64
1200.00	2597.27	46.75	801.99
1300.00	2726.73	46.18	826.48
1400.00	2859.39	45.62	856.64
1500.00	2972.41	45.17	869.25
2000.00	3572.08	42.95	995.66



**Data :** 18/04/2019  
**Localita' :** Loc. Cepparello  
**Descrizione :** Sez.1 - Stato di progetto  
**[n] = N. strato o lente**

# Parametri Geotecnici degli strati #

N.	phi'	C'	Cu	Gamm	GammSat	sgci	GSI	mi	D
deg	kPa	kPa	kN/m3	kN/m3	MPa	..	..	..	..
1	0	0	0	24.00	24.50	50.00	50.00	17.00	1.00
2	0	0	0	24.00	24.50	100.00	65.00	17.00	1.00
3	21.00	6.32	0	17.50	18.50	0	0	0	0
4	0	0	500.00	25.00	25.00	0	0	0	0



### DATI 10 SUP. CON MINOR Fs

Fs minimo : 1.2342    1.2974  
 Range Fs : 1.2342  
 Differenza % Range Fs : 4.87  
 Coefficiente Sismico orizzontale - Kh: 0.0510

### GENERAZIONE SUPERFICI RANDOM

Campione Superfici - N.: 20000  
 Lunghezza media segmenti (m): 1.0  
 Range X inizio generazione : 2.3 - 107.2  
 Range X termine generazione : 14.0 - 114.2  
 Livello Y minimo considerato : 72.8

# Report elaborazioni #

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SSAP 4.9.9 - Slope Stability Analysis Program (1991,2018)

WWW.SSAP.EU

Build No. 10784

BY

Dr. Geol. LORENZO BORSELLI \*,\*\*

\*UASLP, San Luis Potosi, Mexico

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\*\* Gia' Ricercatore CNR-IRPI fino a Luglio 2011

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Ultima Revisione struttura tabelle del report: 29 dicembre 2018  
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File report: C:\SSAP2010\Verifiche\Risultati\Sez1\_Stato\_Progetto.txt

Data: 18/4/2019

Localita' :

Descrizione:

Modello pendio: Sez1-stato\_progetto\_V1\_ok.mod

----- PARAMETRI DEL MODELLO DEL PENDIO -----

\_\_\_ PARAMETRI GEOMETRICI - Coordinate X Y (in m) \_\_\_

SUP T.		SUP 2		SUP 3		SUP 4	
X	Y	X	Y	X	Y	X	Y
0.00	163.09	0.00	147.27	39.08	190.00	6.19	163.04
6.19	163.04	14.07	149.75	55.91	196.32	6.19	162.54
6.19	165.00	17.64	152.51	59.95	199.01	6.69	162.54
6.70	165.00	22.94	155.93	64.25	202.23	6.69	163.40
11.70	168.60	27.93	158.39	71.10	206.26	13.76	168.60
13.40	168.60	40.35	168.59	74.59	209.08	13.40	168.60
19.45	173.62	45.23	175.60	83.87	212.44	11.70	168.60
23.88	177.21	58.64	185.65	93.54	217.41	6.70	165.00
27.41	179.41	69.00	189.92	98.65	220.23	6.19	165.00
39.08	190.00	80.28	196.01	103.89	222.79	6.19	163.04
50.30	195.70	85.16	201.50	111.28	226.28	-	-
58.44	200.00	92.78	205.46	116.53	228.00	-	-
66.35	204.76	100.40	209.11	116.53	230.00	-	-
71.23	207.95	110.29	213.23	116.02	229.77	-	-
74.44	210.00	116.53	215.00	113.13	228.48	-	-
93.47	219.22	-	-	97.21	221.11	-	-
94.96	220.00	-	-	94.96	220.00	-	-
97.21	221.11	-	-	93.47	219.22	-	-
113.13	228.48	-	-	74.44	210.00	-	-
116.02	229.77	-	-	71.23	207.95	-	-
116.53	230.00	-	-	66.35	204.76	-	-
-	-	-	-	58.44	200.00	-	-
-	-	-	-	50.30	195.70	-	-
-	-	-	-	39.08	190.00	-	-

## ASSENZA DI FALDA ##

----- PARAMETRI GEOMECCANICI -----

STR_IDX	sgci	fi` GSI	mi	C` D	Cu	Gamm	Gamm_sat
STRATO 1	1	0.00		0.00	0.00	24.00	24.50
8.587	50.00	50.00	17.00	1.00			
STRATO 2	2	0.00		0.00	0.00	24.00	24.50
12.882	100.00	65.00	17.00	1.00			
STRATO 3	3	21.00		6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00			
STRATO 4	4	0.00		0.00	500.00	25.00	25.00
1000.000	0.00	0.00	0.00	0.00			

LEGENDA: fi` \_\_\_\_\_ Angolo di attrito interno efficace(in gradi)

C` \_\_\_\_\_ Coesione efficace (in Kpa)

Cu \_\_\_\_\_ Resistenza al taglio Non drenata (in Kpa)

Gamm \_\_\_\_\_ Peso di volume terreno fuori falda (in KN/m^3)

Gamm\_sat \_\_\_\_\_ Peso di volume terreno immerso (in KN/m^3)

STR\_IDX \_\_\_\_\_ Indice di resistenza (usato in solo in 'SNIFF SEARCH)

(adimensionale)

---- SOLO Per AMMASSI ROCCIOSI FRATTURATI - Parametri Criterio di Rottura di Hoek (2002)-

sigci \_\_\_\_\_ Resistenza Compressione Uniassiale Roccia Intatta (in MPa)

GSI \_\_\_\_\_ Geological Strenght Index ammasso(adimensionale)

mi \_\_\_\_\_ Indice litologico ammasso(adimensionale)

D \_\_\_\_\_ Fattore di disturbo ammasso(adimensionale)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 -

ATTIVATO (solo per ROCCE)

Uso CRITERIO DI ROTTURA Hoek et al.(2002,2006) - non-lineare - Generalizzato secondo Lei et al.(2016)

----- INFORMAZIONI GENERAZIONE SUPERFICI RANDOM -----

\*\*\* PARAMETRI PER LA GENERAZIONE DELLE SUPERFICI

METODO DI RICERCA: CONVEX RANDOM - Chen (1992)

FILTRAGGIO SUPERFICI : ATTIVATO

COORDINATE X1,X2,Y OSTACOLO : 0.00 0.00 0.00

LUNGHEZZA MEDIA SEGMENTI (m): 1.0 (+/-) 50%

INTERVALLO ASCISSE RANDOM STARTING POINT (Xmin .. Xmax): 2.33

107.21

LIVELLO MINIMO CONSIDERATO (Ymin): 72.81

INTERVALLO ASCISSE AMMESSO PER LA TERMINAZIONE (Xmin .. Xmax): 13.98

114.20

\*\*\* TOTALE SUPERFICI GENERATE : 20000

----- INFORMAZIONI PARAMETRI DI CALCOLO -----

METODO DI CALCOLO : BORSELLI (Borselli, 2016)

COEFFICIENTE SISMICO UTILIZZATO Kh : 0.0510

COEFFICIENTE SISMICO UTILIZZATO Kv (assunto Positivo): 0.0255

COEFFICIENTE c=Kv/Kh UTILIZZATO : 0.5000

FORZA ORIZZONTALE ADDIZIONALE IN TESTA (kN/m): 0.00

FORZA ORIZZONTALE ADDIZIONALE ALLA BASE (kN/m): 0.00

N.B. Le forze orizzontali addizionali in testa e alla base sono poste uguali a 0

durante le tutte le verifiche globali.

I valori >0 impostati dall'utente sono utilizzati solo in caso di verifica singola

----- RISULTATO FINALE ELABORAZIONI -----

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\* DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR Fs \*

Fattore di sicurezza (FS)	1.2342	- Min. -	X	Y	Lambda=
0.3814			48.07	194.57	
			49.24	194.55	
			49.80	194.55	
			50.17	194.57	
			50.49	194.60	
			50.80	194.65	
			51.08	194.71	
			51.38	194.80	
			51.70	194.89	
			52.06	195.02	
			52.40	195.14	
			52.73	195.26	
			53.05	195.38	
			53.37	195.50	
			53.69	195.62	
			54.01	195.75	
			54.34	195.88	
			54.68	196.01	
			55.00	196.15	
			55.32	196.28	
			55.62	196.43	
			55.94	196.58	
			56.25	196.74	
			56.56	196.91	
			56.88	197.09	
			57.23	197.29	
			57.56	197.49	
			57.88	197.69	
			58.19	197.89	
			58.51	198.09	
			58.82	198.31	
			59.14	198.53	
			59.47	198.76	
			59.81	199.01	
			60.13	199.25	
			60.45	199.49	
			60.76	199.74	
			61.08	200.00	
			61.38	200.27	

61.70	200.54
62.02	200.83
62.35	201.14
62.68	201.44
63.00	201.74
63.22	201.95
63.22	202.88

Fattore di sicurezza (FS)    1.2456   - N.2   --    X            Y            Lambda=  
 0.3666

49.24	195.16
50.82	195.05
51.54	195.03
52.01	195.04
52.38	195.09
52.77	195.18
53.10	195.28
53.48	195.44
53.88	195.63
54.37	195.89
54.83	196.14
55.27	196.37
55.70	196.60
56.12	196.82
56.54	197.05
56.96	197.27
57.39	197.50
57.83	197.74
58.24	197.97
58.64	198.20
59.04	198.45
59.44	198.71
59.84	198.98
60.25	199.27
60.68	199.58
61.14	199.93
61.56	200.26
61.97	200.60
62.37	200.94
62.78	201.31
63.22	201.73
63.64	202.15
63.64	203.13

Fattore di sicurezza (FS)    1.2780   - N.3   --    X            Y            Lambda=  
 0.3698

48.80	194.94
50.09	194.97
50.73	195.00
51.17	195.03
51.56	195.07
51.92	195.12

52.26	195.18
52.62	195.26
53.00	195.34
53.43	195.45
53.80	195.56
54.16	195.67
54.50	195.80
54.85	195.94
55.19	196.09
55.54	196.27
55.91	196.46
56.33	196.69
56.71	196.91
57.07	197.13
57.43	197.35
57.79	197.59
58.15	197.83
58.52	198.08
58.90	198.35
59.31	198.65
59.68	198.94
60.03	199.24
60.37	199.54
60.73	199.88
61.11	200.28
61.55	200.77
61.94	201.22
61.94	202.11

Fattore di sicurezza (FS)    1.2835   - N.4   --    X            Y            Lambda=  
0.3709

48.62	194.85
49.95	194.97
50.60	195.03
51.05	195.09
51.44	195.16
51.81	195.24
52.15	195.32
52.52	195.42
52.90	195.54
53.31	195.67
53.70	195.81
54.07	195.94
54.44	196.09
54.81	196.23
55.17	196.39
55.54	196.55
55.92	196.73
56.32	196.92
56.70	197.11
57.07	197.31
57.44	197.50
57.81	197.70

58.18	197.91
58.55	198.14
58.95	198.38
59.38	198.64
59.75	198.89
60.11	199.16
60.44	199.44
60.80	199.77
61.17	200.16
61.62	200.66
62.21	201.38
62.21	202.27

Fattore di sicurezza (FS)    1.2860   - N.5 --    X            Y            Lambda=  
0.3782

50.27	195.68
51.75	195.83
52.47	195.91
52.96	195.99
53.38	196.07
53.78	196.17
54.15	196.28
54.55	196.42
54.97	196.58
55.44	196.77
55.87	196.96
56.29	197.15
56.69	197.34
57.09	197.54
57.49	197.75
57.90	197.97
58.31	198.21
58.76	198.48
59.18	198.73
59.59	198.99
60.00	199.25
60.41	199.52
60.81	199.80
61.23	200.08
61.65	200.38
62.10	200.70
62.51	201.02
62.92	201.34
63.31	201.66
63.72	202.01
64.16	202.42
64.25	202.51
64.25	203.50

Fattore di sicurezza (FS)    1.2862   - N.6 --    X            Y            Lambda=  
0.3694

51.25	196.20
-------	--------

52.56	196.10
53.17	196.07
53.57	196.07
53.90	196.09
54.23	196.15
54.53	196.21
54.86	196.31
55.21	196.44
55.64	196.61
56.02	196.78
56.38	196.94
56.72	197.10
57.06	197.28
57.40	197.46
57.74	197.66
58.09	197.87
58.47	198.11
58.84	198.34
59.19	198.57
59.53	198.80
59.88	199.04
60.23	199.28
60.58	199.54
60.95	199.80
61.33	200.09
61.68	200.37
62.02	200.66
62.35	200.95
62.70	201.27
63.07	201.65
63.45	202.04
63.45	203.01

Fattore di sicurezza (FS)    1.2909    - N.7 --    X    Y    Lambda=  
0.4169

62.92	202.70
64.02	202.89
64.55	202.99
64.91	203.08
65.22	203.17
65.52	203.27
65.80	203.38
66.09	203.50
66.40	203.64
66.74	203.81
67.06	203.98
67.37	204.14
67.68	204.30
67.98	204.47
68.29	204.64
68.59	204.81
68.90	204.99
69.23	205.18



69.54	205.36
69.84	205.55
70.13	205.74
70.44	205.95
70.73	206.16
71.04	206.37
71.35	206.61
71.69	206.86
72.00	207.11
72.30	207.36
72.59	207.62
72.89	207.90
73.22	208.22
73.39	208.40
73.39	209.33

Fattore di sicurezza (FS)    1.2961   - N.8   --    X            Y            Lambda=  
0.3687

51.84	196.51
53.23	196.28
53.85	196.20
54.25	196.18
54.57	196.19
54.90	196.25
55.19	196.32
55.51	196.44
55.87	196.60
56.32	196.83
56.72	197.04
57.10	197.24
57.46	197.44
57.81	197.65
58.16	197.86
58.52	198.08
58.89	198.32
59.27	198.57
59.64	198.82
60.00	199.07
60.36	199.33
60.71	199.59
61.07	199.86
61.43	200.13
61.80	200.43
62.18	200.74
62.55	201.04
62.90	201.35
63.25	201.66
63.61	201.99
64.00	202.36
64.00	203.34

Fattore di sicurezza (FS)    1.2967   - N.9   --    X            Y            Lambda=

0.4093

65.76	204.41
66.26	204.35
66.49	204.33
66.65	204.33
66.78	204.33
66.91	204.34
67.02	204.35
67.15	204.38
67.29	204.41
67.44	204.46
67.59	204.50
67.72	204.54
67.85	204.59
67.99	204.64
68.12	204.69
68.25	204.74
68.38	204.80
68.53	204.86
68.66	204.93
68.80	204.99
68.93	205.05
69.07	205.12
69.20	205.18
69.33	205.25
69.47	205.33
69.61	205.40
69.75	205.48
69.88	205.56
70.01	205.63
70.14	205.72
70.27	205.80
70.41	205.89
70.54	205.98
70.68	206.07
70.82	206.17
70.95	206.27
71.09	206.36
71.22	206.46
71.36	206.56
71.49	206.66
71.62	206.76
71.76	206.87
71.90	206.97
72.03	207.08
72.17	207.18
72.30	207.29
72.43	207.39
72.57	207.50
72.70	207.61
72.84	207.72
72.98	207.83
73.11	207.94
73.24	208.05

73.38 208.16  
 73.51 208.28  
 73.65 208.39  
 73.79 208.51  
 73.94 208.64  
 74.07 208.76  
 74.20 208.89  
 74.20 209.85

Fattore di sicurezza (FS) 1.2974 - N.10 -- X Y Lambda=  
 0.4147

62.63 202.52  
 63.81 202.76  
 64.39 202.89  
 64.78 202.99  
 65.12 203.10  
 65.44 203.21  
 65.74 203.34  
 66.06 203.48  
 66.39 203.64  
 66.76 203.84  
 67.11 204.02  
 67.45 204.21  
 67.77 204.39  
 68.10 204.59  
 68.42 204.78  
 68.75 204.98  
 69.08 205.19  
 69.42 205.42  
 69.76 205.64  
 70.09 205.86  
 70.42 206.07  
 70.76 206.29  
 71.09 206.51  
 71.43 206.73  
 71.78 206.96  
 72.13 207.19  
 72.46 207.42  
 72.78 207.66  
 73.08 207.90  
 73.41 208.18  
 73.75 208.50  
 74.11 208.85  
 74.11 209.79

----- ANALISI DEFICIT DI RESISTENZA -----

# DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR  $F_s$  \*  
 # Analisi Deficit in riferimento a  $F_s(\text{progetto}) = 1.200$

Sup N.	FS	FTR(kN/m)	FTA(kN/m)	Bilancio(kN/m)	ESITO
1	1.234	259.0	209.9	7.2	Surplus
2	1.246	252.2	202.5	9.2	Surplus

3	1.278	231.3	181.0	14.1	Surplus
4	1.283	225.7	175.9	14.7	Surplus
5	1.286	219.8	170.9	14.7	Surplus
6	1.286	211.1	164.1	14.1	Surplus
7	1.291	147.8	114.5	10.4	Surplus
8	1.296	218.3	168.5	16.2	Surplus
9	1.297	124.7	96.2	9.3	Surplus
10	1.297	159.1	122.6	11.9	Surplus

Esito analisi: SURPLUS di RESISTENZA!

Valore minimo di SURPLUS di RESISTENZA (kN/m): 7.2

Note: FTR --> Forza totale Resistente lungo la superficie di scivolamento  
FTA --> Forza totale Agente lungo la superficie di scivolamento

IMPORTANTE! : Il Deficit o il Surplus di resistenza viene espresso in kN per metro di LARGHEZZA rispetto al fronte della scarpata

TABELLA PARAMETRI CONCI DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

phi'	X	dx	alpha	W	ru	U
(°)	(m)	(m)	(°)	(kN/m)	(-)	(kPa)
21.00	48.075	0.222	-0.99	0.23	0.00	0.00
	6.32					
21.00	48.296	0.222	-0.99	0.69	0.00	0.00
	6.32					
21.00	48.518	0.222	-0.99	1.16	0.00	0.00
	6.32					
21.00	48.739	0.222	-0.99	1.62	0.00	0.00
	6.32					
21.00	48.961	0.222	-0.99	2.08	0.00	0.00
	6.32					
21.00	49.183	0.058	-0.99	0.62	0.00	0.00
	6.32					
21.00	49.241	0.222	0.22	2.66	0.00	0.00
	6.32					
21.00	49.462	0.222	0.22	3.10	0.00	0.00
	6.32					
21.00	49.684	0.112	0.22	1.73	0.00	0.00
	6.32					
21.00	49.796	0.222	2.77	3.75	0.00	0.00
	6.32					
21.00	50.017	0.155	2.77	2.86	0.00	0.00
	6.32					
21.00	50.172	0.128	5.80	2.51	0.00	0.00
	6.32					

21.00	50.300	0.188	5.80	3.91	0.00	0.00
	6.32					
21.00	50.488	0.222	9.48	4.92	0.00	0.00
	6.32					
21.00	50.710	0.086	9.48	2.00	0.00	0.00
	6.32					
21.00	50.796	0.222	12.27	5.34	0.00	0.00
	6.32					
21.00	51.018	0.062	12.27	1.55	0.00	0.00
	6.32					
21.00	51.080	0.222	15.05	5.67	0.00	0.00
	6.32					
21.00	51.301	0.079	15.05	2.08	0.00	0.00
	6.32					
21.00	51.380	0.222	17.44	5.96	0.00	0.00
	6.32					
21.00	51.602	0.094	17.44	2.58	0.00	0.00
	6.32					
21.00	51.696	0.222	19.35	6.21	0.00	0.00
	6.32					
21.00	51.917	0.140	19.35	4.00	0.00	0.00
	6.32					
21.00	52.057	0.222	19.62	6.46	0.00	0.00
	6.32					
21.00	52.279	0.121	19.62	3.58	0.00	0.00
	6.32					
21.00	52.400	0.222	19.91	6.70	0.00	0.00
	6.32					
21.00	52.621	0.108	19.91	3.31	0.00	0.00
	6.32					
21.00	52.729	0.222	20.21	6.91	0.00	0.00
	6.32					
21.00	52.951	0.102	20.21	3.22	0.00	0.00
	6.32					
21.00	53.052	0.222	20.52	7.11	0.00	0.00
	6.32					
21.00	53.274	0.097	20.52	3.17	0.00	0.00
	6.32					
21.00	53.371	0.222	20.82	7.31	0.00	0.00
	6.32					
21.00	53.593	0.099	20.82	3.29	0.00	0.00
	6.32					
21.00	53.691	0.222	21.11	7.49	0.00	0.00
	6.32					
21.00	53.913	0.102	21.11	3.48	0.00	0.00
	6.32					
21.00	54.015	0.222	21.40	7.67	0.00	0.00
	6.32					
21.00	54.236	0.108	21.40	3.78	0.00	0.00
	6.32					
21.00	54.344	0.026	21.67	0.91	0.00	0.00
	6.32					
21.00	54.370	0.222	21.67	7.86	0.00	0.00
	6.32					

21.00	54.592	0.092	21.67	3.31	0.00	0.00
	6.32					
21.00	54.684	0.222	22.72	8.02	0.00	0.00
	6.32					
21.00	54.905	0.098	22.72	3.57	0.00	0.00
	6.32					
21.00	55.003	0.222	23.84	8.15	0.00	0.00
	6.32					
21.00	55.225	0.091	23.84	3.38	0.00	0.00
	6.32					
21.00	55.316	0.222	25.00	8.24	0.00	0.00
	6.32					
21.00	55.538	0.085	25.00	3.16	0.00	0.00
	6.32					
21.00	55.622	0.222	26.13	8.31	0.00	0.00
	6.32					
21.00	55.844	0.066	26.13	2.49	0.00	0.00
	6.32					
21.00	55.910	0.028	26.13	1.04	0.00	0.00
	6.32					
21.00	55.938	0.222	27.25	8.34	0.00	0.00
	6.32					
21.00	56.159	0.086	27.25	3.24	0.00	0.00
	6.32					
21.00	56.245	0.222	28.34	8.35	0.00	0.00
	6.32					
21.00	56.467	0.093	28.34	3.52	0.00	0.00
	6.32					
21.00	56.560	0.222	29.36	8.32	0.00	0.00
	6.32					
21.00	56.782	0.102	29.36	3.83	0.00	0.00
	6.32					
21.00	56.884	0.222	30.27	8.27	0.00	0.00
	6.32					
21.00	57.105	0.124	30.27	4.62	0.00	0.00
	6.32					
21.00	57.230	0.222	30.97	8.19	0.00	0.00
	6.32					
21.00	57.451	0.106	30.97	3.89	0.00	0.00
	6.32					
21.00	57.557	0.222	31.71	8.09	0.00	0.00
	6.32					
21.00	57.779	0.098	31.71	3.54	0.00	0.00
	6.32					
21.00	57.877	0.222	32.46	7.96	0.00	0.00
	6.32					
21.00	58.098	0.092	32.46	3.28	0.00	0.00
	6.32					
21.00	58.190	0.222	33.21	7.82	0.00	0.00
	6.32					
21.00	58.412	0.028	33.21	1.00	0.00	0.00
	6.32					
21.00	58.440	0.067	33.21	2.35	0.00	0.00
	6.32					

21.00	58.507	0.133	33.95	4.63	0.00	0.00
	6.32					
21.00	58.640	0.180	33.95	6.25	0.00	0.00
	6.32					
21.00	58.820	0.222	34.67	7.61	0.00	0.00
	6.32					
21.00	59.042	0.097	34.67	3.31	0.00	0.00
	6.32					
21.00	59.139	0.222	35.35	7.49	0.00	0.00
	6.32					
21.00	59.361	0.105	35.35	3.50	0.00	0.00
	6.32					
21.00	59.465	0.222	35.97	7.34	0.00	0.00
	6.32					
21.00	59.687	0.121	35.97	3.96	0.00	0.00
	6.32					
21.00	59.808	0.142	36.82	4.61	0.00	0.00
	6.32					
21.00	59.950	0.182	36.82	5.81	0.00	0.00
	6.32					
21.00	60.132	0.222	37.73	6.96	0.00	0.00
	6.32					
21.00	60.353	0.095	37.73	2.94	0.00	0.00
	6.32					
21.00	60.448	0.222	38.65	6.73	0.00	0.00
	6.32					
21.00	60.670	0.089	38.65	2.65	0.00	0.00
	6.32					
21.00	60.759	0.222	39.54	6.48	0.00	0.00
	6.32					
21.00	60.980	0.095	39.54	2.71	0.00	0.00
	6.32					
21.00	61.075	0.222	40.40	6.19	0.00	0.00
	6.32					
21.00	61.297	0.088	40.40	2.40	0.00	0.00
	6.32					
21.00	61.385	0.222	41.25	5.87	0.00	0.00
	6.32					
21.00	61.606	0.092	41.25	2.38	0.00	0.00
	6.32					
21.00	61.699	0.222	42.05	5.51	0.00	0.00
	6.32					
21.00	61.920	0.097	42.05	2.33	0.00	0.00
	6.32					
21.00	62.017	0.222	42.78	5.12	0.00	0.00
	6.32					
21.00	62.239	0.110	42.78	2.44	0.00	0.00
	6.32					
21.00	62.349	0.046	42.80	1.00	0.00	0.00
	6.32					
21.00	62.395	0.222	42.80	4.64	0.00	0.00
	6.32					
21.00	62.617	0.061	42.80	1.23	0.00	0.00
	6.32					

21.00	62.678	0.222	42.83	4.27	0.00	0.00
	6.32					
21.00	62.899	0.103	42.83	1.89	0.00	0.00
	6.32					
21.00	63.002	0.222	42.86	3.85	0.00	0.00
	6.32					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 alpha(°) : Angolo pendenza base concio  
 W(kN/m) : Forza peso concio  
 ru(-) : Coefficiente locale pressione interstiziale  
 U(kPa) : Pressione totale dei pori base concio  
 phi'(°) : Angolo di attrito efficace base concio  
 c'/Cu (kPa) : Coesione efficace o Resistenza al taglio in condizioni non drenate

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TABELLA DIAGRAMMA DELLE FORZE DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

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T(x)	X (m)	ht E' (m) (kN)	yt rho(x) (m) (--)	yt' FS_FEM (--) (--)	E(x) FS_p-qFEM (kN/m) (--)
0.0000000000E+000	48.075	0.000	194.570	0.117	0.0000000000E+000
		1.1542206618E+001		0.210	4.185 1.268
2.6797500961E-001	48.296	0.029	194.595	0.117	2.1956857942E+000
		8.2758666280E+000		0.210	4.185 1.268
5.2204276126E-001	48.518	0.059	194.621	0.138	3.6676023070E+000
		7.8367091896E+000		0.224	2.400 0.957
1.0301149781E+000	48.739	0.098	194.656	0.156	5.6686674160E+000
		8.8338673931E+000		0.290	1.855 0.950
1.6205639912E+000	48.961	0.136	194.691	0.153	7.5824929025E+000
		8.3941382726E+000		0.342	1.636 0.982
2.2461515411E+000	49.183	0.174	194.724	0.155	9.3886839747E+000
		8.6799083349E+000		0.381	1.526 1.016
2.4330569967E+000	49.241	0.185	194.734	0.174	9.9010024101E+000
		8.8454874052E+000		0.391	1.503 1.025
3.2123574514E+000	49.462	0.223	194.773	0.182	1.1883822006E+001
		8.9889164091E+000		0.434	1.450 1.072
4.0708483038E+000	49.684	0.263	194.815	0.192	1.3884605825E+001
		9.0051488849E+000		0.473	1.431 1.124
4.5324735692E+000	49.796	0.285	194.837	0.221	1.4890224392E+001
		9.1870131487E+000		0.493	1.432 1.150
5.5737642606E+000	50.017	0.326	194.888	0.253	1.7011159338E+001
		1.0003575416E+001		0.537	1.441 1.200
	50.172	0.362	194.932	0.269	1.8603464955E+001



6.4071175885E+000	9.2345853829E+000	0.570	1.456	1.234
50.300	0.382 194.964	0.283	1.9673277927E+001	
6.9937752302E+000	8.4814721186E+000	0.591	1.468	1.253
50.488	0.420 195.022	0.309	2.1306363913E+001	
7.9386654613E+000	8.2447029097E+000	0.622	1.490	1.277
50.710	0.452 195.091	0.321	2.3019937461E+001	
8.9787981285E+000	7.3972430165E+000	0.655	1.509	1.296
50.796	0.467 195.121	0.331	2.3647116837E+001	
9.3782362302E+000	6.9157822823E+000	0.667	1.517	1.300
51.018	0.491 195.193	0.326	2.4980124804E+001	
1.0262563789E+001	5.3514892756E+000	0.692	1.533	1.307
51.080	0.498 195.213	0.347	2.5301461498E+001	
1.0487245708E+001	5.1161582593E+000	0.698	1.537	1.307
51.301	0.517 195.291	0.349	2.6396601592E+001	
1.1288680435E+001	4.1427868781E+000	0.721	1.543	1.308
51.380	0.522 195.318	0.372	2.6701185908E+001	
1.1530975270E+001	3.8582206372E+000	0.727	1.543	1.307
51.602	0.538 195.403	0.397	2.7556298142E+001	
1.2248575508E+001	3.8408412619E+000	0.748	1.533	1.304
51.696	0.548 195.443	0.433	2.7916352358E+001	
1.2565718130E+001	3.6640815935E+000	0.758	1.525	1.302
51.917	0.567 195.539	0.448	2.8639903442E+001	
1.3253986774E+001	3.1988610258E+000	0.779	1.491	1.299
52.057	0.583 195.605	0.462	2.9081306322E+001	
1.3688895281E+001	2.9707460718E+000	0.793	1.464	1.296
52.279	0.606 195.707	0.463	2.9674206170E+001	
1.4294886193E+001	2.5782834957E+000	0.810	1.416	1.293
52.400	0.620 195.764	0.461	2.9978879853E+001	
1.4607532952E+001	2.4264735032E+000	0.818	1.391	1.292
52.621	0.640 195.864	0.452	3.0476361750E+001	
1.5117191624E+001	2.1107882532E+000	0.831	1.347	1.289
52.729	0.649 195.912	0.441	3.0696946530E+001	
1.5342270052E+001	1.9965288203E+000	0.836	1.329	1.288
52.951	0.665 196.009	0.444	3.1117089795E+001	
1.5771267631E+001	1.8502619486E+000	0.845	1.296	1.286
53.052	0.674 196.056	0.445	3.1302979112E+001	
1.5963919374E+001	1.7723096369E+000	0.849	1.282	1.285
53.274	0.688 196.153	0.442	3.1668185586E+001	
1.6349986570E+001	1.5692243420E+000	0.856	1.256	1.283
53.371	0.695 196.197	0.478	3.1817766269E+001	
1.6512853244E+001	1.5321690655E+000	0.859	1.246	1.281
53.593	0.720 196.306	0.490	3.2156097285E+001	
1.6894147419E+001	1.4337244583E+000	0.867	1.222	1.277
53.691	0.731 196.354	0.469	3.2293305959E+001	
1.7053209717E+001	1.3303033325E+000	0.870	1.213	1.275
53.913	0.747 196.456	0.461	3.2557193227E+001	
1.7370293730E+001	1.1027259508E+000	0.875	1.195	1.270
54.015	0.755 196.503	0.439	3.2665115849E+001	
1.7507804095E+001	9.9495406958E-001	0.877	1.188	1.268
54.236	0.763 196.598	0.432	3.2853037287E+001	
1.7767693885E+001	7.3945097428E-001	0.881	1.175	1.263
54.344	0.768 196.645	0.443	3.2927206142E+001	
1.7886214971E+001	6.1946531657E-001	0.882	1.169	1.260
54.370	0.770 196.657	0.427	3.2942782993E+001	

1.7914196338E+001	5.8554768097E-001	0.883	1.168	1.260
54.592	0.775 196.751	0.436	3.3038471860E+001	
1.8120100477E+001	2.6196648795E-001	0.885	1.158	1.254
54.684	0.782 196.794	0.464	3.3056119626E+001	
1.8198842459E+001	1.2677328319E-001	0.886	1.154	1.251
54.905	0.792 196.896	0.497	3.3049931150E+001	
1.8356911233E+001	-3.7728705704E-001	0.888	1.144	1.245
55.003	0.807 196.953	0.534	3.2998000449E+001	
1.8408032470E+001	-6.0579634416E-001	0.889	1.140	1.241
55.225	0.823 197.067	0.504	3.2826374347E+001	
1.8475933337E+001	-1.0660337767E+000	0.891	1.131	1.234
55.316	0.826 197.110	0.487	3.2718109932E+001	
1.8480643597E+001	-1.2223969599E+000	0.890	1.127	1.231
55.538	0.832 197.219	0.491	3.2427725656E+001	
1.8438240426E+001	-1.5981331579E+000	0.889	1.122	1.226
55.622	0.834 197.261	0.502	3.2283224007E+001	
1.8401933494E+001	-1.7170168929E+000	0.888	1.120	1.224
55.844	0.837 197.373	0.506	3.1897504014E+001	
1.8278677221E+001	-2.0126173842E+000	0.886	1.117	1.221
55.910	0.838 197.406	0.506	3.1758951255E+001	
1.8229351829E+001	-2.1689784105E+000	0.885	1.117	1.220
55.938	0.839 197.420	0.460	3.1698310245E+001	
1.8206150018E+001	-2.2104706362E+000	0.884	1.116	1.220
56.159	0.825 197.521	0.467	3.1190360310E+001	
1.8003817614E+001	-2.6096736670E+000	0.880	1.116	1.218
56.245	0.824 197.564	0.499	3.0955440181E+001	
1.7904304996E+001	-2.7985083205E+000	0.878	1.116	1.218
56.467	0.815 197.674	0.517	3.0297791743E+001	
1.7606085364E+001	-3.3444463879E+000	0.873	1.116	1.217
56.560	0.817 197.726	0.567	2.9970539180E+001	
1.7447791183E+001	-3.5806496230E+000	0.870	1.116	1.217
56.782	0.818 197.853	0.593	2.9136403150E+001	
1.7012313855E+001	-4.1989374451E+000	0.861	1.116	1.217
56.884	0.827 197.918	0.591	2.8687266717E+001	
1.6761765886E+001	-4.2900069207E+000	0.855	1.115	1.217
57.105	0.823 198.044	0.582	2.7789154547E+001	
1.6216819147E+001	-4.3383352900E+000	0.842	1.115	1.218
57.230	0.826 198.120	0.586	2.7230422961E+001	
1.5860949829E+001	-4.4377600933E+000	0.832	1.115	1.219
57.451	0.820 198.247	0.573	2.6270978409E+001	
1.5225843827E+001	-4.9713779952E+000	0.815	1.115	1.222
57.557	0.817 198.308	0.580	2.5711769864E+001	
1.4855903039E+001	-5.2017299564E+000	0.805	1.117	1.224
57.779	0.809 198.437	0.582	2.4594532017E+001	
1.4121828071E+001	-4.8207360506E+000	0.784	1.121	1.230
57.877	0.806 198.493	0.590	2.4132534881E+001	
1.3825678146E+001	-4.6127779773E+000	0.776	1.124	1.232
58.098	0.796 198.625	0.593	2.3165761641E+001	
1.3221571330E+001	-4.4056344435E+000	0.760	1.129	1.239
58.190	0.792 198.679	0.555	2.2759295669E+001	
1.2974327664E+001	-4.3507220023E+000	0.753	1.132	1.241
58.412	0.767 198.799	0.539	2.1834030940E+001	
1.2422575250E+001	-4.4057409359E+000	0.740	1.138	1.247
58.440	0.764 198.814	0.534	2.1707985902E+001	

1.2347309305E+001	-4.4120898256E+000	0.738	1.138	1.248
58.507	0.755 198.850	0.523	2.1415548344E+001	
1.2173370009E+001	-4.3234665252E+000	0.732	1.140	1.250
58.640	0.735 198.919	0.557	2.0849944522E+001	
1.1837054016E+001	-4.4826411289E+000	0.722	1.142	1.252
58.820	0.719 199.024	0.627	1.9985677573E+001	
1.1316329037E+001	-5.0511298836E+000	0.704	1.144	1.255
59.042	0.712 199.171	0.669	1.8795368276E+001	
1.0581441175E+001	-5.5106476575E+000	0.679	1.143	1.255
59.139	0.712 199.238	0.698	1.8254545496E+001	
1.0243982397E+001	-5.6035908818E+000	0.666	1.142	1.254
59.361	0.710 199.393	0.724	1.6996629335E+001	
9.4479599921E+000	-6.0160520576E+000	0.636	1.136	1.249
59.465	0.716 199.474	0.684	1.6350801388E+001	
9.0386751614E+000	-5.8576461768E+000	0.619	1.132	1.245
59.687	0.698 199.616	0.656	1.5202363687E+001	
8.3125028826E+000	-5.3334818134E+000	0.589	1.123	1.236
59.808	0.693 199.698	0.658	1.4546901920E+001	
7.9026700417E+000	-5.2780522327E+000	0.571	1.117	1.229
59.950	0.677 199.790	0.689	1.3819626186E+001	
7.4526723171E+000	-5.3999840266E+000	0.552	1.110	1.222
60.132	0.673 199.921	0.707	1.2773236112E+001	
6.8117458243E+000	-5.6143607274E+000	0.523	1.102	1.211
60.353	0.655 200.075	0.704	1.1569199162E+001	
6.0893164966E+000	-5.6164397756E+000	0.489	1.092	1.200
60.448	0.651 200.144	0.704	1.1028158520E+001	
5.7706700421E+000	-5.5773150346E+000	0.473	1.089	1.196
60.670	0.627 200.298	0.706	9.8530106942E+000	
5.0875111087E+000	-5.4839592307E+000	0.438	1.085	1.188
60.759	0.622 200.364	0.705	9.3589598940E+000	
4.8045917853E+000	-5.4210776611E+000	0.422	1.084	1.187
60.980	0.592 200.517	0.696	8.2324691710E+000	
4.1690756698E+000	-5.0457549699E+000	0.387	1.086	1.187
61.075	0.581 200.584	0.706	7.7554644579E+000	
3.9049372132E+000	-4.9836400822E+000	0.371	1.089	1.189
61.297	0.549 200.740	0.724	6.6748942014E+000	
3.3127309025E+000	-5.0491183366E+000	0.335	1.099	1.198
61.385	0.542 200.808	0.785	6.2242498850E+000	
3.0686253959E+000	-5.0752026084E+000	0.318	1.105	1.204
61.606	0.523 200.983	0.805	5.1233553527E+000	
2.4842700812E+000	-4.9943587164E+000	0.276	1.128	1.226
61.699	0.519 201.061	0.792	4.6605470692E+000	
2.2427900471E+000	-4.8108188270E+000	0.257	1.140	1.237
61.920	0.490 201.232	0.779	3.6977832144E+000	
1.7529359705E+000	-4.2418617637E+000	0.217	1.172	1.268
62.017	0.480 201.309	0.750	3.2907964782E+000	
1.5496554151E+000	-4.0083157502E+000	0.199	1.188	1.284
62.239	0.437 201.471	0.720	2.4980280636E+000	
1.1641060664E+000	-3.4809929976E+000	0.162	1.227	1.321
62.349	0.412 201.548	0.705	2.1202060537E+000	
9.8226786769E-001	-3.3664374085E+000	0.143	1.249	1.342
62.395	0.402 201.581	0.724	1.9666253652E+000	
9.0998197273E-001	-3.2856446383E+000	0.135	1.255	1.348
62.617	0.358 201.741	0.698	1.2951425877E+000	

6.0264188377E-001	-2.3332055001E+000	0.097	1.304	1.392
62.678	0.338	201.778	0.808	1.1645184675E+000
5.4329753566E-001	-2.2658095456E+000	0.090	1.323	1.410
62.899	0.324	201.969	0.797	5.6221458781E-001
2.6064715185E-001	-2.0416921359E+000	0.047	1.396	1.476
63.002	0.296	202.037	0.797	3.8445658120E-001
1.7868130729E-001	-1.7299309827E+000	0.041	1.426	1.504

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#### LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
ht(m) : Altezza linea di thrust da nodo sinistro base concio  
yt(m) : coordinata Y linea di trust  
yt'(-) : gradiente pendenza locale linea di trust  
E(x)(kN/m) : Forza Normale interconcio  
T(x)(kN/m) : Forza Tangenziale interconcio  
E' (kN) : derivata Forza normale interconcio  
Rho(x) (-) : fattore mobilizzazione resistenza al taglio verticale interconcio  
Zhu et al.(2003)  
FS\_FEM(x) (-) : fattore di sicurezza locale stimato (locale in X) by qFEM  
FS\_SRM(x) (-) : fattore di sicurezza locale stimato (locale in X) by SRM  
Procedure

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#### TABELLA SFORZI DI TAGLIO DISTRIBUITI LUNGO SUPERFICIE INDIVIDUATA CON MINOR FS

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X	dx	dI	alpha	TauStress	TauF
(m)	(m)	(m)	(°)	(kPa)	(kN/m)
48.075	0.222	0.222	-0.988	0.035	0.008
7.211	1.598				
48.296	0.222	0.222	-0.988	0.106	0.023
7.988	1.770				
48.518	0.222	0.222	-0.988	0.176	0.039
9.254	2.051				
48.739	0.222	0.222	-0.988	0.247	0.055
10.207	2.262				
48.961	0.222	0.222	-0.988	0.317	0.070
11.074	2.454				
49.183	0.058	0.058	-0.988	0.362	0.021
11.740	0.682				
49.241	0.222	0.222	0.217	0.657	0.146
12.257	2.716				
49.462	0.222	0.222	0.217	0.767	0.170
13.162	2.916				
49.684	0.112	0.112	0.217	0.850	0.095
13.837	1.547				
49.796	0.222	0.222	2.768	1.678	0.372

14.307	3.174					
50.017	0.155	0.155	2.768	1.832	0.283	
15.124	2.340					
50.172	0.128	0.129	5.799	2.957	0.381	
14.893	1.919					
50.300	0.188	0.189	5.799	3.137	0.593	
15.456	2.923					
50.488	0.222	0.225	9.478	4.710	1.058	
15.356	3.450					
50.710	0.086	0.088	9.478	4.921	0.431	
15.714	1.375					
50.796	0.222	0.227	12.270	6.180	1.401	
15.498	3.514					
51.018	0.062	0.064	12.270	6.383	0.406	
15.743	1.002					
51.080	0.222	0.229	15.049	7.633	1.751	
15.530	3.563					
51.301	0.079	0.082	15.049	7.841	0.641	
15.750	1.288					
51.380	0.222	0.232	17.439	8.938	2.076	
15.555	3.613					
51.602	0.094	0.098	17.439	9.140	0.900	
15.763	1.552					
51.696	0.222	0.235	19.348	10.037	2.357	
15.592	3.662					
51.917	0.140	0.148	19.348	10.242	1.518	
15.784	2.339					
52.057	0.222	0.235	19.619	10.547	2.481	
15.939	3.750					
52.279	0.121	0.128	19.619	10.737	1.375	
16.123	2.065					
52.400	0.222	0.236	19.911	11.038	2.601	
16.256	3.831					
52.621	0.108	0.115	19.911	11.217	1.287	
16.431	1.885					
52.729	0.222	0.236	20.211	11.511	2.718	
16.545	3.907					
52.951	0.102	0.108	20.211	11.683	1.265	
16.701	1.809					
53.052	0.222	0.237	20.519	11.975	2.833	
16.804	3.976					
53.274	0.097	0.104	20.519	12.139	1.263	
16.954	1.765					
53.371	0.222	0.237	20.817	12.422	2.945	
17.036	4.039					
53.593	0.099	0.105	20.817	12.583	1.327	
17.184	1.812					
53.691	0.222	0.238	21.110	12.861	3.055	
17.278	4.104					
53.913	0.102	0.109	21.110	13.018	1.418	
17.419	1.897					
54.015	0.222	0.238	21.397	13.293	3.163	
17.511	4.167					
54.236	0.108	0.116	21.397	13.448	1.560	

17.649	2.048					
	54.344	0.026	0.028	21.671	13.627	0.378
17.650	0.490					
	54.370	0.222	0.238	21.671	13.739	3.276
17.759	4.234					
	54.592	0.092	0.099	21.671	13.882	1.379
17.886	1.776					
	54.684	0.222	0.240	22.715	14.456	3.473
17.803	4.277					
	54.905	0.098	0.106	22.715	14.582	1.545
17.925	1.899					
	55.003	0.222	0.242	23.837	15.157	3.672
17.818	4.316					
	55.225	0.091	0.100	23.837	15.257	1.523
17.929	1.789					
	55.316	0.222	0.244	24.998	15.804	3.864
17.800	4.352					
	55.538	0.085	0.093	24.998	15.876	1.482
17.889	1.670					
	55.622	0.222	0.247	26.128	16.363	4.038
17.729	4.376					
	55.844	0.066	0.074	26.128	16.406	1.209
17.792	1.311					
	55.910	0.028	0.031	26.128	16.420	0.504
17.819	0.547					
	55.938	0.222	0.249	27.247	16.844	4.198
17.626	4.393					
	56.159	0.086	0.097	27.247	16.860	1.630
17.685	1.710					
	56.245	0.222	0.252	28.343	17.232	4.338
17.509	4.408					
	56.467	0.093	0.106	28.343	17.217	1.827
17.576	1.866					
	56.560	0.222	0.254	29.362	17.510	4.452
17.423	4.430					
	56.782	0.102	0.117	29.362	17.463	2.046
17.510	2.051					
	56.884	0.222	0.257	30.270	17.670	4.534
17.307	4.440					
	57.105	0.124	0.144	30.270	17.589	2.530
17.361	2.497					
	57.230	0.222	0.258	30.965	17.688	4.571
17.182	4.440					
	57.451	0.106	0.124	30.965	17.587	2.173
17.288	2.136					
	57.557	0.222	0.260	31.706	17.664	4.601
17.048	4.440					
	57.779	0.098	0.115	31.706	17.540	2.017
16.901	1.943					
	57.877	0.222	0.263	32.464	17.584	4.618
16.603	4.360					
	58.098	0.092	0.109	32.464	17.435	1.899
16.512	1.798					
	58.190	0.222	0.265	33.214	17.438	4.618

16.227	4.298					
58.412	0.028	0.034	33.214	17.297	0.588	
16.201	0.550					
58.440	0.067	0.080	33.214	17.266	1.385	
16.167	1.297					
58.507	0.133	0.160	33.950	17.360	2.781	
15.984	2.561					
58.640	0.180	0.218	33.950	17.260	3.754	
16.042	3.489					
58.820	0.222	0.269	34.668	17.250	4.648	
15.976	4.304					
59.042	0.097	0.118	34.668	17.121	2.021	
15.963	1.884					
59.139	0.222	0.272	35.349	17.092	4.643	
15.812	4.296					
59.361	0.105	0.128	35.349	16.933	2.171	
15.840	2.031					
59.465	0.222	0.274	35.973	16.855	4.615	
15.440	4.227					
59.687	0.121	0.150	35.973	16.661	2.492	
15.384	2.301					
59.808	0.142	0.178	36.825	16.616	2.951	
15.087	2.679					
59.950	0.182	0.227	36.825	16.398	3.720	
15.112	3.428					
60.132	0.222	0.280	37.727	16.207	4.540	
14.731	4.127					
60.353	0.095	0.120	37.727	15.955	1.917	
14.652	1.760					
60.448	0.222	0.284	38.645	15.767	4.473	
14.280	4.051					
60.670	0.089	0.114	38.645	15.482	1.762	
14.192	1.616					
60.759	0.222	0.287	39.541	15.240	4.379	
13.796	3.964					
60.980	0.095	0.123	39.541	14.908	1.834	
13.626	1.676					
61.075	0.222	0.291	40.404	14.603	4.249	
13.297	3.869					
61.297	0.088	0.116	40.404	14.240	1.647	
13.188	1.525					
61.385	0.222	0.295	41.251	13.888	4.093	
12.849	3.787					
61.606	0.092	0.123	41.251	13.481	1.658	
12.678	1.559					
61.699	0.222	0.298	42.046	13.071	3.900	
12.233	3.650					
61.920	0.097	0.131	42.046	12.620	1.648	
12.013	1.569					
62.017	0.222	0.302	42.776	12.157	3.670	
11.585	3.497					
62.239	0.110	0.150	42.776	11.651	1.747	
11.360	1.703					
62.349	0.046	0.063	42.803	11.412	0.716	

11.234	0.704					
62.395	0.222	0.302	42.803	11.003	3.323	
11.005	3.324					
62.617	0.061	0.083	42.803	10.570	0.879	
10.674	0.887					
62.678	0.222	0.302	42.830	10.137	3.063	
10.632	3.212					
62.899	0.103	0.140	42.830	9.639	1.352	
10.250	1.438					
63.002	0.222	0.302	42.856	9.140	2.763	
10.065	3.042					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 dl(m) : lunghezza base concio  
 alpha(°) : Angolo pendenza base concio  
 TauStress(kPa) : Sforzo di taglio su base concio  
 TauF (kN/m) : Forza di taglio su base concio  
 TauStrength(kPa) : Resistenza al taglio su base concio  
 TauS (kN/m) : Forza resistente al taglio su base concio

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Strato 1 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso stimati secondo criterio di rottura non lineare Hoek et al.(2002)  
 CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)  
 Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

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SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	137.42	58.47	69.19
50.00	186.72	55.52	76.58
75.00	229.23	53.43	82.28
100.00	269.97	51.71	89.32
125.00	307.76	50.29	95.71
150.00	344.72	49.03	103.03
175.00	380.39	47.92	110.48
200.00	414.33	46.95	117.39
225.00	446.12	46.09	123.16
250.00	479.13	45.26	131.05
275.00	509.50	44.53	137.06
300.00	540.87	43.82	144.79
325.00	569.14	43.21	149.99
350.00	598.21	42.61	156.59
375.00	628.07	42.02	164.54
400.00	654.32	41.52	169.27
425.00	685.72	40.95	179.76
450.00	708.67	40.55	181.95
475.00	736.79	40.07	189.88



500.00	760.71	39.67	193.83
600.00	866.21	38.06	223.16
700.00	957.87	36.80	242.59
800.00	1049.54	35.65	265.80
900.00	1140.54	34.60	291.52
1000.00	1223.57	33.71	311.63
1100.00	1303.83	32.91	331.24
1200.00	1387.74	32.12	356.93
1300.00	1460.58	31.47	372.79
1400.00	1536.19	30.83	393.39
1500.00	1614.69	30.20	418.74
2000.00	1960.39	27.76	515.66

Strato 2 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso

stimati secondo criterio di rottura non lineare Hoek et

al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

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SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	696.24	60.38	513.03
50.00	756.64	59.62	520.01
75.00	806.42	59.04	520.13
100.00	857.50	58.47	523.03
125.00	909.85	57.91	528.58
150.00	949.97	57.49	524.59
175.00	1004.57	56.95	534.68
200.00	1046.36	56.55	534.32
225.00	1103.20	56.03	548.62
250.00	1146.67	55.64	551.63
275.00	1190.86	55.26	556.09
300.00	1235.77	54.89	561.97
325.00	1281.40	54.52	569.22
350.00	1327.76	54.15	577.81
375.00	1359.06	53.91	572.83
400.00	1406.61	53.55	583.74
425.00	1454.89	53.20	595.90
450.00	1487.48	52.96	593.65
475.00	1536.97	52.61	607.98
500.00	1570.37	52.38	607.39
600.00	1724.68	51.37	628.85
700.00	1885.62	50.39	662.51
800.00	2034.30	49.55	689.13
900.00	2188.33	48.73	725.29
1000.00	2327.55	48.02	750.56
1100.00	2450.22	47.43	762.64
1200.00	2597.27	46.75	801.99
1300.00	2726.73	46.18	826.48
1400.00	2859.39	45.62	856.64
1500.00	2972.41	45.17	869.25
2000.00	3572.08	42.95	995.66

Data : 18/04/2019

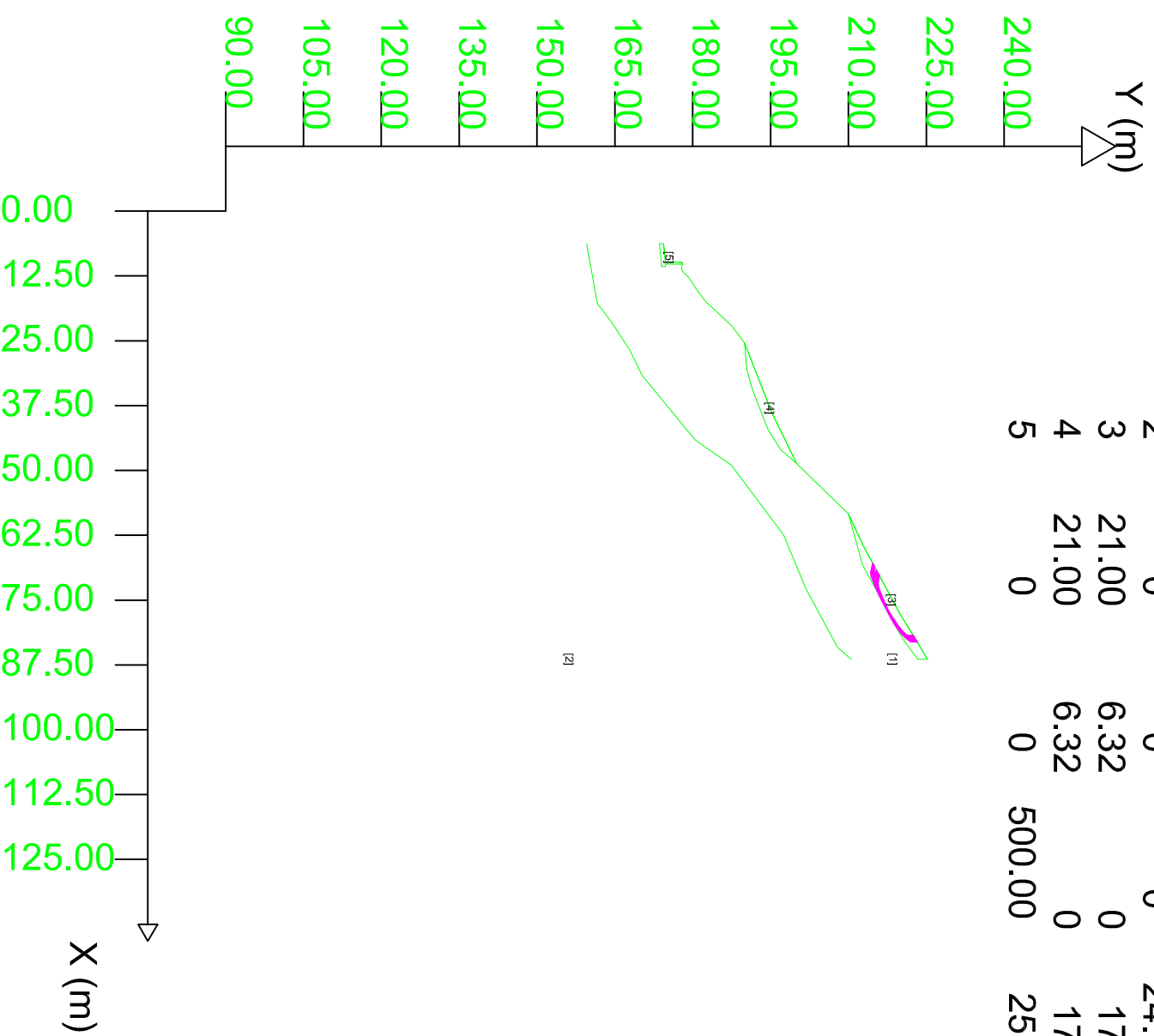
Localita' : Loc. Cepparello

Descrizione : Sez.2 - Stato attuale

[n] = N. strato o lente

# Parametri Geotecnici degli strati #

N.	phi'	C'	Cu	Gamm	GammSat	sgci	GSI	mi	D
1	0 deg	0 kPa	0 kPa	24.00 kN/m3	24.50 kN/m3	50.00 MPa	..	17.00	1.00
2	0	0	0	24.00	24.50	100.00	65.00	17.00	1.00
3	21.00	6.32	0	17.50	18.50	0	0	0	0
4	21.00	6.32	0	17.50	18.50	0	0	0	0
5	0	0	500.00	25.00	25.00	0	0	0	0



### DATI 10 SUP. CON MINOR Fs

Fs minimo : 1.1977  
Range Fs : 1.1977 1.2111  
Differenza % Range Fs : 1.11  
Coefficiente Sismico orizzontale - Kh: 0.0510

### GENERAZIONE SUPERFICI RANDOM

Campione Superfici - N.: 20000  
Lunghezza media segmenti (m) : 1.0  
Range X inizio generazione : 7.9 - 80.0  
Range X termine generazione : 15.9 - 84.8  
Livello Y minimo considerato : 100.5

# Report elaborazioni #

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SSAP 4.9.9 - Slope Stability Analysis Program (1991,2018)

WWW.SSAP.EU

Build No. 10784

BY

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\*\* Gia' Ricercatore CNR-IRPI fino a Luglio 2011

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Ultima Revisione struttura tabelle del report: 29 dicembre 2018  
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File report: C:\SSAP2010\Verifiche\Risultati\Sez2\_Stato\_Attuale.txt

Data: 18/4/2019

Localita' :

Descrizione:

Modello pendio: Sez2-stato attuale\_V5\_1.mod

----- PARAMETRI DEL MODELLO DEL PENDIO -----

\_\_\_ PARAMETRI GEOMETRICI - Coordinate X Y (in m) \_\_\_

SUP T.		SUP 2		SUP 3		SUP 4	
X	Y	X	Y	X	Y	X	Y
6.30	174.39	6.30	159.58	58.33	210.00	25.46	190.00
9.80	174.74	17.84	161.61	68.23	212.76	30.46	190.39
9.89	177.92	21.41	164.37	74.05	215.92	34.10	191.44
10.26	177.96	26.71	167.79	78.60	218.24	36.24	192.19
11.03	177.87	31.70	170.25	82.54	220.54	39.38	193.43
11.57	177.97	44.12	180.45	86.39	223.36	42.27	194.62
12.69	179.12	49.00	187.46	86.39	225.26	46.00	196.96
13.69	179.83	62.41	197.51	77.76	220.00	48.61	200.00
15.02	180.67	72.77	201.78	64.40	212.81	38.81	195.22
17.56	182.60	84.05	207.87	58.33	210.00	25.46	190.00
18.19	183.34	86.39	210.50	-	-	-	-
22.18	187.57	-	-	-	-	-	-
25.46	190.00	-	-	-	-	-	-
38.81	195.22	-	-	-	-	-	-
48.61	200.00	-	-	-	-	-	-
54.08	205.53	-	-	-	-	-	-
58.33	210.00	-	-	-	-	-	-
64.40	212.81	-	-	-	-	-	-
77.76	220.00	-	-	-	-	-	-
81.33	222.22	-	-	-	-	-	-
86.39	225.26	-	-	-	-	-	-
SUP 5		SUP 6		SUP 7		SUP 8	

X	Y	X	Y	X	Y	X	Y
6.30	173.58	-	-	-	-	-	-
6.30	174.39	-	-	-	-	-	-
9.80	174.74	-	-	-	-	-	-
9.89	177.92	-	-	-	-	-	-
10.26	177.96	-	-	-	-	-	-
10.20	174.74	-	-	-	-	-	-
10.70	174.74	-	-	-	-	-	-
10.70	173.94	-	-	-	-	-	-
9.80	173.94	-	-	-	-	-	-
6.30	173.58	-	-	-	-	-	-

## ASSENZA DI FALDA ##

----- PARAMETRI GEOMECCANICI -----

STR_IDX	sgci	fi` GSI	mi	C` D	Cu	Gamm	Gamm_sat
STRATO 1	1	0.00		0.00	0.00	24.00	24.50
8.587	50.00	50.00	17.00	1.00			
STRATO 2	2	0.00		0.00	0.00	24.00	24.50
12.882	100.00	65.00	17.00	1.00			
STRATO 3	3	21.00		6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00			
STRATO 4	4	21.00		6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00			
STRATO 5	5	0.00		0.00	500.00	25.00	25.00
1000.000	0.00	0.00	0.00	0.00			

LEGENDA: fi` \_\_\_\_\_ Angolo di attrito interno efficace(in gradi)  
C` \_\_\_\_\_ Coesione efficace (in Kpa)  
Cu \_\_\_\_\_ Resistenza al taglio Non drenata (in Kpa)  
Gamm \_\_\_\_\_ Peso di volume terreno fuori falda (in KN/m^3)  
Gamm\_sat \_\_\_\_\_ Peso di volume terreno immerso (in KN/m^3)  
STR\_IDX \_\_\_\_\_ Indice di resistenza (usato in solo in 'SNIFF SEARCH)

(adimensionale)

---- SOLO Per AMMASSI ROCCIOSI FRATTURATI - Parametri Criterio di Rottura di Hoek (2002)-

sigci \_\_\_\_\_ Resistenza Compressione Uniassiale Roccia Intatta (in MPa)

GSI \_\_\_\_\_ Geological Strenght Index ammasso(adimensionale)

mi \_\_\_\_\_ Indice litologico ammasso(adimensionale)

D \_\_\_\_\_ Fattore di disturbo ammasso(adimensionale)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 -

ATTIVATO (solo per ROCCE)

Uso CRITERIO DI ROTTURA Hoek et al.(2002,2006) - non-lineare - Generalizzato secondo Lei et al.(2016)

----- INFORMAZIONI GENERAZIONE SUPERFICI RANDOM -----

\*\*\* PARAMETRI PER LA GENERAZIONE DELLE SUPERFICI

METODO DI RICERCA: CONVEX RANDOM - Chen (1992)

FILTRAGGIO SUPERFICI : ATTIVATO

COORDINATE X1,X2,Y OSTACOLO : 0.00 0.00 0.00

LUNGHEZZA MEDIA SEGMENTI (m): 1.0 (+/-) 50%  
INTERVALLO ASCISSE RANDOM STARTING POINT (Xmin .. Xmax): 7.90  
79.98  
LIVELLO MINIMO CONSIDERATO (Ymin): 100.47  
INTERVALLO ASCISSE AMMESSO PER LA TERMINAZIONE (Xmin .. Xmax): 15.91  
84.79

\*\*\* TOTALE SUPERFICI GENERATE : 20000

----- INFORMAZIONI PARAMETRI DI CALCOLO -----

METODO DI CALCOLO : BORSELLI (Borselli, 2016)  
COEFFICIENTE SISMICO UTILIZZATO Kh : 0.0510  
COEFFICIENTE SISMICO UTILIZZATO Kv (assunto Positivo): 0.0255  
COEFFICIENTE c=Kv/Kh UTILIZZATO : 0.5000  
FORZA ORIZZONTALE ADDIZIONALE IN TESTA (kN/m): 0.00  
FORZA ORIZZONTALE ADDIZIONALE ALLA BASE (kN/m): 0.00

N.B. Le forze orizzontali addizionali in testa e alla base sono poste uguali a 0

durante le tutte le verifiche globali.

I valori >0 impostati dall'utente sono utilizzati solo in caso di verifica singola

----- RISULTATO FINALE ELABORAZIONI -----

\* DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR Fs \*

Fattore di sicurezza (FS)	1.1977	- Min. -	X	Y	Lambda=
0.3798			68.25	214.88	
			69.75	214.91	
			70.45	214.95	
			70.93	214.99	
			71.32	215.06	
			71.71	215.15	
			72.06	215.25	
			72.44	215.39	
			72.84	215.55	
			73.31	215.77	
			73.75	215.97	
			74.17	216.17	
			74.58	216.36	
			74.99	216.56	
			75.39	216.76	
			75.80	216.96	
			76.21	217.17	
			76.63	217.39	
			77.04	217.61	
			77.44	217.83	
			77.85	218.05	
			78.25	218.27	
			78.66	218.51	
			79.08	218.75	

79.51	219.00
79.98	219.28
80.38	219.55
80.76	219.83
81.11	220.13
81.51	220.49
81.91	220.91
82.39	221.46
82.75	221.89
82.75	223.07

Fattore di sicurezza (FS)      1.2013   - N.2   --      X                  Y                  Lambda=  
0.3717

69.84	215.74
70.96	215.64
71.49	215.60
71.84	215.60
72.13	215.61
72.42	215.65
72.68	215.70
72.96	215.77
73.26	215.87
73.62	216.00
73.94	216.12
74.25	216.24
74.56	216.36
74.86	216.48
75.15	216.61
75.45	216.74
75.76	216.89
76.08	217.04
76.39	217.19
76.69	217.34
76.99	217.50
77.29	217.66
77.59	217.82
77.89	217.99
78.19	218.16
78.51	218.35
78.82	218.53
79.12	218.71
79.42	218.90
79.72	219.08
80.02	219.28
80.34	219.48
80.66	219.69
81.01	219.93
81.31	220.14
81.59	220.38
81.85	220.63
82.14	220.93
82.44	221.29
82.80	221.76

83.00 222.03  
83.00 223.22

Fattore di sicurezza (FS) 1.2043 - N.3 -- X Y Lambda=  
0.3800

68.43 214.98  
69.65 214.98  
70.23 214.99  
70.62 215.01  
70.95 215.05  
71.27 215.12  
71.57 215.19  
71.88 215.28  
72.22 215.40  
72.60 215.54  
72.96 215.69  
73.30 215.83  
73.63 215.97  
73.96 216.12  
74.29 216.27  
74.61 216.42  
74.95 216.59  
75.29 216.76  
75.64 216.94  
75.97 217.11  
76.31 217.29  
76.64 217.46  
76.98 217.63  
77.32 217.81  
77.66 217.99  
78.01 218.18  
78.35 218.36  
78.67 218.55  
78.99 218.74  
79.32 218.95  
79.65 219.16  
79.98 219.39  
80.33 219.64  
80.72 219.92  
81.05 220.18  
81.37 220.45  
81.68 220.73  
82.00 221.06  
82.34 221.43  
82.74 221.90  
82.74 223.07

Fattore di sicurezza (FS) 1.2065 - N.4 -- X Y Lambda=  
0.3888

70.06 215.85  
70.82 215.67  
71.16 215.60

71.39	215.57
71.57	215.56
71.76	215.57
71.92	215.60
72.10	215.64
72.29	215.69
72.54	215.78
72.76	215.86
72.97	215.93
73.17	216.01
73.37	216.08
73.57	216.16
73.77	216.24
73.97	216.32
74.17	216.41
74.37	216.49
74.57	216.57
74.78	216.66
74.98	216.74
75.18	216.83
75.38	216.91
75.58	216.99
75.78	217.08
75.98	217.16
76.18	217.24
76.38	217.33
76.58	217.41
76.79	217.49
76.99	217.58
77.20	217.67
77.40	217.75
77.60	217.84
77.80	217.93
77.99	218.02
78.19	218.12
78.38	218.22
78.58	218.33
78.78	218.44
79.00	218.57
79.20	218.69
79.40	218.81
79.60	218.94
79.80	219.07
79.99	219.20
80.20	219.33
80.40	219.48
80.63	219.63
80.82	219.78
81.02	219.93
81.21	220.09
81.40	220.27
81.59	220.45
81.78	220.64
81.99	220.85



82.21	221.10
82.42	221.33
82.62	221.56
82.81	221.80
83.00	222.04
83.00	223.23

Fattore di sicurezza (FS)    1.2071   - N.5 --    X            Y            Lambda=  
0.3734

70.15	215.90
71.25	215.76
71.76	215.71
72.10	215.69
72.38	215.70
72.66	215.74
72.91	215.78
73.18	215.86
73.47	215.95
73.82	216.08
74.15	216.20
74.45	216.33
74.74	216.45
75.04	216.57
75.32	216.70
75.62	216.84
75.91	216.98
76.22	217.13
76.52	217.28
76.82	217.43
77.11	217.58
77.41	217.74
77.70	217.89
78.00	218.05
78.30	218.22
78.61	218.39
78.91	218.56
79.20	218.73
79.49	218.91
79.78	219.09
80.07	219.28
80.37	219.49
80.68	219.71
81.02	219.96
81.31	220.19
81.59	220.44
81.86	220.70
82.14	221.00
82.44	221.36
82.79	221.82
82.98	222.08
82.98	223.21

Fattore di sicurezza (FS) 1.2087 - N.6 -- X Y Lambda=  
0.3724

67.91	214.70
68.87	214.47
69.30	214.38
69.58	214.34
69.80	214.33
70.03	214.35
70.23	214.39
70.45	214.45
70.70	214.53
71.00	214.65
71.28	214.76
71.55	214.87
71.80	214.98
72.05	215.08
72.30	215.19
72.55	215.30
72.81	215.41
73.06	215.53
73.32	215.64
73.56	215.76
73.81	215.88
74.06	216.00
74.31	216.12
74.56	216.25
74.81	216.38
75.07	216.52
75.32	216.66
75.57	216.79
75.82	216.93
76.07	217.07
76.32	217.21
76.57	217.35
76.82	217.50
77.08	217.65
77.33	217.80
77.58	217.96
77.83	218.11
78.08	218.27
78.33	218.42
78.58	218.59
78.83	218.75
79.10	218.93
79.35	219.10
79.60	219.28
79.84	219.46
80.08	219.65
80.33	219.84
80.58	220.05
80.84	220.27
81.11	220.51
81.36	220.74
81.61	220.98

81.85 221.22  
81.85 222.53

Fattore di sicurezza (FS) 1.2096 - N.7 -- X Y Lambda=  
0.3793

68.14 214.82  
68.97 214.71  
69.35 214.66  
69.61 214.65  
69.82 214.65  
70.03 214.67  
70.22 214.70  
70.43 214.74  
70.65 214.80  
70.90 214.88  
71.15 214.96  
71.38 215.04  
71.60 215.11  
71.83 215.19  
72.05 215.27  
72.27 215.34  
72.50 215.43  
72.73 215.51  
72.96 215.59  
73.18 215.68  
73.39 215.76  
73.61 215.86  
73.83 215.95  
74.05 216.05  
74.28 216.15  
74.51 216.26  
74.74 216.36  
74.96 216.47  
75.18 216.58  
75.40 216.69  
75.62 216.81  
75.85 216.93  
76.07 217.05  
76.30 217.18  
76.53 217.31  
76.75 217.44  
76.97 217.57  
77.19 217.71  
77.41 217.84  
77.63 217.98  
77.85 218.13  
78.08 218.28  
78.31 218.43  
78.53 218.58  
78.76 218.73  
78.98 218.88  
79.21 219.04  
79.43 219.19

79.66	219.34
79.90	219.50
80.12	219.66
80.34	219.82
80.55	219.98
80.77	220.16
80.98	220.34
81.20	220.53
81.43	220.74
81.68	220.97
81.90	221.19
82.11	221.40
82.11	222.69

Fattore di sicurezza (FS)    1.2103   - N.8   --    X            Y            Lambda=  
0.3832

69.53	215.57
70.50	215.43
70.94	215.38
71.24	215.36
71.48	215.36
71.72	215.38
71.94	215.42
72.18	215.48
72.43	215.56
72.74	215.67
73.02	215.77
73.28	215.87
73.54	215.97
73.80	216.08
74.05	216.18
74.31	216.29
74.57	216.40
74.83	216.52
75.09	216.64
75.35	216.75
75.61	216.87
75.87	216.99
76.13	217.11
76.39	217.23
76.65	217.35
76.91	217.47
77.17	217.60
77.43	217.72
77.68	217.85
77.94	217.98
78.20	218.11
78.46	218.25
78.73	218.40
79.01	218.55
79.27	218.70
79.51	218.85
79.75	219.01

80.00	219.20
80.24	219.39
80.49	219.60
80.76	219.83
81.06	220.11
81.32	220.37
81.58	220.63
81.82	220.90
82.07	221.20
82.35	221.54
82.54	221.79
82.54	222.95

Fattore di sicurezza (FS)    1.2111   - N.9 --    X            Y            Lambda=  
0.3730

68.06	214.78
69.53	214.87
70.23	214.92
70.71	214.98
71.12	215.05
71.51	215.14
71.87	215.24
72.26	215.36
72.67	215.51
73.13	215.69
73.55	215.87
73.97	216.04
74.37	216.22
74.77	216.40
75.17	216.59
75.57	216.79
75.98	216.99
76.41	217.21
76.82	217.43
77.23	217.65
77.62	217.88
78.02	218.11
78.42	218.35
78.83	218.61
79.26	218.89
79.72	219.19
80.12	219.48
80.51	219.79
80.87	220.10
81.27	220.47
81.68	220.90
82.17	221.44
82.17	222.72

Fattore di sicurezza (FS)    1.2111   - N.10 --    X            Y            Lambda=  
0.3663

69.26	215.42
-------	--------

70.29	215.15
70.76	215.04
71.05	214.99
71.29	214.98
71.53	215.00
71.74	215.03
71.98	215.09
72.25	215.18
72.58	215.32
72.88	215.44
73.16	215.56
73.43	215.68
73.70	215.80
73.96	215.92
74.23	216.05
74.50	216.18
74.78	216.32
75.05	216.47
75.32	216.61
75.59	216.75
75.85	216.89
76.12	217.04
76.39	217.19
76.66	217.34
76.94	217.50
77.21	217.66
77.47	217.82
77.74	217.97
78.01	218.14
78.28	218.30
78.55	218.47
78.82	218.64
79.10	218.82
79.37	219.00
79.64	219.18
79.89	219.36
80.16	219.56
80.42	219.76
80.69	219.97
80.97	220.19
81.27	220.44
81.54	220.68
81.80	220.92
82.05	221.17
82.31	221.45
82.51	221.68
82.51	222.93

----- ANALISI DEFICIT DI RESISTENZA -----

# DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR  $F_s$  \*

# Analisi Deficit in riferimento a  $F_s(\text{progetto}) = 1.200$

Sup N.	FS	FTR(kN/m)	FTA(kN/m)	Bilancio(kN/m)	ESITO
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1	1.198	256.4	214.1	-0.5	Deficit
2	1.201	241.0	200.6	0.3	Surplus
3	1.204	248.6	206.5	0.9	Surplus
4	1.206	234.1	194.0	1.3	Surplus
5	1.207	236.6	196.0	1.4	Surplus
6	1.209	252.3	208.7	1.8	Surplus
7	1.210	244.8	202.4	1.9	Surplus
8	1.210	237.7	196.4	2.0	Surplus
9	1.211	246.7	203.7	2.3	Surplus
10	1.211	247.8	204.6	2.3	Surplus

Esito analisi: DEFICIT di RESISTENZA!

Valore massimo di DEFICIT di RESISTENZA(kN/m): -0.5

Note: FTR --> Forza totale Resistente lungo la superficie di scivolamento

FTA --> Forza totale Agente lungo la superficie di scivolamento

IMPORTANTE! : Il Deficit o il Surplus di resistenza viene espresso in kN per metro di LARGHEZZA rispetto al fronte della scarpata

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TABELLA PARAMETRI CONCI DELLA SUPERFICIE INDIVIDUATA CON MINOR FS  
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phi'	X	dx	alpha	W	ru	U
(°)	(m)	(m)	(°)	(kN/m)	(-)	(kPa)
	(c',Cu)					
	(kPa)					
21.00	68.251	0.209	1.23	0.20	0.00	0.00
	6.32					
21.00	68.460	0.209	1.23	0.61	0.00	0.00
	6.32					
21.00	68.668	0.209	1.23	1.01	0.00	0.00
	6.32					
21.00	68.877	0.209	1.23	1.41	0.00	0.00
	6.32					
21.00	69.085	0.209	1.23	1.82	0.00	0.00
	6.32					
21.00	69.294	0.209	1.23	2.22	0.00	0.00
	6.32					
21.00	69.503	0.209	1.23	2.62	0.00	0.00
	6.32					
21.00	69.711	0.039	1.23	0.53	0.00	0.00
	6.32					
21.00	69.750	0.209	2.59	3.09	0.00	0.00
	6.32					
21.00	69.958	0.209	2.59	3.48	0.00	0.00
	6.32					
21.00	70.167	0.209	2.59	3.86	0.00	0.00
	6.32					

	70.376	0.078	2.59	1.55	0.00	0.00
21.00	6.32					
	70.454	0.209	5.54	4.37	0.00	0.00
21.00	6.32					
	70.662	0.209	5.54	4.71	0.00	0.00
21.00	6.32					
	70.871	0.056	5.54	1.33	0.00	0.00
21.00	6.32					
	70.927	0.153	9.10	3.73	0.00	0.00
21.00	6.32					
	71.080	0.209	9.10	5.34	0.00	0.00
21.00	6.32					
	71.289	0.032	9.10	0.84	0.00	0.00
21.00	6.32					
	71.320	0.209	13.36	5.65	0.00	0.00
21.00	6.32					
	71.529	0.180	13.36	5.07	0.00	0.00
21.00	6.32					
	71.709	0.209	16.57	6.07	0.00	0.00
21.00	6.32					
	71.918	0.146	16.57	4.35	0.00	0.00
21.00	6.32					
	72.063	0.209	19.73	6.36	0.00	0.00
21.00	6.32					
	72.272	0.170	19.73	5.30	0.00	0.00
21.00	6.32					
	72.442	0.209	22.37	6.60	0.00	0.00
21.00	6.32					
	72.651	0.119	22.37	3.81	0.00	0.00
21.00	6.32					
	72.770	0.074	22.37	2.39	0.00	0.00
21.00	6.32					
	72.844	0.209	24.39	6.77	0.00	0.00
21.00	6.32					
	73.053	0.209	24.39	6.84	0.00	0.00
21.00	6.32					
	73.261	0.051	24.39	1.67	0.00	0.00
21.00	6.32					
	73.312	0.209	24.75	6.92	0.00	0.00
21.00	6.32					
	73.520	0.209	24.75	6.98	0.00	0.00
21.00	6.32					
	73.729	0.021	24.75	0.71	0.00	0.00
21.00	6.32					
	73.750	0.209	25.13	7.04	0.00	0.00
21.00	6.32					
	73.959	0.091	25.13	3.09	0.00	0.00
21.00	6.32					
	74.050	0.120	25.13	4.09	0.00	0.00
21.00	6.32					
	74.170	0.209	25.53	7.15	0.00	0.00
21.00	6.32					
	74.379	0.201	25.53	6.95	0.00	0.00
21.00	6.32					



	74.580	0.209	25.94	7.23	0.00	0.00
21.00	6.32					
	74.789	0.197	25.94	6.85	0.00	0.00
21.00	6.32					
	74.985	0.209	26.33	7.31	0.00	0.00
21.00	6.32					
	75.194	0.195	26.33	6.86	0.00	0.00
21.00	6.32					
	75.389	0.209	26.72	7.37	0.00	0.00
21.00	6.32					
	75.597	0.198	26.72	7.01	0.00	0.00
21.00	6.32					
	75.795	0.209	27.09	7.42	0.00	0.00
21.00	6.32					
	76.004	0.203	27.09	7.23	0.00	0.00
21.00	6.32					
	76.206	0.209	27.45	7.46	0.00	0.00
21.00	6.32					
	76.415	0.209	27.45	7.47	0.00	0.00
21.00	6.32					
	76.624	0.004	27.45	0.13	0.00	0.00
21.00	6.32					
	76.627	0.209	27.87	7.49	0.00	0.00
21.00	6.32					
	76.836	0.202	27.87	7.26	0.00	0.00
21.00	6.32					
	77.038	0.209	28.30	7.50	0.00	0.00
21.00	6.32					
	77.246	0.197	28.30	7.08	0.00	0.00
21.00	6.32					
	77.443	0.209	28.73	7.49	0.00	0.00
21.00	6.32					
	77.652	0.108	28.73	3.88	0.00	0.00
21.00	6.32					
	77.760	0.086	28.73	3.09	0.00	0.00
21.00	6.32					
	77.846	0.209	29.16	7.54	0.00	0.00
21.00	6.32					
	78.055	0.196	29.16	7.14	0.00	0.00
21.00	6.32					
	78.251	0.209	29.60	7.64	0.00	0.00
21.00	6.32					
	78.459	0.141	29.60	5.17	0.00	0.00
21.00	6.32					
	78.600	0.059	29.60	2.19	0.00	0.00
21.00	6.32					
	78.659	0.209	30.03	7.72	0.00	0.00
21.00	6.32					
	78.868	0.209	30.03	7.76	0.00	0.00
21.00	6.32					
	79.077	0.000	30.03	0.02	0.00	0.00
21.00	6.32					
	79.077	0.209	30.44	7.79	0.00	0.00
21.00	6.32					

21.00	79.286	0.209	30.44	7.82	0.00	0.00
	6.32					
21.00	79.494	0.019	30.44	0.72	0.00	0.00
	6.32					
21.00	79.513	0.209	30.81	7.85	0.00	0.00
	6.32					
21.00	79.722	0.209	30.81	7.88	0.00	0.00
	6.32					
21.00	79.931	0.051	30.81	1.92	0.00	0.00
	6.32					
21.00	79.981	0.209	33.48	7.88	0.00	0.00
	6.32					
21.00	80.190	0.189	33.48	7.11	0.00	0.00
	6.32					
21.00	80.379	0.209	36.60	7.80	0.00	0.00
	6.32					
21.00	80.587	0.171	36.60	6.32	0.00	0.00
	6.32					
21.00	80.758	0.209	39.87	7.59	0.00	0.00
	6.32					
21.00	80.967	0.148	39.87	5.29	0.00	0.00
	6.32					
21.00	81.115	0.209	42.77	7.28	0.00	0.00
	6.32					
21.00	81.323	0.007	42.77	0.23	0.00	0.00
	6.32					
21.00	81.330	0.176	42.77	5.93	0.00	0.00
	6.32					
21.00	81.506	0.209	46.20	6.77	0.00	0.00
	6.32					
21.00	81.714	0.198	46.20	6.12	0.00	0.00
	6.32					
21.00	81.913	0.209	48.67	6.05	0.00	0.00
	6.32					
21.00	82.121	0.209	48.67	5.63	0.00	0.00
	6.32					
21.00	82.330	0.064	48.67	1.65	0.00	0.00
	6.32					
21.00	82.394	0.146	50.57	3.59	0.00	0.00
	6.32					
21.00	82.540	0.209	50.57	4.71	0.00	0.00
	6.32					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
dx(m) : Larghezza concio  
alpha(°) : Angolo pendenza base concio  
W(kN/m) : Forza peso concio  
ru(-) : Coefficiente locale pressione interstiziale  
U(kPa) : Pressione totale dei pori base concio  
phi'(°) : Angolo di attrito efficace base concio  
c'/Cu (kPa) : Coesione efficace o Resistenza al taglio in condizioni non

drenate

TABELLA DIAGRAMMA DELLE FORZE DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

T(x)	X (m)	ht E' (m) (kN)	yt rho(x) (m) (--)	yt' FS_FEM (--) (--)	E(x) FS_p-qFEM (kN/m) (--)
	68.251	0.000	214.883	0.153	0.0000000000E+000
0.0000000000E+000		1.4656973629E+001		0.241	4.100 1.329
	68.460	0.027	214.914	0.153	2.4864281110E+000
3.2897783003E-001		9.1838442911E+000		0.241	4.100 1.329
	68.668	0.055	214.946	0.160	3.8312391275E+000
5.5244909317E-001		6.8727046284E+000		0.234	2.358 0.945
	68.877	0.085	214.981	0.188	5.3535253798E+000
9.2317103565E-001		8.3347964006E+000		0.270	1.853 0.910
	69.085	0.124	215.025	0.205	7.3082795779E+000
1.5456306179E+000		9.1018290457E+000		0.335	1.615 0.938
	69.294	0.161	215.066	0.196	9.1505500752E+000
2.1992295335E+000		8.6500558177E+000		0.381	1.501 0.972
	69.503	0.197	215.106	0.197	1.0916837308E+001
2.8596259473E+000		8.6762961159E+000		0.414	1.426 1.004
	69.711	0.235	215.149	0.203	1.2770054512E+001
3.6282532323E+000		8.8652580268E+000		0.449	1.386 1.051
	69.750	0.242	215.157	0.209	1.3112255525E+001
3.7798508758E+000		8.8700765989E+000		0.456	1.382 1.060
	69.958	0.276	215.200	0.233	1.4971906840E+001
4.6324771143E+000		9.7399699734E+000		0.491	1.361 1.107
	70.167	0.320	215.254	0.259	1.7175494500E+001
5.7121475508E+000		1.0405827873E+001		0.535	1.348 1.159
	70.376	0.365	215.308	0.271	1.9312922828E+001
6.8016721591E+000		1.0919257719E+001		0.571	1.344 1.204
	70.454	0.385	215.332	0.293	2.0187532886E+001
7.2606272229E+000		1.0930691701E+001		0.586	1.345 1.221
	70.662	0.425	215.392	0.278	2.2333700421E+001
8.4164946450E+000		9.4081069613E+000		0.621	1.348 1.257
	70.871	0.461	215.448	0.264	2.4112328033E+001
9.4138500693E+000		7.9144812918E+000		0.644	1.355 1.279
	70.927	0.470	215.462	0.265	2.4546626663E+001
9.6620465321E+000		7.6077096776E+000		0.649	1.359 1.284
	71.080	0.486	215.503	0.290	2.5650615556E+001
1.0329909679E+001		7.2264984480E+000		0.664	1.367 1.293
	71.289	0.516	215.567	0.310	2.7159888942E+001
1.1301780238E+001		7.3446845822E+000		0.687	1.378 1.301
	71.320	0.522	215.578	0.342	2.7393911934E+001
1.1460820343E+001		7.2176103566E+000		0.691	1.380 1.302
	71.529	0.544	215.649	0.358	2.8702770347E+001
1.2423758876E+001		6.0365402451E+000		0.717	1.387 1.305
	71.709	0.569	215.717	0.434	2.9753091099E+001

1.3265540346E+001	5.8283949459E+000	0.739	1.392	1.303
71.918	0.608 215.817	0.478	3.0968260556E+001	
1.4338979981E+001	5.0143706164E+000	0.770	1.388	1.299
72.063	0.633 215.886	0.480	3.1616513204E+001	
1.4967178851E+001	4.1051129220E+000	0.788	1.385	1.294
72.272	0.659 215.988	0.478	3.2370620772E+001	
1.5752756810E+001	2.8822659115E+000	0.810	1.376	1.286
72.442	0.678 216.068	0.461	3.2759757067E+001	
1.6202263218E+001	1.9789217571E+000	0.821	1.369	1.280
72.651	0.687 216.162	0.434	3.3094826161E+001	
1.6624964731E+001	1.2189839440E+000	0.832	1.360	1.273
72.770	0.686 216.210	0.443	3.3213549716E+001	
1.6791034647E+001	8.9357437024E-001	0.836	1.357	1.271
72.844	0.693 216.248	0.488	3.3274910995E+001	
1.6891974292E+001	7.4344908899E-001	0.838	1.355	1.269
73.053	0.699 216.348	0.495	3.3380003029E+001	
1.7110671753E+001	3.1490445321E-001	0.843	1.348	1.266
73.261	0.711 216.454	0.503	3.3406280194E+001	
1.7263064897E+001	-1.6809239011E-002	0.847	1.340	1.264
73.312	0.712 216.478	0.481	3.3403677962E+001	
1.7289886821E+001	-6.8796206178E-002	0.847	1.339	1.264
73.520	0.716 216.579	0.484	3.3374400453E+001	
1.7388602624E+001	-2.0683465215E-001	0.849	1.331	1.263
73.729	0.721 216.680	0.482	3.3317392417E+001	
1.7471150035E+001	-3.1879406319E-001	0.850	1.325	1.262
73.750	0.721 216.690	0.419	3.3310514048E+001	
1.7478438377E+001	-3.3074566014E-001	0.850	1.324	1.262
73.959	0.710 216.776	0.424	3.3226562303E+001	
1.7536604050E+001	-4.7068879222E-001	0.851	1.318	1.262
74.050	0.707 216.817	0.444	3.3180939409E+001	
1.7563056887E+001	-5.3426440789E-001	0.851	1.315	1.262
74.170	0.705 216.870	0.469	3.3111500593E+001	
1.7598077015E+001	-6.3406217278E-001	0.852	1.310	1.262
74.379	0.706 216.971	0.507	3.2959174481E+001	
1.7659460832E+001	-8.3840674633E-001	0.854	1.300	1.263
74.580	0.717 217.078	0.558	3.2769236446E+001	
1.7709226493E+001	-1.0493748087E+000	0.857	1.286	1.263
74.789	0.737 217.200	0.584	3.2527342581E+001	
1.7737863941E+001	-1.2363516204E+000	0.859	1.268	1.264
74.985	0.756 217.315	0.558	3.2270108814E+001	
1.7723698365E+001	-1.3152053432E+000	0.859	1.250	1.265
75.194	0.764 217.426	0.526	3.1994314131E+001	
1.7657764957E+001	-1.3653719639E+000	0.858	1.233	1.266
75.389	0.769 217.527	0.518	3.1720306900E+001	
1.7553258505E+001	-1.4527170942E+000	0.855	1.219	1.267
75.597	0.771 217.634	0.552	3.1406797491E+001	
1.7404741930E+001	-1.6850569871E+000	0.850	1.207	1.268
75.795	0.788 217.751	0.564	3.1039414870E+001	
1.7208632719E+001	-1.8816305773E+000	0.844	1.197	1.269
76.004	0.794 217.864	0.531	3.0641657617E+001	
1.6991149532E+001	-1.8983657303E+000	0.837	1.189	1.270
76.206	0.796 217.969	0.525	3.0258451880E+001	
1.6787161051E+001	-1.8671400032E+000	0.831	1.184	1.271
76.415	0.798 218.079	0.498	2.9873908609E+001	

1.6594916164E+001	-1.8367278414E+000	0.826	1.179	1.272
76.624	0.787 218.177	0.467	2.9492221165E+001	
1.6419323647E+001	-1.6079254482E+000	0.821	1.175	1.272
76.627	0.787 218.178	0.482	2.9486596983E+001	
1.6416886895E+001	-1.6114199284E+000	0.821	1.175	1.272
76.836	0.777 218.279	0.527	2.9060814601E+001	
1.6241323352E+001	-2.2927204104E+000	0.817	1.170	1.270
77.038	0.786 218.395	0.571	2.8548516242E+001	
1.6037739985E+001	-2.5668880815E+000	0.813	1.163	1.267
77.246	0.793 218.514	0.573	2.8006492499E+001	
1.5823626524E+001	-2.6521862538E+000	0.810	1.154	1.262
77.443	0.800 218.628	0.562	2.7473761335E+001	
1.5606897631E+001	-2.7152698293E+000	0.806	1.145	1.257
77.652	0.800 218.742	0.546	2.6904654087E+001	
1.5362169134E+001	-2.7793154392E+000	0.801	1.136	1.251
77.760	0.800 218.800	0.559	2.6601393482E+001	
1.5219939419E+001	-2.7480528301E+000	0.798	1.131	1.247
77.846	0.802 218.850	0.566	2.6369191282E+001	
1.5108770650E+001	-2.7311916141E+000	0.791	1.127	1.244
78.055	0.803 218.967	0.584	2.5784838130E+001	
1.4820146702E+001	-3.0551457415E+000	0.774	1.119	1.236
78.251	0.813 219.086	0.598	2.5138053524E+001	
1.4490935898E+001	-3.3006947507E+000	0.756	1.110	1.226
78.459	0.817 219.209	0.590	2.4448074532E+001	
1.4135974787E+001	-3.4266281346E+000	0.737	1.101	1.215
78.600	0.820 219.292	0.590	2.3955247644E+001	
1.3881228935E+001	-3.6435718427E+000	0.724	1.095	1.207
78.659	0.821 219.327	0.594	2.3735241206E+001	
1.3767721270E+001	-3.6385240646E+000	0.718	1.092	1.203
78.868	0.825 219.452	0.596	2.3022384947E+001	
1.3401145012E+001	-3.3894488266E+000	0.700	1.084	1.191
79.077	0.829 219.576	0.596	2.2321259375E+001	
1.3037123315E+001	-3.4127438133E+000	0.682	1.077	1.178
79.077	0.829 219.576	0.571	2.2319593771E+001	
1.3036247574E+001	-3.4132760475E+000	0.682	1.077	1.178
79.286	0.825 219.695	0.580	2.1570909011E+001	
1.2639459843E+001	-3.7205405472E+000	0.663	1.069	1.165
79.494	0.825 219.818	0.588	2.0767489873E+001	
1.2201891572E+001	-3.8317799046E+000	0.642	1.059	1.150
79.513	0.825 219.829	0.563	2.0693889614E+001	
1.2160999248E+001	-3.8327543184E+000	0.640	1.058	1.148
79.722	0.818 219.946	0.579	1.9888061126E+001	
1.1698226728E+001	-4.0957733295E+000	0.619	1.047	1.133
79.931	0.818 220.071	0.594	1.8985249251E+001	
1.1148305292E+001	-4.3480041520E+000	0.593	1.033	1.116
79.981	0.817 220.100	0.633	1.8764695058E+001	
1.1011042836E+001	-4.5110734455E+000	0.587	1.029	1.112
80.190	0.814 220.235	0.668	1.7687847550E+001	
1.0316251279E+001	-5.5672452054E+000	0.557	1.011	1.095
80.379	0.820 220.366	0.727	1.6567865202E+001	
9.5780475536E+000	-6.7019980897E+000	0.525	0.994	1.080
80.587	0.823 220.524	0.729	1.4992768516E+001	
8.5595626867E+000	-7.3779845856E+000	0.482	0.976	1.066
80.758	0.815 220.642	0.725	1.3756270405E+001	

7.775548942E+000	-7.3724954613E+000	0.448	0.966	1.060
80.967	0.797	220.799	0.750	1.2183716253E+001
6.8123999007E+000	-6.9516851600E+000	0.407	0.958	1.057
81.115	0.784	220.910	0.697	1.1215933718E+001
6.2437951743E+000	-6.5640101669E+000	0.382	0.958	1.061
81.323	0.729	221.047	0.657	9.8381310049E+000
5.4494624569E+000	-6.2794674924E+000	0.347	0.964	1.070
81.330	0.727	221.051	0.722	9.7968277746E+000
5.4256030643E+000	-6.3011820335E+000	0.346	0.965	1.071
81.506	0.692	221.179	0.794	8.5410112380E+000
4.7031337245E+000	-7.5496198240E+000	0.317	0.977	1.087
81.714	0.652	221.356	0.864	6.8682306632E+000
3.7440378875E+000	-8.0737343287E+000	0.274	0.998	1.112
81.913	0.619	221.530	0.950	5.2554679100E+000
2.8116180362E+000	-8.4630684800E+000	0.224	1.036	1.153
82.121	0.595	221.743	0.909	3.4161369545E+000
1.7126168282E+000	-7.4507733797E+000	0.153	1.085	1.204
82.330	0.524	221.909	0.724	2.1472167684E+000
1.0061552848E+000	-4.1383439470E+000	0.100	1.130	1.250
82.394	0.482	221.941	0.694	1.9199078646E+000
9.1062569801E-001	-4.1205602624E+000	0.093	1.132	1.252
82.540	0.419	222.055	0.694	1.1254712800E+000
5.9487941032E-001	-5.4226851897E+000	0.066	1.181	1.303

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LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 ht(m) : Altezza linea di thrust da nodo sinistro base concio  
 yt(m) : coordinata Y linea di trust  
 yt'(-) : gradiente pendenza locale linea di trust  
 E(x)(kN/m) : Forza Normale interconcio  
 T(x)(kN/m) : Forza Tangenziale interconcio  
 E' (kN) : derivata Forza normale interconcio  
 Rho(x) (-) : fattore mobilizzazione resistenza al taglio verticale interconcio  
 ZhU et al.(2003)  
 FS\_FEM(x) (-) : fattore di sicurezza locale stimato (locale in X) by qFEM  
 FS\_SRM(x) (-) : fattore di sicurezza locale stimato (locale in X) by SRM  
 Procedure

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 TABELLA SFORZI DI TAGLIO DISTRIBUITI LUNGO SUPERFICIE INDIVIDUATA CON MINOR FS  
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X	dx	dI	alpha	TauStress	TauF
TauStrength	TauS				
(m)	(m)	(m)	(°)	(kPa)	(kN/m)
(kPa)	(kN/m)				
68.251	0.209	0.209	1.229	0.070	0.015
7.255	1.514				
68.460	0.209	0.209	1.229	0.210	0.044

7.816	1.631						
	68.668	0.209	0.209	1.229	0.350	0.073	
8.810	1.838						
	68.877	0.209	0.209	1.229	0.490	0.102	
9.983	2.083						
	69.085	0.209	0.209	1.229	0.630	0.132	
10.778	2.249						
	69.294	0.209	0.209	1.229	0.770	0.161	
11.531	2.406						
	69.503	0.209	0.209	1.229	0.911	0.190	
12.458	2.599						
	69.711	0.039	0.039	1.229	0.994	0.038	
12.983	0.501						
	69.750	0.209	0.209	2.591	1.424	0.297	
13.329	2.783						
	69.958	0.209	0.209	2.591	1.601	0.334	
14.392	3.005						
	70.167	0.209	0.209	2.591	1.778	0.371	
15.113	3.156						
	70.376	0.078	0.078	2.591	1.900	0.149	
15.808	1.239						
	70.454	0.209	0.210	5.540	3.072	0.644	
15.717	3.294						
	70.662	0.209	0.210	5.540	3.314	0.694	
16.141	3.383						
	70.871	0.056	0.056	5.540	3.467	0.195	
16.444	0.926						
	70.927	0.153	0.155	9.096	5.020	0.777	
16.192	2.508						
	71.080	0.209	0.211	9.096	5.273	1.114	
16.702	3.528						
	71.289	0.032	0.032	9.096	5.441	0.175	
17.069	0.550						
	71.320	0.209	0.214	13.357	7.401	1.587	
16.484	3.534						
	71.529	0.180	0.185	13.357	7.687	1.423	
16.866	3.123						
	71.709	0.209	0.218	16.574	9.316	2.027	
16.551	3.602						
	71.918	0.146	0.152	16.574	9.561	1.454	
16.795	2.554						
	72.063	0.209	0.222	19.733	11.073	2.454	
16.351	3.623						
	72.272	0.170	0.181	19.733	11.295	2.045	
16.601	3.006						
	72.442	0.209	0.226	22.365	12.508	2.821	
16.295	3.675						
	72.651	0.119	0.129	22.365	12.656	1.628	
16.474	2.119						
	72.770	0.074	0.080	22.365	12.742	1.020	
16.548	1.325						
	72.844	0.209	0.229	24.391	13.582	3.111	
16.278	3.728						
	73.053	0.209	0.229	24.391	13.715	3.141	

16.419	3.760					
	73.261	0.051	0.056	24.391	13.797	0.766
16.507	0.917					
	73.312	0.209	0.230	24.745	14.000	3.215
16.506	3.791					
	73.520	0.209	0.230	24.745	14.122	3.244
16.606	3.814					
	73.729	0.021	0.023	24.745	14.189	0.332
16.663	0.390					
	73.750	0.209	0.230	25.133	14.388	3.315
16.644	3.835					
	73.959	0.091	0.101	25.133	14.468	1.457
16.699	1.681					
	74.050	0.120	0.133	25.133	14.523	1.925
16.739	2.219					
	74.170	0.209	0.231	25.532	14.745	3.408
16.721	3.865					
	74.379	0.201	0.223	25.532	14.841	3.313
16.796	3.750					
	74.580	0.209	0.232	25.942	15.075	3.497
16.797	3.896					
	74.789	0.197	0.219	25.942	15.156	3.313
16.887	3.692					
	74.985	0.209	0.233	26.332	15.367	3.576
16.906	3.935					
	75.194	0.195	0.217	26.332	15.436	3.357
16.990	3.695					
	75.389	0.209	0.234	26.717	15.631	3.650
16.991	3.968					
	75.597	0.198	0.221	26.717	15.687	3.473
17.078	3.781					
	75.795	0.209	0.234	27.093	15.865	3.717
17.052	3.995					
	76.004	0.203	0.228	27.093	15.908	3.623
17.074	3.889					
	76.206	0.209	0.235	27.454	16.067	3.777
17.017	4.000					
	76.415	0.209	0.235	27.454	16.098	3.784
17.022	4.001					
	76.624	0.004	0.004	27.454	16.114	0.064
17.005	0.067					
	76.627	0.209	0.236	27.870	16.259	3.836
16.959	4.001					
	76.836	0.202	0.228	27.870	16.275	3.719
17.001	3.885					
	77.038	0.209	0.237	28.297	16.421	3.890
16.929	4.010					
	77.246	0.197	0.224	28.297	16.420	3.676
16.944	3.793					
	77.443	0.209	0.238	28.730	16.548	3.936
16.871	4.013					
	77.652	0.108	0.123	28.730	16.534	2.038
16.893	2.082					
	77.760	0.086	0.098	28.730	16.558	1.623



16.903	1.656					
	77.846	0.209	0.239	29.160	16.777	4.007
16.895	4.036					
	78.055	0.196	0.225	29.160	16.893	3.798
17.029	3.829					
	78.251	0.209	0.240	29.605	17.134	4.111
17.016	4.082					
	78.459	0.141	0.162	29.605	17.220	2.783
17.093	2.763					
	78.600	0.059	0.068	29.605	17.268	1.181
17.144	1.172					
	78.659	0.209	0.241	30.032	17.453	4.205
17.062	4.111					
	78.868	0.209	0.241	30.032	17.538	4.225
17.110	4.122					
	79.077	0.000	0.001	30.032	17.581	0.010
17.147	0.010					
	79.077	0.209	0.242	30.442	17.735	4.291
17.113	4.140					
	79.286	0.209	0.242	30.442	17.804	4.307
17.199	4.161					
	79.494	0.019	0.022	30.442	17.841	0.398
17.228	0.384					
	79.513	0.209	0.243	30.812	17.977	4.366
17.196	4.176					
	79.722	0.209	0.243	30.812	18.031	4.379
17.329	4.209					
	79.931	0.051	0.059	30.812	18.064	1.066
17.366	1.025					
	79.981	0.209	0.250	33.477	18.721	4.682
17.015	4.255					
	80.190	0.189	0.226	33.477	18.659	4.223
17.148	3.881					
	80.379	0.209	0.260	36.602	19.119	4.968
16.809	4.367					
	80.587	0.171	0.213	36.602	18.916	4.027
16.618	3.537					
	80.758	0.209	0.272	39.870	19.008	5.166
15.881	4.316					
	80.967	0.148	0.193	39.870	18.659	3.601
15.453	2.982					
	81.115	0.209	0.284	42.772	18.359	5.217
14.686	4.173					
	81.323	0.007	0.009	42.772	18.056	0.162
14.500	0.130					
	81.330	0.176	0.239	42.772	17.775	4.251
14.588	3.488					
	81.506	0.209	0.301	46.196	17.002	5.123
13.877	4.182					
	81.714	0.198	0.287	46.196	16.150	4.631
13.635	3.910					
	81.913	0.209	0.316	48.667	15.036	4.749
13.146	4.152					
	82.121	0.209	0.316	48.667	13.989	4.418

12.024	3.798					
82.330	0.064	0.097	48.667	13.305	1.294	
11.005	1.070					
82.394	0.146	0.230	50.566	12.553	2.885	
10.824	2.488					
82.540	0.209	0.328	50.566	11.547	3.792	
10.837	3.559					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 dl(m) : lunghezza base concio  
 alpha(°) : Angolo pendenza base concio  
 TauStress(kPa) : Sforzo di taglio su base concio  
 TauF (kN/m) : Forza di taglio su base concio  
 TauStrength(kPa) : Resistenza al taglio su base concio  
 TauS (kN/m) : Forza resistente al taglio su base concio

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Strato 1 -- Parametri di resistenza al taglio equivalenti dell'ammasso  
 roccioso  
 stimati secondo criterio di rottura non lineare Hoek et  
 al.(2002)  
 CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et  
 al.(2016)  
 Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

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SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	137.42	58.47	69.19
50.00	186.72	55.52	76.58
75.00	229.23	53.43	82.28
100.00	269.97	51.71	89.32
125.00	307.76	50.29	95.71
150.00	344.72	49.03	103.03
175.00	380.39	47.92	110.48
200.00	414.33	46.95	117.39
225.00	446.12	46.09	123.16
250.00	479.13	45.26	131.05
275.00	509.50	44.53	137.06
300.00	540.87	43.82	144.79
325.00	569.14	43.21	149.99
350.00	598.21	42.61	156.59
375.00	628.07	42.02	164.54
400.00	654.32	41.52	169.27
425.00	685.72	40.95	179.76
450.00	708.67	40.55	181.95
475.00	736.79	40.07	189.88
500.00	760.71	39.67	193.83
600.00	866.21	38.06	223.16
700.00	957.87	36.80	242.59
800.00	1049.54	35.65	265.80

900.00	1140.54	34.60	291.52
1000.00	1223.57	33.71	311.63
1100.00	1303.83	32.91	331.24
1200.00	1387.74	32.12	356.93
1300.00	1460.58	31.47	372.79
1400.00	1536.19	30.83	393.39
1500.00	1614.69	30.20	418.74
2000.00	1960.39	27.76	515.66

Strato 2 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso

stimati secondo criterio di rottura non lineare Hoek et

al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

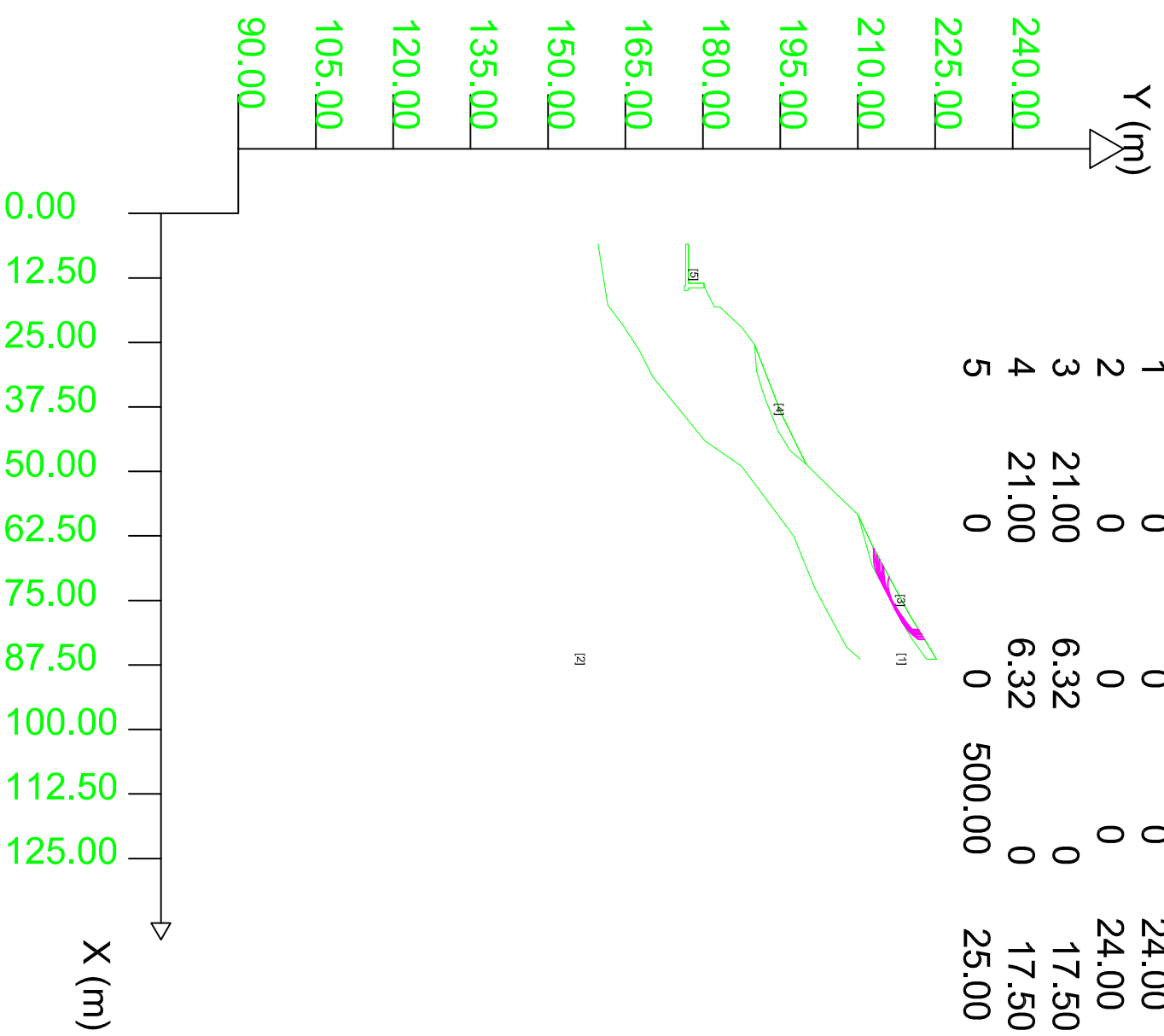
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SigmaN'(kPa)	TauSrength(kPa)	Phi '(deg)	c' (kPa)
25.00	696.24	60.38	513.03
50.00	756.64	59.62	520.01
75.00	806.42	59.04	520.13
100.00	857.50	58.47	523.03
125.00	909.85	57.91	528.58
150.00	949.97	57.49	524.59
175.00	1004.57	56.95	534.68
200.00	1046.36	56.55	534.32
225.00	1103.20	56.03	548.62
250.00	1146.67	55.64	551.63
275.00	1190.86	55.26	556.09
300.00	1235.77	54.89	561.97
325.00	1281.40	54.52	569.22
350.00	1327.76	54.15	577.81
375.00	1359.06	53.91	572.83
400.00	1406.61	53.55	583.74
425.00	1454.89	53.20	595.90
450.00	1487.48	52.96	593.65
475.00	1536.97	52.61	607.98
500.00	1570.37	52.38	607.39
600.00	1724.68	51.37	628.85
700.00	1885.62	50.39	662.51
800.00	2034.30	49.55	689.13
900.00	2188.33	48.73	725.29
1000.00	2327.55	48.02	750.56
1100.00	2450.22	47.43	762.64
1200.00	2597.27	46.75	801.99
1300.00	2726.73	46.18	826.48
1400.00	2859.39	45.62	856.64
1500.00	2972.41	45.17	869.25
2000.00	3572.08	42.95	995.66

**Data :** 18/04/2019  
**Localita' :** Loc. Cepparello  
**Descrizione :** Sez.2 - Stato di progetto  
**[n] = N. strato o lente**

# Parametri Geotecnici degli strati # -----

N.	phi'	C'	Cu	Gamm	GammSat	sgci	GSI	mi	D
deg	kPa	kPa	kN/m3	kN/m3	MPa	..	..	..	..
1	0	0	0	24.00	24.50	50.00	50.00	17.00	1.00
2	0	0	0	24.00	24.50	100.00	65.00	17.00	1.00
3	21.00	6.32	0	17.50	18.50	0	0	0	0
4	21.00	6.32	0	17.50	18.50	0	0	0	0
5	0	0	500.00	25.00	25.00	0	0	0	0



**DATI 10 SUP. CON MINOR Fs**

Fs minimo : 1.2036  
 Range Fs : 1.2036 1.2276  
 Differenza % Range Fs : 1.95  
 Coefficiente Sismico orizzontale - Kh: 0.0510

**GENERAZIONE SUPERFICI RANDOM**

Campione Superfici - N.: 20000  
 Lunghezza media segmenti (m) : 1.0  
 Range X inizio generazione : 7.6 - 80.0  
 Range X termine generazione : 15.6 - 84.8  
 Livello Y minimo considerato : 100.7

# Report elaborazioni #

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SSAP 4.9.9 - Slope Stability Analysis Program (1991,2018)

WWW.SSAP.EU

Build No. 10784

BY

Dr. Geol. LORENZO BORSELLI \*,\*\*

\*UASLP, San Luis Potosi, Mexico

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\*\* Gia' Ricercatore CNR-IRPI fino a Luglio 2011

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Ultima Revisione struttura tabelle del report: 29 dicembre 2018  
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File report: C:\SSAP2010\Verifiche\Risultati\Sez2\_Stato\_Progetto.txt

Data: 18/4/2019

Localita' :

Descrizione:

Modello pendio: Sez2-stato\_progetto\_V1.mod

----- PARAMETRI DEL MODELLO DEL PENDIO -----

\_\_\_ PARAMETRI GEOMETRICI - Coordinate X Y (in m) \_\_\_

SUP T.		SUP 2		SUP 3		SUP 4	
X	Y	X	Y	X	Y	X	Y
5.97	177.20	5.97	159.69	58.33	210.00	25.46	190.00
13.53	177.20	17.84	161.61	68.23	212.76	30.46	190.39
13.53	180.20	21.41	164.37	74.05	215.92	34.10	191.44
14.09	180.20	26.71	167.79	78.60	218.24	36.24	192.19
15.02	180.67	31.70	170.25	82.54	220.54	39.38	193.43
18.13	182.21	44.12	180.45	86.39	223.36	42.27	194.62
18.19	183.34	49.00	187.46	86.39	225.26	46.00	196.96
22.18	187.57	62.41	197.51	77.76	220.00	48.61	200.00
25.46	190.00	72.77	201.78	64.40	212.81	38.81	195.22
38.81	195.22	84.05	207.87	58.33	210.00	25.46	190.00
48.61	200.00	86.39	210.50	-	-	-	-
54.08	205.53	-	-	-	-	-	-
58.33	210.00	-	-	-	-	-	-
64.40	212.81	-	-	-	-	-	-
77.76	220.00	-	-	-	-	-	-
81.33	222.22	-	-	-	-	-	-
86.39	225.26	-	-	-	-	-	-
SUP 5		SUP 6		SUP 7		SUP 8	
X	Y	X	Y	X	Y	X	Y
13.53	180.20	-	-	-	-	-	-

14.43	180.20	-	-	-	-	-	-
14.43	177.20	-	-	-	-	-	-
14.93	177.20	-	-	-	-	-	-
14.93	176.40	-	-	-	-	-	-
14.03	176.40	-	-	-	-	-	-
14.03	176.70	-	-	-	-	-	-
5.97	176.70	-	-	-	-	-	-
5.97	177.20	-	-	-	-	-	-
13.53	177.20	-	-	-	-	-	-
13.53	180.20	-	-	-	-	-	-

## ASSENZA DI FALDA ##

----- PARAMETRI GEOMECCANICI -----

STR_IDX	sgci	fi` GSI	mi	C` D	Cu	Gamm	Gamm_sat
STRATO 1	1	0.00		0.00	0.00	24.00	24.50
8.587	50.00	50.00	17.00	1.00			
STRATO 2	2	0.00		0.00	0.00	24.00	24.50
12.882	100.00	65.00	17.00	1.00			
STRATO 3	3	21.00		6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00			
STRATO 4	4	21.00		6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00			
STRATO 5	5	0.00		0.00	500.00	25.00	25.00
1000.000	0.00	0.00	0.00	0.00			

LEGENDA: fi` \_\_\_\_\_ Angolo di attrito interno efficace(in gradi)  
C` \_\_\_\_\_ Coesione efficace (in Kpa)  
Cu \_\_\_\_\_ Resistenza al taglio Non drenata (in Kpa)  
Gamm \_\_\_\_\_ Peso di volume terreno fuori falda (in KN/m^3)  
Gamm\_sat \_\_\_\_\_ Peso di volume terreno immerso (in KN/m^3)  
STR\_IDX \_\_\_\_\_ Indice di resistenza (usato in solo in 'SNIFF SEARCH)

(adimensionale)

---- SOLO Per AMMASSI ROCCIOSI FRATTURATI - Parametri Criterio di Rottura di Hoek (2002)-

sigci \_\_\_\_\_ Resistenza Compressione Uniassiale Roccia Intatta (in MPa)

GSI \_\_\_\_\_ Geological Strenght Index ammasso(adimensionale)

mi \_\_\_\_\_ Indice litologico ammasso(adimensionale)

D \_\_\_\_\_ Fattore di disturbo ammasso(adimensionale)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 -

ATTIVATO (solo per ROCCE)

Uso CRITERIO DI ROTTURA Hoek et al.(2002,2006) - non-lineare - Generalizzato secondo Lei et al.(2016)

----- INFORMAZIONI GENERAZIONE SUPERFICI RANDOM -----

\*\*\* PARAMETRI PER LA GENERAZIONE DELLE SUPERFICI

METODO DI RICERCA: CONVEX RANDOM - Chen (1992)

FILTRAGGIO SUPERFICI : ATTIVATO

COORDINATE X1,X2,Y OSTACOLO : 0.00 0.00 0.00

LUNGHEZZA MEDIA SEGMENTI (m): 1.0 (+/-) 50%

INTERVALLO ASCISSE RANDOM STARTING POINT (Xmin .. Xmax): 7.58

79.96

LIVELLO MINIMO CONSIDERATO (Ymin): 100.68  
 INTERVALLO ASCISSE AMMESSO PER LA TERMINAZIONE (Xmin .. Xmax): 15.62  
 84.78

\*\*\* TOTALE SUPERFICI GENERATE : 20000

----- INFORMAZIONI PARAMETRI DI CALCOLO -----

METODO DI CALCOLO : BORSELLI (Borselli, 2016)  
 COEFFICIENTE SISMICO UTILIZZATO Kh : 0.0510  
 COEFFICIENTE SISMICO UTILIZZATO Kv (assunto Positivo): 0.0255  
 COEFFICIENTE  $c=Kv/Kh$  UTILIZZATO : 0.5000  
 FORZA ORIZZONTALE ADDIZIONALE IN TESTA (kN/m): 0.00  
 FORZA ORIZZONTALE ADDIZIONALE ALLA BASE (kN/m): 0.00

N.B. Le forze orizzontali addizionali in testa e alla base sono poste uguali a 0

durante le tutte le verifiche globali.

I valori >0 impostati dall'utente sono utilizzati solo in caso di verifica singola

----- RISULTATO FINALE ELABORAZIONI -----

\* DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR  $F_s$  \*

Fattore di sicurezza (FS)	1.2036	- Min. -	X	Y	Lambda=
0.3713			65.92	213.63	
			67.54	213.64	
			68.30	213.66	
			68.80	213.71	
			69.22	213.77	
			69.63	213.87	
			70.01	213.98	
			70.42	214.13	
			70.85	214.31	
			71.36	214.55	
			71.83	214.78	
			72.28	215.00	
			72.72	215.22	
			73.15	215.44	
			73.58	215.67	
			74.01	215.90	
			74.45	216.15	
			74.90	216.40	
			75.35	216.66	
			75.79	216.92	
			76.22	217.17	
			76.66	217.43	
			77.10	217.70	
			77.55	217.97	
			78.01	218.25	
			78.50	218.55	
			78.93	218.84	

79.34	219.15
79.73	219.47
80.16	219.84
80.60	220.28
81.04	220.74
81.04	222.04

Fattore di sicurezza (FS) 1.2074 - N.2 -- X Y Lambda=  
0.3771

66.97	214.19
68.28	214.23
68.90	214.26
69.32	214.29
69.68	214.34
70.03	214.41
70.35	214.49
70.69	214.60
71.05	214.72
71.46	214.88
71.84	215.03
72.20	215.17
72.56	215.32
72.92	215.47
73.27	215.63
73.63	215.79
74.00	215.96
74.37	216.13
74.74	216.31
75.09	216.48
75.45	216.66
75.80	216.85
76.16	217.04
76.52	217.23
76.89	217.44
77.29	217.66
77.64	217.88
77.99	218.10
78.33	218.33
78.69	218.58
79.03	218.83
79.38	219.11
79.74	219.41
80.14	219.75
80.51	220.07
80.87	220.40
81.22	220.73
81.55	221.05
81.55	222.35

Fattore di sicurezza (FS) 1.2120 - N.3 -- X Y Lambda=  
0.3770

64.96	213.11
-------	--------



66.45	213.10
67.14	213.12
67.61	213.15
68.00	213.20
68.38	213.29
68.73	213.38
69.10	213.51
69.50	213.67
69.98	213.88
70.41	214.07
70.82	214.27
71.22	214.46
71.62	214.66
72.01	214.86
72.41	215.07
72.82	215.29
73.24	215.52
73.65	215.76
74.05	215.99
74.45	216.22
74.85	216.46
75.25	216.70
75.65	216.95
76.06	217.21
76.48	217.47
76.88	217.74
77.28	218.00
77.68	218.27
78.08	218.55
78.47	218.84
78.87	219.13
79.29	219.44
79.72	219.77
80.12	220.09
80.52	220.41
80.75	220.61
80.75	221.86

Fattore di sicurezza (FS)    1.2202   - N.4   --    X            Y            Lambda=  
0.3722

68.41	214.97
69.78	215.06
70.45	215.11
70.91	215.16
71.30	215.22
71.67	215.30
72.03	215.38
72.40	215.49
72.79	215.61
73.22	215.75
73.62	215.90
74.01	216.04
74.38	216.19

74.76	216.35
75.13	216.51
75.51	216.69
75.90	216.88
76.32	217.09
76.71	217.29
77.09	217.50
77.46	217.71
77.84	217.93
78.21	218.16
78.60	218.40
79.01	218.67
79.45	218.96
79.83	219.24
80.20	219.53
80.54	219.84
80.91	220.20
81.30	220.62
81.76	221.15
81.96	221.39
81.96	222.60

Fattore di sicurezza (FS)    1.2204   - N.5   --    X            Y            Lambda=  
0.3707

70.42	216.05
71.22	215.92
71.60	215.86
71.85	215.84
72.06	215.83
72.26	215.84
72.45	215.86
72.65	215.90
72.86	215.94
73.11	216.01
73.35	216.07
73.57	216.13
73.79	216.19
74.01	216.26
74.23	216.32
74.45	216.38
74.67	216.45
74.90	216.52
75.12	216.59
75.33	216.67
75.53	216.74
75.75	216.83
75.95	216.92
76.16	217.01
76.38	217.12
76.61	217.23
76.84	217.35
77.06	217.46
77.27	217.57

77.49	217.68
77.70	217.80
77.92	217.92
78.14	218.04
78.37	218.16
78.59	218.28
78.80	218.41
79.01	218.53
79.23	218.67
79.44	218.80
79.66	218.94
79.89	219.09
80.13	219.26
80.35	219.41
80.55	219.57
80.75	219.74
80.96	219.93
81.16	220.13
81.37	220.34
81.59	220.58
81.83	220.85
82.06	221.12
82.27	221.38
82.49	221.64
82.54	221.70
82.54	222.95

Fattore di sicurezza (FS)      1.2210 - N.6 --      X      Y      Lambda=  
0.3696

66.17	213.76
67.71	213.76
68.43	213.78
68.92	213.82
69.32	213.87
69.71	213.97
70.07	214.07
70.46	214.21
70.87	214.38
71.36	214.61
71.81	214.82
72.24	215.02
72.66	215.23
73.07	215.44
73.48	215.65
73.90	215.87
74.32	216.10
74.75	216.34
75.17	216.58
75.59	216.82
76.00	217.06
76.42	217.31
76.84	217.56
77.26	217.82

77.71	218.10
78.18	218.39
78.59	218.67
78.98	218.97
79.36	219.28
79.76	219.64
80.19	220.06
80.61	220.52
80.61	221.77

Fattore di sicurezza (FS)    1.2231   - N.7   --    X            Y            Lambda=  
0.3828

64.86	213.06
66.55	213.33
67.39	213.47
67.96	213.59
68.47	213.71
68.94	213.83
69.39	213.97
69.85	214.12
70.34	214.30
70.87	214.50
71.36	214.70
71.84	214.90
72.31	215.11
72.78	215.32
73.24	215.55
73.72	215.79
74.20	216.04
74.72	216.32
75.21	216.60
75.68	216.87
76.15	217.15
76.62	217.45
77.09	217.76
77.56	218.08
78.05	218.42
78.58	218.80
79.06	219.16
79.53	219.53
79.99	219.90
80.46	220.31
80.92	220.73
80.92	221.97

Fattore di sicurezza (FS)    1.2235   - N.8   --    X            Y            Lambda=  
0.3684

66.96	214.19
68.32	214.01
68.93	213.95
69.33	213.95
69.64	213.97

69.97	214.04
70.25	214.12
70.56	214.24
70.91	214.40
71.33	214.63
71.73	214.84
72.11	215.03
72.48	215.23
72.83	215.41
73.19	215.60
73.55	215.79
73.91	215.98
74.27	216.17
74.62	216.36
74.97	216.55
75.33	216.74
75.68	216.94
76.03	217.14
76.39	217.35
76.75	217.56
77.12	217.78
77.48	218.00
77.83	218.22
78.17	218.44
78.53	218.67
78.88	218.91
79.23	219.16
79.60	219.43
79.99	219.71
80.35	219.99
80.69	220.27
81.02	220.57
81.37	220.89
81.59	221.11
81.59	222.37

Fattore di sicurezza (FS)    1.2257   - N.9 --    X            Y            Lambda=  
0.3724

67.87	214.68
69.05	214.77
69.64	214.82
70.05	214.86
70.41	214.91
70.74	214.97
71.06	215.03
71.39	215.10
71.74	215.19
72.13	215.29
72.47	215.39
72.80	215.49
73.11	215.61
73.44	215.74
73.75	215.88

74.07	216.04
74.41	216.21
74.77	216.41
75.13	216.61
75.47	216.80
75.81	216.99
76.15	217.18
76.49	217.37
76.82	217.57
77.17	217.77
77.51	217.97
77.85	218.17
78.18	218.37
78.52	218.58
78.85	218.79
79.19	219.00
79.53	219.23
79.89	219.46
80.27	219.72
80.60	219.96
80.92	220.21
81.22	220.48
81.55	220.79
81.89	221.16
82.10	221.40
82.10	222.68

Fattore di sicurezza (FS)      1.2276   - N.10   --      X            Y            Lambda=  
0.3744

68.33	214.93
69.19	214.73
69.58	214.65
69.83	214.62
70.03	214.60
70.24	214.61
70.43	214.64
70.63	214.68
70.85	214.74
71.12	214.83
71.37	214.92
71.61	215.00
71.83	215.08
72.06	215.16
72.28	215.25
72.50	215.33
72.73	215.42
72.97	215.51
73.19	215.61
73.42	215.70
73.64	215.80
73.86	215.89
74.09	215.99
74.31	216.10

74.54	216.20
74.77	216.31
75.00	216.42
75.22	216.53
75.45	216.65
75.67	216.76
75.89	216.88
76.12	217.00
76.35	217.13
76.59	217.26
76.81	217.39
77.03	217.52
77.25	217.66
77.47	217.80
77.69	217.95
77.91	218.10
78.14	218.27
78.38	218.44
78.61	218.62
78.83	218.79
79.06	218.96
79.28	219.14
79.50	219.32
79.73	219.50
79.95	219.68
80.19	219.88
80.41	220.07
80.64	220.26
80.86	220.46
81.09	220.65
81.31	220.85
81.33	220.87
81.33	222.22

----- ANALISI DEFICIT DI RESISTENZA -----

# DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR  $F_s$  \*

# Analisi Deficit in riferimento a  $F_s(\text{progetto}) = 1.200$

Sup N.	$F_s$	FTR(kN/m)	FTA(kN/m)	Bilancio(kN/m)	ESITO
1	1.204	270.2	224.5	0.8	Surplus
2	1.207	255.8	211.8	1.6	Surplus
3	1.212	274.6	226.6	2.7	Surplus
4	1.220	239.6	196.3	4.0	Surplus
5	1.220	225.3	184.6	3.8	Surplus
6	1.221	255.4	209.2	4.4	Surplus
7	1.223	268.0	219.1	5.1	Surplus
8	1.223	261.0	213.3	5.0	Surplus
9	1.226	244.0	199.1	5.1	Surplus
10	1.228	234.8	191.3	5.3	Surplus

Esito analisi: SURPLUS di RESISTENZA!

Valore minimo di SURPLUS di RESISTENZA (kN/m): 0.8

Note: FTR --> Forza totale Resistente lungo la superficie di scivolamento  
 FTA --> Forza totale Agente lungo la superficie di scivolamento

IMPORTANTE! : Il Deficit o il Surplus di resistenza viene espresso in kN per metro di LARGHEZZA rispetto al fronte della scarpata

TABELLA PARAMETRI CONCI DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

phi'	X	dx	alpha	W	ru	U
(°)	(m) (c',Cu) (kPa)	(m)	(°)	(kN/m)	(-)	(kPa)
21.00	65.923 6.32	0.218	0.37	0.23	0.00	0.00
21.00	66.141 6.32	0.218	0.37	0.68	0.00	0.00
21.00	66.359 6.32	0.218	0.37	1.14	0.00	0.00
21.00	66.577 6.32	0.218	0.37	1.59	0.00	0.00
21.00	66.796 6.32	0.218	0.37	2.04	0.00	0.00
21.00	67.014 6.32	0.218	0.37	2.50	0.00	0.00
21.00	67.232 6.32	0.218	0.37	2.95	0.00	0.00
21.00	67.450 6.32	0.090	0.37	1.35	0.00	0.00
21.00	67.540 6.32	0.218	1.79	3.58	0.00	0.00
21.00	67.758 6.32	0.218	1.79	4.02	0.00	0.00
21.00	67.976 6.32	0.218	1.79	4.45	0.00	0.00
21.00	68.195 6.32	0.035	1.79	0.76	0.00	0.00
21.00	68.230 6.32	0.065	1.79	1.44	0.00	0.00
21.00	68.295 6.32	0.218	4.91	5.06	0.00	0.00
21.00	68.514 6.32	0.218	4.91	5.44	0.00	0.00
21.00	68.732 6.32	0.069	4.91	1.81	0.00	0.00
21.00	68.801 6.32	0.218	8.72	5.92	0.00	0.00
21.00	69.019 6.32	0.199	8.72	5.70	0.00	0.00



21.00	69.218	0.218	13.27	6.52	0.00	0.00
	6.32					
21.00	69.437	0.198	13.27	6.13	0.00	0.00
	6.32					
21.00	69.634	0.218	16.72	6.98	0.00	0.00
	6.32					
21.00	69.852	0.159	16.72	5.22	0.00	0.00
	6.32					
21.00	70.011	0.218	20.09	7.31	0.00	0.00
	6.32					
21.00	70.230	0.188	20.09	6.41	0.00	0.00
	6.32					
21.00	70.417	0.218	22.86	7.56	0.00	0.00
	6.32					
21.00	70.636	0.215	22.86	7.55	0.00	0.00
	6.32					
21.00	70.851	0.218	24.94	7.73	0.00	0.00
	6.32					
21.00	71.069	0.011	24.94	0.40	0.00	0.00
	6.32					
21.00	71.080	0.218	24.94	7.80	0.00	0.00
	6.32					
21.00	71.298	0.063	24.94	2.26	0.00	0.00
	6.32					
21.00	71.361	0.218	25.49	7.88	0.00	0.00
	6.32					
21.00	71.579	0.218	25.49	7.93	0.00	0.00
	6.32					
21.00	71.797	0.035	25.49	1.29	0.00	0.00
	6.32					
21.00	71.832	0.218	26.09	7.98	0.00	0.00
	6.32					
21.00	72.051	0.218	26.09	8.02	0.00	0.00
	6.32					
21.00	72.269	0.013	26.09	0.47	0.00	0.00
	6.32					
21.00	72.282	0.218	26.72	8.06	0.00	0.00
	6.32					
21.00	72.500	0.218	26.72	8.09	0.00	0.00
	6.32					
21.00	72.718	0.052	27.36	1.94	0.00	0.00
	6.32					
21.00	72.770	0.218	27.36	8.12	0.00	0.00
	6.32					
21.00	72.988	0.163	27.36	6.09	0.00	0.00
	6.32					
21.00	73.151	0.218	27.96	8.15	0.00	0.00
	6.32					
21.00	73.370	0.210	27.96	7.86	0.00	0.00
	6.32					
21.00	73.580	0.218	28.55	8.15	0.00	0.00
	6.32					
21.00	73.798	0.215	28.55	8.02	0.00	0.00
	6.32					

	74.013	0.037	29.13	1.39	0.00	0.00
21.00	6.32					
	74.050	0.218	29.13	8.13	0.00	0.00
21.00	6.32					
	74.268	0.183	29.13	6.82	0.00	0.00
21.00	6.32					
	74.451	0.218	29.67	8.10	0.00	0.00
21.00	6.32					
	74.669	0.218	29.67	8.07	0.00	0.00
21.00	6.32					
	74.888	0.016	29.67	0.60	0.00	0.00
21.00	6.32					
	74.904	0.218	29.92	8.04	0.00	0.00
21.00	6.32					
	75.122	0.218	29.92	8.01	0.00	0.00
21.00	6.32					
	75.340	0.008	29.92	0.29	0.00	0.00
21.00	6.32					
	75.348	0.218	30.18	7.97	0.00	0.00
21.00	6.32					
	75.566	0.218	30.18	7.94	0.00	0.00
21.00	6.32					
	75.784	0.002	30.18	0.09	0.00	0.00
21.00	6.32					
	75.787	0.218	30.44	7.90	0.00	0.00
21.00	6.32					
	76.005	0.218	30.44	7.85	0.00	0.00
21.00	6.32					
	76.223	0.218	30.70	7.81	0.00	0.00
21.00	6.32					
	76.441	0.218	30.70	7.74	0.00	0.00
21.00	6.32					
	76.659	0.218	30.97	7.71	0.00	0.00
21.00	6.32					
	76.877	0.218	30.97	7.66	0.00	0.00
21.00	6.32					
	77.095	0.005	30.97	0.16	0.00	0.00
21.00	6.32					
	77.099	0.218	31.23	7.60	0.00	0.00
21.00	6.32					
	77.318	0.218	31.23	7.54	0.00	0.00
21.00	6.32					
	77.536	0.012	31.23	0.40	0.00	0.00
21.00	6.32					
	77.547	0.213	31.48	7.29	0.00	0.00
21.00	6.32					
	77.760	0.218	31.48	7.46	0.00	0.00
21.00	6.32					
	77.978	0.033	31.48	1.14	0.00	0.00
21.00	6.32					
	78.011	0.218	31.72	7.47	0.00	0.00
21.00	6.32					
	78.229	0.218	31.72	7.47	0.00	0.00
21.00	6.32					

21.00	78.448	0.052	31.72	1.80	0.00	0.00
	6.32					
21.00	78.500	0.100	33.96	3.42	0.00	0.00
	6.32					
21.00	78.600	0.218	33.96	7.44	0.00	0.00
	6.32					
21.00	78.818	0.110	33.96	3.72	0.00	0.00
	6.32					
21.00	78.928	0.218	36.50	7.35	0.00	0.00
	6.32					
21.00	79.146	0.194	36.50	6.46	0.00	0.00
	6.32					
21.00	79.340	0.218	39.15	7.14	0.00	0.00
	6.32					
21.00	79.558	0.174	39.15	5.58	0.00	0.00
	6.32					
21.00	79.732	0.218	41.55	6.82	0.00	0.00
	6.32					
21.00	79.950	0.205	41.55	6.20	0.00	0.00
	6.32					
21.00	80.155	0.218	44.45	6.35	0.00	0.00
	6.32					
21.00	80.373	0.218	44.45	6.04	0.00	0.00
	6.32					
21.00	80.591	0.009	44.45	0.25	0.00	0.00
	6.32					
21.00	80.600	0.218	46.60	5.70	0.00	0.00
	6.32					
21.00	80.819	0.218	46.60	5.33	0.00	0.00
	6.32					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 alpha(°) : Angolo pendenza base concio  
 W(kN/m) : Forza peso concio  
 ru(-) : Coefficiente locale pressione interstiziale  
 U(kPa) : Pressione totale dei pori base concio  
 phi'(°) : Angolo di attrito efficace base concio  
 c'/Cu (kPa) : Coesione efficace o Resistenza al taglio in condizioni non drenate

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TABELLA DIAGRAMMA DELLE FORZE DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

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T(x)	X (m)	ht E' (m)	yt rho(x) (m)	yt' FS_FEM (--)	E(x) FS_p-qFEM (kN/m)
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(kN/m)	(kN)	(--)	(--)	(--)	
65.923	0.000	213.630	0.142	0.0000000000E+000	
0.0000000000E+000	9.4518681273E+000		0.199	4.118	1.266
66.141	0.029	213.660	0.142	1.8523818948E+000	
2.3847863466E-001	7.5322131240E+000		0.199	4.118	1.266
66.359	0.059	213.691	0.150	3.2860264885E+000	
4.6650064781E-001	7.0522775759E+000		0.206	2.471	0.969
66.577	0.092	213.725	0.176	4.9290302234E+000	
8.5158954122E-001	8.5306518051E+000		0.251	1.954	0.967
66.796	0.133	213.768	0.193	7.0076349100E+000	
1.5185651575E+000	9.3472195586E+000		0.325	1.689	1.009
67.014	0.173	213.809	0.190	9.0068770072E+000	
2.2502207942E+000	9.1361169547E+000		0.380	1.558	1.052
67.232	0.213	213.851	0.213	1.0993385422E+001	
3.0138190194E+000	1.0182657596E+001		0.421	1.472	1.094
67.450	0.263	213.902	0.232	1.3449194562E+001	
4.0621627217E+000	1.0640156289E+001		0.475	1.418	1.154
67.540	0.282	213.922	0.219	1.4386897889E+001	
4.4777616320E+000	1.0296537915E+001		0.492	1.406	1.176
67.758	0.323	213.970	0.226	1.6586693260E+001	
5.4836199585E+000	1.0287553781E+001		0.528	1.386	1.225
67.976	0.367	214.021	0.226	1.8874977776E+001	
6.5695665365E+000	9.9627334886E+000		0.562	1.375	1.268
68.195	0.408	214.069	0.221	2.0933066046E+001	
7.5766815238E+000	9.7302475233E+000		0.586	1.372	1.302
68.230	0.415	214.077	0.228	2.1279016377E+001	
7.7517759264E+000	9.4932004088E+000		0.590	1.372	1.307
68.295	0.428	214.092	0.238	2.1865995957E+001	
8.0552552411E+000	9.0425376244E+000		0.597	1.373	1.313
68.514	0.462	214.144	0.249	2.3894101322E+001	
9.1411414040E+000	9.0301699255E+000		0.623	1.374	1.334
68.732	0.499	214.200	0.259	2.5805525692E+001	
1.0255372908E+001	8.5616748830E+000		0.649	1.373	1.345
68.801	0.511	214.219	0.308	2.6393370727E+001	
1.0615726900E+001	8.6334702883E+000		0.658	1.373	1.347
69.019	0.548	214.289	0.358	2.8369839609E+001	
1.1932658680E+001	9.4401455134E+000		0.693	1.366	1.347
69.218	0.597	214.368	0.394	3.0321919768E+001	
1.3340364392E+001	8.6496209605E+000		0.731	1.355	1.339
69.437	0.631	214.453	0.398	3.1937368087E+001	
1.4667415705E+001	6.8350050916E+000		0.768	1.333	1.324
69.634	0.665	214.534	0.421	3.3186035637E+001	
1.5775258826E+001	5.8054610710E+000		0.796	1.314	1.306
69.852	0.694	214.628	0.426	3.4329051804E+001	
1.6874228083E+001	4.3002902628E+000		0.825	1.290	1.287
70.011	0.712	214.695	0.460	3.4903917141E+001	
1.7481103329E+001	3.2670837834E+000		0.839	1.277	1.273
70.230	0.740	214.802	0.501	3.5512389421E+001	
1.8212954608E+001	2.2395217171E+000		0.858	1.258	1.256
70.417	0.767	214.898	0.488	3.5844161129E+001	
1.8690945988E+001	1.4108566175E+000		0.869	1.246	1.243
70.636	0.777	215.000	0.468	3.6062017650E+001	
1.9108524608E+001	6.4207946762E-001		0.880	1.232	1.231
70.851	0.787	215.101	0.481	3.6124480899E+001	

1.9370182514E+001	1.5969623556E-002	0.886	1.224	1.223
71.069	0.794 215.209	0.494	3.6067229653E+001	
1.9524013077E+001	-5.0361929120E-001	0.891	1.215	1.218
71.080	0.794 215.214	0.479	3.6061418112E+001	
1.9528282121E+001	-5.2139234820E-001	0.891	1.215	1.218
71.298	0.797 215.318	0.480	3.5925194194E+001	
1.9592690125E+001	-8.7432384218E-001	0.892	1.208	1.215
71.361	0.798 215.349	0.478	3.5865740271E+001	
1.9597993005E+001	-9.6484727732E-001	0.892	1.207	1.215
71.579	0.798 215.453	0.482	3.5641215633E+001	
1.9591583137E+001	-1.1283550143E+000	0.892	1.201	1.214
71.797	0.800 215.559	0.498	3.5373480638E+001	
1.9549877478E+001	-1.4797204792E+000	0.891	1.195	1.213
71.832	0.803 215.579	0.540	3.5319846631E+001	
1.9538450923E+001	-1.5260377031E+000	0.890	1.194	1.213
72.051	0.814 215.696	0.524	3.4979529690E+001	
1.9452681779E+001	-1.6051376771E+000	0.889	1.190	1.214
72.269	0.818 215.808	0.510	3.4619584326E+001	
1.9345593799E+001	-1.6857193786E+000	0.886	1.186	1.214
72.282	0.818 215.814	0.472	3.4597954562E+001	
1.9338971761E+001	-1.6888596902E+000	0.886	1.186	1.214
72.500	0.811 215.917	0.479	3.4225664655E+001	
1.9216867096E+001	-1.8083821733E+000	0.883	1.184	1.215
72.718	0.808 216.023	0.488	3.3809169182E+001	
1.9068723701E+001	-1.9520241334E+000	0.880	1.181	1.216
72.770	0.806 216.049	0.489	3.3706682384E+001	
1.9031288227E+001	-1.9914632513E+000	0.880	1.180	1.216
72.988	0.800 216.155	0.536	3.3245522869E+001	
1.8847968216E+001	-2.4817381835E+000	0.876	1.176	1.216
73.151	0.813 216.253	0.604	3.2795319091E+001	
1.8643698294E+001	-2.8294460762E+000	0.872	1.172	1.217
73.370	0.830 216.386	0.577	3.2156999656E+001	
1.8331346657E+001	-2.9350903610E+000	0.865	1.165	1.217
73.580	0.833 216.500	0.544	3.1537894798E+001	
1.8001352939E+001	-2.9907255583E+000	0.857	1.159	1.218
73.798	0.833 216.619	0.542	3.0874853349E+001	
1.7630555788E+001	-3.0172436990E+000	0.848	1.154	1.218
74.013	0.832 216.735	0.543	3.0231643878E+001	
1.7248242185E+001	-2.8079175833E+000	0.839	1.150	1.219
74.050	0.832 216.755	0.550	3.0128301636E+001	
1.7185818041E+001	-2.8082987528E+000	0.837	1.150	1.219
74.268	0.830 216.875	0.550	2.9473741218E+001	
1.6785816470E+001	-3.2168238850E+000	0.827	1.148	1.220
74.451	0.829 216.976	0.554	2.8851121696E+001	
1.6398670412E+001	-3.4057990091E+000	0.817	1.147	1.222
74.669	0.826 217.097	0.557	2.8106262527E+001	
1.5934162542E+001	-3.4687556900E+000	0.804	1.148	1.225
74.888	0.823 217.219	0.557	2.7337831659E+001	
1.5461721324E+001	-3.4625733237E+000	0.792	1.149	1.228
74.904	0.823 217.228	0.560	2.7282058812E+001	
1.5427969454E+001	-3.4601275871E+000	0.791	1.149	1.229
75.122	0.820 217.350	0.552	2.6521376897E+001	
1.4975385009E+001	-3.2807413020E+000	0.779	1.152	1.233
75.340	0.813 217.469	0.540	2.5850792511E+001	

1.4591809638E+001	-2.7916079753E+000	0.769	1.155	1.236
75.348	0.812 217.472	0.471	2.5828822048E+001	
1.4579593809E+001	-2.7900830588E+000	0.769	1.155	1.236
75.566	0.788 217.576	0.488	2.5167755801E+001	
1.4217739183E+001	-3.1261814046E+000	0.760	1.157	1.239
75.784	0.771 217.685	0.502	2.4464984523E+001	
1.3833581796E+001	-3.1277681601E+000	0.751	1.158	1.241
75.787	0.771 217.686	0.526	2.4457452918E+001	
1.3829439863E+001	-3.1292772268E+000	0.751	1.158	1.241
76.005	0.757 217.801	0.575	2.3724543410E+001	
1.3416869237E+001	-3.6553606640E+000	0.740	1.157	1.240
76.223	0.765 217.937	0.649	2.2862870198E+001	
1.2902620695E+001	-4.1023621241E+000	0.725	1.153	1.236
76.441	0.783 218.084	0.652	2.1934938225E+001	
1.2322722724E+001	-4.2501828152E+000	0.707	1.146	1.227
76.659	0.791 218.221	0.603	2.1011064277E+001	
1.1732018194E+001	-4.1121712931E+000	0.687	1.138	1.217
76.877	0.785 218.347	0.575	2.0143419647E+001	
1.1183386475E+001	-3.6632087175E+000	0.668	1.132	1.207
77.095	0.780 218.472	0.575	1.9412941563E+001	
1.0735906410E+001	-3.1790321697E+000	0.653	1.127	1.199
77.099	0.780 218.475	0.575	1.9398335120E+001	
1.0727197489E+001	-3.1768076826E+000	0.653	1.127	1.199
77.318	0.773 218.600	0.544	1.8691352867E+001	
1.0313526003E+001	-3.2189290489E+000	0.640	1.123	1.191
77.536	0.753 218.712	0.515	1.7994035222E+001	
9.9145506329E+000	-3.3633465869E+000	0.627	1.120	1.183
77.547	0.752 218.719	0.586	1.7954653420E+001	
9.8920985573E+000	-3.3854380061E+000	0.626	1.120	1.183
77.760	0.747 218.844	0.601	1.7183577341E+001	
9.4520132865E+000	-3.7068793304E+000	0.611	1.115	1.173
77.978	0.747 218.978	0.614	1.6356754216E+001	
8.9825482397E+000	-3.8738544715E+000	0.584	1.110	1.163
78.011	0.747 218.998	0.601	1.6227594515E+001	
8.9095591291E+000	-3.8700758347E+000	0.580	1.109	1.161
78.229	0.743 219.129	0.588	1.5407005789E+001	
8.4474804762E+000	-3.7637132167E+000	0.553	1.101	1.150
78.448	0.734 219.255	0.578	1.4585625399E+001	
7.9886187103E+000	-3.7940427158E+000	0.527	1.092	1.139
78.500	0.732 219.285	0.573	1.4386276824E+001	
7.8779696095E+000	-3.8499994916E+000	0.520	1.089	1.136
78.600	0.722 219.342	0.581	1.3992216986E+001	
7.6605863979E+000	-4.0264808700E+000	0.509	1.085	1.131
78.818	0.702 219.470	0.589	1.3074424236E+001	
7.1520906507E+000	-4.3616023158E+000	0.481	1.074	1.122
78.928	0.694 219.535	0.639	1.2587926722E+001	
6.8795053766E+000	-4.6553726271E+000	0.466	1.068	1.117
79.146	0.677 219.679	0.689	1.1478512022E+001	
6.2433864978E+000	-5.4284618450E+000	0.433	1.059	1.111
79.340	0.673 219.819	0.764	1.0366134416E+001	
5.5894838942E+000	-6.0815260562E+000	0.398	1.052	1.107
79.558	0.670 219.994	0.821	8.9541149208E+000	
4.7495736333E+000	-6.6993385326E+000	0.351	1.050	1.108
79.732	0.676 220.141	0.850	7.7558113697E+000	

4.0434327135E+000	-6.9007331691E+000	0.310	1.055	1.116
79.950	0.669	220.327	0.799	6.2448441927E+000
3.1726795946E+000	-6.4447295457E+000	0.256	1.065	1.129
80.155	0.639	220.479	0.767	5.0181423981E+000
2.4740906098E+000	-6.1702998560E+000	0.209	1.081	1.147
80.373	0.597	220.652	0.742	3.6308220670E+000
1.7275625504E+000	-5.8618927519E+000	0.156	1.107	1.175
80.591	0.534	220.802	0.685	2.4608150179E+000
1.1625832243E+000	-4.2608743462E+000	0.112	1.132	1.199
80.600	0.530	220.807	0.855	2.4222392817E+000
1.1445438634E+000	-4.2858044885E+000	0.110	1.132	1.200
80.819	0.489	220.997	0.855	1.1171946420E+000
5.1171828006E-001	-5.5522445029E+000	0.053	1.183	1.251

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LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 ht(m) : Altezza linea di thrust da nodo sinistro base concio  
 yt(m) : coordinata Y linea di trust  
 yt'(-) : gradiente pendenza locale linea di trust  
 E(x)(kN/m) : Forza Normale interconcio  
 T(x)(kN/m) : Forza Tangenziale interconcio  
 E' (kN) : derivata Forza normale interconcio  
 Rho(x) (-) : fattore mobilizzazione resistenza al taglio verticale interconcio  
 ZhU et al.(2003)  
 FS\_FEM(x) (-) : fattore di sicurezza locale stimato (locale in X) by qFEM  
 FS\_SRM(x) (-) : fattore di sicurezza locale stimato (locale in X) by SRM  
 Procedure

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TABELLA SFORZI DI TAGLIO DISTRIBUITI LUNGO SUPERFICIE INDIVIDUATA CON MINOR FS

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X	dx	dI	alpha	TauStress	TauF
TauStrength (m) (kPa)	TauS (m) (kN/m)	(m)	(°)	(kPa)	(kN/m)
65.923	0.218	0.218	0.372	0.060	0.013
7.130	1.555				
66.141	0.218	0.218	0.372	0.180	0.039
7.911	1.726				
66.359	0.218	0.218	0.372	0.299	0.065
8.980	1.959				
66.577	0.218	0.218	0.372	0.419	0.091
10.265	2.239				
66.796	0.218	0.218	0.372	0.539	0.117
11.175	2.438				
67.014	0.218	0.218	0.372	0.658	0.144
12.029	2.624				
67.232	0.218	0.218	0.372	0.778	0.170

13.318	2.905					
67.450	0.090	0.090	0.372	0.862	0.078	
13.806	1.247					
67.540	0.218	0.218	1.795	1.351	0.295	
14.203	3.100					
67.758	0.218	0.218	1.795	1.514	0.330	
15.089	3.293					
67.976	0.218	0.218	1.795	1.677	0.366	
15.724	3.432					
68.195	0.035	0.035	1.795	1.772	0.063	
16.280	0.576					
68.230	0.065	0.065	1.795	1.810	0.119	
16.347	1.071					
68.295	0.218	0.219	4.913	3.152	0.690	
16.502	3.613					
68.514	0.218	0.219	4.913	3.393	0.743	
17.210	3.768					
68.732	0.069	0.069	4.913	3.551	0.247	
17.680	1.228					
68.801	0.218	0.221	8.717	5.421	1.196	
17.601	3.884					
69.019	0.199	0.202	8.717	5.709	1.152	
18.336	3.700					
69.218	0.218	0.224	13.269	8.118	1.819	
17.631	3.951					
69.437	0.198	0.203	13.269	8.424	1.711	
17.991	3.653					
69.634	0.218	0.228	16.718	10.316	2.349	
17.521	3.991					
69.852	0.159	0.166	16.718	10.575	1.756	
17.775	2.951					
70.011	0.218	0.232	20.088	12.309	2.859	
17.281	4.014					
70.230	0.188	0.200	20.088	12.540	2.509	
17.530	3.507					
70.417	0.218	0.237	22.857	13.898	3.290	
17.166	4.064					
70.636	0.215	0.233	22.857	14.080	3.286	
17.384	4.057					
70.851	0.218	0.241	24.944	15.046	3.620	
17.143	4.124					
71.069	0.011	0.012	24.944	15.110	0.188	
17.236	0.214					
71.080	0.218	0.241	24.944	15.174	3.650	
17.295	4.161					
71.298	0.063	0.069	24.944	15.252	1.057	
17.382	1.204					
71.361	0.218	0.242	25.487	15.525	3.751	
17.343	4.191					
71.579	0.218	0.242	25.487	15.628	3.776	
17.442	4.215					
71.797	0.035	0.039	25.487	15.688	0.613	
17.505	0.684					
71.832	0.218	0.243	26.090	15.962	3.877	



17.434	4.234					
	72.051	0.218	0.243	26.090	16.044	3.897
17.508	4.252					
	72.269	0.013	0.014	26.090	16.088	0.230
17.542	0.250					
	72.282	0.218	0.244	26.716	16.348	3.992
17.450	4.261					
	72.500	0.218	0.244	26.716	16.408	4.006
17.512	4.275					
	72.718	0.052	0.059	27.357	16.670	0.980
17.416	1.024					
	72.770	0.218	0.246	27.357	16.692	4.100
17.454	4.287					
	72.988	0.163	0.184	27.357	16.724	3.075
17.552	3.227					
	73.151	0.218	0.247	27.958	16.951	4.186
17.487	4.318					
	73.370	0.210	0.238	27.958	16.964	4.039
17.522	4.172					
	73.580	0.218	0.248	28.554	17.163	4.262
17.438	4.330					
	73.798	0.215	0.244	28.554	17.152	4.193
17.448	4.266					
	74.013	0.037	0.043	29.127	17.327	0.739
17.312	0.738					
	74.050	0.218	0.250	29.127	17.307	4.322
17.334	4.328					
	74.268	0.183	0.210	29.127	17.275	3.623
17.376	3.644					
	74.451	0.218	0.251	29.669	17.399	4.368
17.253	4.331					
	74.669	0.218	0.251	29.669	17.341	4.353
17.227	4.325					
	74.888	0.016	0.019	29.669	17.310	0.321
17.191	0.319					
	74.904	0.218	0.252	29.922	17.349	4.366
17.119	4.308					
	75.122	0.218	0.252	29.922	17.280	4.349
17.004	4.280					
	75.340	0.008	0.009	29.922	17.244	0.157
16.934	0.154					
	75.348	0.218	0.252	30.181	17.278	4.360
16.886	4.261					
	75.566	0.218	0.252	30.181	17.198	4.340
16.863	4.255					
	75.784	0.002	0.003	30.181	17.157	0.048
16.829	0.047					
	75.787	0.218	0.253	30.442	17.185	4.348
16.793	4.249					
	76.005	0.218	0.253	30.442	17.093	4.324
16.852	4.263					
	76.223	0.218	0.254	30.704	17.066	4.330
16.822	4.268					
	76.441	0.218	0.253	30.704	16.963	4.292

16.776	4.245					
	76.659	0.218	0.254	30.972	16.924	4.306
16.617	4.227					
	76.877	0.218	0.254	30.972	16.808	4.276
16.435	4.181					
	77.095	0.005	0.005	30.972	16.748	0.090
16.362	0.088					
	77.099	0.218	0.255	31.231	16.750	4.273
16.278	4.153					
	77.318	0.218	0.255	31.231	16.622	4.240
16.188	4.130					
	77.536	0.012	0.014	31.231	16.554	0.226
16.174	0.221					
	77.547	0.213	0.249	31.484	16.545	4.126
16.126	4.022					
	77.760	0.218	0.256	31.484	16.490	4.218
16.116	4.122					
	77.978	0.033	0.039	31.484	16.505	0.643
16.136	0.629					
	78.011	0.218	0.256	31.717	16.571	4.249
16.080	4.123					
	78.229	0.218	0.256	31.717	16.587	4.253
16.085	4.125					
	78.448	0.052	0.062	31.717	16.597	1.023
16.092	0.992					
	78.500	0.100	0.120	33.956	17.068	2.056
15.692	1.890					
	78.600	0.218	0.263	33.956	17.001	4.471
15.704	4.130					
	78.818	0.110	0.132	33.956	16.932	2.237
15.714	2.076					
	78.928	0.218	0.271	36.503	17.227	4.675
15.319	4.157					
	79.146	0.194	0.241	36.503	17.013	4.107
15.368	3.709					
	79.340	0.218	0.281	39.149	17.023	4.788
14.940	4.202					
	79.558	0.174	0.225	39.149	16.680	3.746
14.867	3.339					
	79.732	0.218	0.291	41.552	16.408	4.783
14.262	4.157					
	79.950	0.205	0.274	41.552	15.891	4.347
13.838	3.786					
	80.155	0.218	0.306	44.453	15.303	4.676
13.117	4.008					
	80.373	0.218	0.306	44.453	14.573	4.453
12.521	3.826					
	80.591	0.009	0.013	44.453	14.193	0.182
12.135	0.156					
	80.600	0.218	0.317	46.596	13.666	4.338
12.015	3.814					
	80.819	0.218	0.317	46.596	12.783	4.058
11.493	3.648					

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LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
dx(m) : Larghezza concio  
dl(m) : lunghezza base concio  
alpha(°) : Angolo pendenza base concio  
TauStress(kPa) : Sforzo di taglio su base concio  
TauF (kN/m) : Forza di taglio su base concio  
TauStrength(kPa) : Resistenza al taglio su base concio  
TauS (kN/m) : Forza resistente al taglio su base concio

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Strato 1 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso

stimati secondo criterio di rottura non lineare Hoek et

al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

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SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	137.42	58.47	69.19
50.00	186.72	55.52	76.58
75.00	229.23	53.43	82.28
100.00	269.97	51.71	89.32
125.00	307.76	50.29	95.71
150.00	344.72	49.03	103.03
175.00	380.39	47.92	110.48
200.00	414.33	46.95	117.39
225.00	446.12	46.09	123.16
250.00	479.13	45.26	131.05
275.00	509.50	44.53	137.06
300.00	540.87	43.82	144.79
325.00	569.14	43.21	149.99
350.00	598.21	42.61	156.59
375.00	628.07	42.02	164.54
400.00	654.32	41.52	169.27
425.00	685.72	40.95	179.76
450.00	708.67	40.55	181.95
475.00	736.79	40.07	189.88
500.00	760.71	39.67	193.83
600.00	866.21	38.06	223.16
700.00	957.87	36.80	242.59
800.00	1049.54	35.65	265.80
900.00	1140.54	34.60	291.52
1000.00	1223.57	33.71	311.63
1100.00	1303.83	32.91	331.24
1200.00	1387.74	32.12	356.93
1300.00	1460.58	31.47	372.79
1400.00	1536.19	30.83	393.39
1500.00	1614.69	30.20	418.74
2000.00	1960.39	27.76	515.66

Strato 2 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso

stimati secondo criterio di rottura non lineare Hoek et

al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

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SigmaN'(kPa)	TauStrength(kPa)	Phi'(deg)	c'(kPa)
25.00	696.24	60.38	513.03
50.00	756.64	59.62	520.01
75.00	806.42	59.04	520.13
100.00	857.50	58.47	523.03
125.00	909.85	57.91	528.58
150.00	949.97	57.49	524.59
175.00	1004.57	56.95	534.68
200.00	1046.36	56.55	534.32
225.00	1103.20	56.03	548.62
250.00	1146.67	55.64	551.63
275.00	1190.86	55.26	556.09
300.00	1235.77	54.89	561.97
325.00	1281.40	54.52	569.22
350.00	1327.76	54.15	577.81
375.00	1359.06	53.91	572.83
400.00	1406.61	53.55	583.74
425.00	1454.89	53.20	595.90
450.00	1487.48	52.96	593.65
475.00	1536.97	52.61	607.98
500.00	1570.37	52.38	607.39
600.00	1724.68	51.37	628.85
700.00	1885.62	50.39	662.51
800.00	2034.30	49.55	689.13
900.00	2188.33	48.73	725.29
1000.00	2327.55	48.02	750.56
1100.00	2450.22	47.43	762.64
1200.00	2597.27	46.75	801.99
1300.00	2726.73	46.18	826.48
1400.00	2859.39	45.62	856.64
1500.00	2972.41	45.17	869.25
2000.00	3572.08	42.95	995.66

Data : 18/04/2019

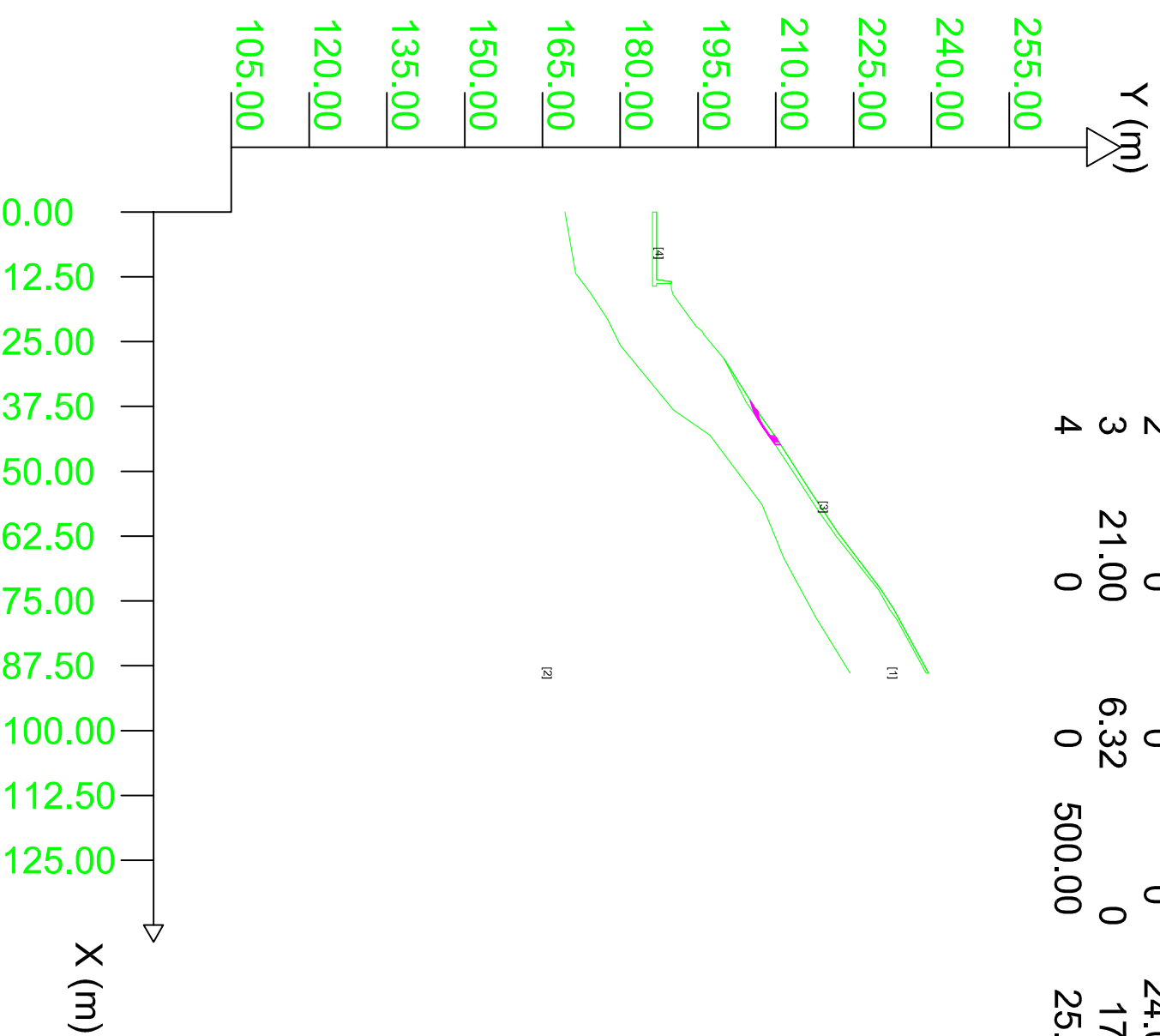
Localita' : Loc. Cepparello

Descrizione : Sez.3 - Stato attuale

[n] = N. strato o lente

# Parametri Geotecnici degli strati #

N.	phi` deg	C` kPa	Cu kPa	Gamm kN/m3	GammSat kN/m3	sgci MPa	GSI	mi	D
1	0	0	0	24.00	24.50	50.00	..	17.00	1.00
2	0	0	0	24.00	24.50	100.00	65.00	17.00	1.00
3	21.00	6.32	0	17.50	18.50	0	0	0	0
4	0	0	500.00	25.00	25.00	0	0	0	0



### DATI 10 SUP. CON MINOR Fs

Fs minimo : 1.4879  
Range Fs : 1.4879 1.5382  
Differenza % Range Fs : 3.27  
Coefficiente Sismico orizzontale - Kh: 0.0510

### GENERAZIONE SUPERFICI RANDOM

Campione Superfici - N.: 20000  
Lunghezza media segmenti (m) : 1.0  
Range X inizio generazione : 1.8 - 81.8  
Range X termine generazione : 10.7 - 87.1  
Livello Y minimo considerato : 106.2

# Report elaborazioni #

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SSAP 4.9.9 - Slope Stability Analysis Program (1991,2018)

WWW.SSAP.EU

Build No. 10784

BY

Dr. Geol. LORENZO BORSELLI \*,\*\*

\*UASLP, San Luis Potosi, Mexico

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\*\* Gia' Ricercatore CNR-IRPI fino a Luglio 2011

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Ultima Revisione struttura tabelle del report: 29 dicembre 2018  
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File report: C:\SSAP2010\Verifiche\Risultati\Sez3\_Stato\_Attuale.txt

Data: 18/4/2019

Localita' :

Descrizione:

Modello pendio: Sez3-stato\_attuale\_V1.mod

----- PARAMETRI DEL MODELLO DEL PENDIO -----

\_\_\_ PARAMETRI GEOMETRICI - Coordinate X Y (in m) \_\_\_

SUP T.		SUP 2		SUP 3		SUP 4	
X	Y	X	Y	X	Y	X	Y
0.00	187.00	0.00	169.32	28.33	200.02	13.79	189.89
13.09	187.01	11.86	171.41	36.75	204.31	13.79	187.01
13.16	188.35	15.44	174.16	44.31	209.52	14.29	187.01
13.31	188.34	20.73	177.59	50.95	213.91	14.29	186.21
13.38	189.86	25.73	180.05	56.88	217.69	0.00	186.21
13.58	189.86	38.14	190.25	62.65	221.74	0.00	187.00
13.79	189.89	43.02	197.26	65.87	224.31	13.09	187.01
13.85	189.83	56.43	207.31	69.88	227.41	13.16	188.35
14.81	189.85	66.80	211.58	72.89	229.81	13.31	188.34
15.92	190.20	78.08	217.67	76.58	231.88	13.38	189.86
17.34	191.17	88.92	224.33	78.56	233.30	13.58	189.86
22.09	194.65	-	-	88.92	238.97	13.79	189.89
23.02	195.84	-	-	88.92	239.44	-	-
23.56	196.07	-	-	76.45	232.68	-	-
28.33	200.02	-	-	72.44	230.02	-	-
37.35	205.71	-	-	61.71	221.87	-	-
43.46	210.02	-	-	53.84	216.63	-	-
53.84	216.63	-	-	43.46	210.02	-	-
61.71	221.87	-	-	37.35	205.71	-	-
72.44	230.02	-	-	28.33	200.02	-	-
76.45	232.68	-	-	-	-	-	-
88.92	239.44	-	-	-	-	-	-

## ASSENZA DI FALDA ##

----- PARAMETRI GEOMECCANICI -----

STR_IDX	sgci	fi` GSI	mi	C` D	Cu	Gamm	Gamm_sat
STRATO 1	1	0.00		0.00	0.00	24.00	24.50
8.587	50.00	50.00	17.00	1.00			
STRATO 2	2	0.00		0.00	0.00	24.00	24.50
12.882	100.00	65.00	17.00	1.00			
STRATO 3	3	21.00		6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00			
STRATO 4	4	0.00		0.00	500.00	25.00	25.00
1000.000	0.00	0.00	0.00	0.00			

LEGENDA: fi` \_\_\_\_\_ Angolo di attrito interno efficace(in gradi)  
 C` \_\_\_\_\_ Coesione efficace (in Kpa)  
 Cu \_\_\_\_\_ Resistenza al taglio Non drenata (in Kpa)  
 Gamm \_\_\_\_\_ Peso di volume terreno fuori falda (in KN/m^3)  
 Gamm\_sat \_\_\_\_\_ Peso di volume terreno immerso (in KN/m^3)  
 STR\_IDX \_\_\_\_\_ Indice di resistenza (usato in solo in 'SNIFF SEARCH)

(adimensionale)

---- SOLO Per AMMASSI ROCCIOSI FRATTURATI - Parametri Criterio di Rottura di Hoek (2002)-

sgci \_\_\_\_\_ Resistenza Compressione Uniassiale Roccia Intatta (in MPa)

GSI \_\_\_\_\_ Geological Strenght Index ammasso(adimensionale)

mi \_\_\_\_\_ Indice litologico ammasso(adimensionale)

D \_\_\_\_\_ Fattore di disturbo ammasso(adimensionale)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 -

ATTIVATO (solo per ROCCE)

Uso CRITERIO DI ROTTURA Hoek et al.(2002,2006) - non-lineare - Generalizzato secondo Lei et al.(2016)

----- INFORMAZIONI GENERAZIONE SUPERFICI RANDOM -----

\*\*\* PARAMETRI PER LA GENERAZIONE DELLE SUPERFICI

METODO DI RICERCA: CONVEX RANDOM - Chen (1992)

FILTRAGGIO SUPERFICI : ATTIVATO

COORDINATE X1,X2,Y OSTACOLO : 0.00 0.00 0.00

LUNGHEZZA MEDIA SEGMENTI (m): 1.0 (+/-) 50%

INTERVALLO ASCISSE RANDOM STARTING POINT (Xmin .. Xmax): 1.78

81.81

LIVELLO MINIMO CONSIDERATO (Ymin): 106.21

INTERVALLO ASCISSE AMMESSO PER LA TERMINAZIONE (Xmin .. Xmax): 10.67

87.14

\*\*\* TOTALE SUPERFICI GENERATE : 20000

----- INFORMAZIONI PARAMETRI DI CALCOLO -----

METODO DI CALCOLO : BORSELLI (Borselli, 2016)

COEFFICIENTE SISMICO UTILIZZATO Kh : 0.0510

COEFFICIENTE SISMICO UTILIZZATO Kv (assunto Positivo): 0.0255

COEFFICIENTE c=Kv/Kh UTILIZZATO : 0.5000

FORZA ORIZZONTALE ADDIZIONALE IN TESTA (kN/m): 0.00

FORZA ORIZZONTALE ADDIZIONALE ALLA BASE (kN/m): 0.00

N.B. Le forze orizzontali aggiuntive in testa e alla base sono poste uguali a 0

durante le tutte le verifiche globali.

I valori >0 impostati dall'utente sono utilizzati solo in caso di verifica singola

----- RISULTATO FINALE ELABORAZIONI -----

\* DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR FS \*

Fattore di sicurezza (FS) 1.4879 - Min. - X Y Lambda=  
0.4260

37.53	205.84
38.41	206.06
38.84	206.18
39.13	206.27
39.38	206.37
39.62	206.47
39.84	206.58
40.07	206.70
40.32	206.84
40.59	207.01
40.85	207.17
41.10	207.33
41.35	207.49
41.59	207.65
41.83	207.81
42.07	207.98
42.32	208.15
42.57	208.34
42.82	208.52
43.07	208.69
43.32	208.87
43.56	209.05
43.81	209.23
44.06	209.41
44.06	210.40

Fattore di sicurezza (FS) 1.5021 - N.2 -- X Y Lambda=  
0.4294

37.19	205.61
37.92	205.79
38.28	205.89
38.52	205.96
38.73	206.03
38.94	206.11
39.13	206.20
39.32	206.29
39.53	206.40
39.76	206.52
39.97	206.64
40.18	206.76



40.38	206.88
40.58	207.01
40.78	207.13
40.99	207.26
41.19	207.40
41.40	207.55
41.61	207.69
41.82	207.83
42.03	207.97
42.23	208.11
42.44	208.26
42.66	208.40
42.87	208.55
43.10	208.71
43.30	208.86
43.49	209.01
43.68	209.18
43.68	210.16

Fattore di sicurezza (FS) 1.5053 - N.3 -- X Y Lambda=  
0.4155

38.28	206.36
39.19	206.55
39.62	206.64
39.91	206.72
40.15	206.81
40.39	206.91
40.60	207.02
40.84	207.16
41.08	207.31
41.36	207.50
41.63	207.69
41.89	207.87
42.14	208.04
42.39	208.21
42.64	208.38
42.89	208.56
43.15	208.73
43.40	208.91
43.65	209.08
43.89	209.26
44.14	209.44
44.28	209.55
44.28	210.54

Fattore di sicurezza (FS) 1.5064 - N.4 -- X Y Lambda=  
0.4311

37.25	205.64
38.01	205.83
38.38	205.93
38.63	206.01
38.85	206.08

39.06	206.17
39.25	206.26
39.45	206.36
39.66	206.48
39.90	206.62
40.13	206.75
40.34	206.88
40.56	207.02
40.77	207.15
40.98	207.28
41.19	207.42
41.41	207.56
41.63	207.70
41.84	207.84
42.05	207.98
42.26	208.13
42.48	208.28
42.69	208.42
42.91	208.58
43.13	208.74
43.36	208.91
43.57	209.07
43.70	209.18
43.70	210.18

Fattore di sicurezza (FS)      1.5125   - N.5   --      X      Y      Lambda=  
0.4383

38.16	206.28
39.01	206.51
39.42	206.63
39.70	206.72
39.94	206.81
40.17	206.92
40.39	207.02
40.61	207.14
40.85	207.28
41.11	207.45
41.36	207.60
41.60	207.76
41.84	207.91
42.08	208.06
42.32	208.21
42.56	208.36
42.80	208.52
43.04	208.67
43.28	208.83
43.51	208.98
43.75	209.14
43.98	209.30
44.22	209.47
44.46	209.64
44.71	209.81
44.85	209.92

44.85 210.90

Fattore di sicurezza (FS) 1.5198 - N.6 -- X Y Lambda=  
0.4281

36.42 205.12  
37.27 205.36  
37.69 205.48  
37.98 205.58  
38.23 205.67  
38.47 205.77  
38.69 205.87  
38.92 205.98  
39.16 206.11  
39.43 206.26  
39.68 206.41  
39.92 206.55  
40.16 206.70  
40.40 206.85  
40.64 207.00  
40.87 207.16  
41.12 207.32  
41.37 207.50  
41.61 207.67  
41.85 207.84  
42.09 208.02  
42.33 208.19  
42.57 208.37  
42.82 208.55  
43.07 208.74  
43.21 208.85  
43.21 209.84

Fattore di sicurezza (FS) 1.5280 - N.7 -- X Y Lambda=  
0.4128

37.96 206.14  
38.69 206.25  
39.03 206.31  
39.25 206.36  
39.44 206.42  
39.63 206.49  
39.80 206.57  
39.99 206.66  
40.18 206.77  
40.40 206.91  
40.62 207.04  
40.82 207.17  
41.02 207.29  
41.21 207.42  
41.41 207.55  
41.60 207.68  
41.80 207.81  
42.00 207.95

42.20	208.09
42.40	208.23
42.59	208.37
42.79	208.51
42.98	208.66
43.18	208.81
43.39	208.96
43.58	209.12
43.58	210.10

Fattore di sicurezza (FS) 1.5340 - N.8 -- X Y Lambda=  
0.4318

36.86	205.40
37.94	205.74
38.47	205.91
38.83	206.05
39.13	206.18
39.43	206.32
39.70	206.47
39.99	206.64
40.29	206.83
40.62	207.04
40.94	207.26
41.25	207.47
41.56	207.67
41.86	207.88
42.16	208.09
42.46	208.30
42.76	208.51
43.07	208.73
43.37	208.95
43.68	209.17
43.68	210.16

Fattore di sicurezza (FS) 1.5344 - N.9 -- X Y Lambda=  
0.4138

38.50	206.52
39.13	206.60
39.43	206.65
39.63	206.69
39.79	206.73
39.96	206.79
40.11	206.85
40.27	206.92
40.44	207.01
40.64	207.12
40.82	207.22
41.00	207.32
41.17	207.42
41.34	207.52
41.50	207.63
41.67	207.73

41.85 207.85  
 42.02 207.96  
 42.20 208.08  
 42.37 208.19  
 42.54 208.30  
 42.71 208.42  
 42.88 208.54  
 43.06 208.66  
 43.24 208.79  
 43.44 208.92  
 43.60 209.05  
 43.76 209.18  
 43.91 209.33  
 43.91 210.31

Fattore di sicurezza (FS) 1.5382 - N.10 -- X Y Lambda=  
 0.4112

38.16 206.28  
 38.83 206.38  
 39.15 206.43  
 39.36 206.48  
 39.54 206.53  
 39.72 206.59  
 39.88 206.66  
 40.05 206.74  
 40.24 206.84  
 40.45 206.96  
 40.64 207.07  
 40.83 207.18  
 41.01 207.29  
 41.19 207.40  
 41.37 207.52  
 41.55 207.64  
 41.74 207.76  
 41.93 207.89  
 42.12 208.01  
 42.30 208.14  
 42.48 208.27  
 42.66 208.40  
 42.84 208.54  
 43.03 208.68  
 43.22 208.82  
 43.42 208.98  
 43.57 209.10  
 43.57 210.09

----- ANALISI DEFICIT DI RESISTENZA -----

# DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR Fs \*

# Analisi Deficit in riferimento a FS(progetto) = 1.200

Sup N.	FS	FTR(kN/m)	FTA(kN/m)	Bilancio(kN/m)	ESITO
1	1.488	80.7	54.3	15.6	Surplus

2	1.502	79.4	52.8	16.0	Surplus
3	1.505	75.5	50.1	15.3	Surplus
4	1.506	78.9	52.3	16.0	Surplus
5	1.513	81.5	53.9	16.8	Surplus
6	1.520	82.2	54.1	17.3	Surplus
7	1.528	70.1	45.9	15.0	Surplus
8	1.534	81.9	53.4	17.8	Surplus
9	1.534	67.7	44.1	14.8	Surplus
10	1.538	67.4	43.8	14.8	Surplus

Esito analisi: SURPLUS di RESISTENZA!

Valore minimo di SURPLUS di RESISTENZA (kN/m): 14.8

Note: FTR --> Forza totale Resistente lungo la superficie di scivolamento

FTA --> Forza totale Agente lungo la superficie di scivolamento

IMPORTANTE! : Il Deficit o il Surplus di resistenza viene espresso in kN per metro di LARGHEZZA rispetto al fronte della scarpata

TABELLA PARAMETRI CONCI DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

phi'	X	dx	alpha	W	ru	U
(°)	(m)	(m)	(°)	(kN/m)	(-)	(kPa)
	(c', Cu)					
	(kPa)					
21.00	37.528	0.145	14.39	0.09	0.00	0.00
	6.32					
21.00	37.673	0.145	14.39	0.26	0.00	0.00
	6.32					
21.00	37.819	0.145	14.39	0.43	0.00	0.00
	6.32					
21.00	37.964	0.145	14.39	0.60	0.00	0.00
	6.32					
21.00	38.109	0.031	14.39	0.15	0.00	0.00
	6.32					
21.00	38.140	0.145	14.39	0.80	0.00	0.00
	6.32					
21.00	38.285	0.127	14.39	0.84	0.00	0.00
	6.32					
21.00	38.413	0.145	15.51	1.12	0.00	0.00
	6.32					
21.00	38.558	0.145	15.51	1.28	0.00	0.00
	6.32					
21.00	38.703	0.135	15.51	1.34	0.00	0.00
	6.32					
21.00	38.838	0.145	17.79	1.58	0.00	0.00
	6.32					
21.00	38.984	0.145	17.79	1.73	0.00	0.00

21.00	6.32					
	39.129	0.001	17.79	0.01	0.00	0.00
21.00	6.32					
	39.130	0.145	20.36	1.87	0.00	0.00
21.00	6.32					
	39.275	0.103	20.36	1.40	0.00	0.00
21.00	6.32					
	39.378	0.145	23.42	2.07	0.00	0.00
21.00	6.32					
	39.524	0.093	23.42	1.38	0.00	0.00
21.00	6.32					
	39.616	0.145	25.69	2.23	0.00	0.00
21.00	6.32					
	39.762	0.078	25.69	1.24	0.00	0.00
21.00	6.32					
	39.840	0.145	27.90	2.35	0.00	0.00
21.00	6.32					
	39.985	0.089	27.90	1.48	0.00	0.00
21.00	6.32					
	40.074	0.145	29.81	2.45	0.00	0.00
21.00	6.32					
	40.220	0.100	29.81	1.71	0.00	0.00
21.00	6.32					
	40.319	0.086	31.36	1.49	0.00	0.00
21.00	6.32					
	40.405	0.145	31.36	2.55	0.00	0.00
21.00	6.32					
	40.550	0.044	31.36	0.78	0.00	0.00
21.00	6.32					
	40.594	0.145	31.89	2.60	0.00	0.00
21.00	6.32					
	40.740	0.113	31.89	2.05	0.00	0.00
21.00	6.32					
	40.853	0.145	32.45	2.65	0.00	0.00
21.00	6.32					
	40.999	0.104	32.45	1.92	0.00	0.00
21.00	6.32					
	41.103	0.145	33.03	2.69	0.00	0.00
21.00	6.32					
	41.248	0.099	33.03	1.84	0.00	0.00
21.00	6.32					
	41.347	0.145	33.62	2.73	0.00	0.00
21.00	6.32					
	41.492	0.099	33.62	1.86	0.00	0.00
21.00	6.32					
	41.591	0.145	34.17	2.75	0.00	0.00
21.00	6.32					
	41.736	0.096	34.17	1.81	0.00	0.00
21.00	6.32					
	41.832	0.145	34.72	2.76	0.00	0.00
21.00	6.32					
	41.977	0.097	34.72	1.85	0.00	0.00
21.00	6.32					
	42.074	0.145	35.25	2.77	0.00	0.00

21.00	6.32						
	42.220	0.100	35.25	1.90	0.00	0.00	
21.00	6.32						
	42.319	0.145	35.76	2.76	0.00	0.00	
21.00	6.32						
	42.465	0.105	35.76	2.00	0.00	0.00	
21.00	6.32						
	42.570	0.145	35.76	2.75	0.00	0.00	
21.00	6.32						
	42.716	0.105	35.76	1.98	0.00	0.00	
21.00	6.32						
	42.820	0.145	35.77	2.74	0.00	0.00	
21.00	6.32						
	42.966	0.054	35.77	1.02	0.00	0.00	
21.00	6.32						
	43.020	0.049	35.77	0.91	0.00	0.00	
21.00	6.32						
	43.069	0.145	35.77	2.73	0.00	0.00	
21.00	6.32						
	43.214	0.103	35.77	1.93	0.00	0.00	
21.00	6.32						
	43.317	0.143	35.77	2.69	0.00	0.00	
21.00	6.32						
	43.460	0.102	35.77	1.91	0.00	0.00	
21.00	6.32						
	43.562	0.145	35.78	2.68	0.00	0.00	
21.00	6.32						
	43.708	0.104	35.78	1.90	0.00	0.00	
21.00	6.32						
	43.812	0.145	35.78	2.63	0.00	0.00	
21.00	6.32						
	43.957	0.106	35.78	1.89	0.00	0.00	
21.00	6.32						

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 alpha(°) : Angolo pendenza base concio  
 W(kN/m) : Forza peso concio  
 ru(-) : Coefficiente locale pressione interstiziale  
 U(kPa) : Pressione totale dei pori base concio  
 phi'(°) : Angolo di attrito efficace base concio  
 c'/Cu (kPa) : Coesione efficace o Resistenza al taglio in condizioni non drenate

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TABELLA DIAGRAMMA DELLE FORZE DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

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T(x)	X	ht	yt	yt'	E(x)
(kN/m)	(m)	E'	rho(x)	FS_FEM	FS_p-qFEM
		(m)	(m)	(--)	(kN/m)
		(kN)	(--)	(--)	(--)
0.0000000000E+000	37.528	0.000	205.836	0.372	0.0000000000E+000
0.0000000000E+000	37.673	0.016	205.889	0.443	34.871 1.816
2.4336829018E-001	37.819	0.033	205.944	0.443	1.0571429507E+000
4.1533941666E-001	37.964	0.062	206.010	0.414	34.871 1.816
6.5992144504E-001	38.109	0.074	206.059	0.423	1.6595187914E+000
8.6288576904E-001	38.140	0.078	206.070	0.423	16.613 1.197
9.1272550008E-001	38.285	0.092	206.122	0.397	2.3588091474E+000
1.1631465942E+000	38.413	0.110	206.173	0.458	19.906 1.077
1.4457163027E+000	38.558	0.139	206.242	0.344	2.8626947561E+000
1.8587866006E+000	38.703	0.174	206.317	0.467	18.390 1.053
2.3107343220E+000	38.838	0.208	206.389	0.356	2.9755760080E+000
2.7157107694E+000	38.984	0.232	206.459	0.472	16.994 1.052
3.0730650927E+000	39.129	0.246	206.520	0.376	3.4690316219E+000
3.3485276642E+000	39.130	0.246	206.520	0.497	10.459 1.084
3.3498905378E+000	39.275	0.257	206.585	0.442	3.9329899184E+000
3.6177597421E+000	39.378	0.272	206.638	0.535	6.416 1.143
3.8141612256E+000	39.524	0.293	206.722	0.497	4.5254913083E+000
4.1032528835E+000	39.616	0.315	206.785	0.596	3.882 1.246
4.2896669511E+000	39.762	0.328	206.868	0.523	5.1118375824E+000
4.4810137064E+000	39.840	0.334	206.912	0.654	2.777 1.364
4.5570825106E+000	39.985	0.352	207.006	0.506	5.6205483838E+000
4.6607053101E+000	40.074	0.357	207.058	0.694	2.304 1.469
4.6986980122E+000	40.220	0.374	207.159	0.451	6.0671749699E+000
4.7195217402E+000	40.319	0.381	207.223	0.721	2.071 1.549
4.7156299544E+000	40.405	0.378	207.271	0.417	6.4038040340E+000
4.7003328462E+000	40.405	0.378	207.271	0.730	1.978 1.599
				0.449	6.4053951218E+000
				0.730	1.978 1.600
				0.475	6.6888164224E+000
				0.743	1.927 1.635
				0.551	6.8670489882E+000
				0.754	1.895 1.656
				0.617	7.0905687971E+000
				0.776	1.822 1.681
				0.611	7.2146221870E+000
				0.791	1.768 1.694
				0.567	7.3086582504E+000
				0.802	1.688 1.702
				0.616	7.3340468922E+000
				0.804	1.650 1.703
				0.627	7.3347221422E+000
				0.807	1.584 1.701
				0.653	7.3172398420E+000
				0.805	1.554 1.698
				0.671	7.2327934603E+000
				0.800	1.505 1.694
				0.608	7.1605228389E+000
				0.794	1.479 1.691
				0.599	7.0913212741E+000
				0.789	1.461 1.689

40.550	0.379	207.361	0.599	6.9484550916E+000	
4.6596835651E+000	-9.6192746734E-001		0.780	1.428	1.684
40.594	0.376	207.385	0.627	6.9062716083E+000	
4.6443657248E+000	-1.0207317708E+000		0.776	1.419	1.683
40.740	0.381	207.480	0.672	6.7267203595E+000	
4.5705400302E+000	-1.3230899042E+000		0.763	1.381	1.674
40.853	0.388	207.559	0.707	6.5689732419E+000	
4.4941168787E+000	-1.4581926943E+000		0.750	1.348	1.662
40.999	0.400	207.663	0.714	6.3446106504E+000	
4.3708340479E+000	-1.5789446525E+000		0.732	1.302	1.641
41.103	0.408	207.737	0.692	6.1773945345E+000	
4.2726131614E+000	-1.6206581797E+000		0.717	1.272	1.624
41.248	0.412	207.836	0.678	5.9385154547E+000	
4.1258017126E+000	-1.6811926193E+000		0.695	1.235	1.598
41.347	0.415	207.902	0.683	5.7698960595E+000	
4.0197163385E+000	-1.7561088211E+000		0.680	1.214	1.580
41.492	0.418	208.002	0.687	5.5041098004E+000	
3.8488648653E+000	-1.8611179224E+000		0.656	1.185	1.552
41.591	0.420	208.070	0.690	5.3185641991E+000	
3.7271022592E+000	-1.9233958660E+000		0.638	1.168	1.534
41.736	0.422	208.171	0.693	5.0303745019E+000	
3.5343751027E+000	-2.0107402978E+000		0.611	1.144	1.505
41.832	0.423	208.236	0.695	4.8364756851E+000	
3.4027812349E+000	-2.0613832988E+000		0.593	1.130	1.487
41.977	0.424	208.338	0.698	4.5297303058E+000	
3.1923122473E+000	-2.1319709322E+000		0.563	1.111	1.459
42.074	0.424	208.406	0.703	4.3206521621E+000	
3.0475900775E+000	-2.1768118043E+000		0.542	1.101	1.443
42.220	0.424	208.509	0.703	3.9976653705E+000	
2.8219572729E+000	-2.2141118093E+000		0.510	1.091	1.425
42.319	0.423	208.578	0.711	3.7776375307E+000	
2.6650463758E+000	-2.2410685123E+000		0.486	1.088	1.417
42.465	0.423	208.683	0.718	3.4450169966E+000	
2.4225631578E+000	-2.3359738468E+000		0.450	1.093	1.414
42.570	0.423	208.758	0.714	3.1949713587E+000	
2.2384214550E+000	-2.4768422312E+000		0.421	1.101	1.418
42.716	0.422	208.862	0.714	2.8136668734E+000	
1.9613742212E+000	-2.4081356325E+000		0.377	1.119	1.430
42.820	0.421	208.937	0.714	2.5774273155E+000	
1.7966792856E+000	-2.1781037041E+000		0.350	1.132	1.438
42.966	0.420	209.041	0.711	2.2758936337E+000	
1.5960645482E+000	-1.9285560738E+000		0.316	1.148	1.449
43.020	0.419	209.079	0.634	2.1742924874E+000	
1.5299565705E+000	-1.8377737600E+000		0.305	1.154	1.453
43.069	0.412	209.106	0.616	2.0866598198E+000	
1.4732200134E+000	-1.8608429484E+000		0.295	1.159	1.456
43.214	0.399	209.198	0.658	1.7920218512E+000	
1.2789311822E+000	-2.1078643039E+000		0.260	1.178	1.468
43.317	0.396	209.269	0.749	1.5696269363E+000	
1.1257501276E+000	-2.2771139835E+000		0.232	1.195	1.478
43.460	0.406	209.382	0.768	1.2206563057E+000	
8.7472105678E-001	-2.3154061703E+000		0.184	1.225	1.494
43.562	0.408	209.458	0.698	9.9237808566E-001	
7.0703503906E-001	-2.1392492704E+000		0.152	1.245	1.505

43.708	0.400	209.555	0.683	7.0038356914E-001
4.8999777463E-001	-2.0510085938E+000		0.108	1.279 1.522
43.812	0.398	209.628	0.688	4.8353642098E-001
3.3394595081E-001	-2.0256273126E+000		0.075	1.298 1.531
43.957	0.392	209.727	0.688	2.0037651802E-001
1.3558731051E-001	-1.9180172545E+000		0.050	1.331 1.546

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 LEGENDA SIMBOLI

- X(m) : Ascissa sinistra concio
  - ht(m) : Altezza linea di thrust da nodo sinistro base concio
  - yt(m) : coordinata Y linea di trust
  - yt'(-) : gradiente pendenza locale linea di trust
  - E(x)(kN/m) : Forza Normale interconcio
  - T(x)(kN/m) : Forza Tangenziale interconcio
  - E' (kN) : derivata Forza normale interconcio
  - Rho(x) (-) : fattore mobilizzazione resistenza al taglio verticale interconcio  
 ZhU et al.(2003)
  - FS\_FEM(x) (-) : fattore di sicurezza locale stimato (locale in X) by qFEM
  - FS\_SRM(x) (-) : fattore di sicurezza locale stimato (locale in X) by SRM
- Procedure
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TABELLA SFORZI DI TAGLIO DISTRIBUITI LUNGO SUPERFICIE INDIVIDUATA CON MINOR FS

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X	dx	dl	alpha	TauStress	TauF
(m)	(m)	(m)	(°)	(kPa)	(kN/m)
37.528	0.145	0.150	14.392	0.169	0.025
6.531	0.980				
37.673	0.145	0.150	14.392	0.507	0.076
6.946	1.042				
37.819	0.145	0.150	14.392	0.845	0.127
7.363	1.105				
37.964	0.145	0.150	14.392	1.182	0.177
7.779	1.167				
38.109	0.031	0.032	14.392	1.387	0.044
8.031	0.254				
38.140	0.145	0.150	14.392	1.592	0.239
8.283	1.243				
38.285	0.127	0.131	14.392	1.908	0.251
8.674	1.139				
38.413	0.145	0.151	15.512	2.344	0.354
8.942	1.349				
38.558	0.145	0.151	15.512	2.684	0.405
9.327	1.407				
38.703	0.135	0.140	15.512	3.013	0.423
9.709	1.362				

9.842	38.838	0.145	0.153	17.786	3.673	0.561
10.233	38.984	0.145	0.153	17.786	4.011	0.612
10.425	39.129	0.001	0.001	17.786	4.181	0.004
10.298	39.130	0.145	0.155	20.363	4.765	0.739
10.534	39.275	0.103	0.110	20.363	5.042	0.553
10.388	39.378	0.145	0.158	23.416	5.809	0.920
10.568	39.524	0.093	0.101	23.416	6.046	0.611
10.633	39.616	0.145	0.161	25.689	6.633	1.070
10.863	39.762	0.078	0.087	25.689	6.828	0.593
10.818	39.840	0.145	0.164	27.897	7.339	1.207
11.016	39.985	0.089	0.101	27.897	7.507	0.757
11.003	40.074	0.145	0.168	29.808	7.926	1.328
11.150	40.220	0.100	0.115	29.808	8.063	0.927
11.095	40.319	0.086	0.100	31.363	8.359	0.838
11.187	40.405	0.145	0.170	31.363	8.455	1.439
11.257	40.550	0.044	0.052	31.363	8.533	0.441
11.306	40.594	0.145	0.171	31.886	8.670	1.484
11.423	40.740	0.113	0.134	31.886	8.764	1.170
11.482	40.853	0.145	0.172	32.452	8.918	1.536
11.561	40.999	0.104	0.124	32.452	8.995	1.111
11.567	41.103	0.145	0.173	33.032	9.131	1.583
11.625	41.248	0.099	0.118	33.032	9.190	1.083
11.636	41.347	0.145	0.175	33.618	9.307	1.624
11.684	41.492	0.099	0.118	33.618	9.352	1.106
11.685	41.591	0.145	0.176	34.173	9.447	1.660
11.721	41.736	0.096	0.116	34.173	9.476	1.094
11.707	41.832	0.145	0.177	34.724	9.552	1.689

	41.977	0.097	0.119	34.724	9.566	1.134
11.731	1.390					
	42.074	0.145	0.178	35.254	9.622	1.713
11.710	2.084					
	42.220	0.100	0.122	35.254	9.621	1.174
11.719	1.430					
	42.319	0.145	0.179	35.760	9.657	1.730
11.706	2.097					
	42.465	0.105	0.130	35.760	9.640	1.253
11.733	1.525					
	42.570	0.145	0.179	35.763	9.623	1.724
11.797	2.113					
	42.716	0.105	0.129	35.763	9.606	1.241
11.637	1.504					
	42.820	0.145	0.179	35.766	9.590	1.718
11.543	2.068					
	42.966	0.054	0.067	35.766	9.576	0.640
11.463	0.766					
	43.020	0.049	0.060	35.766	9.569	0.572
11.437	0.684					
	43.069	0.145	0.179	35.770	9.556	1.712
11.506	2.061					
	43.214	0.103	0.127	35.770	9.539	1.208
11.568	1.465					
	43.317	0.143	0.177	35.773	9.522	1.683
11.677	2.064					
	43.460	0.102	0.126	35.773	9.474	1.195
11.603	1.463					
	43.562	0.145	0.179	35.776	9.379	1.680
11.492	2.059					
	43.708	0.104	0.128	35.776	9.284	1.192
11.448	1.470					
	43.812	0.145	0.179	35.780	9.189	1.646
11.342	2.032					
	43.957	0.106	0.130	35.780	9.093	1.185
11.259	1.467					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 dl(m) : lunghezza base concio  
 alpha(°) : Angolo pendenza base concio  
 TauStress(kPa) : Sforzo di taglio su base concio  
 TauF (kN/m) : Forza di taglio su base concio  
 TauStrength(kPa) : Resistenza al taglio su base concio  
 TauS (kN/m) : Forza resistente al taglio su base concio

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Strato 1 -- Parametri di resistenza al taglio equivalenti dell'ammasso  
 roccioso  
 stimati secondo criterio di rottura non lineare Hoek et

al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

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SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	137.42	58.47	69.19
50.00	186.72	55.52	76.58
75.00	229.23	53.43	82.28
100.00	269.97	51.71	89.32
125.00	307.76	50.29	95.71
150.00	344.72	49.03	103.03
175.00	380.39	47.92	110.48
200.00	414.33	46.95	117.39
225.00	446.12	46.09	123.16
250.00	479.13	45.26	131.05
275.00	509.50	44.53	137.06
300.00	540.87	43.82	144.79
325.00	569.14	43.21	149.99
350.00	598.21	42.61	156.59
375.00	628.07	42.02	164.54
400.00	654.32	41.52	169.27
425.00	685.72	40.95	179.76
450.00	708.67	40.55	181.95
475.00	736.79	40.07	189.88
500.00	760.71	39.67	193.83
600.00	866.21	38.06	223.16
700.00	957.87	36.80	242.59
800.00	1049.54	35.65	265.80
900.00	1140.54	34.60	291.52
1000.00	1223.57	33.71	311.63
1100.00	1303.83	32.91	331.24
1200.00	1387.74	32.12	356.93
1300.00	1460.58	31.47	372.79
1400.00	1536.19	30.83	393.39
1500.00	1614.69	30.20	418.74
2000.00	1960.39	27.76	515.66

Strato 2 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso

stimati secondo criterio di rottura non lineare Hoek et

al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

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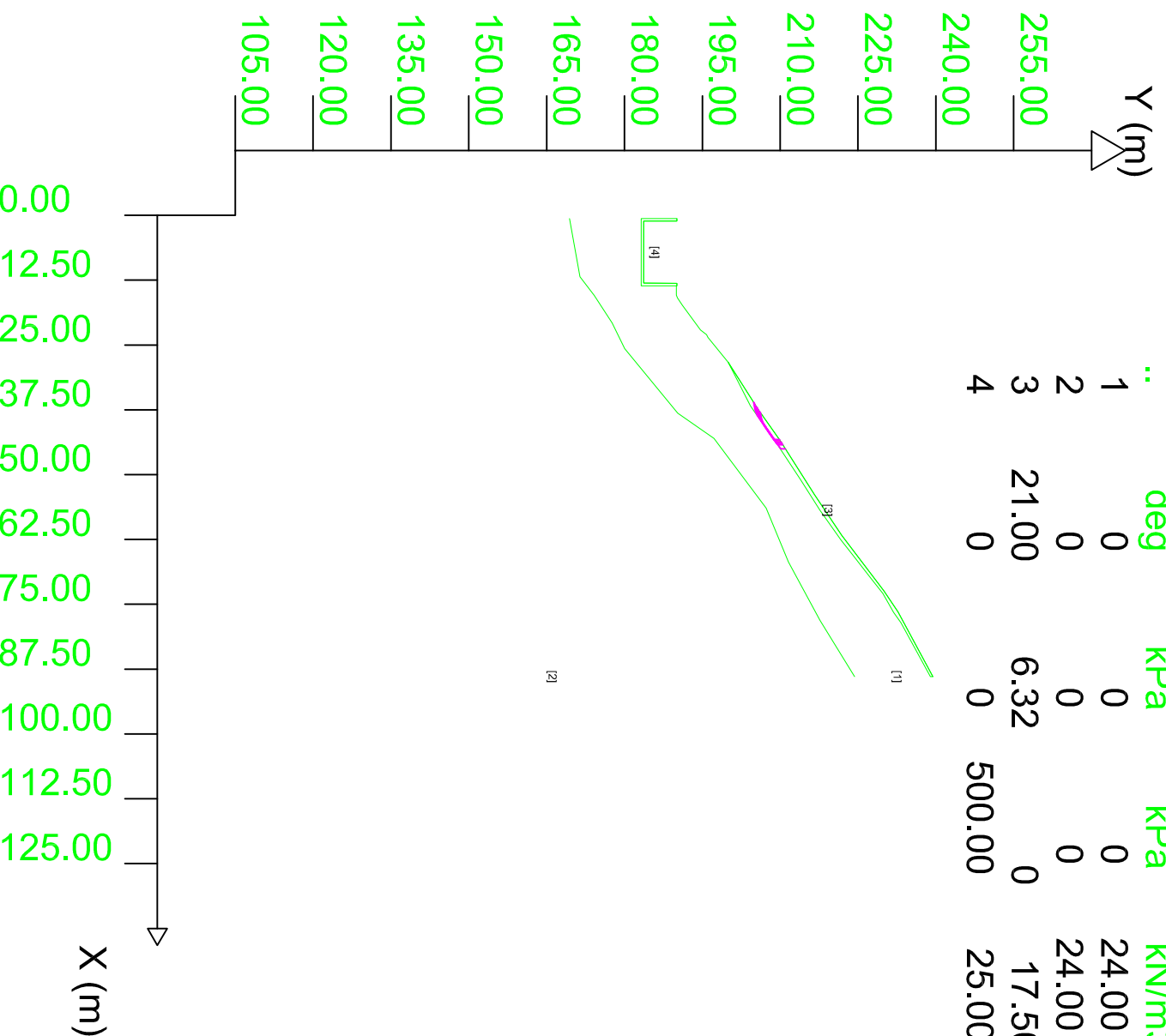
SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	696.24	60.38	513.03
50.00	756.64	59.62	520.01
75.00	806.42	59.04	520.13
100.00	857.50	58.47	523.03
125.00	909.85	57.91	528.58
150.00	949.97	57.49	524.59

175.00	1004.57	56.95	534.68
200.00	1046.36	56.55	534.32
225.00	1103.20	56.03	548.62
250.00	1146.67	55.64	551.63
275.00	1190.86	55.26	556.09
300.00	1235.77	54.89	561.97
325.00	1281.40	54.52	569.22
350.00	1327.76	54.15	577.81
375.00	1359.06	53.91	572.83
400.00	1406.61	53.55	583.74
425.00	1454.89	53.20	595.90
450.00	1487.48	52.96	593.65
475.00	1536.97	52.61	607.98
500.00	1570.37	52.38	607.39
600.00	1724.68	51.37	628.85
700.00	1885.62	50.39	662.51
800.00	2034.30	49.55	689.13
900.00	2188.33	48.73	725.29
1000.00	2327.55	48.02	750.56
1100.00	2450.22	47.43	762.64
1200.00	2597.27	46.75	801.99
1300.00	2726.73	46.18	826.48
1400.00	2859.39	45.62	856.64
1500.00	2972.41	45.17	869.25
2000.00	3572.08	42.95	995.66

**Data : 18/04/2019**  
**Localita' : Loc. Cepparello**  
**Descrizione : Sez.3 - Stato di progetto**  
**[n] = N. strato o lente**

# Parametri Geotecnici degli strati # -----

N.	phi'	C'	Cu	Gamm	GammSat	sgci	GSI	mi	D
deg	kPa	kPa	kN/m3	kN/m3	MPa				
1	0	0	0	24.00	24.50	50.00	50.00	17.00	1.00
2	0	0	0	24.00	24.50	100.00	65.00	17.00	1.00
3	21.00	6.32	0	17.50	18.50	0	0	0	0
4	0	0	500.00	25.00	25.00	0	0	0	0



**DATI 10 SUP. CON MINOR Fs**

Es minimo : 1.4715  
 Range Fs : 1.4715 1.5143  
 Differenza % Range Fs : 2.82  
 Coefficiente Sismico orizzontale - Kh: 0.0510

**GENERAZIONE SUPERFICI RANDOM**

Campione Superfici - N.: 20000  
 Lunghezza media segmenti (m) : 1.0  
 Range X inizio generazione : 2.4 - 81.9  
 Range X termine generazione : 11.2 - 87.2  
 Livello Y minimo considerato : 106.4



# Report elaborazioni #

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SSAP 4.9.9 - Slope Stability Analysis Program (1991,2018)

WWW.SSAP.EU

Build No. 10784

BY

Dr. Geol. LORENZO BORSELLI \*,\*\*

\*UASLP, San Luis Potosi, Mexico

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\*\* Gia' Ricercatore CNR-IRPI fino a Luglio 2011

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Ultima Revisione struttura tabelle del report: 29 dicembre 2018  
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File report: C:\SSAP2010\Verifiche\Risultati\Sez3\_Stato\_Progetto.txt

Data: 18/4/2019

Localita' :

Descrizione:

Modello pendio: Sez3-stato\_progetto\_V1.mod

----- PARAMETRI DEL MODELLO DEL PENDIO -----

\_\_\_ PARAMETRI GEOMETRICI - Coordinate X Y (in m) \_\_\_

SUP T.		SUP 2		SUP 3		SUP 4	
X	Y	X	Y	X	Y	X	Y
0.61	190.12	0.61	169.42	28.33	200.02	13.11	190.02
1.10	190.12	11.86	171.41	36.75	204.31	13.11	190.12
1.10	190.02	15.44	174.16	44.31	209.52	13.61	190.12
1.11	183.72	20.73	177.59	50.95	213.91	13.59	183.72
13.09	183.72	25.73	180.05	56.88	217.69	13.59	183.22
13.11	190.02	38.14	190.25	62.65	221.74	1.11	183.22
13.11	190.12	43.02	197.26	65.87	224.31	0.61	183.22
13.61	190.12	56.43	207.31	69.88	227.41	0.61	190.00
13.61	190.02	66.80	211.58	72.89	229.81	0.61	190.12
15.37	190.02	78.08	217.67	76.58	231.88	1.10	190.12
15.92	190.20	88.92	224.33	78.56	233.30	1.10	190.02
17.34	191.17	-	-	88.92	238.97	1.11	183.72
22.09	194.65	-	-	88.92	239.44	13.09	183.72
23.02	195.84	-	-	76.45	232.68	13.11	190.02
23.56	196.07	-	-	72.44	230.02	-	-
28.33	200.02	-	-	61.71	221.87	-	-
37.35	205.71	-	-	53.84	216.63	-	-
43.46	210.02	-	-	43.46	210.02	-	-
53.84	216.63	-	-	37.35	205.71	-	-
61.71	221.87	-	-	28.33	200.02	-	-
72.44	230.02	-	-	-	-	-	-
76.45	232.68	-	-	-	-	-	-
88.92	239.44	-	-	-	-	-	-

## ASSENZA DI FALDA ##

----- PARAMETRI GEOMECCANICI -----

STR_IDX	sgci	fi` GSI	mi	C` D	Cu	Gamm	Gamm_sat
8.587	STRATO 1	0.00	17.00	0.00	0.00	24.00	24.50
12.882	STRATO 2	50.00	17.00	1.00	0.00	24.00	24.50
1.294	STRATO 3	100.00	17.00	1.00	0.00	17.50	18.50
1000.000	STRATO 4	0.00	0.00	0.00	500.00	25.00	25.00

LEGENDA: fi` \_\_\_\_\_ Angolo di attrito interno efficace(in gradi)  
 C` \_\_\_\_\_ Coesione efficace (in Kpa)  
 Cu \_\_\_\_\_ Resistenza al taglio Non drenata (in Kpa)  
 Gamm \_\_\_\_\_ Peso di volume terreno fuori falda (in KN/m^3)  
 Gamm\_sat \_\_\_\_\_ Peso di volume terreno immerso (in KN/m^3)  
 STR\_IDX \_\_\_\_\_ Indice di resistenza (usato in solo in 'SNIFF SEARCH)

(adimensionale)

----- SOLO Per AMMASSI ROCCIOSI FRATTURATI - Parametri Criterio di Rottura di Hoek (2002)-

sigci \_\_\_\_\_ Resistenza Compressione Uniassiale Roccia Intatta (in MPa)

GSI \_\_\_\_\_ Geological Strenght Index ammasso(adimensionale)

mi \_\_\_\_\_ Indice litologico ammasso(adimensionale)

D \_\_\_\_\_ Fattore di disturbo ammasso(adimensionale)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 -

ATTIVATO (solo per ROCCE)

Uso CRITERIO DI ROTTURA Hoek et al.(2002,2006) - non-lineare - Generalizzato secondo Lei et al.(2016)

----- INFORMAZIONI GENERAZIONE SUPERFICI RANDOM -----

\*\*\* PARAMETRI PER LA GENERAZIONE DELLE SUPERFICI

METODO DI RICERCA: CONVEX RANDOM - Chen (1992)

FILTRAGGIO SUPERFICI : ATTIVATO

COORDINATE X1,X2,Y OSTACOLO : 0.00 0.00 0.00

LUNGHEZZA MEDIA SEGMENTI (m): 1.0 (+/-) 50%

INTERVALLO ASCISSE RANDOM STARTING POINT (Xmin .. Xmax): 2.38

81.86

LIVELLO MINIMO CONSIDERATO (Ymin): 106.40

INTERVALLO ASCISSE AMMESSO PER LA TERMINAZIONE (Xmin .. Xmax): 11.21

87.15

\*\*\* TOTALE SUPERFICI GENERATE : 20000

----- INFORMAZIONI PARAMETRI DI CALCOLO -----

METODO DI CALCOLO : BORSELLI (Borselli, 2016)

COEFFICIENTE SISMICO UTILIZZATO Kh : 0.0510

COEFFICIENTE SISMICO UTILIZZATO Kv (assunto Positivo): 0.0255

COEFFICIENTE c=Kv/Kh UTILIZZATO : 0.5000

FORZA ORIZZONTALE ADDIZIONALE IN TESTA (kN/m): 0.00

FORZA ORIZZONTALE ADDIZIONALE ALLA BASE (kN/m): 0.00

N.B. Le forze orizzontali aggiuntive in testa e alla base sono poste uguali a 0

durante le tutte le verifiche globali.

I valori >0 impostati dall'utente sono utilizzati solo in caso di verifica singola

----- RISULTATO FINALE ELABORAZIONI -----

\* DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR FS \*

Fattore di sicurezza (FS) 1.4715 - Min. - X Y Lambda=  
0.4138

37.17	205.60
37.95	205.70
38.31	205.76
38.56	205.81
38.75	205.87
38.95	205.95
39.13	206.03
39.32	206.13
39.53	206.26
39.77	206.42
40.00	206.57
40.22	206.71
40.43	206.86
40.64	207.00
40.85	207.14
41.05	207.29
41.26	207.44
41.48	207.59
41.69	207.74
41.90	207.89
42.11	208.04
42.32	208.19
42.53	208.34
42.75	208.49
42.97	208.65
43.20	208.82
43.40	208.97
43.59	209.13
43.59	210.10

Fattore di sicurezza (FS) 1.4778 - N.2 -- X Y Lambda=  
0.4184

36.10	204.92
37.00	205.07
37.42	205.16
37.70	205.23
37.93	205.30
38.17	205.40
38.38	205.50

38.60	205.63
38.84	205.78
39.12	205.97
39.38	206.14
39.64	206.31
39.88	206.48
40.13	206.65
40.37	206.82
40.61	206.99
40.85	207.16
41.10	207.34
41.35	207.51
41.59	207.69
41.84	207.87
42.08	208.04
42.33	208.22
42.58	208.39
42.83	208.58
43.09	208.76
43.24	208.87
43.24	209.86

Fattore di sicurezza (FS)    1.4930    - N.3 --    X    Y    Lambda=  
0.4131

37.87	206.08
38.65	206.18
39.02	206.24
39.26	206.30
39.46	206.36
39.66	206.44
39.84	206.52
40.04	206.63
40.25	206.75
40.49	206.91
40.72	207.06
40.94	207.20
41.15	207.35
41.36	207.49
41.57	207.63
41.78	207.78
41.99	207.93
42.20	208.08
42.42	208.24
42.63	208.39
42.84	208.54
43.05	208.69
43.26	208.85
43.47	209.00
43.69	209.16
43.84	209.27
43.84	210.26

Fattore di sicurezza (FS) 1.4931 - N.4 -- X Y Lambda=  
0.4335

37.09	205.54
37.95	205.78
38.37	205.90
38.66	206.00
38.91	206.09
39.14	206.20
39.36	206.31
39.59	206.43
39.83	206.57
40.10	206.73
40.36	206.89
40.60	207.04
40.84	207.20
41.08	207.35
41.32	207.51
41.56	207.67
41.80	207.83
42.05	208.00
42.30	208.17
42.54	208.34
42.78	208.51
43.02	208.68
43.27	208.85
43.52	209.02
43.77	209.20
44.03	209.39
44.17	209.49
44.17	210.47

Fattore di sicurezza (FS) 1.5040 - N.5 -- X Y Lambda=  
0.4378

37.11	205.56
38.25	205.93
38.79	206.13
39.17	206.27
39.49	206.42
39.79	206.57
40.08	206.73
40.38	206.92
40.69	207.12
41.03	207.36
41.36	207.59
41.69	207.81
42.01	208.03
42.33	208.25
42.64	208.47
42.96	208.69
43.28	208.91
43.59	209.13
43.91	209.35
44.22	209.57

44.54 209.79  
44.85 210.02  
45.03 210.14  
45.03 211.02

Fattore di sicurezza (FS) 1.5111 - N.6 -- X Y Lambda=  
0.4391

36.94 205.45  
37.97 205.79  
38.48 205.96  
38.82 206.10  
39.12 206.22  
39.41 206.36  
39.68 206.50  
39.96 206.66  
40.25 206.83  
40.56 207.03  
40.87 207.22  
41.16 207.41  
41.45 207.60  
41.74 207.79  
42.03 207.99  
42.32 208.18  
42.61 208.38  
42.91 208.59  
43.20 208.79  
43.49 209.00  
43.78 209.20  
44.07 209.41  
44.24 209.53  
44.24 210.52

Fattore di sicurezza (FS) 1.5112 - N.7 -- X Y Lambda=  
0.4417

36.26 205.03  
37.20 205.33  
37.66 205.49  
37.98 205.61  
38.25 205.72  
38.51 205.84  
38.76 205.96  
39.01 206.09  
39.28 206.23  
39.57 206.40  
39.84 206.56  
40.11 206.72  
40.37 206.88  
40.63 207.04  
40.89 207.21  
41.16 207.37  
41.42 207.55  
41.70 207.73

41.97	207.91
42.23	208.09
42.49	208.27
42.75	208.46
43.01	208.65
43.28	208.85
43.55	209.05
43.83	209.27
43.83	210.26

Fattore di sicurezza (FS)    1.5113   - N.8   --    X            Y            Lambda=  
0.4204

37.47	205.79
38.30	205.94
38.69	206.03
38.95	206.10
39.17	206.17
39.38	206.26
39.58	206.36
39.79	206.48
40.01	206.62
40.26	206.80
40.51	206.97
40.75	207.13
40.98	207.29
41.20	207.44
41.43	207.60
41.66	207.75
41.88	207.91
42.11	208.07
42.34	208.22
42.56	208.38
42.79	208.54
43.01	208.70
43.24	208.86
43.47	209.02
43.71	209.19
43.71	210.18

Fattore di sicurezza (FS)    1.5116   - N.9   --    X            Y            Lambda=  
0.4265

36.07	204.90
37.17	205.20
37.69	205.36
38.04	205.48
38.34	205.60
38.64	205.74
38.91	205.88
39.19	206.05
39.49	206.24
39.82	206.48
40.15	206.70

40.46 206.91  
 40.76 207.13  
 41.07 207.34  
 41.37 207.55  
 41.67 207.77  
 41.98 207.99  
 42.29 208.21  
 42.59 208.43  
 42.89 208.65  
 43.19 208.87  
 43.36 209.00  
 43.36 209.95

Fattore di sicurezza (FS) 1.5143 - N.10 -- X Y Lambda=  
 0.4135

38.04 206.20  
 38.93 206.37  
 39.34 206.46  
 39.62 206.54  
 39.86 206.62  
 40.09 206.72  
 40.30 206.83  
 40.53 206.96  
 40.76 207.10  
 41.04 207.29  
 41.30 207.46  
 41.55 207.63  
 41.79 207.80  
 42.03 207.96  
 42.28 208.13  
 42.52 208.30  
 42.76 208.48  
 43.02 208.66  
 43.26 208.83  
 43.50 209.01  
 43.73 209.19  
 43.87 209.31  
 43.87 210.28

----- ANALISI DEFICIT DI RESISTENZA -----

# DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR Fs \*

# Analisi Deficit in riferimento a FS(progetto) = 1.200

Sup N.	FS	FTR(kN/m)	FTA(kN/m)	Bilancio(kN/m)	ESITO
1	1.472	81.5	55.4	15.0	Surplus
2	1.478	89.4	60.5	16.8	Surplus
3	1.493	75.8	50.8	14.9	Surplus
4	1.493	86.3	57.8	17.0	Surplus
5	1.504	95.0	63.2	19.2	Surplus
6	1.511	87.9	58.2	18.1	Surplus
7	1.511	90.7	60.0	18.7	Surplus
8	1.511	77.5	51.3	16.0	Surplus



9	1.512	88.5	58.5	18.2	Surplus
10	1.514	73.0	48.2	15.2	Surplus

Esito analisi: SURPLUS di RESISTENZA!

Valore minimo di SURPLUS di RESISTENZA (kN/m): 14.9

Note: FTR --> Forza totale Resistente lungo la superficie di scivolamento

FTA --> Forza totale Agente lungo la superficie di scivolamento

IMPORTANTE! : Il Deficit o il Surplus di resistenza viene espresso in kN per metro di LARGHEZZA rispetto al fronte della scarpata

TABELLA PARAMETRI CONCI DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

phi'	X	dx	alpha	W	ru	U
(°)	(m)	(m)	(°)	(kN/m)	(-)	(kPa)
	37.174	0.128	7.39	0.07	0.00	0.00
21.00	6.32					
	37.302	0.048	7.39	0.07	0.00	0.00
21.00	6.32					
	37.350	0.128	7.39	0.29	0.00	0.00
21.00	6.32					
	37.478	0.128	7.39	0.45	0.00	0.00
21.00	6.32					
	37.605	0.128	7.39	0.62	0.00	0.00
21.00	6.32					
	37.733	0.128	7.39	0.79	0.00	0.00
21.00	6.32					
	37.861	0.093	7.39	0.68	0.00	0.00
21.00	6.32					
	37.954	0.128	8.96	1.08	0.00	0.00
21.00	6.32					
	38.081	0.059	8.96	0.55	0.00	0.00
21.00	6.32					
	38.140	0.128	8.96	1.31	0.00	0.00
21.00	6.32					
	38.268	0.047	8.96	0.52	0.00	0.00
21.00	6.32					
	38.315	0.128	12.40	1.52	0.00	0.00
21.00	6.32					
	38.442	0.113	12.40	1.47	0.00	0.00
21.00	6.32					
	38.555	0.128	16.55	1.78	0.00	0.00
21.00	6.32					
	38.683	0.070	16.55	1.03	0.00	0.00
21.00	6.32					

	38.753	0.128	21.39	1.95	0.00	0.00
21.00	6.32					
	38.881	0.071	21.39	1.12	0.00	0.00
21.00	6.32					
	38.952	0.128	24.96	2.08	0.00	0.00
21.00	6.32					
	39.079	0.052	24.96	0.86	0.00	0.00
21.00	6.32					
	39.131	0.128	28.39	2.17	0.00	0.00
21.00	6.32					
	39.259	0.066	28.39	1.13	0.00	0.00
21.00	6.32					
	39.324	0.128	31.13	2.23	0.00	0.00
21.00	6.32					
	39.452	0.079	31.13	1.39	0.00	0.00
21.00	6.32					
	39.530	0.128	33.17	2.27	0.00	0.00
21.00	6.32					
	39.658	0.115	33.17	2.05	0.00	0.00
21.00	6.32					
	39.773	0.128	33.44	2.30	0.00	0.00
21.00	6.32					
	39.900	0.100	33.44	1.81	0.00	0.00
21.00	6.32					
	40.000	0.128	33.73	2.32	0.00	0.00
21.00	6.32					
	40.128	0.090	33.73	1.64	0.00	0.00
21.00	6.32					
	40.218	0.128	34.04	2.34	0.00	0.00
21.00	6.32					
	40.345	0.060	34.04	1.10	0.00	0.00
21.00	6.32					
	40.405	0.025	34.04	0.46	0.00	0.00
21.00	6.32					
	40.430	0.128	34.35	2.35	0.00	0.00
21.00	6.32					
	40.557	0.081	34.35	1.50	0.00	0.00
21.00	6.32					
	40.639	0.128	34.65	2.36	0.00	0.00
21.00	6.32					
	40.766	0.080	34.65	1.49	0.00	0.00
21.00	6.32					
	40.846	0.128	34.94	2.37	0.00	0.00
21.00	6.32					
	40.974	0.081	34.94	1.50	0.00	0.00
21.00	6.32					
	41.055	0.128	35.23	2.37	0.00	0.00
21.00	6.32					
	41.182	0.082	35.23	1.52	0.00	0.00
21.00	6.32					
	41.264	0.128	35.51	2.37	0.00	0.00
21.00	6.32					
	41.392	0.084	35.51	1.55	0.00	0.00
21.00	6.32					

21.00	41.476	0.128	35.51	2.37	0.00	0.00
	6.32					
21.00	41.603	0.084	35.51	1.56	0.00	0.00
	6.32					
21.00	41.688	0.128	35.51	2.36	0.00	0.00
	6.32					
21.00	41.815	0.083	35.51	1.54	0.00	0.00
	6.32					
21.00	41.898	0.128	35.51	2.36	0.00	0.00
	6.32					
21.00	42.026	0.084	35.51	1.54	0.00	0.00
	6.32					
21.00	42.110	0.128	35.52	2.35	0.00	0.00
	6.32					
21.00	42.237	0.082	35.52	1.51	0.00	0.00
	6.32					
21.00	42.319	0.128	35.52	2.35	0.00	0.00
	6.32					
21.00	42.447	0.086	35.52	1.58	0.00	0.00
	6.32					
21.00	42.532	0.128	35.52	2.35	0.00	0.00
	6.32					
21.00	42.660	0.088	35.52	1.61	0.00	0.00
	6.32					
21.00	42.748	0.128	35.52	2.34	0.00	0.00
	6.32					
21.00	42.875	0.094	35.52	1.72	0.00	0.00
	6.32					
21.00	42.969	0.051	35.52	0.93	0.00	0.00
	6.32					
21.00	43.020	0.128	35.52	2.34	0.00	0.00
	6.32					
21.00	43.148	0.050	35.52	0.92	0.00	0.00
	6.32					
21.00	43.198	0.128	37.53	2.33	0.00	0.00
	6.32					
21.00	43.325	0.077	37.53	1.39	0.00	0.00
	6.32					
21.00	43.402	0.058	39.74	1.04	0.00	0.00
	6.32					
21.00	43.460	0.128	39.74	2.26	0.00	0.00
	6.32					

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#### LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
dx(m) : Larghezza concio  
alpha(°) : Angolo pendenza base concio  
W(kN/m) : Forza peso concio  
ru(-) : Coefficiente locale pressione interstiziale  
U(kPa) : Pressione totale dei pori base concio  
phi'(°) : Angolo di attrito efficace base concio  
c'/Cu (kPa) : Coesione efficace o Resistenza al taglio in condizioni non

drenate

TABELLA DIAGRAMMA DELLE FORZE DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

T(x)	X (m)	ht E' (m) (kN)	yt rho(x) (m) (--)	yt' FS_FEM (--) (--)	E(x) FS_p-qFEM (kN/m) (--)	
	37.174	0.000	205.599	0.258	0.0000000000E+000	
0.0000000000E+000		1.3267993855E+001		0.401	5.688	1.673
	37.302	0.021	205.637	0.258	1.1295752880E+000	
2.2855792236E-001		4.4328593314E+000		0.401	5.413	1.550
	37.350	0.023	205.645	0.232	1.2627775420E+000	
2.5642651782E-001		3.1546716469E+000		0.362	5.096	1.416
	37.478	0.039	205.677	0.289	1.7968555812E+000	
4.1353995344E-001		4.6202002863E+000		0.356	3.943	1.200
	37.605	0.063	205.718	0.342	2.4421250038E+000	
6.9109908900E-001		5.3005126711E+000		0.420	2.970	1.171
	37.733	0.093	205.765	0.360	3.1498588662E+000	
1.0368689584E+000		5.4127432421E+000		0.483	2.435	1.179
	37.861	0.122	205.810	0.365	3.8237761462E+000	
1.4038755286E+000		5.2912609191E+000		0.532	2.134	1.230
	37.954	0.145	205.845	0.354	4.3180586894E+000	
1.7005495074E+000		4.9895169967E+000		0.567	2.003	1.290
	38.081	0.168	205.889	0.337	4.9007678365E+000	
2.0722116653E+000		4.3274345066E+000		0.601	1.891	1.370
	38.140	0.178	205.908	0.341	5.1478620703E+000	
2.2398379293E+000		4.2073496150E+000		0.613	1.858	1.404
	38.268	0.202	205.952	0.365	5.6818526265E+000	
2.6201848612E+000		4.4959756538E+000		0.640	1.807	1.475
	38.315	0.215	205.972	0.419	5.8988272688E+000	
2.7865334059E+000		4.4880325005E+000		0.654	1.793	1.501
	38.442	0.240	206.025	0.466	6.4290543538E+000	
3.2291564686E+000		4.2300150401E+000		0.692	1.754	1.556
	38.555	0.274	206.084	0.511	6.9149717213E+000	
3.6738123849E+000		3.8165748354E+000		0.731	1.724	1.596
	38.683	0.300	206.148	0.532	7.3328768785E+000	
4.0979225296E+000		3.0616179358E+000		0.765	1.690	1.618
	38.753	0.320	206.189	0.537	7.5390057236E+000	
4.3236550456E+000		2.5305928658E+000		0.781	1.678	1.623
	38.881	0.336	206.254	0.522	7.7655543659E+000	
4.6067170737E+000		1.4127293397E+000		0.799	1.661	1.619
	38.952	0.346	206.293	0.540	7.8514968437E+000	
4.7335589999E+000		1.0375422455E+000		0.804	1.661	1.614
	39.079	0.356	206.362	0.568	7.9440217829E+000	
4.9134064521E+000		4.5787290360E-001		0.813	1.661	1.605
	39.131	0.364	206.394	0.589	7.9621040223E+000	
4.9781777129E+000		2.2032593886E-001		0.816	1.666	1.600
	39.259	0.368	206.467	0.576	7.9494871814E+000	

5.0802209116E+000	-2.9828482898E-001	0.821	1.672	1.592
39.324	0.371 206.506	0.606	7.9231707124E+000	
5.1168014120E+000	-5.2521521137E-001	0.822	1.678	1.588
39.452	0.373 206.584	0.644	7.8252833876E+000	
5.1490598400E+000	-9.7364740729E-001	0.823	1.670	1.582
39.530	0.380 206.639	0.684	7.7387615673E+000	
5.1459946192E+000	-1.1759013863E+000	0.821	1.659	1.579
39.658	0.383 206.725	0.716	7.5731400363E+000	
5.0968160340E+000	-1.4352420394E+000	0.815	1.619	1.575
39.773	0.395 206.812	0.735	7.3944120938E+000	
5.0152765252E+000	-1.5558289597E+000	0.805	1.570	1.572
39.900	0.402 206.903	0.704	7.1962681540E+000	
4.9002122094E+000	-1.6904102314E+000	0.790	1.517	1.569
40.000	0.405 206.972	0.686	7.0166964752E+000	
4.7875546509E+000	-1.7684153255E+000	0.775	1.479	1.567
40.128	0.407 207.059	0.683	6.7958719359E+000	
4.6476961462E+000	-1.6817119972E+000	0.757	1.442	1.565
40.218	0.408 207.121	0.686	6.6480450833E+000	
4.5569380580E+000	-1.5914673271E+000	0.745	1.425	1.564
40.345	0.410 207.208	0.687	6.4551227561E+000	
4.4416787198E+000	-1.4601647035E+000	0.730	1.407	1.562
40.405	0.410 207.250	0.670	6.3692361122E+000	
4.3907653194E+000	-1.5377382402E+000	0.724	1.401	1.561
40.430	0.409 207.265	0.600	6.3299409968E+000	
4.3670925831E+000	-1.5755366419E+000	0.721	1.398	1.561
40.557	0.398 207.341	0.629	6.1317897112E+000	
4.2465079566E+000	-1.7066191295E+000	0.705	1.383	1.557
40.639	0.398 207.397	0.704	5.9855317168E+000	
4.1529073538E+000	-1.8411857341E+000	0.693	1.371	1.552
40.766	0.401 207.488	0.762	5.7431619742E+000	
3.9909766158E+000	-2.1029375156E+000	0.673	1.348	1.541
40.846	0.412 207.555	0.752	5.5640852355E+000	
3.8677432218E+000	-2.0994236571E+000	0.656	1.330	1.530
40.974	0.413 207.644	0.707	5.3228771157E+000	
3.6984095454E+000	-1.9592419628E+000	0.634	1.305	1.513
41.055	0.414 207.702	0.703	5.1611336201E+000	
3.5847577688E+000	-1.9655087102E+000	0.619	1.289	1.499
41.182	0.412 207.791	0.706	4.9178614626E+000	
3.4153736562E+000	-2.0029693328E+000	0.596	1.267	1.479
41.264	0.414 207.850	0.708	4.7488413159E+000	
3.2979463389E+000	-2.0226743862E+000	0.580	1.253	1.465
41.392	0.412 207.939	0.710	4.4991324394E+000	
3.1248672268E+000	-2.0442875724E+000	0.556	1.235	1.444
41.476	0.413 208.000	0.712	4.3231407628E+000	
3.0022216520E+000	-2.0503324395E+000	0.539	1.224	1.430
41.603	0.411 208.089	0.710	4.0714843958E+000	
2.8264510244E+000	-2.0466326321E+000	0.514	1.210	1.411
41.688	0.413 208.151	0.711	3.8948645054E+000	
2.7027357121E+000	-2.0420641789E+000	0.496	1.203	1.400
41.815	0.411 208.240	0.710	3.6446743576E+000	
2.5276532099E+000	-2.0332500821E+000	0.470	1.198	1.387
41.898	0.412 208.300	0.710	3.4715852593E+000	
2.4065737063E+000	-2.0296413428E+000	0.452	1.198	1.383
42.026	0.410 208.390	0.710	3.2225623673E+000	

2.2330841112E+000	-2.0138067949E+000	0.425	1.202	1.381
42.110	0.411	208.450	0.706	3.0509342266E+000
2.1137941079E+000	-2.0073643471E+000	0.406	1.208	1.383
42.237	0.408	208.539	0.704	2.8039900093E+000
1.9426151776E+000	-1.9898977098E+000	0.378	1.221	1.389
42.319	0.409	208.598	0.705	2.6382014598E+000
1.8268726890E+000	-1.9832048416E+000	0.358	1.231	1.395
42.447	0.406	208.686	0.703	2.3934432175E+000
1.6548675247E+000	-1.9590704970E+000	0.329	1.248	1.405
42.532	0.407	208.748	0.728	2.2229959195E+000
1.5337148774E+000	-2.0329058927E+000	0.308	1.261	1.413
42.660	0.409	208.842	0.724	1.9547942352E+000
1.3411360429E+000	-2.0677646213E+000	0.273	1.284	1.424
42.748	0.409	208.904	0.710	1.7755042073E+000
1.2128273813E+000	-2.0104330538E+000	0.250	1.299	1.432
42.875	0.409	208.994	0.710	1.5252699395E+000
1.0357433778E+000	-1.9484646685E+000	0.216	1.319	1.442
42.969	0.408	209.061	0.710	1.3433992321E+000
9.0901416491E-001	-1.9300625062E+000	0.192	1.332	1.449
43.020	0.408	209.097	0.709	1.2454989558E+000
8.4197901614E-001	-1.9277994825E+000	0.179	1.337	1.452
43.148	0.408	209.188	0.681	9.9853576325E-001
6.7543528004E-001	-1.8184965832E+000	0.146	1.350	1.461
43.198	0.402	209.218	0.705	9.0976773310E-001
6.1587820889E-001	-1.9032849721E+000	0.133	1.352	1.464
43.325	0.399	209.313	0.734	6.2440022030E-001
4.2671917896E-001	-2.2721533842E+000	0.095	1.359	1.477
43.402	0.395	209.368	0.630	4.4851994291E-001
3.1268547125E-001	-1.9986608191E+000	0.070	1.345	1.483
43.460	0.377	209.398	0.630	3.4555807559E-001
2.5613038561E-001	-2.0665665666E+000	0.058	1.357	1.490

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#### LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 ht(m) : Altezza linea di thrust da nodo sinistro base concio  
 yt(m) : coordinata Y linea di trust  
 yt'(-) : gradiente pendenza locale linea di trust  
 E(x)(kN/m) : Forza Normale interconcio  
 T(x)(kN/m) : Forza Tangenziale interconcio  
 E' (kN) : derivata Forza normale interconcio  
 Rho(x) (-) : fattore mobilizzazione resistenza al taglio verticale interconcio  
 ZhU et al.(2003)  
 FS\_FEM(x) (-) : fattore di sicurezza locale stimato (locale in X) by qFEM  
 FS\_SRM(x) (-) : fattore di sicurezza locale stimato (locale in X) by SRM  
 Procedure

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 TABELLA SFORZI DI TAGLIO DISTRIBUITI LUNGO SUPERFICIE INDIVIDUATA CON MINOR FS  
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	X	dx	dI	alpha	TauStress	TauF
TauStrength	TauS					
(kPa)	(m)	(m)	(m)	(°)	(kPa)	(kN/m)
6.875	37.174	0.128	0.129	7.393	0.102	0.013
6.941	37.302	0.048	0.049	7.393	0.243	0.012
7.394	37.350	0.128	0.129	7.393	0.398	0.051
8.067	37.478	0.128	0.129	7.393	0.633	0.081
8.663	37.605	0.128	0.129	7.393	0.867	0.112
9.189	37.733	0.128	0.129	7.393	1.101	0.142
9.675	37.861	0.093	0.094	7.393	1.304	0.123
9.890	37.954	0.128	0.129	8.957	1.719	0.222
10.222	38.081	0.059	0.059	8.957	1.905	0.113
10.580	38.140	0.128	0.129	8.957	2.092	0.270
10.981	38.268	0.047	0.048	8.957	2.267	0.108
10.836	38.315	0.128	0.131	12.395	3.080	0.402
11.243	38.442	0.113	0.116	12.395	3.351	0.388
10.996	38.555	0.128	0.133	16.552	4.457	0.593
11.252	38.683	0.070	0.073	16.552	4.689	0.342
10.931	38.753	0.128	0.137	21.387	5.861	0.803
11.185	38.881	0.071	0.076	21.387	6.075	0.463
10.993	38.952	0.128	0.141	24.962	6.922	0.974
11.151	39.079	0.052	0.057	24.962	7.085	0.404
10.974	39.131	0.128	0.145	28.386	7.777	1.128
11.134	39.259	0.066	0.075	28.386	7.908	0.590
10.995	39.324	0.128	0.149	31.128	8.394	1.251
11.154	39.452	0.079	0.092	31.128	8.484	0.779
11.107	39.530	0.128	0.152	33.166	8.792	1.341
	39.658	0.115	0.137	33.166	8.848	1.212

11.268	1.543					
39.773	0.128	0.153	33.437	8.930	1.366	
11.346	1.735					
39.900	0.100	0.120	33.437	8.975	1.074	
11.462	1.372					
40.000	0.128	0.153	33.734	9.049	1.389	
11.442	1.756					
40.128	0.090	0.108	33.734	9.085	0.980	
11.426	1.233					
40.218	0.128	0.154	34.039	9.150	1.409	
11.366	1.751					
40.345	0.060	0.072	34.039	9.175	0.662	
11.357	0.820					
40.405	0.025	0.030	34.039	9.186	0.276	
11.405	0.342					
40.430	0.128	0.155	34.354	9.234	1.428	
11.378	1.759					
40.557	0.081	0.098	34.354	9.255	0.909	
11.478	1.127					
40.639	0.128	0.155	34.648	9.301	1.443	
11.505	1.785					
40.766	0.080	0.098	34.648	9.314	0.909	
11.626	1.134					
40.846	0.128	0.156	34.941	9.352	1.456	
11.512	1.792					
40.974	0.081	0.099	34.941	9.358	0.922	
11.550	1.138					
41.055	0.128	0.156	35.229	9.387	1.467	
11.488	1.795					
41.182	0.082	0.100	35.229	9.386	0.940	
11.535	1.156					
41.264	0.128	0.157	35.509	9.407	1.475	
11.470	1.798					
41.392	0.084	0.103	35.509	9.399	0.967	
11.514	1.184					
41.476	0.128	0.157	35.511	9.391	1.473	
11.472	1.799					
41.603	0.084	0.104	35.511	9.384	0.971	
11.508	1.191					
41.688	0.128	0.157	35.513	9.376	1.470	
11.461	1.797					
41.815	0.083	0.102	35.513	9.368	0.957	
11.495	1.175					
41.898	0.128	0.157	35.514	9.360	1.468	
11.448	1.795					
42.026	0.084	0.103	35.514	9.352	0.960	
11.475	1.177					
42.110	0.128	0.157	35.516	9.344	1.465	
11.432	1.793					
42.237	0.082	0.101	35.516	9.336	0.939	
11.460	1.153					
42.319	0.128	0.157	35.518	9.329	1.463	
11.427	1.792					
42.447	0.086	0.105	35.518	9.321	0.982	



11.452	1.207					
	42.532	0.128	0.157	35.520	9.313	1.460
11.490	1.802					
	42.660	0.088	0.108	35.520	9.304	1.002
11.466	1.235					
	42.748	0.128	0.157	35.521	9.296	1.458
11.429	1.792					
	42.875	0.094	0.115	35.521	9.288	1.070
11.409	1.314					
	42.969	0.051	0.062	35.523	9.282	0.580
11.391	0.712					
	43.020	0.128	0.157	35.523	9.275	1.455
11.382	1.785					
	43.148	0.050	0.062	35.523	9.269	0.570
11.327	0.697					
	43.198	0.128	0.161	37.527	9.385	1.510
11.242	1.809					
	43.325	0.077	0.097	37.527	9.326	0.902
11.218	1.085					
	43.402	0.058	0.075	39.739	9.388	0.708
10.715	0.808					
	43.460	0.128	0.166	39.739	9.238	1.533
11.165	1.853					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 dl(m) : lunghezza base concio  
 alpha(°) : Angolo pendenza base concio  
 TauStress(kPa) : Sforzo di taglio su base concio  
 TauF (kN/m) : Forza di taglio su base concio  
 TauStrength(kPa) : Resistenza al taglio su base concio  
 TauS (kN/m) : Forza resistente al taglio su base concio

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Strato 1 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso stimati secondo criterio di rottura non lineare Hoek et al.(2002)  
 CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)  
 Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

SigmaN' (kPa)	TauSrength(kPa)	Phi' (deg)	c' (kPa)
25.00	137.42	58.47	69.19
50.00	186.72	55.52	76.58
75.00	229.23	53.43	82.28
100.00	269.97	51.71	89.32
125.00	307.76	50.29	95.71
150.00	344.72	49.03	103.03
175.00	380.39	47.92	110.48

200.00	414.33	46.95	117.39
225.00	446.12	46.09	123.16
250.00	479.13	45.26	131.05
275.00	509.50	44.53	137.06
300.00	540.87	43.82	144.79
325.00	569.14	43.21	149.99
350.00	598.21	42.61	156.59
375.00	628.07	42.02	164.54
400.00	654.32	41.52	169.27
425.00	685.72	40.95	179.76
450.00	708.67	40.55	181.95
475.00	736.79	40.07	189.88
500.00	760.71	39.67	193.83
600.00	866.21	38.06	223.16
700.00	957.87	36.80	242.59
800.00	1049.54	35.65	265.80
900.00	1140.54	34.60	291.52
1000.00	1223.57	33.71	311.63
1100.00	1303.83	32.91	331.24
1200.00	1387.74	32.12	356.93
1300.00	1460.58	31.47	372.79
1400.00	1536.19	30.83	393.39
1500.00	1614.69	30.20	418.74
2000.00	1960.39	27.76	515.66

Strato 2 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso

stimati secondo criterio di rottura non lineare Hoek et

al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

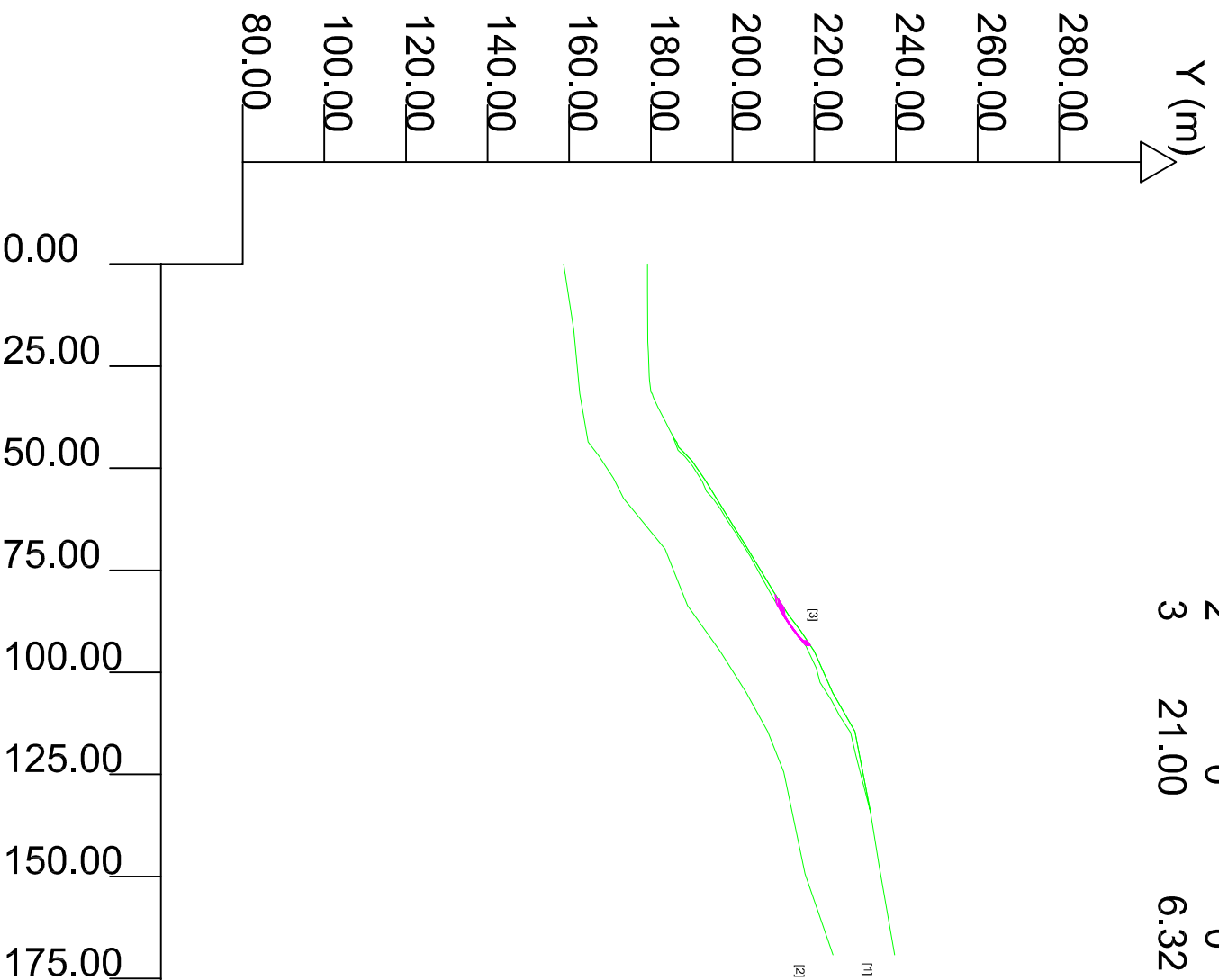
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SigmaN'(kPa)	TauStrength(kPa)	Phi'(deg)	c'(kPa)
25.00	696.24	60.38	513.03
50.00	756.64	59.62	520.01
75.00	806.42	59.04	520.13
100.00	857.50	58.47	523.03
125.00	909.85	57.91	528.58
150.00	949.97	57.49	524.59
175.00	1004.57	56.95	534.68
200.00	1046.36	56.55	534.32
225.00	1103.20	56.03	548.62
250.00	1146.67	55.64	551.63
275.00	1190.86	55.26	556.09
300.00	1235.77	54.89	561.97
325.00	1281.40	54.52	569.22
350.00	1327.76	54.15	577.81
375.00	1359.06	53.91	572.83
400.00	1406.61	53.55	583.74
425.00	1454.89	53.20	595.90
450.00	1487.48	52.96	593.65
475.00	1536.97	52.61	607.98

500.00	1570.37	52.38	607.39
600.00	1724.68	51.37	628.85
700.00	1885.62	50.39	662.51
800.00	2034.30	49.55	689.13
900.00	2188.33	48.73	725.29
1000.00	2327.55	48.02	750.56
1100.00	2450.22	47.43	762.64
1200.00	2597.27	46.75	801.99
1300.00	2726.73	46.18	826.48
1400.00	2859.39	45.62	856.64
1500.00	2972.41	45.17	869.25
2000.00	3572.08	42.95	995.66

Data : 18/04/2019  
 Localita' : Loc. Cepparello  
 Descrizione : Sez.4 - Stato attuale  
 [n] = N. strato o lente

#	Parametri Geotecnici degli strati #	-----									
N.	phi` deg	C` kPa	Cu kPa	Gamm kN/m3	GammSat kN/m3	sgci MPa	GSI	mi	D		
1	0	0	0	24.00	24.50	50.00	..	..	1.00		
2	0	0	0	24.00	24.50	100.00	65.00	17.00	1.00		
3	21.00	6.32	0	17.50	18.50	0	0	0	0		



**DATI 10 SUP. CON MINOR Fs**

Fs minimo : 1.1764  
 Range Fs : 1.1764 1.1941  
 Differenza % Range Fs : 1.48  
 Coefficiente Sismico orizzontale - Kh: 0.0510

**GENERAZIONE SUPERFICI RANDOM**

Campione Superfici - N.: 20000  
 Lunghezza media segmenti (m) : 1.0  
 Range X inizio generazione : 3.4 - 155.7  
 Range X termine generazione : 20.3 - 165.8  
 Livello Y minimo considerato : 85.6

X (m)

# Report elaborazioni #

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SSAP 4.9.9 - Slope Stability Analysis Program (1991,2018)

WWW.SSAP.EU

Build No. 10784

BY

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\*UASLP, San Luis Potosi, Mexico

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\*\* Gia' Ricercatore CNR-IRPI fino a Luglio 2011

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Ultima Revisione struttura tabelle del report: 29 dicembre 2018  
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File report: C:\SSAP2010\Verifiche\Risultati\Sez4\_Stato\_Attuale.txt

Data: 17/4/2019

Localita' :

Descrizione:

Modello pendio: Sez4-stato\_attuale\_V1.mod

----- PARAMETRI DEL MODELLO DEL PENDIO -----

\_\_\_ PARAMETRI GEOMETRICI - Coordinate X Y (in m) \_\_\_

SUP T.		SUP 2		SUP 3		SUP 4	
X	Y	X	Y	X	Y	X	Y
0.00	179.19	0.00	158.61	42.20	185.39	-	-
6.60	179.19	16.03	161.09	45.64	186.66	-	-
19.00	179.26	31.68	162.56	47.16	188.34	-	-
21.54	179.36	43.55	164.66	49.39	190.18	-	-
27.39	179.60	47.13	167.41	53.23	192.57	-	-
28.45	179.67	52.42	170.84	55.71	193.61	-	-
31.34	180.03	57.41	173.30	57.39	195.21	-	-
31.60	180.20	69.83	183.50	59.87	196.97	-	-
31.68	180.25	83.63	188.96	62.83	198.73	-	-
31.88	180.34	94.91	197.04	65.87	200.73	-	-
32.35	180.54	104.85	203.27	71.62	204.32	-	-
32.89	180.74	114.63	208.66	76.90	207.28	-	-
34.09	181.25	124.40	212.54	82.02	210.08	-	-
35.04	181.71	149.41	217.76	87.12	213.14	-	-
37.11	182.74	169.20	224.61	90.08	215.27	-	-
37.92	183.19	-	-	93.61	217.99	-	-
38.54	183.51	-	-	98.96	220.53	-	-
40.96	184.74	-	-	102.50	221.44	-	-
41.45	185.00	-	-	106.80	224.17	-	-
42.57	185.59	-	-	110.64	226.20	-	-
43.71	186.35	-	-	114.76	228.94	-	-
44.80	186.74	-	-	120.26	230.18	-	-
45.87	187.85	-	-	134.20	233.75	-	-
48.12	190.00	-	-	132.34	233.44	-	-

53.10	193.45	-	-	114.45	230.00	-	-
63.82	200.00	-	-	105.03	224.51	-	-
68.03	202.65	-	-	94.84	220.00	-	-
80.21	210.00	-	-	89.77	216.63	-	-
85.89	213.66	-	-	85.89	213.66	-	-
89.77	216.63	-	-	80.21	210.00	-	-
94.84	220.00	-	-	68.03	202.65	-	-
105.03	224.51	-	-	63.82	200.00	-	-
114.45	230.00	-	-	53.10	193.45	-	-
132.34	233.44	-	-	48.12	190.00	-	-
134.20	233.75	-	-	45.87	187.85	-	-
147.77	236.00	-	-	44.80	186.74	-	-
169.20	239.74	-	-	43.71	186.35	-	-
-	-	-	-	42.57	185.59	-	-
-	-	-	-	42.20	185.39	-	-

## ASSENZA DI FALDA ##

----- PARAMETRI GEOMECCANICI -----

STR_IDX	sgci	fi` GSI	mi	C` D	Cu	Gamm	Gamm_sat
STRATO 1	1	0.00		0.00	0.00	24.00	24.50
8.587	50.00	50.00	17.00	1.00			
STRATO 2	2	0.00		0.00	0.00	24.00	24.50
12.882	100.00	65.00	17.00	1.00			
STRATO 3	3	21.00		6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00			

LEGENDA: fi` \_\_\_\_\_ Angolo di attrito interno efficace(in gradi)  
C` \_\_\_\_\_ Coesione efficace (in Kpa)  
Cu \_\_\_\_\_ Resistenza al taglio Non drenata (in Kpa)  
Gamm \_\_\_\_\_ Peso di volume terreno fuori falda (in KN/m^3)  
Gamm\_sat \_\_\_\_\_ Peso di volume terreno immerso (in KN/m^3)  
STR\_IDX \_\_\_\_\_ Indice di resistenza (usato in solo in 'SNIFF SEARCH)

(adimensionale)

---- SOLO Per AMMASSI ROCCIOSI FRATTURATI - Parametri Criterio di Rottura di Hoek (2002)-

sigci \_\_\_\_\_ Resistenza Compressione Uniassiale Roccia Intatta (in MPa)

GSI \_\_\_\_\_ Geological Strenght Index ammasso(adimensionale)

mi \_\_\_\_\_ Indice litologico ammasso(adimensionale)

D \_\_\_\_\_ Fattore di disturbo ammasso(adimensionale)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 -

ATTIVATO (solo per ROCCE)

Uso CRITERIO DI ROTTURA Hoek et al.(2002,2006) - non-lineare - Generalizzato secondo Lei et al.(2016)

----- INFORMAZIONI GENERAZIONE SUPERFICI RANDOM -----

\*\*\* PARAMETRI PER LA GENERAZIONE DELLE SUPERFICI

METODO DI RICERCA: CONVEX RANDOM - Chen (1992)

FILTRAGGIO SUPERFICI : ATTIVATO

COORDINATE X1,X2,Y OSTACOLO : 0.00 0.00 0.00

LUNGHEZZA MEDIA SEGMENTI (m): 1.0 (+/-) 50%

INTERVALLO ASCISSE RANDOM STARTING POINT (Xmin .. Xmax): 3.38

155.66

LIVELLO MINIMO CONSIDERATO (Ymin): 85.59  
INTERVALLO ASCISSE AMMESSO PER LA TERMINAZIONE (Xmin .. Xmax): 20.30

165.82

\*\*\* TOTALE SUPERFICI GENERATE : 20000

----- INFORMAZIONI PARAMETRI DI CALCOLO -----

METODO DI CALCOLO : BORSELLI (Borselli, 2016)  
COEFFICIENTE SISMICO UTILIZZATO Kh : 0.0510  
COEFFICIENTE SISMICO UTILIZZATO Kv (assunto Positivo): 0.0255  
COEFFICIENTE  $c=Kv/Kh$  UTILIZZATO : 0.5000  
FORZA ORIZZONTALE ADDIZIONALE IN TESTA (kN/m): 0.00  
FORZA ORIZZONTALE ADDIZIONALE ALLA BASE (kN/m): 0.00

N.B. Le forze orizzontali addizionali in testa e alla base sono poste uguali a 0

durante le tutte le verifiche globali.

I valori >0 impostati dall'utente sono utilizzati solo in caso di verifica singola

----- RISULTATO FINALE ELABORAZIONI -----

\* DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR  $F_s$  \*

Fattore di sicurezza (FS) 1.1764 - Min. - X Y Lambda=  
0.4507

81.92	211.10
82.87	211.23
83.32	211.31
83.62	211.37
83.88	211.44
84.13	211.53
84.36	211.62
84.60	211.73
84.86	211.86
85.16	212.02
85.44	212.18
85.70	212.33
85.96	212.48
86.22	212.64
86.47	212.80
86.73	212.96
86.99	213.13
87.26	213.31
87.53	213.49
87.79	213.66
88.05	213.84
88.31	214.02
88.56	214.20
88.83	214.39
89.09	214.58
89.36	214.77

89.62	214.96
89.88	215.15
90.13	215.35
90.39	215.55
90.65	215.75
90.91	215.96
91.18	216.17
91.47	216.40
91.73	216.63
91.98	216.86
92.22	217.09
92.47	217.35
92.75	217.66
92.75	218.61

Fattore di sicurezza (FS)    1.1786   - N.2   --    X            Y            Lambda=  
0.4596

81.03	210.53
81.96	210.61
82.39	210.66
82.68	210.71
82.92	210.78
83.16	210.86
83.37	210.95
83.60	211.06
83.85	211.20
84.14	211.38
84.41	211.54
84.67	211.71
84.93	211.86
85.18	212.02
85.43	212.18
85.68	212.34
85.93	212.50
86.19	212.66
86.44	212.83
86.69	212.99
86.95	213.15
87.20	213.32
87.45	213.48
87.70	213.65
87.96	213.82
88.21	213.99
88.46	214.16
88.71	214.33
88.96	214.50
89.21	214.68
89.46	214.86
89.71	215.04
89.96	215.23
90.22	215.43
90.48	215.62
90.73	215.82



90.98	216.02
91.23	216.22
91.47	216.42
91.73	216.64
91.98	216.86
92.25	217.09
92.50	217.32
92.75	217.55
92.99	217.78
92.99	218.77

Fattore di sicurezza (FS)    1.1807   - N.3 --    X            Y            Lambda=  
0.4499

82.59	211.53
83.73	211.72
84.27	211.82
84.63	211.91
84.93	212.01
85.23	212.12
85.50	212.25
85.79	212.40
86.10	212.58
86.45	212.81
86.79	213.02
87.11	213.23
87.42	213.44
87.73	213.65
88.04	213.85
88.35	214.07
88.67	214.28
88.99	214.51
89.30	214.73
89.61	214.95
89.92	215.18
90.23	215.41
90.53	215.65
90.85	215.89
91.17	216.15
91.50	216.42
91.81	216.69
92.12	216.96
92.41	217.23
92.72	217.53
93.05	217.87
93.05	218.81

Fattore di sicurezza (FS)    1.1873   - N.4 --    X            Y            Lambda=  
0.4412

84.13	212.53
85.17	212.65
85.65	212.72
85.97	212.78

86.23	212.86
86.50	212.96
86.74	213.07
86.99	213.21
87.27	213.37
87.59	213.58
87.89	213.78
88.18	213.98
88.47	214.17
88.74	214.36
89.02	214.55
89.30	214.75
89.58	214.95
89.87	215.15
90.15	215.36
90.43	215.57
90.70	215.77
90.98	215.99
91.26	216.20
91.54	216.42
91.83	216.65
92.13	216.89
92.41	217.13
92.68	217.37
92.94	217.62
93.22	217.88
93.38	218.05
93.38	219.03

Fattore di sicurezza (FS)    1.1892   - N.5   --    X            Y            Lambda=  
0.4347

83.85	212.35
84.74	212.35
85.14	212.36
85.41	212.39
85.62	212.43
85.84	212.50
86.03	212.57
86.24	212.67
86.48	212.80
86.76	212.97
87.02	213.13
87.26	213.28
87.49	213.44
87.72	213.59
87.95	213.75
88.18	213.92
88.41	214.09
88.66	214.27
88.90	214.45
89.13	214.63
89.37	214.81
89.60	214.99

89.84	215.17
90.08	215.34
90.32	215.52
90.55	215.70
90.79	215.88
91.02	216.07
91.25	216.25
91.48	216.44
91.72	216.63
91.95	216.82
92.19	217.03
92.44	217.24
92.68	217.45
92.91	217.66
93.13	217.88
93.13	218.86

Fattore di sicurezza (FS)    1.1905   - N.6   --    X            Y            Lambda=  
0.4494

82.10	211.22
83.24	211.43
83.78	211.54
84.15	211.64
84.45	211.73
84.75	211.85
85.03	211.98
85.33	212.13
85.64	212.31
85.99	212.53
86.33	212.74
86.65	212.95
86.96	213.15
87.27	213.36
87.58	213.56
87.89	213.78
88.20	214.00
88.52	214.23
88.84	214.45
89.15	214.68
89.47	214.90
89.78	215.13
90.10	215.36
90.42	215.59
90.75	215.83
91.09	216.07
91.40	216.31
91.69	216.55
91.98	216.81
92.28	217.10
92.61	217.45
92.78	217.64
92.78	218.63

Fattore di sicurezza (FS) 1.1923 - N.7 -- X Y Lambda=  
0.4495

83.08	211.85
83.99	211.96
84.42	212.02
84.71	212.08
84.95	212.14
85.18	212.22
85.40	212.31
85.63	212.42
85.88	212.55
86.16	212.71
86.43	212.86
86.68	213.02
86.93	213.17
87.18	213.32
87.42	213.47
87.67	213.62
87.92	213.78
88.18	213.95
88.43	214.12
88.68	214.28
88.92	214.45
89.17	214.62
89.41	214.79
89.66	214.97
89.92	215.16
90.18	215.36
90.43	215.55
90.67	215.74
90.91	215.94
91.15	216.16
91.39	216.37
91.63	216.60
91.88	216.84
92.14	217.10
92.39	217.36
92.56	217.53
92.56	218.49

Fattore di sicurezza (FS) 1.1923 - N.8 -- X Y Lambda=  
0.4421

83.63	212.21
84.68	212.35
85.17	212.43
85.49	212.51
85.77	212.59
86.04	212.69
86.28	212.80
86.55	212.93
86.83	213.09
87.16	213.29

87.46	213.48
87.75	213.66
88.03	213.84
88.31	214.03
88.59	214.22
88.87	214.42
89.16	214.62
89.46	214.84
89.74	215.05
90.03	215.26
90.30	215.48
90.58	215.70
90.86	215.92
91.15	216.16
91.44	216.40
91.74	216.66
92.02	216.91
92.30	217.17
92.57	217.43
92.85	217.71
92.85	218.68

Fattore di sicurezza (FS)    1.1930   - N.9 --    X            Y            Lambda=  
0.4429

82.02	211.17
83.13	211.36
83.66	211.46
84.01	211.55
84.31	211.64
84.60	211.75
84.87	211.86
85.16	212.00
85.46	212.17
85.81	212.37
86.13	212.56
86.44	212.75
86.74	212.95
87.04	213.14
87.33	213.34
87.63	213.55
87.94	213.77
88.25	214.00
88.56	214.22
88.87	214.45
89.17	214.68
89.47	214.90
89.78	215.13
90.09	215.37
90.41	215.61
90.73	215.86
91.03	216.11
91.32	216.36
91.61	216.62

91.90 216.91  
 92.22 217.25  
 92.31 217.34  
 92.31 218.32

Fattore di sicurezza (FS) 1.1941 - N.10 -- X Y Lambda=  
 0.4340

83.52 212.13  
 84.49 212.19  
 84.94 212.22  
 85.23 212.27  
 85.47 212.33  
 85.71 212.41  
 85.93 212.50  
 86.16 212.62  
 86.42 212.77  
 86.73 212.96  
 87.01 213.15  
 87.28 213.32  
 87.54 213.50  
 87.80 213.67  
 88.05 213.85  
 88.31 214.03  
 88.57 214.21  
 88.83 214.40  
 89.09 214.59  
 89.35 214.78  
 89.61 214.97  
 89.87 215.16  
 90.13 215.35  
 90.40 215.55  
 90.67 215.75  
 90.96 215.96  
 91.21 216.16  
 91.45 216.37  
 91.69 216.60  
 91.94 216.86  
 92.20 217.16  
 92.46 217.47  
 92.46 218.42

----- ANALISI DEFICIT DI RESISTENZA -----

# DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR FS \*

# Analisi Deficit in riferimento a FS(progetto) = 1.200

Sup N.	FS	FTR(kN/m)	FTA(kN/m)	Bilancio(kN/m)	ESITO
1	1.176	156.9	133.4	-3.2	Deficit
2	1.179	173.0	146.8	-3.1	Deficit
3	1.181	151.4	128.3	-2.5	Deficit
4	1.187	135.2	113.9	-1.4	Deficit
5	1.189	138.7	116.6	-1.3	Deficit
6	1.190	153.2	128.7	-1.2	Deficit

7	1.192	137.2	115.1	-0.9	Deficit
8	1.192	133.8	112.3	-0.9	Deficit
9	1.193	148.2	124.2	-0.9	Deficit
10	1.194	133.3	111.6	-0.7	Deficit

Esito analisi: DEFICIT di RESISTENZA!

Valore massimo di DEFICIT di RESISTENZA(kN/m): -3.2

Note: FTR --> Forza totale Resistente lungo la superficie di scivolamento

FTA --> Forza totale Agente lungo la superficie di scivolamento

IMPORTANTE! : Il Deficit o il Surplus di resistenza viene espresso in kN per metro di LARGHEZZA rispetto al fronte della scarpata

TABELLA PARAMETRI CONCI DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

phi'	X	dx	alpha	W	ru	U
(°)	(m)	(m)	(°)	(kN/m)	(-)	(kPa)
	(c',Cu)					
	(kPa)					
21.00	81.919	0.101	7.97	0.05	0.00	0.00
	6.32					
21.00	82.020	0.174	7.97	0.30	0.00	0.00
	6.32					
21.00	82.194	0.174	7.97	0.57	0.00	0.00
	6.32					
21.00	82.368	0.174	7.97	0.85	0.00	0.00
	6.32					
21.00	82.542	0.174	7.97	1.12	0.00	0.00
	6.32					
21.00	82.717	0.151	7.97	1.20	0.00	0.00
	6.32					
21.00	82.868	0.174	9.25	1.63	0.00	0.00
	6.32					
21.00	83.042	0.008	9.25	0.08	0.00	0.00
	6.32					
21.00	83.050	0.174	9.25	1.90	0.00	0.00
	6.32					
21.00	83.224	0.094	9.25	1.13	0.00	0.00
	6.32					
21.00	83.318	0.174	11.96	2.29	0.00	0.00
	6.32					
21.00	83.492	0.131	11.96	1.87	0.00	0.00
	6.32					
21.00	83.622	0.008	15.13	0.11	0.00	0.00
	6.32					
21.00	83.630	0.174	15.13	2.70	0.00	0.00
	6.32					

	83.804	0.074	15.13	1.21	0.00	0.00
21.00	6.32					
	83.878	0.174	18.89	2.97	0.00	0.00
21.00	6.32					
	84.052	0.076	18.89	1.34	0.00	0.00
21.00	6.32					
	84.128	0.174	21.71	3.19	0.00	0.00
21.00	6.32					
	84.302	0.057	21.71	1.07	0.00	0.00
21.00	6.32					
	84.359	0.174	24.45	3.35	0.00	0.00
21.00	6.32					
	84.533	0.071	24.45	1.40	0.00	0.00
21.00	6.32					
	84.604	0.174	26.75	3.48	0.00	0.00
21.00	6.32					
	84.779	0.085	26.75	1.73	0.00	0.00
21.00	6.32					
	84.864	0.174	28.56	3.58	0.00	0.00
21.00	6.32					
	85.038	0.124	28.56	2.58	0.00	0.00
21.00	6.32					
	85.162	0.174	29.16	3.67	0.00	0.00
21.00	6.32					
	85.336	0.103	29.16	2.19	0.00	0.00
21.00	6.32					
	85.438	0.174	29.82	3.74	0.00	0.00
21.00	6.32					
	85.612	0.091	29.82	1.97	0.00	0.00
21.00	6.32					
	85.703	0.174	30.51	3.80	0.00	0.00
21.00	6.32					
	85.877	0.013	30.51	0.27	0.00	0.00
21.00	6.32					
	85.890	0.071	30.51	1.57	0.00	0.00
21.00	6.32					
	85.961	0.174	31.20	3.90	0.00	0.00
21.00	6.32					
	86.135	0.084	31.20	1.90	0.00	0.00
21.00	6.32					
	86.219	0.174	31.85	4.02	0.00	0.00
21.00	6.32					
	86.393	0.080	31.85	1.88	0.00	0.00
21.00	6.32					
	86.473	0.174	32.50	4.13	0.00	0.00
21.00	6.32					
	86.648	0.083	32.50	2.00	0.00	0.00
21.00	6.32					
	86.731	0.174	33.12	4.23	0.00	0.00
21.00	6.32					
	86.905	0.087	33.12	2.13	0.00	0.00
21.00	6.32					
	86.991	0.129	33.70	3.19	0.00	0.00
21.00	6.32					



21.00	87.120	0.141	33.70	3.53	0.00	0.00
	6.32					
21.00	87.261	0.174	33.95	4.40	0.00	0.00
	6.32					
21.00	87.435	0.090	33.95	2.30	0.00	0.00
	6.32					
21.00	87.526	0.174	34.22	4.48	0.00	0.00
	6.32					
21.00	87.700	0.087	34.22	2.25	0.00	0.00
	6.32					
21.00	87.787	0.043	34.49	1.12	0.00	0.00
	6.32					
21.00	87.830	0.174	34.49	4.55	0.00	0.00
	6.32					
21.00	88.004	0.042	34.49	1.11	0.00	0.00
	6.32					
21.00	88.046	0.174	34.75	4.61	0.00	0.00
	6.32					
21.00	88.220	0.085	34.75	2.26	0.00	0.00
	6.32					
21.00	88.306	0.174	35.02	4.66	0.00	0.00
	6.32					
21.00	88.480	0.085	35.02	2.29	0.00	0.00
	6.32					
21.00	88.565	0.174	35.28	4.71	0.00	0.00
	6.32					
21.00	88.739	0.086	35.28	2.34	0.00	0.00
	6.32					
21.00	88.825	0.174	35.54	4.76	0.00	0.00
	6.32					
21.00	88.999	0.089	35.54	2.44	0.00	0.00
	6.32					
21.00	89.088	0.174	35.79	4.80	0.00	0.00
	6.32					
21.00	89.262	0.093	35.79	2.57	0.00	0.00
	6.32					
21.00	89.355	0.174	36.20	4.83	0.00	0.00
	6.32					
21.00	89.529	0.087	36.20	2.43	0.00	0.00
	6.32					
21.00	89.617	0.153	36.63	4.28	0.00	0.00
	6.32					
21.00	89.770	0.105	36.63	2.93	0.00	0.00
	6.32					
21.00	89.875	0.174	37.06	4.81	0.00	0.00
	6.32					
21.00	90.049	0.031	37.06	0.84	0.00	0.00
	6.32					
21.00	90.080	0.052	37.06	1.43	0.00	0.00
	6.32					
21.00	90.132	0.174	37.49	4.73	0.00	0.00
	6.32					
21.00	90.306	0.084	37.49	2.28	0.00	0.00
	6.32					

21.00	90.391	0.174	37.92	4.65	0.00	0.00
	6.32					
21.00	90.565	0.085	37.92	2.25	0.00	0.00
	6.32					
21.00	90.650	0.174	38.34	4.55	0.00	0.00
	6.32					
21.00	90.824	0.089	38.34	2.30	0.00	0.00
	6.32					
21.00	90.913	0.174	38.75	4.45	0.00	0.00
	6.32					
21.00	91.087	0.097	38.75	2.43	0.00	0.00
	6.32					
21.00	91.184	0.174	39.12	4.33	0.00	0.00
	6.32					
21.00	91.358	0.110	39.12	2.68	0.00	0.00
	6.32					
21.00	91.468	0.174	40.73	4.18	0.00	0.00
	6.32					
21.00	91.642	0.084	40.73	1.97	0.00	0.00
	6.32					
21.00	91.726	0.174	42.48	4.01	0.00	0.00
	6.32					
21.00	91.900	0.077	42.48	1.72	0.00	0.00
	6.32					
21.00	91.977	0.174	44.26	3.80	0.00	0.00
	6.32					
21.00	92.151	0.068	44.26	1.44	0.00	0.00
	6.32					
21.00	92.219	0.086	45.92	1.78	0.00	0.00
	6.32					
21.00	92.305	0.168	45.92	3.34	0.00	0.00
	6.32					
21.00	92.473	0.174	47.95	3.23	0.00	0.00
	6.32					
21.00	92.648	0.099	47.95	1.74	0.00	0.00
	6.32					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 alpha(°) : Angolo pendenza base concio  
 W(kN/m) : Forza peso concio  
 ru(-) : Coefficiente locale pressione interstiziale  
 U(kPa) : Pressione totale dei pori base concio  
 phi'(°) : Angolo di attrito efficace base concio  
 c'/Cu (kPa) : Coesione efficace o Resistenza al taglio in condizioni non drenate

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TABELLA DIAGRAMMA DELLE FORZE DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

T(x)	X (m)	ht E' (m) (kN)	yt rho(x) (m) (--)	yt' FS_FEM (--) (--)	E(x) FS_p-qFEM (kN/m) (--)
0.000000000E+000	81.919	0.000	211.101	0.268	0.000000000E+000
2.9217126333E-001	82.020	1.6982726807E+001	211.128	0.398	5.783 1.643
5.3314056089E-001	82.194	0.013	211.175	0.268	1.4099081056E+000
8.9213140026E-001	82.368	1.0963717895E+001	211.223	0.398	5.783 1.643
1.4756096398E+000	82.542	0.035	211.284	0.274	2.4146573227E+000
2.1088485444E+000	82.717	5.9716305729E+000	211.344	0.348	3.267 1.065
2.5881804657E+000	82.868	6.8795308497E+000	211.389	0.312	3.4898117756E+000
3.2274335886E+000	83.042	0.059	211.446	0.379	2.261 0.949
3.2545162251E+000	83.050	6.7954071536E+000	211.448	0.347	4.8107803393E+000
3.9228133175E+000	83.224	7.5236225626E+000	211.507	0.453	1.782 0.937
4.2642220143E+000	83.318	0.131	211.537	0.324	6.1102702901E+000
4.9779808596E+000	83.492	6.7954071536E+000	211.602	0.508	1.557 0.945
5.4832799279E+000	83.622	0.155	211.649	0.312	7.0505597781E+000
5.5106287624E+000	83.804	6.3752632236E+000	211.726	0.531	1.460 0.959
6.5049032619E+000	84.052	0.183	211.836	0.325	8.1926416483E+000
7.1756894987E+000	84.128	5.9273251993E+000	211.871	0.567	1.402 0.988
7.4314118239E+000	84.302	0.185	211.962	0.335	8.2398207790E+000
8.0569743929E+000	84.359	5.9176570375E+000	211.994	0.568	1.401 0.990
8.2599599002E+000	84.533	0.215	212.083	0.331	9.3435612337E+000
8.7347217333E+000	84.604	5.9931433262E+000	212.117	0.600	1.388 1.023
8.8999585702E+000	84.779	0.230	212.216	0.355	9.8870165482E+000
9.2968874689E+000	84.864	5.9213061645E+000	212.262	0.613	1.396 1.040
		0.258		0.369	1.0954963358E+001
		5.7830540439E+000		0.645	1.421 1.072
		0.277		0.364	1.1675974515E+001
		4.9818704931E+000		0.664	1.452 1.093
		0.278		0.420	1.1713296418E+001
		4.9713248776E+000		0.666	1.453 1.094
		0.305		0.419	1.2661847465E+001
		4.7307566779E+000		0.697	1.501 1.116
		0.315		0.446	1.2989979650E+001
		4.4294531686E+000		0.707	1.525 1.123
		0.336		0.460	1.3762805284E+001
		3.8480862579E+000		0.737	1.582 1.134
		0.344		0.501	1.4034807291E+001
		3.6057437861E+000		0.747	1.609 1.137
		0.366		0.534	1.4668379576E+001
		3.4765333485E+000		0.776	1.670 1.141
		0.376		0.526	1.4862996894E+001
		3.1615586326E+000		0.785	1.692 1.142
		0.386		0.502	1.5273665215E+001
		2.0192847366E+000		0.807	1.744 1.141
		0.387		0.539	1.5407479028E+001
		1.8118201058E+000		0.813	1.761 1.141
		0.398		0.559	1.5693579940E+001
		1.4130491591E+000		0.832	1.779 1.139
		0.402		0.601	1.5804126783E+001

9.4635874838E+000	1.2333572472E+000	0.840	1.778	1.139
85.038	0.416 212.371	0.607	1.5994803010E+001	
9.7851659120E+000	8.9695781159E-001	0.856	1.745	1.139
85.162	0.420 212.443	0.683	1.6088444827E+001	
9.9611821349E+000	7.2413892349E-001	0.864	1.708	1.140
85.336	0.455 212.575	0.700	1.6206699451E+001	
1.0221626688E+001	4.9107012594E-001	0.878	1.638	1.142
85.438	0.459 212.637	0.626	1.6245710769E+001	
1.0324598087E+001	3.3857635977E-001	0.882	1.608	1.144
85.612	0.471 212.748	0.601	1.6292316445E+001	
1.0496823703E+001	1.5775007283E-001	0.891	1.565	1.146
85.703	0.467 212.796	0.557	1.6301443057E+001	
1.0564828450E+001	5.7974703281E-002	0.894	1.552	1.147
85.877	0.464 212.896	0.568	1.6297384985E+001	
1.0697770100E+001	-6.8370500494E-002	0.901	1.529	1.151
85.890	0.463 212.902	0.507	1.6296487631E+001	
1.0706459459E+001	-8.7388634660E-002	0.902	1.528	1.152
85.961	0.457 212.938	0.585	1.6283858224E+001	
1.0750425818E+001	-2.2364004563E-001	0.900	1.523	1.154
86.135	0.459 213.046	0.613	1.6225132977E+001	
1.0865810062E+001	-4.2586580552E-001	0.900	1.498	1.161
86.219	0.459 213.096	0.677	1.6185955643E+001	
1.0908446870E+001	-5.4609581360E-001	0.899	1.486	1.166
86.393	0.475 213.220	0.725	1.6062693844E+001	
1.0979278046E+001	-8.5320873301E-001	0.898	1.445	1.179
86.473	0.485 213.280	0.768	1.5988960988E+001	
1.0996247896E+001	-9.6913814229E-001	0.897	1.422	1.186
86.648	0.509 213.416	0.728	1.5801635188E+001	
1.1006577004E+001	-1.0411562651E+000	0.893	1.367	1.202
86.731	0.509 213.468	0.689	1.5716541304E+001	
1.0992853063E+001	-1.1192786409E+000	0.890	1.344	1.208
86.905	0.520 213.593	0.692	1.5487079748E+001	
1.0927806712E+001	-1.2949851891E+000	0.883	1.289	1.222
86.991	0.519 213.648	0.719	1.5375826422E+001	
1.0888529063E+001	-1.4405012930E+000	0.878	1.265	1.227
87.120	0.533 213.748	0.770	1.5160591749E+001	
1.0799530530E+001	-1.7318700856E+000	0.871	1.225	1.235
87.261	0.547 213.856	0.778	1.4907036957E+001	
1.0681523014E+001	-1.9104703142E+000	0.862	1.185	1.242
87.435	0.567 213.993	0.761	1.4549789258E+001	
1.0504054680E+001	-1.8991475754E+000	0.850	1.141	1.249
87.526	0.570 214.057	0.713	1.4385236971E+001	
1.0419322573E+001	-1.8890145225E+000	0.844	1.125	1.251
87.700	0.576 214.182	0.704	1.4033153114E+001	
1.0234144116E+001	-1.8383144211E+000	0.831	1.096	1.255
87.787	0.576 214.241	0.666	1.3881274123E+001	
1.0152830186E+001	-1.8204489088E+000	0.825	1.087	1.256
87.830	0.574 214.268	0.635	1.3801075360E+001	
1.0109213826E+001	-1.8747269116E+000	0.822	1.082	1.256
88.004	0.565 214.379	0.633	1.3462189027E+001	
9.9193663935E+000	-1.9569012670E+000	0.809	1.065	1.256
88.046	0.562 214.405	0.698	1.3379504173E+001	
9.8710973720E+000	-2.0263342497E+000	0.806	1.061	1.256
88.220	0.566 214.530	0.706	1.2978621947E+001	

9.6297608125E+000	-2.2680763781E+000	0.790	1.041	1.252
88.306	0.565 214.588	0.766	1.2787207062E+001	
9.5099792556E+000	-2.4049646634E+000	0.782	1.031	1.250
88.480	0.584 214.729	0.794	1.2313653239E+001	
9.2024891071E+000	-2.6636310597E+000	0.763	1.007	1.240
88.565	0.589 214.794	0.777	1.2089475877E+001	
9.0529076188E+000	-2.6811012600E+000	0.753	0.996	1.235
88.739	0.602 214.930	0.747	1.1606648460E+001	
8.7213076172E+000	-2.5577098771E+000	0.732	0.971	1.220
88.825	0.600 214.988	0.741	1.1395357309E+001	
8.5740007461E+000	-2.5909217548E+000	0.722	0.961	1.213
88.999	0.610 215.123	0.753	1.0895060045E+001	
8.2153888938E+000	-2.7628001596E+000	0.699	0.940	1.195
89.088	0.610 215.186	0.740	1.0654389027E+001	
8.0392578559E+000	-2.8089349606E+000	0.687	0.931	1.186
89.262	0.616 215.318	0.745	1.0130322190E+001	
7.6480326170E+000	-2.8334022361E+000	0.661	0.913	1.167
89.355	0.616 215.385	0.743	9.8755556994E+000	
7.4541645988E+000	-3.0255896174E+000	0.647	0.907	1.159
89.529	0.620 215.516	0.750	9.2553454305E+000	
6.9762346520E+000	-3.2166580890E+000	0.615	0.894	1.142
89.617	0.621 215.581	0.750	8.9898945534E+000	
6.7718551422E+000	-3.1398816932E+000	0.601	0.890	1.136
89.770	0.622 215.697	0.736	8.4823545726E+000	
6.3848238658E+000	-3.0472848755E+000	0.574	0.884	1.128
89.875	0.619 215.772	0.716	8.1804401146E+000	
6.1572861414E+000	-2.9289459692E+000	0.561	0.883	1.125
90.049	0.613 215.897	0.708	7.6528233254E+000	
5.7624795159E+000	-2.7342423671E+000	0.537	0.883	1.123
90.080	0.609 215.917	0.595	7.5707887385E+000	
5.7014922918E+000	-2.6493129298E+000	0.534	0.883	1.123
90.132	0.599 215.946	0.646	7.4354367113E+000	
5.6010614368E+000	-2.7000259544E+000	0.528	0.884	1.124
90.306	0.582 216.063	0.659	6.9029985835E+000	
5.2015313558E+000	-2.9404652126E+000	0.503	0.891	1.130
90.391	0.571 216.117	0.702	6.6594380102E+000	
5.0164459867E+000	-3.0073371778E+000	0.491	0.895	1.135
90.565	0.563 216.244	0.725	6.0913417020E+000	
4.5752136400E+000	-3.1455818630E+000	0.461	0.908	1.148
90.650	0.557 216.305	0.788	5.8286637372E+000	
4.3672174414E+000	-3.2379468094E+000	0.446	0.914	1.155
90.824	0.564 216.449	0.766	5.2115443775E+000	
3.8692837193E+000	-2.9707709465E+000	0.409	0.933	1.175
90.913	0.551 216.506	0.731	4.9732171739E+000	
3.6743688023E+000	-2.8398963651E+000	0.394	0.941	1.184
91.087	0.546 216.641	0.741	4.4234896811E+000	
3.2219025979E+000	-2.8703723752E+000	0.357	0.961	1.206
91.184	0.534 216.707	0.762	4.1615165707E+000	
3.0065212030E+000	-2.8763672946E+000	0.339	0.971	1.217
91.358	0.533 216.847	0.772	3.6088632217E+000	
2.5584828770E+000	-2.9251710635E+000	0.299	0.993	1.243
91.468	0.522 216.926	0.806	3.3049858705E+000	
2.3185568229E+000	-2.9751558449E+000	0.277	1.006	1.258
91.642	0.523 217.076	0.816	2.7298157914E+000	

1.8811176925E+000	-2.8955568034E+000	0.236	1.030	1.290
91.726	0.511	217.136	0.751	2.5035645312E+000
1.7163023348E+000	-2.7471105837E+000	0.219	1.040	1.303
91.900	0.485	217.270	0.746	2.0079638282E+000
1.3642945164E+000	-2.5730313869E+000	0.184	1.064	1.334
91.977	0.468	217.323	0.722	1.8200315311E+000
1.2357112434E+000	-2.5047845086E+000	0.170	1.073	1.346
92.151	0.426	217.451	0.751	1.3633319706E+000
9.2888160752E-001	-2.7129382182E+000	0.136	1.099	1.380
92.219	0.414	217.505	0.739	1.1757139126E+000
8.0678267941E-001	-2.5392984594E+000	0.121	1.108	1.393
92.305	0.385	217.565	0.870	9.7987760378E-001
6.7980079625E-001	-2.4144797334E+000	0.106	1.123	1.412
92.473	0.372	217.727	0.956	5.2755889600E-001
3.6194955399E-001	-2.4109392635E+000	0.061	1.174	1.477
92.648	0.345	217.893	0.956	1.5724368860E-001
9.4667218659E-002	-1.7799883374E+000	0.039	1.229	1.541

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#### LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
ht(m) : Altezza linea di thrust da nodo sinistro base concio  
yt(m) : coordinata Y linea di trust  
yt'(-) : gradiente pendenza locale linea di trust  
E(x)(kN/m) : Forza Normale interconcio  
T(x)(kN/m) : Forza Tangenziale interconcio  
E' (kN) : derivata Forza normale interconcio  
Rho(x) (-) : fattore mobilizzazione resistenza al taglio verticale interconcio  
ZhU et al.(2003)  
FS\_FEM(x) (-) : fattore di sicurezza locale stimato (locale in X) by qFEM  
FS\_SRM(x) (-) : fattore di sicurezza locale stimato (locale in X) by SRM  
Procedure

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#### TABELLA SFORZI DI TAGLIO DISTRIBUITI LUNGO SUPERFICIE INDIVIDUATA CON MINOR FS

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X	dx	dI	alpha	TauStress	TauF
(m)	(m)	(m)	(°)	(kPa)	(kN/m)
81.919	0.101	0.102	7.967	0.086	0.009
7.113	0.725				
82.020	0.174	0.176	7.967	0.319	0.056
7.254	1.276				
82.194	0.174	0.176	7.967	0.614	0.108
7.989	1.405				
82.368	0.174	0.176	7.967	0.909	0.160
8.855	1.557				
82.542	0.174	0.176	7.967	1.204	0.212

9.506	1.672					
	82.717	0.151	0.153	7.967	1.480	0.226
9.956	1.521					
	82.868	0.174	0.176	9.254	1.947	0.343
10.471	1.848					
	83.042	0.008	0.008	9.254	2.111	0.017
10.710	0.087					
	83.050	0.174	0.176	9.254	2.275	0.401
11.086	1.956					
	83.224	0.094	0.095	9.254	2.516	0.238
11.479	1.088					
	83.318	0.174	0.178	11.961	3.308	0.589
11.627	2.070					
	83.492	0.131	0.133	11.961	3.606	0.481
12.028	1.606					
	83.622	0.008	0.008	15.130	4.452	0.035
11.787	0.092					
	83.630	0.174	0.180	15.130	4.635	0.836
12.034	2.171					
	83.804	0.074	0.077	15.130	4.884	0.375
12.298	0.944					
	83.878	0.174	0.184	18.888	5.994	1.103
12.006	2.210					
	84.052	0.076	0.080	18.888	6.232	0.499
12.242	0.980					
	84.128	0.174	0.187	21.707	7.093	1.330
11.998	2.249					
	84.302	0.057	0.061	21.707	7.291	0.446
12.165	0.744					
	84.359	0.174	0.191	24.446	8.058	1.541
11.955	2.287					
	84.533	0.071	0.078	24.446	8.233	0.643
12.135	0.948					
	84.604	0.174	0.195	26.754	8.847	1.725
11.901	2.321					
	84.779	0.085	0.095	26.754	8.992	0.856
12.051	1.147					
	84.864	0.174	0.198	28.561	9.450	1.874
11.879	2.355					
	85.038	0.124	0.141	28.561	9.573	1.350
12.040	1.698					
	85.162	0.174	0.199	29.161	9.795	1.953
12.007	2.395					
	85.336	0.103	0.117	29.161	9.894	1.162
12.171	1.429					
	85.438	0.174	0.201	29.822	10.100	2.027
12.133	2.435					
	85.612	0.091	0.105	29.822	10.179	1.067
12.233	1.282					
	85.703	0.174	0.202	30.505	10.364	2.095
12.173	2.460					
	85.877	0.013	0.015	30.505	10.408	0.151
12.214	0.178					
	85.890	0.071	0.083	30.505	10.465	0.866

12.265	1.015					
85.961	0.174	0.204	31.198	10.753	2.189	
12.254	2.495					
86.135	0.084	0.098	31.198	10.931	1.069	
12.391	1.211					
86.219	0.174	0.205	31.852	11.204	2.297	
12.413	2.545					
86.393	0.080	0.094	31.852	11.364	1.072	
12.550	1.184					
86.473	0.174	0.206	32.497	11.615	2.398	
12.574	2.596					
86.648	0.083	0.098	32.497	11.760	1.158	
12.711	1.252					
86.731	0.174	0.208	33.116	11.990	2.493	
12.747	2.650					
86.905	0.087	0.103	33.116	12.120	1.254	
12.837	1.328					
86.991	0.129	0.155	33.695	12.307	1.903	
12.869	1.990					
87.120	0.141	0.170	33.695	12.426	2.108	
12.971	2.201					
87.261	0.174	0.210	33.954	12.597	2.645	
13.053	2.740					
87.435	0.090	0.109	33.954	12.706	1.385	
13.086	1.426					
87.526	0.174	0.211	34.219	12.849	2.706	
13.135	2.766					
87.700	0.087	0.105	34.219	12.948	1.362	
13.149	1.383					
87.787	0.043	0.052	34.487	13.035	0.683	
13.154	0.689					
87.830	0.174	0.211	34.487	13.112	2.770	
13.216	2.792					
88.004	0.042	0.051	34.487	13.188	0.675	
13.270	0.679					
88.046	0.174	0.212	34.754	13.297	2.819	
13.335	2.827					
88.220	0.085	0.103	34.754	13.381	1.385	
13.383	1.385					
88.306	0.174	0.213	35.019	13.496	2.870	
13.487	2.868					
88.480	0.085	0.104	35.019	13.572	1.409	
13.523	1.404					
88.565	0.174	0.213	35.281	13.679	2.918	
13.561	2.893					
88.739	0.086	0.106	35.281	13.747	1.451	
13.537	1.429					
88.825	0.174	0.214	35.538	13.844	2.963	
13.634	2.918					
88.999	0.089	0.109	35.538	13.906	1.520	
13.640	1.490					
89.088	0.174	0.215	35.787	13.994	3.004	
13.710	2.943					
89.262	0.093	0.115	35.787	14.048	1.611	



13.686	1.569					
89.355	0.174	0.216	36.205	14.147	3.053	
13.849	2.989					
89.529	0.087	0.108	36.205	14.187	1.533	
13.744	1.485					
89.617	0.153	0.191	36.633	14.267	2.727	
13.749	2.628					
89.770	0.105	0.131	36.633	14.244	1.869	
13.624	1.787					
89.875	0.174	0.218	37.064	14.182	3.095	
13.540	2.955					
90.049	0.031	0.038	37.064	14.096	0.540	
13.413	0.514					
90.080	0.052	0.065	37.064	14.062	0.920	
13.375	0.875					
90.132	0.174	0.219	37.490	14.002	3.073	
13.382	2.937					
90.306	0.084	0.106	37.490	13.879	1.477	
13.293	1.415					
90.391	0.174	0.221	37.922	13.788	3.044	
13.282	2.932					
90.565	0.085	0.108	37.922	13.651	1.472	
13.192	1.422					
90.650	0.174	0.222	38.342	13.540	3.006	
13.205	2.932					
90.824	0.089	0.113	38.342	13.385	1.519	
12.913	1.465					
90.913	0.174	0.223	38.746	13.253	2.959	
12.922	2.885					
91.087	0.097	0.124	38.746	13.079	1.620	
12.721	1.576					
91.184	0.174	0.224	39.119	12.922	2.901	
12.709	2.853					
91.358	0.110	0.141	39.119	12.726	1.800	
12.492	1.767					
91.468	0.174	0.230	40.730	12.575	2.890	
12.287	2.824					
91.642	0.084	0.111	40.730	12.337	1.364	
11.995	1.327					
91.726	0.174	0.236	42.480	12.102	2.858	
11.663	2.754					
91.900	0.077	0.104	42.480	11.805	1.226	
11.422	1.186					
91.977	0.174	0.243	44.260	11.464	2.787	
11.087	2.696					
92.151	0.068	0.095	44.260	11.109	1.059	
10.971	1.046					
92.219	0.086	0.124	45.916	10.828	1.339	
10.547	1.305					
92.305	0.168	0.242	45.916	10.387	2.514	
10.565	2.557					
92.473	0.174	0.260	47.946	9.654	2.510	
9.969	2.592					
92.648	0.099	0.148	47.946	9.088	1.348	

9.552      1.417

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LEGENDA SIMBOLI

X(m)                       : Ascissa sinistra concio  
dx(m)                      : Larghezza concio  
dl(m)                      : lunghezza base concio  
alpha(°)                   : Angolo pendenza base concio  
TauStress(kPa)             : Sforzo di taglio su base concio  
TauF (kN/m)                : Forza di taglio su base concio  
TauStrength(kPa)           : Resistenza al taglio su base concio  
TauS (kN/m)                : Forza resistente al taglio su base concio  
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Strato 1 -- Parametri di resistenza al taglio equivalenti dell'ammasso  
roccioso   stimati secondo criterio di rottura non lineare Hoek et  
al.(2002)  
CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et  
al.(2016)  
Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO  
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SigmaN'(kPa)	TauStrength(kPa)	Phi'(deg)	c'(kPa)
25.00	137.42	58.47	69.19
50.00	186.72	55.52	76.58
75.00	229.23	53.43	82.28
100.00	269.97	51.71	89.32
125.00	307.76	50.29	95.71
150.00	344.72	49.03	103.03
175.00	380.39	47.92	110.48
200.00	414.33	46.95	117.39
225.00	446.12	46.09	123.16
250.00	479.13	45.26	131.05
275.00	509.50	44.53	137.06
300.00	540.87	43.82	144.79
325.00	569.14	43.21	149.99
350.00	598.21	42.61	156.59
375.00	628.07	42.02	164.54
400.00	654.32	41.52	169.27
425.00	685.72	40.95	179.76
450.00	708.67	40.55	181.95
475.00	736.79	40.07	189.88
500.00	760.71	39.67	193.83
600.00	866.21	38.06	223.16
700.00	957.87	36.80	242.59
800.00	1049.54	35.65	265.80
900.00	1140.54	34.60	291.52
1000.00	1223.57	33.71	311.63
1100.00	1303.83	32.91	331.24
1200.00	1387.74	32.12	356.93
1300.00	1460.58	31.47	372.79
1400.00	1536.19	30.83	393.39

1500.00	1614.69	30.20	418.74
2000.00	1960.39	27.76	515.66

Strato 2 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso

stimati secondo criterio di rottura non lineare Hoek et

al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

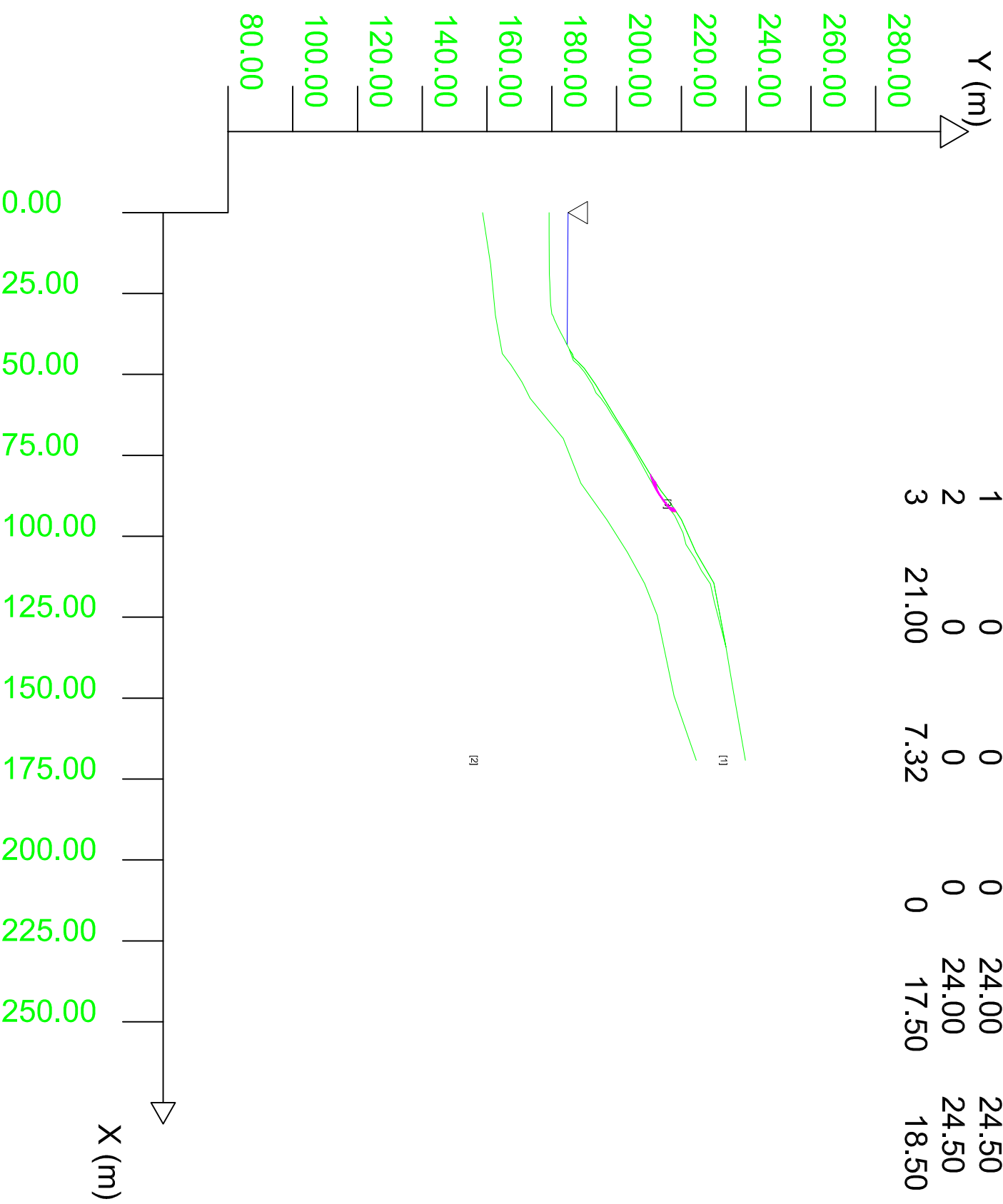
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SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	696.24	60.38	513.03
50.00	756.64	59.62	520.01
75.00	806.42	59.04	520.13
100.00	857.50	58.47	523.03
125.00	909.85	57.91	528.58
150.00	949.97	57.49	524.59
175.00	1004.57	56.95	534.68
200.00	1046.36	56.55	534.32
225.00	1103.20	56.03	548.62
250.00	1146.67	55.64	551.63
275.00	1190.86	55.26	556.09
300.00	1235.77	54.89	561.97
325.00	1281.40	54.52	569.22
350.00	1327.76	54.15	577.81
375.00	1359.06	53.91	572.83
400.00	1406.61	53.55	583.74
425.00	1454.89	53.20	595.90
450.00	1487.48	52.96	593.65
475.00	1536.97	52.61	607.98
500.00	1570.37	52.38	607.39
600.00	1724.68	51.37	628.85
700.00	1885.62	50.39	662.51
800.00	2034.30	49.55	689.13
900.00	2188.33	48.73	725.29
1000.00	2327.55	48.02	750.56
1100.00	2450.22	47.43	762.64
1200.00	2597.27	46.75	801.99
1300.00	2726.73	46.18	826.48
1400.00	2859.39	45.62	856.64
1500.00	2972.41	45.17	869.25
2000.00	3572.08	42.95	995.66

Data : 18/04/2019  
 Localita' : Loc. Cepparello  
 Descrizione : Sez.4 - Stato di progetto  
 [n] = N. strato o lente

# Parametri Geotecnici degli strati #

N.	phi` deg	C` KPa	Cu KPa	Gamm KN/m3	GammSat KN/m3	sgci MPa	GSI	mi	D
1	0	0	0	24.00	24.50	50.00	..	17.00	1.00
2	0	0	0	24.00	24.50	100.00	65.00	17.00	1.00
3	21.00	7.32	0	17.50	18.50	0	0	0	0



**DATI 10 SUP. CON MINOR Fs**

Fs minimo : 1.2970  
 Range Fs : 1.2970 1.3223  
 Differenza % Range Fs : 1.92  
 Coefficiente Sismico orizzontale - Kh: 0.05

**GENERAZIONE SUPERFICI RANDOM**

Campione Superfici - N.: 20000  
 Lunghezza media segmenti (m) : 1.0  
 Range X inizio generazione : 3.4 - 155.7  
 Range X termine generazione : 20.3 - 165.8  
 Livello Y minimo considerato : 85.6

# Report elaborazioni #

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SSAP 4.9.9 - Slope Stability Analysis Program (1991,2018)

WWW.SSAP.EU

Build No. 10784

BY

Dr. Geol. LORENZO BORSELLI \*,\*\*

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\*\* Gia' Ricercatore CNR-IRPI fino a Luglio 2011

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Ultima Revisione struttura tabelle del report: 29 dicembre 2018  
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File report: C:\SSAP2010\Verifiche\Risultati\Sez4\_Stato\_Progetto.txt

Data: 17/4/2019

Localita' :

Descrizione:

Modello pendio: Sez4-stato\_progetto\_V1.mod

----- PARAMETRI DEL MODELLO DEL PENDIO -----

\_\_\_ PARAMETRI GEOMETRICI - Coordinate X Y (in m) \_\_\_

SUP T.		SUP 2		SUP 3		SUP 4	
X	Y	X	Y	X	Y	X	Y
0.00	179.19	0.00	158.61	42.20	185.39	-	-
6.60	179.19	16.03	161.09	45.64	186.66	-	-
19.00	179.26	31.68	162.56	47.16	188.34	-	-
21.54	179.36	43.55	164.66	49.39	190.18	-	-
27.39	179.60	47.13	167.41	53.23	192.57	-	-
28.45	179.67	52.42	170.84	55.71	193.61	-	-
31.34	180.03	57.41	173.30	57.39	195.21	-	-
31.60	180.20	69.83	183.50	59.87	196.97	-	-
31.68	180.25	83.63	188.96	62.83	198.73	-	-
31.88	180.34	94.91	197.04	65.87	200.73	-	-
32.35	180.54	104.85	203.27	71.62	204.32	-	-
32.89	180.74	114.63	208.66	76.90	207.28	-	-
34.09	181.25	124.40	212.54	82.02	210.08	-	-
35.04	181.71	149.41	217.76	87.12	213.14	-	-
37.11	182.74	169.20	224.61	90.08	215.27	-	-
37.92	183.19	-	-	93.61	217.99	-	-
38.54	183.51	-	-	98.96	220.53	-	-
40.96	184.74	-	-	102.50	221.44	-	-
41.45	185.00	-	-	106.80	224.17	-	-
42.57	185.59	-	-	110.64	226.20	-	-
43.71	186.35	-	-	114.76	228.94	-	-
44.80	186.74	-	-	120.26	230.18	-	-
45.87	187.85	-	-	134.20	233.75	-	-
48.12	190.00	-	-	132.34	233.44	-	-

53.10	193.45	-	-	114.45	230.00	-	-
63.82	200.00	-	-	105.03	224.51	-	-
68.03	202.65	-	-	94.84	220.00	-	-
80.21	210.00	-	-	89.77	216.63	-	-
85.89	213.66	-	-	85.89	213.66	-	-
89.77	216.63	-	-	80.21	210.00	-	-
94.84	220.00	-	-	68.03	202.65	-	-
105.03	224.51	-	-	63.82	200.00	-	-
114.45	230.00	-	-	53.10	193.45	-	-
132.34	233.44	-	-	48.12	190.00	-	-
134.20	233.75	-	-	45.87	187.85	-	-
147.77	236.00	-	-	44.80	186.74	-	-
169.20	239.74	-	-	43.71	186.35	-	-
-	-	-	-	42.57	185.59	-	-
-	-	-	-	42.20	185.39	-	-

---- SUP FALDA -----  
X            Y    (in m)

0.00 185.00  
169.20 185.00

----- GESTIONE ACQUIFERI -----

Strati esclusi da acquifero:

Esclusione sovraccarico pendio sommerso: NON ATTIVATA

Peso unitario fluido (kN/m<sup>3</sup>): 9.81

Parametri funzione dissipazione superficiale pressione dei fluidi:

Coefficiente A 0

Coefficiente K 0.000800

Pressione minima fluidi Uo\_Min (kPa) 0.01

Coefficiente di soprapressione oltre pressione idrostatica 1.00

Limitazione dissipazione a Pressione Idrostatica = ATTIVA

STABILITE CONDIZIONI PER LA VERIFICA CON SOVRAPPRESSIONE ACQUIFERI CON DISSIPAZIONE IN DIREZIONE DELLA SUPERFICIE

CALCOLO EFFETTO DI FILTRAZIONE NON ATTIVATO

----- PARAMETRI GEOMECCANICI -----

STR_IDX	sgci	fi` GSI	mi	C` D	Cu	Gamm	Gamm_sat
STRATO 1	1	0.00	0.00	0.00	0.00	24.00	24.50
8.587	50.00	50.00	17.00	1.00			
STRATO 2	2	0.00	0.00	0.00	0.00	24.00	24.50
12.882	100.00	65.00	17.00	1.00			
STRATO 3	3	21.00	7.32	0.00	0.00	17.50	18.50
1.331	0.00	0.00	0.00	0.00			

LEGENDA: fi` \_\_\_\_\_ Angolo di attrito interno efficace(in gradi)

C` \_\_\_\_\_ Coesione efficace (in Kpa)

Cu \_\_\_\_\_ Resistenza al taglio Non drenata (in Kpa)

Gamm \_\_\_\_\_ Peso di volume terreno fuori falda (in KN/m<sup>3</sup>)  
 Gamm\_sat \_\_\_ Peso di volume terreno immerso (in KN/m<sup>3</sup>)  
 STR\_IDX \_\_\_ Indice di resistenza (usato in solo in 'SNIFF SEARCH')  
 (adimensionale)  
 ---- SOLO Per AMMASSI ROCCIOSI FRATTURATI - Parametri Criterio di Rottura di Hoek (2002)-  
 sigci \_\_\_\_\_ Resistenza Compressione Uniassiale Roccia Intatta (in MPa)  
 GSI \_\_\_\_\_ Geological Strenght Index ammasso(adimensionale)  
 mi \_\_\_\_\_ Indice litologico ammasso(adimensionale)  
 D \_\_\_\_\_ Fattore di disturbo ammasso(adimensionale)  
 Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 -  
 ATTIVATO (solo per ROCCE)  
 Uso CRITERIO DI ROTTURA Hoek et al.(2002,2006) - non-lineare - Generalizzato secondo Lei et al.(2016)

----- INFORMAZIONI GENERAZIONE SUPERFICI RANDOM -----  
 \*\*\* PARAMETRI PER LA GENERAZIONE DELLE SUPERFICI  
 METODO DI RICERCA: CONVEX RANDOM - Chen (1992)  
 FILTRAGGIO SUPERFICI : ATTIVATO  
 COORDINATE X1,X2,Y OSTACOLO : 0.00 0.00 0.00  
 LUNGHEZZA MEDIA SEGMENTI (m): 1.0 (+/-) 50%  
 INTERVALLO ASCISSE RANDOM STARTING POINT (Xmin .. Xmax): 3.38  
 155.66  
 LIVELLO MINIMO CONSIDERATO (Ymin): 85.59  
 INTERVALLO ASCISSE AMMESSO PER LA TERMINAZIONE (Xmin .. Xmax): 20.30  
 165.82  
 \*\*\* TOTALE SUPERFICI GENERATE : 20000

----- INFORMAZIONI PARAMETRI DI CALCOLO -----  
 METODO DI CALCOLO : BORSELLI (Borselli, 2016)  
 COEFFICIENTE SISMICO UTILIZZATO Kh : 0.0510  
 COEFFICIENTE SISMICO UTILIZZATO Kv (assunto Positivo): 0.0255  
 COEFFICIENTE c=Kv/Kh UTILIZZATO : 0.5000  
 FORZA ORIZZONTALE ADDIZIONALE IN TESTA (kN/m): 0.00  
 FORZA ORIZZONTALE ADDIZIONALE ALLA BASE (kN/m): 0.00

N.B. Le forze orizzontali addizionali in testa e alla base sono poste uguali a 0 durante le tutte le verifiche globali.  
 I valori >0 impostati dall'utente sono utilizzati solo in caso di verifica singola

----- RISULTATO FINALE ELABORAZIONI -----  
 \* DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR Fs \*

Fattore di sicurezza (FS)	1.2970 - Min. -	X	Y	Lambda=
0.4342		83.40	212.06	
		84.26	212.08	
		84.65	212.10	

84.91	212.13
85.12	212.17
85.33	212.23
85.52	212.30
85.73	212.40
85.95	212.52
86.22	212.67
86.47	212.82
86.71	212.96
86.93	213.10
87.16	213.25
87.38	213.39
87.61	213.54
87.83	213.70
88.07	213.86
88.30	214.03
88.53	214.19
88.75	214.35
88.98	214.51
89.21	214.68
89.43	214.85
89.66	215.02
89.89	215.19
90.12	215.37
90.35	215.54
90.58	215.72
90.80	215.89
91.03	216.07
91.26	216.26
91.50	216.45
91.75	216.65
91.97	216.84
92.19	217.04
92.40	217.25
92.40	218.38

Fattore di sicurezza (FS)    1.3057    - N.2 --    X    Y    Lambda=  
0.4380

81.88	211.08
82.81	211.16
83.25	211.21
83.54	211.26
83.78	211.32
84.02	211.40
84.24	211.49
84.47	211.60
84.72	211.72
85.01	211.89
85.29	212.05
85.54	212.20
85.80	212.35
86.05	212.50
86.29	212.66



86.54	212.82
86.80	212.99
87.06	213.16
87.31	213.33
87.57	213.51
87.82	213.68
88.07	213.86
88.32	214.04
88.57	214.22
88.82	214.41
89.08	214.61
89.34	214.80
89.59	215.00
89.84	215.19
90.09	215.39
90.34	215.60
90.59	215.81
90.85	216.03
91.12	216.26
91.37	216.49
91.62	216.72
91.62	217.86

Fattore di sicurezza (FS)    1.3118   - N.3 --    X            Y            Lambda=  
0.4480

80.94	210.47
82.12	210.80
82.70	210.98
83.11	211.11
83.46	211.23
83.79	211.36
84.10	211.50
84.43	211.65
84.77	211.82
85.14	212.01
85.49	212.20
85.82	212.38
86.14	212.57
86.47	212.77
86.79	212.98
87.12	213.20
87.45	213.43
87.80	213.68
88.15	213.93
88.49	214.17
88.82	214.41
89.16	214.66
89.50	214.90
89.84	215.16
90.19	215.41
90.55	215.68
90.88	215.94
91.20	216.21

91.51 216.49  
91.84 216.81  
92.02 217.00  
92.02 218.13

Fattore di sicurezza (FS) 1.3136 - N.4 -- X Y Lambda=  
0.4420

83.09 211.86  
84.09 212.02  
84.56 212.11  
84.88 212.19  
85.15 212.27  
85.41 212.36  
85.66 212.47  
85.91 212.59  
86.19 212.74  
86.50 212.92  
86.79 213.09  
87.07 213.26  
87.34 213.43  
87.61 213.60  
87.88 213.78  
88.15 213.96  
88.43 214.14  
88.71 214.34  
88.99 214.53  
89.26 214.73  
89.53 214.92  
89.81 215.12  
90.08 215.32  
90.36 215.52  
90.65 215.74  
90.95 215.96  
91.22 216.18  
91.48 216.40  
91.73 216.64  
92.00 216.91  
92.15 217.08  
92.15 218.21

Fattore di sicurezza (FS) 1.3171 - N.5 -- X Y Lambda=  
0.4394

83.30 211.99  
84.30 212.11  
84.76 212.17  
85.07 212.24  
85.33 212.31  
85.58 212.40  
85.81 212.50  
86.06 212.63  
86.32 212.78  
86.63 212.97

86.92	213.16
87.20	213.34
87.47	213.51
87.74	213.68
88.01	213.86
88.28	214.04
88.55	214.22
88.83	214.41
89.10	214.59
89.37	214.78
89.63	214.97
89.89	215.17
90.16	215.37
90.43	215.58
90.71	215.80
91.00	216.05
91.27	216.28
91.53	216.52
91.78	216.76
91.94	216.92
91.94	218.07

Fattore di sicurezza (FS)    1.3190   - N.6 --    X            Y            Lambda=  
0.4353

83.39	212.05
84.35	212.21
84.81	212.30
85.12	212.37
85.38	212.45
85.64	212.54
85.88	212.63
86.13	212.74
86.40	212.88
86.70	213.04
86.98	213.19
87.24	213.34
87.50	213.50
87.76	213.66
88.02	213.82
88.28	214.00
88.54	214.18
88.82	214.38
89.09	214.58
89.36	214.78
89.62	214.98
89.88	215.18
90.15	215.38
90.42	215.59
90.69	215.80
90.98	216.03
91.24	216.25
91.50	216.48
91.74	216.72

92.00 216.99  
92.00 218.11

Fattore di sicurezza (FS) 1.3194 - N.7 -- X Y Lambda=  
0.4346

83.20 211.93  
84.22 212.06  
84.70 212.13  
85.02 212.20  
85.28 212.27  
85.54 212.37  
85.78 212.47  
86.04 212.60  
86.31 212.75  
86.63 212.95  
86.93 213.13  
87.21 213.31  
87.49 213.49  
87.76 213.68  
88.03 213.86  
88.30 214.05  
88.58 214.25  
88.86 214.46  
89.14 214.67  
89.42 214.87  
89.69 215.08  
89.97 215.29  
90.25 215.50  
90.53 215.71  
90.82 215.94  
91.12 216.17  
91.39 216.39  
91.65 216.62  
91.91 216.87  
92.06 217.02  
92.06 218.15

Fattore di sicurezza (FS) 1.3212 - N.8 -- X Y Lambda=  
0.4350

82.65 211.57  
83.57 211.68  
84.01 211.75  
84.31 211.80  
84.55 211.86  
84.79 211.94  
85.02 212.03  
85.26 212.13  
85.51 212.25  
85.80 212.41  
86.07 212.56  
86.32 212.70  
86.57 212.85

86.82	213.00
87.06	213.15
87.31	213.32
87.56	213.49
87.82	213.67
88.08	213.86
88.33	214.04
88.59	214.22
88.84	214.39
89.10	214.58
89.36	214.76
89.63	214.95
89.91	215.15
90.16	215.34
90.39	215.54
90.61	215.76
90.85	216.02
91.11	216.32
91.26	216.51
91.26	217.62

Fattore di sicurezza (FS)    1.3214   - N.9 --    X            Y            Lambda=  
0.4288

83.60	212.19
84.61	212.24
85.06	212.28
85.36	212.32
85.60	212.38
85.85	212.47
86.07	212.57
86.31	212.70
86.57	212.86
86.88	213.06
87.18	213.26
87.46	213.45
87.73	213.63
87.99	213.81
88.26	213.99
88.53	214.17
88.80	214.36
89.08	214.56
89.35	214.74
89.60	214.94
89.86	215.14
90.12	215.35
90.38	215.56
90.64	215.79
90.91	216.03
91.20	216.29
91.47	216.55
91.73	216.80
91.73	217.93

Fattore di sicurezza (FS) 1.3223 - N.10 -- X Y Lambda=  
 0.4285

83.35	212.02
84.12	212.05
84.48	212.08
84.72	212.11
84.92	212.14
85.12	212.20
85.30	212.26
85.50	212.33
85.71	212.43
85.95	212.55
86.18	212.66
86.39	212.78
86.59	212.89
86.80	213.01
87.00	213.13
87.21	213.26
87.42	213.39
87.64	213.54
87.86	213.68
88.07	213.83
88.27	213.97
88.48	214.12
88.68	214.27
88.89	214.43
89.10	214.60
89.31	214.77
89.52	214.94
89.74	215.11
89.94	215.29
90.15	215.46
90.36	215.63
90.58	215.81
90.80	215.99
91.03	216.18
91.23	216.36
91.43	216.56
91.58	216.71
91.58	217.83

----- ANALISI DEFICIT DI RESISTENZA -----

# DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR FS \*

# Analisi Deficit in riferimento a FS(progetto) = 1.200

Sup N.	FS	FTR(kN/m)	FTA(kN/m)	Bilancio(kN/m)	ESITO
1	1.297	144.6	111.5	10.8	Surplus
2	1.306	153.5	117.6	12.4	Surplus
3	1.312	169.0	128.9	14.4	Surplus
4	1.314	141.0	107.3	12.2	Surplus
5	1.317	136.0	103.2	12.1	Surplus
6	1.319	134.1	101.6	12.1	Surplus

7	1.319	138.8	105.2	12.6	Surplus
8	1.321	136.3	103.2	12.5	Surplus
9	1.321	131.3	99.4	12.1	Surplus
10	1.322	131.0	99.0	12.1	Surplus

Esito analisi: SURPLUS di RESISTENZA!

Valore minimo di SURPLUS di RESISTENZA (kN/m): 10.8

Note: FTR --> Forza totale Resistente lungo la superficie di scivolamento

FTA --> Forza totale Agente lungo la superficie di scivolamento

IMPORTANTE! : Il Deficit o il Surplus di resistenza viene espresso in kN per metro di LARGHEZZA rispetto al fronte della scarpata

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TABELLA PARAMETRI CONCI DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

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phi'	X	dx	alpha	W	ru	U
(°)	(m)	(m)	(°)	(kN/m)	(-)	(kPa)
	(c', Cu)					
	(kPa)					
21.00	83.403	0.158	1.25	0.14	0.00	0.00
	7.32					
21.00	83.560	0.070	1.25	0.15	0.00	0.00
	7.32					
21.00	83.630	0.158	1.25	0.54	0.00	0.00
	7.32					
21.00	83.788	0.158	1.25	0.82	0.00	0.00
	7.32					
21.00	83.945	0.158	1.25	1.09	0.00	0.00
	7.32					
21.00	84.103	0.154	1.25	1.34	0.00	0.00
	7.32					
21.00	84.257	0.158	2.88	1.64	0.00	0.00
	7.32					
21.00	84.414	0.158	2.88	1.90	0.00	0.00
	7.32					
21.00	84.572	0.076	2.88	1.01	0.00	0.00
	7.32					
21.00	84.648	0.158	6.59	2.28	0.00	0.00
	7.32					
21.00	84.805	0.101	6.59	1.58	0.00	0.00
	7.32					
21.00	84.906	0.158	11.24	2.65	0.00	0.00
	7.32					
21.00	85.064	0.052	11.24	0.91	0.00	0.00
	7.32					
21.00	85.115	0.158	16.71	2.89	0.00	0.00
	7.32					

21.00	85.273	0.056	16.71	1.06	0.00	0.00
	7.32					
21.00	85.329	0.158	20.82	3.08	0.00	0.00
	7.32					
21.00	85.486	0.033	20.82	0.66	0.00	0.00
	7.32					
21.00	85.519	0.158	24.76	3.20	0.00	0.00
	7.32					
21.00	85.677	0.050	24.76	1.04	0.00	0.00
	7.32					
21.00	85.727	0.158	27.84	3.29	0.00	0.00
	7.32					
21.00	85.885	0.005	27.84	0.11	0.00	0.00
	7.32					
21.00	85.890	0.062	27.84	1.32	0.00	0.00
	7.32					
21.00	85.952	0.158	30.05	3.40	0.00	0.00
	7.32					
21.00	86.110	0.113	30.05	2.49	0.00	0.00
	7.32					
21.00	86.223	0.158	30.60	3.54	0.00	0.00
	7.32					
21.00	86.380	0.091	30.60	2.07	0.00	0.00
	7.32					
21.00	86.471	0.158	31.22	3.66	0.00	0.00
	7.32					
21.00	86.628	0.077	31.22	1.82	0.00	0.00
	7.32					
21.00	86.705	0.158	31.85	3.77	0.00	0.00
	7.32					
21.00	86.863	0.070	31.85	1.69	0.00	0.00
	7.32					
21.00	86.933	0.158	32.51	3.85	0.00	0.00
	7.32					
21.00	87.090	0.030	32.51	0.73	0.00	0.00
	7.32					
21.00	87.120	0.038	32.51	0.94	0.00	0.00
	7.32					
21.00	87.158	0.158	33.12	3.93	0.00	0.00
	7.32					
21.00	87.316	0.065	33.12	1.64	0.00	0.00
	7.32					
21.00	87.381	0.158	33.72	4.00	0.00	0.00
	7.32					
21.00	87.538	0.067	33.72	1.72	0.00	0.00
	7.32					
21.00	87.606	0.158	34.29	4.06	0.00	0.00
	7.32					
21.00	87.763	0.067	34.29	1.74	0.00	0.00
	7.32					
21.00	87.830	0.004	34.29	0.09	0.00	0.00
	7.32					
21.00	87.834	0.158	34.83	4.11	0.00	0.00
	7.32					



	87.991	0.078	34.83	2.04	0.00	0.00
21.00	7.32					
	88.069	0.158	35.11	4.16	0.00	0.00
21.00	7.32					
	88.226	0.073	35.11	1.94	0.00	0.00
21.00	7.32					
	88.300	0.158	35.39	4.19	0.00	0.00
21.00	7.32					
	88.457	0.070	35.39	1.88	0.00	0.00
21.00	7.32					
	88.527	0.158	35.68	4.23	0.00	0.00
21.00	7.32					
	88.685	0.069	35.68	1.86	0.00	0.00
21.00	7.32					
	88.754	0.158	35.96	4.26	0.00	0.00
21.00	7.32					
	88.911	0.069	35.96	1.86	0.00	0.00
21.00	7.32					
	88.980	0.158	36.24	4.28	0.00	0.00
21.00	7.32					
	89.138	0.068	36.24	1.86	0.00	0.00
21.00	7.32					
	89.206	0.158	36.52	4.30	0.00	0.00
21.00	7.32					
	89.363	0.069	36.52	1.89	0.00	0.00
21.00	7.32					
	89.433	0.158	36.79	4.31	0.00	0.00
21.00	7.32					
	89.590	0.071	36.79	1.95	0.00	0.00
21.00	7.32					
	89.661	0.109	37.05	2.99	0.00	0.00
21.00	7.32					
	89.770	0.122	37.05	3.35	0.00	0.00
21.00	7.32					
	89.892	0.158	37.27	4.27	0.00	0.00
21.00	7.32					
	90.050	0.030	37.27	0.81	0.00	0.00
21.00	7.32					
	90.080	0.041	37.27	1.11	0.00	0.00
21.00	7.32					
	90.121	0.158	37.49	4.21	0.00	0.00
21.00	7.32					
	90.279	0.070	37.49	1.85	0.00	0.00
21.00	7.32					
	90.349	0.158	37.71	4.14	0.00	0.00
21.00	7.32					
	90.506	0.069	37.71	1.80	0.00	0.00
21.00	7.32					
	90.575	0.158	37.93	4.07	0.00	0.00
21.00	7.32					
	90.733	0.069	37.93	1.77	0.00	0.00
21.00	7.32					
	90.802	0.158	38.16	4.00	0.00	0.00
21.00	7.32					

21.00	90.959	0.071	38.16	1.79	0.00	0.00
	7.32					
21.00	91.030	0.158	38.38	3.92	0.00	0.00
	7.32					
21.00	91.188	0.074	38.38	1.82	0.00	0.00
	7.32					
21.00	91.262	0.158	38.59	3.83	0.00	0.00
	7.32					
21.00	91.420	0.081	38.59	1.95	0.00	0.00
	7.32					
21.00	91.501	0.158	38.79	3.74	0.00	0.00
	7.32					
21.00	91.658	0.091	38.79	2.13	0.00	0.00
	7.32					
21.00	91.749	0.158	40.67	3.63	0.00	0.00
	7.32					
21.00	91.907	0.066	40.67	1.49	0.00	0.00
	7.32					
21.00	91.972	0.158	42.72	3.49	0.00	0.00
	7.32					
21.00	92.130	0.059	42.72	1.28	0.00	0.00
	7.32					
21.00	92.189	0.116	44.81	2.45	0.00	0.00
	7.32					
21.00	92.305	0.093	44.81	1.91	0.00	0.00
	7.32					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 alpha(°) : Angolo pendenza base concio  
 W(kN/m) : Forza peso concio  
 ru(-) : Coefficiente locale pressione interstiziale  
 U(kPa) : Pressione totale dei pori base concio  
 phi'(°) : Angolo di attrito efficace base concio  
 c'/Cu (kPa) : Coesione efficace o Resistenza al taglio in condizioni non drenate

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TABELLA DIAGRAMMA DELLE FORZE DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

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T(x)	X (m)	ht E' (m) (kN)	yt rho(x) (m) (--)	yt' FS_FEM (--)	E(x) FS_p-qFEM (kN/m) (--)
	83.403	0.000	212.057	0.179	0.0000000000E+000
0.0000000000E+000		1.6846053052E+001		0.322	3.119 1.463
	83.560	0.029	212.090	0.179	1.8400382425E+000

3.5391440559E-001	6.5145461823E+000	0.322	2.869	1.356
83.630	0.036 212.098	0.157	2.1348973814E+000	
4.0697100831E-001	4.9316108787E+000	0.284	2.553	1.239
83.788	0.060 212.125	0.193	3.1623762663E+000	
6.7385887776E-001	7.1828327248E+000	0.294	1.979	1.103
83.945	0.090 212.159	0.231	4.3979706476E+000	
1.1460725164E+000	8.3799028054E+000	0.357	1.678	1.089
84.103	0.126 212.198	0.265	5.8026067630E+000	
1.7989763400E+000	9.3005788851E+000	0.431	1.499	1.100
84.257	0.165 212.241	0.281	7.2932625872E+000	
2.5545388558E+000	9.3788180969E+000	0.495	1.390	1.126
84.414	0.202 212.286	0.292	8.7228277405E+000	
3.3863585925E+000	8.9487043083E+000	0.554	1.341	1.173
84.572	0.242 212.333	0.295	1.0112703644E+001	
4.2675846515E+000	7.8982230025E+000	0.605	1.330	1.217
84.648	0.259 212.354	0.324	1.0679498353E+001	
4.6448563839E+000	7.6425932070E+000	0.622	1.338	1.235
84.805	0.295 212.409	0.344	1.1945698379E+001	
5.5406434714E+000	7.3702290081E+000	0.666	1.368	1.268
84.906	0.318 212.443	0.374	1.2645212499E+001	
6.0595507208E+000	6.7757679342E+000	0.687	1.399	1.284
85.064	0.349 212.506	0.399	1.3671330055E+001	
6.8820313936E+000	5.7289569829E+000	0.722	1.463	1.301
85.115	0.360 212.527	0.435	1.3954724228E+001	
7.1252120138E+000	5.3531647038E+000	0.732	1.489	1.303
85.273	0.382 212.597	0.457	1.4741603862E+001	
7.8452580783E+000	4.0778864173E+000	0.763	1.574	1.307
85.329	0.393 212.624	0.514	1.4951474225E+001	
8.0688028785E+000	3.6380218376E+000	0.772	1.611	1.306
85.486	0.415 212.706	0.520	1.5473892905E+001	
8.6701427075E+000	2.7391559996E+000	0.800	1.721	1.299
85.519	0.420 212.723	0.514	1.5559815515E+001	
8.7807758995E+000	2.4940329763E+000	0.805	1.746	1.297
85.677	0.428 212.804	0.506	1.5858200448E+001	
9.2392975588E+000	1.4600033819E+000	0.828	1.856	1.289
85.727	0.429 212.828	0.500	1.5924862770E+001	
9.3626897977E+000	1.2000549053E+000	0.833	1.888	1.286
85.885	0.426 212.908	0.507	1.6054466372E+001	
9.7032811042E+000	4.7487124489E-001	0.853	1.959	1.281
85.890	0.426 212.911	0.529	1.6056906370E+001	
9.7135243666E+000	4.5603118073E-001	0.853	1.960	1.281
85.952	0.426 212.944	0.583	1.6079924042E+001	
9.8295590715E+000	2.8712716580E-001	0.857	1.972	1.281
86.110	0.430 213.039	0.628	1.6091540391E+001	
1.0113061863E+001	-1.3611287722E-001	0.869	1.956	1.283
86.223	0.439 213.114	0.730	1.6059170717E+001	
1.0276358486E+001	-4.0312975084E-001	0.874	1.894	1.290
86.380	0.469 213.236	0.778	1.5970056659E+001	
1.0468811664E+001	-6.6779727460E-001	0.881	1.768	1.304
86.471	0.485 213.307	0.800	1.5904248183E+001	
1.0547354036E+001	-8.4086092743E-001	0.883	1.695	1.313
86.628	0.518 213.435	0.776	1.5740456119E+001	
1.0600173661E+001	-1.0177894796E+000	0.880	1.579	1.329
86.705	0.525 213.489	0.698	1.5662593080E+001	

1.0604632854E+001	-1.0646348266E+000	0.877	1.538	1.336
86.863	0.537 213.599	0.667	1.5476385749E+001	
1.0581973672E+001	-1.1042853136E+000	0.870	1.477	1.347
86.933	0.536 213.640	0.634	1.5401745581E+001	
1.0567197472E+001	-1.1501980385E+000	0.866	1.460	1.351
87.090	0.538 213.743	0.627	1.5191973688E+001	
1.0506917081E+001	-1.1454430737E+000	0.858	1.425	1.359
87.120	0.534 213.758	0.511	1.5159004022E+001	
1.0495503954E+001	-1.1439968668E+000	0.856	1.421	1.360
87.158	0.529 213.778	0.690	1.5113824683E+001	
1.0479043420E+001	-1.3100468708E+000	0.854	1.416	1.362
87.316	0.542 213.893	0.706	1.4827288493E+001	
1.0356985415E+001	-1.7523228960E+000	0.843	1.387	1.368
87.381	0.541 213.935	0.745	1.4715113253E+001	
1.0304677475E+001	-1.8666219896E+000	0.838	1.377	1.370
87.538	0.560 214.059	0.749	1.4366955645E+001	
1.0134174651E+001	-2.0351650312E+000	0.825	1.347	1.374
87.606	0.560 214.103	0.740	1.4234842281E+001	
1.0066963898E+001	-2.0899051488E+000	0.820	1.336	1.375
87.763	0.574 214.225	0.705	1.3857903724E+001	
9.8681171701E+000	-1.9749309886E+000	0.806	1.308	1.377
87.830	0.565 214.262	0.545	1.3737629360E+001	
9.8030541879E+000	-1.7437161421E+000	0.801	1.299	1.377
87.834	0.564 214.263	0.686	1.3731463476E+001	
9.7996935029E+000	-1.7545635981E+000	0.801	1.299	1.377
87.991	0.563 214.372	0.662	1.3359123695E+001	
9.5860150391E+000	-2.2159369237E+000	0.786	1.274	1.375
88.069	0.556 214.419	0.728	1.3192413926E+001	
9.4868670854E+000	-2.3766123823E+000	0.779	1.262	1.373
88.226	0.570 214.543	0.758	1.2743504052E+001	
9.2060237941E+000	-2.6507380005E+000	0.761	1.231	1.365
88.300	0.569 214.594	0.819	1.2556265003E+001	
9.0849701091E+000	-2.7950017125E+000	0.753	1.218	1.361
88.457	0.595 214.732	0.804	1.2035711171E+001	
8.7381683506E+000	-2.7103982195E+000	0.731	1.182	1.346
88.527	0.590 214.777	0.736	1.1863903821E+001	
8.6213365776E+000	-2.6483136532E+000	0.723	1.171	1.340
88.685	0.600 214.900	0.740	1.1375061163E+001	
8.2857726282E+000	-2.7081053151E+000	0.700	1.141	1.322
88.754	0.595 214.945	0.740	1.1200431870E+001	
8.1659319474E+000	-2.7547683812E+000	0.692	1.131	1.316
88.911	0.604 215.067	0.745	1.0687425056E+001	
7.8099340297E+000	-2.8211246909E+000	0.669	1.105	1.296
88.980	0.600 215.113	0.745	1.0506540550E+001	
7.6848282505E+000	-2.8575753981E+000	0.660	1.097	1.288
89.138	0.607 215.236	0.768	9.9746334522E+000	
7.3072504812E+000	-3.1839732176E+000	0.635	1.076	1.268
89.206	0.608 215.287	0.749	9.7627407305E+000	
7.1539456859E+000	-3.1844569528E+000	0.624	1.069	1.260
89.363	0.609 215.405	0.734	9.2305817715E+000	
6.7648892077E+000	-2.9190205318E+000	0.597	1.052	1.242
89.433	0.606 215.453	0.754	9.0427219932E+000	
6.6259170061E+000	-3.0585989289E+000	0.587	1.047	1.236
89.590	0.611 215.576	0.771	8.4384660503E+000	

6.1689083499E+000	-3.3374125664E+000	0.555	1.037	1.222
89.661	0.611 215.629	0.758	8.2176373453E+000	
6.0012998598E+000	-3.3353327357E+000	0.543	1.035	1.218
89.770	0.612 215.712	0.738	7.8171504214E+000	
5.6979862675E+000	-3.4405814283E+000	0.520	1.033	1.214
89.892	0.608 215.800	0.721	7.4285560421E+000	
5.4051813175E+000	-3.2597176761E+000	0.502	1.034	1.212
90.050	0.601 215.914	0.705	6.8979226030E+000	
5.0078753012E+000	-2.6920669477E+000	0.476	1.039	1.215
90.080	0.597 215.932	0.572	6.8208148399E+000	
4.9513281663E+000	-2.5689161327E+000	0.472	1.040	1.216
90.121	0.588 215.955	0.670	6.7142582432E+000	
4.8735679951E+000	-2.7300923895E+000	0.467	1.042	1.218
90.279	0.578 216.066	0.673	6.1923968347E+000	
4.4889285541E+000	-2.9646546507E+000	0.441	1.053	1.228
90.349	0.567 216.108	0.698	5.9966127149E+000	
4.3451041455E+000	-2.9818392369E+000	0.431	1.058	1.233
90.506	0.561 216.224	0.718	5.4659216221E+000	
3.9491148444E+000	-3.1003755869E+000	0.401	1.075	1.248
90.575	0.554 216.270	0.786	5.2599714120E+000	
3.7944246975E+000	-3.1926675438E+000	0.390	1.082	1.255
90.733	0.563 216.402	0.768	4.6815698584E+000	
3.3541048569E+000	-2.9262160618E+000	0.355	1.103	1.274
90.802	0.551 216.444	0.715	4.5023248747E+000	
3.2173492163E+000	-2.7806965251E+000	0.344	1.110	1.281
90.959	0.548 216.564	0.718	3.9992312026E+000	
2.8355323464E+000	-2.7581258199E+000	0.311	1.132	1.300
91.030	0.536 216.609	0.715	3.8166298333E+000	
2.6986827072E+000	-2.7100004872E+000	0.300	1.140	1.308
91.188	0.530 216.728	0.720	3.3378682044E+000	
2.3394938368E+000	-2.6875657771E+000	0.267	1.162	1.327
91.262	0.519 216.775	0.731	3.1508358326E+000	
2.2008025900E+000	-2.6606685135E+000	0.255	1.172	1.335
91.420	0.515 216.897	0.738	2.6853125230E+000	
1.8533481655E+000	-2.6539558575E+000	0.221	1.195	1.357
91.501	0.505 216.951	0.761	2.4829742497E+000	
1.7023356113E+000	-2.6558657209E+000	0.206	1.206	1.367
91.658	0.505 217.079	0.791	2.0165646476E+000	
1.3572880014E+000	-2.8304993490E+000	0.170	1.229	1.392
91.749	0.502 217.148	0.773	1.7657695635E+000	
1.1759461147E+000	-2.7744049480E+000	0.150	1.241	1.406
91.907	0.489 217.271	0.750	1.3234903184E+000	
8.5748273633E-001	-2.5531690513E+000	0.114	1.261	1.431
91.972	0.477 217.315	0.729	1.1627877169E+000	
7.4607661850E-001	-2.5268890425E+000	0.100	1.267	1.441
92.130	0.450 217.433	0.772	7.3457976774E-001	
4.6760666634E-001	-2.9086633876E+000	0.066	1.288	1.470
92.189	0.444 217.483	0.813	5.5788238745E-001	
3.5342232601E-001	-2.8994373479E+000	0.051	1.289	1.476
92.305	0.422 217.576	0.813	2.4039998238E-001	
1.5162548381E-001	-2.6563207322E+000	0.043	1.316	1.509

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LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
ht(m) : Altezza linea di thrust da nodo sinistro base concio  
yt(m) : coordinata Y linea di trust  
yt'(-) : gradiente pendenza locale linea di trust  
E(x)(kN/m) : Forza Normale interconcio  
T(x)(kN/m) : Forza Tangenziale interconcio  
E' (kN) : derivata Forza normale interconcio  
Rho(x) (-) : fattore mobilizzazione resistenza al taglio verticale interconcio  
ZhU et al.(2003)  
FS\_FEM(x) (-) : fattore di sicurezza locale stimato (locale in X) by qFEM  
FS\_SRM(x) (-) : fattore di sicurezza locale stimato (locale in X) by SRM  
Procedure

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TABELLA SFORZI DI TAGLIO DISTRIBUITI LUNGO SUPERFICIE INDIVIDUATA CON MINOR FS

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X	dx	dI	alpha	TauStress	TauF
TauStrength (m) (kPa)	TauS (m) (kN/m)	(m)	(°)	(kPa)	(kN/m)
83.403	0.158	0.158	1.246	0.064	0.010
8.456	1.332				
83.560	0.070	0.070	1.246	0.156	0.011
8.414	0.587				
83.630	0.158	0.158	1.246	0.249	0.039
9.233	1.455				
83.788	0.158	0.158	1.246	0.377	0.059
10.371	1.634				
83.945	0.158	0.158	1.246	0.505	0.080
11.453	1.805				
84.103	0.154	0.154	1.246	0.631	0.097
12.390	1.909				
84.257	0.158	0.158	2.878	1.049	0.165
12.963	2.045				
84.414	0.158	0.158	2.878	1.218	0.192
13.704	2.162				
84.572	0.076	0.076	2.878	1.344	0.102
13.978	1.065				
84.648	0.158	0.159	6.590	2.376	0.377
14.078	2.233				
84.805	0.101	0.101	6.590	2.578	0.261
14.416	1.462				
84.906	0.158	0.161	11.238	4.034	0.648
14.092	2.263				
85.064	0.052	0.053	11.238	4.235	0.224
14.334	0.757				
85.115	0.158	0.164	16.709	5.903	0.971
13.651	2.245				
85.273	0.056	0.058	16.709	6.116	0.357

13.882	0.811					
85.329	0.158	0.169	20.819	7.358	1.240	
13.378	2.255					
85.486	0.033	0.035	20.819	7.528	0.264	
13.569	0.476					
85.519	0.158	0.173	24.757	8.581	1.489	
13.086	2.270					
85.677	0.050	0.056	24.757	8.725	0.485	
13.274	0.738					
85.727	0.158	0.178	27.843	9.467	1.687	
12.916	2.301					
85.885	0.005	0.006	27.843	9.544	0.057	
13.017	0.078					
85.890	0.062	0.070	27.843	9.607	0.674	
13.075	0.917					
85.952	0.158	0.182	30.055	10.193	1.855	
12.857	2.340					
86.110	0.113	0.130	30.055	10.407	1.358	
13.080	1.707					
86.223	0.158	0.183	30.601	10.708	1.960	
13.178	2.412					
86.380	0.091	0.105	30.601	10.892	1.146	
13.386	1.409					
86.471	0.158	0.184	31.215	11.173	2.058	
13.548	2.496					
86.628	0.077	0.090	31.215	11.335	1.025	
13.721	1.241					
86.705	0.158	0.185	31.853	11.594	2.150	
13.774	2.555					
86.863	0.070	0.082	31.853	11.737	0.964	
13.874	1.140					
86.933	0.158	0.187	32.508	11.977	2.237	
13.903	2.597					
87.090	0.030	0.035	32.508	12.082	0.425	
13.961	0.492					
87.120	0.038	0.045	32.508	12.120	0.547	
13.996	0.632					
87.158	0.158	0.188	33.116	12.317	2.317	
14.070	2.646					
87.316	0.065	0.078	33.116	12.429	0.965	
14.139	1.098					
87.381	0.158	0.189	33.716	12.622	2.390	
14.196	2.689					
87.538	0.067	0.081	33.716	12.720	1.031	
14.219	1.152					
87.606	0.158	0.191	34.292	12.893	2.458	
14.269	2.721					
87.763	0.067	0.081	34.292	12.977	1.051	
14.212	1.151					
87.830	0.004	0.004	34.292	13.004	0.056	
14.218	0.061					
87.834	0.158	0.192	34.834	13.131	2.520	
14.303	2.745					
87.991	0.078	0.095	34.834	13.205	1.251	

14.311	1.356					
88.069	0.158	0.193	35.110	13.311	2.563	
14.483	2.789					
88.226	0.073	0.089	35.110	13.376	1.197	
14.469	1.295					
88.300	0.158	0.193	35.392	13.473	2.604	
14.653	2.832					
88.457	0.070	0.086	35.392	13.530	1.166	
14.488	1.249					
88.527	0.158	0.194	35.676	13.619	2.641	
14.639	2.839					
88.685	0.069	0.085	35.676	13.668	1.159	
14.522	1.231					
88.754	0.158	0.195	35.960	13.747	2.675	
14.689	2.859					
88.911	0.069	0.085	35.960	13.788	1.171	
14.548	1.236					
88.980	0.158	0.195	36.240	13.858	2.707	
14.736	2.878					
89.138	0.068	0.085	36.240	13.892	1.177	
14.695	1.245					
89.206	0.158	0.196	36.517	13.953	2.735	
14.751	2.892					
89.363	0.069	0.086	36.517	13.979	1.202	
14.593	1.255					
89.433	0.158	0.197	36.790	14.031	2.760	
14.895	2.930					
89.590	0.071	0.089	36.790	14.049	1.244	
14.702	1.302					
89.661	0.109	0.136	37.054	14.089	1.923	
14.827	2.024					
89.770	0.122	0.153	37.054	14.043	2.154	
14.658	2.248					
89.892	0.158	0.198	37.272	13.945	2.761	
14.620	2.894					
90.050	0.030	0.038	37.272	13.862	0.524	
14.336	0.542					
90.080	0.041	0.052	37.272	13.830	0.719	
14.322	0.744					
90.121	0.158	0.199	37.493	13.759	2.732	
14.463	2.872					
90.279	0.070	0.088	37.493	13.652	1.198	
14.269	1.253					
90.349	0.158	0.199	37.714	13.561	2.700	
14.360	2.860					
90.506	0.069	0.087	37.714	13.447	1.174	
14.203	1.240					
90.575	0.158	0.200	37.935	13.348	2.666	
14.335	2.863					
90.733	0.069	0.087	37.935	13.228	1.156	
13.965	1.221					
90.802	0.158	0.200	38.161	13.122	2.629	
14.050	2.815					
90.959	0.071	0.091	38.161	12.993	1.178	



13.795	1.251					
91.030	0.158	0.201	38.380	12.877	2.588	
13.848	2.783					
91.188	0.074	0.095	38.380	12.740	1.205	
13.626	1.289					
91.262	0.158	0.202	38.594	12.614	2.543	
13.668	2.755					
91.420	0.081	0.104	38.594	12.466	1.291	
13.468	1.395					
91.501	0.158	0.202	38.795	12.328	2.492	
13.505	2.730					
91.658	0.091	0.117	38.795	12.167	1.421	
13.356	1.560					
91.749	0.158	0.208	40.671	12.065	2.506	
13.035	2.707					
91.907	0.066	0.087	40.671	11.861	1.027	
12.816	1.110					
91.972	0.158	0.214	42.723	11.660	2.500	
12.473	2.675					
92.130	0.059	0.081	42.723	11.396	0.920	
12.443	1.004					
92.189	0.116	0.163	44.810	11.137	1.818	
11.999	1.959					
92.305	0.093	0.131	44.810	10.814	1.416	
11.836	1.550					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 dl(m) : lunghezza base concio  
 alpha(°) : Angolo pendenza base concio  
 TauStress(kPa) : Sforzo di taglio su base concio  
 TauF (kN/m) : Forza di taglio su base concio  
 TauStrength(kPa) : Resistenza al taglio su base concio  
 TauS (kN/m) : Forza resistente al taglio su base concio

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Strato 1 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso stimati secondo criterio di rottura non lineare Hoek et al.(2002)  
 CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)  
 Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

SigmaN' (kPa)	TauSrength(kPa)	Phi' (deg)	c' (kPa)
25.00	137.42	58.47	69.19
50.00	186.72	55.52	76.58
75.00	229.23	53.43	82.28
100.00	269.97	51.71	89.32
125.00	307.76	50.29	95.71

150.00	344.72	49.03	103.03
175.00	380.39	47.92	110.48
200.00	414.33	46.95	117.39
225.00	446.12	46.09	123.16
250.00	479.13	45.26	131.05
275.00	509.50	44.53	137.06
300.00	540.87	43.82	144.79
325.00	569.14	43.21	149.99
350.00	598.21	42.61	156.59
375.00	628.07	42.02	164.54
400.00	654.32	41.52	169.27
425.00	685.72	40.95	179.76
450.00	708.67	40.55	181.95
475.00	736.79	40.07	189.88
500.00	760.71	39.67	193.83
600.00	866.21	38.06	223.16
700.00	957.87	36.80	242.59
800.00	1049.54	35.65	265.80
900.00	1140.54	34.60	291.52
1000.00	1223.57	33.71	311.63
1100.00	1303.83	32.91	331.24
1200.00	1387.74	32.12	356.93
1300.00	1460.58	31.47	372.79
1400.00	1536.19	30.83	393.39
1500.00	1614.69	30.20	418.74
2000.00	1960.39	27.76	515.66

Strato 2 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso

stimati secondo criterio di rottura non lineare Hoek et

al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

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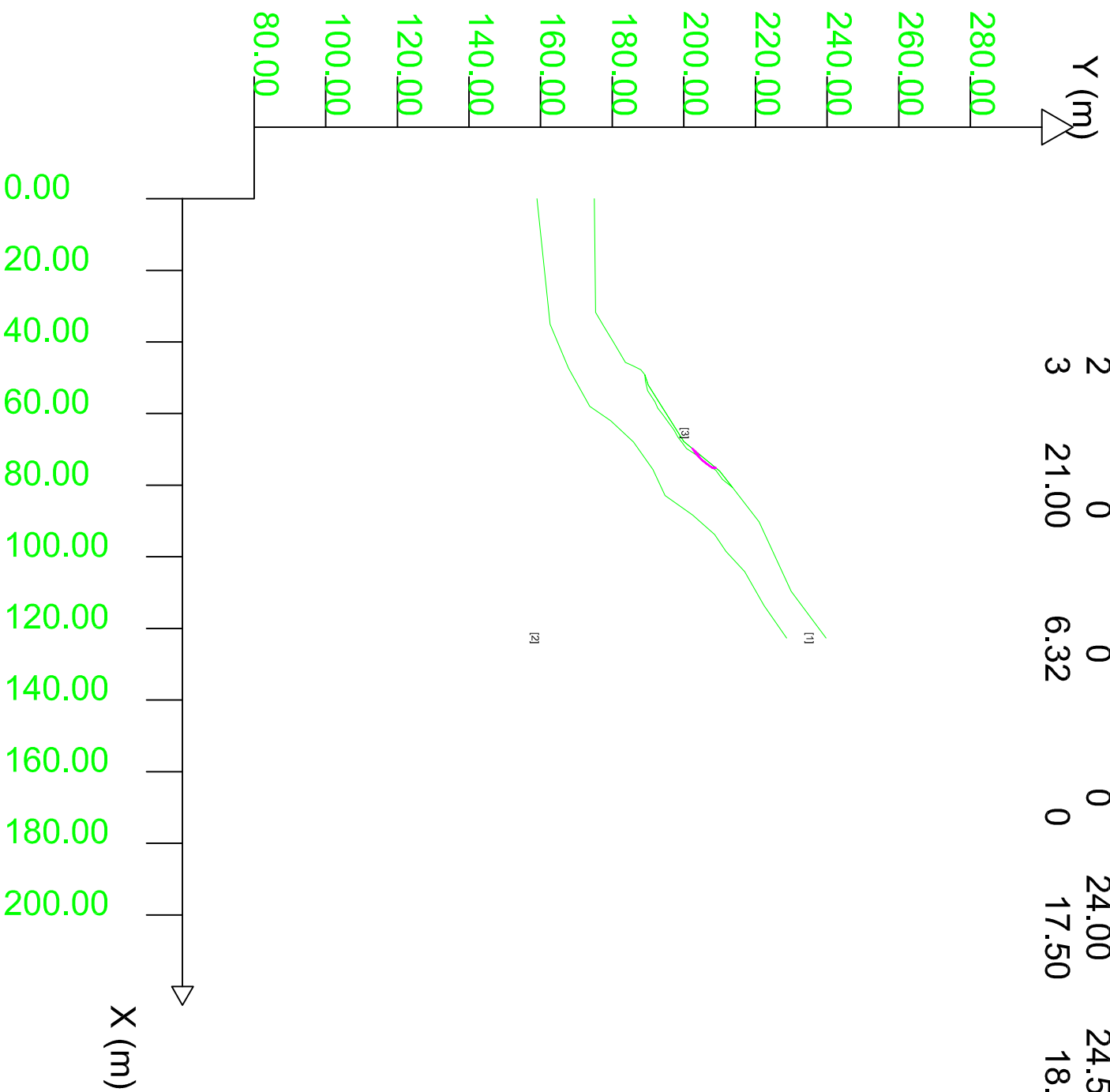
SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	696.24	60.38	513.03
50.00	756.64	59.62	520.01
75.00	806.42	59.04	520.13
100.00	857.50	58.47	523.03
125.00	909.85	57.91	528.58
150.00	949.97	57.49	524.59
175.00	1004.57	56.95	534.68
200.00	1046.36	56.55	534.32
225.00	1103.20	56.03	548.62
250.00	1146.67	55.64	551.63
275.00	1190.86	55.26	556.09
300.00	1235.77	54.89	561.97
325.00	1281.40	54.52	569.22
350.00	1327.76	54.15	577.81
375.00	1359.06	53.91	572.83
400.00	1406.61	53.55	583.74
425.00	1454.89	53.20	595.90

450.00	1487.48	52.96	593.65
475.00	1536.97	52.61	607.98
500.00	1570.37	52.38	607.39
600.00	1724.68	51.37	628.85
700.00	1885.62	50.39	662.51
800.00	2034.30	49.55	689.13
900.00	2188.33	48.73	725.29
1000.00	2327.55	48.02	750.56
1100.00	2450.22	47.43	762.64
1200.00	2597.27	46.75	801.99
1300.00	2726.73	46.18	826.48
1400.00	2859.39	45.62	856.64
1500.00	2972.41	45.17	869.25
2000.00	3572.08	42.95	995.66

Data : 18/04/2019  
 Localita' : Loc. Cepparello  
 Descrizione : Sez.5 - Stato attuale  
 [n] = N. strato o lente

# Parametri Geotecnici degli strati # -----

N.	phi'	C'	Cu	Gamm	GammSat	sgci	GSI	mi	D
	deg	kPa	kPa	KN/m3	KN/m3	MPa			
1	0	0	0	24.00	24.50	50.00	50.00	17.00	1.00
2	0	0	0	24.00	24.50	100.00	65.00	17.00	1.00
3	21.00	6.32	0	17.50	18.50	0	0	0	0



**DATI 10 SUP. CON MINOR Fs**

Fs minimo : 1.0915  
 Range Fs : 1.0915 1.1106  
 Differenza % Range Fs : 1.73  
 Coefficiente Sismico orizzontale - Kh: 0.0510

**GENERAZIONE SUPERFICI RANDOM**

Campione Superfici - N.: 20000  
 Lunghezza media segmenti (m) : 1.0  
 Range X inizio generazione : 2.5 - 112.9  
 Range X termine generazione : 14.7 - 120.2  
 Livello Y minimo considerato : 86.4

# Report elaborazioni #

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SSAP 4.9.9 - Slope Stability Analysis Program (1991,2018)

WWW.SSAP.EU

Build No. 10784

BY

Dr. Geol. LORENZO BORSELLI \*,\*\*

\*UASLP, San Luis Potosi, Mexico

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\*\* Gia' Ricercatore CNR-IRPI fino a Luglio 2011

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Ultima Revisione struttura tabelle del report: 29 dicembre 2018  
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File report: C:\SSAP2010\Verifiche\Risultati\Sez5\_Stato\_Attuale.txt

Data: 18/4/2019

Localita' :

Descrizione:

Modello pendio: Sez5-stato\_attuale\_V1.mod

----- PARAMETRI DEL MODELLO DEL PENDIO -----

\_\_\_ PARAMETRI GEOMETRICI - Coordinate X Y (in m) \_\_\_

SUP T.		SUP 2		SUP 3		SUP 4	
X	Y	X	Y	X	Y	X	Y
0.00	175.00	0.00	159.00	49.16	189.14	-	-
31.72	175.33	35.07	162.62	50.93	189.24	-	-
35.68	177.70	47.31	167.83	53.64	189.91	-	-
40.24	180.43	57.96	173.71	56.71	191.96	-	-
45.73	183.71	62.03	179.60	58.50	192.73	-	-
46.66	185.70	67.92	185.94	60.41	194.21	-	-
47.73	187.97	75.63	191.37	62.13	195.45	-	-
49.16	189.14	82.87	194.77	64.58	197.22	-	-
52.03	190.00	88.31	202.47	66.58	198.35	-	-
67.78	200.00	93.75	208.58	67.61	199.11	-	-
76.05	210.00	98.51	211.75	69.79	200.78	-	-
80.66	213.57	104.17	216.96	71.89	203.99	-	-
90.23	220.98	113.68	222.40	73.82	205.92	-	-
109.64	230.00	122.66	228.69	75.87	208.96	-	-
122.66	239.69	-	-	78.35	210.78	-	-
-	-	-	-	80.66	213.57	-	-
-	-	-	-	76.05	210.00	-	-
-	-	-	-	67.78	200.00	-	-
-	-	-	-	52.03	190.00	-	-
-	-	-	-	49.16	189.14	-	-

## ASSENZA DI FALDA ##

----- PARAMETRI GEOMECCANICI -----

STR_IDX	sgci	fi` GSI	mi	C` D	Cu	Gamm	Gamm_sat
8.587	1	0.00	17.00	1.00	0.00	24.00	24.50
12.882	2	0.00	17.00	1.00	0.00	24.00	24.50
1.294	3	21.00	0.00	0.00	0.00	17.50	18.50

LEGENDA: fi` \_\_\_\_\_ Angolo di attrito interno efficace(in gradi)  
C` \_\_\_\_\_ Coesione efficace (in Kpa)  
Cu \_\_\_\_\_ Resistenza al taglio Non drenata (in Kpa)  
Gamm \_\_\_\_\_ Peso di volume terreno fuori falda (in KN/m^3)  
Gamm\_sat \_\_\_\_\_ Peso di volume terreno immerso (in KN/m^3)  
STR\_IDX \_\_\_\_\_ Indice di resistenza (usato in solo in 'SNIFF SEARCH')

(adimensionale)

---- SOLO Per AMMASSI ROCCIOSI FRATTURATI - Parametri Criterio di Rottura di Hoek (2002)-

sigci \_\_\_\_\_ Resistenza Compressione Uniassiale Roccia Intatta (in MPa)

GSI \_\_\_\_\_ Geological Strenght Index ammasso(adimensionale)

mi \_\_\_\_\_ Indice litologico ammasso(adimensionale)

D \_\_\_\_\_ Fattore di disturbo ammasso(adimensionale)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 -

ATTIVATO (solo per ROCCE)

Uso CRITERIO DI ROTTURA Hoek et al.(2002,2006) - non-lineare - Generalizzato secondo Lei et al.(2016)

----- INFORMAZIONI GENERAZIONE SUPERFICI RANDOM -----

\*\*\* PARAMETRI PER LA GENERAZIONE DELLE SUPERFICI

METODO DI RICERCA: CONVEX RANDOM - Chen (1992)

FILTRAGGIO SUPERFICI : ATTIVATO

COORDINATE X1,X2,Y OSTACOLO : 0.00 0.00 0.00

LUNGHEZZA MEDIA SEGMENTI (m): 1.0 (+/-) 50%

INTERVALLO ASCISSE RANDOM STARTING POINT (Xmin .. Xmax): 2.45

112.85

LIVELLO MINIMO CONSIDERATO (Ymin): 86.38

INTERVALLO ASCISSE AMMESSO PER LA TERMINAZIONE (Xmin .. Xmax): 14.72

120.21

\*\*\* TOTALE SUPERFICI GENERATE : 20000

----- INFORMAZIONI PARAMETRI DI CALCOLO -----

METODO DI CALCOLO : BORSELLI (Borselli, 2016)

COEFFICIENTE SISMICO UTILIZZATO Kh : 0.0510

COEFFICIENTE SISMICO UTILIZZATO Kv (assunto Positivo): 0.0255

COEFFICIENTE c=Kv/Kh UTILIZZATO : 0.5000

FORZA ORIZZONTALE ADDIZIONALE IN TESTA (kN/m): 0.00

FORZA ORIZZONTALE ADDIZIONALE ALLA BASE (kN/m): 0.00

N.B. Le forze orizzontali addizionali in testa e alla base sono poste uguali a 0

durante le tutte le verifiche globali.

I valori >0 impostati dall'utente sono utilizzati solo in caso di

verifica singola

----- RISULTATO FINALE ELABORAZIONI -----

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\* DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR Fs \*

Fattore di sicurezza (FS)	1.0915 - Min. -	X	Y	Lambda=
1.2500		70.48	203.26	
		71.09	203.57	
		71.38	203.72	
		71.58	203.84	
		71.74	203.95	
		71.91	204.07	
		72.06	204.20	
		72.22	204.34	
		72.39	204.50	
		72.58	204.70	
		72.76	204.88	
		72.93	205.06	
		73.10	205.24	
		73.26	205.44	
		73.43	205.63	
		73.59	205.83	
		73.76	206.05	
		73.94	206.27	
		74.11	206.50	
		74.28	206.72	
		74.45	206.95	
		74.62	207.18	
		74.78	207.41	
		74.95	207.64	
		75.12	207.87	
		75.23	208.02	
		75.23	209.00	

Fattore di sicurezza (FS)	1.1011 - N.2 --	X	Y	Lambda=
0.8840		71.04	203.94	
		71.60	204.17	
		71.87	204.28	
		72.05	204.37	
		72.20	204.46	
		72.35	204.56	
		72.48	204.66	
		72.63	204.77	
		72.79	204.91	
		72.97	205.08	
		73.13	205.24	
		73.29	205.39	
		73.43	205.55	
		73.58	205.73	

73.73	205.91
73.87	206.10
74.03	206.31
74.19	206.54
74.35	206.77
74.51	206.99
74.66	207.21
74.82	207.43
74.97	207.65
75.13	207.88
75.22	208.02
75.22	209.00

Fattore di sicurezza (FS)    1.1037   - N.3 --    X            Y            Lambda=  
1.2500

69.90	202.56
70.55	202.96
70.87	203.17
71.09	203.32
71.28	203.46
71.45	203.60
71.63	203.75
71.80	203.91
71.99	204.09
72.19	204.30
72.38	204.49
72.56	204.69
72.74	204.89
72.92	205.09
73.10	205.29
73.28	205.51
73.47	205.73
73.66	205.96
73.85	206.20
74.03	206.43
74.21	206.66
74.39	206.90
74.57	207.14
74.75	207.39
74.94	207.64
75.05	207.80
75.05	208.79

Fattore di sicurezza (FS)    1.1038   - N.4 --    X            Y            Lambda=  
1.2500

70.18	202.91
70.80	203.27
71.10	203.46
71.30	203.59
71.48	203.72
71.65	203.85
71.82	203.98



71.98	204.13
72.16	204.29
72.35	204.47
72.53	204.64
72.70	204.82
72.87	205.00
73.04	205.18
73.21	205.38
73.38	205.58
73.55	205.79
73.73	206.02
73.91	206.25
74.08	206.48
74.25	206.71
74.43	206.94
74.60	207.18
74.77	207.42
74.94	207.66
75.05	207.82
75.05	208.79

Fattore di sicurezza (FS) 1.1057 - N.5 -- X Y Lambda=  
1.2500

70.51	203.31
71.11	203.64
71.41	203.81
71.61	203.93
71.78	204.05
71.95	204.17
72.10	204.29
72.27	204.43
72.44	204.58
72.64	204.75
72.81	204.92
72.97	205.09
73.13	205.26
73.30	205.44
73.46	205.63
73.62	205.84
73.78	206.06
73.96	206.30
74.14	206.55
74.31	206.78
74.48	207.02
74.65	207.25
74.82	207.48
74.99	207.72
75.09	207.87
75.09	208.84

Fattore di sicurezza (FS) 1.1070 - N.6 -- X Y Lambda=  
1.2500

69.97	202.65
70.62	203.07
70.94	203.28
71.16	203.44
71.35	203.59
71.53	203.73
71.71	203.88
71.89	204.04
72.07	204.21
72.27	204.41
72.46	204.59
72.65	204.78
72.82	204.97
73.00	205.17
73.18	205.37
73.36	205.59
73.55	205.81
73.74	206.05
73.93	206.28
74.11	206.52
74.30	206.76
74.48	207.00
74.66	207.24
74.84	207.49
75.02	207.74
75.14	207.90
75.14	208.90

Fattore di sicurezza (FS)    1.1074   - N.7 --    X    Y    Lambda=  
 1.2500

69.72	202.34
70.40	202.81
70.73	203.04
70.97	203.22
71.17	203.38
71.36	203.53
71.55	203.69
71.74	203.86
71.93	204.04
72.15	204.25
72.34	204.45
72.54	204.64
72.72	204.85
72.91	205.06
73.10	205.27
73.29	205.50
73.48	205.74
73.68	206.00
73.88	206.26
74.08	206.51
74.27	206.76
74.46	207.01
74.66	207.26

74.85 207.52  
75.05 207.77  
75.24 208.03  
75.24 209.02

Fattore di sicurezza (FS) 1.1076 - N.8 -- X Y Lambda=  
1.2500

70.14 202.86  
70.80 203.25  
71.12 203.45  
71.33 203.59  
71.52 203.73  
71.70 203.88  
71.87 204.02  
72.05 204.18  
72.24 204.36  
72.44 204.57  
72.63 204.77  
72.82 204.97  
73.00 205.17  
73.18 205.38  
73.35 205.59  
73.53 205.81  
73.72 206.04  
73.91 206.29  
74.10 206.54  
74.28 206.78  
74.47 207.02  
74.65 207.26  
74.84 207.51  
75.02 207.75  
75.21 207.99  
75.21 208.98

Fattore di sicurezza (FS) 1.1085 - N.9 -- X Y Lambda=  
1.2500

69.93 202.60  
70.56 203.01  
70.87 203.23  
71.09 203.38  
71.28 203.53  
71.46 203.67  
71.63 203.81  
71.81 203.96  
71.99 204.13  
72.19 204.31  
72.37 204.49  
72.55 204.66  
72.73 204.84  
72.90 205.03  
73.08 205.23  
73.25 205.43

73.43 205.65  
 73.63 205.89  
 73.81 206.12  
 73.99 206.35  
 74.17 206.59  
 74.35 206.83  
 74.52 207.07  
 74.70 207.32  
 74.88 207.57  
 74.99 207.73  
 74.99 208.72

Fattore di sicurezza (FS) 1.1106 - N.10 -- X Y Lambda=  
 1.2500

69.74 202.37  
 70.39 202.79  
 70.71 203.01  
 70.93 203.16  
 71.12 203.31  
 71.30 203.46  
 71.48 203.61  
 71.65 203.78  
 71.84 203.95  
 72.04 204.16  
 72.23 204.35  
 72.41 204.54  
 72.60 204.74  
 72.78 204.94  
 72.96 205.14  
 73.14 205.35  
 73.33 205.56  
 73.52 205.79  
 73.71 206.01  
 73.89 206.24  
 74.07 206.47  
 74.25 206.71  
 74.43 206.95  
 74.61 207.20  
 74.79 207.46  
 74.98 207.73  
 74.98 208.71

----- ANALISI DEFICIT DI RESISTENZA -----

# DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR FS \*

# Analisi Deficit in riferimento a FS(progetto) = 1.200

Sup N.	FS	FTR(kN/m)	FTA(kN/m)	Bilancio(kN/m)	ESITO
1	1.091	65.0	59.6	-6.5	Deficit
2	1.101	59.0	53.6	-5.3	Deficit
3	1.104	68.8	62.3	-6.0	Deficit
4	1.104	65.4	59.2	-5.7	Deficit
5	1.106	62.1	56.1	-5.3	Deficit

6	1.107	68.7	62.1	-5.8	Deficit
7	1.107	73.2	66.1	-6.1	Deficit
8	1.108	67.7	61.2	-5.7	Deficit
9	1.109	67.4	60.8	-5.6	Deficit
10	1.111	69.6	62.7	-5.6	Deficit

Esito analisi: DEFICIT di RESISTENZA!

Valore massimo di DEFICIT di RESISTENZA(kN/m): -6.5

Note: FTR --> Forza totale Resistente lungo la superficie di scivolamento

FTA --> Forza totale Agente lungo la superficie di scivolamento

IMPORTANTE! : Il Deficit o il Surplus di resistenza viene espresso in kN per metro di LARGHEZZA rispetto al fronte della scarpata

TABELLA PARAMETRI CONCI DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

phi'	X	dx	alpha	W	ru	U
(°)	(m)	(m)	(°)	(kN/m)	(-)	(kPa)
21.00	70.476	0.106	26.57	0.07	0.00	0.00
	6.32					
21.00	70.581	0.106	26.57	0.21	0.00	0.00
	6.32					
21.00	70.687	0.106	26.57	0.36	0.00	0.00
	6.32					
21.00	70.793	0.106	26.57	0.50	0.00	0.00
	6.32					
21.00	70.899	0.106	26.57	0.64	0.00	0.00
	6.32					
21.00	71.005	0.082	26.57	0.60	0.00	0.00
	6.32					
21.00	71.087	0.106	27.89	0.89	0.00	0.00
	6.32					
21.00	71.193	0.106	27.89	1.03	0.00	0.00
	6.32					
21.00	71.299	0.079	27.89	0.86	0.00	0.00
	6.32					
21.00	71.378	0.106	30.58	1.26	0.00	0.00
	6.32					
21.00	71.484	0.093	30.58	1.21	0.00	0.00
	6.32					
21.00	71.577	0.106	33.56	1.49	0.00	0.00
	6.32					
21.00	71.683	0.062	33.56	0.92	0.00	0.00
	6.32					
21.00	71.745	0.106	36.95	1.65	0.00	0.00

21.00	6.32					
	71.851	0.039	36.95	0.64	0.00	0.00
21.00	6.32					
	71.890	0.018	36.95	0.29	0.00	0.00
21.00	6.32					
	71.908	0.007	39.42	0.12	0.00	0.00
21.00	6.32					
	71.915	0.106	39.42	1.79	0.00	0.00
21.00	6.32					
	72.021	0.039	39.42	0.69	0.00	0.00
21.00	6.32					
	72.060	0.106	41.72	1.89	0.00	0.00
21.00	6.32					
	72.166	0.055	41.72	1.01	0.00	0.00
21.00	6.32					
	72.221	0.106	43.64	1.98	0.00	0.00
21.00	6.32					
	72.327	0.064	43.64	1.23	0.00	0.00
21.00	6.32					
	72.391	0.106	45.13	2.06	0.00	0.00
21.00	6.32					
	72.497	0.087	45.13	1.73	0.00	0.00
21.00	6.32					
	72.584	0.106	46.03	2.13	0.00	0.00
21.00	6.32					
	72.690	0.071	46.03	1.46	0.00	0.00
21.00	6.32					
	72.762	0.106	47.00	2.19	0.00	0.00
21.00	6.32					
	72.867	0.064	47.00	1.34	0.00	0.00
21.00	6.32					
	72.931	0.106	48.00	2.23	0.00	0.00
21.00	6.32					
	73.037	0.059	48.00	1.25	0.00	0.00
21.00	6.32					
	73.096	0.106	48.98	2.25	0.00	0.00
21.00	6.32					
	73.202	0.061	48.98	1.30	0.00	0.00
21.00	6.32					
	73.263	0.106	49.89	2.27	0.00	0.00
21.00	6.32					
	73.368	0.057	49.89	1.23	0.00	0.00
21.00	6.32					
	73.426	0.106	50.77	2.27	0.00	0.00
21.00	6.32					
	73.531	0.060	50.77	1.28	0.00	0.00
21.00	6.32					
	73.591	0.106	51.59	2.26	0.00	0.00
21.00	6.32					
	73.697	0.063	51.59	1.34	0.00	0.00
21.00	6.32					
	73.760	0.060	52.32	1.27	0.00	0.00
21.00	6.32					
	73.820	0.106	52.32	2.23	0.00	0.00

21.00	6.32						
	73.926	0.011	52.32	0.24	0.00	0.00	
21.00	6.32						
	73.937	0.106	52.61	2.21	0.00	0.00	
21.00	6.32						
	74.043	0.067	52.61	1.38	0.00	0.00	
21.00	6.32						
	74.110	0.106	52.92	2.18	0.00	0.00	
21.00	6.32						
	74.216	0.064	52.92	1.30	0.00	0.00	
21.00	6.32						
	74.280	0.106	53.22	2.14	0.00	0.00	
21.00	6.32						
	74.385	0.062	53.22	1.25	0.00	0.00	
21.00	6.32						
	74.448	0.106	53.52	2.10	0.00	0.00	
21.00	6.32						
	74.554	0.062	53.52	1.22	0.00	0.00	
21.00	6.32						
	74.616	0.106	53.82	2.05	0.00	0.00	
21.00	6.32						
	74.722	0.062	53.82	1.18	0.00	0.00	
21.00	6.32						
	74.783	0.106	54.11	2.00	0.00	0.00	
21.00	6.32						
	74.889	0.062	54.11	1.16	0.00	0.00	
21.00	6.32						
	74.951	0.106	54.39	1.94	0.00	0.00	
21.00	6.32						
	75.057	0.063	54.39	1.14	0.00	0.00	
21.00	6.32						
	75.120	0.106	54.66	1.88	0.00	0.00	
21.00	6.32						

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 alpha(°) : Angolo pendenza base concio  
 W(kN/m) : Forza peso concio  
 ru(-) : Coefficiente locale pressione interstiziale  
 U(kPa) : Pressione totale dei pori base concio  
 phi'(°) : Angolo di attrito efficace base concio  
 c'/Cu (kPa) : Coesione efficace o Resistenza al taglio in condizioni non drenate

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TABELLA DIAGRAMMA DELLE FORZE DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

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T(x)	X (m)	ht E'	yt rho(x)	yt' FS_FEM (--)	E(x) FS_p-qFEM (kN/m)
(kN/m)	(m)	(kN)	(--)	(--)	(--)
	70.476	0.000	203.260	0.681	0.0000000000E+000
0.0000000000E+000		1.6316690331E+001		1.000	7.842 0.901
	70.581	0.019	203.331	0.681	1.3274856266E+000
9.0154747294E-001		8.7656334375E+000		1.000	7.842 0.901
	70.687	0.038	203.404	0.716	1.8556896887E+000
1.5224566015E+000		5.0153242010E+000		1.000	4.701 0.648
	70.793	0.065	203.483	0.731	2.3892326722E+000
2.1704542606E+000		4.8005551586E+000		1.012	2.957 0.634
	70.899	0.087	203.558	0.714	2.8719700033E+000
2.7419420022E+000		4.4279213024E+000		0.998	2.231 0.644
	71.005	0.110	203.634	0.732	3.3266261831E+000
3.2625354726E+000		4.2243090720E+000		0.976	1.826 0.678
	71.087	0.131	203.696	0.763	3.6703829329E+000
3.6313294657E+000		4.0555480511E+000		0.955	1.655 0.719
	71.193	0.156	203.778	0.789	4.0842438222E+000
4.0560576876E+000		3.7956251160E+000		0.929	1.500 0.784
	71.299	0.186	203.863	0.816	4.4739189739E+000
4.4434817690E+000		3.4958759211E+000		0.903	1.403 0.858
	71.378	0.210	203.929	0.857	4.7405430620E+000
4.7082201803E+000		3.2027619132E+000		0.884	1.362 0.915
	71.484	0.240	204.022	0.936	5.0578463273E+000
5.0323362925E+000		2.8545529956E+000		0.865	1.300 0.988
	71.577	0.278	204.115	1.057	5.3107693952E+000
5.2936812028E+000		2.5703814959E+000		0.849	1.268 1.047
	71.683	0.325	204.232	1.023	5.5636355154E+000
5.5530312980E+000		1.8668818843E+000		0.834	1.247 1.109
	71.745	0.338	204.287	0.837	5.6603351258E+000
5.6476381050E+000		1.3481811937E+000		0.820	1.253 1.131
	71.851	0.345	204.372	0.774	5.7644519844E+000
5.7443406516E+000		7.0582559338E-001		0.797	1.270 1.154
	71.890	0.342	204.399	0.698	5.7881761064E+000
5.7649740817E+000		5.7317709227E-001		0.788	1.278 1.160
	71.908	0.341	204.412	0.749	5.7980065231E+000
5.7735284048E+000		5.3617153759E-001		0.784	1.283 1.163
	71.915	0.341	204.418	0.752	5.8019249242E+000
5.7769723479E+000		5.1191244619E-001		0.782	1.285 1.164
	72.021	0.334	204.497	0.786	5.8349094893E+000
5.8034984379E+000		1.6015006827E-001		0.760	1.307 1.177
	72.060	0.336	204.532	0.989	5.8389928392E+000
5.8066449562E+000		4.1047154077E-002		0.752	1.310 1.181
	72.166	0.350	204.641	1.125	5.8254058540E+000
5.7953006351E+000		-3.0562063334E-001		0.732	1.296 1.192
	72.221	0.373	204.713	1.189	5.8034324432E+000
5.7759791781E+000		-4.9842591892E-001		0.721	1.275 1.196
	72.327	0.392	204.832	1.142	5.7303027837E+000
5.7096901930E+000		-8.5853781846E-001		0.701	1.206 1.193
	72.391	0.405	204.907	1.153	5.6686467433E+000
5.6509723436E+000		-1.0461209318E+000		0.688	1.159 1.188
	72.497	0.420	205.028	1.150	5.5429286292E+000
5.5260921500E+000		-1.2839336742E+000		0.666	1.081 1.172



72.584	0.433	205.129	1.172	5.4241958178E+000	
5.4060001753E+000	-1.4650875457E+000		0.647	1.028	1.158
72.690	0.449	205.255	1.172	5.2560003156E+000	
5.2344713309E+000	-1.6563679451E+000		0.623	0.972	1.139
72.762	0.457	205.337	1.136	5.1343764383E+000	
5.1116709464E+000	-1.7440263347E+000		0.606	0.946	1.129
72.867	0.463	205.456	1.130	4.9431592722E+000	
4.9206784061E+000	-1.9315721094E+000		0.582	0.917	1.116
72.931	0.467	205.529	1.143	4.8144720655E+000	
4.7930198999E+000	-2.0255072361E+000		0.567	0.906	1.111
73.037	0.471	205.650	1.150	4.5968947699E+000	
4.5789764585E+000	-2.1468368713E+000		0.543	0.895	1.107
73.096	0.473	205.718	1.165	4.4675912866E+000	
4.4520773382E+000	-2.2186873832E+000		0.528	0.893	1.108
73.202	0.476	205.842	1.173	4.2287265217E+000	
4.2176908550E+000	-2.3530840388E+000		0.503	0.894	1.113
73.263	0.477	205.913	1.188	4.0827585623E+000	
4.0732433371E+000	-2.3956449236E+000		0.488	0.898	1.118
73.368	0.478	206.040	1.196	3.8315209672E+000	
3.8235408528E+000	-2.4363115450E+000		0.462	0.906	1.128
73.426	0.479	206.108	1.211	3.6904255592E+000	
3.6811457719E+000	-2.5233121918E+000		0.447	0.912	1.135
73.531	0.478	206.237	1.219	3.4129131793E+000	
3.3977440092E+000	-2.4883762680E+000		0.418	0.923	1.150
73.591	0.478	206.310	1.232	3.2684015930E+000	
3.2508741770E+000	-2.5196046548E+000		0.403	0.929	1.157
73.697	0.476	206.442	1.240	2.9817415232E+000	
2.9649981044E+000	-2.6205777845E+000		0.374	0.940	1.173
73.760	0.474	206.520	1.250	2.8197940190E+000	
2.8081793231E+000	-2.4671312595E+000		0.357	0.946	1.181
73.820	0.472	206.595	1.202	2.6781005725E+000	
2.6751209942E+000	-2.3620689999E+000		0.344	0.950	1.188
73.926	0.459	206.719	1.164	2.4297783414E+000	
2.4440812045E+000	-2.2876847224E+000		0.320	0.957	1.201
73.937	0.457	206.732	1.161	2.4036904731E+000	
2.4196490422E+000	-2.2849655952E+000		0.317	0.958	1.203
74.043	0.442	206.855	1.219	2.1583203070E+000	
2.1863058538E+000	-2.4126265302E+000		0.292	0.965	1.217
74.110	0.442	206.942	1.295	1.9934724440E+000	
2.0233115874E+000	-2.4139497001E+000		0.274	0.970	1.227
74.216	0.438	207.078	1.364	1.7477398906E+000	
1.7710577923E+000	-2.4838716313E+000		0.245	0.979	1.245
74.280	0.448	207.173	1.343	1.5829302868E+000	
1.5994343891E+000	-2.3947662157E+000		0.225	0.984	1.257
74.385	0.440	207.306	1.262	1.3622691860E+000	
1.3712339343E+000	-2.0643618788E+000		0.197	0.993	1.274
74.448	0.436	207.386	1.266	1.2341764054E+000	
1.2414106249E+000	-2.0208270517E+000		0.181	0.998	1.285
74.554	0.426	207.519	1.274	1.0259389983E+000	
1.0336565840E+000	-1.9456004818E+000		0.154	1.007	1.302
74.616	0.422	207.600	1.278	9.0593758786E-001	
9.1517357420E-001	-1.8838911434E+000		0.138	1.012	1.312
74.722	0.412	207.734	1.280	7.1536877568E-001	
7.2705093990E-001	-1.7559455780E+000		0.113	1.021	1.329

74.783	0.408	207.814	1.288	6.0882456469E-001	
6.2086544764E-001	-1.6842590772E+000		0.098	1.026	1.339
74.889	0.397	207.950	1.242	4.3888638509E-001	
4.5200337198E-001	-1.4912132941E+000		0.073	1.036	1.355
74.951	0.384	208.023	1.297	3.5046482586E-001	
3.6413299143E-001	-1.4533306432E+000		0.060	1.042	1.366
75.057	0.381	208.167	1.208	1.9137311394E-001	
2.0185643804E-001	-1.1963068660E+000		0.036	1.053	1.384
75.120	0.353	208.227	1.208	1.2732889618E-001	
1.4571902525E-001	-1.0841099717E+000		0.036	1.059	1.393

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LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 ht(m) : Altezza linea di thrust da nodo sinistro base concio  
 yt(m) : coordinata Y linea di trust  
 yt'(-) : gradiente pendenza locale linea di trust  
 E(x)(kN/m) : Forza Normale interconcio  
 T(x)(kN/m) : Forza Tangenziale interconcio  
 E' (kN) : derivata Forza normale interconcio  
 Rho(x) (-) : fattore mobilizzazione resistenza al taglio verticale interconcio  
 ZhU et al.(2003)  
 FS\_FEM(x) (-) : fattore di sicurezza locale stimato (locale in X) by qFEM  
 FS\_SRM(x) (-) : fattore di sicurezza locale stimato (locale in X) by SRM  
 Procedure

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 TABELLA SFORZI DI TAGLIO DISTRIBUITI LUNGO SUPERFICIE INDIVIDUATA CON MINOR FS

X	dx	dI	alpha	TauStress	TauF
TauStrength (m) (kPa)	TauS (m) (kN/m)	(m)	(°)	(kPa)	(kN/m)
70.476	0.106	0.118	26.566	0.297	0.035
5.419	0.641				
70.581	0.106	0.118	26.566	0.891	0.105
6.165	0.730				
70.687	0.106	0.118	26.566	1.485	0.176
6.535	0.773				
70.793	0.106	0.118	26.566	2.078	0.246
7.032	0.832				
70.899	0.106	0.118	26.566	2.672	0.316
7.497	0.887				
71.005	0.082	0.092	26.566	3.200	0.295
7.914	0.730				
71.087	0.106	0.120	27.892	3.822	0.458
8.172	0.979				
71.193	0.106	0.120	27.892	4.407	0.528
8.603	1.030				

	71.299	0.079	0.090	27.892	4.920	0.442
8.982	0.807					
	71.378	0.106	0.123	30.577	5.673	0.698
9.018	1.109					
	71.484	0.093	0.108	30.577	6.197	0.667
9.369	1.008					
	71.577	0.106	0.127	33.564	6.975	0.886
9.361	1.189					
	71.683	0.062	0.074	33.564	7.382	0.549
9.791	0.728					
	71.745	0.106	0.132	36.954	8.011	1.061
9.746	1.291					
	71.851	0.039	0.049	36.954	8.317	0.410
9.996	0.493					
	71.890	0.018	0.022	36.954	8.437	0.185
10.061	0.221					
	71.908	0.007	0.010	39.418	8.619	0.083
9.810	0.095					
	71.915	0.106	0.137	39.418	8.824	1.209
9.961	1.365					
	72.021	0.039	0.051	39.418	9.087	0.462
10.124	0.515					
	72.060	0.106	0.142	41.721	9.390	1.332
10.005	1.419					
	72.166	0.055	0.074	41.721	9.631	0.712
10.178	0.753					
	72.221	0.106	0.146	43.635	9.860	1.442
10.120	1.480					
	72.327	0.064	0.089	43.635	10.065	0.893
10.294	0.913					
	72.391	0.106	0.150	45.131	10.230	1.535
10.268	1.541					
	72.497	0.087	0.123	45.131	10.416	1.286
10.403	1.284					
	72.584	0.106	0.152	46.026	10.564	1.610
10.436	1.591					
	72.690	0.071	0.103	46.026	10.708	1.102
10.519	1.083					
	72.762	0.106	0.155	47.004	10.797	1.676
10.467	1.625					
	72.867	0.064	0.094	47.004	10.906	1.025
10.571	0.994					
	72.931	0.106	0.158	48.002	10.946	1.732
10.482	1.658					
	73.037	0.059	0.088	48.002	11.021	0.969
10.555	0.928					
	73.096	0.106	0.161	48.983	11.015	1.777
10.466	1.688					
	73.202	0.061	0.092	48.983	11.061	1.022
10.543	0.974					
	73.263	0.106	0.164	49.894	11.019	1.810
10.422	1.712					
	73.368	0.057	0.089	49.894	11.035	0.978
10.477	0.929					

10.431	73.426	0.106	0.167	50.774	10.956	1.834
	1.746					
10.341	73.531	0.060	0.095	50.774	10.944	1.036
	0.979					
10.321	73.591	0.106	0.170	51.587	10.834	1.846
	1.758					
10.228	73.697	0.063	0.101	51.587	10.794	1.095
	1.038					
10.021	73.760	0.060	0.098	52.320	10.677	1.044
	0.980					
9.987	73.820	0.106	0.173	52.320	10.613	1.838
	1.729					
9.957	73.926	0.011	0.019	52.320	10.568	0.198
	0.186					
9.931	73.937	0.106	0.174	52.615	10.483	1.828
	1.731					
10.003	74.043	0.067	0.110	52.615	10.406	1.143
	1.099					
9.919	74.110	0.106	0.176	52.918	10.287	1.806
	1.741					
10.014	74.216	0.064	0.106	52.918	10.201	1.080
	1.060					
9.746	74.280	0.106	0.177	53.222	10.072	1.781
	1.723					
9.692	74.385	0.062	0.104	53.222	9.975	1.040
	1.010					
9.582	74.448	0.106	0.178	53.525	9.836	1.751
	1.706					
9.534	74.554	0.062	0.104	53.525	9.729	1.016
	0.996					
9.419	74.616	0.106	0.179	53.819	9.581	1.718
	1.689					
9.369	74.722	0.062	0.104	53.819	9.463	0.987
	0.977					
9.254	74.783	0.106	0.181	54.109	9.305	1.680
	1.671					
9.152	74.889	0.062	0.106	54.109	9.177	0.972
	0.969					
9.132	74.951	0.106	0.182	54.391	9.009	1.638
	1.660					
8.848	75.057	0.063	0.109	54.391	8.869	0.963
	0.961					
8.971	75.120	0.106	0.183	54.665	8.692	1.591
	1.642					

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 -----  
 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 dl(m) : lunghezza base concio  
 alpha(°) : Angolo pendenza base concio  
 TauStress(kPa) : Sforzo di taglio su base concio  
 TauF (kN/m) : Forza di taglio su base concio  
 TauStrength(kPa) : Resistenza al taglio su base concio

TauS (kN/m) : Forza resistente al taglio su base concio

-----  
-----  
Strato 1 -- Parametri di resistenza al taglio equivalenti dell'ammasso  
roccioso  
stimati secondo criterio di rottura non lineare Hoek et  
al.(2002)  
CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et  
al.(2016)  
Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

-----

SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	137.42	58.47	69.19
50.00	186.72	55.52	76.58
75.00	229.23	53.43	82.28
100.00	269.97	51.71	89.32
125.00	307.76	50.29	95.71
150.00	344.72	49.03	103.03
175.00	380.39	47.92	110.48
200.00	414.33	46.95	117.39
225.00	446.12	46.09	123.16
250.00	479.13	45.26	131.05
275.00	509.50	44.53	137.06
300.00	540.87	43.82	144.79
325.00	569.14	43.21	149.99
350.00	598.21	42.61	156.59
375.00	628.07	42.02	164.54
400.00	654.32	41.52	169.27
425.00	685.72	40.95	179.76
450.00	708.67	40.55	181.95
475.00	736.79	40.07	189.88
500.00	760.71	39.67	193.83
600.00	866.21	38.06	223.16
700.00	957.87	36.80	242.59
800.00	1049.54	35.65	265.80
900.00	1140.54	34.60	291.52
1000.00	1223.57	33.71	311.63
1100.00	1303.83	32.91	331.24
1200.00	1387.74	32.12	356.93
1300.00	1460.58	31.47	372.79
1400.00	1536.19	30.83	393.39
1500.00	1614.69	30.20	418.74
2000.00	1960.39	27.76	515.66

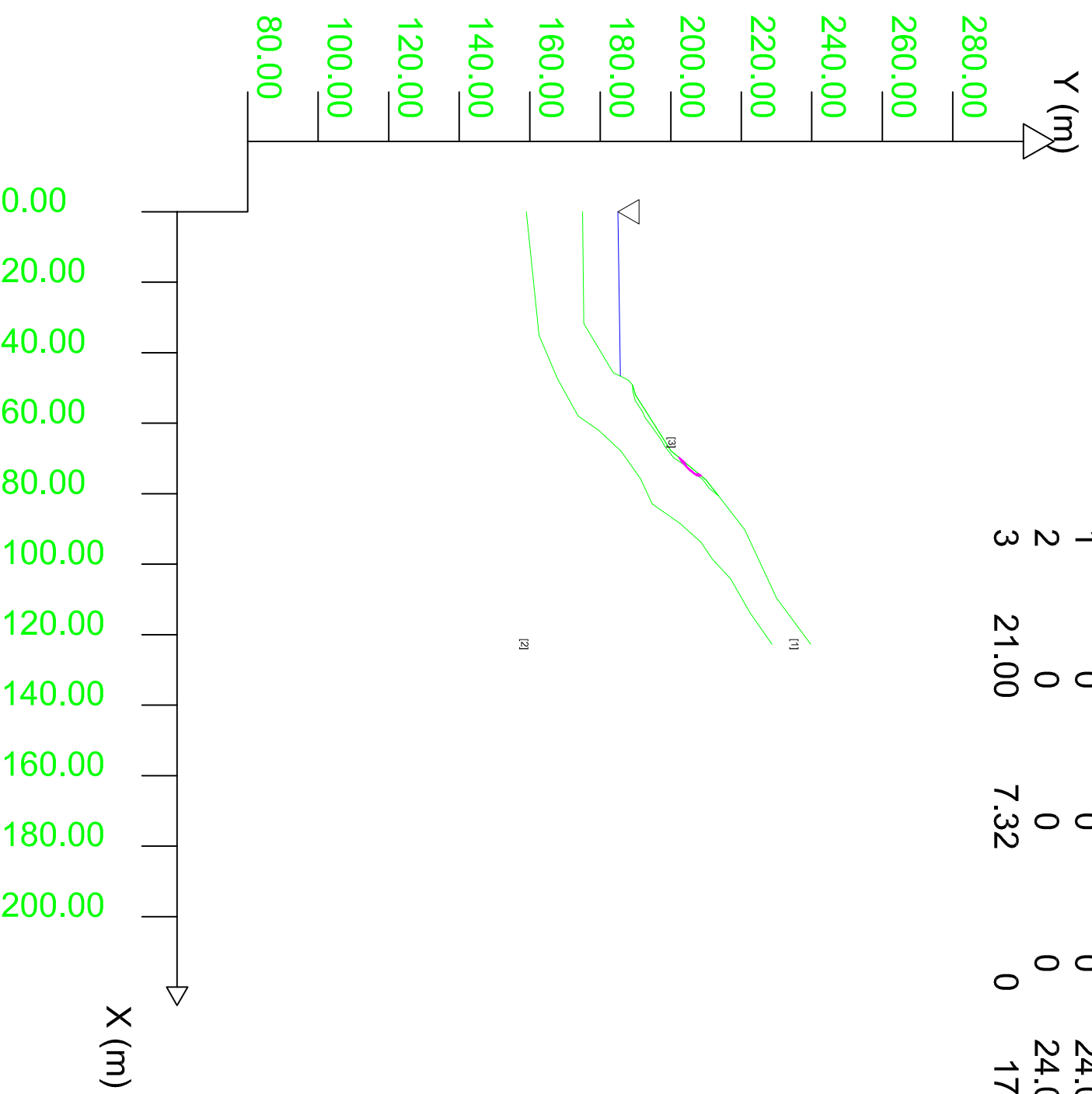
Strato 2 -- Parametri di resistenza al taglio equivalenti dell'ammasso  
roccioso  
stimati secondo criterio di rottura non lineare Hoek et  
al.(2002)  
CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et  
al.(2016)  
Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

SigmaN' (kPa)	TauSrength(kPa)	Phi' (deg)	c' (kPa)
25.00	696.24	60.38	513.03
50.00	756.64	59.62	520.01
75.00	806.42	59.04	520.13
100.00	857.50	58.47	523.03
125.00	909.85	57.91	528.58
150.00	949.97	57.49	524.59
175.00	1004.57	56.95	534.68
200.00	1046.36	56.55	534.32
225.00	1103.20	56.03	548.62
250.00	1146.67	55.64	551.63
275.00	1190.86	55.26	556.09
300.00	1235.77	54.89	561.97
325.00	1281.40	54.52	569.22
350.00	1327.76	54.15	577.81
375.00	1359.06	53.91	572.83
400.00	1406.61	53.55	583.74
425.00	1454.89	53.20	595.90
450.00	1487.48	52.96	593.65
475.00	1536.97	52.61	607.98
500.00	1570.37	52.38	607.39
600.00	1724.68	51.37	628.85
700.00	1885.62	50.39	662.51
800.00	2034.30	49.55	689.13
900.00	2188.33	48.73	725.29
1000.00	2327.55	48.02	750.56
1100.00	2450.22	47.43	762.64
1200.00	2597.27	46.75	801.99
1300.00	2726.73	46.18	826.48
1400.00	2859.39	45.62	856.64
1500.00	2972.41	45.17	869.25
2000.00	3572.08	42.95	995.66

Data : 18/04/2019  
 Localita' : Loc. Cepparello  
 Descrizione : Sez.5 - Stato di progetto  
 [n] = N. strato o lente

# Parametri Geotecnici degli strati #

N.	phi` deg	C` kPa	Cu kPa	Gamm kN/m3	GammSat kN/m3	sgci MPa	GSI	mi	D
1	0	0	0	24.00	24.50	50.00	..	17.00	1.00
2	0	0	0	24.00	24.50	100.00	65.00	17.00	1.00
3	21.00	7.32	0	17.50	18.50	0	0	0	0



**DATI 10 SUP. CON MINOR Fs**

Fs minimo : 1.2378  
 Range Fs : 1.2378 1.2586  
 Differenza % Range Fs : 1.66  
 Coefficiente Sismico orizzontale - Kh: 0.0510

**GENERAZIONE SUPERFICI RANDOM**

Campione Superfici - N.: 20000  
 Lunghezza media segmenti (m) : 1.0  
 Range X inizio generazione : 2.5 - 112.9  
 Range X termine generazione : 14.7 - 120.2  
 Livello Y minimo considerato : 86.4

# Report elaborazioni #

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SSAP 4.9.9 - Slope Stability Analysis Program (1991,2018)

WWW.SSAP.EU

Build No. 10784

BY

Dr. Geol. LORENZO BORSELLI \*,\*\*

\*UASLP, San Luis Potosi, Mexico

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\*\* Gia' Ricercatore CNR-IRPI fino a Luglio 2011

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Ultima Revisione struttura tabelle del report: 29 dicembre 2018  
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File report: C:\SSAP2010\Verifiche\Risultati\Sez5\_Stato\_Progetto.txt

Data: 18/4/2019

Localita' :

Descrizione:

Modello pendio: Sez5-stato\_progetto\_V5.mod

----- PARAMETRI DEL MODELLO DEL PENDIO -----

\_\_\_ PARAMETRI GEOMETRICI - Coordinate X Y (in m) \_\_\_

SUP T.		SUP 2		SUP 3		SUP 4	
X	Y	X	Y	X	Y	X	Y
0.00	175.00	0.00	159.00	49.16	189.14	-	-
31.72	175.33	35.07	162.62	50.93	189.24	-	-
35.68	177.70	47.31	167.83	53.64	189.91	-	-
40.24	180.43	57.96	173.71	56.71	191.96	-	-
45.73	183.71	62.03	179.60	58.50	192.73	-	-
46.66	185.70	67.92	185.94	60.41	194.21	-	-
47.73	187.97	75.63	191.37	62.13	195.45	-	-
49.16	189.14	82.87	194.77	64.58	197.22	-	-
52.03	190.00	88.31	202.47	66.58	198.35	-	-
67.78	200.00	93.75	208.58	67.61	199.11	-	-
76.05	210.00	98.51	211.75	69.79	200.78	-	-
80.66	213.57	104.17	216.96	71.89	203.99	-	-
90.23	220.98	113.68	222.40	73.82	205.92	-	-
109.64	230.00	122.66	228.69	75.87	208.96	-	-
122.66	239.69	-	-	78.35	210.78	-	-
-	-	-	-	80.66	213.57	-	-
-	-	-	-	76.05	210.00	-	-
-	-	-	-	67.78	200.00	-	-
-	-	-	-	52.03	190.00	-	-
-	-	-	-	49.16	189.14	-	-

----- SUP FALDA -----

X Y (in m)



0.00 185.00  
122.66 185.00

----- GESTIONE ACQUIFERI -----

Strati esclusi da acquifero:

STRATO 1  
STRATO 2  
STRATO 3

Esclusione sovraccarico pendio sommerso: NON ATTIVATA

Peso unitario fluido (kN/m<sup>3</sup>): 9.81

Parametri funzione dissipazione superficiale pressione dei fluidi:

Coefficiente A 0  
Coefficiente K 0.000800  
Pressione minima fluidi Uo\_Min (kPa) 0.01  
Coefficiente di soprapressione oltre pressione idrostatica 1.00  
Limitazione dissipazione a Pressione Idrostatica = ATTIVA

STABILITE CONDIZIONI PER LA VERIFICA CON SOVRAPPRESSIONE ACQUIFERI CON DISSIPAZIONE IN DIREZIONE DELLA SUPERFICIE

CALCOLO EFFETTO DI FILTRAZIONE NON ATTIVATO

----- PARAMETRI GEOMECCANICI -----

STR_IDX	sgci	fi` GSI	mi	C` D	Cu	Gamm	Gamm_sat
STRATO 1	1	0.00	0.00	0.00	0.00	24.00	24.50
8.587	50.00	50.00	17.00	1.00			
STRATO 2	2	0.00	0.00	0.00	0.00	24.00	24.50
12.882	100.00	65.00	17.00	1.00			
STRATO 3	3	21.00	7.32	0.00	0.00	17.50	18.50
1.331	0.00	0.00	0.00	0.00			

LEGENDA: fi` \_\_\_\_\_ Angolo di attrito interno efficace(in gradi)

C` \_\_\_\_\_ Coesione efficace (in Kpa)

Cu \_\_\_\_\_ Resistenza al taglio Non drenata (in Kpa)

Gamm \_\_\_\_\_ Peso di volume terreno fuori falda (in KN/m<sup>3</sup>)

Gamm\_sat \_\_\_\_\_ Peso di volume terreno immerso (in KN/m<sup>3</sup>)

STR\_IDX \_\_\_\_\_ Indice di resistenza (usato in solo in 'SNIFF SEARCH')  
(adimensionale)

---- SOLO Per AMMASSI ROCCIOSI FRATTURATI - Parametri Criterio di Rottura di Hoek (2002)-

sigci \_\_\_\_\_ Resistenza Compressione Uniassiale Roccia Intatta (in MPa)

GSI \_\_\_\_\_ Geological Strenght Index ammasso(adimensionale)

mi \_\_\_\_\_ Indice litologico ammasso(adimensionale)

D \_\_\_\_\_ Fattore di disturbo ammasso(adimensionale)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 -

ATTIVATO (solo per ROCCE)

Uso CRITERIO DI ROTTURA Hoek et al.(2002,2006) - non-lineare - Generalizzato secondo Lei et al.(2016)

----- INFORMAZIONI GENERAZIONE SUPERFICI RANDOM -----

\*\*\* PARAMETRI PER LA GENERAZIONE DELLE SUPERFICI

METODO DI RICERCA: CONVEX RANDOM - Chen (1992)

FILTRAGGIO SUPERFICI : ATTIVATO

COORDINATE X1,X2,Y OSTACOLO : 0.00 0.00 0.00

LUNGHEZZA MEDIA SEGMENTI (m): 1.0 (+/-) 50%

INTERVALLO ASCISSE RANDOM STARTING POINT (Xmin .. Xmax): 2.45

112.85

LIVELLO MINIMO CONSIDERATO (Ymin): 86.38

INTERVALLO ASCISSE AMMESSO PER LA TERMINAZIONE (Xmin .. Xmax): 14.72

120.21

\*\*\* TOTALE SUPERFICI GENERATE : 20000

----- INFORMAZIONI PARAMETRI DI CALCOLO -----

METODO DI CALCOLO : BORSELLI (Borselli, 2016)

COEFFICIENTE SISMICO UTILIZZATO Kh : 0.0510

COEFFICIENTE SISMICO UTILIZZATO Kv (assunto Positivo): 0.0255

COEFFICIENTE  $c=Kv/Kh$  UTILIZZATO : 0.5000

FORZA ORIZZONTALE ADDIZIONALE IN TESTA (kN/m): 0.00

FORZA ORIZZONTALE ADDIZIONALE ALLA BASE (kN/m): 0.00

N.B. Le forze orizzontali addizionali in testa e alla base sono poste uguali a 0

durante le tutte le verifiche globali.

I valori >0 impostati dall'utente sono utilizzati solo in caso di verifica singola

----- RISULTATO FINALE ELABORAZIONI -----

\* DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR Fs \*

Fattore di sicurezza (FS) 1.2378 - Min. - X Y Lambda=  
1.2500

70.28	203.03
70.91	203.41
71.22	203.61
71.44	203.75
71.62	203.89
71.80	204.02
71.97	204.16
72.14	204.31
72.33	204.47
72.53	204.65
72.71	204.82
72.88	205.00
73.05	205.17
73.23	205.37
73.40	205.56
73.57	205.77
73.75	205.99
73.94	206.23
74.12	206.47

74.30 206.71  
74.48 206.94  
74.59 207.09  
74.59 208.24

Fattore di sicurezza (FS) 1.2381 - N.2 -- X Y Lambda=  
0.7000

70.99 203.88  
71.58 204.12  
71.86 204.24  
72.04 204.34  
72.20 204.43  
72.35 204.53  
72.49 204.64  
72.64 204.77  
72.81 204.93  
73.00 205.11  
73.17 205.29  
73.33 205.46  
73.48 205.63  
73.64 205.82  
73.79 206.01  
73.95 206.21  
74.11 206.42  
74.28 206.65  
74.44 206.88  
74.61 207.10  
74.71 207.24  
74.71 208.38

Fattore di sicurezza (FS) 1.2451 - N.3 -- X Y Lambda=  
1.2500

70.54 203.34  
71.16 203.65  
71.45 203.81  
71.66 203.93  
71.83 204.04  
71.99 204.17  
72.15 204.29  
72.31 204.44  
72.48 204.60  
72.68 204.80  
72.86 204.99  
73.03 205.17  
73.20 205.36  
73.37 205.55  
73.53 205.75  
73.70 205.95  
73.87 206.16  
74.05 206.39  
74.22 206.62  
74.40 206.84

74.50 206.98  
74.50 208.13

Fattore di sicurezza (FS) 1.2476 - N.4 -- X Y Lambda=  
1.2500

70.47 203.26  
71.09 203.63  
71.39 203.82  
71.60 203.95  
71.78 204.08  
71.96 204.21  
72.12 204.35  
72.29 204.49  
72.47 204.65  
72.66 204.83  
72.84 205.00  
73.01 205.17  
73.18 205.35  
73.35 205.53  
73.52 205.72  
73.69 205.93  
73.86 206.14  
74.05 206.38  
74.23 206.61  
74.40 206.84  
74.58 207.07  
74.69 207.21  
74.69 208.35

Fattore di sicurezza (FS) 1.2505 - N.5 -- X Y Lambda=  
1.2500

69.65 202.27  
70.34 202.70  
70.67 202.92  
70.90 203.09  
71.10 203.24  
71.29 203.40  
71.46 203.56  
71.65 203.75  
71.84 203.94  
72.05 204.17  
72.25 204.39  
72.44 204.60  
72.64 204.82  
72.83 205.03  
73.02 205.25  
73.21 205.47  
73.41 205.70  
73.60 205.93  
73.80 206.16  
73.99 206.39  
74.18 206.63

74.37 206.86  
74.56 207.11  
74.75 207.35  
74.75 208.43

Fattore di sicurezza (FS) 1.2521 - N.6 -- X Y Lambda=  
1.2500

70.62 203.43  
71.22 203.74  
71.51 203.89  
71.70 204.01  
71.87 204.13  
72.03 204.25  
72.18 204.38  
72.33 204.52  
72.50 204.68  
72.69 204.88  
72.86 205.06  
73.03 205.25  
73.20 205.43  
73.36 205.62  
73.52 205.81  
73.69 206.00  
73.85 206.21  
74.03 206.43  
74.20 206.64  
74.36 206.86  
74.53 207.07  
74.69 207.29  
74.86 207.51  
74.96 207.66  
74.96 208.68

Fattore di sicurezza (FS) 1.2522 - N.7 -- X Y Lambda=  
0.8455

70.64 203.46  
71.23 203.78  
71.52 203.94  
71.72 204.07  
71.89 204.18  
72.05 204.30  
72.20 204.42  
72.36 204.55  
72.53 204.70  
72.72 204.87  
72.89 205.03  
73.06 205.19  
73.21 205.36  
73.38 205.54  
73.53 205.72  
73.69 205.92  
73.86 206.12

74.04 206.36  
74.21 206.58  
74.37 206.81  
74.54 207.03  
74.54 208.17

Fattore di sicurezza (FS) 1.2546 - N.8 -- X Y Lambda=  
1.2500

69.94 202.61  
70.61 203.05  
70.94 203.27  
71.16 203.43  
71.36 203.58  
71.55 203.73  
71.72 203.89  
71.91 204.06  
72.10 204.24  
72.31 204.45  
72.50 204.66  
72.69 204.86  
72.88 205.06  
73.06 205.27  
73.25 205.48  
73.43 205.70  
73.62 205.94  
73.82 206.18  
74.01 206.42  
74.20 206.67  
74.39 206.91  
74.58 207.15  
74.76 207.40  
74.88 207.56  
74.88 208.59

Fattore di sicurezza (FS) 1.2571 - N.9 -- X Y Lambda=  
0.8199

70.57 203.37  
71.18 203.70  
71.47 203.87  
71.67 204.00  
71.85 204.11  
72.01 204.24  
72.17 204.37  
72.34 204.51  
72.51 204.67  
72.70 204.85  
72.88 205.03  
73.05 205.20  
73.21 205.38  
73.38 205.57  
73.54 205.76  
73.71 205.96

73.88 206.17  
 74.06 206.40  
 74.24 206.63  
 74.41 206.86  
 74.51 207.00  
 74.51 208.14

Fattore di sicurezza (FS) 1.2586 - N.10 -- X Y Lambda=  
 1.2500

70.15 202.87  
 70.76 203.32  
 71.08 203.55  
 71.30 203.71  
 71.50 203.86  
 71.68 204.00  
 71.86 204.14  
 72.04 204.28  
 72.23 204.42  
 72.43 204.58  
 72.61 204.73  
 72.78 204.88  
 72.94 205.05  
 73.12 205.23  
 73.29 205.41  
 73.46 205.61  
 73.64 205.83  
 73.83 206.08  
 74.02 206.32  
 74.20 206.56  
 74.38 206.80  
 74.56 207.04  
 74.67 207.19  
 74.67 208.33

----- ANALISI DEFICIT DI RESISTENZA -----

# DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR FS \*

# Analisi Deficit in riferimento a FS(progetto) = 1.200

Sup N.	FS	FTR(kN/m)	FTA(kN/m)	Bilancio(kN/m)	ESITO
1	1.238	63.3	51.1	1.9	Surplus
2	1.238	57.0	46.1	1.8	Surplus
3	1.245	58.9	47.3	2.1	Surplus
4	1.248	61.7	49.5	2.4	Surplus
5	1.251	74.3	59.4	3.0	Surplus
6	1.252	64.5	51.5	2.7	Surplus
7	1.252	57.4	45.9	2.4	Surplus
8	1.255	72.2	57.5	3.1	Surplus
9	1.257	58.0	46.1	2.6	Surplus
10	1.259	65.6	52.1	3.1	Surplus

Esito analisi: SURPLUS di RESISTENZA!

Valore minimo di SURPLUS di RESISTENZA (kN/m): 1.8

Note: FTR --> Forza totale Resistente lungo la superficie di scivolamento

FTA --> Forza totale Agente lungo la superficie di scivolamento

IMPORTANTE! : Il Deficit o il Surplus di resistenza viene espresso in kN per metro di LARGHEZZA rispetto al fronte della scarpata

TABELLA PARAMETRI CONCI DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

phi'	X	dx	alpha	W	ru	U
(°)	(m)	(m)	(°)	(kN/m)	(-)	(kPa)
21.00	70.282	0.111	31.65	0.07	0.00	0.00
21.00	70.393	0.111	31.65	0.20	0.00	0.00
21.00	70.504	0.111	31.65	0.33	0.00	0.00
21.00	70.616	0.111	31.65	0.46	0.00	0.00
21.00	70.727	0.111	31.65	0.59	0.00	0.00
21.00	70.838	0.071	31.65	0.45	0.00	0.00
21.00	70.909	0.111	32.42	0.81	0.00	0.00
21.00	71.020	0.111	32.42	0.93	0.00	0.00
21.00	71.132	0.088	32.42	0.83	0.00	0.00
21.00	71.220	0.111	33.90	1.16	0.00	0.00
21.00	71.331	0.105	33.90	1.20	0.00	0.00
21.00	71.436	0.111	35.48	1.38	0.00	0.00
21.00	71.547	0.077	35.48	1.02	0.00	0.00
21.00	71.624	0.111	37.35	1.57	0.00	0.00
21.00	71.735	0.064	37.35	0.94	0.00	0.00
21.00	71.799	0.091	38.75	1.40	0.00	0.00
21.00	71.890	0.025	38.75	0.39	0.00	0.00
21.00	71.915	0.054	38.75	0.86	0.00	0.00



21.00	7.32					
	71.969	0.111	40.09	1.85	0.00	0.00
21.00	7.32					
	72.080	0.064	40.09	1.11	0.00	0.00
21.00	7.32					
	72.144	0.111	41.29	1.97	0.00	0.00
21.00	7.32					
	72.255	0.071	41.29	1.31	0.00	0.00
21.00	7.32					
	72.327	0.111	42.31	2.09	0.00	0.00
21.00	7.32					
	72.438	0.088	42.31	1.71	0.00	0.00
21.00	7.32					
	72.526	0.111	43.57	2.21	0.00	0.00
21.00	7.32					
	72.637	0.071	43.57	1.44	0.00	0.00
21.00	7.32					
	72.708	0.111	44.94	2.29	0.00	0.00
21.00	7.32					
	72.819	0.065	44.94	1.35	0.00	0.00
21.00	7.32					
	72.884	0.111	46.34	2.36	0.00	0.00
21.00	7.32					
	72.995	0.059	46.34	1.27	0.00	0.00
21.00	7.32					
	73.054	0.111	47.67	2.41	0.00	0.00
21.00	7.32					
	73.165	0.064	47.67	1.40	0.00	0.00
21.00	7.32					
	73.229	0.111	48.92	2.45	0.00	0.00
21.00	7.32					
	73.340	0.058	48.92	1.29	0.00	0.00
21.00	7.32					
	73.399	0.111	50.11	2.46	0.00	0.00
21.00	7.32					
	73.510	0.062	50.11	1.38	0.00	0.00
21.00	7.32					
	73.572	0.111	51.18	2.46	0.00	0.00
21.00	7.32					
	73.684	0.067	51.18	1.47	0.00	0.00
21.00	7.32					
	73.750	0.070	52.12	1.53	0.00	0.00
21.00	7.32					
	73.820	0.111	52.12	2.43	0.00	0.00
21.00	7.32					
	73.931	0.008	52.12	0.18	0.00	0.00
21.00	7.32					
	73.940	0.111	52.35	2.41	0.00	0.00
21.00	7.32					
	74.051	0.073	52.35	1.57	0.00	0.00
21.00	7.32					
	74.124	0.111	52.58	2.38	0.00	0.00
21.00	7.32					
	74.235	0.069	52.58	1.47	0.00	0.00

21.00	7.32					
	74.304	0.111	52.81	2.34	0.00	0.00
21.00	7.32					
	74.415	0.068	52.81	1.42	0.00	0.00
21.00	7.32					
	74.483	0.111	53.05	2.30	0.00	0.00
21.00	7.32					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 alpha(°) : Angolo pendenza base concio  
 W(kN/m) : Forza peso concio  
 ru(-) : Coefficiente locale pressione interstiziale  
 U(kPa) : Pressione totale dei pori base concio  
 phi'(°) : Angolo di attrito efficace base concio  
 c'/Cu (kPa) : Coesione efficace o Resistenza al taglio in condizioni non drenate

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TABELLA DIAGRAMMA DELLE FORZE DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

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T(x)	X (m)	ht E' (m) (kN)	yt rho(x) (m) (--)	yt' FS_FEM (--) (--)	E(x) FS_p-qFEM (kN/m) (--)
0.0000000000E+000	70.282	0.000	203.026	0.767	0.0000000000E+000
0.0000000000E+000	70.393	1.4504163259E+001	203.111	1.000	5.932 1.216
7.7964903963E-001	70.504	8.1038838859E+000	203.196	0.767	1.2569751071E+000
1.3379211103E+000	70.616	4.8654126269E+000	203.290	1.000	5.932 1.216
1.9285611663E+000	70.727	4.6276723334E+000	203.381	0.808	1.8022574440E+000
2.4800612907E+000	70.838	4.1264453068E+000	203.465	1.000	2.871 0.823
2.9746522198E+000	70.909	3.5210993083E+000	203.517	0.829	2.3390150584E+000
3.2584308373E+000	71.020	3.3584513288E+000	203.608	1.018	2.611 0.764
3.7196348853E+000	71.132	3.3362061131E+000	203.704	0.788	2.8314253132E+000
4.1548157243E+000	71.220	3.1122647762E+000	203.781	1.017	2.717 0.745
4.4543089495E+000	71.331	2.8625960931E+000	203.885	0.750	3.2567129025E+000
4.7749345051E+000	71.331	2.5036121192E+000	203.885	1.005	3.414 0.767
				0.779	3.4932488098E+000
				0.993	4.121 0.791
				0.841	3.8721627967E+000
				0.985	5.900 0.845
				0.872	4.2352019753E+000
				0.974	5.921 0.915
				0.905	4.4985769398E+000
				0.958	4.894 0.978
				0.923	4.7987896344E+000
				0.937	3.245 1.062

71.436	0.226	203.981	0.962	5.0418648082E+000	
5.0247336806E+000	2.2062632888E+000		0.913	2.517	1.143
71.547	0.259	204.093	0.997	5.2739425469E+000	
5.2641028513E+000	1.7887750145E+000		0.892	2.043	1.228
71.624	0.280	204.168	1.002	5.3958556864E+000	
5.3867233853E+000	1.4768752535E+000		0.874	1.887	1.277
71.735	0.308	204.281	0.948	5.5432049281E+000	
5.5320731717E+000	1.0289869361E+000		0.851	1.725	1.339
71.799	0.312	204.334	0.848	5.5980997727E+000	
5.5836712069E+000	7.7704347609E-001		0.835	1.684	1.362
71.890	0.317	204.413	0.822	5.6582115440E+000	
5.6386366268E+000	4.6623989352E-001		0.814	1.628	1.391
71.915	0.314	204.430	0.756	5.6685311342E+000	
5.6477930375E+000	3.8535782166E-001		0.808	1.617	1.397
71.969	0.314	204.472	0.908	5.6860855299E+000	
5.6630826904E+000	2.6697128341E-001		0.795	1.591	1.408
72.080	0.327	204.579	0.986	5.7021230325E+000	
5.6770635592E+000	1.4363030061E-003		0.770	1.500	1.432
72.144	0.339	204.645	1.129	5.6969113106E+000	
5.6722542157E+000	-1.8993263904E-001		0.755	1.439	1.442
72.255	0.374	204.777	1.093	5.6548514007E+000	
5.6325831100E+000	-4.8298702162E-001		0.730	1.304	1.450
72.327	0.378	204.845	1.077	5.6156022695E+000	
5.5944099489E+000	-7.0866005870E-001		0.713	1.241	1.447
72.438	0.406	204.974	1.106	5.5093330854E+000	
5.4861745523E+000	-1.0256049076E+000		0.685	1.130	1.427
72.526	0.417	205.065	1.118	5.4140196254E+000	
5.3886165650E+000	-1.2692687714E+000		0.663	1.072	1.408
72.637	0.443	205.197	1.105	5.2464838812E+000	
5.2182538632E+000	-1.4868985520E+000		0.633	1.004	1.378
72.708	0.445	205.266	1.074	5.1420596340E+000	
5.1145519076E+000	-1.6443760717E+000		0.614	0.979	1.363
72.819	0.460	205.392	1.099	4.9295215878E+000	
4.9048521372E+000	-1.9231825798E+000		0.584	0.944	1.340
72.884	0.463	205.459	1.111	4.8050225605E+000	
4.7828443754E+000	-2.0678525038E+000		0.567	0.932	1.332
72.995	0.475	205.588	1.121	4.5486666197E+000	
4.5310075320E+000	-2.2758598945E+000		0.535	0.919	1.324
73.054	0.476	205.650	1.147	4.4156476809E+000	
4.4000546509E+000	-2.3978109941E+000		0.519	0.917	1.323
73.165	0.486	205.783	1.160	4.1201093419E+000	
4.1077880157E+000	-2.5996211010E+000		0.485	0.919	1.329
73.229	0.487	205.853	1.162	3.9560899190E+000	
3.9454911628E+000	-2.6858919251E+000		0.467	0.923	1.335
73.340	0.492	205.986	1.180	3.6342689737E+000	
3.6248459029E+000	-2.7600887683E+000		0.432	0.932	1.349
73.399	0.492	206.053	1.191	3.4770374300E+000	
3.4666845026E+000	-2.8208473933E+000		0.414	0.938	1.357
73.510	0.494	206.188	1.207	3.1356090610E+000	
3.1172559025E+000	-3.0101102190E+000		0.377	0.949	1.375
73.572	0.494	206.263	1.219	2.9496396599E+000	
2.9259547264E+000	-3.1028873324E+000		0.356	0.955	1.385
73.684	0.492	206.400	1.229	2.5795358319E+000	
2.5529971450E+000	-3.0780295172E+000		0.316	0.966	1.405

73.750	0.492	206.482	1.242	2.3843378843E+000	
2.3641769985E+000	-2.9928205271E+000		0.295	0.971	1.415
73.820	0.489	206.569	1.196	2.1708596453E+000	
2.1632090560E+000	-2.9610641796E+000		0.273	0.976	1.426
73.931	0.475	206.698	1.149	1.8592594259E+000	
1.8770843304E+000	-2.5820110562E+000		0.242	0.982	1.441
73.940	0.473	206.707	1.206	1.8379499583E+000	
1.8571911230E+000	-2.5949942046E+000		0.240	0.982	1.442
74.051	0.465	206.842	1.218	1.5055784875E+000	
1.5386357913E+000	-2.9057386685E+000		0.203	0.988	1.459
74.124	0.459	206.931	1.320	1.2975170840E+000	
1.3311590670E+000	-2.9574779017E+000		0.178	0.991	1.471
74.235	0.468	207.085	1.311	9.5062589035E-001	
9.7319543181E-001	-2.8154132948E+000		0.133	0.997	1.491
74.304	0.460	207.168	1.263	7.6847598995E-001	
7.8598711506E-001	-2.7170374751E+000		0.109	1.001	1.502
74.415	0.459	207.314	1.158	4.5005790003E-001	
4.6518244439E-001	-2.4168558136E+000		0.066	1.005	1.518
74.483	0.431	207.375	1.158	3.0481396065E-001	
3.4564147068E-001	-2.3705500059E+000		0.050	1.009	1.525

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#### LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 ht(m) : Altezza linea di thrust da nodo sinistro base concio  
 yt(m) : coordinata Y linea di trust  
 yt'(-) : gradiente pendenza locale linea di trust  
 E(x)(kN/m) : Forza Normale interconcio  
 T(x)(kN/m) : Forza Tangenziale interconcio  
 E' (kN) : derivata Forza normale interconcio  
 Rho(x) (-) : fattore mobilizzazione resistenza al taglio verticale interconcio  
 ZhU et al.(2003)  
 FS\_FEM(x) (-) : fattore di sicurezza locale stimato (locale in X) by qFEM  
 FS\_SRM(x) (-) : fattore di sicurezza locale stimato (locale in X) by SRM  
 Procedure

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#### TABELLA SFORZI DI TAGLIO DISTRIBUITI LUNGO SUPERFICIE INDIVIDUATA CON MINOR FS

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X	dx	dl	alpha	TauStress	TauF
(m)	(m)	(m)	(°)	(kPa)	(kN/m)
70.282	0.111	0.131	31.650	0.286	0.037
5.553	0.725				
70.393	0.111	0.131	31.650	0.858	0.112
6.419	0.838				
70.504	0.111	0.131	31.650	1.430	0.187
6.658	0.870				

	70.616	0.111	0.131	31.650	2.002	0.262
7.073	0.924					
	70.727	0.111	0.131	31.650	2.575	0.336
7.532	0.984					
	70.838	0.071	0.084	31.650	3.044	0.254
7.919	0.661					
	70.909	0.111	0.132	32.421	3.542	0.467
8.048	1.060					
	71.020	0.111	0.132	32.421	4.102	0.540
8.419	1.109					
	71.132	0.088	0.104	32.421	4.603	0.480
8.837	0.922					
	71.220	0.111	0.134	33.896	5.182	0.694
9.088	1.217					
	71.331	0.105	0.126	33.896	5.701	0.720
9.509	1.201					
	71.436	0.111	0.137	35.480	6.304	0.861
9.662	1.319					
	71.547	0.077	0.095	35.480	6.729	0.637
10.053	0.951					
	71.624	0.111	0.140	37.354	7.242	1.013
10.138	1.418					
	71.735	0.064	0.080	37.354	7.602	0.611
10.478	0.843					
	71.799	0.091	0.117	38.750	7.976	0.930
10.536	1.229					
	71.890	0.025	0.032	38.750	8.196	0.263
10.719	0.344					
	71.915	0.054	0.069	38.750	8.345	0.576
10.814	0.746					
	71.969	0.111	0.145	40.087	8.693	1.263
10.849	1.577					
	72.080	0.064	0.084	40.087	8.995	0.756
11.051	0.928					
	72.144	0.111	0.148	41.287	9.316	1.379
11.138	1.648					
	72.255	0.071	0.095	41.287	9.600	0.911
11.321	1.075					
	72.327	0.111	0.150	42.307	9.888	1.487
11.481	1.726					
	72.438	0.088	0.119	42.307	10.169	1.212
11.642	1.388					
	72.526	0.111	0.153	43.569	10.438	1.602
11.762	1.805					
	72.637	0.071	0.098	43.569	10.660	1.042
11.815	1.155					
	72.708	0.111	0.157	44.941	10.845	1.704
11.891	1.868					
	72.819	0.065	0.091	44.941	11.020	1.004
11.954	1.089					
	72.884	0.111	0.161	46.337	11.131	1.793
11.986	1.931					
	72.995	0.059	0.085	46.337	11.260	0.960
12.012	1.024					

12.047	73.054	0.111	0.165	47.669	11.302	1.866
	1.989					
12.036	73.165	0.064	0.095	47.669	11.393	1.081
	1.142					
12.043	73.229	0.111	0.169	48.915	11.379	1.925
	2.038					
11.978	73.340	0.058	0.089	48.915	11.428	1.017
	1.066					
12.019	73.399	0.111	0.173	50.109	11.356	1.969
	2.084					
11.986	73.510	0.062	0.097	50.109	11.367	1.107
	1.168					
11.968	73.572	0.111	0.177	51.182	11.251	1.996
	2.123					
11.724	73.684	0.067	0.106	51.182	11.224	1.194
	1.247					
11.608	73.750	0.070	0.114	52.119	11.089	1.260
	1.319					
11.451	73.820	0.111	0.181	52.119	11.026	1.997
	2.074					
11.358	73.931	0.008	0.014	52.119	10.985	0.149
	0.154					
11.529	73.940	0.111	0.182	52.345	10.913	1.986
	2.099					
11.500	74.051	0.073	0.119	52.345	10.841	1.295
	1.374					
11.619	74.124	0.111	0.183	52.579	10.736	1.965
	2.126					
11.361	74.235	0.069	0.114	52.579	10.657	1.217
	1.297					
11.393	74.304	0.111	0.184	52.814	10.545	1.940
	2.096					
10.859	74.415	0.068	0.112	52.814	10.457	1.172
	1.217					
11.417	74.483	0.111	0.185	53.050	10.337	1.912
	2.112					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 dl(m) : lunghezza base concio  
 alpha(°) : Angolo pendenza base concio  
 TauStress(kPa) : Sforzo di taglio su base concio  
 TauF (kN/m) : Forza di taglio su base concio  
 TauStrength(kPa) : Resistenza al taglio su base concio  
 TauS (kN/m) : Forza resistente al taglio su base concio

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Strato 1 -- Parametri di resistenza al taglio equivalenti dell'ammasso  
 roccioso  
 stimati secondo criterio di rottura non lineare Hoek et

al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

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SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	137.42	58.47	69.19
50.00	186.72	55.52	76.58
75.00	229.23	53.43	82.28
100.00	269.97	51.71	89.32
125.00	307.76	50.29	95.71
150.00	344.72	49.03	103.03
175.00	380.39	47.92	110.48
200.00	414.33	46.95	117.39
225.00	446.12	46.09	123.16
250.00	479.13	45.26	131.05
275.00	509.50	44.53	137.06
300.00	540.87	43.82	144.79
325.00	569.14	43.21	149.99
350.00	598.21	42.61	156.59
375.00	628.07	42.02	164.54
400.00	654.32	41.52	169.27
425.00	685.72	40.95	179.76
450.00	708.67	40.55	181.95
475.00	736.79	40.07	189.88
500.00	760.71	39.67	193.83
600.00	866.21	38.06	223.16
700.00	957.87	36.80	242.59
800.00	1049.54	35.65	265.80
900.00	1140.54	34.60	291.52
1000.00	1223.57	33.71	311.63
1100.00	1303.83	32.91	331.24
1200.00	1387.74	32.12	356.93
1300.00	1460.58	31.47	372.79
1400.00	1536.19	30.83	393.39
1500.00	1614.69	30.20	418.74
2000.00	1960.39	27.76	515.66

Strato 2 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso

stimati secondo criterio di rottura non lineare Hoek et

al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

-----

SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	696.24	60.38	513.03
50.00	756.64	59.62	520.01
75.00	806.42	59.04	520.13
100.00	857.50	58.47	523.03
125.00	909.85	57.91	528.58
150.00	949.97	57.49	524.59

175.00	1004.57	56.95	534.68
200.00	1046.36	56.55	534.32
225.00	1103.20	56.03	548.62
250.00	1146.67	55.64	551.63
275.00	1190.86	55.26	556.09
300.00	1235.77	54.89	561.97
325.00	1281.40	54.52	569.22
350.00	1327.76	54.15	577.81
375.00	1359.06	53.91	572.83
400.00	1406.61	53.55	583.74
425.00	1454.89	53.20	595.90
450.00	1487.48	52.96	593.65
475.00	1536.97	52.61	607.98
500.00	1570.37	52.38	607.39
600.00	1724.68	51.37	628.85
700.00	1885.62	50.39	662.51
800.00	2034.30	49.55	689.13
900.00	2188.33	48.73	725.29
1000.00	2327.55	48.02	750.56
1100.00	2450.22	47.43	762.64
1200.00	2597.27	46.75	801.99
1300.00	2726.73	46.18	826.48
1400.00	2859.39	45.62	856.64
1500.00	2972.41	45.17	869.25
2000.00	3572.08	42.95	995.66



Data : 18/04/2019

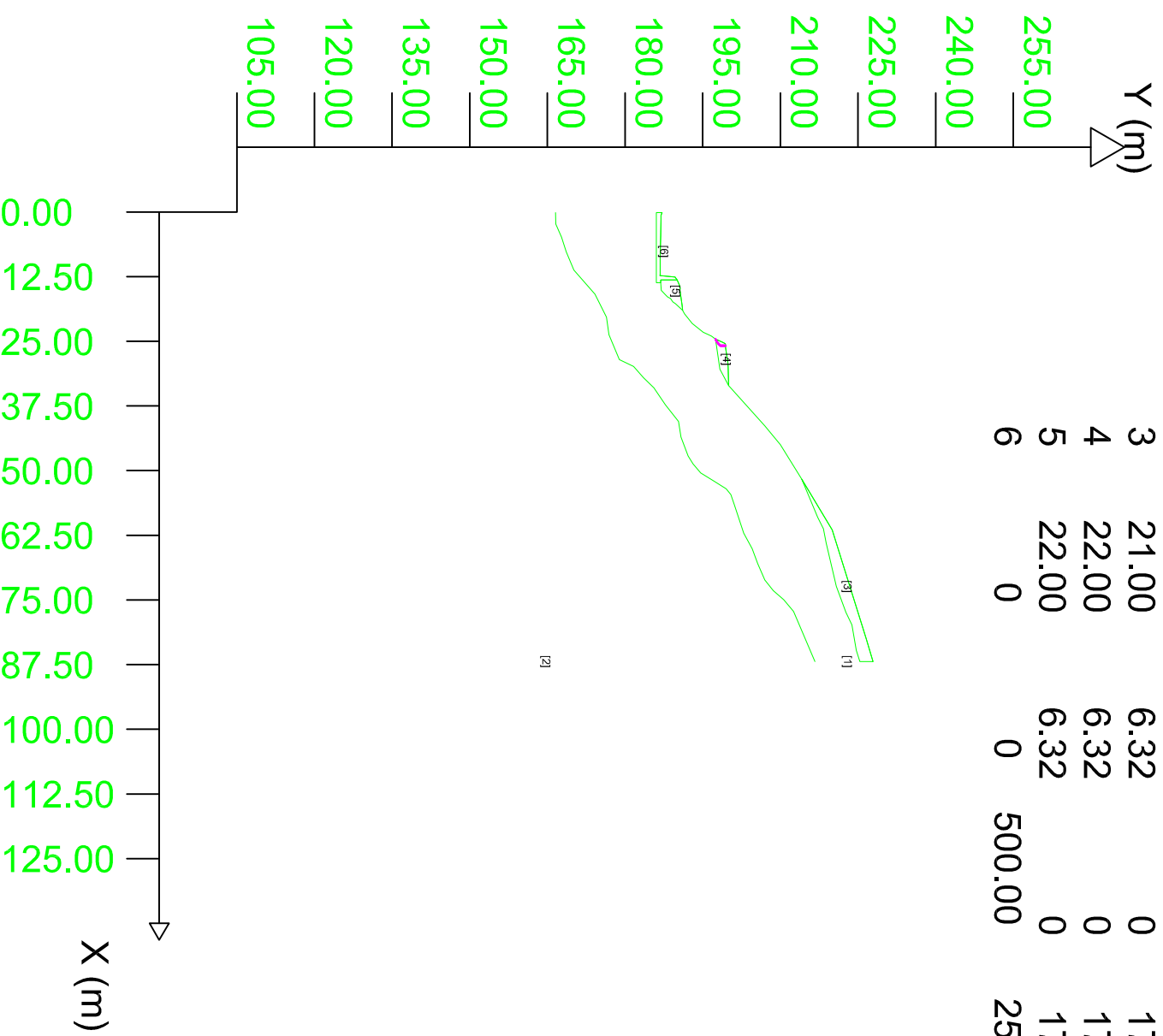
Localita' : Loc. Cepparello

Descrizione : Sez.6 - Stato attuale

[n] = N. strato o lente

# Parametri Geotecnici degli strati #

N.	phi` deg	C` kPa	Cu kPa	Gamm KN/m3	GammSat KN/m3	sgci MPa	GSI	mi	D
1	0	0	0	24.00	24.50	50.00	50.00	17.00	1.00
2	0	0	0	24.00	24.50	100.00	65.00	17.00	1.00
3	21.00	6.32	0	17.50	18.50	0	0	0	0
4	22.00	6.32	0	17.50	18.50	0	0	0	0
5	22.00	6.32	0	17.50	18.50	0	0	0	0
6	0	0	500.00	25.00	25.00	0	0	0	0



### DATI 10 SUP. CON MINOR Fs

Fs minimo : 1.2771  
Range Fs : 1.2771 1.2811  
Differenza % Range Fs : 0.31  
Coefficiente Sismico orizzontale - Kh: 0.0510

### GENERAZIONE SUPERFICI RANDOM

Campione Superfici - N.: 20000  
Lunghezza media segmenti (m) : 1.0  
Range X inizio generazione : 1.9 - 80.0  
Range X termine generazione : 10.5 - 85.2  
Livello Y minimo considerato : 111.3

# Report elaborazioni #

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SSAP 4.9.9 - Slope Stability Analysis Program (1991,2018)

WWW.SSAP.EU

Build No. 10784

BY

Dr. Geol. LORENZO BORSELLI \*,\*\*

\*UASLP, San Luis Potosi, Mexico

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\*\* Gia' Ricercatore CNR-IRPI fino a Luglio 2011

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Ultima Revisione struttura tabelle del report: 29 dicembre 2018  
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File report: C:\SSAP2010\Verifiche\Risultati\Sez6\_Stato\_Attuale.txt

Data: 18/4/2019

Localita' :

Descrizione:

Modello pendio: Sez6-stato\_attuale\_V1.mod

----- PARAMETRI DEL MODELLO DEL PENDIO -----

\_\_\_ PARAMETRI GEOMETRICI - Coordinate X Y (in m) \_\_\_

SUP T.		SUP 2		SUP 3		SUP 4	
X	Y	X	Y	X	Y	X	Y
0.12	187.16	0.12	166.55	86.89	225.35	33.56	200.02
0.65	186.97	2.33	166.60	84.76	224.69	30.42	198.33
1.41	186.95	4.89	167.72	79.82	223.85	24.55	197.47
4.62	186.87	7.70	168.63	77.38	222.67	25.30	199.09
6.40	186.83	11.25	170.12	72.37	220.79	25.40	199.20
8.29	186.79	15.88	174.21	64.02	218.83	25.45	199.38
9.63	186.76	20.34	176.39	61.27	218.32	26.32	199.45
12.06	186.78	23.72	176.89	59.03	217.19	29.13	199.84
12.15	186.80	28.52	178.88	51.67	214.13	29.92	199.89
12.28	186.74	29.86	181.64	61.46	220.02	33.56	200.02
12.55	189.45	32.06	183.54	82.47	226.59	-	-
12.57	189.59	33.97	185.59	86.89	227.91	-	-
12.57	189.60	37.29	187.79	86.89	225.35	-	-
12.58	189.63	40.51	190.34	-	-	-	-
12.58	189.65	43.52	190.79	-	-	-	-
13.15	190.04	47.17	192.16	-	-	-	-
14.38	190.62	48.71	193.16	-	-	-	-
14.87	190.64	50.45	194.62	-	-	-	-
15.06	190.57	52.00	197.08	-	-	-	-
17.99	191.01	53.54	199.54	-	-	-	-
18.00	191.01	54.64	200.45	-	-	-	-
18.49	191.05	56.46	201.09	-	-	-	-
19.04	191.11	62.11	202.91	-	-	-	-
19.70	191.52	65.12	204.55	-	-	-	-

21.57	193.00	67.94	205.64	-	-	-	-
23.24	195.07	71.13	207.01	-	-	-	-
23.98	196.68	73.23	208.65	-	-	-	-
24.55	197.47	74.96	210.65	-	-	-	-
25.30	199.09	77.24	212.56	-	-	-	-
25.40	199.20	86.89	216.71	-	-	-	-
25.45	199.38	-	-	-	-	-	-
26.32	199.45	-	-	-	-	-	-
29.13	199.84	-	-	-	-	-	-
29.92	199.89	-	-	-	-	-	-
33.56	200.02	-	-	-	-	-	-
41.37	206.98	-	-	-	-	-	-
44.99	210.02	-	-	-	-	-	-
51.67	214.13	-	-	-	-	-	-
61.46	220.02	-	-	-	-	-	-
82.47	226.59	-	-	-	-	-	-
86.89	227.91	-	-	-	-	-	-

SUP 5		SUP 6		SUP 7		SUP 8	
X	Y	X	Y	X	Y	X	Y
19.04	191.11	13.15	190.04	-	-	-	-
17.74	189.74	13.15	186.87	-	-	-	-
17.36	189.24	13.65	186.87	-	-	-	-
16.75	188.82	13.65	186.07	-	-	-	-
16.41	188.24	0.12	186.07	-	-	-	-
16.01	187.79	0.12	187.16	-	-	-	-
15.18	187.01	0.65	186.97	-	-	-	-
13.65	186.87	1.41	186.95	-	-	-	-
13.15	186.87	4.62	186.87	-	-	-	-
13.15	190.04	6.40	186.83	-	-	-	-
14.38	190.62	8.29	186.79	-	-	-	-
14.87	190.64	9.63	186.76	-	-	-	-
15.06	190.57	12.06	186.78	-	-	-	-
17.99	191.01	12.15	186.80	-	-	-	-
18.00	191.01	12.28	186.74	-	-	-	-
18.49	191.05	12.55	189.45	-	-	-	-
19.04	191.11	12.57	189.59	-	-	-	-
-	-	12.57	189.60	-	-	-	-
-	-	12.58	189.63	-	-	-	-
-	-	12.58	189.65	-	-	-	-
-	-	13.15	190.04	-	-	-	-

## ASSENZA DI FALDA ##

----- PARAMETRI GEOMECCANICI -----

STR_IDX	sgci	fi` GSI	mi	C` D	Cu	Gamm	Gamm_sat
STRATO 1	1	0.00		0.00	0.00	24.00	24.50
8.587	50.00	50.00	17.00	1.00			
STRATO 2	2	0.00		0.00	0.00	24.00	24.50
12.882	100.00	65.00	17.00	1.00			

STRATO	3	21.00	6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00		
STRATO	4	22.00	6.32	0.00	17.50	18.50
1.369	0.00	0.00	0.00	0.00		
STRATO	5	22.00	6.32	0.00	17.50	18.50
1.369	0.00	0.00	0.00	0.00		
STRATO	6	0.00	0.00	500.00	25.00	25.00
1000.000	0.00	0.00	0.00	0.00		

LEGENDA:  $f_i$  \_\_\_\_\_ Angolo di attrito interno efficace(in gradi)  
 $C$  \_\_\_\_\_ Coesione efficace (in Kpa)  
 $C_u$  \_\_\_\_\_ Resistenza al taglio Non drenata (in Kpa)  
 $\gamma_{vol}$  \_\_\_\_\_ Peso di volume terreno fuori falda (in KN/m<sup>3</sup>)  
 $\gamma_{sat}$  \_\_\_\_\_ Peso di volume terreno immerso (in KN/m<sup>3</sup>)  
STR\_IDX \_\_\_\_\_ Indice di resistenza (usato in solo in 'SNIFF SEARCH')

(adimensionale)

---- SOLO Per AMMASSI ROCCIOSI FRATTURATI - Parametri Criterio di Rottura di Hoek (2002)-

$\sigma_{ci}$  \_\_\_\_\_ Resistenza Compressione Uniassiale Roccia Intatta (in MPa)

GSI \_\_\_\_\_ Geological Strenght Index ammasso(adimensionale)

$m_i$  \_\_\_\_\_ Indice litologico ammasso(adimensionale)

$D$  \_\_\_\_\_ Fattore di disturbo ammasso(adimensionale)

Fattore di riduzione NTC2018  $\gamma_{PHI}=1.25$  e  $\gamma_C=1.25$  -

ATTIVATO (solo per ROCCE)

Uso CRITERIO DI ROTTURA Hoek et al.(2002,2006) - non-lineare - Generalizzato secondo Lei et al.(2016)

----- INFORMAZIONI GENERAZIONE SUPERFICI RANDOM -----

\*\*\* PARAMETRI PER LA GENERAZIONE DELLE SUPERFICI

METODO DI RICERCA: CONVEX RANDOM - Chen (1992)

FILTRAGGIO SUPERFICI : ATTIVATO

COORDINATE X1,X2,Y OSTACOLO : 0.00 0.00 0.00

LUNGHEZZA MEDIA SEGMENTI (m): 1.0 (+/-) 50%

INTERVALLO ASCISSE RANDOM STARTING POINT (Xmin .. Xmax): 1.86 79.95

LIVELLO MINIMO CONSIDERATO (Ymin): 111.33

INTERVALLO ASCISSE AMMESSO PER LA TERMINAZIONE (Xmin .. Xmax): 10.53 85.15

\*\*\* TOTALE SUPERFICI GENERATE : 20000

----- INFORMAZIONI PARAMETRI DI CALCOLO -----

METODO DI CALCOLO : BORSELLI (Borselli, 2016)

COEFFICIENTE SISMICO UTILIZZATO  $K_h$  : 0.0510

COEFFICIENTE SISMICO UTILIZZATO  $K_v$  (assunto Positivo): 0.0255

COEFFICIENTE  $c=K_v/K_h$  UTILIZZATO : 0.5000

FORZA ORIZZONTALE ADDIZIONALE IN TESTA (kN/m): 0.00

FORZA ORIZZONTALE ADDIZIONALE ALLA BASE (kN/m): 0.00

N.B. Le forze orizzontali addizionali in testa e alla base sono poste uguali a 0

durante le tutte le verifiche globali.

I valori >0 impostati dall'utente sono utilizzati solo in caso di

verifica singola

----- RISULTATO FINALE ELABORAZIONI -----

-----  
\* DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR Fs \*

Fattore di sicurezza (FS)	1.2771 - Min. -	X	Y	Lambda=
1.2500		24.55	197.48	
		24.76	197.56	
		24.85	197.61	
		24.92	197.64	
		24.98	197.68	
		25.04	197.71	
		25.09	197.74	
		25.14	197.78	
		25.20	197.82	
		25.26	197.87	
		25.32	197.92	
		25.38	197.97	
		25.44	198.01	
		25.49	198.06	
		25.55	198.11	
		25.60	198.17	
		25.66	198.22	
		25.72	198.28	
		25.78	198.34	
		25.83	198.40	
		25.87	198.43	
		25.87	199.41	

Fattore di sicurezza (FS)	1.2775 - N.2 --	X	Y	Lambda=
1.2500		24.55	197.47	
		24.77	197.54	
		24.87	197.58	
		24.94	197.61	
		25.00	197.64	
		25.06	197.67	
		25.11	197.70	
		25.17	197.74	
		25.23	197.78	
		25.30	197.83	
		25.36	197.88	
		25.42	197.93	
		25.48	197.97	
		25.54	198.03	
		25.59	198.08	
		25.65	198.14	
		25.71	198.20	
		25.77	198.26	
		25.83	198.33	

25.90 198.39  
25.93 198.44  
25.93 199.42

Fattore di sicurezza (FS) 1.2775 - N.3 -- X Y Lambda=  
1.2500

24.55 197.47  
24.74 197.55  
24.83 197.59  
24.90 197.62  
24.95 197.64  
25.00 197.67  
25.05 197.70  
25.10 197.73  
25.16 197.77  
25.21 197.81  
25.27 197.86  
25.32 197.90  
25.37 197.94  
25.43 197.98  
25.48 198.03  
25.53 198.07  
25.59 198.12  
25.64 198.17  
25.70 198.22  
25.75 198.27  
25.80 198.33  
25.85 198.38  
25.89 198.42  
25.89 199.42

Fattore di sicurezza (FS) 1.2783 - N.4 -- X Y Lambda=  
1.2500

24.55 197.47  
24.74 197.56  
24.84 197.60  
24.90 197.63  
24.96 197.66  
25.01 197.70  
25.06 197.73  
25.11 197.77  
25.17 197.81  
25.23 197.86  
25.29 197.90  
25.34 197.95  
25.39 197.99  
25.45 198.04  
25.50 198.09  
25.55 198.14  
25.61 198.20  
25.67 198.26  
25.72 198.32

25.78 198.37  
25.81 198.41  
25.81 199.41

Fattore di sicurezza (FS) 1.2792 - N.5 -- X Y Lambda=  
1.2500

24.55 197.47  
24.77 197.55  
24.87 197.60  
24.94 197.63  
25.00 197.66  
25.05 197.70  
25.11 197.73  
25.16 197.78  
25.22 197.82  
25.29 197.88  
25.35 197.93  
25.41 197.99  
25.47 198.04  
25.53 198.09  
25.59 198.14  
25.65 198.20  
25.71 198.25  
25.77 198.30  
25.83 198.36  
25.89 198.41  
25.89 199.42

Fattore di sicurezza (FS) 1.2801 - N.6 -- X Y Lambda=  
1.2500

24.56 197.48  
24.75 197.56  
24.84 197.61  
24.91 197.64  
24.96 197.67  
25.01 197.70  
25.06 197.73  
25.11 197.77  
25.17 197.82  
25.23 197.87  
25.28 197.91  
25.34 197.96  
25.39 198.01  
25.44 198.06  
25.50 198.11  
25.55 198.16  
25.61 198.22  
25.66 198.27  
25.72 198.33  
25.77 198.39  
25.81 198.43  
25.81 199.41

Fattore di sicurezza (FS) 1.2801 - N.7 -- X Y Lambda=  
1.2500

24.56	197.49
24.76	197.56
24.85	197.59
24.91	197.62
24.97	197.65
25.02	197.67
25.07	197.70
25.12	197.74
25.17	197.78
25.24	197.83
25.29	197.87
25.35	197.92
25.40	197.96
25.45	198.01
25.51	198.06
25.56	198.11
25.61	198.17
25.67	198.22
25.73	198.28
25.78	198.34
25.83	198.40
25.87	198.44
25.87	199.41

Fattore di sicurezza (FS) 1.2803 - N.8 -- X Y Lambda=  
1.2500

24.56	197.48
24.75	197.56
24.84	197.60
24.90	197.63
24.96	197.66
25.01	197.69
25.06	197.72
25.11	197.76
25.16	197.80
25.22	197.85
25.28	197.90
25.33	197.94
25.38	197.99
25.44	198.03
25.49	198.08
25.54	198.13
25.60	198.18
25.65	198.23
25.71	198.28
25.76	198.33
25.81	198.39
25.85	198.42
25.85	199.41



Fattore di sicurezza (FS) 1.2810 - N.9 -- X Y Lambda=  
1.2500

24.55 197.47  
24.75 197.57  
24.85 197.62  
24.92 197.65  
24.98 197.69  
25.03 197.73  
25.09 197.76  
25.14 197.81  
25.20 197.85  
25.26 197.91  
25.32 197.96  
25.38 198.01  
25.44 198.06  
25.49 198.12  
25.55 198.17  
25.61 198.22  
25.66 198.28  
25.72 198.33  
25.78 198.39  
25.82 198.43  
25.82 199.41

Fattore di sicurezza (FS) 1.2811 - N.10 -- X Y Lambda=  
1.2500

24.55 197.47  
24.74 197.56  
24.84 197.60  
24.90 197.64  
24.96 197.67  
25.01 197.70  
25.07 197.73  
25.12 197.77  
25.17 197.81  
25.23 197.85  
25.29 197.90  
25.34 197.94  
25.40 197.98  
25.45 198.03  
25.50 198.07  
25.56 198.12  
25.61 198.17  
25.67 198.23  
25.73 198.28  
25.78 198.33  
25.83 198.39  
25.87 198.42  
25.87 199.41

----- ANALISI DEFICIT DI RESISTENZA -----  
 # DATI RELATIVI ALLE 10 SUPERFICIE GENERATE CON MINOR FS \*  
 # Analisi Deficit in riferimento a FS(progetto) = 1.200

Sup N.	FS	FTR(kN/m)	FTA(kN/m)	Bilancio(kN/m)	ESITO
1	1.277	17.2	13.5	1.0	Surplus
2	1.278	18.9	14.8	1.1	Surplus
3	1.278	17.7	13.8	1.1	Surplus
4	1.278	16.4	12.9	1.0	Surplus
5	1.279	17.6	13.8	1.1	Surplus
6	1.280	16.3	12.7	1.0	Surplus
7	1.280	17.6	13.7	1.1	Surplus
8	1.280	16.9	13.2	1.1	Surplus
9	1.281	16.3	12.7	1.0	Surplus
10	1.281	17.2	13.4	1.1	Surplus

Esito analisi: SURPLUS di RESISTENZA!

Valore minimo di SURPLUS di RESISTENZA (kN/m): 1.0

Note: FTR --> Forza totale Resistente lungo la superficie di scivolamento  
 FTA --> Forza totale Agente lungo la superficie di scivolamento

IMPORTANTE! : Il Deficit o il Surplus di resistenza viene espresso in kN per metro di LARGHEZZA rispetto al fronte della scarpata

-----  
 TABELLA PARAMETRI CONCI DELLA SUPERFICIE INDIVIDUATA CON MINOR FS  
 -----

phi'	X	dx	alpha	W	ru	U
(°)	(c', Cu) (m) (kPa)	(m)	(°)	(kN/m)	(-)	(kPa)
22.00	24.553	0.038	23.47	0.02	0.00	0.00
22.00	6.32					
22.00	24.591	0.038	23.47	0.07	0.00	0.00
22.00	6.32					
22.00	24.628	0.038	23.47	0.11	0.00	0.00
22.00	6.32					
22.00	24.666	0.038	23.47	0.15	0.00	0.00
22.00	6.32					
22.00	24.704	0.038	23.47	0.20	0.00	0.00
22.00	6.32					
22.00	24.741	0.014	23.47	0.09	0.00	0.00
22.00	6.32					
22.00	24.756	0.038	24.47	0.26	0.00	0.00
22.00	6.32					
22.00	24.793	0.038	24.47	0.30	0.00	0.00
22.00	6.32					
	24.831	0.023	24.47	0.21	0.00	0.00

22.00	6.32					
	24.854	0.038	26.45	0.37	0.00	0.00
22.00	6.32					
	24.892	0.030	26.45	0.33	0.00	0.00
22.00	6.32					
	24.922	0.003	28.64	0.03	0.00	0.00
22.00	6.32					
	24.925	0.038	28.64	0.45	0.00	0.00
22.00	6.32					
	24.963	0.018	28.64	0.23	0.00	0.00
22.00	6.32					
	24.980	0.038	31.21	0.51	0.00	0.00
22.00	6.32					
	25.018	0.018	31.21	0.25	0.00	0.00
22.00	6.32					
	25.036	0.038	33.11	0.57	0.00	0.00
22.00	6.32					
	25.073	0.015	33.11	0.24	0.00	0.00
22.00	6.32					
	25.088	0.038	34.94	0.62	0.00	0.00
22.00	6.32					
	25.126	0.017	34.94	0.30	0.00	0.00
22.00	6.32					
	25.143	0.038	36.54	0.67	0.00	0.00
22.00	6.32					
	25.181	0.020	36.54	0.37	0.00	0.00
22.00	6.32					
	25.200	0.038	37.86	0.73	0.00	0.00
22.00	6.32					
	25.238	0.026	37.86	0.52	0.00	0.00
22.00	6.32					
	25.264	0.036	38.69	0.75	0.00	0.00
22.00	6.32					
	25.300	0.023	38.69	0.49	0.00	0.00
22.00	6.32					
	25.323	0.027	39.60	0.58	0.00	0.00
22.00	6.32					
	25.350	0.030	39.60	0.65	0.00	0.00
22.00	6.32					
	25.380	0.020	40.53	0.44	0.00	0.00
22.00	6.32					
	25.400	0.025	40.53	0.56	0.00	0.00
22.00	6.32					
	25.425	0.010	40.53	0.24	0.00	0.00
22.00	6.32					
	25.435	0.015	41.44	0.35	0.00	0.00
22.00	6.32					
	25.450	0.038	41.44	0.90	0.00	0.00
22.00	6.32					
	25.488	0.004	41.44	0.09	0.00	0.00
22.00	6.32					
	25.491	0.038	42.31	0.88	0.00	0.00
22.00	6.32					
	25.529	0.017	42.31	0.40	0.00	0.00

22.00	6.32					
	25.546	0.038	43.15	0.85	0.00	0.00
22.00	6.32					
	25.584	0.018	43.15	0.40	0.00	0.00
22.00	6.32					
	25.602	0.038	43.95	0.82	0.00	0.00
22.00	6.32					
	25.640	0.019	43.95	0.41	0.00	0.00
22.00	6.32					
	25.659	0.038	44.67	0.78	0.00	0.00
22.00	6.32					
	25.697	0.022	44.67	0.45	0.00	0.00
22.00	6.32					
	25.719	0.038	45.01	0.75	0.00	0.00
22.00	6.32					
	25.756	0.020	45.01	0.39	0.00	0.00
22.00	6.32					
	25.777	0.038	45.35	0.71	0.00	0.00
22.00	6.32					
	25.814	0.019	45.35	0.36	0.00	0.00
22.00	6.32					
	25.834	0.038	45.71	0.67	0.00	0.00
22.00	6.32					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 alpha(°) : Angolo pendenza base concio  
 W(kN/m) : Forza peso concio  
 ru(-) : Coefficiente locale pressione interstiziale  
 U(kPa) : Pressione totale dei pori base concio  
 phi'(°) : Angolo di attrito efficace base concio  
 c'/Cu (kPa) : Coesione efficace o Resistenza al taglio in condizioni non drenate

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TABELLA DIAGRAMMA DELLE FORZE DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

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T(x)	X (m)	ht E' (m) (kN)	yt rho(x) (m) (--)	yt' FS_FEM (--) (--)	E(x) FS_p-qFEM (kN/m) (--)
	24.553	0.000	197.477	0.874	0.0000000000E+000
0.0000000000E+000	24.591	1.0016146094E+001	197.509	0.732	12.127 1.867
3.0639335769E-001	24.628	6.2658089642E+000	197.543	0.732	12.127 1.867
4.7302180783E-001		4.4641107519E+000		0.937	4.7163924487E-001 5.481 1.433

24.666	0.054	197.580	0.991	6.4241538391E-001	
6.4901341904E-001	4.4278678976E+000		0.556	3.585	1.516
24.704	0.075	197.617	0.936	8.0493320316E-001	
8.1076556202E-001	3.9413873933E+000		0.526	2.825	1.657
24.741	0.092	197.650	0.873	9.3909103817E-001	
9.3859979896E-001	3.2895788586E+000		0.493	2.475	1.819
24.756	0.098	197.663	0.957	9.8442730868E-001	
9.8147054047E-001	3.2594327295E+000		0.481	2.378	1.863
24.793	0.118	197.700	1.100	1.1144501664E+000	
1.1093465670E+000	3.5816902088E+000		0.462	2.118	1.920
24.831	0.146	197.745	1.275	1.2540278782E+000	
1.2538597602E+000	3.8496473012E+000		0.454	1.877	1.879
24.854	0.168	197.778	1.235	1.3454208776E+000	
1.3483340819E+000	3.5209886417E+000		0.452	1.742	1.805
24.892	0.192	197.821	1.051	1.4525769665E+000	
1.4542824782E+000	2.4489194152E+000		0.437	1.606	1.687
24.922	0.206	197.849	0.958	1.5169795217E+000	
1.5131094157E+000	2.2886001245E+000		0.421	1.533	1.611
24.925	0.207	197.852	1.097	1.5239871171E+000	
1.5196033704E+000	2.2784226119E+000		0.419	1.524	1.601
24.963	0.228	197.894	1.080	1.5975140357E+000	
1.5869498940E+000	1.6923504900E+000		0.402	1.435	1.501
24.980	0.237	197.912	1.314	1.6252641917E+000	
1.6129006562E+000	1.6061447309E+000		0.394	1.397	1.460
25.018	0.268	197.966	1.360	1.6886400106E+000	
1.6765588736E+000	1.2289923629E+000		0.380	1.306	1.359
25.036	0.279	197.987	1.320	1.7065816371E+000	
1.6951118315E+000	9.3495612621E-001		0.373	1.281	1.332
25.073	0.306	198.039	1.314	1.7353195738E+000	
1.7256421270E+000	4.6079459281E-001		0.357	1.229	1.278
25.088	0.314	198.057	1.341	1.7404225202E+000	
1.7308876612E+000	2.6251532056E-001		0.349	1.216	1.266
25.126	0.341	198.110	1.347	1.7429809260E+000	
1.7339800173E+000	-1.1720598393E-001		0.332	1.183	1.233
25.143	0.349	198.130	1.395	1.7394998798E+000	
1.7307911418E+000	-3.3097155885E-001		0.324	1.172	1.223
25.181	0.377	198.186	1.385	1.7164425656E+000	
1.7083177568E+000	-6.8889243960E-001		0.305	1.146	1.197
25.200	0.386	198.210	1.468	1.7021454783E+000	
1.6941718019E+000	-9.4713720951E-001		0.295	1.136	1.187
25.238	0.417	198.270	1.528	1.6507262912E+000	
1.6418551577E+000	-1.4845604952E+000		0.275	1.116	1.165
25.264	0.434	198.307	1.424	1.6101736082E+000	
1.6004604825E+000	-1.7103273979E+000		0.260	1.106	1.154
25.300	0.457	198.359	1.314	1.5412094701E+000	
1.5295392573E+000	-1.9241814008E+000		0.240	1.094	1.141
25.323	0.464	198.384	1.249	1.4969450048E+000	
1.4832547301E+000	-2.1810968790E+000		0.232	1.087	1.134
25.350	0.478	198.421	1.182	1.4298822918E+000	
1.4131098038E+000	-2.4860386813E+000		0.221	1.079	1.125
25.380	0.484	198.452	0.994	1.3554178129E+000	
1.3378152300E+000	-2.6101090604E+000		0.208	1.069	1.116
25.400	0.486	198.471	1.474	1.3011900050E+000	
1.2857348472E+000	-2.6468897090E+000		0.200	1.064	1.111

25.425	0.512	198.518	1.639	1.2362339445E+000	
1.2269825662E+000	-2.4548263241E+000		0.182	1.059	1.106
25.435	0.514	198.529	1.059	1.2117647652E+000	
1.2055880326E+000	-2.6044178550E+000		0.175	1.057	1.105
25.450	0.517	198.545	0.959	1.1687907874E+000	
1.1676833570E+000	-2.9661176699E+000		0.165	1.056	1.103
25.488	0.518	198.579	0.899	1.0513901782E+000	
1.0627990307E+000	-3.3148379489E+000		0.155	1.056	1.104
25.491	0.517	198.582	0.748	1.0392433848E+000	
1.0513872462E+000	-3.3645626060E+000		0.153	1.056	1.105
25.529	0.511	198.610	0.672	9.0064052542E-001	
9.1498142602E-001	-3.3255112860E+000		0.137	1.064	1.115
25.546	0.504	198.619	0.540	8.4582910494E-001	
8.5875732437E-001	-3.2463208644E+000		0.131	1.068	1.121
25.584	0.490	198.639	0.512	7.1667542500E-001	
7.2355773962E-001	-2.9723360267E+000		0.114	1.084	1.140
25.602	0.481	198.647	0.499	6.6651379814E-001	
6.7253385722E-001	-2.8960214995E+000		0.107	1.090	1.147
25.640	0.464	198.667	0.489	5.4615780140E-001	
5.5093637511E-001	-2.6773586924E+000		0.091	1.109	1.167
25.659	0.454	198.675	0.511	4.9965852916E-001	
5.0514187251E-001	-2.6252717809E+000		0.085	1.116	1.175
25.697	0.438	198.696	0.518	3.8508765107E-001	
3.8960589059E-001	-2.5551386876E+000		0.068	1.138	1.198
25.719	0.426	198.706	0.533	3.3520848632E-001	
3.3992413829E-001	-2.4442385309E+000		0.060	1.148	1.208
25.756	0.410	198.728	0.529	2.3195903657E-001	
2.3546553896E-001	-2.1945872641E+000		0.043	1.171	1.231
25.777	0.398	198.737	0.517	1.9336217248E-001	
1.9775933509E-001	-2.0608406539E+000		0.043	1.184	1.244
25.814	0.381	198.758	0.501	1.0446285032E-001	
1.1002103008E-001	-1.7881774824E+000		0.043	1.209	1.268
25.834	0.369	198.765	0.501	7.5547716286E-002	
8.4995884875E-002	-1.6676367226E+000		0.043	1.218	1.278

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#### LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
ht(m) : Altezza linea di thrust da nodo sinistro base concio  
yt(m) : coordinata Y linea di trust  
yt'(-) : gradiente pendenza locale linea di trust  
E(x)(kN/m) : Forza Normale interconcio  
T(x)(kN/m) : Forza Tangenziale interconcio  
E' (kN) : derivata Forza normale interconcio  
Rho(x) (-) : fattore mobilizzazione resistenza al taglio verticale interconcio  
Zhu et al.(2003)  
FS\_FEM(x) (-) : fattore di sicurezza locale stimato (locale in X) by qFEM  
FS\_SRM(x) (-) : fattore di sicurezza locale stimato (locale in X) by SRM  
Procedure

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TABELLA SFORZI DI TAGLIO DISTRIBUITI LUNGO SUPERFICIE INDIVIDUATA CON MINOR FS

	X	dx	dI	alpha	TauStress	TauF
TauStrength	TauS					
(kPa)	(m)	(m)	(m)	(°)	(kPa)	(kN/m)
5.483	24.553	0.038	0.041	23.470	0.238	0.010
6.341	24.591	0.038	0.041	23.470	0.714	0.029
6.697	24.628	0.038	0.041	23.470	1.190	0.049
7.132	24.666	0.038	0.041	23.470	1.665	0.068
7.634	24.704	0.038	0.041	23.470	2.141	0.088
7.949	24.741	0.014	0.016	23.470	2.469	0.038
8.059	24.756	0.038	0.041	24.473	2.870	0.119
8.370	24.793	0.038	0.041	24.473	3.353	0.139
8.641	24.831	0.023	0.026	24.473	3.743	0.095
8.905	24.854	0.038	0.042	26.454	4.328	0.182
9.386	24.892	0.030	0.034	26.454	4.774	0.161
9.272	24.922	0.003	0.003	28.638	5.221	0.018
9.528	24.925	0.038	0.043	28.638	5.492	0.236
9.843	24.963	0.018	0.020	28.638	5.860	0.118
9.736	24.980	0.038	0.044	31.207	6.497	0.286
10.130	25.018	0.018	0.021	31.207	6.868	0.142
10.200	25.036	0.038	0.045	33.111	7.425	0.334
10.534	25.073	0.015	0.018	33.111	7.776	0.139
10.602	25.088	0.038	0.046	34.939	8.291	0.381
10.879	25.126	0.017	0.021	34.939	8.653	0.182
11.017	25.143	0.038	0.047	36.539	9.143	0.428
11.243	25.181	0.020	0.024	36.539	9.516	0.232
11.505	25.200	0.038	0.048	37.860	9.980	0.476
	0.548					

11.772	25.238	0.026	0.033	37.860	10.387	0.341
	0.386					
11.990	25.264	0.036	0.046	38.694	10.836	0.501
	0.554					
12.129	25.300	0.023	0.029	38.694	11.096	0.326
	0.356					
12.265	25.323	0.027	0.035	39.598	11.215	0.394
	0.431					
12.272	25.350	0.030	0.039	39.598	11.287	0.437
	0.475					
12.204	25.380	0.020	0.027	40.525	11.391	0.303
	0.324					
12.260	25.400	0.025	0.033	40.525	11.737	0.386
	0.403					
12.353	25.425	0.010	0.013	40.525	12.191	0.164
	0.166					
12.545	25.435	0.015	0.020	41.441	12.545	0.247
	0.247					
12.656	25.450	0.038	0.050	41.441	12.592	0.632
	0.635					
12.731	25.488	0.004	0.005	41.441	12.436	0.060
	0.062					
12.752	25.491	0.038	0.051	42.308	12.296	0.626
	0.649					
12.507	25.529	0.017	0.023	42.308	12.081	0.283
	0.293					
12.456	25.546	0.038	0.052	43.154	11.870	0.612
	0.643					
12.032	25.584	0.018	0.025	43.154	11.644	0.291
	0.301					
12.025	25.602	0.038	0.052	43.945	11.413	0.597
	0.629					
11.568	25.640	0.019	0.027	43.945	11.176	0.299
	0.310					
11.686	25.659	0.038	0.053	44.666	10.927	0.578
	0.618					
11.240	25.697	0.022	0.031	44.666	10.672	0.330
	0.347					
11.328	25.719	0.038	0.053	45.005	10.409	0.554
	0.603					
10.834	25.756	0.020	0.029	45.005	10.157	0.292
	0.312					
10.909	25.777	0.038	0.054	45.355	9.897	0.530
	0.584					
10.363	25.814	0.019	0.028	45.355	9.647	0.266
	0.286					
10.657	25.834	0.038	0.054	45.707	9.387	0.506
	0.574					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 dl(m) : lunghezza base concio



alpha(°) : Angolo pendenza base concio  
 TauStress(kPa) : Sforzo di taglio su base concio  
 TauF (kN/m) : Forza di taglio su base concio  
 TauStrength(kPa) : Resistenza al taglio su base concio  
 TauS (kN/m) : Forza resistente al taglio su base concio

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Strato 1 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso stimati secondo criterio di rottura non lineare Hoek et al.(2002)  
 CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)  
 Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	137.42	58.47	69.19
50.00	186.72	55.52	76.58
75.00	229.23	53.43	82.28
100.00	269.97	51.71	89.32
125.00	307.76	50.29	95.71
150.00	344.72	49.03	103.03
175.00	380.39	47.92	110.48
200.00	414.33	46.95	117.39
225.00	446.12	46.09	123.16
250.00	479.13	45.26	131.05
275.00	509.50	44.53	137.06
300.00	540.87	43.82	144.79
325.00	569.14	43.21	149.99
350.00	598.21	42.61	156.59
375.00	628.07	42.02	164.54
400.00	654.32	41.52	169.27
425.00	685.72	40.95	179.76
450.00	708.67	40.55	181.95
475.00	736.79	40.07	189.88
500.00	760.71	39.67	193.83
600.00	866.21	38.06	223.16
700.00	957.87	36.80	242.59
800.00	1049.54	35.65	265.80
900.00	1140.54	34.60	291.52
1000.00	1223.57	33.71	311.63
1100.00	1303.83	32.91	331.24
1200.00	1387.74	32.12	356.93
1300.00	1460.58	31.47	372.79
1400.00	1536.19	30.83	393.39
1500.00	1614.69	30.20	418.74
2000.00	1960.39	27.76	515.66

Strato 2 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso stimati secondo criterio di rottura non lineare Hoek et

al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

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SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	696.24	60.38	513.03
50.00	756.64	59.62	520.01
75.00	806.42	59.04	520.13
100.00	857.50	58.47	523.03
125.00	909.85	57.91	528.58
150.00	949.97	57.49	524.59
175.00	1004.57	56.95	534.68
200.00	1046.36	56.55	534.32
225.00	1103.20	56.03	548.62
250.00	1146.67	55.64	551.63
275.00	1190.86	55.26	556.09
300.00	1235.77	54.89	561.97
325.00	1281.40	54.52	569.22
350.00	1327.76	54.15	577.81
375.00	1359.06	53.91	572.83
400.00	1406.61	53.55	583.74
425.00	1454.89	53.20	595.90
450.00	1487.48	52.96	593.65
475.00	1536.97	52.61	607.98
500.00	1570.37	52.38	607.39
600.00	1724.68	51.37	628.85
700.00	1885.62	50.39	662.51
800.00	2034.30	49.55	689.13
900.00	2188.33	48.73	725.29
1000.00	2327.55	48.02	750.56
1100.00	2450.22	47.43	762.64
1200.00	2597.27	46.75	801.99
1300.00	2726.73	46.18	826.48
1400.00	2859.39	45.62	856.64
1500.00	2972.41	45.17	869.25
2000.00	3572.08	42.95	995.66

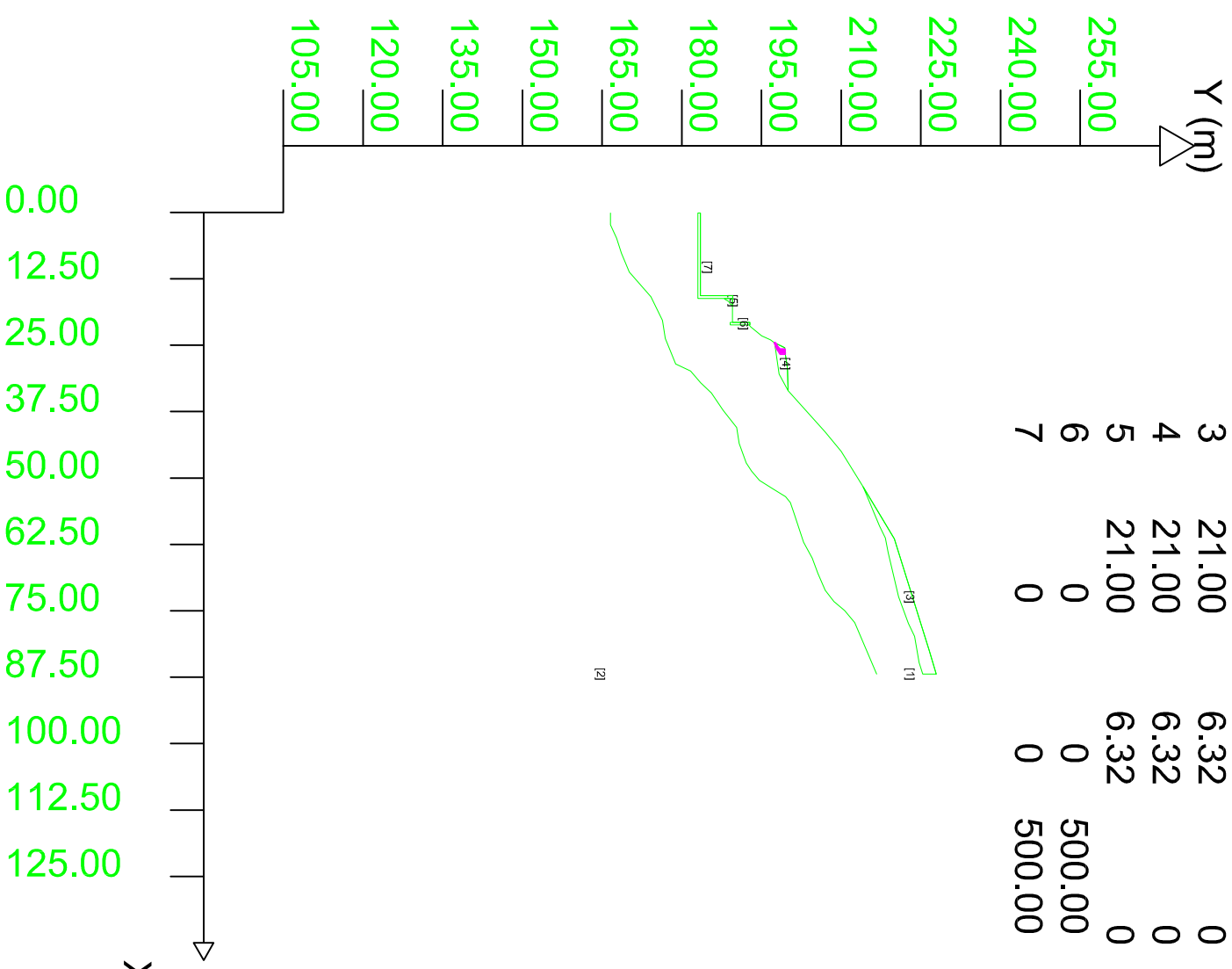
Data : 18/04/2019

Localita' : Loc. Cepparello

Descrizione : Sez.6 - Stato di progetto  
[n] = N. strato o lente

# Parametri Geotecnici degli strati #

N.	phi'	C'	Cu	Gamm	GammSat	sgci	GSI	mi	D
..	deg	kPa	kPa	kN/m <sup>3</sup>	kN/m <sup>3</sup>	MPa	..	..	..
1	0	0	0	24.00	24.50	50.00	50.00	17.00	1.00
2	0	0	0	24.00	24.50	100.00	65.00	17.00	1.00
3	21.00	6.32	0	17.50	18.50	0	0	0	0
4	21.00	6.32	0	17.50	18.50	0	0	0	0
5	21.00	6.32	0	17.50	18.50	0	0	0	0
6	0	0	500.00	25.00	25.00	0	0	0	0
7	0	0	500.00	25.00	25.00	0	0	0	0



**DATI 10 SUP. CON MINOR Fs**

Fs minimo : 1.3157      1.4190  
Range Fs : 1.3157  
Differenza % Range Fs : 7.28  
Coefficiente Sismico orizzontale - Kh: 0.0510

**GENERAZIONE SUPERFICI RANDOM**

Campione Superfici - N.: 20000  
Lunghezza media segmenti (m) : 1.0  
Range X inizio generazione : 1.9 - 80.0  
Range X termine generazione : 10.6 - 85.2  
Livello Y minimo considerato : 111.4

# Report elaborazioni #

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SSAP 4.9.9 - Slope Stability Analysis Program (1991,2018)

WWW.SSAP.EU

Build No. 10784

BY

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\*\* Gia' Ricercatore CNR-IRPI fino a Luglio 2011

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Ultima Revisione struttura tabelle del report: 29 dicembre 2018  
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File report: C:\SSAP2010\Verifiche\Risultati\Sez6\_Stato\_Progetto.txt

Data: 18/4/2019

Localita' :

Descrizione:

Modello pendio: Sez6-stato\_progetto\_V1.mod

----- PARAMETRI DEL MODELLO DEL PENDIO -----

\_\_\_ PARAMETRI GEOMETRICI - Coordinate X Y (in m) \_\_\_

SUP T.		SUP 2		SUP 3		SUP 4	
X	Y	X	Y	X	Y	X	Y
0.14	183.52	0.14	166.56	86.89	225.35	33.56	200.02
15.69	183.52	2.33	166.60	84.76	224.69	30.42	198.33
15.69	189.52	4.89	167.72	79.82	223.85	24.55	197.47
15.69	189.62	7.70	168.63	77.38	222.67	25.30	199.09
16.19	189.62	11.25	170.12	72.37	220.79	25.40	199.20
16.19	189.52	15.88	174.21	64.02	218.83	25.45	199.38
17.57	189.52	20.34	176.39	61.27	218.32	26.32	199.45
20.69	189.52	23.72	176.89	59.03	217.19	29.13	199.84
20.69	192.70	28.52	178.88	51.67	214.13	29.92	199.89
20.69	192.80	29.86	181.64	61.46	220.02	33.56	200.02
21.19	192.80	32.06	183.54	82.47	226.59	-	-
21.19	192.70	33.97	185.59	86.89	227.91	-	-
21.57	193.00	37.29	187.79	86.89	225.35	-	-
23.24	195.07	40.51	190.34	-	-	-	-
23.98	196.68	43.52	190.79	-	-	-	-
24.55	197.47	47.17	192.16	-	-	-	-
25.30	199.09	48.71	193.16	-	-	-	-
25.40	199.20	50.45	194.62	-	-	-	-
25.45	199.38	52.00	197.08	-	-	-	-
26.32	199.45	53.54	199.54	-	-	-	-
29.13	199.84	54.64	200.45	-	-	-	-
29.92	199.89	56.46	201.09	-	-	-	-
33.56	200.02	62.11	202.91	-	-	-	-
41.37	206.98	65.12	204.55	-	-	-	-

44.99	210.02	67.94	205.64	-	-	-	-
51.67	214.13	71.13	207.01	-	-	-	-
61.46	220.02	73.23	208.65	-	-	-	-
82.47	226.59	74.96	210.65	-	-	-	-
86.89	227.91	77.24	212.56	-	-	-	-
-	-	86.89	216.71	-	-	-	-

SUP 5		SUP 6		SUP 7		SUP 8	
X	Y	X	Y	X	Y	X	Y
16.19	187.99	20.69	189.52	0.14	183.52	-	-
16.19	189.52	20.69	189.12	0.14	183.02	-	-
17.57	189.52	21.19	189.12	15.69	183.02	-	-
17.36	189.24	21.19	192.70	16.19	183.02	-	-
16.75	188.82	21.19	192.80	16.19	189.62	-	-
16.41	188.24	20.69	192.80	15.69	189.62	-	-
16.19	187.99	20.69	192.70	15.69	189.52	-	-
-	-	20.69	189.52	15.69	183.52	-	-
-	-	-	-	0.14	183.52	-	-

## ASSENZA DI FALDA ##

----- PARAMETRI GEOMECCANICI -----

STR_IDX	sgci	fi` GSI	C` mi	D	Cu	Gamm	Gamm_sat
STRATO 1	1	0.00	0.00		0.00	24.00	24.50
8.587	50.00	50.00	17.00	1.00			
STRATO 2	2	0.00	0.00		0.00	24.00	24.50
12.882	100.00	65.00	17.00	1.00			
STRATO 3	3	21.00	6.32		0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00			
STRATO 4	4	21.00	6.32		0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00			
STRATO 5	5	21.00	6.32		0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00			
STRATO 6	6	0.00	0.00		500.00	25.00	25.00
1000.000	0.00	0.00	0.00	0.00			
STRATO 7	7	0.00	0.00		500.00	25.00	25.00
1000.000	0.00	0.00	0.00	0.00			

LEGENDA: fi` \_\_\_\_\_ Angolo di attrito interno efficace(in gradi)  
C` \_\_\_\_\_ Coesione efficace (in Kpa)  
Cu \_\_\_\_\_ Resistenza al taglio Non drenata (in Kpa)  
Gamm \_\_\_\_\_ Peso di volume terreno fuori falda (in KN/m^3)  
Gamm\_sat \_\_\_\_\_ Peso di volume terreno immerso (in KN/m^3)  
STR\_IDX \_\_\_\_\_ Indice di resistenza (usato in solo in 'SNIFF SEARCH)

(adimensionale)

---- SOLO Per AMMASSI ROCCIOSI FRATTURATI - Parametri Criterio di Rottura di Hoek (2002)-

sigci \_\_\_\_\_ Resistenza Compressione Uniassiale Roccia Intatta (in MPa)

GSI \_\_\_\_\_ Geological Strenght Index ammasso(adimensionale)

mi \_\_\_\_\_ Indice litologico ammasso(adimensionale)  
 D \_\_\_\_\_ Fattore di disturbo ammasso(adimensionale)  
 Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 -  
 ATTIVATO (solo per ROCCE)  
 Uso CRITERIO DI ROTTURA Hoek et al.(2002,2006) - non-lineare - Generalizzato  
 secondo Lei et al.(2016)

----- INFORMAZIONI GENERAZIONE SUPERFICI RANDOM -----

\*\*\* PARAMETRI PER LA GENERAZIONE DELLE SUPERFICI  
 METODO DI RICERCA: CONVEX RANDOM - Chen (1992)  
 FILTRAGGIO SUPERFICI : ATTIVATO  
 COORDINATE X1,X2,Y OSTACOLO : 0.00 0.00 0.00  
 LUNGHEZZA MEDIA SEGMENTI (m): 1.0 (+/-) 50%  
 INTERVALLO ASCISSE RANDOM STARTING POINT (Xmin .. Xmax): 1.88  
 79.95  
 LIVELLO MINIMO CONSIDERATO (Ymin): 111.35  
 INTERVALLO ASCISSE AMMESSO PER LA TERMINAZIONE (Xmin .. Xmax): 10.55  
 85.16

\*\*\* TOTALE SUPERFICI GENERATE : 20000

----- INFORMAZIONI PARAMETRI DI CALCOLO -----

METODO DI CALCOLO : BORSELLI (Borselli, 2016)  
 COEFFICIENTE SISMICO UTILIZZATO Kh : 0.0510  
 COEFFICIENTE SISMICO UTILIZZATO Kv (assunto Positivo): 0.0255  
 COEFFICIENTE c=Kv/Kh UTILIZZATO : 0.5000  
 FORZA ORIZZONTALE ADDIZIONALE IN TESTA (kN/m): 0.00  
 FORZA ORIZZONTALE ADDIZIONALE ALLA BASE (kN/m): 0.00

N.B. Le forze orizzontali addizionali in testa e alla base sono poste uguali a 0 durante le tutte le verifiche globali.  
 I valori >0 impostati dall'utente sono utilizzati solo in caso di verifica singola

----- RISULTATO FINALE ELABORAZIONI -----

\* DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR Fs \*

Fattore di sicurezza (FS)	1.3157	- Min. -	X	Y	Lambda=
1.2500			24.55	197.48	
			24.81	197.62	
			24.94	197.69	
			25.04	197.75	
			25.12	197.80	
			25.19	197.84	
			25.27	197.89	
			25.34	197.93	
			25.42	197.98	
			25.50	198.04	
			25.57	198.09	
			25.65	198.14	

25.72	198.19
25.80	198.24
25.87	198.30
25.94	198.35
26.02	198.41
26.07	198.45
26.07	199.43

Fattore di sicurezza (FS) 1.3294 - N.2 -- X Y Lambda=  
1.2500

24.59	197.57
24.82	197.66
24.93	197.71
25.01	197.75
25.08	197.79
25.14	197.82
25.20	197.85
25.26	197.89
25.33	197.93
25.40	197.97
25.46	198.02
25.53	198.06
25.59	198.10
25.65	198.15
25.71	198.20
25.77	198.25
25.84	198.31
25.91	198.37
25.97	198.43
26.01	198.47
26.01	199.43

Fattore di sicurezza (FS) 1.3620 - N.3 -- X Y Lambda=  
1.2500

24.55	197.48
24.83	197.62
24.98	197.69
25.08	197.74
25.17	197.79
25.25	197.83
25.33	197.88
25.42	197.92
25.50	197.97
25.59	198.02
25.67	198.06
25.75	198.11
25.83	198.16
25.91	198.21
25.99	198.26
26.07	198.32
26.15	198.37
26.24	198.43

26.29 198.47  
26.29 199.45

Fattore di sicurezza (FS) 1.3733 - N.4 -- X Y Lambda=  
1.2500

24.61 197.59  
24.81 197.70  
24.91 197.76  
24.99 197.80  
25.06 197.84  
25.12 197.87  
25.18 197.90  
25.24 197.94  
25.30 197.97  
25.37 198.01  
25.43 198.04  
25.48 198.08  
25.54 198.12  
25.60 198.16  
25.65 198.20  
25.71 198.25  
25.77 198.30  
25.84 198.36  
25.90 198.41  
25.94 198.45  
25.94 199.42

Fattore di sicurezza (FS) 1.3761 - N.5 -- X Y Lambda=  
1.2500

24.57 197.51  
24.81 197.68  
24.93 197.76  
25.02 197.82  
25.10 197.88  
25.18 197.93  
25.25 197.98  
25.32 198.03  
25.39 198.08  
25.46 198.13  
25.53 198.18  
25.60 198.22  
25.68 198.27  
25.75 198.32  
25.82 198.37  
25.89 198.42  
25.89 199.42

Fattore di sicurezza (FS) 1.3773 - N.6 -- X Y Lambda=  
1.2500

24.58 197.53  
24.83 197.67



24.97	197.74
25.06	197.80
25.15	197.85
25.22	197.89
25.30	197.93
25.38	197.97
25.46	198.02
25.54	198.06
25.61	198.11
25.69	198.15
25.76	198.20
25.83	198.25
25.91	198.30
25.98	198.35
26.06	198.41
26.11	198.45
26.11	199.43

Fattore di sicurezza (FS)    1.3996   - N.7 --    X            Y            Lambda=  
1.2500

24.61	197.60
24.85	197.75
24.97	197.82
25.05	197.88
25.13	197.93
25.20	197.97
25.27	198.02
25.33	198.07
25.40	198.11
25.47	198.16
25.54	198.21
25.61	198.26
25.68	198.31
25.75	198.36
25.82	198.41
25.86	198.44
25.86	199.41

Fattore di sicurezza (FS)    1.4072   - N.8 --    X            Y            Lambda=  
0.8237

24.56	197.49
24.89	197.57
25.05	197.61
25.16	197.65
25.25	197.68
25.34	197.72
25.42	197.76
25.51	197.80
25.60	197.85
25.70	197.91
25.80	197.97
25.90	198.03

25.99	198.09
26.08	198.14
26.17	198.20
26.26	198.26
26.36	198.32
26.45	198.38
26.54	198.44
26.64	198.50
26.70	198.54
26.70	199.50

Fattore di sicurezza (FS) 1.4107 - N.9 -- X Y Lambda=  
1.2500

24.55	197.47
24.85	197.62
25.01	197.70
25.12	197.75
25.22	197.80
25.31	197.84
25.40	197.89
25.49	197.93
25.58	197.98
25.68	198.02
25.76	198.07
25.85	198.11
25.94	198.16
26.02	198.21
26.11	198.26
26.20	198.32
26.29	198.38
26.38	198.44
26.44	198.48
26.44	199.47

Fattore di sicurezza (FS) 1.4190 - N.10 -- X Y Lambda=  
1.2500

24.65	197.69
24.85	197.79
24.94	197.84
25.01	197.88
25.07	197.92
25.13	197.95
25.18	197.99
25.24	198.02
25.29	198.06
25.35	198.11
25.41	198.15
25.47	198.19
25.52	198.24
25.58	198.28
25.63	198.33
25.69	198.37

25.74 198.42  
25.74 199.40

----- ANALISI DEFICIT DI RESISTENZA -----

# DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR Fs \*

# Analisi Deficit in riferimento a FS(progetto) = 1.200

Sup N.	FS	FTR(kN/m)	FTA(kN/m)	Bilancio(kN/m)	ESITO
1	1.316	19.1	14.6	1.7	Surplus
2	1.329	18.2	13.7	1.8	Surplus
3	1.362	22.6	16.6	2.7	Surplus
4	1.373	16.6	12.1	2.1	Surplus
5	1.376	15.9	11.6	2.0	Surplus
6	1.377	19.3	14.0	2.5	Surplus
7	1.400	15.0	10.7	2.1	Surplus
8	1.407	30.1	21.4	4.4	Surplus
9	1.411	24.8	17.6	3.7	Surplus
10	1.419	13.1	9.2	2.0	Surplus

Esito analisi: SURPLUS di RESISTENZA!

Valore minimo di SURPLUS di RESISTENZA (kN/m): 1.7

Note: FTR --> Forza totale Resistente lungo la superficie di scivolamento

FTA --> Forza totale Agente lungo la superficie di scivolamento

IMPORTANTE! : Il Deficit o il Surplus di resistenza viene espresso in kN per metro di LARGHEZZA rispetto al fronte della scarpata

----- TABELLA PARAMETRI CONCI DELLA SUPERFICIE INDIVIDUATA CON MINOR FS -----

phi'	X	dx	alpha	W	ru	U
(°)	(m)	(m)	(°)	(kN/m)	(-)	(kPa)
21.00	24.553	0.050	29.10	0.04	0.00	0.00
	6.32					
21.00	24.602	0.050	29.10	0.11	0.00	0.00
	6.32					
21.00	24.652	0.050	29.10	0.18	0.00	0.00
	6.32					
21.00	24.702	0.050	29.10	0.25	0.00	0.00
	6.32					
21.00	24.751	0.050	29.10	0.32	0.00	0.00
	6.32					
21.00	24.801	0.010	29.10	0.07	0.00	0.00
	6.32					
21.00	24.811	0.050	29.40	0.40	0.00	0.00

21.00	6.32					
	24.860	0.050	29.40	0.47	0.00	0.00
21.00	6.32					
	24.910	0.015	29.40	0.16	0.00	0.00
21.00	6.32					
	24.925	0.017	29.40	0.19	0.00	0.00
21.00	6.32					
	24.942	0.050	29.94	0.59	0.00	0.00
21.00	6.32					
	24.992	0.044	29.94	0.58	0.00	0.00
21.00	6.32					
	25.036	0.050	30.51	0.72	0.00	0.00
21.00	6.32					
	25.085	0.033	30.51	0.52	0.00	0.00
21.00	6.32					
	25.119	0.050	31.21	0.84	0.00	0.00
21.00	6.32					
	25.168	0.025	31.21	0.45	0.00	0.00
21.00	6.32					
	25.193	0.050	31.74	0.94	0.00	0.00
21.00	6.32					
	25.243	0.025	31.74	0.49	0.00	0.00
21.00	6.32					
	25.268	0.032	32.26	0.67	0.00	0.00
21.00	6.32					
	25.300	0.043	32.26	0.91	0.00	0.00
21.00	6.32					
	25.343	0.007	32.76	0.16	0.00	0.00
21.00	6.32					
	25.350	0.050	32.76	1.08	0.00	0.00
21.00	6.32					
	25.400	0.000	32.76	0.01	0.00	0.00
21.00	6.32					
	25.400	0.019	32.76	0.42	0.00	0.00
21.00	6.32					
	25.419	0.006	33.23	0.14	0.00	0.00
21.00	6.32					
	25.425	0.025	33.23	0.60	0.00	0.00
21.00	6.32					
	25.450	0.048	33.23	1.16	0.00	0.00
21.00	6.32					
	25.498	0.050	33.83	1.19	0.00	0.00
21.00	6.32					
	25.547	0.026	33.83	0.62	0.00	0.00
21.00	6.32					
	25.574	0.050	34.45	1.15	0.00	0.00
21.00	6.32					
	25.623	0.025	34.45	0.57	0.00	0.00
21.00	6.32					
	25.648	0.050	35.08	1.11	0.00	0.00
21.00	6.32					
	25.698	0.024	35.08	0.53	0.00	0.00
21.00	6.32					
	25.722	0.050	35.71	1.07	0.00	0.00

21.00	6.32					
	25.772	0.025	35.71	0.53	0.00	0.00
21.00	6.32					
	25.797	0.050	36.31	1.02	0.00	0.00
21.00	6.32					
	25.846	0.024	36.31	0.48	0.00	0.00
21.00	6.32					
	25.870	0.015	36.91	0.29	0.00	0.00
21.00	6.32					
	25.885	0.050	36.91	0.97	0.00	0.00
21.00	6.32					
	25.935	0.010	36.91	0.19	0.00	0.00
21.00	6.32					
	25.944	0.050	37.49	0.93	0.00	0.00
21.00	6.32					
	25.994	0.025	37.49	0.47	0.00	0.00
21.00	6.32					
	26.019	0.050	38.04	0.89	0.00	0.00
21.00	6.32					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 alpha(°) : Angolo pendenza base concio  
 W(kN/m) : Forza peso concio  
 ru(-) : Coefficiente locale pressione interstiziale  
 U(kPa) : Pressione totale dei pori base concio  
 phi'(°) : Angolo di attrito efficace base concio  
 c'/Cu (kPa) : Coesione efficace o Resistenza al taglio in condizioni non drenate

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TABELLA DIAGRAMMA DELLE FORZE DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

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T(x)	X (m)	ht E' (m) (kN)	yt rho(x) (m) (--)	yt' FS_FEM (--) (--)	E(x) FS_p-qFEM (kN/m) (--)
	24.553	0.000	197.476	0.967	0.0000000000E+000
0.0000000000E+000		5.5258679459E+000		0.488	46.148 3.067
	24.602	0.020	197.523	0.967	2.4620066477E-001
2.2157763367E-001		4.3983270589E+000		0.488	46.148 3.067
	24.652	0.041	197.572	1.022	4.3645698024E-001
4.0772471140E-001		3.7291857029E+000		0.457	9.292 2.242
	24.702	0.066	197.625	1.112	6.1625707686E-001
6.0521346302E-001		3.5798146287E+000		0.456	4.244 2.178
	24.751	0.096	197.682	1.047	7.9169092754E-001
7.9192889828E-001		3.0464755388E+000		0.450	2.745 2.200

24.801	0.115	197.729	0.957	9.1856645409E-001	
9.1841555495E-001	2.5610657855E+000		0.422	2.218	2.166
24.811	0.120	197.739	1.228	9.4383526182E-001	
9.4356521640E-001	2.5901675652E+000		0.417	2.133	2.142
24.860	0.154	197.802	1.194	1.0794180403E+000	
1.0778320553E+000	2.4523882977E+000		0.402	1.760	1.913
24.910	0.182	197.858	1.106	1.1871918782E+000	
1.1822598534E+000	1.9243693940E+000		0.382	1.553	1.723
24.925	0.190	197.873	0.926	1.2151010271E+000	
1.2085209318E+000	1.5657736346E+000		0.376	1.516	1.683
24.942	0.194	197.888	0.994	1.2367484802E+000	
1.2277269550E+000	1.2777131023E+000		0.366	1.483	1.641
24.992	0.218	197.940	1.308	1.3057934889E+000	
1.2912818897E+000	1.5211633365E+000		0.344	1.386	1.513
25.036	0.262	198.010	1.468	1.3769332795E+000	
1.3635599371E+000	1.2876302148E+000		0.332	1.292	1.383
25.085	0.300	198.077	1.337	1.4211797601E+000	
1.4118086171E+000	6.7881930969E-001		0.314	1.239	1.306
25.119	0.324	198.121	1.333	1.4390656969E+000	
1.4306663712E+000	3.8227392839E-001		0.301	1.213	1.268
25.168	0.361	198.187	1.358	1.4467439348E+000	
1.4370436956E+000	-4.5078599478E-002		0.280	1.184	1.224
25.193	0.381	198.222	1.380	1.4430657866E+000	
1.4325074468E+000	-2.5325606608E-001		0.270	1.170	1.205
25.243	0.418	198.291	1.330	1.4200277868E+000	
1.4074571919E+000	-6.4758603792E-001		0.248	1.149	1.172
25.268	0.433	198.321	1.258	1.4019013038E+000	
1.3875101315E+000	-8.6176104640E-001		0.237	1.140	1.158
25.300	0.454	198.362	1.264	1.3686601720E+000	
1.3523106983E+000	-1.2105281181E+000		0.223	1.129	1.142
25.343	0.481	198.416	1.189	1.3067788745E+000	
1.2928885932E+000	-1.4528771827E+000		0.210	1.115	1.123
25.350	0.482	198.422	0.826	1.2959656778E+000	
1.2833367082E+000	-1.4261075740E+000		0.208	1.113	1.120
25.400	0.491	198.463	0.826	1.2339897726E+000	
1.2321916084E+000	-1.1011427767E+000		0.197	1.104	1.108
25.400	0.491	198.463	1.139	1.2335676470E+000	
1.2318651566E+000	-1.1004644824E+000		0.197	1.104	1.107
25.419	0.501	198.485	1.014	1.2124407155E+000	
1.2160019011E+000	-9.7903463361E-001		0.186	1.101	1.104
25.425	0.500	198.488	0.777	1.2066724464E+000	
1.2119090693E+000	-1.0319705763E+000		0.183	1.100	1.104
25.450	0.504	198.509	0.876	1.1707358465E+000	
1.1826121601E+000	-1.6954647087E+000		0.170	1.097	1.100
25.498	0.517	198.552	0.900	1.0664954355E+000	
1.0824098396E+000	-2.6141959486E+000		0.159	1.095	1.097
25.547	0.528	198.596	0.730	9.1473671205E-001	
9.1803744321E-001	-2.3164135227E+000		0.139	1.102	1.103
25.574	0.521	198.608	0.395	8.6414639181E-001	
8.6290139102E-001	-1.9805316363E+000		0.132	1.106	1.108
25.623	0.506	198.626	0.362	7.6048008227E-001	
7.5807516236E-001	-1.9344194071E+000		0.120	1.117	1.121
25.648	0.497	198.635	0.371	7.1391580144E-001	
7.1382331934E-001	-1.9639532522E+000		0.114	1.122	1.128

25.698	0.482	198.654	0.369	6.0588605162E-001	
6.0697208121E-001	-1.8563548180E+000		0.100	1.136	1.145
25.722	0.472	198.662	0.382	5.6480817726E-001	
5.6564733390E-001	-1.8202000304E+000		0.094	1.141	1.153
25.772	0.457	198.682	0.416	4.6225585909E-001	
4.5929753737E-001	-2.0041979693E+000		0.079	1.158	1.172
25.797	0.450	198.693	0.420	4.1295480188E-001	
4.0874939612E-001	-1.9442365354E+000		0.072	1.166	1.183
25.846	0.434	198.714	0.389	3.1928369606E-001	
3.1582699556E-001	-1.5620826696E+000		0.057	1.183	1.203
25.870	0.424	198.722	0.344	2.8561714186E-001	
2.8479219613E-001	-1.5034121609E+000		0.052	1.189	1.210
25.885	0.419	198.727	0.380	2.6256076302E-001	
2.6353194194E-001	-1.5486773325E+000		0.049	1.193	1.215
25.935	0.400	198.746	0.375	1.8830183184E-001	
1.9568741838E-001	-1.3043627637E+000		0.044	1.208	1.234
25.944	0.396	198.749	0.420	1.7580595352E-001	
1.8416187822E-001	-1.3152597007E+000		0.044	1.211	1.238
25.994	0.380	198.771	0.420	9.8288309154E-002	
1.0901773119E-001	-1.3615047918E+000		0.044	1.235	1.264
26.019	0.370	198.781	0.420	6.6380473479E-002	
7.6861676500E-002	-1.2856097505E+000		0.044	1.242	1.277

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LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 ht(m) : Altezza linea di thrust da nodo sinistro base concio  
 yt(m) : coordinata Y linea di trust  
 yt'(-) : gradiente pendenza locale linea di trust  
 E(x)(kN/m) : Forza Normale interconcio  
 T(x)(kN/m) : Forza Tangenziale interconcio  
 E' (kN) : derivata Forza normale interconcio  
 Rho(x) (-) : fattore mobilizzazione resistenza al taglio verticale interconcio  
 ZhU et al.(2003)  
 FS\_FEM(x) (-) : fattore di sicurezza locale stimato (locale in X) by qFEM  
 FS\_SRM(x) (-) : fattore di sicurezza locale stimato (locale in X) by SRM  
 Procedure

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TABELLA SFORZI DI TAGLIO DISTRIBUITI LUNGO SUPERFICIE INDIVIDUATA CON MINOR FS

X	dx	dI	alpha	TauStress	TauF
TauStrength	TauS				
(m)	(m)	(m)	(°)	(kPa)	(kN/m)
(kPa)	(kN/m)				
24.553	0.050	0.057	29.104	0.331	0.019
5.335	0.303				
24.602	0.050	0.057	29.104	0.993	0.056
5.931	0.337				

6.277	24.652 0.356	0.050	0.057	29.104	1.656	0.094
6.741	24.702 0.383	0.050	0.057	29.104	2.318	0.132
7.471	24.751 0.424	0.050	0.057	29.104	2.980	0.169
7.714	24.801 0.087	0.010	0.011	29.104	3.377	0.038
7.887	24.811 0.449	0.050	0.057	29.399	3.793	0.216
8.453	24.860 0.481	0.050	0.057	29.399	4.456	0.254
8.814	24.910 0.153	0.015	0.017	29.399	4.888	0.085
9.120	24.925 0.183	0.017	0.020	29.399	5.106	0.103
9.291	24.942 0.532	0.050	0.057	29.942	5.604	0.321
9.554	24.992 0.480	0.044	0.050	29.942	6.228	0.313
10.057	25.036 0.579	0.050	0.058	30.512	6.913	0.398
10.499	25.085 0.407	0.033	0.039	30.512	7.469	0.290
10.874	25.119 0.631	0.050	0.058	31.213	8.110	0.471
11.251	25.168 0.331	0.025	0.029	31.213	8.611	0.253
11.574	25.193 0.675	0.050	0.058	31.741	9.181	0.536
11.946	25.243 0.345	0.025	0.029	31.741	9.678	0.279
12.184	25.268 0.467	0.032	0.038	32.260	10.131	0.389
12.449	25.300 0.626	0.043	0.050	32.260	10.436	0.525
12.411	25.343 0.110	0.007	0.009	32.761	10.609	0.094
12.390	25.350 0.731	0.050	0.059	32.761	10.724	0.633
12.385	25.400 0.006	0.000	0.000	32.761	10.824	0.005
12.514	25.400 0.280	0.019	0.022	32.761	11.070	0.248
12.565	25.419 0.093	0.006	0.007	33.232	11.464	0.085
12.950	25.425 0.387	0.025	0.030	33.232	11.872	0.355
13.369	25.450 0.762	0.048	0.057	33.232	12.077	0.688
13.581	25.498 0.811	0.050	0.060	33.830	11.911	0.711
13.060	25.547 0.414	0.026	0.032	33.830	11.711	0.371



12.890	25.574	0.050	0.060	34.452	11.589	0.697
	0.776					
12.664	25.623	0.025	0.030	34.452	11.385	0.346
	0.385					
12.627	25.648	0.050	0.061	35.084	11.252	0.682
	0.766					
12.365	25.698	0.024	0.030	35.084	11.045	0.326
	0.365					
12.350	25.722	0.050	0.061	35.706	10.899	0.666
	0.755					
12.201	25.772	0.025	0.031	35.706	10.682	0.329
	0.376					
11.974	25.797	0.050	0.062	36.314	10.518	0.648
	0.737					
11.651	25.846	0.024	0.030	36.314	10.298	0.306
	0.347					
11.585	25.870	0.015	0.018	36.915	10.231	0.189
	0.214					
11.465	25.885	0.050	0.062	36.915	10.032	0.623
	0.711					
11.303	25.935	0.010	0.012	36.915	9.848	0.122
	0.140					
11.291	25.944	0.050	0.063	37.491	9.703	0.607
	0.706					
11.087	25.994	0.025	0.032	37.491	9.465	0.302
	0.354					
11.035	26.019	0.050	0.063	38.036	9.258	0.583
	0.695					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 dl(m) : lunghezza base concio  
 alpha(°) : Angolo pendenza base concio  
 TauStress(kPa) : Sforzo di taglio su base concio  
 TauF (kN/m) : Forza di taglio su base concio  
 TauStrength(kPa) : Resistenza al taglio su base concio  
 TauS (kN/m) : Forza resistente al taglio su base concio

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Strato 1 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso  
 stimati secondo criterio di rottura non lineare Hoek et al.(2002)  
 CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)  
 Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

SigmaN' (kPa)	TauSrength(kPa)	Phi' (deg)	c' (kPa)
25.00	137.42	58.47	69.19
50.00	186.72	55.52	76.58

75.00	229.23	53.43	82.28
100.00	269.97	51.71	89.32
125.00	307.76	50.29	95.71
150.00	344.72	49.03	103.03
175.00	380.39	47.92	110.48
200.00	414.33	46.95	117.39
225.00	446.12	46.09	123.16
250.00	479.13	45.26	131.05
275.00	509.50	44.53	137.06
300.00	540.87	43.82	144.79
325.00	569.14	43.21	149.99
350.00	598.21	42.61	156.59
375.00	628.07	42.02	164.54
400.00	654.32	41.52	169.27
425.00	685.72	40.95	179.76
450.00	708.67	40.55	181.95
475.00	736.79	40.07	189.88
500.00	760.71	39.67	193.83
600.00	866.21	38.06	223.16
700.00	957.87	36.80	242.59
800.00	1049.54	35.65	265.80
900.00	1140.54	34.60	291.52
1000.00	1223.57	33.71	311.63
1100.00	1303.83	32.91	331.24
1200.00	1387.74	32.12	356.93
1300.00	1460.58	31.47	372.79
1400.00	1536.19	30.83	393.39
1500.00	1614.69	30.20	418.74
2000.00	1960.39	27.76	515.66

Strato 2 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso

stimati secondo criterio di rottura non lineare Hoek et

al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

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SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	696.24	60.38	513.03
50.00	756.64	59.62	520.01
75.00	806.42	59.04	520.13
100.00	857.50	58.47	523.03
125.00	909.85	57.91	528.58
150.00	949.97	57.49	524.59
175.00	1004.57	56.95	534.68
200.00	1046.36	56.55	534.32
225.00	1103.20	56.03	548.62
250.00	1146.67	55.64	551.63
275.00	1190.86	55.26	556.09
300.00	1235.77	54.89	561.97
325.00	1281.40	54.52	569.22
350.00	1327.76	54.15	577.81

375.00	1359.06	53.91	572.83
400.00	1406.61	53.55	583.74
425.00	1454.89	53.20	595.90
450.00	1487.48	52.96	593.65
475.00	1536.97	52.61	607.98
500.00	1570.37	52.38	607.39
600.00	1724.68	51.37	628.85
700.00	1885.62	50.39	662.51
800.00	2034.30	49.55	689.13
900.00	2188.33	48.73	725.29
1000.00	2327.55	48.02	750.56
1100.00	2450.22	47.43	762.64
1200.00	2597.27	46.75	801.99
1300.00	2726.73	46.18	826.48
1400.00	2859.39	45.62	856.64
1500.00	2972.41	45.17	869.25
2000.00	3572.08	42.95	995.66

**Data :** 18/04/2019

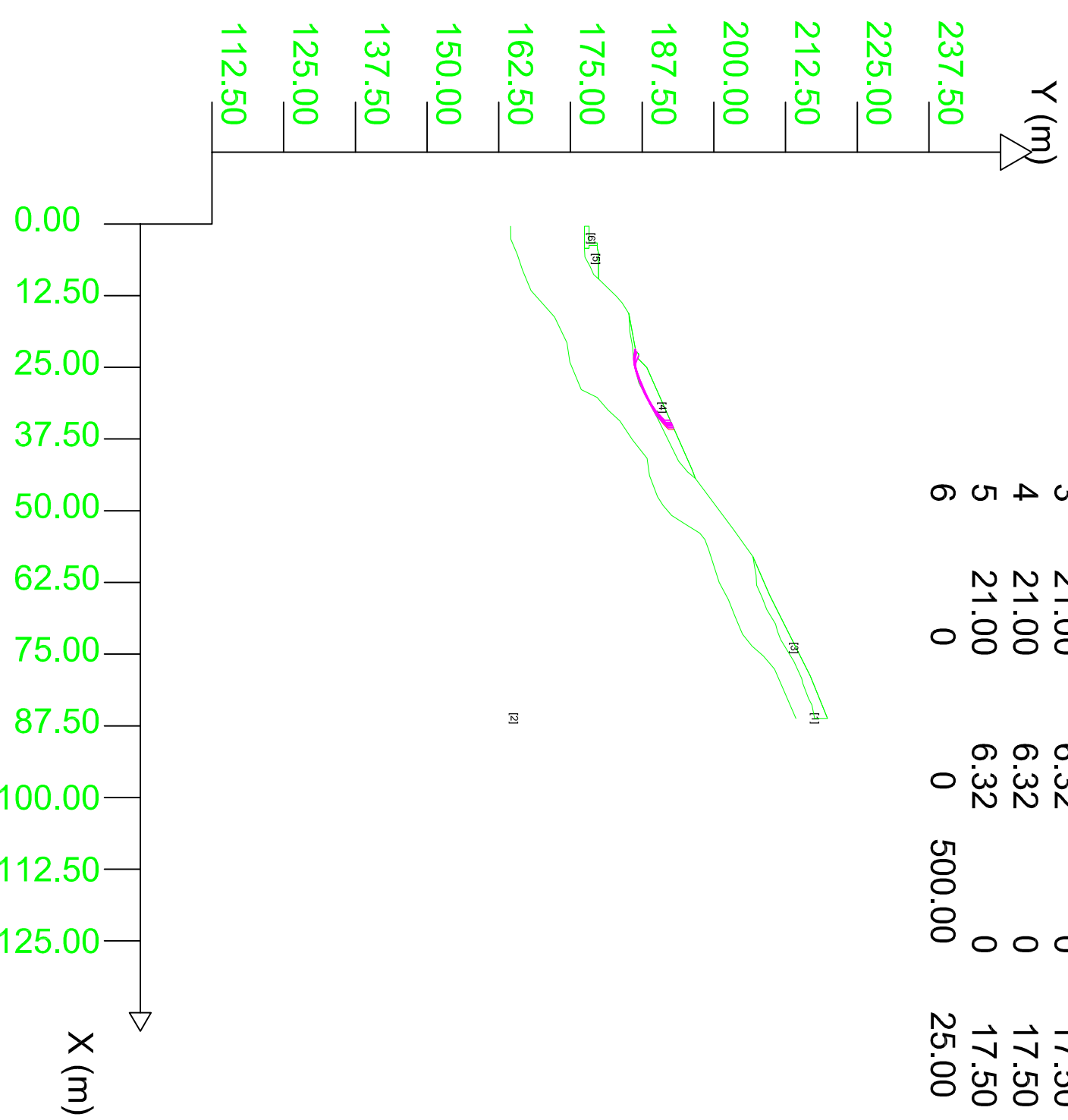
**Localita' :** Loc. Cepparello

**Descrizione :** Sez.7 - Stato attuale

**[n] = N. strato o lente**

# Parametri Geotecnici degli strati #

N.	phi` deg	C` kPa	Cu kPa	Gamm kN/m3	GammSat kN/m3	sgci MPa	GSI	mi	D
1	0	0	0	24.00	24.50	50.00	50.00	17.00	1.00
2	0	0	0	24.00	24.50	100.00	65.00	17.00	1.00
3	21.00	6.32	0	17.50	18.50	0	0	0	0
4	21.00	6.32	0	17.50	18.50	0	0	0	0
5	21.00	6.32	0	17.50	18.50	0	0	0	0
6	0	0	500.00	25.00	25.00	0	0	0	0



### DATI 10 SUP. CON MINOR Fs

Fs minimo : 1.2896      1.3170  
Range Fs : 1.2896  
Differenza % Range Fs : 2.08  
Coefficiente Sismico orizzontale - Kh: 0.0510

### GENERAZIONE SUPERFICI RANDOM

Campione Superfici - N.: 20000  
Lunghezza media segmenti (m): 1.0  
Range X inizio generazione : 2.1 - 79.4  
Range X termine generazione : 10.7 - 84.5  
Livello Y minimo considerato : 114.8

# Report elaborazioni #

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SSAP 4.9.9 - Slope Stability Analysis Program (1991,2018)

WWW.SSAP.EU

Build No. 10784

BY

Dr. Geol. LORENZO BORSELLI \*,\*\*

\*UASLP, San Luis Potosi, Mexico

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CV e WEB page personale: WWW.LORENZO-BORSELLI.EU

\*\* Gia' Ricercatore CNR-IRPI fino a Luglio 2011

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Ultima Revisione struttura tabelle del report: 29 dicembre 2018  
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File report: C:\SSAP2010\Verifiche\Risultati\Sez7\_Stato\_Attuale.txt

Data: 18/4/2019

Localita' :

Descrizione:

Modello pendio: Sez7-stato\_attuale\_V1.mod

----- PARAMETRI DEL MODELLO DEL PENDIO -----

\_\_\_ PARAMETRI GEOMETRICI - Coordinate X Y (in m) \_\_\_

SUP T.		SUP 2		SUP 3		SUP 4	
X	Y	X	Y	X	Y	X	Y
0.41	178.23	0.41	164.55	86.21	217.57	44.37	196.80
3.34	178.23	2.70	164.60	83.89	217.11	43.23	195.41
3.34	179.67	5.27	165.73	82.74	216.49	41.36	193.87
3.74	179.67	8.07	166.64	80.07	215.51	33.97	190.23
4.25	179.67	11.63	168.12	79.27	215.33	27.71	186.92
4.93	179.85	16.25	172.21	76.30	213.97	24.37	186.08
9.60	179.89	20.71	174.40	72.43	211.62	21.33	185.83
12.69	183.06	24.10	174.89	71.03	211.09	18.78	185.35
13.52	183.79	28.89	176.88	69.75	210.76	15.62	185.17
13.71	183.96	30.24	179.64	67.23	209.24	15.62	185.17
14.28	184.32	32.44	181.54	65.26	208.47	15.62	185.17
15.62	185.17	34.34	183.60	62.97	207.46	15.62	185.17
21.59	186.27	37.66	185.80	61.22	207.35	21.59	186.27
22.14	186.33	40.89	188.34	60.51	207.23	22.14	186.33
22.66	186.93	43.89	188.79	59.85	207.11	22.66	186.93
23.46	186.80	47.54	190.16	58.00	206.80	23.46	186.80
25.04	188.33	49.09	191.16	64.73	209.75	25.04	188.33
42.91	196.22	50.82	192.62	78.82	216.80	42.91	196.22
44.37	196.80	52.37	195.08	86.21	219.81	44.37	196.80
53.11	203.29	53.92	197.54	86.21	217.57	-	-
58.00	206.80	55.01	198.45	-	-	-	-
64.73	209.75	56.84	199.09	-	-	-	-
78.82	216.80	62.49	200.91	-	-	-	-
86.21	219.81	65.49	202.55	-	-	-	-

-	-	68.32	203.64	-	-	-	-
-	-	71.51	205.01	-	-	-	-
-	-	73.61	206.65	-	-	-	-
-	-	75.34	208.65	-	-	-	-
-	-	77.62	210.57	-	-	-	-
-	-	86.21	214.31	-	-	-	-

SUP 5		SUP 6		SUP 7		SUP 8	
X	Y	X	Y	X	Y	X	Y
4.24	177.43	3.74	179.67	-	-	-	-
5.77	177.50	3.34	179.67	-	-	-	-
7.47	178.46	3.34	178.23	-	-	-	-
8.84	179.05	0.41	178.23	-	-	-	-
9.60	179.89	0.41	177.43	-	-	-	-
9.60	179.89	4.24	177.43	-	-	-	-
4.93	179.85	4.24	178.23	-	-	-	-
4.25	179.67	3.74	178.23	-	-	-	-
3.74	179.67	3.74	179.67	-	-	-	-
3.74	178.23	-	-	-	-	-	-
4.24	178.23	-	-	-	-	-	-
4.24	177.43	-	-	-	-	-	-

## ASSENZA DI FALDA ##

----- PARAMETRI GEOMECCANICI -----

STR_IDX	sgci	fi`	C`	Cu	Gamm	Gamm_sat
		GSI	mi	D		
STRATO 1	1	0.00	0.00	0.00	24.00	24.50
8.587	50.00	50.00	17.00	1.00		
STRATO 2	2	0.00	0.00	0.00	24.00	24.50
12.882	100.00	65.00	17.00	1.00		
STRATO 3	3	21.00	6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00		
STRATO 4	4	21.00	6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00		
STRATO 5	5	21.00	6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00		
STRATO 6	6	0.00	0.00	500.00	25.00	25.00
1000.000	0.00	0.00	0.00	0.00		

LEGENDA: fi` \_\_\_\_\_ Angolo di attrito interno efficace(in gradi)  
 C` \_\_\_\_\_ Coesione efficace (in Kpa)  
 Cu \_\_\_\_\_ Resistenza al taglio Non drenata (in Kpa)  
 Gamm \_\_\_\_\_ Peso di volume terreno fuori falda (in KN/m^3)  
 Gamm\_sat \_\_\_\_\_ Peso di volume terreno immerso (in KN/m^3)  
 STR\_IDX \_\_\_\_\_ Indice di resistenza (usato in solo in 'SNIFF SEARCH')

(adimensionale)  
 ---- SOLO Per AMMASSI ROCCIOSI FRATTURATI - Parametri Criterio di Rottura di Hoek (2002)-  
 sigci \_\_\_\_\_ Resistenza Compressione Uniassiale Roccia Intatta (in MPa)

GSI \_\_\_\_\_ Geological Strenght Index ammasso(adimensionale)  
 mi \_\_\_\_\_ Indice litologico ammasso(adimensionale)  
 D \_\_\_\_\_ Fattore di disturbo ammasso(adimensionale)  
 Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 -

ATTIVATO (solo per ROCCE)

Uso CRITERIO DI ROTTURA Hoek et al.(2002,2006) - non-lineare - Generalizzato  
 secondo Lei et al.(2016)

----- INFORMAZIONI GENERAZIONE SUPERFICI RANDOM -----

\*\*\* PARAMETRI PER LA GENERAZIONE DELLE SUPERFICI

METODO DI RICERCA: CONVEX RANDOM - Chen (1992)

FILTRAGGIO SUPERFICI : ATTIVATO

COORDINATE X1,X2,Y OSTACOLO : 0.00 0.00 0.00

LUNGHEZZA MEDIA SEGMENTI (m): 1.0 (+/-) 50%

INTERVALLO ASCISSE RANDOM STARTING POINT (Xmin .. Xmax): 2.13

79.35

LIVELLO MINIMO CONSIDERATO (Ymin): 114.82

INTERVALLO ASCISSE AMMESSO PER LA TERMINAZIONE (Xmin .. Xmax): 10.71

84.49

\*\*\* TOTALE SUPERFICI GENERATE : 20000

----- INFORMAZIONI PARAMETRI DI CALCOLO -----

METODO DI CALCOLO : BORSELLI (Borselli, 2016)

COEFFICIENTE SISMICO UTILIZZATO Kh : 0.0510

COEFFICIENTE SISMICO UTILIZZATO Kv (assunto Positivo): 0.0255

COEFFICIENTE c=Kv/Kh UTILIZZATO : 0.5000

FORZA ORIZZONTALE ADDIZIONALE IN TESTA (kN/m): 0.00

FORZA ORIZZONTALE ADDIZIONALE ALLA BASE (kN/m): 0.00

N.B. Le forze orizzontali addizionali in testa e alla base sono poste uguali a 0

durante le tutte le verifiche globali.

I valori >0 impostati dall'utente sono utilizzati solo in caso di verifica singola

----- RISULTATO FINALE ELABORAZIONI -----

\* DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR Fs \*

Fattore di sicurezza (FS) 1.2896 - Min. - X Y Lambda=  
 0.3658

22.19	186.39
23.05	186.23
23.45	186.17
23.72	186.15
23.94	186.14
24.16	186.14
24.36	186.16
24.58	186.20
24.81	186.25
25.08	186.32
25.33	186.38

25.57	186.45
25.80	186.51
26.03	186.57
26.26	186.64
26.50	186.71
26.74	186.79
26.98	186.86
27.22	186.94
27.44	187.02
27.67	187.10
27.89	187.20
28.12	187.29
28.34	187.39
28.58	187.50
28.82	187.62
29.06	187.73
29.29	187.85
29.53	187.96
29.76	188.08
29.99	188.20
30.23	188.32
30.46	188.44
30.70	188.56
30.93	188.69
31.16	188.81
31.39	188.94
31.62	189.07
31.85	189.21
32.08	189.34
32.31	189.49
32.55	189.64
32.79	189.79
33.02	189.93
33.26	190.08
33.49	190.23
33.72	190.38
33.96	190.54
34.21	190.70
34.47	190.87
34.69	191.04
34.91	191.21
35.12	191.39
35.35	191.60
35.58	191.85
35.86	192.16
35.86	193.11

Fattore di sicurezza (FS)  
0.3564

1.3022 - N.2 --

X

Y

Lambda=

21.83	186.30
22.95	186.17
23.48	186.13
23.83	186.11



24.12	186.12
24.41	186.15
24.68	186.19
24.96	186.25
25.26	186.32
25.61	186.43
25.94	186.53
26.25	186.63
26.56	186.73
26.86	186.84
27.16	186.94
27.46	187.06
27.77	187.17
28.09	187.30
28.40	187.42
28.70	187.55
28.99	187.67
29.29	187.81
29.59	187.95
29.89	188.10
30.19	188.25
30.51	188.42
30.82	188.58
31.12	188.74
31.43	188.91
31.73	189.07
32.04	189.24
32.35	189.41
32.68	189.60
33.03	189.79
33.32	189.97
33.60	190.17
33.86	190.39
34.16	190.65
34.46	190.96
34.81	191.36
35.20	191.83
35.20	192.82

Fattore di sicurezza (FS)    1.3024    - N.3    --    X    Y    Lambda=  
0.3617

21.91	186.31
22.90	186.14
23.36	186.08
23.67	186.06
23.91	186.06
24.16	186.08
24.38	186.11
24.63	186.17
24.88	186.24
25.19	186.35
25.48	186.45
25.76	186.54

26.03	186.64
26.30	186.73
26.56	186.82
26.83	186.92
27.10	187.01
27.37	187.11
27.64	187.21
27.90	187.31
28.16	187.41
28.42	187.52
28.68	187.62
28.95	187.74
29.22	187.85
29.49	187.97
29.76	188.09
30.02	188.22
30.29	188.34
30.55	188.47
30.81	188.60
31.08	188.74
31.36	188.88
31.65	189.03
31.92	189.18
32.17	189.34
32.41	189.50
32.67	189.69
32.92	189.88
33.17	190.09
33.43	190.32
33.72	190.58
34.00	190.84
34.27	191.09
34.54	191.34
34.80	191.59
35.00	191.78
35.00	192.73

Fattore di sicurezza (FS)    1.3088    - N.4 --    X    Y    Lambda=  
0.3593

22.02	186.32
23.12	186.18
23.63	186.13
23.97	186.11
24.25	186.12
24.53	186.15
24.78	186.19
25.06	186.26
25.35	186.35
25.69	186.47
26.02	186.59
26.32	186.70
26.62	186.81
26.91	186.92

27.21	187.04
27.50	187.16
27.80	187.28
28.11	187.41
28.41	187.54
28.71	187.67
29.00	187.80
29.29	187.94
29.58	188.08
29.87	188.23
30.18	188.38
30.49	188.55
30.79	188.71
31.08	188.87
31.37	189.04
31.66	189.22
31.95	189.40
32.25	189.59
32.56	189.80
32.89	190.03
33.18	190.24
33.47	190.47
33.75	190.70
34.03	190.95
34.34	191.25
34.70	191.61
34.70	192.60

Fattore di sicurezza (FS)      1.3115   - N.5 --      X      Y      Lambda=  
0.3554

21.98	186.31
23.29	186.23
23.91	186.21
24.33	186.21
24.68	186.23
25.02	186.28
25.33	186.34
25.67	186.43
26.02	186.54
26.44	186.68
26.82	186.82
27.19	186.95
27.54	187.09
27.90	187.23
28.25	187.37
28.60	187.53
28.97	187.69
29.35	187.86
29.71	188.03
30.06	188.21
30.41	188.38
30.76	188.57
31.12	188.76

31.48	188.96
31.85	189.18
32.26	189.43
32.62	189.66
32.96	189.90
33.28	190.15
33.63	190.45
33.99	190.79
34.42	191.22
34.99	191.84
34.99	192.72

Fattore di sicurezza (FS)    1.3147   - N.6 --    X            Y            Lambda=  
0.3597

21.89	186.30
22.96	186.19
23.47	186.15
23.81	186.14
24.10	186.14
24.38	186.17
24.64	186.20
24.92	186.25
25.21	186.32
25.55	186.41
25.86	186.50
26.16	186.58
26.44	186.68
26.73	186.77
27.01	186.88
27.30	186.99
27.60	187.11
27.92	187.24
28.21	187.37
28.50	187.50
28.79	187.63
29.08	187.77
29.36	187.92
29.65	188.07
29.94	188.23
30.25	188.40
30.55	188.57
30.84	188.74
31.13	188.91
31.42	189.09
31.72	189.26
32.02	189.44
32.33	189.63
32.66	189.84
32.94	190.03
33.22	190.24
33.48	190.45
33.76	190.70
34.06	191.00

34.41 191.37  
34.60 191.58  
34.60 192.55

Fattore di sicurezza (FS) 1.3151 - N.7 -- X Y Lambda=  
0.3584

22.99 186.88  
23.74 186.57  
24.07 186.45  
24.29 186.38  
24.45 186.35  
24.63 186.34  
24.78 186.34  
24.95 186.37  
25.14 186.41  
25.39 186.48  
25.61 186.54  
25.81 186.61  
26.00 186.67  
26.20 186.73  
26.39 186.80  
26.58 186.87  
26.77 186.94  
26.97 187.02  
27.17 187.10  
27.36 187.18  
27.56 187.25  
27.75 187.33  
27.95 187.41  
28.14 187.49  
28.34 187.57  
28.53 187.64  
28.73 187.72  
28.92 187.80  
29.12 187.88  
29.31 187.96  
29.51 188.04  
29.70 188.12  
29.90 188.20  
30.10 188.28  
30.30 188.37  
30.49 188.45  
30.68 188.54  
30.87 188.63  
31.06 188.72  
31.25 188.82  
31.45 188.93  
31.66 189.05  
31.86 189.16  
32.05 189.27  
32.23 189.39  
32.42 189.52  
32.61 189.65

32.80	189.79
32.99	189.93
33.20	190.09
33.40	190.25
33.59	190.40
33.79	190.56
33.98	190.71
34.18	190.87
34.37	191.02
34.58	191.19
34.78	191.35
34.97	191.51
35.16	191.68
35.35	191.85
35.53	192.03
35.53	192.96

Fattore di sicurezza (FS)    1.3164   - N.8   --    X            Y            Lambda=  
0.3620

21.87	186.30
22.58	186.15
22.91	186.08
23.13	186.05
23.31	186.04
23.50	186.04
23.66	186.05
23.84	186.07
24.03	186.10
24.25	186.15
24.46	186.20
24.65	186.24
24.84	186.29
25.03	186.34
25.22	186.39
25.41	186.44
25.61	186.50
25.81	186.56
26.00	186.62
26.19	186.68
26.38	186.74
26.57	186.81
26.76	186.88
26.94	186.95
27.14	187.02
27.33	187.10
27.53	187.17
27.72	187.25
27.91	187.33
28.10	187.41
28.30	187.48
28.49	187.56
28.68	187.64
28.88	187.73

29.07	187.81
29.26	187.89
29.45	187.98
29.64	188.07
29.82	188.16
30.01	188.25
30.21	188.35
30.41	188.46
30.61	188.57
30.80	188.67
30.98	188.78
31.17	188.89
31.36	189.01
31.55	189.13
31.74	189.26
31.95	189.40
32.14	189.54
32.33	189.68
32.52	189.82
32.70	189.97
32.89	190.13
33.07	190.29
33.27	190.47
33.47	190.66
33.67	190.85
33.86	191.04
34.05	191.23
34.24	191.43
34.24	192.39

Fattore di sicurezza (FS)    1.3168    - N.9    --    X    Y    Lambda=  
0.3613

22.12	186.33
23.47	186.29
24.10	186.29
24.53	186.31
24.88	186.35
25.23	186.42
25.55	186.50
25.89	186.60
26.25	186.73
26.67	186.90
27.06	187.06
27.44	187.22
27.81	187.38
28.18	187.54
28.55	187.69
28.91	187.86
29.29	188.02
29.67	188.19
30.04	188.36
30.40	188.54
30.75	188.72

31.12	188.91
31.48	189.10
31.84	189.31
32.23	189.53
32.64	189.77
33.01	190.01
33.36	190.25
33.70	190.51
34.05	190.79
34.43	191.13
34.87	191.55
35.26	191.94
35.26	192.84

Fattore di sicurezza (FS)    1.3170   - N.10   --    X            Y            Lambda=  
0.3583

22.35	186.57
23.06	186.37
23.39	186.28
23.62	186.23
23.80	186.21
23.98	186.20
24.14	186.20
24.32	186.22
24.51	186.24
24.73	186.28
24.94	186.32
25.14	186.36
25.33	186.41
25.52	186.45
25.71	186.49
25.90	186.54
26.10	186.59
26.30	186.65
26.50	186.70
26.69	186.76
26.87	186.82
27.06	186.88
27.25	186.95
27.44	187.02
27.63	187.09
27.83	187.17
28.03	187.25
28.22	187.33
28.41	187.41
28.60	187.49
28.80	187.58
28.99	187.66
29.19	187.75
29.39	187.84
29.58	187.93
29.77	188.02
29.95	188.12



30.14	188.22
30.32	188.33
30.51	188.44
30.70	188.56
30.90	188.69
31.10	188.82
31.30	188.95
31.49	189.08
31.68	189.20
31.87	189.33
32.07	189.46
32.26	189.59
32.46	189.73
32.65	189.86
32.84	190.00
33.03	190.13
33.22	190.27
33.41	190.41
33.61	190.56
33.81	190.71
34.02	190.88
34.21	191.03
34.39	191.20
34.57	191.37
34.76	191.55
34.95	191.76
34.95	192.70

----- ANALISI DEFICIT DI RESISTENZA -----  
 # DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR FS \*  
 # Analisi Deficit in riferimento a FS(progetto) = 1.200

Sup N.	FS	FTR(kN/m)	FTA(kN/m)	Bilancio(kN/m)	ESITO
1	1.290	259.8	201.5	18.1	Surplus
2	1.302	255.8	196.4	20.1	Surplus
3	1.302	245.7	188.7	19.3	Surplus
4	1.309	236.3	180.6	19.6	Surplus
5	1.312	246.9	188.2	21.0	Surplus
6	1.315	237.9	180.9	20.8	Surplus
7	1.315	239.4	182.0	21.0	Surplus
8	1.316	229.1	174.0	20.3	Surplus
9	1.317	239.1	181.6	21.2	Surplus
10	1.317	240.6	182.7	21.4	Surplus

Esito analisi: SURPLUS di RESISTENZA!

Valore minimo di SURPLUS di RESISTENZA (kN/m): 18.1

Note: FTR --> Forza totale Resistente lungo la superficie di scivolamento  
 FTA --> Forza totale Agente lungo la superficie di scivolamento

IMPORTANTE! : Il Deficit o il Surplus di resistenza viene espresso in kN per metro di LARGHEZZA rispetto al fronte della scarpata

TABELLA PARAMETRI CONCI DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

phi'	X	dx	alpha	W	ru	U
(°)	(m) (c',Cu) (kPa)	(m)	(°)	(kN/m)	(-)	(kPa)
21.00	22.189 6.32	0.197	-10.05	0.46	0.00	0.00
21.00	22.385 6.32	0.197	-10.05	1.38	0.00	0.00
21.00	22.582 6.32	0.078	-10.05	0.81	0.00	0.00
21.00	22.660 6.32	0.197	-10.05	2.22	0.00	0.00
21.00	22.857 6.32	0.190	-10.05	2.15	0.00	0.00
21.00	23.046 6.32	0.197	-8.74	2.23	0.00	0.00
21.00	23.243 6.32	0.197	-8.74	2.22	0.00	0.00
21.00	23.439 6.32	0.009	-8.74	0.11	0.00	0.00
21.00	23.449 6.32	0.011	-5.85	0.13	0.00	0.00
21.00	23.460 6.32	0.197	-5.85	2.59	0.00	0.00
21.00	23.657 6.32	0.062	-5.85	0.96	0.00	0.00
21.00	23.718 6.32	0.197	-2.25	3.54	0.00	0.00
21.00	23.915 6.32	0.027	-2.25	0.54	0.00	0.00
21.00	23.941 6.32	0.159	2.19	3.42	0.00	0.00
21.00	24.100 6.32	0.063	2.19	1.47	0.00	0.00
21.00	24.163 6.32	0.087	5.62	2.15	0.00	0.00
21.00	24.250 6.32	0.113	5.62	2.95	0.00	0.00
21.00	24.363 6.32	0.007	9.07	0.20	0.00	0.00
21.00	24.370 6.32	0.197	9.07	5.63	0.00	0.00
21.00	24.567 6.32	0.011	9.07	0.34	0.00	0.00
21.00	24.578 6.32	0.197	11.99	6.20	0.00	0.00

	24.774	0.032	11.99	1.05	0.00	0.00
21.00	6.32					
	24.806	0.197	14.22	6.80	0.00	0.00
21.00	6.32					
	25.003	0.037	14.22	1.34	0.00	0.00
21.00	6.32					
	25.040	0.035	14.22	1.29	0.00	0.00
21.00	6.32					
	25.075	0.197	14.58	7.23	0.00	0.00
21.00	6.32					
	25.272	0.055	14.58	2.03	0.00	0.00
21.00	6.32					
	25.327	0.197	14.98	7.38	0.00	0.00
21.00	6.32					
	25.523	0.043	14.98	1.64	0.00	0.00
21.00	6.32					
	25.567	0.197	15.39	7.53	0.00	0.00
21.00	6.32					
	25.763	0.038	15.39	1.45	0.00	0.00
21.00	6.32					
	25.801	0.197	15.82	7.66	0.00	0.00
21.00	6.32					
	25.997	0.035	15.82	1.36	0.00	0.00
21.00	6.32					
	26.032	0.197	16.22	7.79	0.00	0.00
21.00	6.32					
	26.228	0.035	16.22	1.38	0.00	0.00
21.00	6.32					
	26.263	0.197	16.63	7.91	0.00	0.00
21.00	6.32					
	26.460	0.037	16.63	1.51	0.00	0.00
21.00	6.32					
	26.497	0.197	17.02	8.02	0.00	0.00
21.00	6.32					
	26.693	0.042	17.02	1.73	0.00	0.00
21.00	6.32					
	26.736	0.197	17.39	8.14	0.00	0.00
21.00	6.32					
	26.932	0.051	17.39	2.12	0.00	0.00
21.00	6.32					
	26.983	0.197	18.40	8.24	0.00	0.00
21.00	6.32					
	27.180	0.036	18.40	1.51	0.00	0.00
21.00	6.32					
	27.215	0.197	19.49	8.32	0.00	0.00
21.00	6.32					
	27.412	0.031	19.49	1.31	0.00	0.00
21.00	6.32					
	27.443	0.197	20.62	8.39	0.00	0.00
21.00	6.32					
	27.639	0.026	20.62	1.11	0.00	0.00
21.00	6.32					
	27.665	0.045	21.73	1.91	0.00	0.00
21.00	6.32					

	27.710	0.184	21.73	7.91	0.00	0.00
21.00	6.32					
	27.894	0.197	22.82	8.46	0.00	0.00
21.00	6.32					
	28.091	0.026	22.82	1.12	0.00	0.00
21.00	6.32					
	28.117	0.197	23.90	8.46	0.00	0.00
21.00	6.32					
	28.313	0.030	23.90	1.31	0.00	0.00
21.00	6.32					
	28.344	0.197	24.92	8.46	0.00	0.00
21.00	6.32					
	28.541	0.035	24.92	1.50	0.00	0.00
21.00	6.32					
	28.576	0.197	25.83	8.43	0.00	0.00
21.00	6.32					
	28.772	0.048	25.83	2.07	0.00	0.00
21.00	6.32					
	28.820	0.070	26.03	2.97	0.00	0.00
21.00	6.32					
	28.890	0.170	26.03	7.23	0.00	0.00
21.00	6.32					
	29.060	0.197	26.23	8.35	0.00	0.00
21.00	6.32					
	29.256	0.038	26.23	1.63	0.00	0.00
21.00	6.32					
	29.295	0.197	26.43	8.31	0.00	0.00
21.00	6.32					
	29.491	0.037	26.43	1.55	0.00	0.00
21.00	6.32					
	29.528	0.197	26.63	8.26	0.00	0.00
21.00	6.32					
	29.725	0.035	26.63	1.48	0.00	0.00
21.00	6.32					
	29.760	0.197	26.83	8.21	0.00	0.00
21.00	6.32					
	29.956	0.036	26.83	1.50	0.00	0.00
21.00	6.32					
	29.992	0.197	27.03	8.16	0.00	0.00
21.00	6.32					
	30.189	0.037	27.03	1.53	0.00	0.00
21.00	6.32					
	30.226	0.014	27.22	0.58	0.00	0.00
21.00	6.32					
	30.240	0.197	27.22	8.09	0.00	0.00
21.00	6.32					
	30.437	0.026	27.22	1.05	0.00	0.00
21.00	6.32					
	30.462	0.197	27.41	8.03	0.00	0.00
21.00	6.32					
	30.659	0.043	27.41	1.76	0.00	0.00
21.00	6.32					
	30.702	0.197	27.99	7.97	0.00	0.00
21.00	6.32					

	30.899	0.036	27.99	1.45	0.00	0.00
21.00	6.32					
	30.935	0.197	28.60	7.89	0.00	0.00
21.00	6.32					
	31.131	0.033	28.60	1.33	0.00	0.00
21.00	6.32					
	31.165	0.197	29.21	7.80	0.00	0.00
21.00	6.32					
	31.361	0.031	29.21	1.22	0.00	0.00
21.00	6.32					
	31.392	0.197	29.81	7.70	0.00	0.00
21.00	6.32					
	31.589	0.034	29.81	1.32	0.00	0.00
21.00	6.32					
	31.623	0.197	30.41	7.59	0.00	0.00
21.00	6.32					
	31.819	0.031	30.41	1.19	0.00	0.00
21.00	6.32					
	31.850	0.197	30.99	7.47	0.00	0.00
21.00	6.32					
	32.047	0.033	30.99	1.25	0.00	0.00
21.00	6.32					
	32.080	0.197	31.56	7.33	0.00	0.00
21.00	6.32					
	32.277	0.036	31.56	1.33	0.00	0.00
21.00	6.32					
	32.313	0.127	32.10	4.66	0.00	0.00
21.00	6.32					
	32.440	0.112	32.10	4.07	0.00	0.00
21.00	6.32					
	32.552	0.197	32.26	7.03	0.00	0.00
21.00	6.32					
	32.749	0.040	32.26	1.41	0.00	0.00
21.00	6.32					
	32.789	0.197	32.43	6.87	0.00	0.00
21.00	6.32					
	32.985	0.037	32.43	1.28	0.00	0.00
21.00	6.32					
	33.022	0.197	32.60	6.71	0.00	0.00
21.00	6.32					
	33.219	0.036	32.60	1.22	0.00	0.00
21.00	6.32					
	33.255	0.197	32.76	6.54	0.00	0.00
21.00	6.32					
	33.452	0.035	32.76	1.16	0.00	0.00
21.00	6.32					
	33.487	0.197	32.94	6.38	0.00	0.00
21.00	6.32					
	33.684	0.039	32.94	1.24	0.00	0.00
21.00	6.32					
	33.723	0.197	33.10	6.20	0.00	0.00
21.00	6.32					
	33.919	0.042	33.10	1.31	0.00	0.00
21.00	6.32					

21.00	33.961	0.009	33.27	0.27	0.00	0.00
	6.32					
21.00	33.970	0.005	33.27	0.15	0.00	0.00
	6.32					
21.00	33.975	0.197	33.27	6.01	0.00	0.00
	6.32					
21.00	34.172	0.037	33.27	1.10	0.00	0.00
	6.32					
21.00	34.208	0.132	33.42	3.93	0.00	0.00
	6.32					
21.00	34.340	0.127	33.42	3.72	0.00	0.00
	6.32					
21.00	34.467	0.197	35.68	5.62	0.00	0.00
	6.32					
21.00	34.663	0.030	35.68	0.84	0.00	0.00
	6.32					
21.00	34.694	0.197	38.22	5.37	0.00	0.00
	6.32					
21.00	34.890	0.022	38.22	0.59	0.00	0.00
	6.32					
21.00	34.912	0.197	40.85	5.08	0.00	0.00
	6.32					
21.00	35.109	0.012	40.85	0.30	0.00	0.00
	6.32					
21.00	35.121	0.197	43.23	4.74	0.00	0.00
	6.32					
21.00	35.318	0.028	43.23	0.65	0.00	0.00
	6.32					
21.00	35.346	0.197	46.10	4.31	0.00	0.00
	6.32					
21.00	35.542	0.041	46.10	0.84	0.00	0.00
	6.32					
21.00	35.583	0.197	48.20	3.78	0.00	0.00
	6.32					
21.00	35.780	0.081	48.20	1.42	0.00	0.00
	6.32					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 alpha(°) : Angolo pendenza base concio  
 W(kN/m) : Forza peso concio  
 ru(-) : Coefficiente locale pressione interstiziale  
 U(kPa) : Pressione totale dei pori base concio  
 phi'(°) : Angolo di attrito efficace base concio  
 c'/Cu (kPa) : Coesione efficace o Resistenza al taglio in condizioni non drenate

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TABELLA DIAGRAMMA DELLE FORZE DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

T(x)	X (m)	ht E' (m) (kN)	yt rho(x) (m) (--)	yt' FS_FEM (--) (--)	E(x) FS_p-qFEM (kN/m) (--)
0.000000000E+000	22.189	0.000	186.386	0.149	0.000000000E+000
1.4607178091E-001	22.385	0.066	186.417	0.096	37.004 27.305
2.0560890313E-001	22.582	0.128	186.445	0.149	8.0789249935E-001
1.9583243203E-001	22.660	0.140	186.443	0.096	37.004 27.305
4.4043288289E-001	22.857	0.155	186.423	0.095	2.7625606882E+000
1.2118341394E+000	23.046	0.169	186.403	0.061	36.475 3.527
2.0637421990E+000	23.243	0.195	186.399	-0.081	3.4179755741E+000
3.1204409836E+000	23.439	0.235	186.409	0.073	28.511 2.745
3.1761765240E+000	23.449	0.237	186.410	-0.104	5.8302630462E+000
3.2453365207E+000	23.460	0.240	186.411	0.091	9.807 1.748
6.3160442065E+000	23.657	0.297	186.448	-0.061	8.7303338159E+000
6.4814891873E+000	23.718	0.317	186.462	0.213	4.392 1.429
7.5391510043E+000	23.915	0.380	186.518	0.015	1.1175093861E+001
7.9155141889E+000	24.100	0.441	186.583	0.322	3.066 1.314
8.5343748600E+000	24.163	0.461	186.605	0.052	1.3506279535E+001
9.2446971740E+000	24.250	0.493	186.646	0.439	2.384 1.286
9.2786550784E+000	24.363	0.533	186.698	0.104	1.3614563607E+001
1.0334042554E+001	24.578	0.598	186.797	0.445	2.361 1.286
1.0391562726E+001	24.774	0.652	186.892	0.184	1.3732091968E+001
1.1390814859E+001	24.806	0.661	186.908	0.453	2.336 1.287
1.1550942169E+001	25.003	0.707	187.004	0.196	1.5913820272E+001
				0.518	1.994 1.344
				0.268	1.6574929888E+001
				0.533	1.918 1.365
				0.287	1.8648959057E+001
				0.576	1.765 1.460
				0.353	1.8901565572E+001
				0.581	1.752 1.473
				0.359	2.0510278249E+001
				0.610	1.689 1.556
				0.421	2.1075279819E+001
				0.617	1.675 1.585
				0.462	2.1975918140E+001
				0.634	1.653 1.626
				0.453	2.3003509205E+001
				0.649	1.635 1.665
				0.460	2.3052393334E+001
				0.649	1.635 1.666
				0.462	2.4515118631E+001
				0.667	1.614 1.690
				0.484	2.4591799882E+001
				0.667	1.613 1.690
				0.488	2.5866682138E+001
				0.683	1.585 1.674
				0.491	2.6066770234E+001
				0.685	1.580 1.669
				0.488	2.7172139786E+001

1.2454826390E+001	5.3327045438E+000	0.697	1.542	1.622
25.040	0.716 187.022	0.457	2.7368651324E+001	
1.2613103873E+001	4.9964641763E+000	0.698	1.534	1.612
25.075	0.722 187.038	0.446	2.7536371287E+001	
1.2747282234E+001	4.7355425281E+000	0.703	1.527	1.603
25.272	0.759 187.126	0.434	2.8474929737E+001	
1.3465118011E+001	4.1340524749E+000	0.724	1.487	1.546
25.327	0.766 187.147	0.409	2.8691286615E+001	
1.3619107678E+001	4.0300022781E+000	0.728	1.477	1.532
25.523	0.795 187.229	0.409	2.9535871601E+001	
1.4172514831E+001	3.9136222120E+000	0.741	1.441	1.480
25.567	0.800 187.245	0.397	2.9701717054E+001	
1.4274407739E+001	3.8659508786E+000	0.743	1.434	1.471
25.763	0.825 187.324	0.397	3.0494394771E+001	
1.4743313182E+001	3.7365963210E+000	0.752	1.404	1.428
25.801	0.828 187.338	0.386	3.0632417218E+001	
1.4823074733E+001	3.6769433678E+000	0.753	1.399	1.421
25.997	0.849 187.414	0.380	3.1351902334E+001	
1.5250441228E+001	3.0198855626E+000	0.761	1.373	1.388
26.032	0.850 187.425	0.364	3.1452502945E+001	
1.5310963579E+001	2.9427026372E+000	0.761	1.370	1.384
26.228	0.866 187.498	0.364	3.2070620671E+001	
1.5706278656E+001	2.6976893225E+000	0.768	1.348	1.359
26.263	0.867 187.509	0.371	3.2161042734E+001	
1.5768131161E+001	2.6547572545E+000	0.770	1.345	1.355
26.460	0.883 187.584	0.371	3.2722662534E+001	
1.6166614247E+001	2.4268938657E+000	0.777	1.325	1.333
26.497	0.884 187.596	0.382	3.2809932709E+001	
1.6231802576E+001	2.3737766376E+000	0.779	1.322	1.329
26.693	0.901 187.673	0.383	3.3305942528E+001	
1.6611901176E+001	2.0975663601E+000	0.786	1.301	1.309
26.736	0.903 187.688	0.410	3.3390527817E+001	
1.6678842748E+001	2.0235942501E+000	0.788	1.297	1.305
26.932	0.924 187.771	0.417	3.3804192998E+001	
1.7021673282E+001	1.7082395392E+000	0.794	1.275	1.286
26.983	0.928 187.791	0.386	3.3885795727E+001	
1.7093086628E+001	1.5602778964E+000	0.796	1.269	1.282
27.180	0.939 187.867	0.383	3.4157852889E+001	
1.7345566575E+001	1.0011259273E+000	0.801	1.248	1.267
27.215	0.940 187.880	0.387	3.4191261717E+001	
1.7379351258E+001	8.8691055960E-001	0.801	1.245	1.265
27.412	0.947 187.957	0.382	3.4317833775E+001	
1.7549504025E+001	3.2992795416E-001	0.804	1.224	1.252
27.443	0.946 187.967	0.388	3.4326504212E+001	
1.7567374273E+001	2.2661077697E-001	0.805	1.222	1.251
27.639	0.950 188.045	0.388	3.4303564438E+001	
1.7654986934E+001	-3.4374466858E-001	0.807	1.203	1.240
27.665	0.949 188.053	0.356	3.4293848558E+001	
1.7660546581E+001	-4.6295753712E-001	0.807	1.201	1.239
27.710	0.948 188.070	0.413	3.4266413138E+001	
1.7666412697E+001	-6.9855044820E-001	0.807	1.197	1.237
27.894	0.952 188.148	0.441	3.4074580985E+001	
1.7656247427E+001	-1.4181989633E+000	0.807	1.181	1.229
28.091	0.960 188.238	0.454	3.3716664319E+001	



1.7565370900E+001	-2.0114257249E+000	0.806	1.165	1.220
28.117	0.960 188.249	0.441	3.3663719081E+001	
1.7548060731E+001	-2.0719885939E+000	0.806	1.163	1.219
28.313	0.960 188.336	0.443	3.3203868634E+001	
1.7387061483E+001	-2.2142982535E+000	0.803	1.151	1.212
28.344	0.960 188.349	0.454	3.3136935747E+001	
1.7361125927E+001	-2.2850111057E+000	0.803	1.149	1.211
28.541	0.958 188.439	0.455	3.2573573663E+001	
1.7127899855E+001	-2.7136723319E+000	0.799	1.139	1.205
28.576	0.957 188.455	0.442	3.2479506358E+001	
1.7086440796E+001	-2.7399025016E+000	0.798	1.138	1.204
28.772	0.949 188.541	0.430	3.1882038140E+001	
1.6803918817E+001	-2.9774737854E+000	0.793	1.133	1.200
28.820	0.944 188.560	0.414	3.1739008397E+001	
1.6733625912E+001	-3.0743440746E+000	0.792	1.132	1.199
28.890	0.940 188.590	0.467	3.1513865046E+001	
1.6620322935E+001	-3.3837962131E+000	0.790	1.131	1.197
29.060	0.939 188.672	0.492	3.0878671204E+001	
1.6280503285E+001	-3.8431614022E+000	0.782	1.128	1.193
29.256	0.941 188.770	0.489	3.0100715725E+001	
1.5838922826E+001	-3.5413787834E+000	0.771	1.127	1.188
29.295	0.938 188.787	0.492	2.9967726277E+001	
1.5760486516E+001	-3.5888331173E+000	0.769	1.127	1.188
29.491	0.940 188.886	0.499	2.9132730737E+001	
1.5255826316E+001	-3.8925407662E+000	0.756	1.127	1.183
29.528	0.939 188.903	0.477	2.8992318238E+001	
1.5169229330E+001	-3.8845577036E+000	0.753	1.127	1.183
29.725	0.934 188.997	0.477	2.8167298650E+001	
1.4663530918E+001	-3.6331600046E+000	0.739	1.127	1.180
29.760	0.933 189.014	0.480	2.8042899369E+001	
1.4587601193E+001	-3.5484427896E+000	0.737	1.128	1.179
29.956	0.928 189.108	0.472	2.7327490000E+001	
1.4161825901E+001	-3.3573316520E+000	0.726	1.129	1.178
29.992	0.926 189.124	0.443	2.7208536139E+001	
1.4092363921E+001	-3.3749697305E+000	0.724	1.129	1.178
30.189	0.913 189.211	0.434	2.6470717575E+001	
1.3671864535E+001	-3.2616369598E+000	0.713	1.131	1.177
30.226	0.908 189.225	0.373	2.6353507753E+001	
1.3607192821E+001	-3.1641342707E+000	0.711	1.131	1.177
30.240	0.906 189.230	0.441	2.6308785854E+001	
1.3582652252E+001	-3.2068471299E+000	0.711	1.131	1.177
30.437	0.892 189.318	0.440	2.5556433475E+001	
1.3173923488E+001	-3.4581028773E+000	0.700	1.131	1.176
30.462	0.889 189.328	0.467	2.5469098609E+001	
1.3127194690E+001	-3.4975858598E+000	0.699	1.131	1.176
30.659	0.881 189.422	0.467	2.4649409828E+001	
1.2684801055E+001	-3.8348386713E+000	0.687	1.131	1.174
30.702	0.877 189.440	0.498	2.4486428561E+001	
1.2596660131E+001	-3.9140627237E+000	0.685	1.131	1.174
30.899	0.873 189.541	0.505	2.3580516461E+001	
1.2098558148E+001	-4.2179102823E+000	0.671	1.129	1.171
30.935	0.871 189.558	0.529	2.3431048715E+001	
1.2015505167E+001	-4.2788975374E+000	0.668	1.128	1.170
31.131	0.870 189.664	0.525	2.2447768782E+001	

1.1460917465E+001	-4.0983645969E+000	0.652	1.125	1.166
31.165	0.866 189.678	0.496	2.2316378243E+001	
1.1385642393E+001	-4.0754109766E+000	0.649	1.125	1.166
31.361	0.856 189.778	0.497	2.1364245403E+001	
1.0839533919E+001	-4.1909591814E+000	0.633	1.121	1.162
31.392	0.852 189.791	0.504	2.1237401859E+001	
1.0766435234E+001	-4.2203086658E+000	0.630	1.121	1.162
31.589	0.841 189.893	0.513	2.0242946448E+001	
1.0197123500E+001	-4.9005702996E+000	0.612	1.118	1.159
31.623	0.838 189.910	0.513	2.0077559956E+001	
1.0103286150E+001	-4.9146426219E+000	0.609	1.118	1.159
31.819	0.824 190.011	0.505	1.9064314259E+001	
9.5319929166E+000	-4.4005559635E+000	0.590	1.116	1.157
31.850	0.819 190.025	0.504	1.8931129050E+001	
9.4577860783E+000	-4.4071019183E+000	0.588	1.116	1.156
32.047	0.803 190.126	0.505	1.7908464992E+001	
8.8909734936E+000	-4.5357128691E+000	0.569	1.115	1.155
32.080	0.797 190.141	0.513	1.7761223502E+001	
8.8101289714E+000	-4.5494239495E+000	0.566	1.115	1.155
32.277	0.780 190.244	0.514	1.6719948404E+001	
8.2382497420E+000	-4.6381498689E+000	0.546	1.115	1.153
32.313	0.774 190.260	0.519	1.6557229827E+001	
8.1492666315E+000	-4.7067802311E+000	0.543	1.115	1.152
32.440	0.763 190.329	0.529	1.5874163045E+001	
7.7723714727E+000	-5.2367764291E+000	0.529	1.116	1.150
32.552	0.751 190.387	0.548	1.5299578004E+001	
7.4523360747E+000	-5.2518180919E+000	0.517	1.116	1.148
32.749	0.738 190.498	0.552	1.4220022602E+001	
6.8429388034E+000	-4.7879862864E+000	0.492	1.117	1.143
32.789	0.732 190.517	0.552	1.4035166686E+001	
6.7375417580E+000	-4.7578173758E+000	0.488	1.117	1.141
32.985	0.718 190.629	0.553	1.2990840532E+001	
6.1390055494E+000	-4.6193822734E+000	0.461	1.119	1.135
33.022	0.713 190.647	0.610	1.2823981148E+001	
6.0425509599E+000	-4.6808631833E+000	0.457	1.119	1.134
33.219	0.711 190.771	0.625	1.1703660817E+001	
5.4075675751E+000	-5.2416360786E+000	0.426	1.123	1.128
33.255	0.709 190.792	0.580	1.1516332339E+001	
5.3030938686E+000	-5.1381782279E+000	0.420	1.124	1.128
33.452	0.697 190.906	0.572	1.0526415196E+001	
4.7660721605E+000	-4.5823252258E+000	0.393	1.129	1.126
33.487	0.693 190.925	0.539	1.0367432303E+001	
4.6824889271E+000	-4.5101928663E+000	0.389	1.130	1.126
33.684	0.672 191.031	0.525	9.4706100072E+000	
4.2220472615E+000	-3.8317707867E+000	0.365	1.137	1.127
33.723	0.664 191.049	0.467	9.3276576931E+000	
4.1514786737E+000	-3.7138199529E+000	0.361	1.139	1.128
33.919	0.628 191.141	0.460	8.5716083385E+000	
3.7853413510E+000	-3.3419802583E+000	0.342	1.146	1.133
33.961	0.618 191.158	0.405	8.4355820530E+000	
3.7215497269E+000	-3.1947311480E+000	0.339	1.148	1.135
33.970	0.616 191.162	0.401	8.4077450704E+000	
3.7085246652E+000	-3.1783686373E+000	0.338	1.148	1.135
33.975	0.614 191.164	0.478	8.3918766260E+000	

3.7011102354E+000	-3.1876550687E+000	0.338	1.148	1.135
34.172	0.580	191.258	0.476	7.6573015657E+000
3.3563702982E+000	-3.5284076269E+000	0.319	1.156	1.146
34.208	0.572	191.275	0.547	7.5297659078E+000
3.2962938832E+000	-3.6779177911E+000	0.315	1.158	1.149
34.340	0.561	191.350	0.565	6.9551766481E+000
3.0226849388E+000	-4.2639876730E+000	0.298	1.164	1.161
34.467	0.548	191.421	0.632	6.4259955694E+000
2.7685444836E+000	-4.5281630953E+000	0.281	1.170	1.175
34.663	0.541	191.555	0.680	5.4280076250E+000
2.2924178174E+000	-5.0267384595E+000	0.247	1.183	1.204
34.694	0.539	191.575	0.727	5.2766475965E+000
2.2206487076E+000	-5.0657204407E+000	0.241	1.185	1.209
34.890	0.529	191.719	0.715	4.2210437543E+000
1.7294668289E+000	-4.0943175694E+000	0.202	1.203	1.248
34.912	0.523	191.732	0.629	4.1328684412E+000
1.6892807992E+000	-4.0137964627E+000	0.199	1.204	1.251
35.109	0.479	191.857	0.632	3.2324682079E+000
1.2850046014E+000	-3.8733962749E+000	0.165	1.222	1.290
35.121	0.475	191.863	0.651	3.1864646032E+000
1.2651460044E+000	-3.8757911707E+000	0.163	1.223	1.292
35.318	0.420	191.993	0.665	2.2778880841E+000
8.9144148318E-001	-4.7735800792E+000	0.127	1.253	1.340
35.346	0.413	192.013	0.767	2.1423522502E+000
8.3840503229E-001	-4.7941805031E+000	0.121	1.259	1.350
35.542	0.361	192.165	0.799	1.2015597937E+000
4.6152057106E-001	-5.0171197532E+000	0.076	1.320	1.424
35.583	0.356	192.202	0.888	9.9631385611E-001
3.7581088028E-001	-4.8643064733E+000	0.064	1.331	1.437
35.780	0.310	192.376	0.888	2.3128637130E-001
7.3950090146E-002	-3.1647489346E+000	0.043	1.441	1.553

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#### LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 ht(m) : Altezza linea di thrust da nodo sinistro base concio  
 yt(m) : coordinata Y linea di trust  
 yt'(-) : gradiente pendenza locale linea di trust  
 E(x)(kN/m) : Forza Normale interconcio  
 T(x)(kN/m) : Forza Tangenziale interconcio  
 E' (kN) : derivata Forza normale interconcio  
 Rho(x) (-) : fattore mobilizzazione resistenza al taglio verticale interconcio  
 ZhU et al.(2003)  
 FS\_FEM(x) (-) : fattore di sicurezza locale stimato (locale in X) by qFEM  
 FS\_SRM(x) (-) : fattore di sicurezza locale stimato (locale in X) by SRM  
 Procedure

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 TABELLA SFORZI DI TAGLIO DISTRIBUITI LUNGO SUPERFICIE INDIVIDUATA CON MINOR FS  
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	X	dx	dI	alpha	TauStress	TauF
TauStrength	TauS					
(kPa)	(m)	(m)	(m)	(°)	(kPa)	(kN/m)
7.643	22.189	0.197	0.200	-10.045	-0.287	-0.057
9.145	22.385	0.197	0.200	-10.045	-0.861	-0.172
10.122	22.582	0.078	0.079	-10.045	-1.263	-0.100
11.295	22.660	0.197	0.200	-10.045	-1.380	-0.275
12.991	22.857	0.190	0.193	-10.045	-1.386	-0.267
13.070	23.046	0.197	0.199	-8.736	-1.137	-0.226
13.651	23.243	0.197	0.199	-8.736	-1.134	-0.226
13.975	23.439	0.009	0.009	-8.736	-1.133	-0.011
13.741	23.449	0.011	0.011	-5.846	-0.574	-0.007
14.826	23.460	0.197	0.198	-5.846	-0.670	-0.132
15.683	23.657	0.062	0.062	-5.846	-0.796	-0.049
16.160	23.718	0.197	0.197	-2.253	0.210	0.041
16.703	23.915	0.027	0.027	-2.253	0.233	0.006
16.814	23.941	0.159	0.159	2.185	1.923	0.305
17.298	24.100	0.063	0.063	2.185	2.088	0.131
17.449	24.163	0.087	0.088	5.618	3.647	0.320
17.841	24.250	0.113	0.113	5.618	3.878	0.439
17.208	24.363	0.007	0.007	9.074	5.578	0.041
17.880	24.370	0.197	0.199	9.074	5.882	1.171
18.399	24.567	0.011	0.011	9.074	6.192	0.070
18.318	24.578	0.197	0.201	11.986	7.949	1.597
18.876	24.774	0.032	0.033	11.986	8.339	0.271
18.876	24.806	0.197	0.203	14.223	9.892	2.006
19.392	25.003	0.037	0.038	14.223	10.321	0.396
	25.040	0.035	0.037	14.223	10.406	0.381

19.473	0.713					
	25.075	0.197	0.203	14.584	10.712	2.176
19.524	3.966					
	25.272	0.055	0.057	14.584	10.831	0.612
19.631	1.109					
	25.327	0.197	0.203	14.981	11.167	2.272
19.692	4.007					
	25.523	0.043	0.045	14.981	11.278	0.506
19.808	0.888					
	25.567	0.197	0.204	15.392	11.615	2.368
19.856	4.049					
	25.763	0.038	0.039	15.392	11.721	0.456
19.972	0.777					
	25.801	0.197	0.204	15.817	12.062	2.464
20.008	4.088					
	25.997	0.035	0.036	15.817	12.163	0.437
20.116	0.723					
	26.032	0.197	0.205	16.224	12.492	2.558
20.150	4.125					
	26.228	0.035	0.036	16.224	12.591	0.453
20.257	0.728					
	26.263	0.197	0.205	16.626	12.914	2.649
20.281	4.161					
	26.460	0.037	0.039	16.626	13.010	0.505
20.386	0.792					
	26.497	0.197	0.206	17.016	13.326	2.740
20.404	4.195					
	26.693	0.042	0.044	17.016	13.420	0.592
20.508	0.904					
	26.736	0.197	0.206	17.385	13.724	2.827
20.526	4.228					
	26.932	0.051	0.053	17.385	13.818	0.736
20.630	1.099					
	26.983	0.197	0.207	18.397	14.480	3.000
20.512	4.249					
	27.180	0.036	0.038	18.397	14.558	0.550
20.603	0.779					
	27.215	0.197	0.209	19.490	15.235	3.177
20.447	4.264					
	27.412	0.031	0.033	19.490	15.300	0.502
20.525	0.673					
	27.443	0.197	0.210	20.623	15.968	3.354
20.348	4.274					
	27.639	0.026	0.028	20.623	16.016	0.445
20.412	0.567					
	27.665	0.045	0.048	21.734	16.613	0.797
20.200	0.969					
	27.710	0.184	0.198	21.734	16.647	3.303
20.250	4.018					
	27.894	0.197	0.213	22.824	17.243	3.678
20.109	4.289					
	28.091	0.026	0.028	22.824	17.260	0.487
20.149	0.568					
	28.117	0.197	0.215	23.905	17.787	3.825

19.951	4.290					
	28.313	0.030	0.033	23.905	17.785	0.593
19.955	0.666					
	28.344	0.197	0.217	24.916	18.239	3.953
19.789	4.289					
	28.541	0.035	0.039	24.916	18.219	0.703
19.774	0.763					
	28.576	0.197	0.218	25.834	18.592	4.061
19.606	4.282					
	28.772	0.048	0.054	25.834	18.551	0.995
19.581	1.050					
	28.820	0.070	0.077	26.027	18.613	1.441
19.562	1.515					
	28.890	0.170	0.189	26.027	18.569	3.505
19.606	3.701					
	29.060	0.197	0.219	26.225	18.583	4.072
19.567	4.288					
	29.256	0.038	0.043	26.225	18.536	0.794
19.493	0.835					
	29.295	0.197	0.220	26.426	18.569	4.076
19.528	4.287					
	29.491	0.037	0.041	26.426	18.518	0.759
19.450	0.797					
	29.528	0.197	0.220	26.628	18.547	4.079
19.419	4.270					
	29.725	0.035	0.039	26.628	18.492	0.729
19.295	0.760					
	29.760	0.197	0.220	26.829	18.515	4.079
19.219	4.234					
	29.956	0.036	0.040	26.829	18.455	0.744
19.128	0.771					
	29.992	0.197	0.221	27.027	18.471	4.076
19.093	4.213					
	30.189	0.037	0.042	27.027	18.407	0.764
18.965	0.787					
	30.226	0.014	0.016	27.222	18.469	0.294
18.914	0.301					
	30.240	0.197	0.221	27.222	18.408	4.069
18.949	4.189					
	30.437	0.026	0.029	27.222	18.343	0.528
18.850	0.543					
	30.462	0.197	0.221	27.412	18.347	4.063
18.863	4.177					
	30.659	0.043	0.049	27.412	18.273	0.892
18.765	0.916					
	30.702	0.197	0.223	27.994	18.404	4.097
18.714	4.166					
	30.899	0.036	0.041	27.994	18.319	0.748
18.605	0.760					
	30.935	0.197	0.224	28.596	18.437	4.128
18.556	4.155					
	31.131	0.033	0.038	28.596	18.339	0.696
18.357	0.696					
	31.165	0.197	0.225	29.207	18.437	4.152

18.304	4.122					
	31.361	0.031	0.036	29.207	18.325	0.651
18.127	0.644					
	31.392	0.197	0.227	29.810	18.396	4.168
18.081	4.096					
	31.589	0.034	0.039	29.810	18.268	0.715
17.970	0.703					
	31.623	0.197	0.228	30.405	18.311	4.174
17.816	4.061					
	31.819	0.031	0.036	30.405	18.170	0.655
17.590	0.634					
	31.850	0.197	0.229	30.995	18.187	4.171
17.532	4.020					
	32.047	0.033	0.039	30.995	18.030	0.700
17.311	0.672					
	32.080	0.197	0.231	31.562	18.014	4.156
17.251	3.980					
	32.277	0.036	0.042	31.562	17.840	0.754
17.023	0.720					
	32.313	0.127	0.150	32.099	17.847	2.677
17.002	2.551					
	32.440	0.112	0.133	32.099	17.653	2.341
16.860	2.236					
	32.552	0.197	0.232	32.262	17.439	4.054
16.769	3.898					
	32.749	0.040	0.047	32.262	17.242	0.811
16.524	0.778					
	32.789	0.197	0.233	32.429	17.081	3.978
16.509	3.845					
	32.985	0.037	0.044	32.429	16.882	0.744
16.261	0.716					
	33.022	0.197	0.233	32.596	16.718	3.901
16.322	3.808					
	33.219	0.036	0.043	32.596	16.515	0.712
16.102	0.694					
	33.255	0.197	0.234	32.764	16.345	3.821
15.918	3.721					
	33.452	0.035	0.042	32.764	16.138	0.678
15.693	0.659					
	33.487	0.197	0.234	32.937	15.964	3.739
15.544	3.641					
	33.684	0.039	0.046	32.937	15.749	0.727
15.264	0.705					
	33.723	0.197	0.235	33.104	15.564	3.652
15.133	3.551					
	33.919	0.042	0.050	33.104	15.342	0.770
14.905	0.748					
	33.961	0.009	0.010	33.267	15.326	0.160
14.844	0.155					
	33.970	0.005	0.006	33.267	15.313	0.092
14.834	0.089					
	33.975	0.197	0.235	33.267	15.121	3.555
14.821	3.485					
	34.172	0.037	0.044	33.267	14.899	0.651

14.669	0.641					
34.208	0.132	0.158	33.420	14.764	2.333	
14.699	2.322					
34.340	0.127	0.152	33.420	14.513	2.204	
14.546	2.209					
34.467	0.197	0.242	35.675	14.496	3.508	
14.158	3.426					
34.663	0.030	0.037	35.675	14.211	0.528	
14.006	0.520					
34.694	0.197	0.250	38.223	14.141	3.538	
13.507	3.380					
34.890	0.022	0.028	38.223	13.789	0.392	
13.080	0.372					
34.912	0.197	0.260	40.854	13.532	3.517	
12.602	3.275					
35.109	0.012	0.016	40.854	13.117	0.208	
12.267	0.195					
35.121	0.197	0.270	43.231	12.684	3.422	
11.834	3.193					
35.318	0.028	0.039	43.231	12.155	0.472	
11.628	0.451					
35.346	0.197	0.283	46.095	11.491	3.258	
11.034	3.128					
35.542	0.041	0.058	46.095	10.825	0.633	
10.903	0.637					
35.583	0.197	0.295	48.202	9.996	2.948	
10.136	2.990					
35.780	0.081	0.121	48.202	9.121	1.104	
9.574	1.159					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 dl(m) : lunghezza base concio  
 alpha(°) : Angolo pendenza base concio  
 TauStress(kPa) : Sforzo di taglio su base concio  
 TauF (kN/m) : Forza di taglio su base concio  
 TauStrength(kPa) : Resistenza al taglio su base concio  
 TauS (kN/m) : Forza resistente al taglio su base concio

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Strato 1 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso  
 stimati secondo criterio di rottura non lineare Hoek et al.(2002)  
 CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)  
 Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

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 SigmaN'(kPa)    TauSrength(kPa)    Phi'(deg)    c'(kPa)  
 25.00            137.42            58.47            69.19



50.00	186.72	55.52	76.58
75.00	229.23	53.43	82.28
100.00	269.97	51.71	89.32
125.00	307.76	50.29	95.71
150.00	344.72	49.03	103.03
175.00	380.39	47.92	110.48
200.00	414.33	46.95	117.39
225.00	446.12	46.09	123.16
250.00	479.13	45.26	131.05
275.00	509.50	44.53	137.06
300.00	540.87	43.82	144.79
325.00	569.14	43.21	149.99
350.00	598.21	42.61	156.59
375.00	628.07	42.02	164.54
400.00	654.32	41.52	169.27
425.00	685.72	40.95	179.76
450.00	708.67	40.55	181.95
475.00	736.79	40.07	189.88
500.00	760.71	39.67	193.83
600.00	866.21	38.06	223.16
700.00	957.87	36.80	242.59
800.00	1049.54	35.65	265.80
900.00	1140.54	34.60	291.52
1000.00	1223.57	33.71	311.63
1100.00	1303.83	32.91	331.24
1200.00	1387.74	32.12	356.93
1300.00	1460.58	31.47	372.79
1400.00	1536.19	30.83	393.39
1500.00	1614.69	30.20	418.74
2000.00	1960.39	27.76	515.66

Strato 2 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso

stimati secondo criterio di rottura non lineare Hoek et al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

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SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	696.24	60.38	513.03
50.00	756.64	59.62	520.01
75.00	806.42	59.04	520.13
100.00	857.50	58.47	523.03
125.00	909.85	57.91	528.58
150.00	949.97	57.49	524.59
175.00	1004.57	56.95	534.68
200.00	1046.36	56.55	534.32
225.00	1103.20	56.03	548.62
250.00	1146.67	55.64	551.63
275.00	1190.86	55.26	556.09
300.00	1235.77	54.89	561.97
325.00	1281.40	54.52	569.22

350.00	1327.76	54.15	577.81
375.00	1359.06	53.91	572.83
400.00	1406.61	53.55	583.74
425.00	1454.89	53.20	595.90
450.00	1487.48	52.96	593.65
475.00	1536.97	52.61	607.98
500.00	1570.37	52.38	607.39
600.00	1724.68	51.37	628.85
700.00	1885.62	50.39	662.51
800.00	2034.30	49.55	689.13
900.00	2188.33	48.73	725.29
1000.00	2327.55	48.02	750.56
1100.00	2450.22	47.43	762.64
1200.00	2597.27	46.75	801.99
1300.00	2726.73	46.18	826.48
1400.00	2859.39	45.62	856.64
1500.00	2972.41	45.17	869.25
2000.00	3572.08	42.95	995.66

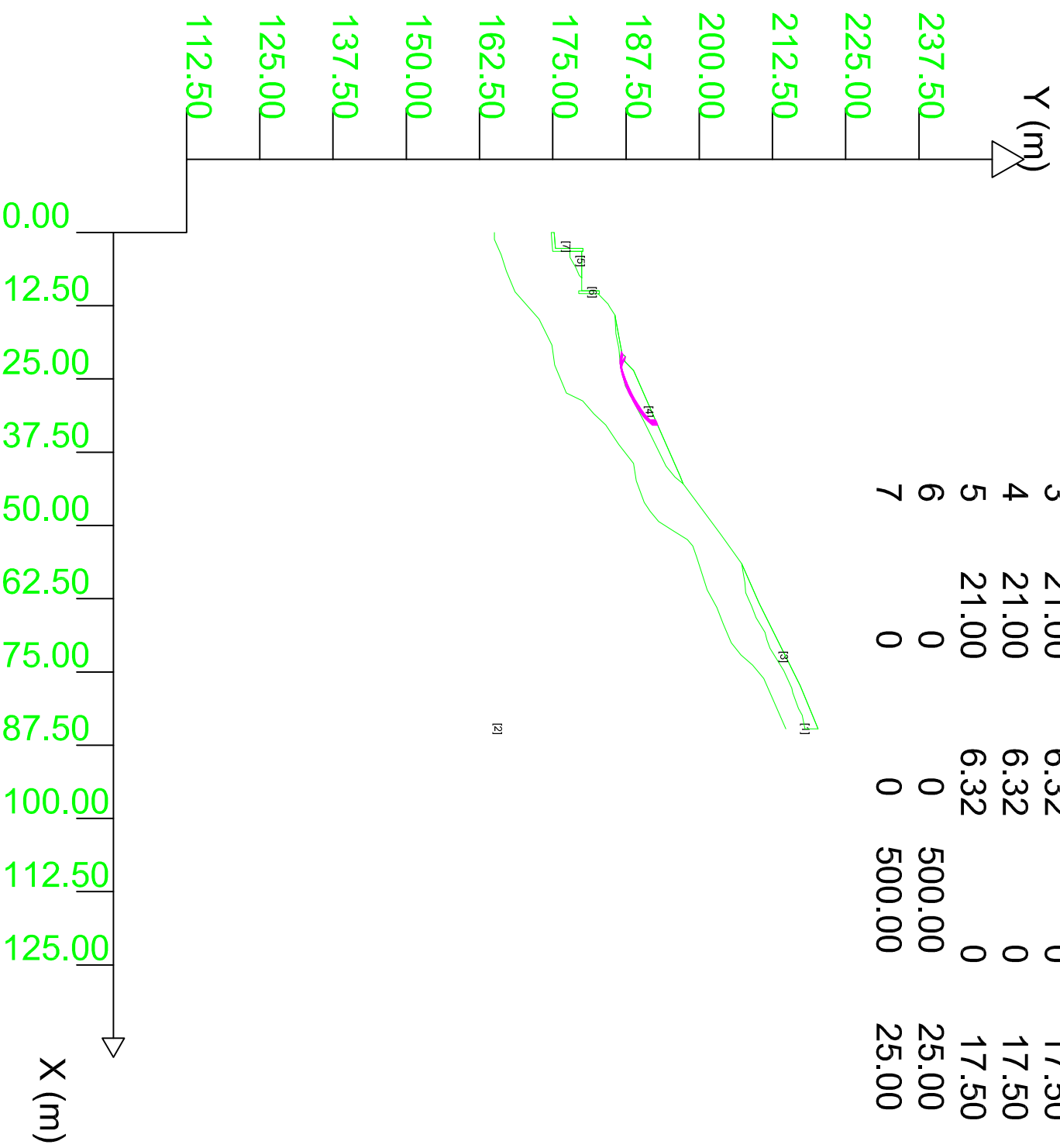
**Data : 18/04/2019**

**Localita' : Loc. Cepparello**

**Descrizione : Sez.7 - Stato di progetto**

**[n] = N. strato o lente**

#	Parametri	Geotecnici	degli	strati	#							
N.	phi'	C'	Cu	Gamm	GammSat	sgci	GSI	mi	D			
deg	KPa	KPa	KPa	KN/m3	KN/m3	MPa	..	..	..			
1	0	0	0	24.00	24.50	50.00	50.00	17.00	1.00			
2	0	0	0	24.00	24.50	100.00	65.00	17.00	1.00			
3	21.00	6.32	0	17.50	18.50	0	0	0	0			
4	21.00	6.32	0	17.50	18.50	0	0	0	0			
5	21.00	6.32	0	17.50	18.50	0	0	0	0			
6	0	0	500.00	25.00	25.00	0	0	0	0			
7	0	0	500.00	25.00	25.00	0	0	0	0			



**DATI 10 SUP. CON MINOR Fs**

Fs minimo : 1.3270  
Range Fs : 1.3270 1.3334  
Differenza % Range Fs : 0.48  
Coefficiente Sismico orizzontale - Kh: 0.0510

**GENERAZIONE SUPERFICI RANDOM**

Campione Superfici - N.: 20000  
Lunghezza media segmenti (m) : 1.0  
Range X inizio generazione : 1.7 - 77.9  
Range X termine generazione : 10.2 - 83.0  
Livello Y minimo considerato : 115.3

# Report elaborazioni #

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SSAP 4.9.9 - Slope Stability Analysis Program (1991,2018)

WWW.SSAP.EU

Build No. 10784

BY

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\*\* Gia' Ricercatore CNR-IRPI fino a Luglio 2011

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Ultima Revisione struttura tabelle del report: 29 dicembre 2018  
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File report: C:\SSAP2010\Verifiche\Risultati\Sez7\_Stato\_Progetto.txt

Data: 18/4/2019

Localita' :

Descrizione:

Modello pendio: Sez7-stato\_progetto\_V1.mod

----- PARAMETRI DEL MODELLO DEL PENDIO -----

\_\_\_ PARAMETRI GEOMETRICI - Coordinate X Y (in m) \_\_\_

SUP T.		SUP 2		SUP 3		SUP 4	
X	Y	X	Y	X	Y	X	Y
0.00	175.25	0.00	165.03	84.72	218.02	42.88	197.25
2.70	175.45	1.21	165.05	82.40	217.56	41.74	195.86
2.71	179.95	3.77	166.18	81.25	216.94	39.87	194.33
2.71	180.15	6.58	167.09	78.58	215.96	32.48	190.68
3.21	180.15	10.13	168.57	77.78	215.78	26.22	187.37
3.21	179.95	14.76	172.66	74.81	214.42	22.88	186.53
7.75	179.95	19.22	174.85	70.94	212.07	19.83	186.28
9.94	179.95	22.61	175.34	69.54	211.54	17.29	185.80
9.96	182.95	27.40	177.33	68.26	211.21	14.13	185.62
10.46	182.95	28.74	180.09	65.73	209.69	14.13	185.62
10.46	182.75	30.95	182.00	63.77	208.92	14.13	185.62
12.03	184.24	32.85	184.05	61.48	207.91	14.13	185.62
12.21	184.41	36.17	186.25	59.73	207.80	14.35	185.66
12.79	184.77	39.40	188.79	59.02	207.68	20.10	186.72
14.11	185.62	42.40	189.25	58.36	207.56	20.65	186.78
14.13	185.62	46.05	190.61	56.51	207.25	21.17	187.38
14.35	185.66	47.60	191.61	63.24	210.20	21.97	187.25
20.10	186.72	49.33	193.07	77.33	217.25	23.55	188.78
20.65	186.78	50.88	195.53	84.72	220.26	41.42	196.68
21.17	187.38	52.43	197.99	84.72	218.02	42.88	197.25
21.97	187.25	53.52	198.90	-	-	-	-
23.55	188.78	55.34	199.54	-	-	-	-
41.42	196.68	60.99	201.36	-	-	-	-
42.88	197.25	64.00	203.00	-	-	-	-

51.62	203.74	66.83	204.09	-	-	-	-
56.51	207.25	70.02	205.46	-	-	-	-
63.24	210.20	72.11	207.10	-	-	-	-
77.33	217.25	73.84	209.10	-	-	-	-
84.72	220.26	76.12	211.02	-	-	-	-
-	-	84.72	214.76	-	-	-	-

SUP 5		SUP 6		SUP 7		SUP 8	
X	Y	X	Y	X	Y	X	Y
3.21	177.90	9.94	179.45	0.00	174.75	-	-
4.28	177.95	9.96	182.95	2.70	174.95	-	-
5.98	178.91	10.46	182.95	3.21	174.99	-	-
7.35	179.50	10.46	182.75	3.21	180.15	-	-
7.75	179.95	10.44	179.45	2.71	180.15	-	-
7.75	179.95	9.94	179.45	2.71	179.95	-	-
3.21	179.95	-	-	2.71	177.88	-	-
3.21	179.95	-	-	2.70	175.45	-	-
3.21	179.95	-	-	0.00	175.25	-	-
3.21	179.95	-	-	0.00	174.75	-	-
3.21	177.90	-	-	-	-	-	-
3.21	177.90	-	-	-	-	-	-

## ASSENZA DI FALDA ##

----- PARAMETRI GEOMECCANICI -----

STR_IDX	sgci	fi` GSI	mi	C` D	Cu	Gamm	Gamm_sat
STRATO 1	1	0.00		0.00	0.00	24.00	24.50
8.587	50.00	50.00	17.00	1.00			
STRATO 2	2	0.00		0.00	0.00	24.00	24.50
12.882	100.00	65.00	17.00	1.00			
STRATO 3	3	21.00		6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00			
STRATO 4	4	21.00		6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00			
STRATO 5	5	21.00		6.32	0.00	17.50	18.50
1.294	0.00	0.00	0.00	0.00			
STRATO 6	6	0.00		0.00	500.00	25.00	25.00
1000.000	0.00	0.00	0.00	0.00			
STRATO 7	7	0.00		0.00	500.00	25.00	25.00
1000.000	0.00	0.00	0.00	0.00			

LEGENDA: fi` \_\_\_\_\_ Angolo di attrito interno efficace(in gradi)  
 C` \_\_\_\_\_ Coesione efficace (in Kpa)  
 Cu \_\_\_\_\_ Resistenza al taglio Non drenata (in Kpa)  
 Gamm \_\_\_\_\_ Peso di volume terreno fuori falda (in KN/m^3)  
 Gamm\_sat \_\_\_\_\_ Peso di volume terreno immerso (in KN/m^3)  
 STR\_IDX \_\_\_\_\_ Indice di resistenza (usato in solo in 'SNIFF SEARCH)  
 (adimensionale)

----- SOLO Per AMMASSI ROCCIOSI FRATTURATI - Parametri Criterio di Rottura di Hoek (2002)-

MPa) sigci \_\_\_\_\_ Resistenza Compressione Uniassiale Roccia Intatta (in

GSI \_\_\_\_\_ Geological Strenght Index ammasso(adimensionale)

mi \_\_\_\_\_ Indice litologico ammasso(adimensionale)

D \_\_\_\_\_ Fattore di disturbo ammasso(adimensionale)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 -

ATTIVATO (solo per ROCCE)

Uso CRITERIO DI ROTTURA Hoek et al.(2002,2006) - non-lineare - Generalizzato secondo Lei et al.(2016)

----- INFORMAZIONI GENERAZIONE SUPERFICI RANDOM -----

\*\*\* PARAMETRI PER LA GENERAZIONE DELLE SUPERFICI

METODO DI RICERCA: CONVEX RANDOM - Chen (1992)

FILTRAGGIO SUPERFICI : ATTIVATO

COORDINATE X1,X2,Y OSTACOLO : 0.00 0.00 0.00

LUNGHEZZA MEDIA SEGMENTI (m): 1.0 (+/-) 50%

INTERVALLO ASCISSE RANDOM STARTING POINT (Xmin .. Xmax): 1.69

77.94

LIVELLO MINIMO CONSIDERATO (Ymin): 115.32

INTERVALLO ASCISSE AMMESSO PER LA TERMINAZIONE (Xmin .. Xmax): 10.17

83.03

\*\*\* TOTALE SUPERFICI GENERATE : 20000

----- INFORMAZIONI PARAMETRI DI CALCOLO -----

METODO DI CALCOLO : BORSELLI (Borselli, 2016)

COEFFICIENTE SISMICO UTILIZZATO Kh : 0.0510

COEFFICIENTE SISMICO UTILIZZATO Kv (assunto Positivo): 0.0255

COEFFICIENTE c=Kv/Kh UTILIZZATO : 0.5000

FORZA ORIZZONTALE ADDIZIONALE IN TESTA (kN/m): 0.00

FORZA ORIZZONTALE ADDIZIONALE ALLA BASE (kN/m): 0.00

N.B. Le forze orizzontali addizionali in testa e alla base sono poste uguali a 0

durante le tutte le verifiche globali.

I valori >0 impostati dall'utente sono utilizzati solo in caso di verifica singola

----- RISULTATO FINALE ELABORAZIONI -----

\* DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR Fs \*

Fattore di sicurezza (FS) 1.3270 - Min. - X Y Lambda=  
0.3568

20.65 186.78

21.37 186.63

21.72 186.56

21.95 186.53

22.14 186.52

22.33 186.52

22.51 186.53

22.69 186.55

22.89 186.58

23.13	186.63
23.34	186.67
23.54	186.72
23.73	186.78
23.93	186.83
24.12	186.89
24.31	186.96
24.51	187.03
24.71	187.12
24.92	187.20
25.12	187.28
25.32	187.36
25.52	187.44
25.72	187.51
25.92	187.59
26.12	187.67
26.32	187.75
26.52	187.83
26.72	187.91
26.92	187.99
27.12	188.08
27.31	188.16
27.51	188.24
27.72	188.32
27.92	188.41
28.12	188.49
28.32	188.58
28.51	188.67
28.71	188.76
28.90	188.86
29.11	188.96
29.32	189.06
29.54	189.18
29.74	189.29
29.93	189.41
30.10	189.53
30.30	189.68
30.48	189.83
30.67	190.00
30.86	190.19
31.09	190.42
31.30	190.64
31.50	190.85
31.70	191.07
31.89	191.29
32.11	191.55
32.29	191.76
32.29	192.64

Fattore di sicurezza (FS)	1.3277	- N.2 --	X	Y	Lambda=
0.3566			21.57	187.31	
			22.15	187.03	

22.42	186.90
22.59	186.84
22.73	186.79
22.87	186.77
22.99	186.76
23.13	186.76
23.29	186.77
23.48	186.80
23.65	186.83
23.81	186.85
23.95	186.89
24.10	186.92
24.25	186.96
24.39	187.01
24.55	187.06
24.71	187.12
24.87	187.18
25.03	187.24
25.18	187.30
25.33	187.36
25.49	187.42
25.64	187.48
25.79	187.55
25.95	187.61
26.10	187.68
26.26	187.75
26.41	187.81
26.56	187.88
26.71	187.95
26.87	188.02
27.02	188.09
27.18	188.16
27.33	188.24
27.49	188.31
27.64	188.38
27.79	188.46
27.94	188.53
28.09	188.61
28.25	188.69
28.40	188.77
28.56	188.85
28.71	188.93
28.87	189.02
29.02	189.10
29.17	189.18
29.33	189.26
29.49	189.34
29.64	189.42
29.79	189.50
29.95	189.59
30.10	189.67
30.25	189.76
30.40	189.85
30.56	189.94



30.72	190.04
30.88	190.14
31.04	190.24
31.18	190.35
31.33	190.45
31.47	190.57
31.62	190.70
31.77	190.83
31.92	190.98
32.10	191.15
32.25	191.32
32.41	191.48
32.55	191.65
32.70	191.83
32.85	192.01
32.85	192.89

Fattore di sicurezza (FS)    1.3280   - N.3   --    X            Y            Lambda=  
0.3666

20.56	186.77
21.32	186.63
21.68	186.57
21.91	186.54
22.11	186.53
22.30	186.54
22.48	186.56
22.66	186.59
22.87	186.63
23.10	186.70
23.33	186.76
23.54	186.82
23.75	186.88
23.95	186.94
24.15	187.00
24.36	187.06
24.57	187.13
24.78	187.19
24.99	187.26
25.19	187.33
25.39	187.41
25.59	187.49
25.79	187.56
26.00	187.65
26.20	187.74
26.42	187.83
26.63	187.93
26.83	188.02
27.03	188.12
27.24	188.22
27.44	188.32
27.64	188.42
27.85	188.53
28.07	188.65

28.27	188.76
28.48	188.87
28.68	188.99
28.88	189.11
29.09	189.23
29.29	189.35
29.50	189.48
29.73	189.62
29.93	189.76
30.13	189.89
30.32	190.04
30.52	190.19
30.72	190.35
30.92	190.52
31.12	190.70
31.35	190.90
31.56	191.10
31.76	191.29
31.97	191.49
32.15	191.66
32.15	192.58

Fattore di sicurezza (FS)    1.3290    - N.4    --    X    Y    Lambda=  
0.3575

20.67	186.81
21.66	186.69
22.12	186.65
22.44	186.63
22.70	186.63
22.96	186.65
23.20	186.68
23.45	186.73
23.72	186.79
24.03	186.87
24.32	186.94
24.60	187.02
24.86	187.10
25.13	187.18
25.40	187.27
25.67	187.35
25.95	187.45
26.24	187.55
26.51	187.65
26.77	187.76
27.03	187.87
27.29	187.99
27.55	188.11
27.81	188.25
28.08	188.39
28.38	188.56
28.66	188.72
28.92	188.88
29.19	189.05

29.45	189.22
29.72	189.39
29.99	189.57
30.27	189.77
30.58	189.99
30.85	190.19
31.10	190.41
31.35	190.63
31.61	190.88
31.89	191.17
32.22	191.53
32.40	191.74
32.40	192.69

Fattore di sicurezza (FS)    1.3307   - N.5 --    X    Y    Lambda=  
0.3717

20.71	186.85
21.38	186.67
21.69	186.59
21.89	186.55
22.05	186.54
22.22	186.53
22.37	186.54
22.53	186.57
22.71	186.60
22.92	186.66
23.12	186.71
23.30	186.76
23.48	186.81
23.66	186.86
23.83	186.92
24.01	186.98
24.19	187.04
24.37	187.10
24.55	187.17
24.73	187.23
24.91	187.30
25.09	187.37
25.27	187.43
25.44	187.50
25.62	187.57
25.81	187.64
25.99	187.72
26.16	187.79
26.34	187.86
26.52	187.94
26.70	188.01
26.88	188.09
27.06	188.17
27.25	188.26
27.43	188.34
27.60	188.43
27.77	188.52

27.95	188.61
28.12	188.71
28.30	188.81
28.47	188.92
28.66	189.03
28.85	189.15
29.02	189.26
29.20	189.38
29.38	189.50
29.56	189.62
29.74	189.74
29.92	189.86
30.10	189.99
30.28	190.11
30.46	190.24
30.63	190.37
30.81	190.50
30.99	190.63
31.17	190.77
31.35	190.91
31.55	191.07
31.72	191.21
31.90	191.36
32.06	191.52
32.24	191.69
32.24	192.62

Fattore di sicurezza (FS)      1.3314   - N.6 --      X      Y      Lambda=  
0.3571

20.82	186.98
21.58	186.76
21.92	186.67
22.15	186.63
22.34	186.61
22.52	186.61
22.69	186.62
22.87	186.65
23.07	186.69
23.31	186.76
23.53	186.82
23.74	186.88
23.94	186.94
24.14	187.01
24.33	187.07
24.53	187.14
24.73	187.22
24.94	187.30
25.15	187.38
25.35	187.46
25.55	187.54
25.75	187.62
25.95	187.71
26.15	187.79

26.35	187.88
26.56	187.97
26.76	188.06
26.96	188.16
27.16	188.25
27.36	188.34
27.56	188.44
27.76	188.54
27.96	188.63
28.16	188.74
28.37	188.84
28.57	188.94
28.77	189.04
28.97	189.14
29.17	189.25
29.37	189.35
29.58	189.46
29.80	189.58
29.99	189.69
30.19	189.80
30.38	189.92
30.57	190.05
30.77	190.18
30.97	190.32
31.17	190.48
31.40	190.66
31.61	190.83
31.80	191.01
31.99	191.19
32.18	191.39
32.39	191.62
32.63	191.91
32.63	192.80

Fattore di sicurezza (FS)    1.3317    - N.7 --    X            Y            Lambda=  
0.3547

21.23	187.37
21.82	186.99
22.09	186.82
22.26	186.74
22.39	186.69
22.52	186.65
22.63	186.64
22.77	186.64
22.92	186.65
23.12	186.68
23.29	186.71
23.45	186.75
23.60	186.78
23.75	186.82
23.89	186.86
24.04	186.90
24.19	186.95

24.35	187.00
24.51	187.05
24.66	187.11
24.82	187.16
24.97	187.21
25.12	187.26
25.28	187.32
25.43	187.37
25.58	187.42
25.74	187.48
25.89	187.53
26.04	187.59
26.19	187.65
26.34	187.70
26.49	187.76
26.65	187.83
26.81	187.89
26.96	187.96
27.11	188.03
27.26	188.09
27.41	188.17
27.56	188.24
27.71	188.32
27.86	188.40
28.02	188.49
28.17	188.58
28.33	188.66
28.48	188.75
28.63	188.84
28.78	188.93
28.93	189.02
29.09	189.11
29.24	189.20
29.39	189.29
29.55	189.38
29.70	189.47
29.85	189.57
30.01	189.66
30.16	189.75
30.32	189.85
30.48	189.95
30.63	190.04
30.78	190.14
30.92	190.24
31.07	190.36
31.21	190.47
31.36	190.60
31.52	190.74
31.70	190.90
31.85	191.05
32.00	191.20
32.14	191.36
32.29	191.54
32.45	191.74

32.45 192.71

Fattore di sicurezza (FS) 1.3320 - N.8 -- X Y Lambda=  
0.3624

20.60 186.77  
21.35 186.65  
21.70 186.60  
21.94 186.58  
22.14 186.57  
22.34 186.57  
22.52 186.59  
22.71 186.62  
22.91 186.65  
23.15 186.70  
23.37 186.75  
23.58 186.80  
23.79 186.85  
23.99 186.90  
24.19 186.95  
24.40 187.01  
24.61 187.06  
24.83 187.13  
25.03 187.19  
25.23 187.25  
25.43 187.32  
25.63 187.39  
25.83 187.47  
26.03 187.55  
26.23 187.64  
26.45 187.74  
26.66 187.84  
26.87 187.93  
27.07 188.03  
27.28 188.13  
27.48 188.24  
27.68 188.34  
27.89 188.45  
28.10 188.57  
28.31 188.68  
28.52 188.80  
28.72 188.92  
28.92 189.04  
29.12 189.16  
29.33 189.29  
29.54 189.43  
29.76 189.57  
29.97 189.71  
30.17 189.86  
30.36 190.01  
30.56 190.17  
30.75 190.34  
30.95 190.51  
31.16 190.70

31.38 190.92  
31.59 191.12  
31.80 191.33  
32.00 191.53  
32.00 192.52

Fattore di sicurezza (FS) 1.3328 - N.9 -- X Y Lambda=  
0.3526

20.69 186.83  
21.90 186.70  
22.46 186.66  
22.83 186.65  
23.14 186.66  
23.44 186.70  
23.72 186.75  
24.02 186.83  
24.33 186.93  
24.71 187.07  
25.06 187.20  
25.40 187.32  
25.73 187.45  
26.05 187.58  
26.37 187.70  
26.70 187.84  
27.03 187.97  
27.37 188.12  
27.69 188.26  
28.01 188.40  
28.32 188.55  
28.64 188.72  
28.96 188.88  
29.29 189.06  
29.63 189.26  
30.01 189.48  
30.33 189.69  
30.64 189.91  
30.92 190.14  
31.23 190.42  
31.56 190.75  
31.94 191.17  
32.48 191.80  
32.48 192.73

Fattore di sicurezza (FS) 1.3334 - N.10 -- X Y Lambda=  
0.3690

20.37 186.75  
21.26 186.61  
21.67 186.55  
21.95 186.53  
22.18 186.53  
22.40 186.54  
22.61 186.57



22.83	186.61
23.07	186.68
23.35	186.76
23.61	186.84
23.85	186.92
24.09	187.00
24.33	187.09
24.57	187.17
24.81	187.26
25.05	187.35
25.30	187.45
25.54	187.55
25.78	187.65
26.02	187.75
26.25	187.85
26.49	187.95
26.73	188.06
26.98	188.17
27.23	188.29
27.47	188.41
27.71	188.53
27.94	188.65
28.17	188.78
28.40	188.92
28.64	189.06
28.88	189.21
29.13	189.37
29.37	189.52
29.62	189.68
29.86	189.84
30.10	189.99
30.34	190.15
30.59	190.31
30.84	190.47
31.11	190.64
31.34	190.80
31.57	190.97
31.78	191.15
32.02	191.35
32.26	191.59
32.44	191.79
32.44	192.71

----- ANALISI DEFICIT DI RESISTENZA -----

# DATI RELATIVI ALLE 10 SUPERFICI GENERATE CON MINOR  $F_s$  \*

# Analisi Deficit in riferimento a  $F_s(\text{progetto}) = 1.200$

Sup N.	$F_s$	FTR(kN/m)	FTA(kN/m)	Bilancio(kN/m)	ESITO
1	1.327	222.2	167.4	21.3	Surplus
2	1.328	216.9	163.4	20.9	Surplus
3	1.328	209.5	157.8	20.2	Surplus
4	1.329	225.2	169.5	21.9	Surplus
5	1.331	206.2	154.9	20.3	Surplus

6	1.331	215.5	161.9	21.3	Surplus
7	1.332	217.1	163.1	21.5	Surplus
8	1.332	212.0	159.2	21.0	Surplus
9	1.333	226.2	169.7	22.5	Surplus
10	1.333	211.4	158.5	21.2	Surplus

Esito analisi: SURPLUS di RESISTENZA!

Valore minimo di SURPLUS di RESISTENZA (kN/m): 20.2

Note: FTR --> Forza totale Resistente lungo la superficie di scivolamento

FTA --> Forza totale Agente lungo la superficie di scivolamento

IMPORTANTE! : Il Deficit o il Surplus di resistenza viene espresso in kN per metro di LARGHEZZA rispetto al fronte della scarpata

TABELLA PARAMETRI CONCI DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

phi'	X	dx	alpha	W	ru	U
(°)	(m)	(m)	(°)	(kN/m)	(-)	(kPa)
21.00	20.645	0.005	-11.80	0.00	0.00	0.00
	6.32					
21.00	20.650	0.176	-11.80	0.39	0.00	0.00
	6.32					
21.00	20.826	0.084	-11.80	0.45	0.00	0.00
	6.32					
21.00	20.910	0.176	-11.80	1.51	0.00	0.00
	6.32					
21.00	21.086	0.084	-11.80	0.98	0.00	0.00
	6.32					
21.00	21.170	0.176	-11.80	2.26	0.00	0.00
	6.32					
21.00	21.346	0.029	-11.80	0.37	0.00	0.00
	6.32					
21.00	21.375	0.176	-10.55	2.28	0.00	0.00
	6.32					
21.00	21.551	0.168	-10.55	2.19	0.00	0.00
	6.32					
21.00	21.719	0.176	-7.80	2.30	0.00	0.00
	6.32					
21.00	21.896	0.055	-7.80	0.71	0.00	0.00
	6.32					
21.00	21.950	0.020	-4.41	0.25	0.00	0.00
	6.32					
21.00	21.970	0.173	-4.41	2.52	0.00	0.00
	6.32					
21.00	22.143	0.176	-0.19	3.12	0.00	0.00

21.00	6.32					
	22.319	0.013	-0.19	0.25	0.00	0.00
21.00	6.32					
	22.332	0.173	3.13	3.62	0.00	0.00
21.00	6.32					
	22.506	0.104	6.46	2.41	0.00	0.00
21.00	6.32					
	22.610	0.082	6.46	2.02	0.00	0.00
21.00	6.32					
	22.692	0.068	9.28	1.74	0.00	0.00
21.00	6.32					
	22.760	0.120	9.28	3.24	0.00	0.00
21.00	6.32					
	22.880	0.012	9.28	0.34	0.00	0.00
21.00	6.32					
	22.892	0.176	11.43	5.17	0.00	0.00
21.00	6.32					
	23.069	0.061	11.43	1.89	0.00	0.00
21.00	6.32					
	23.130	0.176	12.53	5.74	0.00	0.00
21.00	6.32					
	23.306	0.035	12.53	1.20	0.00	0.00
21.00	6.32					
	23.342	0.176	13.81	6.23	0.00	0.00
21.00	6.32					
	23.518	0.023	13.81	0.86	0.00	0.00
21.00	6.32					
	23.542	0.008	15.18	0.31	0.00	0.00
21.00	6.32					
	23.550	0.176	15.18	6.55	0.00	0.00
21.00	6.32					
	23.726	0.007	15.18	0.24	0.00	0.00
21.00	6.32					
	23.733	0.176	16.57	6.64	0.00	0.00
21.00	6.32					
	23.909	0.019	16.57	0.70	0.00	0.00
21.00	6.32					
	23.928	0.176	17.87	6.73	0.00	0.00
21.00	6.32					
	24.104	0.012	17.87	0.45	0.00	0.00
21.00	6.32					
	24.116	0.176	19.16	6.79	0.00	0.00
21.00	6.32					
	24.293	0.016	19.16	0.63	0.00	0.00
21.00	6.32					
	24.309	0.176	20.37	6.84	0.00	0.00
21.00	6.32					
	24.485	0.020	20.37	0.79	0.00	0.00
21.00	6.32					
	24.505	0.176	21.45	6.88	0.00	0.00
21.00	6.32					
	24.682	0.033	21.45	1.30	0.00	0.00
21.00	6.32					
	24.715	0.176	21.49	6.91	0.00	0.00

21.00	6.32					
	24.891	0.029	21.49	1.16	0.00	0.00
21.00	6.32					
	24.921	0.176	21.53	6.94	0.00	0.00
21.00	6.32					
	25.097	0.026	21.53	1.02	0.00	0.00
21.00	6.32					
	25.123	0.176	21.58	6.97	0.00	0.00
21.00	6.32					
	25.299	0.025	21.58	0.98	0.00	0.00
21.00	6.32					
	25.324	0.176	21.62	7.00	0.00	0.00
21.00	6.32					
	25.501	0.022	21.62	0.88	0.00	0.00
21.00	6.32					
	25.523	0.176	21.67	7.03	0.00	0.00
21.00	6.32					
	25.699	0.023	21.67	0.92	0.00	0.00
21.00	6.32					
	25.722	0.176	21.71	7.06	0.00	0.00
21.00	6.32					
	25.899	0.023	21.71	0.91	0.00	0.00
21.00	6.32					
	25.921	0.176	21.76	7.09	0.00	0.00
21.00	6.32					
	26.098	0.023	21.76	0.94	0.00	0.00
21.00	6.32					
	26.121	0.099	21.80	3.99	0.00	0.00
21.00	6.32					
	26.220	0.100	21.80	4.04	0.00	0.00
21.00	6.32					
	26.320	0.176	21.91	7.14	0.00	0.00
21.00	6.32					
	26.497	0.023	21.91	0.93	0.00	0.00
21.00	6.32					
	26.519	0.176	22.02	7.16	0.00	0.00
21.00	6.32					
	26.696	0.022	22.02	0.90	0.00	0.00
21.00	6.32					
	26.718	0.176	22.13	7.19	0.00	0.00
21.00	6.32					
	26.894	0.022	22.13	0.92	0.00	0.00
21.00	6.32					
	26.917	0.176	22.23	7.21	0.00	0.00
21.00	6.32					
	27.093	0.022	22.23	0.90	0.00	0.00
21.00	6.32					
	27.115	0.176	22.34	7.23	0.00	0.00
21.00	6.32					
	27.292	0.023	22.34	0.95	0.00	0.00
21.00	6.32					
	27.315	0.085	22.45	3.50	0.00	0.00
21.00	6.32					
	27.400	0.115	22.45	4.72	0.00	0.00

21.00	6.32					
	27.515	0.176	22.56	7.27	0.00	0.00
21.00	6.32					
	27.691	0.026	22.56	1.06	0.00	0.00
21.00	6.32					
	27.717	0.176	22.66	7.28	0.00	0.00
21.00	6.32					
	27.893	0.028	22.66	1.14	0.00	0.00
21.00	6.32					
	27.921	0.176	23.23	7.29	0.00	0.00
21.00	6.32					
	28.098	0.022	23.23	0.91	0.00	0.00
21.00	6.32					
	28.119	0.176	23.83	7.30	0.00	0.00
21.00	6.32					
	28.296	0.020	23.83	0.82	0.00	0.00
21.00	6.32					
	28.316	0.176	24.43	7.30	0.00	0.00
21.00	6.32					
	28.492	0.018	24.43	0.75	0.00	0.00
21.00	6.32					
	28.510	0.176	25.02	7.29	0.00	0.00
21.00	6.32					
	28.687	0.021	25.02	0.85	0.00	0.00
21.00	6.32					
	28.707	0.033	25.63	1.35	0.00	0.00
21.00	6.32					
	28.740	0.165	25.63	6.77	0.00	0.00
21.00	6.32					
	28.905	0.176	26.22	7.24	0.00	0.00
21.00	6.32					
	29.081	0.026	26.22	1.05	0.00	0.00
21.00	6.32					
	29.107	0.176	26.79	7.20	0.00	0.00
21.00	6.32					
	29.283	0.034	26.79	1.39	0.00	0.00
21.00	6.32					
	29.317	0.176	27.29	7.16	0.00	0.00
21.00	6.32					
	29.494	0.050	27.29	2.00	0.00	0.00
21.00	6.32					
	29.543	0.176	29.54	7.09	0.00	0.00
21.00	6.32					
	29.719	0.020	29.54	0.78	0.00	0.00
21.00	6.32					
	29.739	0.176	32.15	7.00	0.00	0.00
21.00	6.32					
	29.915	0.011	32.15	0.44	0.00	0.00
21.00	6.32					
	29.927	0.176	34.90	6.87	0.00	0.00
21.00	6.32					
	30.103	0.001	34.90	0.05	0.00	0.00
21.00	6.32					
	30.104	0.176	37.44	6.70	0.00	0.00

21.00	6.32					
	30.281	0.015	37.44	0.56	0.00	0.00
21.00	6.32					
	30.296	0.176	39.83	6.49	0.00	0.00
21.00	6.32					
	30.472	0.004	39.83	0.13	0.00	0.00
21.00	6.32					
	30.476	0.176	42.08	6.25	0.00	0.00
21.00	6.32					
	30.652	0.013	42.08	0.46	0.00	0.00
21.00	6.32					
	30.665	0.176	43.95	5.95	0.00	0.00
21.00	6.32					
	30.842	0.023	43.95	0.76	0.00	0.00
21.00	6.32					
	30.865	0.085	45.43	2.75	0.00	0.00
21.00	6.32					
	30.950	0.140	45.43	4.36	0.00	0.00
21.00	6.32					
	31.090	0.176	46.16	5.19	0.00	0.00
21.00	6.32					
	31.266	0.033	46.16	0.92	0.00	0.00
21.00	6.32					
	31.299	0.176	46.96	4.79	0.00	0.00
21.00	6.32					
	31.476	0.025	46.96	0.64	0.00	0.00
21.00	6.32					
	31.500	0.176	47.77	4.38	0.00	0.00
21.00	6.32					
	31.676	0.019	47.77	0.45	0.00	0.00
21.00	6.32					
	31.696	0.176	48.58	3.96	0.00	0.00
21.00	6.32					
	31.872	0.020	48.58	0.43	0.00	0.00
21.00	6.32					
	31.892	0.176	49.57	3.52	0.00	0.00
21.00	6.32					
	32.069	0.041	49.57	0.75	0.00	0.00
21.00	6.32					
	32.109	0.176	50.33	3.01	0.00	0.00
21.00	6.32					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 alpha(°) : Angolo pendenza base concio  
 W(kN/m) : Forza peso concio  
 ru(-) : Coefficiente locale pressione interstiziale  
 U(kPa) : Pressione totale dei pori base concio  
 phi'(°) : Angolo di attrito efficace base concio  
 c'/Cu (kPa) : Coesione efficace o Resistenza al taglio in condizioni non drenate

TABELLA DIAGRAMMA DELLE FORZE DELLA SUPERFICIE INDIVIDUATA CON MINOR FS

T(x)	X (m)	ht E' (m) (kN)	yt rho(x) (m) (--)	yt' FS_FEM (--) (--)	E(x) FS_p-qFEM (kN/m) (--)	
	20.645	0.000	186.779	0.149	0.0000000000E+000	
0.0000000000E+000		9.0304271398E+001		0.580	5.480	1.360
	20.650	0.000	186.779	0.149	4.1678213086E-001	
7.4057839504E-002		8.6146235537E+001		0.580	5.480	1.360
	20.826	0.065	186.806	0.142	1.9177704807E+000	
3.8414159138E-001		6.9902082464E+000		0.225	5.824	1.220
	20.910	0.092	186.816	0.116	2.4419330096E+000	
4.6088612588E-001		7.8291971625E+000		0.192	7.408	1.388
	21.086	0.149	186.837	0.077	4.4033099692E+000	
5.0112882658E-001		1.0277453801E+001		0.122	11.815	1.684
	21.170	0.166	186.836	-0.060	5.2290752429E+000	
5.2360509753E-001		1.0556581514E+001		0.131	13.743	1.690
	21.346	0.188	186.821	-0.090	7.3436213532E+000	
7.8496875806E-001		1.3436332914E+001		0.142	9.764	1.593
	21.375	0.191	186.818	-0.087	7.7338340054E+000	
8.5957771480E-001		1.3501786906E+001		0.152	8.707	1.574
	21.551	0.209	186.803	-0.069	9.9312939132E+000	
1.3294750162E+000		1.2907546080E+001		0.210	5.571	1.505
	21.719	0.231	186.794	-0.029	1.2169931859E+001	
2.0819938815E+000		1.2978606927E+001		0.298	3.576	1.435
	21.896	0.254	186.793	0.014	1.4393103265E+001	
3.0644359410E+000		1.1304596156E+001		0.403	2.571	1.393
	21.950	0.266	186.797	0.087	1.4990817229E+001	
3.4047882773E+000		1.1465672241E+001		0.438	2.378	1.394
	21.970	0.270	186.800	0.193	1.5218715890E+001	
3.5531554228E+000		1.1707661687E+001		0.454	2.318	1.395
	22.143	0.318	186.834	0.257	1.7305739521E+001	
4.9466578290E+000		1.1479418008E+001		0.532	1.915	1.434
	22.319	0.374	186.889	0.314	1.9224561400E+001	
6.3551405555E+000		9.2145432168E+000		0.596	1.735	1.511
	22.332	0.378	186.894	0.387	1.9344031130E+001	
6.4451154125E+000		9.1391269568E+000		0.599	1.728	1.516
	22.506	0.436	186.962	0.402	2.1036495177E+001	
7.7156530350E+000		9.2443957104E+000		0.643	1.663	1.605
	22.610	0.468	187.005	0.447	2.1968309325E+001	
8.4293144209E+000		8.9811683545E+000		0.664	1.640	1.658
	22.692	0.498	187.045	0.435	2.2710094184E+001	
9.0015977968E+000		7.3552825105E+000		0.679	1.629	1.694
	22.760	0.513	187.070	0.461	2.3115390074E+001	
9.3075673861E+000		6.3471195286E+000		0.683	1.630	1.712
	22.880	0.554	187.131	0.510	2.3955906098E+001	
9.9761185899E+000		6.6837726519E+000		0.696	1.623	1.733

22.892	0.559	187.138	0.564	2.4036444237E+001	
1.0042362685E+001	6.6572967822E+000		0.697	1.622	1.733
23.069	0.623	187.238	0.552	2.5225958865E+001	
1.1051409001E+001	5.7271510154E+000		0.718	1.596	1.729
23.130	0.642	187.269	0.548	2.5555304489E+001	
1.1346346113E+001	5.4393087988E+000		0.722	1.585	1.718
23.306	0.702	187.368	0.556	2.6547858482E+001	
1.2234843510E+001	5.1599616652E+000		0.736	1.547	1.674
23.342	0.713	187.387	0.512	2.6727463561E+001	
1.2396039377E+001	4.9697178915E+000		0.738	1.539	1.665
23.518	0.759	187.476	0.495	2.7519446344E+001	
1.3085329139E+001	3.4342807996E+000		0.742	1.501	1.613
23.542	0.762	187.486	0.392	2.7596784181E+001	
1.3150829540E+001	3.2515239427E+000		0.741	1.497	1.607
23.550	0.763	187.489	0.411	2.7624097669E+001	
1.3173669297E+001	3.2309461758E+000		0.741	1.496	1.605
23.726	0.788	187.562	0.410	2.8174311266E+001	
1.3591734470E+001	2.5230223346E+000		0.752	1.462	1.562
23.733	0.789	187.564	0.399	2.8190660847E+001	
1.3603218733E+001	2.4996193862E+000		0.752	1.461	1.560
23.909	0.807	187.635	0.395	2.8625334193E+001	
1.3877803078E+001	1.8960271332E+000		0.757	1.429	1.523
23.928	0.808	187.641	0.406	2.8659463591E+001	
1.3896362539E+001	1.8357760448E+000		0.757	1.426	1.520
24.104	0.824	187.714	0.410	2.8982625014E+001	
1.4066768553E+001	1.2713206742E+000		0.758	1.395	1.489
24.116	0.824	187.718	0.431	2.8997100912E+001	
1.4073428184E+001	1.2305261513E+000		0.758	1.393	1.488
24.293	0.840	187.795	0.427	2.9204834526E+001	
1.4182111646E+001	5.0002872001E-001		0.758	1.365	1.462
24.309	0.840	187.800	0.406	2.9211922819E+001	
1.4186504599E+001	4.2603797805E-001		0.758	1.363	1.461
24.485	0.847	187.873	0.407	2.9264360401E+001	
1.4240135361E+001	-2.8133778778E-002		0.758	1.343	1.442
24.505	0.847	187.880	0.419	2.9263034480E+001	
1.4244372909E+001	-8.3602767703E-002		0.758	1.341	1.441
24.682	0.852	187.956	0.417	2.9220433437E+001	
1.4279313641E+001	-3.9687944586E-001		0.759	1.325	1.425
24.715	0.852	187.968	0.425	2.9206277099E+001	
1.4283658372E+001	-4.5264363982E-001		0.759	1.323	1.423
24.891	0.859	188.045	0.427	2.9101596307E+001	
1.4297802780E+001	-6.1934437996E-001		0.759	1.312	1.408
24.921	0.859	188.056	0.426	2.9083215099E+001	
1.4297869902E+001	-6.4429303439E-001		0.759	1.311	1.406
25.097	0.865	188.132	0.426	2.8947787973E+001	
1.4285940161E+001	-7.1848632573E-001		0.758	1.303	1.393
25.123	0.865	188.142	0.421	2.8929461955E+001	
1.4282821001E+001	-7.2756105384E-001		0.758	1.302	1.391
25.299	0.871	188.217	0.421	2.8781472080E+001	
1.4250440036E+001	-7.5617850397E-001		0.757	1.296	1.379
25.324	0.870	188.227	0.424	2.8763121914E+001	
1.4245584010E+001	-7.6339905218E-001		0.756	1.296	1.377
25.501	0.876	188.303	0.430	2.8604739570E+001	
1.4200849590E+001	-8.9474871504E-001		0.754	1.290	1.366



25.523	0.877	188.312	0.424	2.8584993148E+001	
1.4194932817E+001	-8.9841045415E-001		0.754	1.290	1.364
25.699	0.882	188.387	0.417	2.8420803294E+001	
1.4145637329E+001	-8.0676766428E-001		0.752	1.285	1.353
25.722	0.881	188.395	0.409	2.8402526932E+001	
1.4140137212E+001	-8.1026943780E-001		0.751	1.285	1.352
25.899	0.884	188.469	0.409	2.8233005456E+001	
1.4090622016E+001	-8.4882259065E-001		0.749	1.280	1.341
25.921	0.883	188.477	0.411	2.8214046270E+001	
1.4085237497E+001	-8.5553939593E-001		0.749	1.280	1.340
26.098	0.886	188.551	0.411	2.8034140205E+001	
1.4033654435E+001	-8.9984686287E-001		0.747	1.275	1.328
26.121	0.885	188.559	0.412	2.8013484153E+001	
1.4027783969E+001	-9.2341131221E-001		0.747	1.275	1.327
26.220	0.888	188.601	0.419	2.7905586895E+001	
1.3995459727E+001	-1.0864748693E+000		0.745	1.272	1.321
26.320	0.889	188.642	0.432	2.7797209577E+001	
1.3961676540E+001	-1.1315301027E+000		0.744	1.269	1.314
26.497	0.896	188.720	0.436	2.7582331909E+001	
1.3888840087E+001	-1.0791911740E+000		0.741	1.264	1.302
26.519	0.896	188.729	0.447	2.7558071050E+001	
1.3880076496E+001	-1.0928341398E+000		0.741	1.263	1.300
26.696	0.905	188.809	0.453	2.7322214425E+001	
1.3789855043E+001	-1.2997840294E+000		0.738	1.258	1.288
26.718	0.905	188.819	0.429	2.7293438616E+001	
1.3778281255E+001	-1.3034646673E+000		0.737	1.257	1.286
26.894	0.909	188.895	0.428	2.7051777271E+001	
1.3679878954E+001	-1.1853002394E+000		0.733	1.252	1.275
26.917	0.910	188.904	0.407	2.7025699952E+001	
1.3669062889E+001	-1.1806553616E+000		0.733	1.252	1.274
27.093	0.909	188.975	0.399	2.6791298426E+001	
1.3572738072E+001	-1.2200502504E+000		0.729	1.248	1.264
27.115	0.908	188.983	0.412	2.6764861112E+001	
1.3561961943E+001	-1.2354478346E+000		0.729	1.247	1.263
27.292	0.909	189.057	0.412	2.6505873414E+001	
1.3456896811E+001	-1.3062873565E+000		0.725	1.243	1.253
27.315	0.908	189.066	0.400	2.6476115761E+001	
1.3444983762E+001	-1.3325877026E+000		0.725	1.243	1.252
27.400	0.908	189.101	0.424	2.6347652329E+001	
1.3392582196E+001	-1.5617277188E+000		0.723	1.240	1.247
27.515	0.910	189.150	0.447	2.6159917301E+001	
1.3313995042E+001	-1.7063342432E+000		0.720	1.237	1.240
27.691	0.917	189.231	0.447	2.5839505414E+001	
1.3173733368E+001	-1.6407300706E+000		0.715	1.230	1.228
27.717	0.917	189.241	0.436	2.5797935967E+001	
1.3154853605E+001	-1.6662318754E+000		0.715	1.229	1.226
27.893	0.921	189.319	0.440	2.5442188712E+001	
1.2987181852E+001	-1.8300945707E+000		0.709	1.220	1.215
27.921	0.921	189.331	0.433	2.5392320504E+001	
1.2962896655E+001	-1.8901166508E+000		0.708	1.219	1.213
28.098	0.922	189.407	0.434	2.4958528305E+001	
1.2749639852E+001	-2.3118100869E+000		0.701	1.208	1.202
28.119	0.922	189.417	0.441	2.4908209880E+001	
1.2724753002E+001	-2.2949069562E+000		0.700	1.206	1.201

28.296	0.922	189.495	0.442	2.4501377131E+001	
1.2524870853E+001	-2.1184592938E+000		0.693	1.196	1.192
28.316	0.922	189.503	0.449	2.4459751278E+001	
1.2504530007E+001	-2.1577449653E+000		0.693	1.194	1.191
28.492	0.921	189.583	0.443	2.3984384674E+001	
1.2275822302E+001	-2.4094368608E+000		0.685	1.183	1.183
28.510	0.920	189.590	0.427	2.3941404520E+001	
1.2255435571E+001	-2.4391083867E+000		0.685	1.182	1.183
28.687	0.914	189.666	0.424	2.3409663885E+001	
1.2002404633E+001	-2.7177643327E+000		0.677	1.171	1.174
28.707	0.912	189.673	0.366	2.3354338866E+001	
1.1976265940E+001	-2.6969618911E+000		0.677	1.170	1.173
28.740	0.908	189.685	0.446	2.3265186910E+001	
1.1934165462E+001	-2.8586447120E+000		0.675	1.168	1.172
28.905	0.905	189.761	0.476	2.2679471173E+001	
1.1647143640E+001	-3.7788884638E+000		0.667	1.158	1.163
29.081	0.905	189.848	0.485	2.1971342843E+001	
1.1285562392E+001	-3.8340328123E+000		0.655	1.144	1.151
29.107	0.903	189.859	0.508	2.1873839272E+001	
1.1234014049E+001	-3.9078503491E+000		0.654	1.142	1.150
29.283	0.906	189.950	0.509	2.1062968674E+001	
1.0794880532E+001	-4.3724253685E+000		0.639	1.125	1.138
29.317	0.904	189.966	0.496	2.0915252178E+001	
1.0712687298E+001	-4.4905030651E+000		0.636	1.121	1.136
29.494	0.902	190.055	0.498	1.9975855063E+001	
1.0183629616E+001	-4.5432442593E+000		0.617	1.098	1.124
29.543	0.900	190.079	0.509	1.9761639683E+001	
1.0061203487E+001	-4.6173924396E+000		0.612	1.092	1.122
29.719	0.891	190.170	0.514	1.8762585141E+001	
9.4926826495E+000	-5.9087512712E+000		0.592	1.067	1.115
29.739	0.890	190.180	0.527	1.8646786127E+001	
9.4270887976E+000	-6.0056547231E+000		0.589	1.065	1.114
29.915	0.873	190.273	0.531	1.7476045243E+001	
8.7693210135E+000	-7.0709454969E+000		0.566	1.040	1.111
29.927	0.872	190.279	0.545	1.7396606025E+001	
8.7251523224E+000	-7.1152978099E+000		0.564	1.039	1.111
30.103	0.845	190.375	0.546	1.6094698512E+001	
8.0052942226E+000	-7.3193159545E+000		0.538	1.020	1.111
30.104	0.845	190.376	0.614	1.6085156396E+001	
8.0000765205E+000	-7.3288628392E+000		0.538	1.019	1.111
30.281	0.818	190.485	0.610	1.4553675295E+001	
7.1688155528E+000	-8.0158217731E+000		0.506	1.007	1.117
30.296	0.815	190.493	0.598	1.4434685075E+001	
7.1049923313E+000	-8.0108889987E+000		0.504	1.007	1.118
30.472	0.774	190.599	0.601	1.2914343118E+001	
6.2959706086E+000	-8.0334239873E+000		0.472	1.003	1.128
30.476	0.773	190.601	0.627	1.2885030135E+001	
6.2804795475E+000	-8.0376495235E+000		0.472	1.003	1.128
30.652	0.724	190.712	0.630	1.1327956993E+001	
5.4632952713E+000	-9.0509644170E+000		0.438	1.008	1.144
30.665	0.721	190.721	0.680	1.1208505851E+001	
5.4007581427E+000	-9.0698520090E+000		0.435	1.009	1.145
30.842	0.671	190.841	0.677	9.6034787217E+000	
4.5663468288E+000	-8.3110131657E+000		0.397	1.025	1.168

30.865	0.664	190.856	0.644	9.4137920285E+000	
4.4682695475E+000	-8.1891908008E+000		0.392	1.027	1.172
30.950	0.633	190.911	0.746	8.7222986875E+000	
4.1111452689E+000	-8.6559397004E+000		0.375	1.038	1.185
31.090	0.603	191.024	0.826	7.3868448063E+000	
3.4222784184E+000	-9.3522906723E+000		0.336	1.065	1.215
31.266	0.568	191.172	0.825	5.7779924818E+000	
2.6007044950E+000	-7.8110036997E+000		0.282	1.109	1.262
31.299	0.558	191.196	0.822	5.5307939197E+000	
2.4759732927E+000	-7.6162069970E+000		0.273	1.118	1.271
31.476	0.517	191.344	0.826	4.1419243726E+000	
1.7915685448E+000	-6.7579137611E+000		0.220	1.174	1.331
31.500	0.509	191.362	0.756	3.9797806797E+000	
1.7133695925E+000	-6.5995649973E+000		0.214	1.181	1.339
31.676	0.448	191.496	0.753	2.8195243377E+000	
1.1578419195E+000	-5.7648143669E+000		0.162	1.238	1.398
31.696	0.441	191.509	0.801	2.7110653552E+000	
1.1081156349E+000	-5.6921175168E+000		0.158	1.246	1.407
31.872	0.384	191.652	0.827	1.6820528181E+000	
6.5865073979E-001	-6.3238724355E+000		0.107	1.317	1.482
31.892	0.380	191.672	0.866	1.5524426245E+000	
6.0355052371E-001	-6.2042102558E+000		0.100	1.331	1.497
32.069	0.324	191.823	0.824	7.2786813294E-001	
2.6929758877E-001	-3.6385480275E+000		0.052	1.435	1.607
32.109	0.304	191.851	0.824	5.9002827191E-001	
2.1669089141E-001	-3.3901430004E+000		0.044	1.461	1.635

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#### LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 ht(m) : Altezza linea di thrust da nodo sinistro base concio  
 yt(m) : coordinata Y linea di trust  
 yt'(-) : gradiente pendenza locale linea di trust  
 E(x)(kN/m) : Forza Normale interconcio  
 T(x)(kN/m) : Forza Tangenziale interconcio  
 E' (kN) : derivata Forza normale interconcio  
 Rho(x) (-) : fattore mobilizzazione resistenza al taglio verticale interconcio  
 ZhU et al.(2003)  
 FS\_FEM(x) (-) : fattore di sicurezza locale stimato (locale in X) by qFEM  
 FS\_SRM(x) (-) : fattore di sicurezza locale stimato (locale in X) by SRM  
 Procedure

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#### TABELLA SFORZI DI TAGLIO DISTRIBUITI LUNGO SUPERFICIE INDIVIDUATA CON MINOR FS

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X	dx	dl	alpha	TauStress	TauF
TauStrength (m)	(m)	(m)	(°)	(kPa)	(kN/m)
(kPa)					
(kN/m)					

16.255	20.645	0.005	0.005	-11.799	-0.002	-0.000
	0.078					
8.245	20.650	0.176	0.180	-11.799	-0.330	-0.060
	1.486					
8.895	20.826	0.084	0.085	-11.799	-0.811	-0.069
	0.760					
9.640	20.910	0.176	0.180	-11.799	-1.292	-0.233
	1.737					
10.848	21.086	0.084	0.085	-11.799	-1.773	-0.151
	0.926					
12.023	21.170	0.176	0.180	-11.799	-1.939	-0.349
	2.167					
12.772	21.346	0.029	0.029	-11.799	-1.952	-0.057
	0.372					
12.795	21.375	0.176	0.179	-10.546	-1.692	-0.304
	2.296					
13.932	21.551	0.168	0.171	-10.546	-1.702	-0.291
	2.379					
14.353	21.719	0.176	0.178	-7.803	-1.100	-0.196
	2.556					
14.687	21.896	0.055	0.055	-7.803	-1.095	-0.061
	0.813					
14.948	21.950	0.020	0.020	-4.409	-0.336	-0.007
	0.293					
15.788	21.970	0.173	0.173	-4.409	-0.377	-0.065
	2.738					
16.219	22.143	0.176	0.176	-0.192	0.844	0.149
	2.861					
16.411	22.319	0.013	0.013	-0.192	0.922	0.012
	0.216					
16.572	22.332	0.173	0.173	3.130	2.202	0.382
	2.873					
16.607	22.506	0.104	0.105	6.456	3.746	0.394
	1.745					
17.177	22.610	0.082	0.083	6.456	3.979	0.329
	1.421					
16.571	22.692	0.068	0.069	9.277	5.358	0.368
	1.139					
17.247	22.760	0.120	0.122	9.277	5.642	0.686
	2.097					
17.584	22.880	0.012	0.012	9.277	5.841	0.072
	0.216					
17.641	22.892	0.176	0.180	11.431	7.122	1.282
	3.175					
18.137	23.069	0.061	0.063	11.431	7.519	0.470
	1.134					
18.507	23.130	0.176	0.181	12.527	8.465	1.530
	3.344					
18.978	23.306	0.035	0.036	12.527	8.834	0.321
	0.689					
19.156	23.342	0.176	0.182	13.810	9.885	1.796
	3.480					
19.558	23.518	0.023	0.024	13.810	10.247	0.248
	0.473					

	23.542	0.008	0.009	15.180	11.053	0.097
19.361	0.169					
	23.550	0.176	0.183	15.180	11.150	2.038
19.468	3.559					
	23.726	0.007	0.007	15.180	11.234	0.076
19.553	0.132					
	23.733	0.176	0.184	16.568	12.057	2.219
19.383	3.568					
	23.909	0.019	0.019	16.568	12.138	0.235
19.477	0.378					
	23.928	0.176	0.185	17.868	12.895	2.390
19.321	3.581					
	24.104	0.012	0.012	17.868	12.963	0.160
19.406	0.239					
	24.116	0.176	0.187	19.163	13.685	2.556
19.227	3.591					
	24.293	0.016	0.017	19.163	13.744	0.236
19.305	0.331					
	24.309	0.176	0.188	20.366	14.390	2.708
19.126	3.599					
	24.485	0.020	0.022	20.366	14.436	0.312
19.177	0.414					
	24.505	0.176	0.190	21.446	14.993	2.842
19.004	3.602					
	24.682	0.033	0.036	21.446	15.029	0.536
19.042	0.680					
	24.715	0.176	0.190	21.489	15.084	2.860
19.070	3.616					
	24.891	0.029	0.032	21.489	15.119	0.479
19.108	0.605					
	24.921	0.176	0.190	21.534	15.174	2.878
19.137	3.629					
	25.097	0.026	0.028	21.534	15.207	0.421
19.172	0.531					
	25.123	0.176	0.190	21.578	15.261	2.895
19.198	3.642					
	25.299	0.025	0.027	21.578	15.294	0.405
19.227	0.510					
	25.324	0.176	0.190	21.624	15.348	2.912
19.253	3.654					
	25.501	0.022	0.024	21.624	15.379	0.365
19.281	0.458					
	25.523	0.176	0.190	21.669	15.431	2.929
19.300	3.664					
	25.699	0.023	0.025	21.669	15.462	0.385
19.321	0.481					
	25.722	0.176	0.190	21.713	15.514	2.946
19.343	3.673					
	25.899	0.023	0.024	21.713	15.545	0.380
19.363	0.474					
	25.921	0.176	0.190	21.757	15.596	2.962
19.387	3.682					
	26.098	0.023	0.025	21.757	15.626	0.393
19.407	0.488					

	26.121	0.099	0.107	21.802	15.666	1.669
19.423	2.070					
	26.220	0.100	0.108	21.802	15.695	1.692
19.448	2.097					
	26.320	0.176	0.190	21.910	15.786	3.002
19.470	3.702					
	26.497	0.023	0.025	21.910	15.814	0.390
19.490	0.480					
	26.519	0.176	0.190	22.017	15.893	3.024
19.508	3.712					
	26.696	0.022	0.024	22.017	15.919	0.382
19.531	0.468					
	26.718	0.176	0.190	22.125	15.997	3.046
19.536	3.720					
	26.894	0.022	0.024	22.125	16.021	0.388
19.546	0.474					
	26.917	0.176	0.191	22.233	16.097	3.068
19.554	3.727					
	27.093	0.022	0.024	22.233	16.121	0.382
19.565	0.463					
	27.115	0.176	0.191	22.342	16.195	3.089
19.577	3.734					
	27.292	0.023	0.025	22.342	16.217	0.406
19.583	0.490					
	27.315	0.085	0.092	22.450	16.281	1.501
19.586	1.806					
	27.400	0.115	0.124	22.450	16.301	2.026
19.612	2.437					
	27.515	0.176	0.191	22.557	16.382	3.129
19.631	3.750					
	27.691	0.026	0.028	22.557	16.401	0.457
19.638	0.547					
	27.717	0.176	0.191	22.662	16.469	3.148
19.663	3.759					
	27.893	0.028	0.030	22.662	16.487	0.495
19.667	0.590					
	27.921	0.176	0.192	23.234	16.770	3.220
19.619	3.766					
	28.098	0.022	0.024	23.234	16.779	0.401
19.614	0.468					
	28.119	0.176	0.193	23.826	17.056	3.289
19.503	3.761					
	28.296	0.020	0.022	23.826	17.056	0.370
19.485	0.423					
	28.316	0.176	0.194	24.428	17.321	3.356
19.411	3.761					
	28.492	0.018	0.020	24.428	17.312	0.343
19.374	0.384					
	28.510	0.176	0.195	25.021	17.556	3.418
19.304	3.758					
	28.687	0.021	0.023	25.021	17.538	0.399
19.258	0.438					
	28.707	0.033	0.036	25.634	17.793	0.647
19.136	0.696					

19.210	28.740	0.165	0.183	25.634	17.764	3.242
	3.506					
19.122	28.905	0.176	0.197	26.225	17.950	3.530
	3.760					
19.087	29.081	0.026	0.029	26.225	17.910	0.511
	0.545					
19.056	29.107	0.176	0.198	26.788	18.086	3.574
	3.766					
19.002	29.283	0.034	0.038	26.788	18.034	0.689
	0.726					
19.010	29.317	0.176	0.199	27.293	18.169	3.607
	3.774					
18.840	29.494	0.050	0.056	27.293	18.102	1.009
	1.050					
18.560	29.543	0.176	0.203	29.537	18.793	3.810
	3.763					
18.537	29.719	0.020	0.022	29.537	18.690	0.419
	0.416					
18.087	29.739	0.176	0.208	32.148	19.318	4.025
	3.769					
18.074	29.915	0.011	0.013	32.148	19.165	0.253
	0.239					
17.499	29.927	0.176	0.215	34.904	19.601	4.216
	3.764					
17.369	30.103	0.001	0.002	34.904	19.395	0.031
	0.028					
17.036	30.104	0.176	0.222	37.435	19.564	4.346
	3.785					
16.730	30.281	0.015	0.019	37.435	19.278	0.363
	0.315					
16.247	30.296	0.176	0.230	39.831	19.198	4.410
	3.732					
15.962	30.472	0.004	0.005	39.831	18.868	0.090
	0.076					
15.541	30.476	0.176	0.238	42.077	18.606	4.422
	3.694					
15.434	30.652	0.013	0.018	42.077	18.194	0.323
	0.274					
14.898	30.665	0.176	0.245	43.952	17.751	4.350
	3.651					
14.496	30.842	0.023	0.032	43.952	17.259	0.554
	0.465					
14.093	30.865	0.085	0.121	45.429	16.939	2.055
	1.710					
14.229	30.950	0.140	0.200	45.429	16.331	3.259
	2.839					
13.682	31.090	0.176	0.255	46.164	15.425	3.929
	3.485					
13.084	31.266	0.033	0.047	46.164	14.836	0.700
	0.617					
12.782	31.299	0.176	0.258	46.961	14.182	3.666
	3.304					
12.254	31.476	0.025	0.036	46.961	13.589	0.489
	0.441					

11.915	31.500	0.176	0.262	47.773	12.924	3.393
	3.128					
11.460	31.676	0.019	0.028	47.773	12.322	0.350
	0.326					
11.124	31.696	0.176	0.267	48.578	11.642	3.104
	2.966					
11.012	31.872	0.020	0.031	48.578	11.009	0.338
	0.338					
10.284	31.892	0.176	0.272	49.566	10.278	2.796
	2.797					
9.773	32.069	0.041	0.062	49.566	9.544	0.596
	0.611					
9.432	32.109	0.176	0.276	50.331	8.734	2.414
	2.607					

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 LEGENDA SIMBOLI

X(m) : Ascissa sinistra concio  
 dx(m) : Larghezza concio  
 dl(m) : lunghezza base concio  
 alpha(°) : Angolo pendenza base concio  
 TauStress(kPa) : Sforzo di taglio su base concio  
 TauF (kN/m) : Forza di taglio su base concio  
 TauStrength(kPa) : Resistenza al taglio su base concio  
 TauS (kN/m) : Forza resistente al taglio su base concio

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Strato 1 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso  
 stimati secondo criterio di rottura non lineare Hoek et al.(2002)  
 CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)  
 Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	137.42	58.47	69.19
50.00	186.72	55.52	76.58
75.00	229.23	53.43	82.28
100.00	269.97	51.71	89.32
125.00	307.76	50.29	95.71
150.00	344.72	49.03	103.03
175.00	380.39	47.92	110.48
200.00	414.33	46.95	117.39
225.00	446.12	46.09	123.16
250.00	479.13	45.26	131.05
275.00	509.50	44.53	137.06
300.00	540.87	43.82	144.79
325.00	569.14	43.21	149.99
350.00	598.21	42.61	156.59
375.00	628.07	42.02	164.54
400.00	654.32	41.52	169.27



425.00	685.72	40.95	179.76
450.00	708.67	40.55	181.95
475.00	736.79	40.07	189.88
500.00	760.71	39.67	193.83
600.00	866.21	38.06	223.16
700.00	957.87	36.80	242.59
800.00	1049.54	35.65	265.80
900.00	1140.54	34.60	291.52
1000.00	1223.57	33.71	311.63
1100.00	1303.83	32.91	331.24
1200.00	1387.74	32.12	356.93
1300.00	1460.58	31.47	372.79
1400.00	1536.19	30.83	393.39
1500.00	1614.69	30.20	418.74
2000.00	1960.39	27.76	515.66

Strato 2 -- Parametri di resistenza al taglio equivalenti dell'ammasso roccioso

stimati secondo criterio di rottura non lineare Hoek et

al.(2002)

CRITERIO DI ROTTURA Hoek et al.(2002,2006) - Generalizzato secondo Lei et al.(2016)

Fattore di riduzione NTC2018 gammaPHI=1.25 e gammaC=1.25 - ATTIVATO

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SigmaN'(kPa)	TauSrength(kPa)	Phi'(deg)	c'(kPa)
25.00	696.24	60.38	513.03
50.00	756.64	59.62	520.01
75.00	806.42	59.04	520.13
100.00	857.50	58.47	523.03
125.00	909.85	57.91	528.58
150.00	949.97	57.49	524.59
175.00	1004.57	56.95	534.68
200.00	1046.36	56.55	534.32
225.00	1103.20	56.03	548.62
250.00	1146.67	55.64	551.63
275.00	1190.86	55.26	556.09
300.00	1235.77	54.89	561.97
325.00	1281.40	54.52	569.22
350.00	1327.76	54.15	577.81
375.00	1359.06	53.91	572.83
400.00	1406.61	53.55	583.74
425.00	1454.89	53.20	595.90
450.00	1487.48	52.96	593.65
475.00	1536.97	52.61	607.98
500.00	1570.37	52.38	607.39
600.00	1724.68	51.37	628.85
700.00	1885.62	50.39	662.51
800.00	2034.30	49.55	689.13
900.00	2188.33	48.73	725.29
1000.00	2327.55	48.02	750.56
1100.00	2450.22	47.43	762.64
1200.00	2597.27	46.75	801.99
1300.00	2726.73	46.18	826.48

1400.00	2859.39	45.62	856.64
1500.00	2972.41	45.17	869.25
2000.00	3572.08	42.95	995.66