

COMMITTENTE:



ALTA SORVEGLIANZA:



GENERAL CONTRACTOR:



**INFRASTRUTTURE FERROVIARIE STRATEGICHE DEFINITE DALLA  
LEGGE OBIETTIVO N. 443/01  
LINEA A.V. /A.C. TORINO – VENEZIA Tratta MILANO – VERONA  
Lotto Funzionale Brescia-Verona  
PROGETTO DEFINITIVO**

**AREA DI CAVA BS3A - MONTICHIARI** IL PROGETTISTA

**ALLEGATO 5 ALLA RELAZIONE TECNICA**

**Verifiche di stabilità delle scarpate**

G.T. ENGINEERING s.r.l.  
Ing. Maurizio Ghizzoni  
Ordine degli Ingegneri della  
Provincia di Parma n° 631

IL PROGETTISTA INTEGRATORE

saipem spa  
Tommaso Taranta  
Dottore in Ingegneria Civile Iscritto all'albo  
degli Ingegneri della Provincia di Milano  
al n. A23408 - Sez. A Settori:  
a) civile e ambientale b) industriale c) dell'informazione  
Tel. 02.52020537 - Fax 02.52020309  
C.F. e P.IVA 00825790157

ALTA SORVEGLIANZA



Verificato	Data	Approvato	Data

COMMESSA    LOTTO    FASE    ENTE    TIPO DOC.    OPERA/DISCIPLINA    PROGR.    REV.

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PROGETTAZIONE GENERAL CONTRACTOR									Autorizzato/Data
Rev.	Data	Descrizione	Redatto	Data	Verificato	Data	Approvato	Data	Consorzio <b>Cepav due</b> Project Director (Ing. F. Lombardi) Data: _____
0	31.03.14	Emissione per CdS	TRAMELLI	31.03.14	GHIZZONI	31.03.14	LAZZARI	31.03.14	

SAIPEM S.p.a. COMM. 032121

Data: 31.03.14

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Progetto cofinanziato  
dalla Unione Europea

CUP: F81H91000000008



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**Vertici profilo**

N	X (m)	y (m)
1	0.0	0.0
2	30.0	0.0
3	36.43	4.5
4	40.43	4.5
5	51.85	12.5
6	55.85	12.5
7	67.28	20.5
8	100.0	20.5

**Falda**

Nr.	X (m)	y (m)
1	0.0	-8.0
2	100.0	-8.0

**Vertici strato .....1**

N	X (m)	y (m)
1	0.0	0.0
2	30.0	0.0
3	36.43	4.5
4	40.43	4.5
5	51.85	12.5
6	55.85	12.5
7	66.57	20.0
8	100.0	20.0

**Stratigrafia**

c: coesione; Fi: Angolo di attrito; G: Peso Specifico; Gs: Peso Specifico Saturo; K: Modulo di Winkler

Strato	c (kg/cm <sup>2</sup> )	Fi (°)	G (Kg/m <sup>3</sup> )	Gs (Kg/m <sup>3</sup> )	K (Kg/cm <sup>3</sup> )	Litologia	
1	0	18	1650	1800	0.00		Terreno vegetale
2	0	45	1950	2150	0.00		Ghiaia

**Risultati analisi pendio**

Fs minimo individuato	1.66	
Ascissa centro superficie	(m)	35.43
Ordinata centro superficie	(m)	31.32

Raggio superficie (m) 26.07

B: Larghezza del concio; Alfa: Angolo di inclinazione della base del concio; Li: Lunghezza della base del concio; Wi: Peso del concio ; Ui: Forze derivanti dalle pressioni neutre; Ni: forze agenti normalmente alla direzione di scivolamento; Ti: forze agenti parallelamente alla superficie di scivolamento; Ei, Ei-1: Forze agenti normalmente alle facce del concio; Xi, Xi-1: Forze di tipo tagliante applicate sulle facce laterali .

**Analisi dei conci; superficie...xc = 35.427 yc = 31.323 Rc = 26.073 Fs=1.66**

Nr.	B (m)	Alfa (°)	Li (m)	Wi (Kg)
1	0.51	17.91	0.54	98.71
2	0.51	19.1	0.54	287.24
3	0.51	20.3	0.55	463.72
4	0.51	21.51	0.55	627.89
5	0.51	22.73	0.56	779.45
6	0.51	23.96	0.56	918.04
7	0.51	25.2	0.57	1043.33
8	0.51	26.46	0.57	1154.89
9	0.51	27.73	0.58	1252.29
10	0.51	29.01	0.59	1335.04
11	0.51	30.31	0.6	1402.58
12	0.51	31.63	0.6	1454.36
13	0.51	32.97	0.61	1489.65
14	0.51	34.32	0.62	1507.74
15	0.51	35.7	0.63	1507.77
16	0.51	37.11	0.64	1488.83
17	0.44	38.43	0.56	1237.25
18	0.59	39.89	0.77	1364.2
19	0.51	41.49	0.69	711.63
20	0.51	43.01	0.7	243.63

**Sforzi sui conci**

Nr.	Xi (Kg)	Ei (Kg)	Xi-1 (Kg)	Ei-1 (Kg)	N'i (Kg)	Ti (Kg)	Ui (Kg)
1	-4.44	24.11	0.0	0.0	90.73	54.66	0.0
2	-35.44	91.56	-4.44	24.11	278.64	167.86	0.0
3	-87.05	189.56	-35.44	91.56	449.34	270.68	0.0
4	-150.35	305.93	-87.05	189.56	600.39	361.68	0.0
5	-218.14	430.1	-150.35	305.93	733.48	441.86	0.0
6	-284.79	552.88	-218.14	430.1	849.99	512.04	0.0
7	-345.94	666.34	-284.79	552.88	951.05	572.92	0.0
8	-398.41	763.69	-345.94	666.34	1037.56	625.03	0.0
9	-440.01	839.23	-398.41	763.69	1110.21	668.8	0.0
10	-469.36	888.23	-440.01	839.23	1169.46	704.49	0.0
11	-485.87	906.97	-469.36	888.23	1215.68	732.34	0.0
12	-489.53	892.7	-485.87	906.97	1248.97	752.39	0.0
13	-480.84	843.63	-489.53	892.7	1269.25	764.61	0.0

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14	-460.77	759.05	-480.84	843.63	1276.37	768.9	0.0
15	-430.59	639.27	-460.77	759.05	1269.83	764.96	0.0
16	-391.93	485.87	-430.59	639.27	1249.13	752.49	0.0
17	-350.2	331.46	-391.93	485.87	1032.57	622.03	0.0
18	-217.77	140.34	-350.2	331.46	1067.74	643.22	0.0
19	-72.4	36.22	-217.77	140.34	493.18	297.1	0.0
20	0.0	0.0	-72.4	36.22	149.92	90.31	0.0

Numero di superfici esaminate....(221)

N°	Xo	Yo	Ro	Fs
1	34.3	21.5	19.3	19.99
2	35.4	22.4	20.2	2.22
3	36.6	21.5	19.3	19.99
4	37.7	22.4	20.2	19.99
5	38.9	21.5	19.3	2.48
6	40.1	22.4	26.3	3.10
7	41.2	21.5	25.4	3.18
8	42.4	22.4	26.3	3.17
9	43.6	21.5	25.4	3.29
10	44.7	22.4	14.1	2.17
11	45.9	21.5	13.2	19.99
12	47.0	22.4	14.1	19.99
13	48.2	21.5	22.3	3.34
14	49.4	22.4	14.1	2.83
15	50.5	21.5	13.2	19.99
16	51.7	22.4	11.0	19.99
17	52.8	21.5	10.1	3.05
18	54.0	22.4	14.1	2.94
19	55.2	21.5	13.2	3.11
20	56.3	22.4	17.1	3.66
21	57.5	21.5	22.3	4.69
22	34.3	23.3	21.1	19.99
23	35.4	24.1	21.9	19.99
24	36.6	23.3	21.1	19.99
25	37.7	24.1	18.9	19.99
26	38.9	23.3	18.0	19.99
27	40.1	24.1	21.9	2.56
28	41.2	23.3	30.2	3.44
29	42.4	24.1	18.9	19.99
30	43.6	23.3	18.0	19.99
31	44.7	24.1	15.8	19.99
32	45.9	23.3	30.2	3.66
33	47.0	24.1	28.0	3.46
34	48.2	23.3	18.0	2.71
35	49.4	24.1	21.9	2.93
36	50.5	23.3	15.0	19.99
37	51.7	24.1	12.8	19.99
38	52.8	23.3	15.0	2.80

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39	54.0	24.1	21.9	3.56
40	55.2	23.3	21.1	3.79
41	56.3	24.1	21.9	3.98
42	57.5	23.3	21.1	4.26
43	34.3	25.0	32.0	3.57
44	35.4	25.9	23.7	19.99
45	36.6	25.0	19.8	19.99
46	37.7	25.9	20.7	19.99
47	38.9	25.0	32.0	3.37
48	40.1	25.9	20.7	19.99
49	41.2	25.0	28.9	3.01
50	42.4	25.9	20.7	19.99
51	43.6	25.0	16.7	19.99
52	44.7	25.9	29.8	3.21
53	45.9	25.0	16.7	19.99
54	47.0	25.9	32.9	3.71
55	48.2	25.0	16.7	19.99
56	49.4	25.9	32.9	3.94
57	50.5	25.0	13.7	19.99
58	51.7	25.9	32.9	4.24
59	52.8	25.0	13.7	19.99
60	54.0	25.9	26.8	3.84
61	55.2	25.0	16.7	2.91
62	56.3	25.9	32.9	4.96
63	57.5	25.0	28.9	4.82
64	34.3	26.8	33.8	3.49
65	35.4	27.7	28.6	2.53
66	36.6	26.8	30.7	2.92
67	37.7	27.7	25.5	2.42
68	38.9	26.8	21.6	19.99
69	40.1	27.7	34.7	3.33
70	41.2	26.8	21.6	2.21
71	42.4	27.7	22.5	19.99
72	43.6	26.8	21.6	2.34
73	44.7	27.7	22.5	2.36
74	45.9	26.8	21.6	2.43
75	47.0	27.7	28.6	3.09
76	48.2	26.8	27.7	3.20
77	49.4	27.7	28.6	3.30
78	50.5	26.8	21.6	2.74
79	51.7	27.7	28.6	3.55
80	52.8	26.8	15.5	19.99
81	54.0	27.7	19.4	2.76
82	55.2	26.8	33.8	4.75
83	56.3	27.7	13.3	19.99
84	57.5	26.8	15.4	2.41
85	34.3	28.6	26.4	19.99
86	35.4	29.5	24.3	19.99
87	36.6	28.6	23.4	19.99
88	37.7	29.5	24.3	19.99
89	38.9	28.6	23.4	19.99
90	40.1	29.5	24.3	19.99

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91	41.2	28.6	23.4	2.22
92	42.4	29.5	21.2	19.99
93	43.6	28.6	20.3	19.99
94	44.7	29.5	33.4	3.16
95	45.9	28.6	20.3	19.99
96	47.0	29.5	36.5	3.67
97	48.2	28.6	35.6	3.79
98	49.4	29.5	21.2	19.99
99	50.5	28.6	29.5	3.41
100	51.7	29.5	21.2	2.52
101	52.8	28.6	20.3	2.63
102	54.0	29.5	24.3	3.18
103	55.2	28.6	20.3	2.92
104	56.3	29.5	27.3	3.89
105	57.5	28.6	13.9	19.99
106	34.3	30.4	28.2	19.99
107	35.4	31.3	26.1	1.66
108	36.6	30.4	28.2	2.36
109	37.7	31.3	38.3	3.28
110	38.9	30.4	25.2	19.99
111	40.1	31.3	32.2	2.60
112	41.2	30.4	31.3	2.67
113	42.4	31.3	29.1	2.45
114	43.6	30.4	25.2	2.26
115	44.7	31.3	23.0	19.99
116	45.9	30.4	22.1	19.99
117	47.0	31.3	23.0	19.99
118	48.2	30.4	28.2	2.80
119	49.4	31.3	23.0	2.34
120	50.5	30.4	34.3	3.75
121	51.7	31.3	23.0	2.54
122	52.8	30.4	28.2	3.33
123	54.0	31.3	26.1	3.20
124	55.2	30.4	19.1	2.31
125	56.3	31.3	38.2	4.84
126	57.5	30.4	37.3	5.04
127	34.3	32.2	36.1	2.83
128	35.4	33.1	40.1	3.29
129	36.6	32.2	27.0	1.88
130	37.7	33.1	27.9	19.99
131	38.9	32.2	27.0	19.99
132	40.1	33.1	34.0	2.59
133	41.2	32.2	39.2	3.35
134	42.4	33.1	34.0	2.73
135	43.6	32.2	23.9	19.99
136	44.7	33.1	24.8	19.99
137	45.9	32.2	27.0	2.34
138	47.0	33.1	24.8	19.99
139	48.2	32.2	30.0	2.82
140	49.4	33.1	37.0	3.61
141	50.5	32.2	20.9	19.99
142	51.7	33.1	37.0	3.89



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143	52.8	32.2	33.1	3.70
144	54.0	33.1	21.8	2.28
145	55.2	32.2	27.0	3.39
146	56.3	33.1	24.5	3.15
147	57.5	32.2	23.3	3.26
148	34.3	34.0	28.8	19.99
149	35.4	34.9	29.7	1.87
150	36.6	34.0	28.8	19.99
151	37.7	34.9	35.8	2.47
152	38.9	34.0	28.8	19.99
153	40.1	34.9	29.7	2.13
154	41.2	34.0	25.7	2.38
155	42.4	34.9	26.6	2.41
156	43.6	34.0	37.9	3.08
157	44.7	34.9	32.7	2.59
158	45.9	34.0	41.0	3.60
159	47.0	34.9	26.6	2.21
160	48.2	34.0	25.7	19.99
161	49.4	34.9	41.9	3.89
162	50.5	34.0	34.9	3.44
163	51.7	34.9	41.9	4.14
164	52.8	34.0	25.7	2.73
165	54.0	34.9	26.6	2.91
166	55.2	34.0	19.6	19.99
167	56.3	34.9	32.3	3.89
168	57.5	34.0	28.1	3.74
169	34.3	35.8	30.6	19.99
170	35.4	36.7	43.7	3.28
171	36.6	35.8	30.6	19.99
172	37.7	36.7	37.6	2.47
173	38.9	35.8	42.8	3.30
174	40.1	36.7	31.5	2.10
175	41.2	35.8	30.6	2.12
176	42.4	36.7	43.7	3.42
177	43.6	35.8	27.5	19.99
178	44.7	36.7	40.6	3.19
179	45.9	35.8	42.8	3.61
180	47.0	36.7	37.6	3.13
181	48.2	35.8	36.7	3.23
182	49.4	36.7	40.6	3.63
183	50.5	35.8	36.7	3.46
184	51.7	36.7	25.4	2.15
185	52.8	35.8	24.5	19.99
186	54.0	36.7	22.3	19.99
187	55.2	35.8	21.1	19.99
188	56.3	36.7	30.8	3.60
189	57.5	35.8	19.9	19.99
190	34.3	37.6	41.5	2.78
191	35.4	38.5	33.2	19.99
192	36.6	37.6	44.5	3.28
193	37.7	38.5	36.3	2.26
194	38.9	37.6	32.3	19.99

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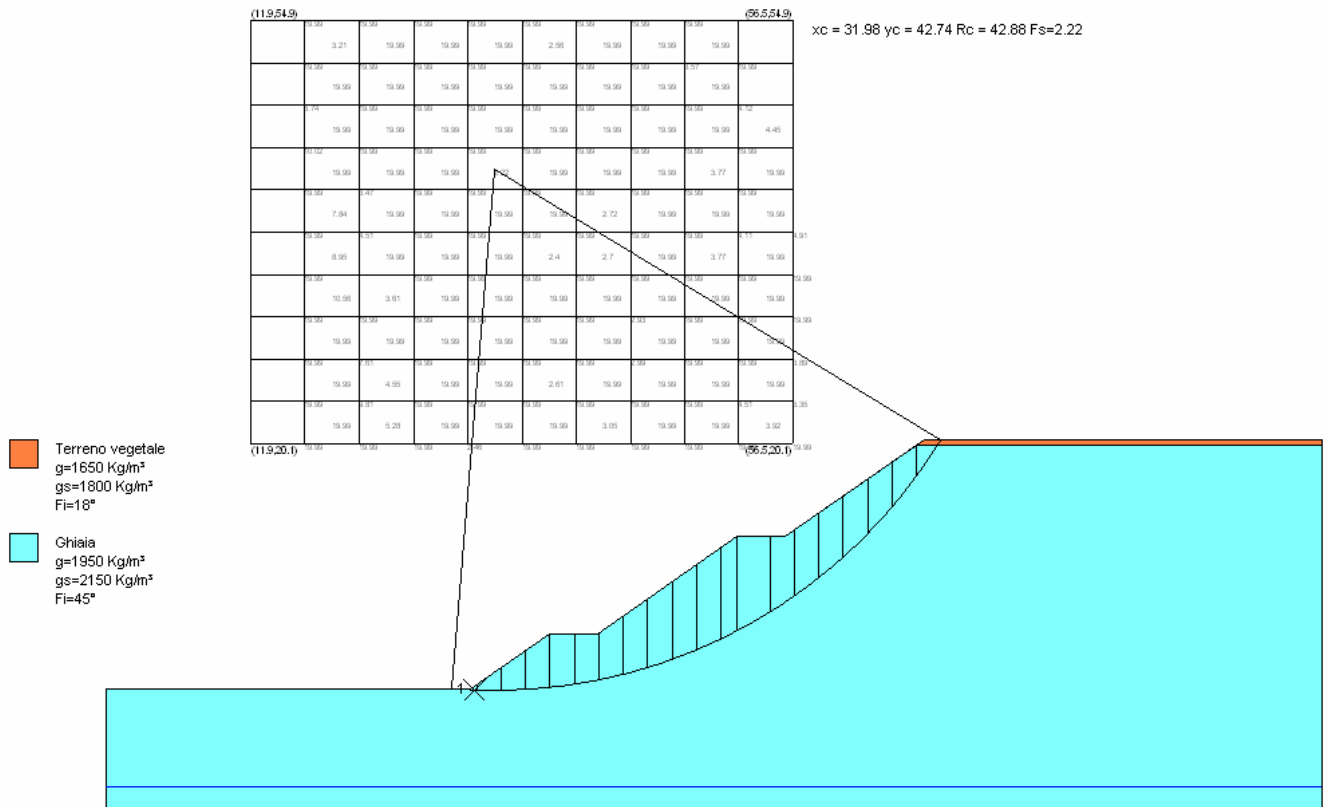
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195	40.1	38.5	30.2	19.99
196	41.2	37.6	38.4	2.68
197	42.4	38.5	30.2	2.18
198	43.6	37.6	35.4	2.55
199	44.7	38.5	42.4	3.21
200	45.9	37.6	29.3	19.99
201	47.0	38.5	30.2	19.99
202	48.2	37.6	44.5	3.81
203	49.4	38.5	39.3	3.38
204	50.5	37.6	35.4	3.14
205	51.7	38.5	39.3	3.63
206	52.8	37.6	23.2	19.99
207	54.0	38.5	23.9	19.99
208	55.2	37.6	44.5	4.61
209	56.3	38.5	34.9	3.86
210	57.5	37.6	30.4	3.69
211	34.3	39.4	34.1	1.96
212	36.6	39.4	40.2	2.42
213	38.9	39.4	34.1	19.99
214	41.2	39.4	46.3	3.41
215	43.6	39.4	31.1	2.09
216	45.9	39.4	31.1	2.19
217	48.2	39.4	28.0	19.99
218	50.5	39.4	28.0	2.12
219	52.8	39.4	25.0	19.99
220	55.2	39.4	24.0	2.00
221	57.5	39.4	31.5	3.66

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**1.2 VERIFICA CON CERCHIO PASSANTE PER IL PIEDE DELLA SCARPATA****Analisi di stabilità dei pendii con SARMA**

=====

Numero di strati            2.0  
 Numero dei conchi        20.0  
 No sisma;  
 Superficie di forma circolare

=====

**Maglia dei Centri**

=====

Ascissa vertice sinistro inferiore xi    (m)    11.93  
 Ordinata vertice sinistro inferiore yi    (m)    20.14  
 Ascissa vertice destro superiore xs    (m)    56.49  
 Ordinata vertice destro superiore ys    (m)    54.91  
 Passo di ricerca            10.0  
 Numero di celle lungo x                10.0  
 Numero di celle lungo y                10.0

=====

**Vertici profilo**

N	X (m)	y (m)
1	0.0	0.0
2	30.0	0.0

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3	36.43	4.5
4	40.43	4.5
5	51.85	12.5
6	55.85	12.5
7	67.28	20.5
8	100.0	20.5

## Falda

Nr.	X (m)	y (m)
1	0.0	-8.0
2	100.0	-8.0

## Vertici strato .....1

N	X (m)	y (m)
1	0.0	0.0
2	30.0	0.0
3	36.43	4.5
4	40.43	4.5
5	51.85	12.5
6	55.85	12.5
7	66.57	20.0
8	100.0	20.0

## Stratigrafia

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c: coesione; Fi: Angolo di attrito; G: Peso Specifico; Gs: Peso Specifico Saturo; K: Modulo di Winkler

=====

Strato	c (kg/cm <sup>2</sup> )	Fi (°)	G (Kg/m <sup>3</sup> )	Gs (Kg/m <sup>3</sup> )	K (Kg/cm <sup>3</sup> )	Litologia	
1	0	18	1650	1800	0.00		Terreno vegetale
2	0	45	1950	2150	0.00		Ghiaia

## Risultati analisi pendio

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Fs minimo individuato	2.22	
Ascissa centro superficie	(m)	31.98
Ordinata centro superficie	(m)	42.74
Raggio superficie	(m)	42.88

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B: Larghezza del concio; Alfa: Angolo di inclinazione della base del concio; Li: Lunghezza della base del concio;  
 Wi: Peso del concio ; Ui: Forze derivanti dalle pressioni neutre; Ni: forze agenti normalmente alla direzione di

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scivolamento; Ti: forze agenti parallelamente alla superficie di scivolamento; Ei, Ei-1: Forze agenti normalmente alle facce del concio; Xi, Xi-1: Forze di tipo tagliante applicate sulle facce laterali .

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Analisi dei conci; superficie... $x_c = 31.984$   $y_c = 42.738$   $R_c = 42.88$   $F_s = 2.22$

Nr.	B (m)	Alfa (°)	Li (m)	Wi (Kg)
1	2.01	-3.33	2.01	275.07
2	2.01	-0.65	2.01	4659.24
3	2.01	2.04	2.01	10065.85
4	1.92	4.67	1.92	14321.08
5	2.1	7.37	2.12	17547.75
6	2.01	10.14	2.04	15556.25
7	2.01	12.88	2.06	17000.09
8	2.01	15.65	2.09	20509.22
9	2.01	18.46	2.12	23605.75
10	2.01	21.31	2.16	26270.49
11	2.01	24.22	2.2	28479.56
12	1.27	26.65	1.43	18992.32
13	2.74	29.71	3.16	37497.88
14	2.01	33.43	2.41	21754.95
15	2.01	36.71	2.5	21044.92
16	2.01	40.14	2.63	20315.98
17	2.01	43.75	2.78	18760.51
18	2.01	47.6	2.98	16224.1
19	2.01	51.75	3.24	12479.66
20	2.01	56.34	3.62	5872.22

Sforzi sui conci

Nr.	Xi (Kg)	Ei (Kg)	Xi-1 (Kg)	Ei-1 (Kg)	N'i (Kg)	Ti (Kg)	Ui (Kg)
1	-7.5	147.59	0.0	0.0	290.67	130.93	0.0
2	-1906.08	3190.72	-7.5	147.59	6591.7	2969.23	0.0
3	-7844.51	9725.01	-1906.08	3190.72	15761.71	7099.87	0.0
4	-15346.68	17487.92	-7844.51	9725.01	21119.32	9513.21	0.0
5	-16883.92	23279.7	-15346.68	17487.92	18184.92	8191.41	0.0
6	-12644.52	26123.13	-16883.92	23279.7	10639.2	4792.44	0.0
7	-13196.12	29651.3	-12644.52	26123.13	16323.32	7352.85	0.0
8	-16754.05	33289.63	-13196.12	29651.3	22193.1	9996.9	0.0
9	-19322.98	35943.17	-16754.05	33289.63	23987.65	10805.25	0.0
10	-20786.39	37364.67	-19322.98	35943.17	25320.12	11405.47	0.0
11	-21159.03	37376.2	-20786.39	37364.67	26306.51	11849.79	0.0
12	-20727.95	36597.95	-21159.03	37376.2	16938.38	7629.91	0.0
13	-15009.37	33558.52	-20727.95	36597.95	29107.4	13111.45	0.0
14	-7841.18	31200.99	-15009.37	33558.52	13472.18	6068.55	0.0
15	-6245.62	26903.15	-7841.18	31200.99	18160.91	8180.6	0.0
16	-4925.49	21495.98	-6245.62	26903.15	18007.59	8111.53	0.0
17	-3533.73	15344.92	-4925.49	21495.98	16799.77	7567.47	0.0
18	-2213.28	8911.54	-3533.73	15344.92	14800.38	6666.84	0.0
19	-1095.81	2995.5	-2213.28	8911.54	11679.61	5261.09	0.0

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20	0.0	0.0	-1095.81	2995.5	5140.42	2315.51	0.0
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Numero di superfici esaminate...(191)

N°	Xo	Yo	Ro	Fs
1	16.4	20.1	24.6	19.99
2	18.6	21.9	24.9	19.99
3	20.8	20.1	22.4	19.99
4	23.1	21.9	23.1	5.28
5	25.3	20.1	20.9	19.99
6	27.5	21.9	22.2	19.99
7	29.8	20.1	20.3	2.46
8	32.0	21.9	22.1	19.99
9	34.2	20.1	20.6	19.99
10	36.4	21.9	22.8	19.99
11	38.7	20.1	21.9	19.99
12	40.9	21.9	24.4	3.05
13	43.1	20.1	24.0	19.99
14	45.4	21.9	26.6	19.99
15	47.6	20.1	26.6	19.99
16	49.8	21.9	29.4	19.99
17	52.0	20.1	29.7	19.99
18	54.3	21.9	32.5	3.92
19	56.5	20.1	33.1	19.99
20	16.4	23.6	27.5	19.99
21	18.6	25.4	28.0	19.99
22	20.8	23.6	25.5	9.81
23	23.1	25.4	26.5	4.55
24	25.3	23.6	24.2	19.99
25	27.5	25.4	25.6	19.99
26	29.8	23.6	23.7	19.99
27	32.0	25.4	25.5	19.99
28	34.2	23.6	24.0	19.99
29	36.4	25.4	26.2	2.61
30	38.7	23.6	25.2	19.99
31	40.9	25.4	27.6	19.99
32	43.1	23.6	27.0	19.99
33	45.4	25.4	29.6	19.99
34	47.6	23.6	29.3	19.99
35	49.8	25.4	32.1	19.99
36	52.0	23.6	32.2	4.51
37	54.3	25.4	35.0	19.99
38	56.5	23.6	35.3	3.35
39	16.4	27.1	30.6	19.99
40	18.6	28.8	31.2	19.99
41	20.8	27.1	28.8	7.61
42	23.1	28.8	29.8	19.99
43	25.3	27.1	27.7	19.99
44	27.5	28.8	29.1	19.99

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45	29.8	27.1	27.2	19.99
46	32.0	28.8	29.0	19.99
47	34.2	27.1	27.5	19.99
48	36.4	28.8	29.6	19.99
49	38.7	27.1	28.5	19.99
50	40.9	28.8	30.8	19.99
51	43.1	27.1	30.1	2.99
52	45.4	28.8	32.6	19.99
53	47.6	27.1	32.2	19.99
54	49.8	28.8	34.9	19.99
55	52.0	27.1	34.8	19.99
56	54.3	28.8	37.6	19.99
57	56.5	27.1	37.8	3.89
58	16.4	30.6	33.7	19.99
59	18.6	32.3	34.5	10.56
60	20.8	30.6	32.1	19.99
61	23.1	32.3	33.2	3.61
62	25.3	30.6	31.1	19.99
63	27.5	32.3	32.5	19.99
64	29.8	30.6	30.7	19.99
65	32.0	32.3	32.5	19.99
66	34.2	30.6	30.9	19.99
67	36.4	32.3	33.0	19.99
68	38.7	30.6	31.8	19.99
69	40.9	32.3	34.1	19.99
70	43.1	30.6	33.2	2.93
71	45.4	32.3	35.7	19.99
72	47.6	30.6	35.2	19.99
73	49.8	32.3	37.8	19.99
74	52.0	30.6	37.6	19.99
75	54.3	32.3	40.3	19.99
76	56.5	30.6	40.3	19.99
77	16.4	34.0	36.9	19.99
78	18.6	35.8	37.8	8.95
79	23.1	35.8	36.6	19.99
80	25.3	34.0	34.5	19.99
81	27.5	35.8	36.0	19.99
82	29.8	34.0	34.2	19.99
83	32.0	35.8	35.9	19.99
84	34.2	34.0	34.4	19.99
85	36.4	35.8	36.4	2.40
86	38.7	34.0	35.2	19.99
87	40.9	35.8	37.4	2.70
88	43.1	34.0	36.5	19.99
89	45.4	35.8	38.9	19.99
90	47.6	34.0	38.3	19.99
91	49.8	35.8	40.8	3.77
92	52.0	34.0	40.5	19.99
93	54.3	35.8	43.2	19.99
94	56.5	34.0	43.0	19.99
95	16.4	37.5	40.1	19.99
96	18.6	39.3	41.1	7.84

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97	20.8	37.5	38.8	4.51
98	23.1	39.3	40.0	19.99
99	25.3	37.5	38.0	19.99
100	27.5	39.3	39.5	19.99
101	29.8	37.5	37.6	19.99
102	32.0	39.3	39.4	19.99
103	34.2	37.5	37.8	19.99
104	36.4	39.3	39.8	19.99
105	38.7	37.5	38.5	19.99
106	40.9	39.3	40.8	2.72
107	43.1	37.5	39.8	19.99
108	45.4	39.3	42.1	19.99
109	47.6	37.5	41.4	19.99
110	49.8	39.3	43.9	19.99
111	52.0	37.5	43.5	4.11
112	54.3	39.3	46.1	19.99
113	56.5	37.5	45.8	4.91
114	16.4	41.0	43.4	19.99
115	18.6	42.7	44.4	19.99
116	20.8	41.0	42.2	3.47
117	23.1	42.7	43.5	19.99
118	25.3	41.0	41.4	19.99
119	27.5	42.7	42.9	19.99
120	29.8	41.0	41.1	19.99
121	32.0	42.7	42.9	2.22
122	34.2	41.0	41.3	19.99
123	36.4	42.7	43.3	19.99
124	38.7	41.0	42.0	19.99
125	40.9	42.7	44.1	19.99
126	43.1	41.0	43.1	19.99
127	45.4	42.7	45.4	19.99
128	47.6	41.0	44.6	19.99
129	49.8	42.7	47.1	3.77
130	52.0	41.0	46.5	19.99
131	54.3	42.7	49.1	19.99
132	16.4	44.5	46.7	10.02
133	18.6	46.2	47.8	19.99
134	20.8	44.5	45.6	19.99
135	23.1	46.2	46.9	19.99
136	25.3	44.5	44.9	19.99
137	27.5	46.2	46.4	19.99
138	29.8	44.5	44.6	19.99
139	32.0	46.2	46.4	19.99
140	34.2	44.5	44.8	19.99
141	36.4	46.2	46.7	19.99
142	38.7	44.5	45.4	19.99
143	40.9	46.2	47.5	19.99
144	43.1	44.5	46.4	19.99
145	45.4	46.2	48.7	19.99
146	47.6	44.5	47.8	19.99
147	49.8	46.2	50.3	19.99
148	52.0	44.5	49.6	19.99



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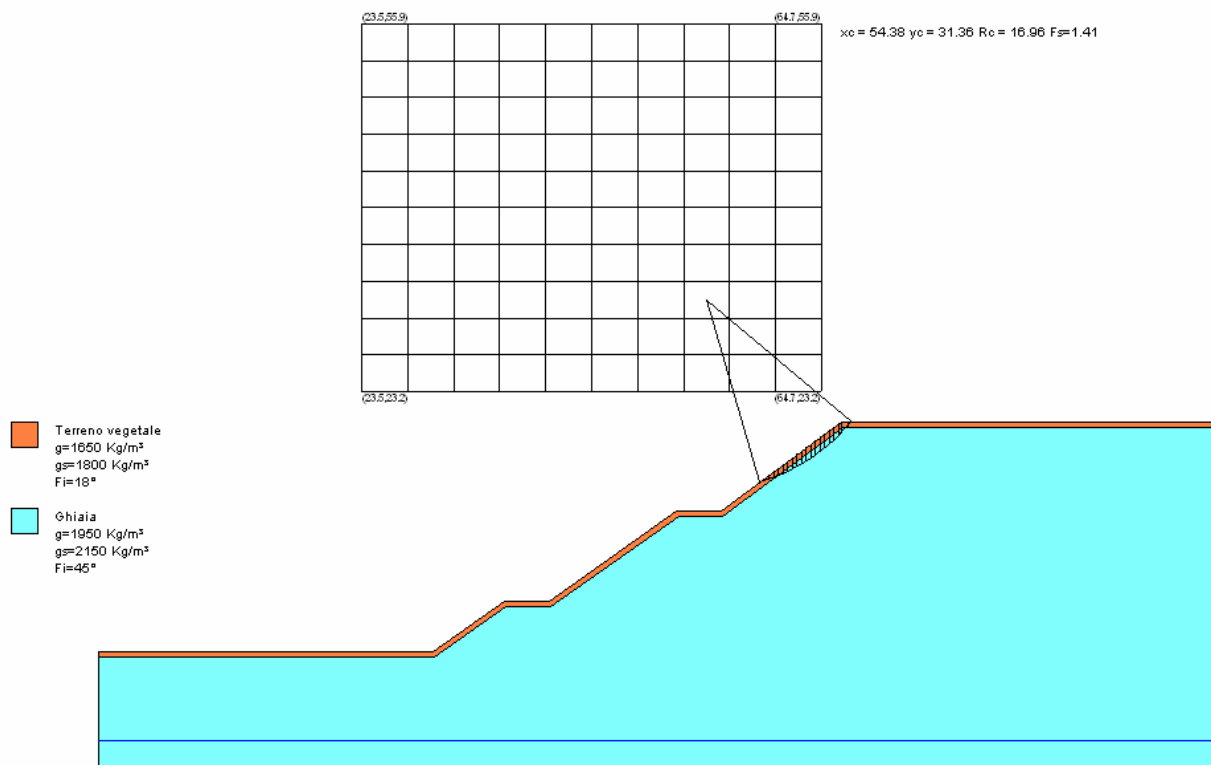
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149	54.3	46.2	52.2	4.45
150	16.4	48.0	50.0	6.74
151	18.6	49.7	51.2	19.99
152	20.8	48.0	49.0	19.99
153	23.1	49.7	50.3	19.99
154	25.3	48.0	48.3	19.99
155	27.5	49.7	49.9	19.99
156	29.8	48.0	48.1	19.99
157	32.0	49.7	49.8	19.99
158	34.2	48.0	48.2	19.99
159	36.4	49.7	50.2	19.99
160	38.7	48.0	48.8	19.99
161	40.9	49.7	50.9	19.99
162	43.1	48.0	49.7	19.99
163	45.4	49.7	52.0	19.99
164	47.6	48.0	51.1	19.99
165	49.8	49.7	53.5	19.99
166	52.0	48.0	52.7	4.12
167	16.4	51.4	53.4	19.99
168	18.6	53.2	54.5	3.21
169	20.8	51.4	52.4	19.99
170	23.1	53.2	53.8	19.99
171	25.3	51.4	51.8	19.99
172	27.5	53.2	53.4	19.99
173	29.8	51.4	51.5	19.99
174	32.0	53.2	53.3	19.99
175	34.2	51.4	51.7	19.99
176	36.4	53.2	53.6	2.56
177	38.7	51.4	52.2	19.99
178	40.9	53.2	54.3	19.99
179	43.1	51.4	53.1	19.99
180	45.4	53.2	55.4	19.99
181	47.6	51.4	54.4	3.57
182	49.8	53.2	56.7	19.99
183	52.0	51.4	55.9	19.99
184	16.4	54.9	56.8	19.99
185	20.8	54.9	55.8	19.99
186	25.3	54.9	55.2	19.99
187	29.8	54.9	55.0	19.99
188	34.2	54.9	55.2	19.99
189	38.7	54.9	55.6	19.99
190	43.1	54.9	56.5	19.99
191	47.6	54.9	57.7	19.99

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## 2 VERIFICA DI STABILITÀ IN FASE DI RECUPERO

### 2.1 VERIFICA CON INDIVIDUAZIONE AUTOMATICA DEL CERCHIO A MINOR STABILITÀ



#### Analisi di stabilità dei pendii con SARMA

Numero di strati	2.0
Numero dei conci	20.0
No sisma;	

#### Superficie di forma circolare

#### Maglia dei Centri

Ascissa vertice sinistro inferiore $x_i$	(m)	23.5
Ordinata vertice sinistro inferiore $y_i$	(m)	23.17
Ascissa vertice destro superiore $x_s$	(m)	64.67
Ordinata vertice destro superiore $y_s$	(m)	55.93
Passo di ricerca		10.0
Numero di celle lungo x		10.0
Numero di celle lungo y		10.0

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40**Vertici profilo**

N	X (m)	y (m)
1	0.0	0.0
2	29.84	0.0
3	36.27	4.5
4	40.27	4.5
5	51.69	12.5
6	55.69	12.5
7	66.41	20.5
8	100.0	20.5

**Falda**

Nr.	X (m)	y (m)
1	0.0	-8.0
2	100.0	-8.0

**Vertici strato .....1**

N	X (m)	y (m)
1	0.0	-0.5
2	30.0	-0.5
3	36.43	4.0
4	40.43	4.0
5	51.85	12.0
6	55.85	12.0
7	66.57	20.0
8	100.0	20.0

**Stratigrafia**

c: coesione; Fi: Angolo di attrito; G: Peso Specifico; Gs: Peso Specifico Saturo; K: Modulo di Winkler

Strato	c (kg/cm <sup>2</sup> )	Fi (°)	G (Kg/m <sup>3</sup> )	Gs (Kg/m <sup>3</sup> )	K (Kg/cm <sup>3</sup> )	Litologia
1	0	18	1650	1800	0.00	Terreno vegetale
2	0	45	1950	2150	0.00	Ghiaia

**Risultati analisi pendio**

Fs minimo individuato 1.41  
 Ascissa centro superficie (m) 54.38  
 Ordinata centro superficie (m) 31.36

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Raggio superficie (m) 16.96

B: Larghezza del concio; Alfa: Angolo di inclinazione della base del concio; Li: Lunghezza della base del concio; Wi: Peso del concio ; Ui: Forze derivanti dalle pressioni neutre; Ni: forze agenti normalmente alla direzione di scivolamento; Ti: forze agenti parallelamente alla superficie di scivolamento; Ei, Ei-1: Forze agenti normalmente alle facce del concio; Xi, Xi-1: Forze di tipo tagliante applicate sulle facce laterali .

**Analisi dei conci; superficie...xc = 54.377 yc = 31.358 Rc = 16.958 Fs=1.41**

Nr.	B (m)	Alfa (°)	Li (m)	Wi (Kg)
1	0.41	17.1	0.43	62.46
2	0.41	18.57	0.43	181.52
3	0.41	20.04	0.44	292.58
4	0.41	21.53	0.44	395.4
5	0.41	23.04	0.45	502.4
6	0.41	24.56	0.45	603.58
7	0.41	26.1	0.46	694.06
8	0.41	27.66	0.47	773.39
9	0.41	29.25	0.47	841.14
10	0.41	30.86	0.48	896.73
11	0.41	32.49	0.49	939.62
12	0.41	34.16	0.5	969.04
13	0.41	35.86	0.51	984.24
14	0.41	37.6	0.52	984.28
15	0.41	39.38	0.53	968.14
16	0.41	41.21	0.55	934.5
17	0.41	43.09	0.56	881.91
18	0.24	44.62	0.34	488.27
19	0.58	46.63	0.85	808.86
20	0.41	49.12	0.63	165.05

**Sforzi sui conci**

Nr.	Xi (Kg)	Ei (Kg)	Xi-1 (Kg)	Ei-1 (Kg)	N'i (Kg)	Ti (Kg)	Ui (Kg)
1	-2.78	-4.7	0.0	0.0	63.74	14.69	0.0
2	-22.77	-24.41	-2.78	-4.7	197.3	45.47	0.0
3	-57.39	-64.94	-22.77	-24.41	321.29	74.04	0.0
4	-101.73	-131.06	-57.39	-64.94	433.33	99.86	0.0
5	-202.87	0.66	-101.73	-131.06	503.88	357.36	0.0
6	-265.59	127.62	-202.87	0.66	553.26	392.38	0.0
7	-320.66	249.58	-265.59	127.62	619.09	439.07	0.0
8	-364.9	359.94	-320.66	249.58	672.97	477.28	0.0
9	-396.22	453.18	-364.9	359.94	715.7	507.59	0.0
10	-413.79	524.99	-396.22	453.18	748.07	530.55	0.0
11	-417.63	572.06	-413.79	524.99	770.52	546.47	0.0
12	-408.19	591.92	-417.63	572.06	782.89	555.24	0.0
13	-386.92	583.28	-408.19	591.92	785.5	557.09	0.0

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14	-355.4	545.82	-386.92	583.28	777.76	551.6	0.0
15	-315.64	480.38	-355.4	545.82	759.14	538.4	0.0
16	-269.94	389.17	-315.64	480.38	728.8	516.88	0.0
17	-220.76	276.01	-269.94	389.17	685.49	486.17	0.0
18	-180.86	202.8	-220.76	276.01	370.57	262.82	0.0
19	-80.94	61.42	-180.86	202.8	589.67	418.21	0.0
20	0.0	0.0	-80.94	61.42	101.5	23.39	0.0

### Numero di superfici esaminate....(220)

N°	Xo	Yo	Ro	Fs
1	23.5	23.2	26.9	19.99
2	25.6	24.8	25.7	19.99
3	27.6	23.2	24.0	19.99
4	29.7	24.8	31.8	4.03
5	31.7	23.2	30.1	3.87
6	33.8	24.8	22.6	19.99
7	35.9	23.2	24.0	2.60
8	37.9	24.8	19.6	19.99
9	40.0	23.2	17.9	19.99
10	42.0	24.8	19.6	19.99
11	44.1	23.2	14.9	2.04
12	46.1	24.8	16.5	19.99
13	48.2	23.2	24.0	3.26
14	50.3	24.8	19.6	2.73
15	52.3	23.2	11.8	19.99
16	54.4	24.8	22.6	3.62
17	56.4	23.2	11.8	19.99
18	58.5	24.8	31.7	5.45
19	60.6	23.2	7.7	19.99
20	62.6	24.8	21.5	5.52
21	64.7	23.2	7.4	3.90
22	23.5	26.4	29.5	19.99
23	25.6	28.1	28.9	19.99
24	27.6	26.4	30.3	3.47
25	29.7	28.1	28.9	2.32
26	31.7	26.4	27.3	2.37
27	33.8	28.1	25.9	19.99
28	35.9	26.4	21.2	19.99
29	37.9	28.1	25.9	2.39
30	40.0	26.4	27.3	2.68
31	42.0	28.1	22.8	19.99
32	44.1	26.4	18.1	19.99
33	46.1	28.1	25.9	2.63
34	48.2	26.4	27.3	3.20
35	50.3	28.1	25.9	2.98
36	52.3	26.4	15.1	2.04
37	54.4	28.1	22.8	3.24
38	56.4	26.4	33.4	4.99

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39	58.5	28.1	25.5	4.34
40	60.6	26.4	26.7	5.20
41	62.6	28.1	21.1	4.79
42	64.7	26.4	11.9	4.28
43	23.5	29.7	32.2	19.99
44	25.6	31.4	34.5	19.99
45	27.6	29.7	33.6	3.40
46	29.7	31.4	38.3	3.65
47	31.7	29.7	27.5	19.99
48	33.8	31.4	29.2	19.99
49	35.9	29.7	24.5	19.99
50	37.9	31.4	38.3	3.27
51	40.0	29.7	24.5	19.99
52	42.0	31.4	23.1	19.99
53	44.1	29.7	24.5	2.22
54	46.1	31.4	38.3	3.61
55	48.2	29.7	21.4	19.99
56	50.3	31.4	32.2	3.40
57	52.3	29.7	21.4	2.56
58	54.4	31.4	17.0	1.41
59	56.4	29.7	15.2	19.99
60	58.5	31.4	18.9	2.62
61	60.6	29.7	23.2	4.31
62	62.6	31.4	16.5	3.52
63	64.7	29.7	33.3	6.52
64	23.5	33.0	34.9	19.99
65	25.6	34.6	34.4	19.99
66	27.6	33.0	33.8	19.99
67	29.7	34.6	35.5	2.38
68	31.7	33.0	30.8	19.99
69	33.8	34.6	38.5	2.78
70	35.9	33.0	27.7	19.99
71	37.9	34.6	29.4	19.99
72	40.0	33.0	33.8	2.57
73	42.0	34.6	26.3	19.99
74	44.1	33.0	36.9	3.12
75	46.1	34.6	29.4	2.37
76	48.2	33.0	27.7	2.53
77	50.3	34.6	23.3	19.99
78	52.3	33.0	21.6	19.99
79	54.4	34.6	20.2	19.99
80	56.4	33.0	18.0	1.89
81	58.5	34.6	27.9	3.90
82	60.6	33.0	22.2	3.52
83	62.6	34.6	21.7	3.94
84	64.7	33.0	19.2	4.68
85	23.5	36.3	40.5	3.93
86	25.6	37.9	37.2	2.00
87	27.6	36.3	39.6	3.05
88	29.7	37.9	35.7	19.99
89	31.7	36.3	40.2	2.81
90	33.8	37.9	44.9	3.28

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91	35.9	36.3	40.2	2.77
92	37.9	37.9	41.8	2.82
93	40.0	36.3	31.0	19.99
94	42.0	37.9	41.8	3.02
95	44.1	36.3	43.2	3.51
96	46.1	37.9	38.8	3.07
97	48.2	36.3	28.0	2.28
98	50.3	37.9	26.6	2.02
99	52.3	36.3	31.0	3.08
100	54.4	37.9	35.5	3.66
101	56.4	36.3	43.1	4.83
102	58.5	37.9	23.7	19.99
103	60.6	36.3	30.3	4.48
104	62.6	37.9	29.7	4.75
105	64.7	36.3	24.2	4.90
106	23.5	39.5	40.6	19.99
107	25.6	41.2	40.1	19.99
108	27.6	39.5	42.4	2.82
109	29.7	41.2	38.7	19.99
110	31.7	39.5	43.4	2.78
111	33.8	41.2	42.0	2.31
112	35.9	39.5	34.3	19.99
113	37.9	41.2	42.0	2.50
114	40.0	39.5	40.4	2.61
115	42.0	41.2	39.0	2.50
116	44.1	39.5	31.2	19.99
117	46.1	41.2	48.1	3.69
118	48.2	39.5	28.2	19.99
119	50.3	41.2	29.8	2.16
120	52.3	39.5	37.3	3.40
121	54.4	41.2	28.8	2.45
122	56.4	39.5	29.3	3.19
123	58.5	41.2	40.6	4.53
124	60.6	39.5	23.5	19.99
125	62.6	41.2	28.8	4.34
126	64.7	39.5	26.3	5.05
127	23.5	42.8	43.5	2.32
128	25.6	44.5	43.1	19.99
129	27.6	42.8	42.4	19.99
130	29.7	44.5	41.7	2.02
131	31.7	42.8	37.6	19.99
132	33.8	44.5	39.2	19.99
133	35.9	42.8	40.6	2.18
134	37.9	44.5	48.4	2.90
135	40.0	42.8	34.5	19.99
136	42.0	44.5	36.2	19.99
137	44.1	42.8	37.6	2.37
138	46.1	44.5	36.2	19.99
139	48.2	42.8	31.5	19.99
140	50.3	44.5	48.4	3.83
141	52.3	42.8	43.5	3.78
142	54.4	44.5	45.7	4.12

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143	56.4	42.8	34.4	3.57
144	58.5	44.5	28.4	3.17
145	60.6	42.8	28.6	3.71
146	62.6	44.5	28.3	19.99
147	64.7	42.8	31.1	5.16
148	25.6	47.7	51.5	2.95
149	27.6	46.1	42.5	1.60
150	29.7	47.7	44.6	19.99
151	31.7	46.1	43.8	2.05
152	33.8	47.7	48.6	2.37
153	35.9	46.1	40.9	19.99
154	37.9	47.7	45.5	2.35
155	40.0	46.1	37.8	19.99
156	42.0	47.7	39.4	19.99
157	44.1	46.1	43.9	2.75
158	46.1	47.7	39.4	19.99
159	48.2	46.1	37.8	2.57
160	50.3	47.7	50.8	3.82
161	52.3	46.1	45.3	3.70
162	54.4	47.7	33.5	2.64
163	56.4	46.1	42.1	4.04
164	58.5	47.7	30.8	3.32
165	60.6	46.1	33.6	3.97
166	62.6	47.7	38.5	4.96
167	64.7	46.1	41.0	5.78
168	23.5	49.4	52.1	2.89
169	25.6	51.0	49.1	19.99
170	27.6	49.4	45.5	19.99
171	29.7	51.0	50.5	19.99
172	31.7	49.4	52.7	2.73
173	33.8	51.0	45.8	19.99
174	35.9	49.4	56.3	3.39
175	37.9	51.0	54.9	3.01
176	40.0	49.4	44.1	2.20
177	42.0	51.0	48.8	2.70
178	44.1	49.4	41.1	19.99
179	46.1	51.0	51.9	3.30
180	48.2	49.4	38.0	19.99
181	50.3	51.0	44.2	3.11
182	52.3	49.4	47.3	3.64
183	54.4	51.0	35.9	2.74
184	56.4	49.4	36.0	3.17
185	58.5	51.0	35.8	3.66
186	60.6	49.4	35.9	4.12
187	62.6	51.0	35.6	4.97
188	64.7	49.4	40.6	5.62
189	23.5	52.7	52.6	19.99
190	25.6	54.3	52.1	19.99
191	27.6	52.7	54.0	2.34
192	29.7	54.3	53.5	19.99
193	31.7	52.7	46.8	19.99
194	33.8	54.3	48.9	19.99



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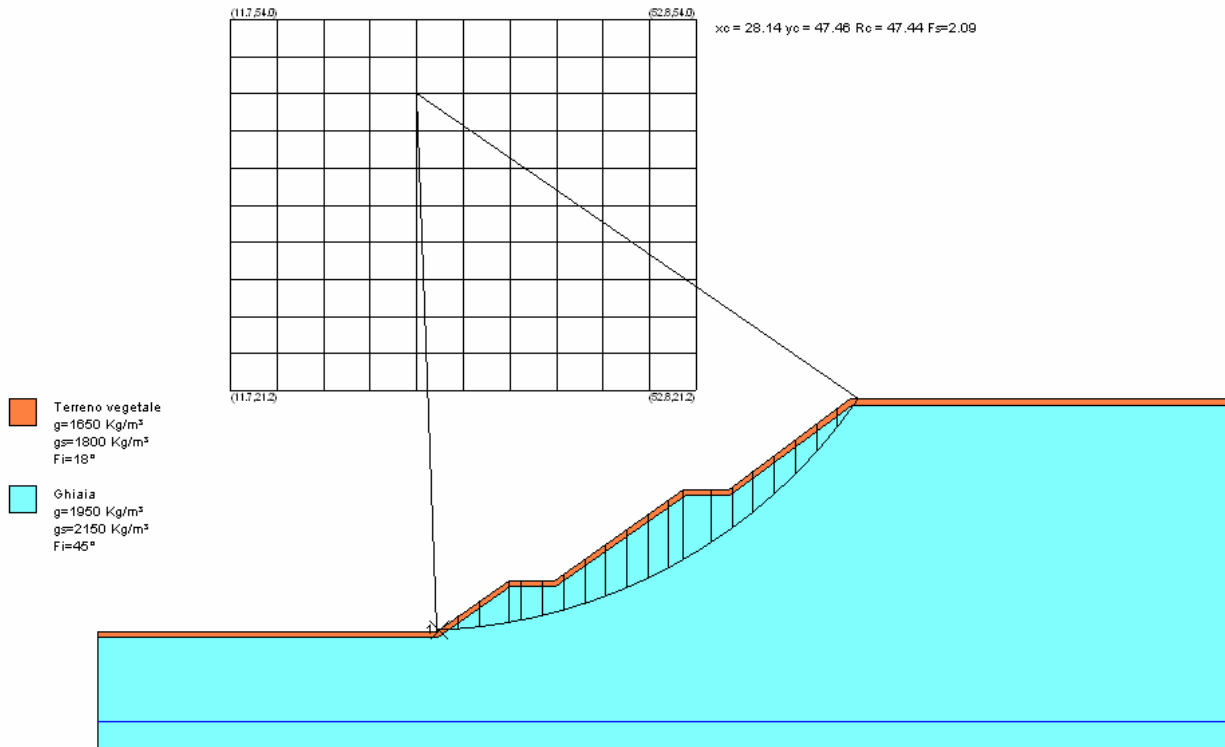
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195	35.9	52.7	59.6	3.44
196	37.9	54.3	46.0	1.93
197	40.0	52.7	44.4	19.99
198	42.0	54.3	58.2	3.28
199	44.1	52.7	50.5	2.90
200	46.1	54.3	51.7	3.08
201	48.2	52.7	43.7	19.99
202	50.3	54.3	41.0	19.99
203	52.3	52.7	38.4	19.99
204	54.4	54.3	43.6	3.42
205	56.4	52.7	43.6	3.87
206	58.5	54.3	45.9	4.35
207	60.6	52.7	48.4	4.94
208	62.6	54.3	45.5	5.23
209	64.7	52.7	40.4	5.61
210	23.5	55.9	55.6	19.99
211	27.6	55.9	54.3	19.99
212	31.7	55.9	49.9	19.99
213	35.9	55.9	59.8	3.01
214	40.0	55.9	47.6	2.12
215	44.1	55.9	47.6	19.99
216	48.2	55.9	43.5	19.99
217	52.3	55.9	56.8	4.04
218	56.4	55.9	53.6	4.35
219	60.6	55.9	43.1	4.45
220	64.7	55.9	42.8	5.85

**2.2 VERIFICA CON CERCHIO PASSANTE PER IL PIEDE DELLA SCARPATA****Analisi di stabilità dei pendii con SARMA**

Numero di strati 2.0  
 Numero dei conci 20.0

No sisma;

**Superficie di forma circolare****Maglia dei Centri**

Ascissa vertice sinistro inferiore  $x_i$  (m) 11.67  
 Ordinata vertice sinistro inferiore  $y_i$  (m) 21.25  
 Ascissa vertice destro superiore  $x_s$  (m) 52.84  
 Ordinata vertice destro superiore  $y_s$  (m) 54.02  
 Passo di ricerca 10.0  
 Numero di celle lungo x 10.0  
 Numero di celle lungo y 10.0

**Vertici profilo**

N	X (m)	y (m)
1	0.0	0.0
2	29.84	0.0

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3	36.27	4.5
4	40.27	4.5
5	51.69	12.5
6	55.69	12.5
7	66.41	20.5
8	100.0	20.5

**Falda**

Nr.	X (m)	y (m)
1	0.0	-8.0
2	100.0	-8.0

**Vertici strato .....1**

N	X (m)	y (m)
1	0.0	-0.5
2	30.0	-0.5
3	36.43	4.0
4	40.43	4.0
5	51.85	12.0
6	55.85	12.0
7	66.57	20.0
8	100.0	20.0

**Stratigrafia**

=====

c: coesione; Fi: Angolo di attrito; G: Peso Specifico; Gs: Peso Specifico Saturo; K: Modulo di Winkler

=====

Strato	c (kg/cm <sup>2</sup> )	Fi (°)	G (Kg/m <sup>3</sup> )	Gs (Kg/m <sup>3</sup> )	K (Kg/cm <sup>3</sup> )	Litologia	
1	0	18	1650	1800	0.00		Terreno vegetale
2	0	45	1950	2150	0.00		Ghiaia

**Risultati analisi pendio**

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Fs minimo individuato	2.09
Ascissa centro superficie	(m) 28.14
Ordinata centro superficie	(m) 47.46
Raggio superficie	(m) 47.44

=====

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B: Larghezza del concio; Alfa: Angolo di inclinazione della base del concio; Li: Lunghezza della base del concio; Wi: Peso del concio ; Ui: Forze derivanti dalle pressioni neutre; Ni: forze agenti normalmente alla direzione di scivolamento; Ti: forze agenti parallelamente alla superficie di scivolamento; Ei, Ei-1: Forze agenti normalmente

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alle facce del concio; Xi, Xi-1: Forze di tipo tagliante applicate sulle facce laterali .

=====

### Analisi dei conci; superficie...xc = 28.139 yc = 47.464 Rc = 47.436 Fs=2.09

Nr.	B (m)	Alfa (°)	Li (m)	Wi (Kg)
1	1.86	3.29	1.86	1865.33
2	1.86	5.54	1.87	6071.36
3	2.62	8.27	2.65	15152.96
4	1.11	10.55	1.12	7749.11
5	1.86	12.38	1.91	11952.98
6	1.86	14.69	1.92	10325.83
7	1.86	17.03	1.95	12820.58
8	1.86	19.4	1.97	15331.72
9	1.86	21.8	2.01	17526.56
10	1.86	24.25	2.04	19389.6
11	1.86	26.74	2.08	20902.36
12	1.28	28.88	1.46	15061.88
13	2.44	31.5	2.86	25780.16
14	1.86	34.59	2.26	14569.73
15	1.86	37.38	2.34	12944.08
16	1.86	40.26	2.44	12552.93
17	1.86	43.28	2.56	11563.25
18	1.86	46.46	2.7	9883.73
19	1.86	49.84	2.89	7389.31
20	1.86	53.47	3.13	3900.5

### Sforzi sui conci

Nr.	Xi (Kg)	Ei (Kg)	Xi-1 (Kg)	Ei-1 (Kg)	N'i (Kg)	Ti (Kg)	Ui (Kg)
1	-178.98	198.43	0.0	0.0	2029.55	315.52	0.0
2	-3452.83	3603.94	-178.98	198.43	8972.38	4293.01	0.0
3	-9303.55	10143.66	-3452.83	3603.94	19844.05	9494.77	0.0
4	-12068.29	12964.2	-9303.55	10143.66	9819.63	4698.39	0.0
5	-9276.32	15110.2	-12068.29	12964.2	8487.68	4061.09	0.0
6	-6198.59	16501.99	-9276.32	15110.2	6657.82	3185.56	0.0
7	-8510.9	18772.63	-6198.59	16501.99	13803.72	6604.66	0.0
8	-10782.58	20674.08	-8510.9	18772.63	15971.83	7642.03	0.0
9	-12480.1	21937.93	-10782.58	20674.08	17378.81	8315.23	0.0
10	-13513.18	22407.35	-12480.1	21937.93	18427.41	8816.95	0.0
11	-13868.48	21970.99	-13513.18	22407.35	19179.71	9176.9	0.0
12	-13673.58	21108.82	-13868.48	21970.99	13433.41	6427.47	0.0
13	-9672.35	18845.24	-13673.58	21108.82	19751.57	9450.52	0.0
14	-4587.6	17337.62	-9672.35	18845.24	8663.28	4145.11	0.0
15	-3182.78	14924.67	-4587.6	17337.62	10634.08	5088.08	0.0
16	-2603.04	11783.72	-3182.78	14924.67	11165.79	5342.49	0.0
17	-1915.8	8309.02	-2603.04	11783.72	10299.12	4927.81	0.0
18	-1213.06	4804.06	-1915.8	8309.02	8864.56	4241.42	0.0
19	-590.4	1752.91	-1213.06	4804.06	6695.55	3203.62	0.0
20	0.0	0.0	-590.4	1752.91	3378.63	1616.57	0.0

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N°	Xo	Yo	Ro	Fs
1	15.8	21.2	25.6	19.99
2	17.8	22.9	25.9	19.99
3	19.9	21.2	23.5	19.99
4	22.0	22.9	24.2	6.58
5	24.0	21.2	22.0	19.99
6	30.2	22.9	22.8	2.28
7	32.3	21.2	21.3	19.99
8	34.3	22.9	23.2	19.99
9	36.4	21.2	22.1	19.99
10	38.4	22.9	24.3	19.99
11	40.5	21.2	23.6	19.99
12	42.5	22.9	26.0	19.99
13	44.6	21.2	25.7	19.99
14	46.7	22.9	28.2	19.99
15	48.7	21.2	28.2	19.99
16	50.8	22.9	30.8	19.99
17	52.8	21.2	31.1	19.99
18	15.8	24.5	28.4	19.99
19	17.8	26.2	28.8	19.99
20	19.9	24.5	26.5	19.99
21	22.0	26.2	27.3	19.99
22	24.0	24.5	25.2	19.99
23	30.2	26.2	26.1	19.99
24	32.3	24.5	24.5	2.26
25	34.3	26.2	26.4	2.44
26	36.4	24.5	25.2	19.99
27	38.4	26.2	27.4	19.99
28	40.5	24.5	26.6	19.99
29	42.5	26.2	28.9	19.99
30	44.6	24.5	28.4	19.99
31	46.7	26.2	30.9	19.99
32	48.7	24.5	30.7	19.99
33	50.8	26.2	33.3	19.99
34	52.8	24.5	33.4	19.99
35	15.8	27.8	31.2	19.99
36	17.8	29.4	31.8	19.99
37	19.9	27.8	29.6	9.16
38	22.0	29.4	30.5	4.48
39	30.2	29.4	29.4	19.99
40	32.3	27.8	27.8	19.99
41	34.3	29.4	29.7	19.99
42	36.4	27.8	28.4	19.99
43	38.4	29.4	30.5	19.99
44	40.5	27.8	29.6	19.99
45	42.5	29.4	31.9	19.99

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46	44.6	27.8	31.3	19.99
47	46.7	29.4	33.7	3.38
48	48.7	27.8	33.4	19.99
49	50.8	29.4	35.9	19.99
50	52.8	27.8	35.8	19.99
51	15.8	31.1	34.2	19.99
52	17.8	32.7	34.9	19.99
53	19.9	31.1	32.7	7.58
54	22.0	32.7	33.7	19.99
55	28.1	31.1	31.1	19.99
56	30.2	32.7	32.6	19.99
57	32.3	31.1	31.1	19.99
58	34.3	32.7	32.9	19.99
59	36.4	31.1	31.6	19.99
60	38.4	32.7	33.7	19.99
61	40.5	31.1	32.7	19.99
62	42.5	32.7	34.9	19.99
63	44.6	31.1	34.2	19.99
64	46.7	32.7	36.6	19.99
65	48.7	31.1	36.2	19.99
66	50.8	32.7	38.6	19.99
67	52.8	31.1	38.4	19.99
68	15.8	34.4	37.2	19.99
69	17.8	36.0	38.0	10.62
70	19.9	34.4	35.8	19.99
71	28.1	34.4	34.3	19.99
72	30.2	36.0	35.9	19.99
73	32.3	34.4	34.4	19.99
74	34.3	36.0	36.2	19.99
75	36.4	34.4	34.9	19.99
76	38.4	36.0	36.9	19.99
77	40.5	34.4	35.8	2.65
78	42.5	36.0	38.0	19.99
79	44.6	34.4	37.2	19.99
80	46.7	36.0	39.5	19.99
81	48.7	34.4	39.0	19.99
82	50.8	36.0	41.4	3.93
83	52.8	34.4	41.1	4.30
84	15.8	37.6	40.2	19.99
85	17.8	39.3	41.1	8.98
86	19.9	37.6	38.9	19.99
87	28.1	37.6	37.6	19.99
88	30.2	39.3	39.2	19.99
89	32.3	37.6	37.6	19.99
90	34.3	39.3	39.4	19.99
91	36.4	37.6	38.1	19.99
92	38.4	39.3	40.1	19.99
93	40.5	37.6	39.0	2.66
94	42.5	39.3	41.1	19.99
95	44.6	37.6	40.3	19.99
96	46.7	39.3	42.5	19.99
97	48.7	37.6	41.9	19.99

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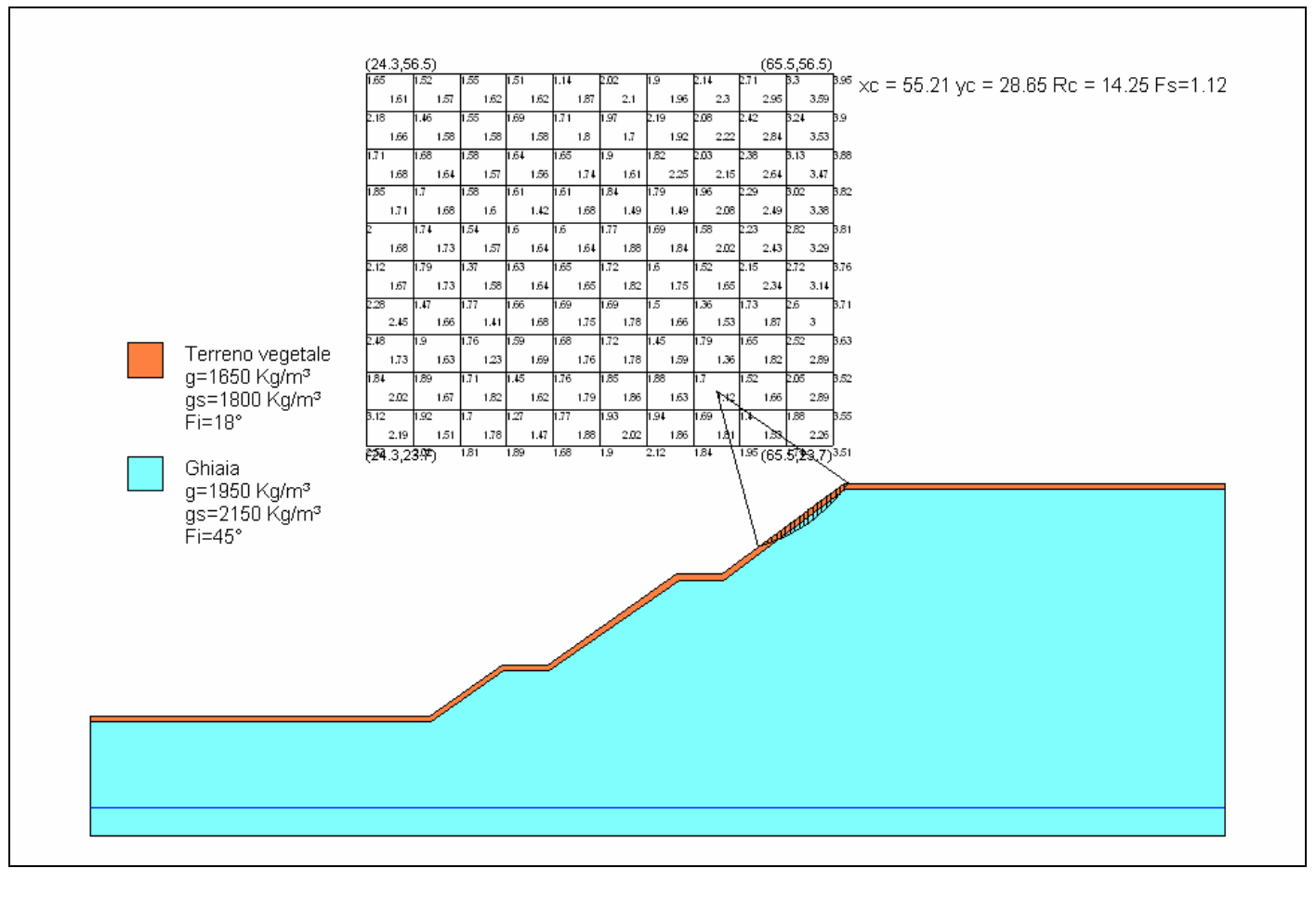
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98	50.8	39.3	44.3	19.99
99	52.8	37.6	43.9	4.26
100	15.8	40.9	43.3	19.99
101	17.8	42.5	44.2	7.15
102	19.9	40.9	42.1	4.02
103	28.1	40.9	40.9	19.99
104	30.2	42.5	42.5	19.99
105	32.3	40.9	40.9	19.99
106	34.3	42.5	42.7	2.28
107	36.4	40.9	41.3	19.99
108	38.4	42.5	43.3	19.99
109	40.5	40.9	42.1	19.99
110	42.5	42.5	44.3	19.99
111	44.6	40.9	43.3	19.99
112	46.7	42.5	45.6	19.99
113	48.7	40.9	44.9	19.99
114	50.8	42.5	47.2	3.92
115	52.8	40.9	46.7	19.99
116	15.8	44.2	46.4	19.99
117	17.8	45.8	47.4	5.01
118	28.1	44.2	44.2	2.13
119	30.2	45.8	45.8	19.99
120	32.3	44.2	44.2	2.20
121	34.3	45.8	45.9	19.99
122	36.4	44.2	44.6	19.99
123	38.4	45.8	46.5	19.99
124	40.5	44.2	45.3	19.99
125	42.5	45.8	47.4	2.95
126	44.6	44.2	46.4	19.99
127	46.7	45.8	48.7	19.99
128	48.7	44.2	47.9	3.64
129	50.8	45.8	50.2	3.94
130	52.8	44.2	49.6	4.24
131	15.8	47.5	49.5	8.84
132	17.8	49.1	50.5	19.99
133	28.1	47.5	47.4	2.09
134	30.2	49.1	49.0	19.99
135	32.3	47.5	47.4	19.99
136	34.3	49.1	49.2	19.99
137	36.4	47.5	47.8	19.99
138	38.4	49.1	49.7	19.99
139	40.5	47.5	48.5	19.99
140	42.5	49.1	50.6	19.99
141	44.6	47.5	49.6	19.99
142	46.7	49.1	51.7	19.99
143	48.7	47.5	50.9	3.67
144	50.8	49.1	53.2	19.99
145	52.8	47.5	52.6	4.25
146	15.8	50.7	52.7	19.99
147	28.1	50.7	50.7	19.99
148	30.2	52.4	52.3	19.99
149	32.3	50.7	50.7	19.99

150	34.3	52.4	52.5	19.99
151	36.4	50.7	51.1	19.99
152	38.4	52.4	53.0	19.99
153	40.5	50.7	51.7	19.99
154	42.5	52.4	53.8	3.05
155	44.6	50.7	52.7	19.99
156	46.7	52.4	54.9	19.99
157	48.7	50.7	54.0	3.71
158	50.8	52.4	56.2	19.99
159	52.8	50.7	55.5	19.99
160	15.8	54.0	55.8	4.54
161	28.1	54.0	54.0	19.99
162	32.3	54.0	54.0	19.99
163	36.4	54.0	54.3	19.99
164	40.5	54.0	54.9	19.99
165	44.6	54.0	55.9	19.99
166	48.7	54.0	57.1	19.99

**2.3 VERIFICA IN CONDIZIONI SIMICHE CON INDIVIDUAZIONE AUTOMATICA DEL CERCHIO A MINOR STABILITÀ**





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### Analisi di stabilità dei pendii con SARMA

=====

Numero di strati	2.0
Numero dei conci	20.0
Zona Sismica	3
Categoria profilo stratigrafico	B
Coefficiente di amplificazione topografica ST	1
Coefficiente azione sismica orizzontale (Kh)	0.094
Coefficiente azione sismica Verticale (Kv)	0.047

### Superficie di forma circolare

### Maglia dei Centri

=====

Ascissa vertice sinistro inferiore xi	(m)	24.33
Ordinata vertice sinistro inferiore yi	(m)	23.73
Ascissa vertice destro superiore xs	(m)	65.5
Ordinata vertice destro superiore ys	(m)	56.5
Passo di ricerca		10.0
Numero di celle lungo x		10.0
Numero di celle lungo y		10.0

=====

### Vertici profilo

N	X (m)	y (m)
1	0.0	0.0
2	29.84	0.0
3	36.27	4.5
4	40.27	4.5
5	51.69	12.5
6	55.69	12.5
7	66.41	20.5
8	100.0	20.5

### Falda

Nr.	X (m)	y (m)
1	0.0	-8.0
2	100.0	-8.0

### Vertici strato .....1

N	X (m)	y (m)
1	0.0	-0.5
2	30.0	-0.5
3	36.43	4.0
4	40.43	4.0

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5	51.85	12.0
6	55.85	12.0
7	66.57	20.0
8	100.0	20.0

### Stratigrafia

c: coesione; Fi: Angolo di attrito; G: Peso Specifico; Gs: Peso Specifico Saturo; K: Modulo di Winkler

Strato	c (kg/cm <sup>2</sup> )	Fi (°)	G (Kg/m <sup>3</sup> )	Gs (Kg/m <sup>3</sup> )	K (Kg/cm <sup>3</sup> )	Litologia
1	0	18	1650	1800	0.00	Terreno vegetale
2	0	45	1950	2150	0.00	Ghiaia

### Risultati analisi pendio

Fs minimo individuato		1.12
Ascissa centro superficie	(m)	55.21
Ordinata centro superficie	(m)	28.65
Raggio superficie	(m)	14.25

B: Larghezza del concio; Alfa: Angolo di inclinazione della base del concio; Li: Lunghezza della base del concio; Wi: Peso del concio ; Ui: Forze derivanti dalle pressioni neutre; Ni: forze agenti normalmente alla direzione di scivolamento; Ti: forze agenti parallelamente alla superficie di scivolamento; Ei, Ei-1: Forze agenti normalmente alle facce del concio; Xi, Xi-1: Forze di tipo tagliante applicate sulle facce laterali .

### Analisi dei concii; superficie...xc = 55.205 yc = 28.649 Rc = 14.249 Fs=1.12

Nr.	B (m)	Alfa (°)	Li (m)	Wi (Kg)
1	0.4	15.79	0.42	62.38
2	0.4	17.48	0.42	180.83
3	0.4	19.17	0.42	290.7
4	0.4	20.89	0.43	391.75
5	0.4	22.62	0.43	497.34
6	0.4	24.38	0.44	594.79
7	0.4	26.16	0.45	680.62
8	0.4	27.97	0.45	754.26
9	0.4	29.81	0.46	815.14
10	0.4	31.68	0.47	862.54
11	0.4	33.6	0.48	895.67
12	0.4	35.56	0.49	913.57
13	0.4	37.56	0.51	915.13
14	0.4	39.62	0.52	898.99
15	0.4	41.75	0.54	863.62

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16	0.4	43.94	0.56	807.06
17	0.4	46.23	0.58	726.85
18	0.4	48.61	0.61	620.09
19	0.32	50.84	0.5	395.07
20	0.48	53.48	0.81	268.45

**Sforzi sui conci**

Nr.	Xi (Kg)	Ei (Kg)	Xi-1 (Kg)	Ei-1 (Kg)	N'i (Kg)	Ti (Kg)	Ui (Kg)
1	-5.24	-5.24	0.0	0.0	64.95	18.84	0.0
2	-42.53	-26.7	-5.24	-5.24	209.53	60.79	0.0
3	-106.13	-71.78	-42.53	-26.7	340.73	98.85	0.0
4	-186.15	-146.43	-106.13	-71.78	454.63	131.89	0.0
5	-372.61	45.48	-186.15	-146.43	539.91	482.07	0.0
6	-478.17	210.39	-372.61	45.48	547.41	488.76	0.0
7	-565.39	362.63	-478.17	210.39	594.66	530.95	0.0
8	-628.93	494.49	-565.39	362.63	628.13	560.83	0.0
9	-666.34	600.54	-628.93	494.49	650.04	580.39	0.0
10	-677.05	676.97	-666.34	600.54	661.59	590.7	0.0
11	-662.41	721.56	-677.05	676.97	663.92	592.78	0.0
12	-625.02	733.43	-662.41	721.56	657.43	586.99	0.0
13	-568.41	712.95	-625.02	733.43	642.13	573.33	0.0
14	-496.82	661.77	-568.41	712.95	617.61	551.44	0.0
15	-415.12	583.12	-496.82	661.77	583.27	520.77	0.0
16	-328.38	481.97	-415.12	583.12	537.7	480.09	0.0
17	-241.76	365.61	-328.38	481.97	479.03	427.71	0.0
18	-160.61	244.28	-241.76	365.61	404.9	361.52	0.0
19	-96.82	155.28	-160.61	244.28	250.25	223.44	0.0
20	0.0	0.0	-96.82	155.28	207.24	60.12	0.0

**Numero di superfici esaminate....(221)**

N°	Xo	Yo	Ro	Fs
1	24.3	23.7	24.6	2.53
2	26.4	25.4	26.2	2.19
3	28.4	23.7	24.6	2.02
4	30.5	25.4	23.2	1.51
5	32.6	23.7	21.5	1.81
6	34.6	25.4	23.2	1.78
7	36.7	23.7	21.5	1.89
8	38.7	25.4	20.1	1.47
9	40.8	23.7	18.5	1.68
10	42.9	25.4	20.1	1.88
11	44.9	23.7	15.4	1.90
12	47.0	25.4	17.1	2.02
13	49.0	23.7	15.4	2.12
14	51.1	25.4	14.0	1.86
15	53.1	23.7	12.4	1.84

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16	55.2	25.4	14.0	1.81
17	57.3	23.7	12.4	1.95
18	59.3	25.4	10.2	1.53
19	61.4	23.7	7.8	1.74
20	63.4	25.4	8.3	2.26
21	65.5	23.7	7.5	3.51
22	24.3	27.0	30.4	3.12
23	26.4	28.6	29.5	2.02
24	28.4	27.0	27.9	1.92
25	30.5	28.6	26.4	1.67
26	32.6	27.0	24.8	1.70
27	34.6	28.6	26.4	1.82
28	36.7	27.0	21.8	1.27
29	38.7	28.6	23.4	1.62
30	40.8	27.0	21.8	1.77
31	42.9	28.6	20.3	1.79
32	44.9	27.0	21.8	1.93
33	47.0	28.6	20.3	1.86
34	49.0	27.0	18.7	1.94
35	51.1	28.6	17.3	1.63
36	53.1	27.0	15.7	1.69
37	55.2	28.6	14.2	1.12
38	57.3	27.0	12.5	1.40
39	59.3	28.6	13.0	1.66
40	61.4	27.0	10.6	1.88
41	63.4	28.6	14.2	2.89
42	65.5	27.0	11.7	3.55
43	24.3	30.3	30.1	1.84
44	26.4	31.9	32.4	1.73
45	28.4	30.3	31.1	1.89
46	30.5	31.9	29.7	1.63
47	32.6	30.3	28.1	1.71
48	34.6	31.9	26.7	1.23
49	36.7	30.3	25.0	1.45
50	38.7	31.9	26.7	1.69
51	40.8	30.3	25.0	1.76
52	42.9	31.9	23.6	1.76
53	44.9	30.3	22.0	1.85
54	47.0	31.9	23.6	1.78
55	49.0	30.3	22.0	1.88
56	51.1	31.9	20.6	1.59
57	53.1	30.3	18.9	1.70
58	55.2	31.9	17.5	1.36
59	57.3	30.3	15.3	1.52
60	59.3	31.9	15.8	1.82
61	61.4	30.3	13.4	2.05
62	63.4	31.9	16.3	2.89
63	65.5	30.3	13.8	3.52
64	24.3	33.6	35.8	2.48
65	26.4	35.2	38.1	2.45
66	28.4	33.6	34.4	1.90
67	30.5	35.2	33.0	1.66

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68	32.6	33.6	31.4	1.76
69	34.6	35.2	30.0	1.41
70	36.7	33.6	28.3	1.59
71	38.7	35.2	30.0	1.68
72	40.8	33.6	25.3	1.68
73	42.9	35.2	26.9	1.75
74	44.9	33.6	25.3	1.72
75	47.0	35.2	26.9	1.78
76	49.0	33.6	22.2	1.45
77	51.1	35.2	23.9	1.66
78	53.1	33.6	22.2	1.79
79	55.2	35.2	20.5	1.53
80	57.3	33.6	18.1	1.65
81	59.3	35.2	18.2	1.87
82	61.4	33.6	18.8	2.52
83	63.4	35.2	18.5	3.00
84	65.5	33.6	19.0	3.63
85	24.3	36.8	38.6	2.28
86	26.4	38.5	38.1	1.67
87	28.4	36.8	34.5	1.47
88	30.5	38.5	36.3	1.73
89	32.6	36.8	34.6	1.77
90	34.6	38.5	33.2	1.58
91	36.7	36.8	31.6	1.66
92	38.7	38.5	33.2	1.64
93	40.8	36.8	31.6	1.69
94	42.9	38.5	30.2	1.65
95	44.9	36.8	28.5	1.69
96	47.0	38.5	30.2	1.82
97	49.0	36.8	25.5	1.50
98	51.1	38.5	27.1	1.75
99	53.1	36.8	22.4	1.36
100	55.2	38.5	23.2	1.65
101	57.3	36.8	20.7	1.73
102	59.3	38.5	23.6	2.34
103	61.4	36.8	21.0	2.60
104	63.4	38.5	20.8	3.14
105	65.5	36.8	21.1	3.71
106	24.3	40.1	41.5	2.12
107	26.4	41.8	41.0	1.68
108	28.4	40.1	40.3	1.79
109	30.5	41.8	39.5	1.73
110	32.6	40.1	34.9	1.37
111	34.6	41.8	36.5	1.57
112	36.7	40.1	34.9	1.63
113	38.7	41.8	36.5	1.64
114	40.8	40.1	31.8	1.65
115	42.9	41.8	33.5	1.64
116	44.9	40.1	31.8	1.72
117	47.0	41.8	33.5	1.88
118	49.0	40.1	28.8	1.60
119	51.1	41.8	30.4	1.84

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120	53.1	40.1	25.6	1.52
121	55.2	41.8	28.6	2.02
122	57.3	40.1	26.1	2.15
123	59.3	41.8	25.9	2.43
124	61.4	40.1	23.3	2.72
125	63.4	41.8	25.9	3.29
126	65.5	40.1	26.1	3.76
127	24.3	43.4	44.4	2.00
128	26.4	45.0	43.9	1.71
129	28.4	43.4	43.2	1.74
130	30.5	45.0	42.4	1.68
131	32.6	43.4	38.1	1.54
132	34.6	45.0	39.8	1.60
133	36.7	43.4	38.1	1.60
134	38.7	45.0	36.7	1.42
135	40.8	43.4	35.1	1.60
136	42.9	45.0	36.7	1.68
137	44.9	43.4	35.1	1.77
138	47.0	45.0	33.7	1.49
139	49.0	43.4	32.0	1.69
140	51.1	45.0	30.6	1.49
141	53.1	43.4	28.2	1.58
142	55.2	45.0	31.0	2.08
143	57.3	43.4	28.4	2.23
144	59.3	45.0	28.2	2.49
145	61.4	43.4	25.7	2.82
146	63.4	45.0	30.8	3.38
147	65.5	43.4	30.9	3.81
148	24.3	46.7	47.3	1.85
149	26.4	48.3	46.9	1.68
150	28.4	46.7	46.1	1.70
151	30.5	48.3	45.4	1.64
152	32.6	46.7	41.4	1.58
153	34.6	48.3	43.1	1.57
154	36.7	46.7	41.4	1.61
155	38.7	48.3	40.0	1.56
156	40.8	46.7	38.4	1.61
157	42.9	48.3	40.0	1.74
158	44.9	46.7	38.4	1.84
159	47.0	48.3	37.0	1.61
160	49.0	46.7	35.3	1.79
161	51.1	48.3	38.9	2.25
162	53.1	46.7	33.5	1.96
163	55.2	48.3	33.3	2.15
164	57.3	46.7	30.8	2.29
165	59.3	48.3	30.7	2.64
166	61.4	46.7	30.8	3.02
167	63.4	48.3	35.7	3.47
168	65.5	46.7	35.7	3.82
169	24.3	49.9	50.3	1.71
170	26.4	51.6	49.9	1.66
171	28.4	49.9	49.1	1.68

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172	30.5	51.6	48.4	1.58
173	32.6	49.9	44.5	1.58
174	34.6	51.6	46.3	1.58
175	36.7	49.9	44.7	1.64
176	38.7	51.6	43.3	1.58
177	40.8	49.9	41.6	1.65
178	42.9	51.6	43.3	1.80
179	44.9	49.9	41.6	1.90
180	47.0	51.6	40.2	1.70
181	49.0	49.9	38.3	1.82
182	51.1	51.6	38.4	1.92
183	53.1	49.9	35.9	2.03
184	55.2	51.6	35.8	2.22
185	57.3	49.9	33.2	2.38
186	59.3	51.6	35.7	2.84
187	61.4	49.9	35.7	3.13
188	63.4	51.6	38.0	3.53
189	65.5	49.9	37.9	3.88
190	24.3	53.2	55.9	2.18
191	26.4	54.9	52.9	1.61
192	28.4	53.2	49.3	1.46
193	30.5	54.9	51.4	1.57
194	32.6	53.2	47.6	1.55
195	34.6	54.9	49.6	1.62
196	36.7	53.2	48.0	1.69
197	38.7	54.9	46.6	1.62
198	40.8	53.2	44.9	1.71
199	42.9	54.9	46.6	1.87
200	44.9	53.2	44.9	1.97
201	47.0	54.9	45.9	2.10
202	49.0	53.2	43.8	2.19
203	51.1	54.9	40.9	1.96
204	53.1	53.2	38.3	2.08
205	55.2	54.9	38.2	2.30
206	57.3	53.2	35.7	2.42
207	59.3	54.9	38.1	2.95
208	61.4	53.2	38.1	3.24
209	63.4	54.9	42.8	3.59
210	65.5	53.2	42.7	3.90
211	24.3	56.5	56.4	1.65
212	28.4	56.5	52.4	1.52
213	32.6	56.5	50.6	1.55
214	36.7	56.5	48.2	1.51
215	40.8	56.5	45.2	1.14
216	44.9	56.5	47.9	2.02
217	49.0	56.5	43.4	1.90
218	53.1	56.5	40.8	2.14
219	57.3	56.5	40.7	2.71
220	61.4	56.5	43.0	3.30
221	65.5	56.5	45.1	3.95

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### 2.3.1 Verifica in condizioni dinamiche (Newmark)

#### Accelerogramma Comune di Montichiari Tr 475 anni

Durata (s) 33  
Valore massimo di (a/g) 0.1401  
Spostamento massimo totale calcolato (cm) 0.00

