ASTALDI

PERIZIA DI VARIANTE N. 3

INTERVENTI PER IL DRAGAGGIO DI 2,3 M m^3 DI SEDIMENTI IN AREA MOLO POLISETTORIALE PER LA REALIZZAZIONE DI UN PRIMO LOTTO DELLA CASSA DI COLMATA FUNZIONALE ALL'AMPLIAMENTO DEL V SPORGENTE DEL PORTO DI TARANTO

Progetto di Variante n. 3

MARGINAMENTO A TERRA - Raccordo Vertice "C"

Relazione di Satbilità della Diga

SCALA:

CODICE PROGETTO	CODICE ELABORATO	REV	REP
PUG102	PC-GEO-MT-00-00-RE-01-A		137

REVISIONI						
	C					
	B					
	A	GEN. 2020	EMISSIONE	VARI	ALTIERI	TOSIANI
	REV	**DATA**	**DESCRIZIONE**	**REDATTO**	**CONTROLLATO**	**APPROVATO**

IL PROGETTISTA

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INDICE

1 PREMESSA

La presente relazione è stata redatta per lo studio della stabilità del ripristino del fondale previsti al vertice “C” di collegamento tra il marginamento a terra e quello a mare della cassa di colmata.

Per poter accogliere i sedimenti contaminati, sebbene non pericolosi, la cassa di colmata deve presentare, ai sensi dell’art. 5 bis della Legge 84/1994, un sistema di impermeabilizzazione naturale o artificiale, al perimetro e sul fondo, in grado di assicurare requisiti di permeabilità almeno equivalenti a: $K \leq 1{,}0 \times 10^{-9}$ m/s per uno spessore ≥ 1 m.

Per garantire tali caratteristiche, sui lati a mare, si è previsto, come largamente illustrato in precedenza, la realizzazione di una struttura in acciaio costituita da monopali e diaframmi.

Per i due lati a terra, invece, il marginamento della cassa di colmata sarà realizzato secondo le modalità e le caratteristiche previste dal progetto esecutivo, costituito cioè da un diaframma impermeabile semiplastico ammorsato per almeno 2 m nella formazione impermeabile di base (argille in facies grigio azzurra).

Ai fini dello svuotamento della cassa stessa fino alla quota batimetrica -3.00 m s.l.m dopo il completamento del marginamento della cassa di colmata, è utile precisare che al marginamento lato terra è assegnata solo ed esclusivamente una funzione di conterminazione dei sedimenti e quindi “i*mpermeabilizzante*”.

Come si vede dalla figura sottostante, infatti, il marginamento a terra è costituito da diaframmi sempre immersi nel terreno, che non assolvono ad alcuna funzione di contenimento delle spinte e ai quali, pertanto, non è richiesta alcuna funzione stabilizzante.

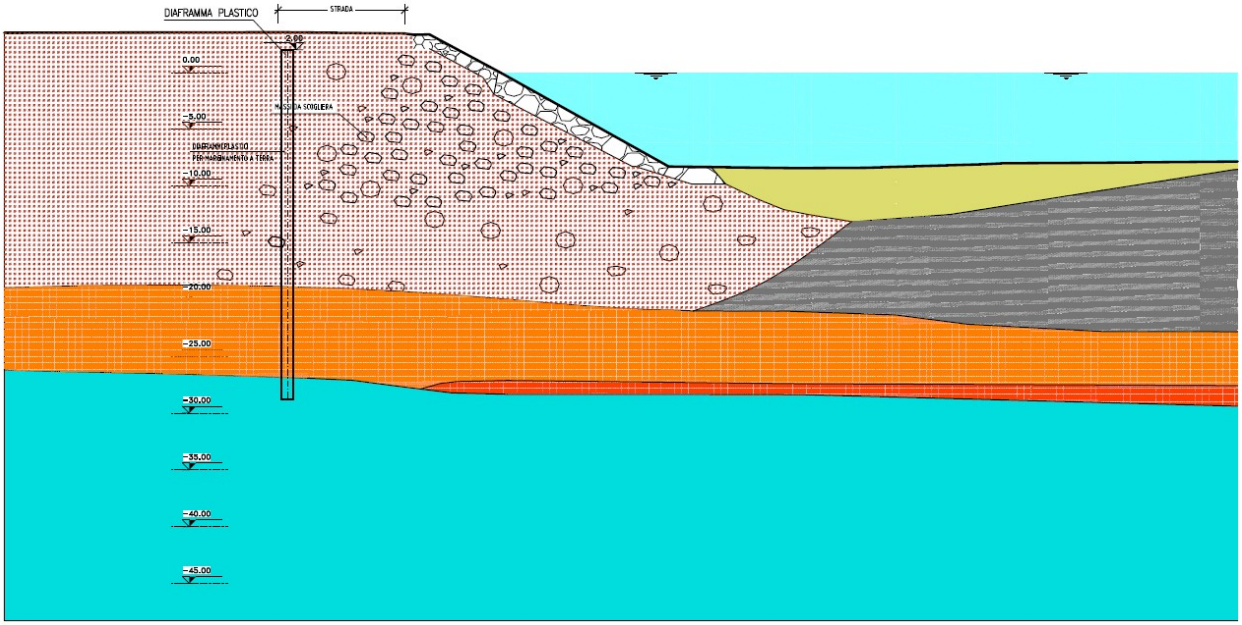


Figura 1. Morfologia del profilo del piano campagna prima del salpaggio

Conseguentemente la morfologia del profilo del piano campagna attualmente stabile (la pendenza media attuale del piano campagna e fondale in rapporto alle caratteristiche di resistenza al taglio dei terreni interessati è tale da non determinare alcun problema), si conserverà tale anche dopo la realizzazione del diaframma verticale, senza alcuna ripercussione sulla stabilità del diaframma.

1.1 DESCRIZIONE DELL'INTERVENTO

Per la realizzazione del collegamento tra il marginamento a terra e quello a mare si è provveduto da prima all'esecuzione del salpaggio per la rimozione dei massi da scogliera nella zona in oggetto, quindi si procede al ripristino del fondale con sabbia sciolta fino a q.ta +2.00, a questo punto si procede alla realizzazione dei diaframmi plastici che collegano il marginamento a terra con il marginamento a mare, tale opera ha lo scopo di rendere impermeabile la cassa di colmata.
Come si evince dalla figura seguente, i diaframmi plastici, per un tratto vengono realizzati parallelamente ai monopali M118 ed M119 e questo per ripristinare l'impermeabilizzazione della cassa di colmata in corrispondenza del monopalo M118 e del diaframma D119.

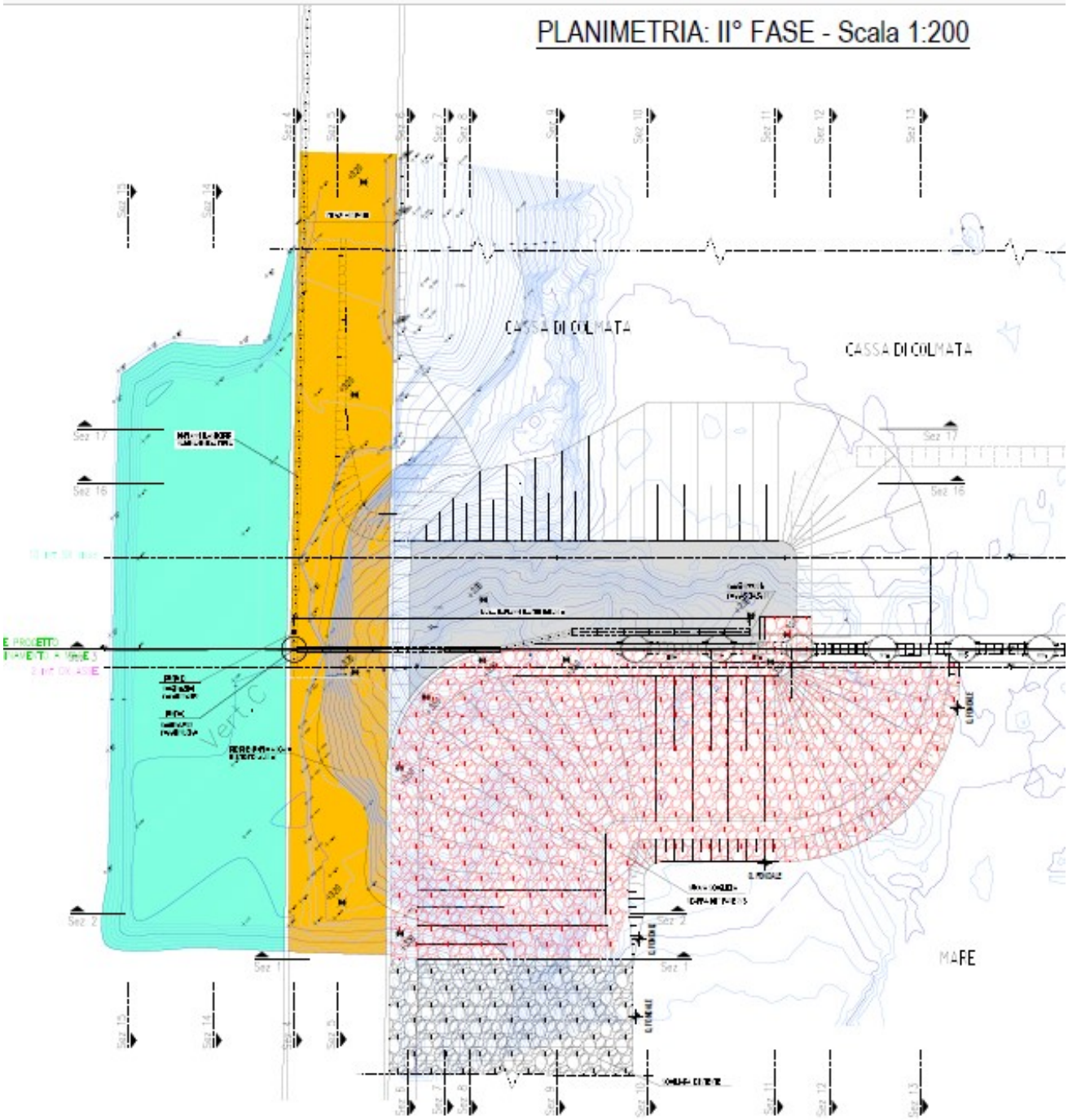


Figura 2. Pianta dell'intervento

2 CARATTERIZZAZIONE GEOMETRICA E GEOTECNICA

Il diaframma verrà realizzato mediante un composto cemento-bentonite posto in opera mediante miscelazione con i terreni in situ o mediante loro sostituzione.

Una volta realizzato il marginamento a mare e quello a terra, è previsto lo svuotamento della cassa di colmata fino alla quota batimetrica -3.00 metri s.l.m.

I calcoli relativi alla verifica di stabilità in tali condizioni, sono stati svolti mediante l'ausilio del modulo di Verifica di Stabilità dei Pendii (Microstabl).

Le sezioni ritenute più gravose, ai fini di tale verifica, sono quelle corrispondente all'allineamento C1-C sul V sporgente, il cui fondale marino si trova ad una quota pari a circa -8.50 m s.l.m. (fig. 3.) a seguito dell'esecuzione del selpaggio e quella relativa alla configurazione con ripristino del fondale (fig. 4.):

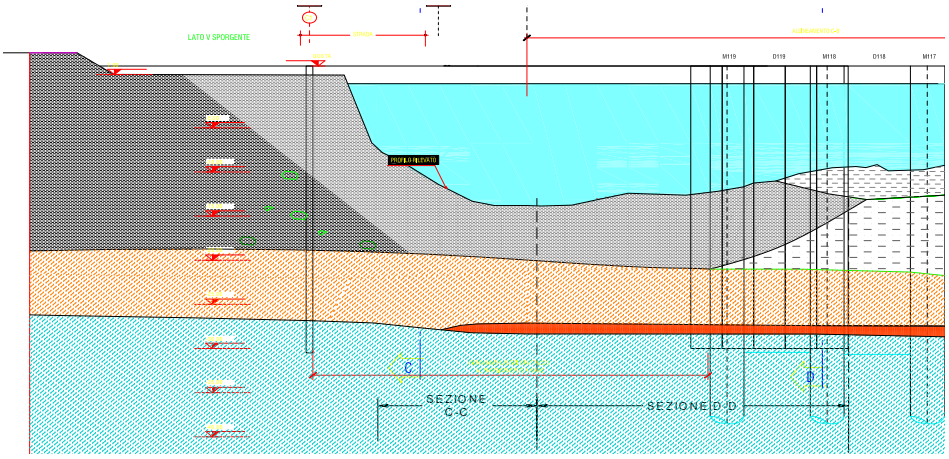


Figura 3. Morfologia del profilo del piano campagna dopo il salpaggio

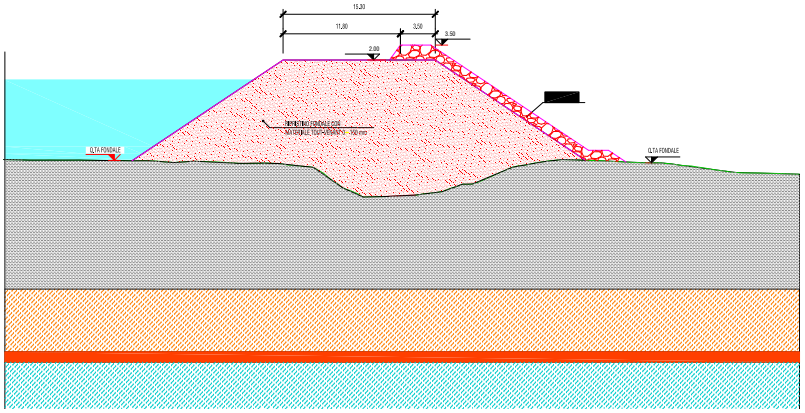


Figura 4. Ripristino del fondale

Come evidenziato dai sondaggi in situ (T1 e T18), è stata adottata la seguente stratigrafia con i seguenti parametri di resistenza:

1) da p.c. a -20 m: TERRENO DI RIPORTO – costituito da ciottoli e blocchi sub-angolari di varie dimensioni di natura calcarea e scorie di loppa in matrice sabbiosa-ghiaiosa;

γ = 20.5 kN/mc

c'= 0.0 kPa

ϕ' = 38°

2) da -8.5 m a -22 m: LIMO ARGILLOSO;

γ = 18.5 kN/mc

c'= 0.0 kPa

ϕ' = 22°

3) da -20 m a -28 m: SABBIE e GHIAIE;

γ = 19.5 kN/mc

c'= 0.0 kPa

ϕ' = 35°

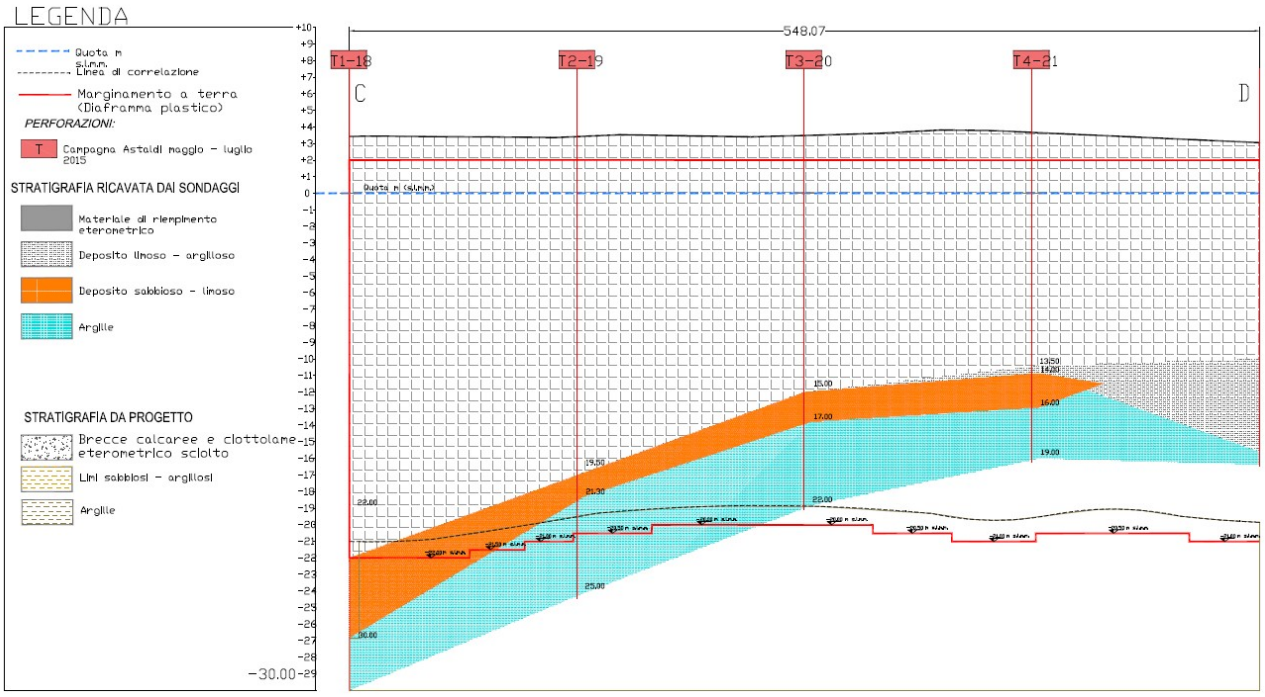
4) da -28 m: ARGILLA GRIGIO AZZURRA;

γ = 20.0 kN/mc

c'= 24 kPa

ϕ' = 27°

Il deposito fangoso viene assimilato all'acqua.



Stratigrafia di progetto

Per il terreno da utilizzare per il **ripristino del fondale**, viene utilizzato un terreno con le seguenti caratteristiche geotecniche:

γ = 20.0 kN/mc

c'= 0.0 kPa

ϕ' = 38°

Per il terreno da utilizzare per la **colmata lato cassa**, viene utilizzato un terreno con le seguenti caratteristiche geotecniche (COLMATA CONSOLIDATA):

γ = 15 KN/m^3

c' = 0 kPa

φ' = 25°

3 VALUTAZIONE DELL'AZIONE SISMICA

Vita Nominale

La vita nominale di un'opera strutturale VN è intesa come il numero di anni nel quale la struttura, purché soggetta alla manutenzione ordinaria, deve potere essere usata per lo scopo al quale è destinata.

Nel presente caso l'opera viene inserita nella seguente tipologia di costruzione:

3) Grandi opere, ponti, opere infrastrutturali e dighe di grandi dimensioni o di importanza strategica

La cui vita nominale è pari a :100 anni.

Classe d'uso

In presenza di azioni sismiche, con riferimento alle conseguenze di un'interruzione di operatività o di un eventuale collasso, l'opera appartiene alla seguente classe d'uso:

Classe III: Costruzioni il cui uso preveda affollamenti significativi. Industrie con attività pericolose per l'ambiente. Reti viarie extraurbane non ricadenti in Classe d'uso IV. Ponti e reti ferroviarie la cui interruzione provochi situazioni di emergenza. Dighe rilevanti per le conseguenze di un loro eventuale collasso.

Il coefficiente d'uso è pari a: 1.50.

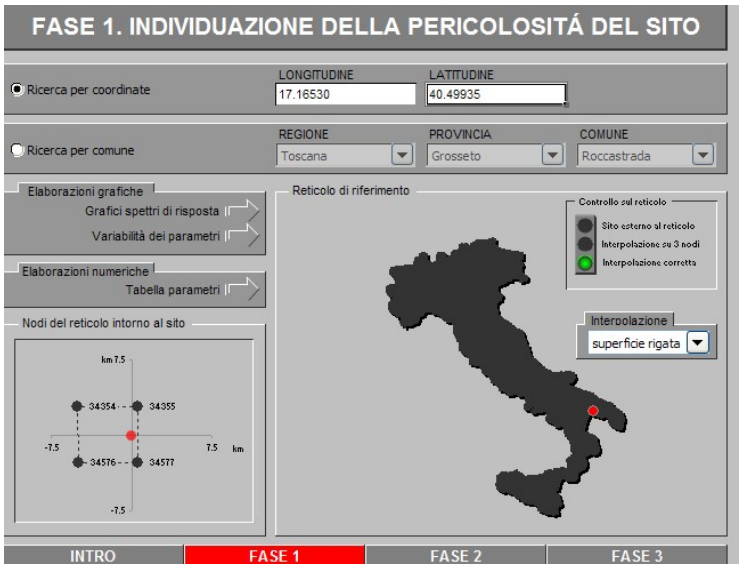
Periodo di riferimento per l'azione sismica

Le azioni sismiche su ciascuna costruzione vengono valutate in relazione al periodo di riferimento VR che si ricava, per ciascun tipo di costruzione, moltiplicandone la vita nominale VN per il coefficiente d'uso Cu.

Pertanto VR = 150 anni

3.1 VALUTAZIONE DELL'AZIONE SISMICA

Individuazione della Pericolosità sismica del sito



Parametri caratterizzanti l'azione sismica associati a ciascun Stato Limite.

SLATO LIMITE	T_R [anni]	a_g [g]	F_o [-]	T_C^* [s]
SLO	90	0.0496	2.430	0.333
SLD	151	0.0627	2.532	0.336
SLV	1424	0.1606	2.526	0.336
SLC	2475	0.1957	2.533	0.335

Determinazione dell'azione sismica di Progetto (SLV)

ag (g) (SLV)	0.1606
Risposta Sismica Locale	
Categoria di sottosuolo	D (*)
Coefficiente di amplificazione stratigrafica Ss	1.79
Categoria Topografica	T1
Coefficiente di amplificazione topografica St	1.0
Coefficiente di riduzione dell'accelerazione massima attesa al sito β_s	0.24
Accelerazione massima attesa al suolo	
amax (g) ($a_{max} = S \cdot a_g = S_S \cdot S_T \cdot a_g$)	0.287

(*) Dall'indagini sismiche svolte emerge che la categoria del sottosuolo è "C". In favore di sicurezza si adotta la categoria "D", come indicato nel progetto di gara.

Pertanto, si ha:

kh = βs*amax/g = 0.07 kv = ±0.035

4 METODO DI ANALISI DI STABILITA'

In accordo con la normativa vigente, le verifiche di stabilità sono state effettuate con l'Approccio 1-Combinazione 2: A2+M2+R2 tenendo conto dei vari coefficienti parziali riportati nelle tabelle 6.2.I, 6.2.II e 6.8.I.

Tabella 6.2.I – *Coefficienti parziali per le azioni o per l'effetto delle azioni.*

CARICHI	EFFETTO	Coefficiente Parziale γ_F (o γ_E)	EQU	**(A1)** STR	**(A2)** GEO
Permanenti	Favorevole	γ_{G1}	0,9	1,0	1,0
	Sfavorevole		1,1	1,3	1,0
Permanenti non strutturali (1)	Favorevole	γ_{G2}	0,0	0,0	0,0
	Sfavorevole		1,5	1,5	1,3
Variabili	Favorevole	γ_{Qi}	0,0	0,0	0,0
	Sfavorevole		1,5	1,5	1,3

(1) Nel caso in cui i carichi permanenti non strutturali (ad es. i carichi permanenti portati) siano compiutamente definiti, si potranno adottare gli stessi coefficienti validi per le azioni permanenti.

Tabella 6.2.II – *Coefficienti parziali per i parametri geotecnici del terreno*

PARAMETRO	GRANDEZZA ALLA QUALE APPLICARE IL COEFFICIENTE PARZIALE	COEFFICIENTE PARZIALE γ_M	**(M1)**	**(M2)**
Tangente dell'angolo di resistenza al taglio	$\tan \varphi'_k$	$\gamma_{\varphi'}$	1,0	1,25
Coesione efficace	c'_k	$\gamma_{c'}$	1,0	1,25
Resistenza non drenata	c_{uk}	γ_{cu}	1,0	1,4
Peso dell'unità di volume	γ	γ_γ	1,0	1,0

Tabella 6.8.I – *Coefficienti parziali per le verifiche di sicurezza di opere di materiali sciolti e di fronti di scavo.*

Coefficiente	**R2**
γ_R	1.1

Le analisi sono state condotte con i metodi all'equilibrio limite tenendo conto della stratigrafia reale del sito. Il livello di sicurezza è espresso come rapporto tra la resistenza a taglio disponibile e lo sforzo di taglio mobilitato lungo la potenziale superficie di scorrimento. In particolare, nei metodi delle strisce la massa di terreno viene discretizzata in strisce verticali e si determina la superficie di scorrimento critica in corrispondenza della quale si ha il minimo coefficiente di sicurezza.

La condizione di verifica $E_d \leq R_d$ equivale ad avere un coefficiente di sicurezza in corrispondenza della superficie di scorrimento critica $F_{min} \geq \gamma R$: $F = R_d/E_d \geq 1.1$

Nelle analisi è stato adottato il metodo di Bishop che considera delle superfici di scorrimento a direttrice circolare.

Gli effetti del sovraccarico di cantiere sono stati valutati in 1.3*10=13.0 kN/mq.

Inoltre, cosi come fatto per il calcolo del marginamento a mere (vedi le relazioni di calcolo PESTRMM00PARE01A e PESTRMM00PARE02A), per le verifiche di stabilità si è considerato anche la presenza della cresta e del cavo d'onda assunti rispettivamente pari a +4.39 m e -2.92 m.

Inoltre, in esercizio si considera anche un sovraccarico di banchina pari a 40 KPa, tale sovraccarico non viene considerato presente in concomitanza della mareggiata estrema perché incompatibile con le attività portuali.

5 RISULTATI

Vengono studiate le seguenti fasi:

SEZIONE DI FIG. 4

1) Fase iniziale con falda a quota 0.00 metri s.l.m. (la verifica vale sia per la scarpata lato mare che per quella lato cassa);

a) In esercizio (SLU) con carico accidentale di cantiere pari a 1.3*10=13 kN/mq;

b) Con mareggiata estrema: cresta d'onda +4.39 m;

c) Con mareggiata estrema: cavo d'onda a -2.92 m;

d) In sismica;

2) fase di svuotamento della cassa fino alla quota batimetrica -3.00 metri s.l.m. (il diaframma ha le stesse caratteristiche meccaniche del terreno circostante), verifica della scarpata lato cassa;

a) In esercizio con carico accidentale di cantiere pari a 1.3*10=13 kN/mq;

b) Con mareggiata estrema: cresta d'onda +4.39 m;

c) Con mareggiata estrema: cavo d'onda a -2.92 m;

d) In sismica;

3) e 4) fase finale a breve e lungo termine con riempimento della cassa fino alla quota + 3.50 m s.l.m. e falda lato cassa a quota fondale (il diaframma ha le stesse caratteristiche meccaniche del terreno circostante), verifica della scarpata lato mare;

a) In esercizio con carico accidentale di banchina pari a 1.3*40=52 kN/mq;

b) Con mareggiata estrema: cresta d'onda +4.39 m;

c) Con mareggiata estrema: cavo d'onda a -2.92 m;

d) In sismica;

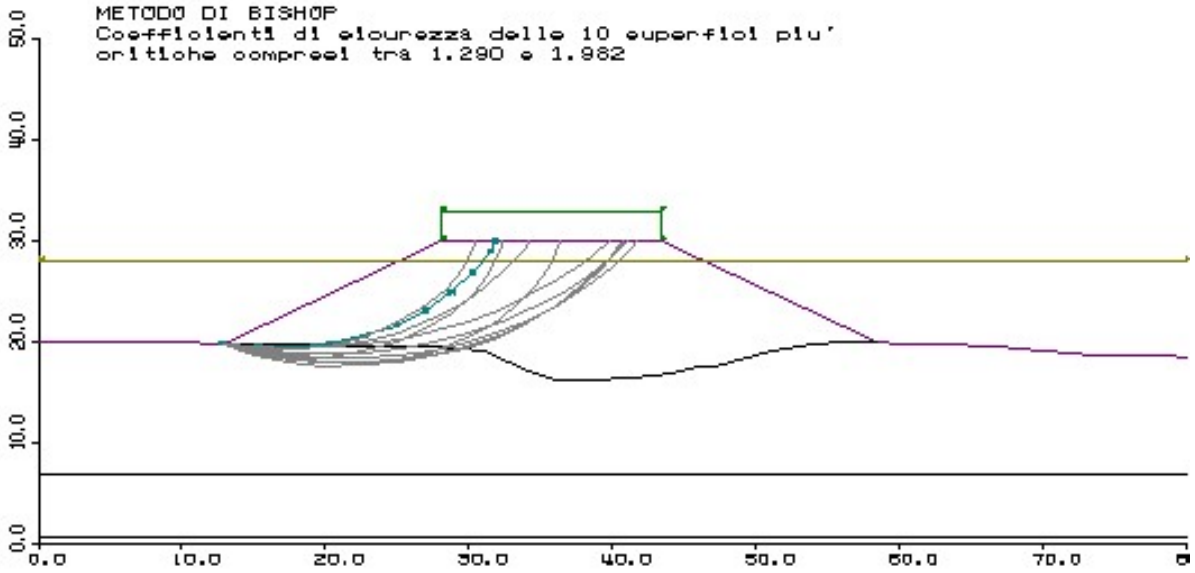
I principali risultati sono riportati di seguito:

	F_{min}
1) Fase iniziale con falda a quota 0.00 metri s.l.m.	
a) In esercizio (SLU) con carico accidentale di cantiere pari a 1.3*10=13 kN/mq;	1.290
b) Con mareggiata estrema: cresta d'onda +4.39 m;	1.547
c) Con mareggiata estrema: cavo d'onda a -2.92 m;	1.320
d) In sismica;	1.142
2) fase di svuotamento della cassa fino alla quota batimetrica -3.00 metri s.l.m.	
a) In esercizio (SLU) con carico accidentale di cantiere pari a 1.3*10=13 kN/mq;	1.213
b) Con mareggiata estrema: cresta d'onda +4.39 m;	1.320
c) Con mareggiata estrema: cavo d'onda a -2.92 m;	1.320
d) In sismica;	1.107
3) fase a breve termine (tempo "0") con riempimento della cassa fino alla quota + 3.50 m s.l.m. e falda lato cassa a quota fondale	
a) In esercizio con carico accidentale di banchina pari a 1.3*40=52 kN/mq;	1.192
b) Con mareggiata estrema: cresta d'onda +4.39 m;	1.547
c) Con mareggiata estrema: cavo d'onda a -2.92 m;	1.298
d) In sismica;	1.113
4) fase a lungo termine (tempo "∞") con riempimento della cassa fino alla quota + 3.50 m s.l.m. e falda lato cassa a quota fondale	
a) In esercizio con carico accidentale di banchina pari a 1.3*40=52 kN/mq;	1.192
b) Con mareggiata estrema: cresta d'onda +4.39 m;	1.547
c) Con mareggiata estrema: cavo d'onda a -2.92 m;	1.298
d) In sismica;	1.113

La verifica di stabilità è soddisfatta ($F_{min} \geq 1.1$).

Le superfici di scorrimento critiche sono riportate nelle figure seguenti:

1) Fase iniziale con falda a quota 0.00 metri s.l.m.



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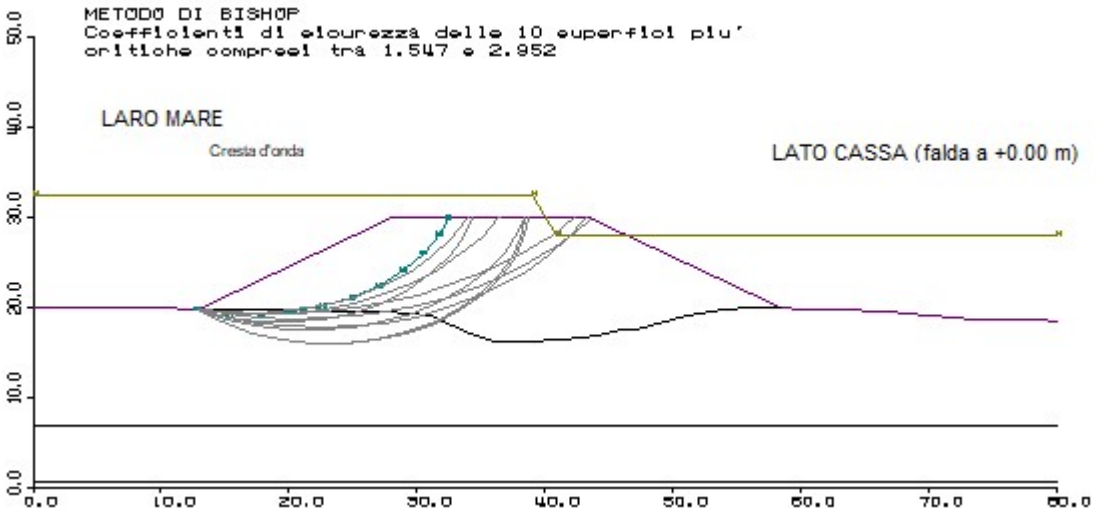
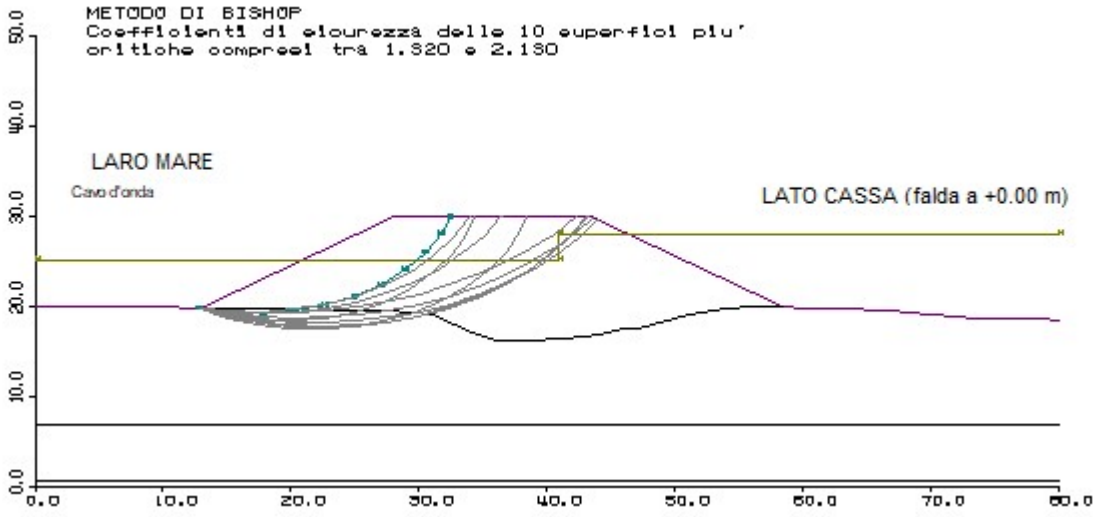
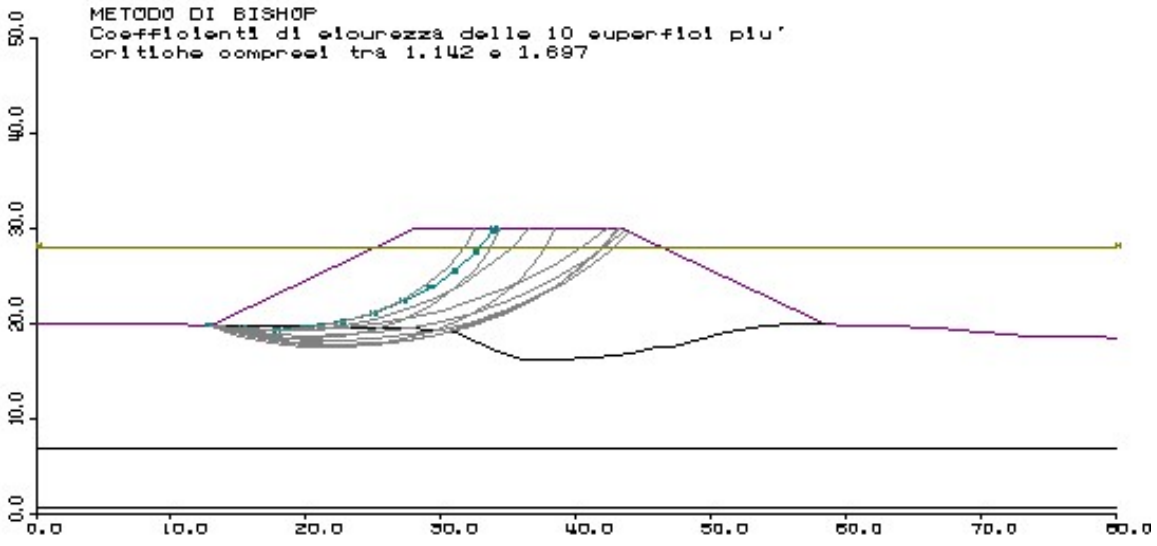


b) Con mareggiata estrema: cresta d'onda +4.39 m;	1.547

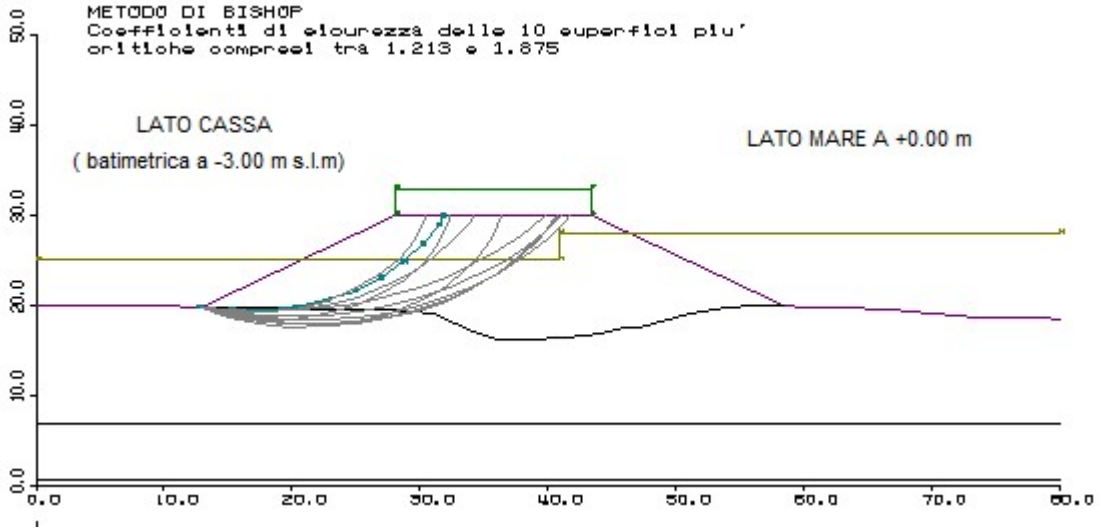


c) Con mareggiata estrema: cavo d'onda a -2.92 m;	1.320



d) In sismica;	1.142

2) fase di svuotamento della cassa fino alla quota batimetrica -3.00 metri s.l.m.



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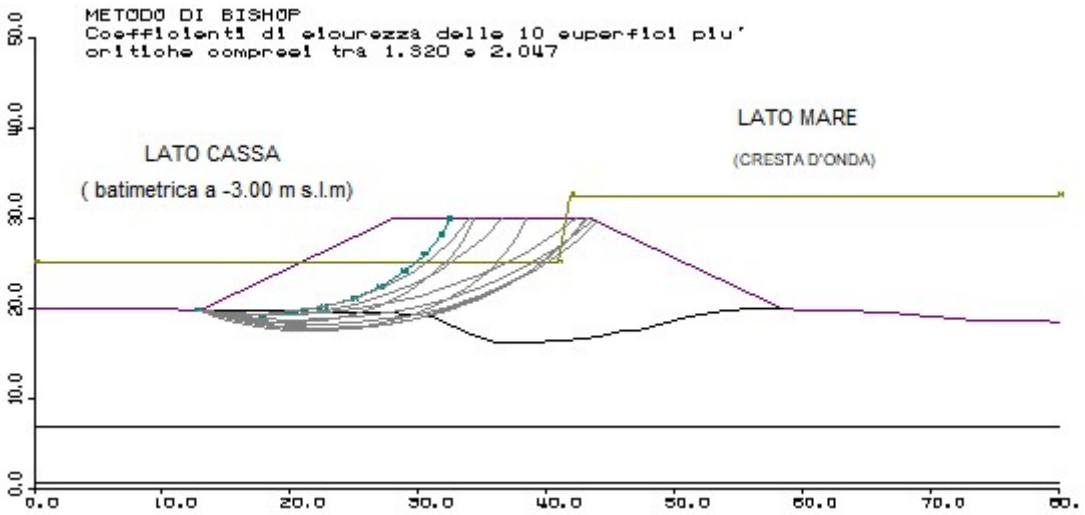

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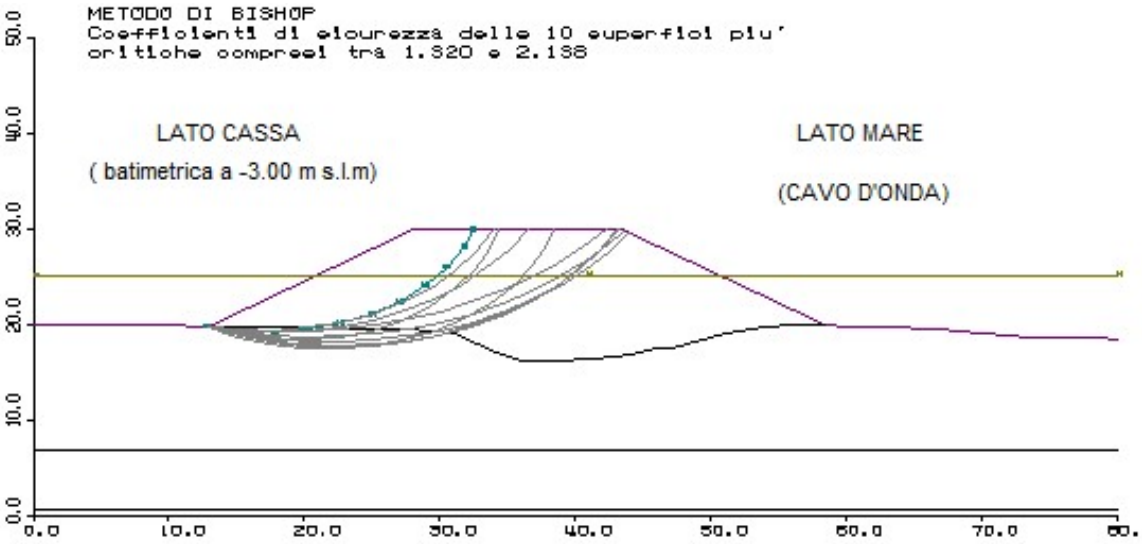

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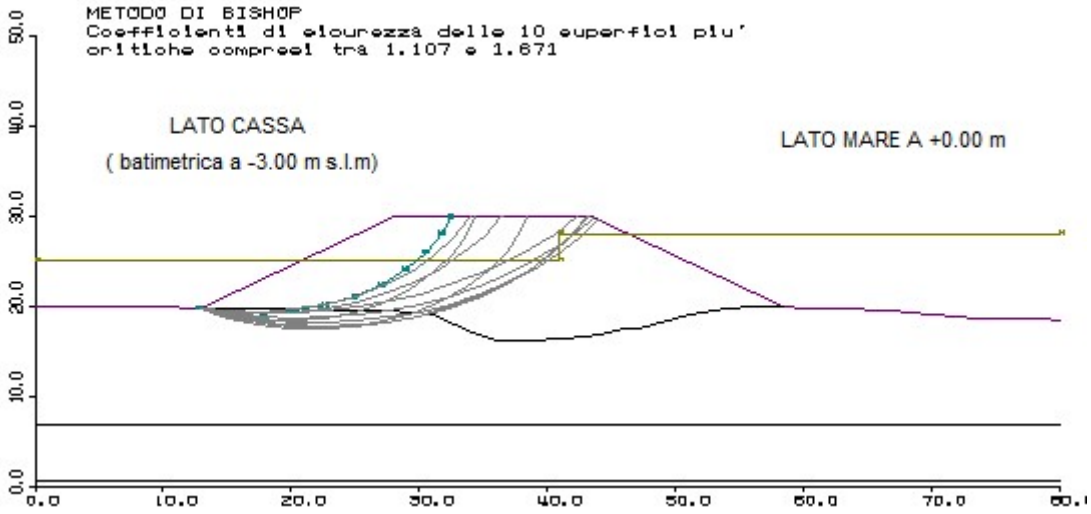
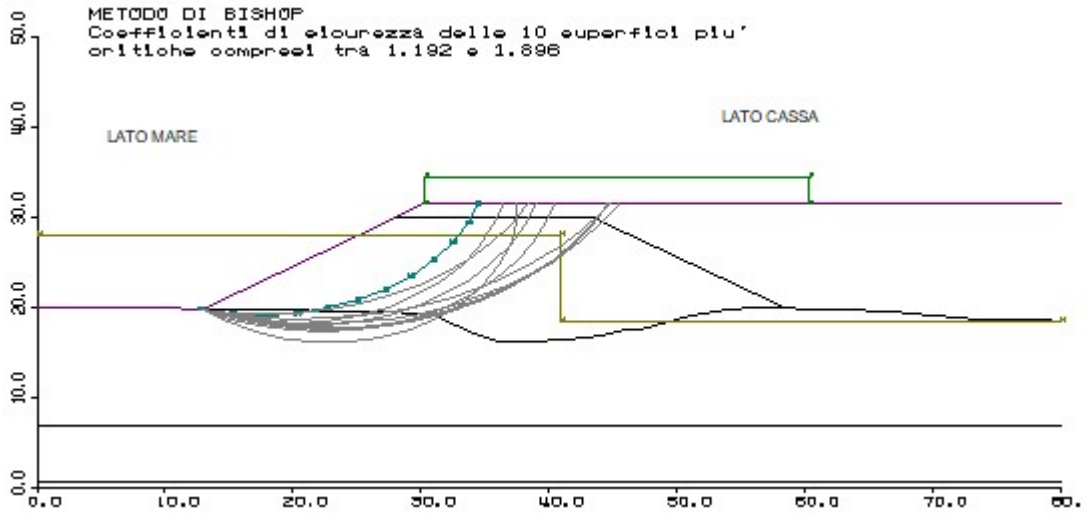


d) In sismica;	1.107

3) fase finale a breve termine (tempo “0”) con riempimento della cassa fino alla quota + 3.50 m s.l.m. e falda lato cassa a quota fondale



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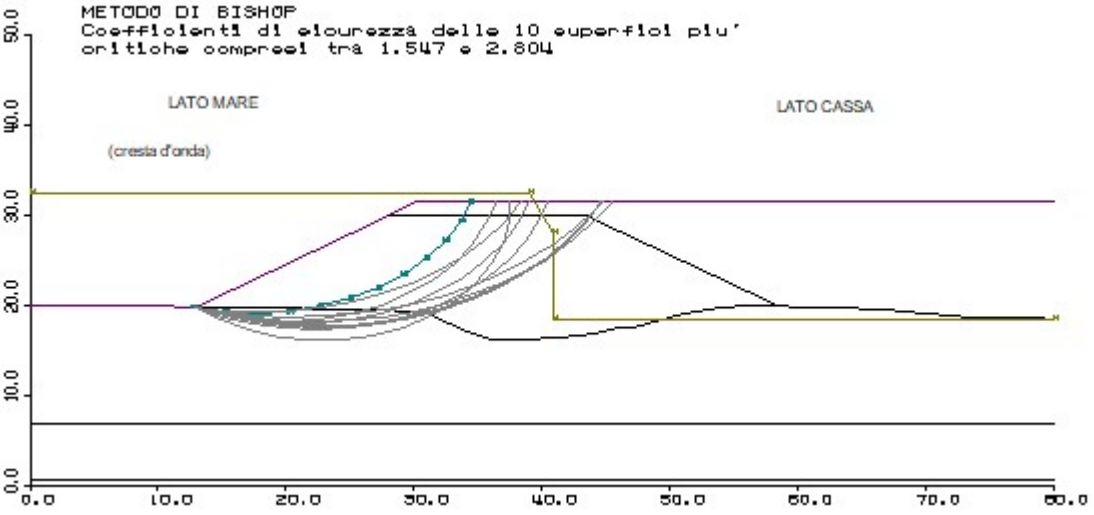

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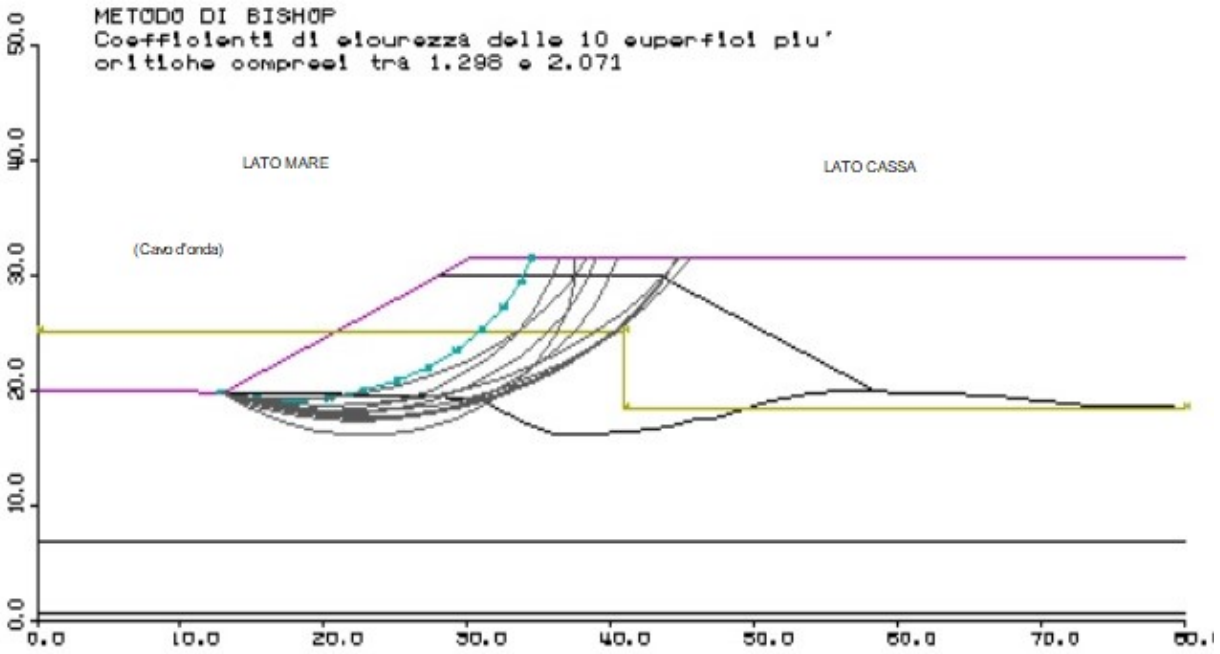
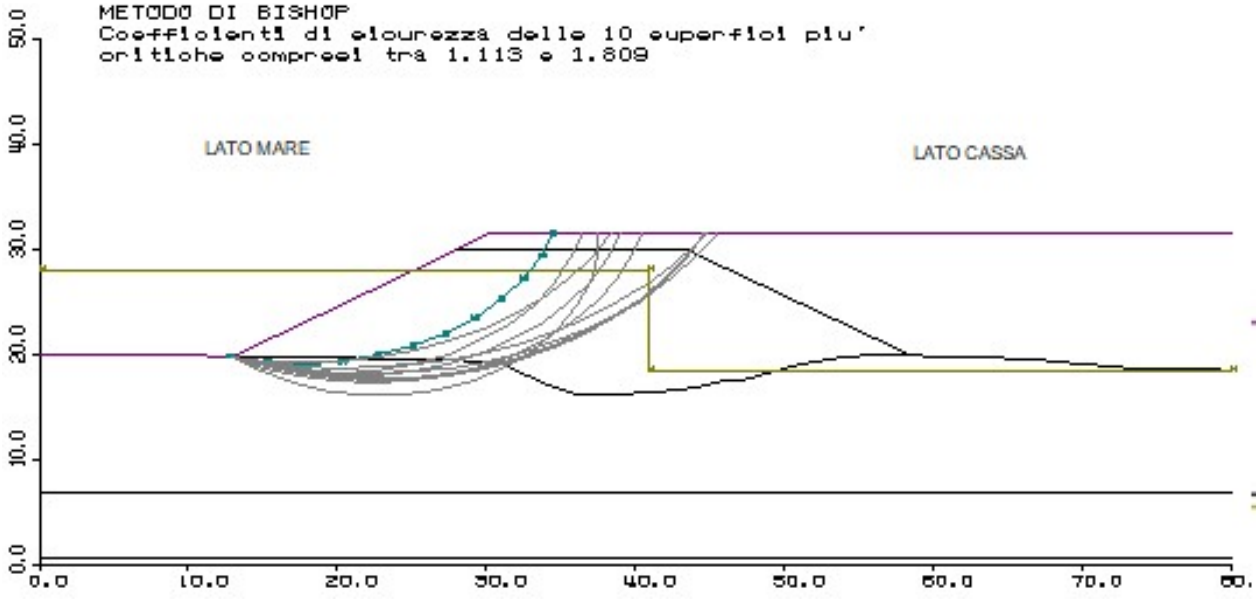
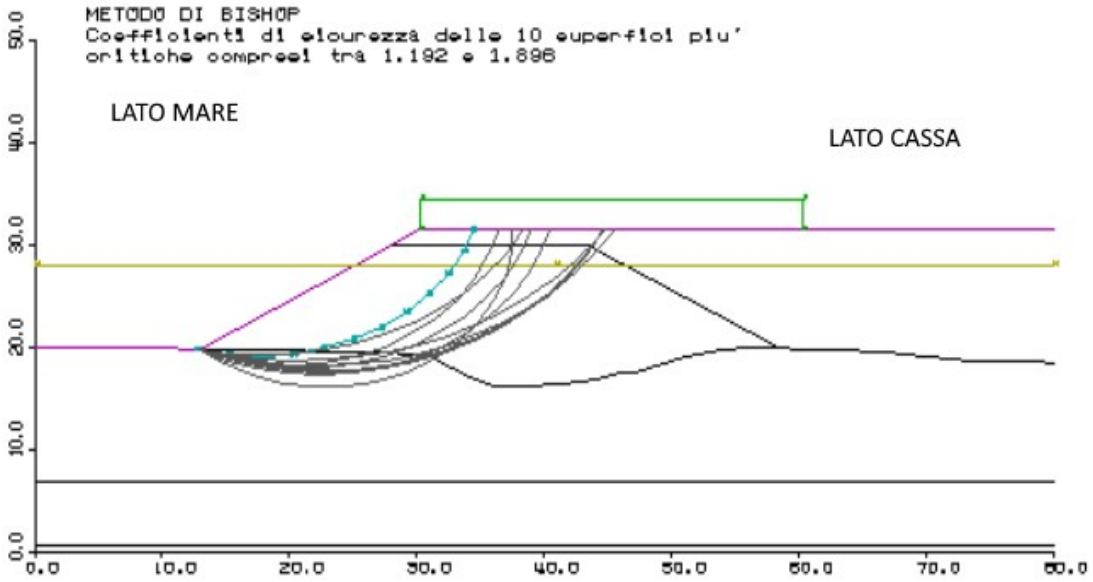


c) Con mareggiata estrema: cavo d'onda a -2.92 m;	1.298

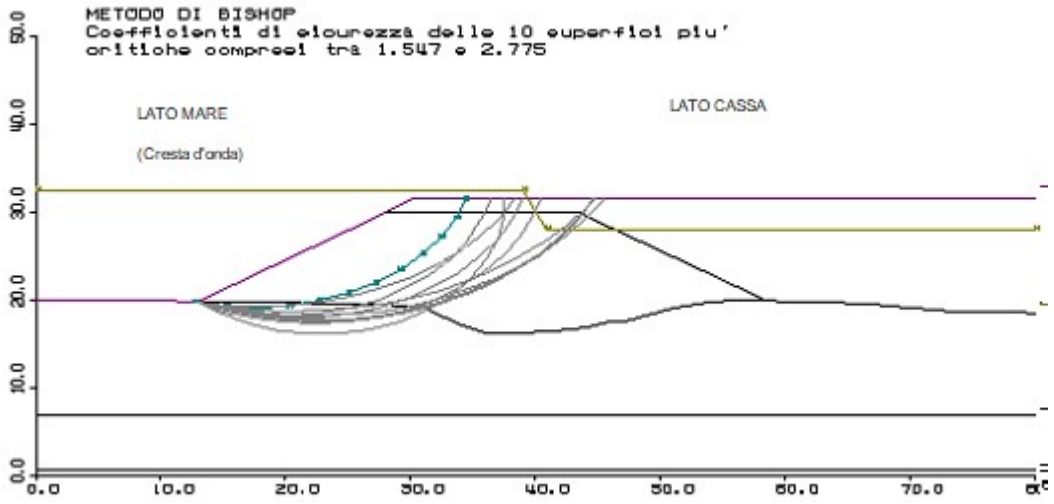


d) In sismica;	1.113

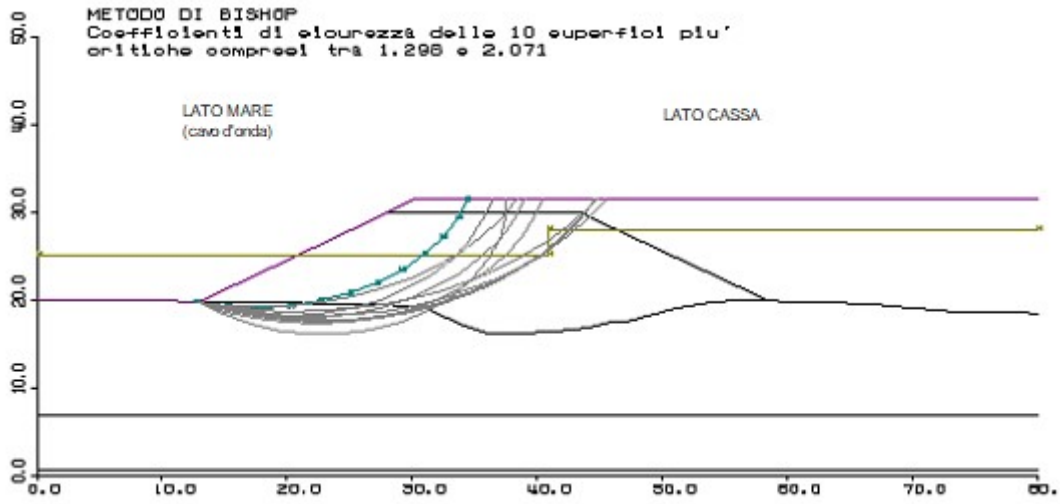
4) fase a lungo termine (tempo "∞") con riempimento della cassa fino alla quota + 3.50 m s.l.m. e falda lato cassa a quota fondale



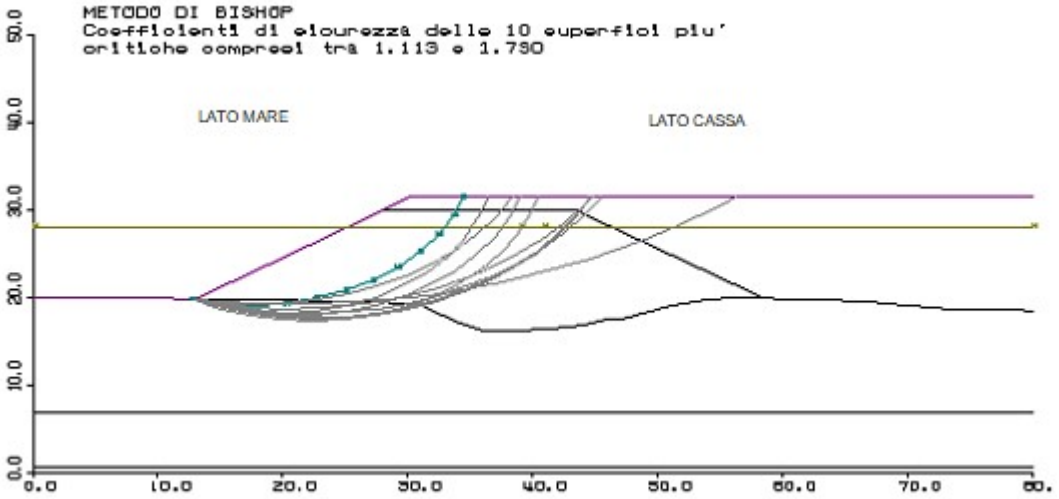
a) In esercizio (SLU) con carico accidentale di cantiere pari a 1.3*10=13 kN/mq;	1.192



b) Con mareggiata estrema: cresta d'onda +4.39 m;	1.547



c) Con mareggiata estrema: cavo d'onda a -2.92 m;	1.298



d) In sismica;	1.113

LEGENDA

Linea colore verde: sovraccarico accidentale

Linea colore magenta: profilo terreno

Linea colore ciano: superficie critica di scorrimento

Linea colore giallo: posizionamento falda con relativo salto di -3.00 m in corrispondenza del diaframma

Linee colore nero: suddivisione stratigrafica

6 ALLEGATI DI CALCOLO

6.1 FASE INIZIALE CON FALDA A QUOTA 0.00 METRI S.L.M.

7 ALLEGATI DI CALCOLO

7.1 FASE INIZIALE CON FALDA A QUOTA 0.00 METRI S.L.M.

7.1.1 **In esercizio (SLU) con carico accidentale di cantiere pari a 1.3*10=13 kN/mq**

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▯▯  ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════

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                                                                 ver. 2.03
▯F


                                DEVELOPED BY
                              RONALD A. SIEGEL
                         GRADUATE INSTRUCTOR IN RESEARCH
                              PURDUE UNIVERSITY


                           MICRO CONVERSION AND REVISION BY
                          Ing. C. MADIAI  and  Ing. M. PERINI
                              (C) studio I.S.G. - Firenze



                        GENERAL SOLUTION OF SLOPE STABILITY
                           PROBLEMS BY A TWO DIMENSIONAL
                            LIMITING EQUILIBRIUM METHOD



      PROBLEM DESCRIPTION ..  PARATIA DI DIAFRAMMI PLASTICI:

      COMMISSIONED BY ......  ********************************

      LOCATION .............  CONDIZIONE DI FALDA A 0.00 M
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BOUNDARY COORDINATES

18 TOP BOUNDARIES
39 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	43.39	30.00	5
8	43.39	30.00	58.49	19.93	5
9	58.49	19.93	60.13	19.87	1
10	60.13	19.87	63.63	19.71	1
11	63.63	19.71	66.13	19.66	1
12	66.13	19.66	67.13	19.56	1
13	67.13	19.56	68.13	19.41	1
14	68.13	19.41	72.13	18.89	1
15	72.13	18.89	73.62	18.70	1
16	73.62	18.70	76.13	18.64	1
17	76.13	18.64	78.62	18.57	1
18	78.62	18.57	80.00	18.52	1
19	12.90	19.87	14.60	19.87	1
20	14.60	19.87	17.13	19.70	1
21	17.13	19.70	19.13	19.82	1
22	19.13	19.82	23.60	19.62	1
23	23.60	19.62	26.13	19.64	1
24	26.13	19.64	27.66	19.60	1
25	27.66	19.60	31.13	19.21	1
26	31.13	19.21	34.13	17.12	1
27	34.13	17.12	36.13	16.23	1
28	36.13	16.23	38.38	16.28	1
29	38.38	16.28	41.38	16.43	1
30	41.38	16.43	44.13	16.78	1
31	44.13	16.78	46.13	17.52	1
32	46.13	17.52	47.13	17.54	1
33	47.13	17.54	51.13	19.22	1
34	51.13	19.22	54.13	19.76	1
35	54.13	19.76	56.13	20.00	1
36	56.13	20.00	58.49	19.93	1
37	.00	6.98	80.00	6.98	2
38	.00	.68	80.00	.68	3
39	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

5 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 2 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	28.00
2	80.00	28.00

BOUNDARY LOAD(S)

1 LOAD(S) SPECIFIED

LOAD NO.	X-LEFT (m)	X-RIGHT (m)	INTENSITY (t/mq)	DEFLECTION (DEG)
1	28.09	43.39	1.3	.0

NOTE - INTENSITY IS SPECIFIED AS A UNIFORMLY DISTRIBUTED
FORCE ACTING ON A HORIZONTALLY PROJECTED SURFACE.

Analisi di stabilita' dei pendii: metodi all'equilibrio limite

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.85 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 28.10 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 28 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.73	18.22
3	16.70	16.68
4	18.75	15.26
5	20.88	13.95
6	23.08	12.76
7	25.35	11.69
8	27.66	10.76
9	30.03	9.95
10	32.44	9.28
11	34.88	8.75
12	37.35	8.35
13	39.83	8.09
14	42.33	7.97
15	44.83	7.98
16	47.33	8.14
17	49.81	8.44
18	52.27	8.88
19	54.70	9.45
20	57.10	10.15
21	59.46	10.99
22	61.76	11.97
23	64.01	13.06
24	66.19	14.28
25	68.30	15.62
26	70.33	17.08
27	72.28	18.65
28	72.49	18.84

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF Å`

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 31 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.69	18.17
3	16.60	16.57
4	18.60	15.07
5	20.68	13.67
6	22.82	12.38
7	25.02	11.20
8	27.28	10.13
9	29.60	9.19
10	31.95	8.36
11	34.35	7.65
12	36.78	7.06
13	39.24	6.60
14	41.72	6.27
15	44.21	6.06
16	46.71	5.98
17	49.21	6.03
18	51.70	6.20
19	54.18	6.50
20	56.65	6.93
21	59.08	7.48
22	61.49	8.16
23	63.86	8.96
24	66.19	9.87
25	68.46	10.91
26	70.68	12.06
27	72.84	13.32
28	74.93	14.69
29	76.95	16.17
30	78.89	17.74
31	79.76	18.53

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF L¾¢ L

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 24 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.79	18.29
3	16.82	16.84
4	18.94	15.51
5	21.14	14.33
6	23.42	13.28
7	25.75	12.38
8	28.13	11.63
9	30.56	11.03
10	33.02	10.59
11	35.50	10.30
12	38.00	10.17
13	40.50	10.19
14	42.99	10.37
15	45.47	10.71
16	47.92	11.21
17	50.33	11.86
18	52.70	12.66
19	55.02	13.60
20	57.27	14.69
21	59.44	15.92
22	61.54	17.29
23	63.54	18.78
24	64.60	19.69

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF Aðâ┴

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 26 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.63	18.11
3	16.52	16.47
4	18.51	14.96
5	20.60	13.59
6	22.77	12.35
7	25.02	11.27
8	27.34	10.33
9	29.71	9.55
10	32.14	8.93
11	34.59	8.46
12	37.07	8.16
13	39.57	8.03
14	42.07	8.06
15	44.56	8.25
16	47.04	8.61
17	49.48	9.14
18	51.89	9.82
19	54.24	10.66
20	56.54	11.65
21	58.76	12.79
22	60.90	14.08
23	62.96	15.50
24	64.91	17.06
25	66.76	18.74
26	67.50	19.51

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF µıC┴

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 27 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.68	18.17
3	16.61	16.58
4	18.63	15.10
5	20.73	13.75
6	22.91	12.53
7	25.16	11.43
8	27.47	10.47
9	29.83	9.65
10	32.23	8.97
11	34.68	8.43
12	37.14	8.03
13	39.63	7.79
14	42.13	7.68
15	44.63	7.73
16	47.12	7.93
17	49.60	8.27
18	52.05	8.75

19	54.47	9.38
20	56.85	10.15
21	59.18	11.06
22	61.45	12.11
23	63.65	13.29
24	65.78	14.60
25	67.83	16.03
26	69.80	17.57
27	71.38	18.98

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ╣[▯┴

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 24 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.02	18.63
3	17.25	17.49
4	19.53	16.46
5	21.85	15.54
6	24.21	14.72
7	26.61	14.02
8	29.04	13.43
9	31.49	12.95
10	33.97	12.59
11	36.46	12.34
12	38.95	12.20
13	41.45	12.19
14	43.95	12.29
15	46.44	12.50
16	48.92	12.84
17	51.38	13.28
18	53.81	13.84
19	56.22	14.51
20	58.60	15.30
21	60.93	16.19
22	63.22	17.19
23	65.46	18.30
24	67.61	19.49

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF
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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 30 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.71	18.19
3	16.65	16.62
4	18.66	15.14
5	20.76	13.78
6	22.92	12.52
7	25.15	11.38

8	27.43	10.36
9	29.76	9.46
10	32.13	8.68
11	34.55	8.02
12	36.99	7.49
13	39.46	7.10
14	41.94	6.83
15	44.44	6.69
16	46.94	6.68
17	49.44	6.80
18	51.92	7.05
19	54.39	7.43
20	56.84	7.94
21	59.26	8.57
22	61.64	9.33
23	63.98	10.22
24	66.27	11.22
25	68.50	12.35
26	70.67	13.59
27	72.78	14.94
28	74.81	16.39
29	76.76	17.96
30	77.48	18.60

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF êZ┌└

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 21 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.03	18.65
3	17.28	17.55
4	19.58	16.58
5	21.94	15.75
6	24.34	15.04
7	26.77	14.46
8	29.23	14.03
9	31.71	13.73
10	34.21	13.57
11	36.71	13.54
12	39.21	13.66
13	41.69	13.91
14	44.16	14.31
15	46.61	14.84
16	49.02	15.50
17	51.38	16.30
18	53.71	17.22
19	55.97	18.28
20	58.18	19.46
21	58.92	19.91

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF 9²ÿ├

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 23 COORDINATE POINTS

POINT	X-SURF	Y-SURF

NO.	(m)	(m)
1	12.85	19.87
2	14.66	18.15
3	16.60	16.57
4	18.65	15.13
5	20.79	13.85
6	23.03	12.73
7	25.34	11.77
8	27.71	10.99
9	30.14	10.38
10	32.60	9.96
11	35.09	9.71
12	37.59	9.65
13	40.08	9.77
14	42.57	10.08
15	45.02	10.57
16	47.43	11.23
17	49.78	12.07
18	52.07	13.08
19	54.27	14.26
20	56.39	15.59
21	58.40	17.08
22	60.29	18.71
23	61.40	19.81

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ├▓÷┴

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 29 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.69	18.17
3	16.61	16.58
4	18.63	15.10
5	20.71	13.72
6	22.88	12.46
7	25.10	11.33
8	27.39	10.31
9	29.72	9.42
10	32.10	8.66
11	34.52	8.03
12	36.97	7.54
13	39.45	7.17
14	41.94	6.95
15	44.44	6.86
16	46.93	6.90
17	49.43	7.08
18	51.91	7.40
19	54.37	7.85
20	56.80	8.44
21	59.19	9.16
22	61.54	10.00
23	63.85	10.98
24	66.09	12.07
25	68.28	13.29
26	70.39	14.63
27	72.43	16.07
28	74.38	17.63
29	75.53	18.65

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF >û-└

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 25 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.19	18.99
3	17.55	18.18
4	19.94	17.44
5	22.35	16.77
6	24.78	16.19
7	27.23	15.67
8	29.69	15.23
9	32.16	14.87
10	34.65	14.58
11	37.14	14.37
12	39.63	14.23
13	42.13	14.18
14	44.63	14.20
15	47.13	14.29
16	49.63	14.46
17	52.11	14.71
18	54.59	15.04
19	57.06	15.44
20	59.51	15.91
21	61.95	16.47
22	64.37	17.09
23	66.77	17.79
24	69.15	18.56
25	70.60	19.09

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ÊU:⊥

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 26 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.26	19.20
3	17.68	18.58
4	20.12	18.02
5	22.56	17.51
6	25.02	17.05
7	27.49	16.65
8	29.96	16.29
9	32.45	16.00
10	34.93	15.75
11	37.43	15.56
12	39.92	15.42
13	42.42	15.34
14	44.92	15.31
15	47.42	15.33
16	49.92	15.41
17	52.42	15.54
18	54.91	15.73
19	57.40	15.97
20	59.88	16.26
21	62.36	16.61
22	64.83	17.01
23	67.28	17.46
24	69.73	17.97

25	72.17	18.52
26	73.11	18.76

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF p¡6⊥

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 28 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.63	18.12
3	16.52	16.47
4	18.50	14.95
5	20.56	13.54
6	22.71	12.26
7	24.93	11.11
8	27.22	10.10
9	29.56	9.22
10	31.95	8.49
11	34.38	7.90
12	36.84	7.46
13	39.32	7.16
14	41.82	7.02
15	44.32	7.02
16	46.81	7.17
17	49.30	7.47
18	51.75	7.92
19	54.18	8.52
20	56.57	9.26
21	58.91	10.14
22	61.19	11.16
23	63.41	12.32
24	65.55	13.60
25	67.62	15.01
26	69.59	16.55
27	71.47	18.19
28	72.17	18.88

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF °-▯⊥

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FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 11 COORDINATE POINTS (R= 16.23 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.32	19.47
3	17.82	19.46
4	20.29	19.82
5	22.68	20.57
6	24.92	21.67
7	26.97	23.09
8	28.78	24.82
9	30.31	26.80
10	31.51	29.00
11	31.87	30.00

*** 1.290 ***

FAILURE SURFACE SPECIFIED BY 11 COORDINATE POINTS (R= 13.96 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.30	19.36
3	17.80	19.29
4	20.27	19.67
5	22.63	20.48
6	24.81	21.70
7	26.74	23.29
8	28.36	25.20
9	29.61	27.36
10	30.45	29.71
11	30.50	30.00

*** 1.328 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 18.57 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.31	19.42
3	17.81	19.30
4	20.30	19.52
5	22.74	20.07
6	25.08	20.94
7	27.28	22.12
8	29.31	23.58
9	31.12	25.30
10	32.69	27.25
11	33.98	29.39
12	34.24	30.00

*** 1.390 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 13.63 m)

POINT NO.	X-SURF (m)	Y-SURF (m)

1	12.85	19.87
2	15.19	18.98
3	17.65	18.54
4	20.15	18.55
5	22.60	19.02
6	24.93	19.93
7	27.06	21.24
8	28.91	22.92
9	30.42	24.91
10	31.55	27.15
11	32.24	29.55
12	32.29	30.00

*** 1.562 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 27.38 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.32	19.50
3	17.82	19.36
4	20.32	19.45
5	22.80	19.76
6	25.24	20.30
7	27.62	21.06
8	29.92	22.04
9	32.13	23.22
10	34.21	24.59
11	36.17	26.15
12	37.97	27.89
13	39.61	29.77
14	39.77	30.00

*** 1.648 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 25.53 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.28	19.28
3	17.76	18.94
4	20.25	18.84
5	22.75	18.98
6	25.22	19.37
7	27.64	19.99
8	29.99	20.85
9	32.24	21.94
10	34.38	23.23
11	36.38	24.74
12	38.22	26.43
13	39.89	28.29
14	41.14	30.00

*** 1.813 ***

FAILURE SURFACE SPECIFIED BY 13 COORDINATE POINTS (R= 15.77 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.09	18.76
3	17.48	18.02
4	19.95	17.66
5	22.45	17.70
6	24.91	18.14
7	27.28	18.96
8	29.48	20.14

9	31.47	21.65
10	33.19	23.46
11	34.61	25.52
12	35.69	27.78
13	36.34	30.00

*** 1.862 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 23.85 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.23	19.11
3	17.68	18.61
4	20.17	18.37
5	22.67	18.38
6	25.15	18.66
7	27.60	19.20
8	29.97	19.99
9	32.25	21.02
10	34.40	22.28
11	36.41	23.77
12	38.26	25.45
13	39.92	27.32
14	41.38	29.35
15	41.74	30.00

*** 1.934 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 21.19 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.18	18.97
3	17.60	18.34
4	20.08	18.01
5	22.58	17.97
6	25.07	18.22
7	27.51	18.77
8	29.87	19.60
9	32.11	20.70
10	34.21	22.05
11	36.14	23.65
12	37.86	25.46
13	39.36	27.46
14	40.61	29.62
15	40.77	30.00

*** 1.959 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 20.73 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.16	18.92
3	17.58	18.27
4	20.05	17.90
5	22.55	17.84
6	25.04	18.07
7	27.48	18.61
8	29.84	19.43
9	32.08	20.53
10	34.18	21.90
11	36.10	23.50
12	37.81	25.33
13	39.28	27.34
14	40.51	29.52

15 40.70 30.00

*** 1.982 ***

7.1.2 **Con mareggiata estrema: cresta d’onda +4.39 m**

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▯▯  ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

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                                                                ver. 2.03
▯F

                                DEVELOPED BY
                              RONALD A. SIEGEL
                        GRADUATE INSTRUCTOR IN RESEARCH
                              PURDUE UNIVERSITY


                          MICRO CONVERSION AND REVISION BY
                        Ing. C. MADIAI  and  Ing. M. PERINI
                            (C) studio I.S.G. - Firenze



                        GENERAL SOLUTION OF SLOPE STABILITY
                           PROBLEMS BY A TWO DIMENSIONAL
                           LIMITING EQUILIBRIUM METHOD



      PROBLEM DESCRIPTION ..  PARATIA DI DIAFRAMMI PLASTICI:


      COMMISSIONED BY ......  ****    CAVO D'ONDA    *********

      LOCATION .............  CONDIZIONE DI FALDA A 0.00 M
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BOUNDARY COORDINATES

18 TOP BOUNDARIES
39 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	43.39	30.00	5
8	43.39	30.00	58.49	19.93	5
9	58.49	19.93	60.13	19.87	1
10	60.13	19.87	63.63	19.71	1
11	63.63	19.71	66.13	19.66	1
12	66.13	19.66	67.13	19.56	1
13	67.13	19.56	68.13	19.41	1
14	68.13	19.41	72.13	18.89	1
15	72.13	18.89	73.62	18.70	1
16	73.62	18.70	76.13	18.64	1
17	76.13	18.64	78.62	18.57	1
18	78.62	18.57	80.00	18.52	1
19	12.90	19.87	14.60	19.87	1
20	14.60	19.87	17.13	19.70	1
21	17.13	19.70	19.13	19.82	1
22	19.13	19.82	23.60	19.62	1
23	23.60	19.62	26.13	19.64	1
24	26.13	19.64	27.66	19.60	1
25	27.66	19.60	31.13	19.21	1
26	31.13	19.21	34.13	17.12	1
27	34.13	17.12	36.13	16.23	1
28	36.13	16.23	38.38	16.28	1
29	38.38	16.28	41.38	16.43	1
30	41.38	16.43	44.13	16.78	1
31	44.13	16.78	46.13	17.52	1
32	46.13	17.52	47.13	17.54	1
33	47.13	17.54	51.13	19.22	1
34	51.13	19.22	54.13	19.76	1
35	54.13	19.76	56.13	20.00	1
36	56.13	20.00	58.49	19.93	1
37	.00	6.98	80.00	6.98	2
38	.00	.68	80.00	.68	3
39	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

5 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	32.39
2	39.00	32.39
3	40.90	28.00
4	80.00	28.00

Analisi di stabilita' dei pendii: metodi all'equilibrio limite

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.85 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 30.00 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 22 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.68	18.17
3	16.64	16.61
4	18.72	15.22
5	20.90	14.00
6	23.17	12.96
7	25.52	12.11
8	27.93	11.44
9	30.39	10.96
10	32.87	10.69
11	35.37	10.61
12	37.87	10.74
13	40.35	11.06
14	42.79	11.57
15	45.19	12.29
16	47.52	13.19
17	49.77	14.27
18	51.93	15.53
19	53.98	16.96
20	55.92	18.55
21	57.72	20.28
22	57.81	20.38

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ä¤

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 28 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87

2	14.73	18.22
3	16.70	16.68
4	18.75	15.25
5	20.88	13.94
6	23.07	12.74
7	25.33	11.67
8	27.65	10.72
9	30.01	9.91
10	32.41	9.22
11	34.85	8.67
12	37.32	8.25
13	39.80	7.97
14	42.30	7.83
15	44.80	7.82
16	47.29	7.96
17	49.78	8.23
18	52.24	8.63
19	54.69	9.17
20	57.09	9.85
21	59.46	10.66
22	61.78	11.59
23	64.04	12.66
24	66.24	13.84
25	68.37	15.15
26	70.43	16.57
27	72.40	18.10
28	73.16	18.76

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF >FÉ└

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 31 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.69	18.17
3	16.60	16.57
4	18.60	15.07
5	20.68	13.67
6	22.82	12.38
7	25.02	11.20
8	27.28	10.13
9	29.60	9.18
10	31.95	8.35
11	34.35	7.65
12	36.78	7.06
13	39.24	6.60
14	41.72	6.26
15	44.21	6.06
16	46.71	5.97
17	49.21	6.02
18	51.70	6.19
19	54.18	6.50
20	56.64	6.92
21	59.08	7.47
22	61.49	8.15
23	63.86	8.95
24	66.19	9.86
25	68.46	10.90
26	70.68	12.05
27	72.84	13.31
28	74.93	14.68
29	76.95	16.15
30	78.89	17.73
31	79.79	18.53

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE

HAS BEEN CALCULATED THROUGH THE METHOD OF ËU]└

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 25 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.79	18.29
3	16.82	16.83
4	18.94	15.50
5	21.13	14.30
6	23.39	13.24
7	25.72	12.32
8	28.09	11.55
9	30.51	10.92
10	32.97	10.44
11	35.45	10.11
12	37.94	9.93
13	40.44	9.90
14	42.94	10.03
15	45.42	10.32
16	47.88	10.75
17	50.31	11.33
18	52.70	12.06
19	55.05	12.94
20	57.33	13.96
21	59.55	15.11
22	61.69	16.40
23	63.75	17.82
24	65.71	19.36
25	66.05	19.66

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ╝ÐÑ└

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 21 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.87	18.40
3	16.99	17.07
4	19.19	15.88
5	21.46	14.84
6	23.80	13.95
7	26.19	13.22
8	28.62	12.65
9	31.09	12.25
10	33.58	12.01
11	36.08	11.93
12	38.58	12.02
13	41.06	12.28
14	43.53	12.70
15	45.96	13.28
16	48.35	14.03
17	50.68	14.93
18	52.94	15.98
19	55.14	17.19
20	57.24	18.53
21	59.11	19.91

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF °ºÒ└

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 21 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.63	18.11
3	16.55	16.52
4	18.62	15.11
5	20.80	13.89
6	23.08	12.87
7	25.45	12.06
8	27.88	11.47
9	30.35	11.10
10	32.85	10.96
11	35.35	11.04
12	37.83	11.35
13	40.27	11.88
14	42.66	12.63
15	44.96	13.59
16	47.18	14.75
17	49.27	16.11
18	51.24	17.66
19	53.06	19.37
20	54.72	21.24
21	55.31	22.05

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ÕZá┴

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 26 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.63	18.11
3	16.51	16.47
4	18.50	14.95
5	20.58	13.57
6	22.75	12.32
7	24.99	11.22
8	27.30	10.26
9	29.67	9.46
10	32.08	8.81
11	34.54	8.31
12	37.01	7.98
13	39.51	7.80
14	42.01	7.79
15	44.50	7.94
16	46.98	8.25
17	49.44	8.72
18	51.86	9.34
19	54.23	10.13
20	56.55	11.06

21	58.81	12.14
22	60.99	13.36
23	63.08	14.73
24	65.09	16.22
25	66.99	17.84
26	68.55	19.36

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ÿÄú└

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 28 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.68	18.17
3	16.61	16.58
4	18.63	15.10
5	20.73	13.74
6	22.90	12.51
7	25.14	11.40
8	27.45	10.43
9	29.80	9.59
10	32.20	8.89
11	34.64	8.34
12	37.10	7.92
13	39.59	7.65
14	42.09	7.52
15	44.59	7.54
16	47.08	7.70
17	49.56	8.01
18	52.02	8.46
19	54.45	9.05
20	56.84	9.79
21	59.18	10.66
22	61.47	11.67
23	63.70	12.80
24	65.85	14.07
25	67.93	15.46
26	69.93	16.96
27	71.83	18.58
28	72.15	18.88

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF \▯ò└

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 25 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.02	18.63
3	17.25	17.49
4	19.52	16.46
5	21.84	15.52
6	24.20	14.70
7	26.60	13.98

8	29.02	13.37
9	31.47	12.87
10	33.94	12.48
11	36.43	12.21
12	38.92	12.05
13	41.42	12.00
14	43.92	12.06
15	46.41	12.24
16	48.90	12.53
17	51.36	12.93
18	53.81	13.44
19	56.23	14.07
20	58.62	14.80
21	60.98	15.64
22	63.29	16.59
23	65.56	17.64
24	67.78	18.79
25	68.72	19.33

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ¶úÅ└

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 30 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.71	18.19
3	16.64	16.62
4	18.66	15.14
5	20.76	13.77
6	22.92	12.52
7	25.14	11.37
8	27.42	10.35
9	29.75	9.44
10	32.13	8.66
11	34.54	8.00
12	36.98	7.47
13	39.45	7.06
14	41.93	6.78
15	44.43	6.64
16	46.93	6.62
17	49.42	6.73
18	51.91	6.97
19	54.38	7.35
20	56.83	7.84
21	59.25	8.47
22	61.64	9.22
23	63.98	10.09
24	66.28	11.09
25	68.51	12.20
26	70.69	13.43
27	72.80	14.77
28	74.84	16.21
29	76.80	17.76
30	77.75	18.59

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ÆÌq└

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 19 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.21	19.04
3	17.60	18.31
4	20.02	17.69
5	22.47	17.17
6	24.93	16.77
7	27.42	16.46
8	29.91	16.27
9	32.41	16.19
10	34.91	16.21
11	37.40	16.35
12	39.89	16.59
13	42.37	16.94
14	44.83	17.39
15	47.26	17.96
16	49.67	18.63
17	52.05	19.40
18	54.39	20.28
19	56.57	21.21

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF í⌂ ⊥

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 22 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.03	18.65
3	17.28	17.55
4	19.58	16.57
5	21.93	15.71
6	24.32	14.98
7	26.74	14.38
8	29.20	13.91
9	31.67	13.57
10	34.17	13.36
11	36.66	13.28
12	39.16	13.34
13	41.66	13.53
14	44.14	13.85
15	46.59	14.30
16	49.03	14.89
17	51.42	15.60
18	53.78	16.44
19	56.08	17.40
20	58.34	18.48
21	60.53	19.68
22	60.78	19.84

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF (Ø╕ └

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 24 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.66	18.15
3	16.60	16.56
4	18.63	15.11
5	20.77	13.82
6	22.99	12.67
7	25.29	11.69
8	27.66	10.88
9	30.07	10.23
10	32.53	9.76
11	35.01	9.46
12	37.51	9.34
13	40.01	9.39
14	42.49	9.63
15	44.96	10.04
16	47.39	10.62
17	49.77	11.38
18	52.10	12.30
19	54.35	13.39
20	56.52	14.63
21	58.59	16.02
22	60.57	17.56
23	62.42	19.23
24	62.91	19.74

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF Ý▯—└

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 29 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.69	18.17
3	16.61	16.58
4	18.62	15.09
5	20.71	13.72
6	22.87	12.46
7	25.09	11.31
8	27.38	10.29
9	29.71	9.40
10	32.09	8.63
11	34.51	7.99
12	36.95	7.48
13	39.43	7.11
14	41.91	6.87
15	44.41	6.77
16	46.91	6.80
17	49.41	6.96
18	51.89	7.27
19	54.35	7.70
20	56.78	8.27
21	59.19	8.97
22	61.54	9.79
23	63.86	10.75
24	66.11	11.82
25	68.31	13.02
26	70.43	14.33
27	72.49	15.76
28	74.46	17.30
29	76.00	18.64

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF Dá~└

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 25 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.19	18.99
3	17.55	18.17
4	19.94	17.43
5	22.35	16.77
6	24.78	16.17
7	27.22	15.65
8	29.68	15.20
9	32.15	14.82
10	34.64	14.52
11	37.13	14.30
12	39.62	14.15
13	42.12	14.07
14	44.62	14.07
15	47.12	14.15
16	49.61	14.29
17	52.10	14.52
18	54.59	14.82
19	57.06	15.19
20	59.52	15.64
21	61.96	16.16
22	64.39	16.76
23	66.80	17.42
24	69.19	18.16
25	71.53	18.96

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF Â╜ä└

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 26 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.26	19.20
3	17.68	18.58
4	20.12	18.02
5	22.56	17.50
6	25.02	17.04
7	27.49	16.63
8	29.96	16.28
9	32.44	15.97
10	34.93	15.72
11	37.42	15.52
12	39.92	15.38
13	42.42	15.28
14	44.92	15.24
15	47.42	15.26
16	49.91	15.32
17	52.41	15.44
18	54.91	15.62
19	57.40	15.84

20	59.88	16.12
21	62.36	16.45
22	64.83	16.83
23	67.29	17.27
24	69.74	17.76
25	72.18	18.30
26	73.81	18.69

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ?~ü└

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 21 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.79	18.29
3	16.84	16.87
4	19.00	15.59
5	21.24	14.49
6	23.55	13.55
7	25.93	12.78
8	28.36	12.19
9	30.83	11.78
10	33.32	11.56
11	35.82	11.52
12	38.31	11.67
13	40.79	12.00
14	43.24	12.51
15	45.64	13.20
16	47.99	14.07
17	50.26	15.11
18	52.45	16.31
19	54.55	17.68
20	56.54	19.19
21	57.85	20.35

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ▯®

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 22 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.70	18.19
3	16.68	16.66
4	18.76	15.28
5	20.95	14.06
6	23.22	13.02
7	25.56	12.15
8	27.97	11.46
9	30.41	10.95
10	32.89	10.63
11	35.39	10.50
12	37.89	10.56
13	40.38	10.80
14	42.84	11.24
15	45.26	11.86
16	47.63	12.66
17	49.93	13.64
18	52.15	14.80
19	54.27	16.11
20	56.29	17.59
21	58.19	19.21
22	58.90	19.91

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF le■└

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 20 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.17	18.95
3	17.54	18.13
4	19.93	17.41
5	22.36	16.80
6	24.81	16.30
7	27.27	15.91
8	29.76	15.62
9	32.25	15.45
10	34.75	15.39
11	37.25	15.43
12	39.75	15.59
13	42.23	15.85
14	44.70	16.23
15	47.16	16.71
16	49.59	17.30
17	51.99	18.00
18	54.35	18.80
19	56.69	19.70
20	57.98	20.27

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ;ÐÎ└

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 28 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.63	18.12
3	16.52	16.47
4	18.49	14.94
5	20.56	13.53
6	22.70	12.25
7	24.92	11.09
8	27.20	10.06
9	29.53	9.17
10	31.92	8.43
11	34.34	7.82
12	36.80	7.36
13	39.28	7.04
14	41.78	6.87
15	44.28	6.85
16	46.77	6.97
17	49.26	7.24
18	51.72	7.66
19	54.16	8.23
20	56.56	8.93
21	58.91	9.78
22	61.21	10.76
23	63.44	11.88
24	65.61	13.13
25	67.70	14.50
26	69.70	16.00
27	71.62	17.61
28	72.87	18.79

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ×-ë└

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FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 11 COORDINATE POINTS (R= 16.03 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.30	19.36
3	17.79	19.23
4	20.28	19.49
5	22.70	20.14
6	24.98	21.15
7	27.08	22.50
8	28.95	24.17
9	30.53	26.10
10	31.80	28.26
11	32.49	30.00

*** 1.547 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 18.80 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.32	19.47
3	17.82	19.40
4	20.30	19.67
5	22.73	20.26
6	25.06	21.17
7	27.25	22.38
8	29.26	23.87
9	31.05	25.61
10	32.60	27.58
11	33.87	29.73
12	33.98	30.00

*** 1.557 ***

FAILURE SURFACE SPECIFIED BY 13 COORDINATE POINTS (R= 21.39 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.31	19.42
3	17.80	19.26
4	20.30	19.39
5	22.76	19.81
6	25.16	20.51
7	27.46	21.49
8	29.63	22.74
9	31.64	24.22
10	33.47	25.93
11	35.08	27.85
12	36.45	29.93
13	36.48	30.00

*** 1.726 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 15.37 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.19	18.98
3	17.64	18.49
4	20.14	18.40
5	22.62	18.71
6	25.01	19.42
7	27.26	20.51
8	29.31	21.95
9	31.09	23.70
10	32.57	25.72
11	33.70	27.95
12	34.34	30.00

*** 1.881 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 17.49 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.09	18.76
3	17.47	17.98
4	19.93	17.55
5	22.43	17.47
6	24.91	17.75
7	27.33	18.38
8	29.64	19.35
9	31.78	20.63
10	33.72	22.21
11	35.41	24.05
12	36.83	26.11
13	37.94	28.35
14	38.48	30.00

*** 2.349 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 31.50 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.32	19.50
3	17.82	19.33
4	20.32	19.36
5	22.81	19.59
6	25.27	20.01
7	27.69	20.63
8	30.06	21.43
9	32.35	22.43
10	34.56	23.60
11	36.67	24.94
12	38.67	26.45
13	40.54	28.10
14	42.27	29.91
15	42.34	30.00

*** 2.356 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 28.86 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.28	19.28
3	17.75	18.91
4	20.25	18.75
5	22.75	18.81

6	25.23	19.08
7	27.68	19.57
8	30.08	20.27
9	32.42	21.17
10	34.66	22.27
11	36.80	23.56
12	38.82	25.03
13	40.71	26.67
14	42.45	28.47
15	43.58	29.87

*** 2.776 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 15.44 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.85	18.37
3	17.06	17.21
4	19.44	16.42
5	21.90	16.02
6	24.40	16.03
7	26.87	16.44
8	29.24	17.24
9	31.45	18.41
10	33.44	19.92
11	35.16	21.74
12	36.57	23.80
13	37.62	26.07
14	38.30	28.48
15	38.47	30.00

*** 2.871 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 15.60 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.85	18.37
3	17.06	17.20
4	19.43	16.41
5	21.90	16.00
6	24.40	15.99
7	26.87	16.38
8	29.24	17.16
9	31.46	18.30
10	33.47	19.79
11	35.22	21.58
12	36.66	23.62
13	37.76	25.87
14	38.48	28.26
15	38.71	30.00

*** 2.891 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 23.60 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.18	18.97
3	17.59	18.31
4	20.06	17.92
5	22.56	17.79
6	25.06	17.93
7	27.52	18.32
8	29.94	18.98
9	32.27	19.89

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10          34.49       21.04
11          36.57       22.42
12          38.50       24.01
13          40.25       25.80
14          41.80       27.76
15          43.13       29.87
16          43.19       30.00

***    2.952 ***
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7.1.3 **Con mareggiata estrema: cavo d'onda a -2.92 m**

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▯▯  ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

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                                                                ver. 2.03
▯F

                                DEVELOPED BY
                              RONALD A. SIEGEL
                        GRADUATE INSTRUCTOR IN RESEARCH
                              PURDUE UNIVERSITY


                          MICRO CONVERSION AND REVISION BY
                        Ing. C. MADIAI  and  Ing. M. PERINI
                            (C) studio I.S.G. - Firenze



                        GENERAL SOLUTION OF SLOPE STABILITY
                           PROBLEMS BY A TWO DIMENSIONAL
                            LIMITING EQUILIBRIUM METHOD



      PROBLEM DESCRIPTION ..  PARATIA DI DIAFRAMMI PLASTICI:

      COMMISSIONED BY ......  ****    CAVO D'ONDA    *********

      LOCATION .............  CONDIZIONE DI FALDA A 0.00 M
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BOUNDARY COORDINATES

18 TOP BOUNDARIES
39 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	43.39	30.00	5
8	43.39	30.00	58.49	19.93	5
9	58.49	19.93	60.13	19.87	1
10	60.13	19.87	63.63	19.71	1
11	63.63	19.71	66.13	19.66	1
12	66.13	19.66	67.13	19.56	1
13	67.13	19.56	68.13	19.41	1
14	68.13	19.41	72.13	18.89	1
15	72.13	18.89	73.62	18.70	1
16	73.62	18.70	76.13	18.64	1
17	76.13	18.64	78.62	18.57	1
18	78.62	18.57	80.00	18.52	1
19	12.90	19.87	14.60	19.87	1
20	14.60	19.87	17.13	19.70	1
21	17.13	19.70	19.13	19.82	1
22	19.13	19.82	23.60	19.62	1
23	23.60	19.62	26.13	19.64	1
24	26.13	19.64	27.66	19.60	1
25	27.66	19.60	31.13	19.21	1
26	31.13	19.21	34.13	17.12	1
27	34.13	17.12	36.13	16.23	1
28	36.13	16.23	38.38	16.28	1
29	38.38	16.28	41.38	16.43	1
30	41.38	16.43	44.13	16.78	1
31	44.13	16.78	46.13	17.52	1
32	46.13	17.52	47.13	17.54	1
33	47.13	17.54	51.13	19.22	1
34	51.13	19.22	54.13	19.76	1
35	54.13	19.76	56.13	20.00	1
36	56.13	20.00	58.49	19.93	1
37	.00	6.98	80.00	6.98	2
38	.00	.68	80.00	.68	3
39	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

5 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	25.08
2	40.90	25.08
3	40.91	28.00
4	80.00	28.00

Analisi di stabilita' dei pendii: metodi all'equilibrio limite

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.85 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 30.00 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 28 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.73	18.22
3	16.70	16.68
4	18.75	15.25
5	20.88	13.94
6	23.07	12.74
7	25.33	11.67
8	27.65	10.72
9	30.01	9.91
10	32.41	9.22
11	34.85	8.67
12	37.32	8.25
13	39.80	7.97
14	42.30	7.83
15	44.80	7.82
16	47.29	7.96
17	49.78	8.23
18	52.24	8.63
19	54.69	9.17
20	57.09	9.85
21	59.46	10.66
22	61.78	11.59
23	64.04	12.66
24	66.24	13.84
25	68.37	15.15
26	70.43	16.57
27	72.40	18.10
28	73.16	18.76

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF P■å┴

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 31 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.69	18.17
3	16.60	16.57
4	18.60	15.07
5	20.68	13.67
6	22.82	12.38
7	25.02	11.20
8	27.28	10.13
9	29.60	9.18
10	31.95	8.35
11	34.35	7.65
12	36.78	7.06
13	39.24	6.60
14	41.72	6.26
15	44.21	6.06
16	46.71	5.97
17	49.21	6.02
18	51.70	6.19
19	54.18	6.50
20	56.64	6.92
21	59.08	7.47
22	61.49	8.15
23	63.86	8.95
24	66.19	9.86
25	68.46	10.90
26	70.68	12.05
27	72.84	13.31
28	74.93	14.68
29	76.95	16.15
30	78.89	17.73
31	79.79	18.53

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF 01

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 25 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.79	18.29
3	16.82	16.83
4	18.94	15.50
5	21.13	14.30
6	23.39	13.24
7	25.72	12.32
8	28.09	11.55
9	30.51	10.92
10	32.97	10.44
11	35.45	10.11
12	37.94	9.93
13	40.44	9.90
14	42.94	10.03
15	45.42	10.32
16	47.88	10.75
17	50.31	11.33
18	52.70	12.06
19	55.05	12.94
20	57.33	13.96
21	59.55	15.11
22	61.69	16.40
23	63.75	17.82
24	65.71	19.36
25	66.05	19.66

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF Q Ñ

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 26 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.63	18.11
3	16.51	16.47
4	18.50	14.95
5	20.58	13.57
6	22.75	12.32
7	24.99	11.22
8	27.30	10.26
9	29.67	9.46
10	32.08	8.81
11	34.54	8.31
12	37.01	7.98
13	39.51	7.80
14	42.01	7.79
15	44.50	7.94
16	46.98	8.25
17	49.44	8.72
18	51.86	9.34
19	54.23	10.13
20	56.55	11.06
21	58.81	12.14
22	60.99	13.36
23	63.08	14.73
24	65.09	16.22
25	66.99	17.84
26	68.55	19.36

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF /õþ

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 28 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.68	18.17
3	16.61	16.58
4	18.63	15.10
5	20.73	13.74
6	22.90	12.51
7	25.14	11.40
8	27.45	10.43
9	29.80	9.59
10	32.20	8.89
11	34.64	8.34
12	37.10	7.92
13	39.59	7.65
14	42.09	7.52
15	44.59	7.54
16	47.08	7.70
17	49.56	8.01

18	52.02	8.46
19	54.45	9.05
20	56.84	9.79
21	59.18	10.66
22	61.47	11.67
23	63.70	12.80
24	65.85	14.07
25	67.93	15.46
26	69.93	16.96
27	71.83	18.58
28	72.15	18.88

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF L£æ┴

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 25 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.02	18.63
3	17.25	17.49
4	19.52	16.46
5	21.84	15.52
6	24.20	14.70
7	26.60	13.98
8	29.02	13.37
9	31.47	12.87
10	33.94	12.48
11	36.43	12.21
12	38.92	12.05
13	41.42	12.00
14	43.92	12.06
15	46.41	12.24
16	48.90	12.53
17	51.36	12.93
18	53.81	13.44
19	56.23	14.07
20	58.62	14.80
21	60.98	15.64
22	63.29	16.59
23	65.56	17.64
24	67.78	18.79
25	68.72	19.33

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ┗I┳

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 30 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.71	18.19
3	16.64	16.62
4	18.66	15.14
5	20.76	13.77

6	22.92	12.52
7	25.14	11.37
8	27.42	10.35
9	29.75	9.44
10	32.13	8.66
11	34.54	8.00
12	36.98	7.47
13	39.45	7.06
14	41.93	6.78
15	44.43	6.64
16	46.93	6.62
17	49.42	6.73
18	51.91	6.97
19	54.38	7.35
20	56.83	7.84
21	59.25	8.47
22	61.64	9.22
23	63.98	10.09
24	66.28	11.09
25	68.51	12.20
26	70.69	13.43
27	72.80	14.77
28	74.84	16.21
29	76.80	17.76
30	77.75	18.59

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF .Â3┴

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 29 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.69	18.17
3	16.61	16.58
4	18.62	15.09
5	20.71	13.72
6	22.87	12.46
7	25.09	11.31
8	27.38	10.29
9	29.71	9.40
10	32.09	8.63
11	34.51	7.99
12	36.95	7.48
13	39.43	7.11
14	41.91	6.87
15	44.41	6.77
16	46.91	6.80
17	49.41	6.96
18	51.89	7.27
19	54.35	7.70
20	56.78	8.27
21	59.19	8.97
22	61.54	9.79
23	63.86	10.75
24	66.11	11.82
25	68.31	13.02
26	70.43	14.33
27	72.49	15.76
28	74.46	17.30
29	76.00	18.64

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF UèH┴

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 25 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.19	18.99
3	17.55	18.17
4	19.94	17.43
5	22.35	16.77
6	24.78	16.17
7	27.22	15.65
8	29.68	15.20
9	32.15	14.82
10	34.64	14.52
11	37.13	14.30
12	39.62	14.15
13	42.12	14.07
14	44.62	14.07
15	47.12	14.15
16	49.61	14.29
17	52.10	14.52
18	54.59	14.82
19	57.06	15.19
20	59.52	15.64
21	61.96	16.16
22	64.39	16.76
23	66.80	17.42
24	69.19	18.16
25	71.53	18.96

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF 9¥:T

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 26 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.26	19.20
3	17.68	18.58
4	20.12	18.02
5	22.56	17.50
6	25.02	17.04
7	27.49	16.63
8	29.96	16.28
9	32.44	15.97
10	34.93	15.72
11	37.42	15.52
12	39.92	15.38
13	42.42	15.28
14	44.92	15.24
15	47.42	15.26
16	49.91	15.32
17	52.41	15.44
18	54.91	15.62
19	57.40	15.84
20	59.88	16.12
21	62.36	16.45
22	64.83	16.83
23	67.29	17.27
24	69.74	17.76
25	72.18	18.30

26	73.81	18.69

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ╚ÇJ┬

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 28 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.63	18.12
3	16.52	16.47
4	18.49	14.94
5	20.56	13.53
6	22.70	12.25
7	24.92	11.09
8	27.20	10.06
9	29.53	9.17
10	31.92	8.43
11	34.34	7.82
12	36.80	7.36
13	39.28	7.04
14	41.78	6.87
15	44.28	6.85
16	46.77	6.97
17	49.26	7.24
18	51.72	7.66
19	54.16	8.23
20	56.56	8.93
21	58.91	9.78
22	61.21	10.76
23	63.44	11.88
24	65.61	13.13
25	67.70	14.50
26	69.70	16.00
27	71.62	17.61
28	72.87	18.79

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF / w┴

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FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 11 COORDINATE POINTS (R= 16.03 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.30	19.36
3	17.79	19.23
4	20.28	19.49
5	22.70	20.14
6	24.98	21.15
7	27.08	22.50
8	28.95	24.17
9	30.53	26.10
10	31.80	28.26
11	32.49	30.00

*** 1.320 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 18.80 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.32	19.47
3	17.82	19.40
4	20.30	19.67
5	22.73	20.26
6	25.06	21.17
7	27.25	22.38
8	29.26	23.87
9	31.05	25.61
10	32.60	27.58
11	33.87	29.73
12	33.98	30.00

*** 1.345 ***

FAILURE SURFACE SPECIFIED BY 13 COORDINATE POINTS (R= 21.39 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.31	19.42
3	17.80	19.26
4	20.30	19.39
5	22.76	19.81
6	25.16	20.51
7	27.46	21.49
8	29.63	22.74
9	31.64	24.22
10	33.47	25.93
11	35.08	27.85
12	36.45	29.93
13	36.48	30.00

*** 1.495 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 15.37 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.19	18.98
3	17.64	18.49
4	20.14	18.40
5	22.62	18.71
6	25.01	19.42
7	27.26	20.51
8	29.31	21.95
9	31.09	23.70
10	32.57	25.72
11	33.70	27.95
12	34.34	30.00

*** 1.573 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 31.50 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.32	19.50
3	17.82	19.33
4	20.32	19.36
5	22.81	19.59
6	25.27	20.01
7	27.69	20.63
8	30.06	21.43
9	32.35	22.43
10	34.56	23.60
11	36.67	24.94
12	38.67	26.45
13	40.54	28.10
14	42.27	29.91
15	42.34	30.00

*** 1.839 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 17.49 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.09	18.76
3	17.47	17.98
4	19.93	17.55
5	22.43	17.47
6	24.91	17.75
7	27.33	18.38
8	29.64	19.35
9	31.78	20.63
10	33.72	22.21
11	35.41	24.05
12	36.83	26.11
13	37.94	28.35
14	38.48	30.00

*** 1.941 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 28.86 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.28	19.28
3	17.75	18.91
4	20.25	18.75
5	22.75	18.81

6	25.23	19.08
7	27.68	19.57
8	30.08	20.27
9	32.42	21.17
10	34.66	22.27
11	36.80	23.56
12	38.82	25.03
13	40.71	26.67
14	42.45	28.47
15	43.58	29.87

*** 1.997 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 26.72 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.23	19.11
3	17.68	18.58
4	20.16	18.28
5	22.66	18.22
6	25.15	18.38
7	27.62	18.78
8	30.04	19.41
9	32.39	20.26
10	34.65	21.33
11	36.80	22.60
12	38.82	24.07
13	40.70	25.73
14	42.41	27.55
15	43.95	29.52
16	44.00	29.59

*** 2.102 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 23.60 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.18	18.97
3	17.59	18.31
4	20.06	17.92
5	22.56	17.79
6	25.06	17.93
7	27.52	18.32
8	29.94	18.98
9	32.27	19.89
10	34.49	21.04
11	36.57	22.42
12	38.50	24.01
13	40.25	25.80
14	41.80	27.76
15	43.13	29.87
16	43.19	30.00

*** 2.112 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 23.05 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.16	18.92
3	17.57	18.24
4	20.03	17.81
5	22.53	17.66
6	25.02	17.77
7	27.49	18.16

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 8         29.91       18.81
 9         32.24       19.72
10         34.45       20.88
11         36.53       22.26
12         38.45       23.87
13         40.18       25.67
14         41.71       27.65
15         43.01       29.79
16         43.11       30.00

***    2.130 ***
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7.1.4 In sismica

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      $$ $$   $   $   $  $   $  $   $  $   $    $     $ $    $  $  $
      $ $ $   $   $      $   $  $   $  $        $    $   $   $  $  $
      $ $ $   $   $      $$$$   $   $   $$$     $    $   $   $$$   $
      $   $   $   $      $ $    $   $      $    $    $$$$$   $  $  $
      $   $   $   $   $  $  $   $   $  $   $    $    $   $   $  $  $
      $   $  $$$   $$$   $   $   $$$    $$$     $    $   $  $$$$   $$$$$
                                                              ver. 2.03
▯F
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DEVELOPED BY
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MICRO CONVERSION AND REVISION BY
Ing. C. MADIAI and Ing. M. PERINI
(C) studio I.S.G. - Firenze

GENERAL SOLUTION OF SLOPE STABILITY
PROBLEMS BY A TWO DIMENSIONAL
LIMITING EQUILIBRIUM METHOD

PROBLEM DESCRIPTION .. PARATIA DI DIAFRAMMI PLASTICI:

COMMISSIONED BY ..... ***** SISMICA ***********

LOCATION ..... CONDIZIONE DI FALDA A 0.00 M

BOUNDARY COORDINATES

18 TOP BOUNDARIES
39 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	43.39	30.00	5
8	43.39	30.00	58.49	19.93	5
9	58.49	19.93	60.13	19.87	1
10	60.13	19.87	63.63	19.71	1
11	63.63	19.71	66.13	19.66	1
12	66.13	19.66	67.13	19.56	1
13	67.13	19.56	68.13	19.41	1
14	68.13	19.41	72.13	18.89	1
15	72.13	18.89	73.62	18.70	1
16	73.62	18.70	76.13	18.64	1
17	76.13	18.64	78.62	18.57	1
18	78.62	18.57	80.00	18.52	1
19	12.90	19.87	14.60	19.87	1
20	14.60	19.87	17.13	19.70	1
21	17.13	19.70	19.13	19.82	1
22	19.13	19.82	23.60	19.62	1
23	23.60	19.62	26.13	19.64	1
24	26.13	19.64	27.66	19.60	1
25	27.66	19.60	31.13	19.21	1
26	31.13	19.21	34.13	17.12	1
27	34.13	17.12	36.13	16.23	1
28	36.13	16.23	38.38	16.28	1
29	38.38	16.28	41.38	16.43	1
30	41.38	16.43	44.13	16.78	1
31	44.13	16.78	46.13	17.52	1
32	46.13	17.52	47.13	17.54	1
33	47.13	17.54	51.13	19.22	1
34	51.13	19.22	54.13	19.76	1
35	54.13	19.76	56.13	20.00	1
36	56.13	20.00	58.49	19.93	1
37	.00	6.98	80.00	6.98	2
38	.00	.68	80.00	.68	3
39	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

5 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 2 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	28.00
2	80.00	28.00

A HORIZONTAL EARTHQUAKE LOADING COEFFICIENT
OF .069 AS BEEN ASSIGNED

A VERTICAL EARTHQUAKE LOADING COEFFICIENT
OF-.034 AS BEEN ASSIGNED

CAVITATION PRESSURE = .0 t/mq

▯▯ ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.86 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 30.00 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 18.78 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.33	19.47
3	17.83	19.40
4	20.31	19.67
5	22.74	20.26
6	25.07	21.17
7	27.26	22.38
8	29.27	23.87
9	31.06	25.62
10	32.60	27.58
11	33.87	29.74
12	33.98	30.00

*** 1.142 ***

FAILURE SURFACE SPECIFIED BY 11 COORDINATE POINTS (R= 16.01 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.31	19.36
3	17.80	19.23
4	20.29	19.49
5	22.71	20.14
6	24.99	21.15
7	27.09	22.51
8	28.96	24.17
9	30.54	26.11
10	31.80	28.26
11	32.49	30.00

*** 1.147 ***

FAILURE SURFACE SPECIFIED BY 13 COORDINATE POINTS (R= 21.38 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.32	19.42
3	17.81	19.26
4	20.31	19.39
5	22.77	19.81
6	25.17	20.52
7	27.47	21.50
8	29.64	22.74
9	31.65	24.23
10	33.47	25.94
11	35.08	27.85
12	36.46	29.94
13	36.48	30.00

*** 1.239 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 15.36 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.20	18.98
3	17.65	18.49
4	20.15	18.40
5	22.63	18.71
6	25.02	19.43
7	27.27	20.52
8	29.32	21.96
9	31.10	23.71
10	32.57	25.73
11	33.70	27.96
12	34.34	30.00

*** 1.365 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 31.48 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.33	19.50
3	17.83	19.33
4	20.33	19.36
5	22.82	19.59
6	25.28	20.01
7	27.70	20.63
8	30.07	21.44
9	32.36	22.43
10	34.57	23.60
11	36.68	24.95
12	38.67	26.45
13	40.54	28.11
14	42.27	29.92
15	42.34	30.00

*** 1.427 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 28.84 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.29	19.28
3	17.76	18.91
4	20.26	18.75
5	22.76	18.81
6	25.24	19.08
7	27.69	19.57
8	30.09	20.27
9	32.43	21.18
10	34.67	22.28
11	36.81	23.57
12	38.83	25.04
13	40.72	26.68
14	42.45	28.48
15	43.58	29.87

*** 1.551 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 17.48 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.10	18.76
3	17.48	17.98
4	19.94	17.55

5	22.44	17.47
6	24.92	17.75
7	27.34	18.38
8	29.65	19.35
9	31.79	20.64
10	33.73	22.22
11	35.42	24.05
12	36.83	26.12
13	37.94	28.36
14	38.48	30.00

*** 1.631 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 26.71 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.24	19.11
3	17.69	18.58
4	20.17	18.28
5	22.67	18.22
6	25.16	18.38
7	27.63	18.78
8	30.05	19.41
9	32.40	20.27
10	34.66	21.33
11	36.81	22.61
12	38.83	24.08
13	40.71	25.73
14	42.42	27.55
15	43.95	29.53
16	43.99	29.59

*** 1.647 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 23.58 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.19	18.97
3	17.60	18.31
4	20.07	17.92
5	22.57	17.79
6	25.07	17.93
7	27.53	18.33
8	29.95	18.99
9	32.28	19.89
10	34.49	21.05
11	36.58	22.43
12	38.51	24.02
13	40.25	25.80
14	41.80	27.77
15	43.14	29.88
16	43.19	30.00

*** 1.678 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 23.04 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.17	18.92
3	17.58	18.24
4	20.04	17.81
5	22.54	17.66
6	25.03	17.78
7	27.50	18.16

8	29.92	18.81
9	32.25	19.72
10	34.46	20.88
11	36.54	22.27
12	38.46	23.88
13	40.19	25.68
14	41.71	27.66
15	43.01	29.80
16	43.10	30.00

*** 1.697 ***

7.2 FASE DI SVUOTAMENTO DELLA CASSA FINO ALLA QUOTA BATIMETRICA -3.00 METRI S.L.M.

7.2.1 **In esercizio (SLU) con carico accidentale di cantiere pari a 1.3*10=13 kN/mq**

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▯▯  ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

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                                                              ver. 2.03
▯F


                                DEVELOPED BY
                              RONALD A. SIEGEL
                         GRADUATE INSTRUCTOR IN RESEARCH
                                PURDUE UNIVERSITY


                          MICRO CONVERSION AND REVISION BY
                         Ing. C. MADIAI  and  Ing. M. PERINI
                             (C) studio I.S.G. - Firenze



                        GENERAL SOLUTION OF SLOPE STABILITY
                           PROBLEMS BY A TWO DIMENSIONAL
                            LIMITING EQUILIBRIUM METHOD



      PROBLEM DESCRIPTION ..  PARATIA DI DIAFRAMMI PLASTICI:

      COMMISSIONED BY ......  ********************************

      LOCATION .............  CONDIZIONE DI FALDA A 0.00 M
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BOUNDARY COORDINATES

18 TOP BOUNDARIES
39 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	43.39	30.00	5
8	43.39	30.00	58.49	19.93	5
9	58.49	19.93	60.13	19.87	1
10	60.13	19.87	63.63	19.71	1
11	63.63	19.71	66.13	19.66	1
12	66.13	19.66	67.13	19.56	1
13	67.13	19.56	68.13	19.41	1
14	68.13	19.41	72.13	18.89	1
15	72.13	18.89	73.62	18.70	1
16	73.62	18.70	76.13	18.64	1
17	76.13	18.64	78.62	18.57	1
18	78.62	18.57	80.00	18.52	1
19	12.90	19.87	14.60	19.87	1
20	14.60	19.87	17.13	19.70	1
21	17.13	19.70	19.13	19.82	1
22	19.13	19.82	23.60	19.62	1
23	23.60	19.62	26.13	19.64	1
24	26.13	19.64	27.66	19.60	1
25	27.66	19.60	31.13	19.21	1
26	31.13	19.21	34.13	17.12	1
27	34.13	17.12	36.13	16.23	1
28	36.13	16.23	38.38	16.28	1
29	38.38	16.28	41.38	16.43	1
30	41.38	16.43	44.13	16.78	1
31	44.13	16.78	46.13	17.52	1
32	46.13	17.52	47.13	17.54	1
33	47.13	17.54	51.13	19.22	1
34	51.13	19.22	54.13	19.76	1
35	54.13	19.76	56.13	20.00	1
36	56.13	20.00	58.49	19.93	1
37	.00	6.98	80.00	6.98	2
38	.00	.68	80.00	.68	3
39	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

5 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	25.00
2	40.90	25.00
3	40.91	28.00
4	80.00	28.00

BOUNDARY LOAD(S)

1 LOAD(S) SPECIFIED

LOAD NO.	X-LEFT (m)	X-RIGHT (m)	INTENSITY (t/mq)	DEFLECTION (DEG)
1	28.09	43.39	1.3	.0

NOTE - INTENSITY IS SPECIFIED AS A UNIFORMLY DISTRIBUTED
FORCE ACTING ON A HORIZONTALLY PROJECTED SURFACE.

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.85 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 28.10 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 28 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.73	18.22
3	16.70	16.68
4	18.75	15.26
5	20.88	13.95
6	23.08	12.76
7	25.35	11.69
8	27.66	10.76
9	30.03	9.95
10	32.44	9.28
11	34.88	8.75
12	37.35	8.35
13	39.83	8.09
14	42.33	7.97
15	44.83	7.98
16	47.33	8.14
17	49.81	8.44
18	52.27	8.88
19	54.70	9.45
20	57.10	10.15
21	59.46	10.99
22	61.76	11.97
23	64.01	13.06
24	66.19	14.28
25	68.30	15.62
26	70.33	17.08
27	72.28	18.65
28	72.49	18.84

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ¥êÊ

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 31 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.69	18.17
3	16.60	16.57
4	18.60	15.07
5	20.68	13.67
6	22.82	12.38
7	25.02	11.20
8	27.28	10.13
9	29.60	9.19
10	31.95	8.36
11	34.35	7.65
12	36.78	7.06
13	39.24	6.60
14	41.72	6.27
15	44.21	6.06
16	46.71	5.98
17	49.21	6.03
18	51.70	6.20
19	54.18	6.50
20	56.65	6.93
21	59.08	7.48
22	61.49	8.16
23	63.86	8.96
24	66.19	9.87
25	68.46	10.91
26	70.68	12.06
27	72.84	13.32
28	74.93	14.69
29	76.95	16.17
30	78.89	17.74
31	79.76	18.53

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF .ü⊥

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 24 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.79	18.29
3	16.82	16.84
4	18.94	15.51
5	21.14	14.33
6	23.42	13.28
7	25.75	12.38
8	28.13	11.63
9	30.56	11.03
10	33.02	10.59
11	35.50	10.30
12	38.00	10.17
13	40.50	10.19
14	42.99	10.37
15	45.47	10.71
16	47.92	11.21
17	50.33	11.86
18	52.70	12.66
19	55.02	13.60
20	57.27	14.69
21	59.44	15.92
22	61.54	17.29
23	63.54	18.78
24	64.60	19.69

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF Î╔á├

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 26 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.63	18.11
3	16.52	16.47
4	18.51	14.96
5	20.60	13.59
6	22.77	12.35
7	25.02	11.27
8	27.34	10.33
9	29.71	9.55
10	32.14	8.93
11	34.59	8.46
12	37.07	8.16
13	39.57	8.03
14	42.07	8.06
15	44.56	8.25
16	47.04	8.61
17	49.48	9.14
18	51.89	9.82
19	54.24	10.66
20	56.54	11.65
21	58.76	12.79
22	60.90	14.08
23	62.96	15.50
24	64.91	17.06
25	66.76	18.74
26	67.50	19.51

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF °*▯┬

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 27 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.68	18.17
3	16.61	16.58
4	18.63	15.10
5	20.73	13.75
6	22.91	12.53
7	25.16	11.43
8	27.47	10.47
9	29.83	9.65
10	32.23	8.97
11	34.68	8.43
12	37.14	8.03
13	39.63	7.79
14	42.13	7.68
15	44.63	7.73
16	47.12	7.93
17	49.60	8.27
18	52.05	8.75

19	54.47	9.38
20	56.85	10.15
21	59.18	11.06
22	61.45	12.11
23	63.65	13.29
24	65.78	14.60
25	67.83	16.03
26	69.80	17.57
27	71.38	18.98

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 24 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.02	18.63
3	17.25	17.49
4	19.53	16.46
5	21.85	15.54
6	24.21	14.72
7	26.61	14.02
8	29.04	13.43
9	31.49	12.95
10	33.97	12.59
11	36.46	12.34
12	38.95	12.20
13	41.45	12.19
14	43.95	12.29
15	46.44	12.50
16	48.92	12.84
17	51.38	13.28
18	53.81	13.84
19	56.22	14.51
20	58.60	15.30
21	60.93	16.19
22	63.22	17.19
23	65.46	18.30
24	67.61	19.49

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF f

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 30 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.71	18.19
3	16.65	16.62
4	18.66	15.14
5	20.76	13.78
6	22.92	12.52
7	25.15	11.38
8	27.43	10.36
9	29.76	9.46
10	32.13	8.68
11	34.55	8.02
12	36.99	7.49
13	39.46	7.10
14	41.94	6.83
15	44.44	6.69
16	46.94	6.68
17	49.44	6.80
18	51.92	7.05
19	54.39	7.43
20	56.84	7.94
21	59.26	8.57

22	61.64	9.33
23	63.98	10.22
24	66.27	11.22
25	68.50	12.35
26	70.67	13.59
27	72.78	14.94
28	74.81	16.39
29	76.76	17.96
30	77.48	18.60

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ¾W0┴

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 29 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.69	18.17
3	16.61	16.58
4	18.63	15.10
5	20.71	13.72
6	22.88	12.46
7	25.10	11.33
8	27.39	10.31
9	29.72	9.42
10	32.10	8.66
11	34.52	8.03
12	36.97	7.54
13	39.45	7.17
14	41.94	6.95
15	44.44	6.86
16	46.93	6.90
17	49.43	7.08
18	51.91	7.40
19	54.37	7.85
20	56.80	8.44
21	59.19	9.16
22	61.54	10.00
23	63.85	10.98
24	66.09	12.07
25	68.28	13.29
26	70.39	14.63
27	72.43	16.07
28	74.38	17.63
29	75.53	18.65

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ëÃI┴

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 25 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.19	18.99
3	17.55	18.18

4	19.94	17.44
5	22.35	16.77
6	24.78	16.19
7	27.23	15.67
8	29.69	15.23
9	32.16	14.87
10	34.65	14.58
11	37.14	14.37
12	39.63	14.23
13	42.13	14.18
14	44.63	14.20
15	47.13	14.29
16	49.63	14.46
17	52.11	14.71
18	54.59	15.04
19	57.06	15.44
20	59.51	15.91
21	61.95	16.47
22	64.37	17.09
23	66.77	17.79
24	69.15	18.56
25	70.60	19.09

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF è{Y$_T$

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 26 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.26	19.20
3	17.68	18.58
4	20.12	18.02
5	22.56	17.51
6	25.02	17.05
7	27.49	16.65
8	29.96	16.29
9	32.45	16.00
10	34.93	15.75
11	37.43	15.56
12	39.92	15.42
13	42.42	15.34
14	44.92	15.31
15	47.42	15.33
16	49.92	15.41
17	52.42	15.54
18	54.91	15.73
19	57.40	15.97
20	59.88	16.26
21	62.36	16.61
22	64.83	17.01
23	67.28	17.46
24	69.73	17.97
25	72.17	18.52
26	73.11	18.76

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ±XU$_T$

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 28 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	14.63	18.12
3	16.52	16.47
4	18.50	14.95
5	20.56	13.54
6	22.71	12.26
7	24.93	11.11
8	27.22	10.10
9	29.56	9.22
10	31.95	8.49
11	34.38	7.90
12	36.84	7.46
13	39.32	7.16
14	41.82	7.02
15	44.32	7.02
16	46.81	7.17
17	49.30	7.47
18	51.75	7.92
19	54.18	8.52
20	56.57	9.26
21	58.91	10.14
22	61.19	11.16
23	63.41	12.32
24	65.55	13.60
25	67.62	15.01
26	69.59	16.55
27	71.47	18.19
28	72.17	18.88

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ÿÎç┴

FS =

FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 11 COORDINATE POINTS (R= 16.23 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.32	19.47
3	17.82	19.46
4	20.29	19.82
5	22.68	20.57
6	24.92	21.67
7	26.97	23.09
8	28.78	24.82
9	30.31	26.80
10	31.51	29.00
11	31.87	30.00

*** 1.213 ***

FAILURE SURFACE SPECIFIED BY 11 COORDINATE POINTS (R= 13.96 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.30	19.36
3	17.80	19.29
4	20.27	19.67
5	22.63	20.48
6	24.81	21.70
7	26.74	23.29
8	28.36	25.20
9	29.61	27.36
10	30.45	29.71
11	30.50	30.00

*** 1.225 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 18.57 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.31	19.42
3	17.81	19.30
4	20.30	19.52
5	22.74	20.07
6	25.08	20.94
7	27.28	22.12
8	29.31	23.58
9	31.12	25.30
10	32.69	27.25
11	33.98	29.39
12	34.24	30.00

*** 1.322 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 13.63 m)

POINT NO.	X-SURF (m)	Y-SURF (m)

1	12.85	19.87
2	15.19	18.98
3	17.65	18.54
4	20.15	18.55
5	22.60	19.02
6	24.93	19.93
7	27.06	21.24
8	28.91	22.92
9	30.42	24.91
10	31.55	27.15
11	32.24	29.55
12	32.29	30.00

*** 1.439 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 27.38 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.32	19.50
3	17.82	19.36
4	20.32	19.45
5	22.80	19.76
6	25.24	20.30
7	27.62	21.06
8	29.92	22.04
9	32.13	23.22
10	34.21	24.59
11	36.17	26.15
12	37.97	27.89
13	39.61	29.77
14	39.77	30.00

*** 1.599 ***

FAILURE SURFACE SPECIFIED BY 13 COORDINATE POINTS (R= 15.77 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.09	18.76
3	17.48	18.02
4	19.95	17.66
5	22.45	17.70
6	24.91	18.14
7	27.28	18.96
8	29.48	20.14
9	31.47	21.65
10	33.19	23.46
11	34.61	25.52
12	35.69	27.78
13	36.34	30.00

*** 1.731 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 25.53 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.28	19.28
3	17.76	18.94
4	20.25	18.84
5	22.75	18.98
6	25.22	19.37
7	27.64	19.99
8	29.99	20.85
9	32.24	21.94

10	34.38	23.23
11	36.38	24.74
12	38.22	26.43
13	39.89	28.29
14	41.14	30.00

*** 1.745 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 23.85 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.23	19.11
3	17.68	18.61
4	20.17	18.37
5	22.67	18.38
6	25.15	18.66
7	27.60	19.20
8	29.97	19.99
9	32.25	21.02
10	34.40	22.28
11	36.41	23.77
12	38.26	25.45
13	39.92	27.32
14	41.38	29.35
15	41.74	30.00

*** 1.848 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 21.19 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.18	18.97
3	17.60	18.34
4	20.08	18.01
5	22.58	17.97
6	25.07	18.22
7	27.51	18.77
8	29.87	19.60
9	32.11	20.70
10	34.21	22.05
11	36.14	23.65
12	37.86	25.46
13	39.36	27.46
14	40.61	29.62
15	40.77	30.00

*** 1.857 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 20.73 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.16	18.92
3	17.58	18.27
4	20.05	17.90
5	22.55	17.84
6	25.04	18.07
7	27.48	18.61
8	29.84	19.43
9	32.08	20.53
10	34.18	21.90
11	36.10	23.50
12	37.81	25.33
13	39.28	27.34
14	40.51	29.52

15 40.70 30.00

*** 1.875 ***

7.2.2 **Con mareggiata estrema: cresta d’onda +4.39 m**

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▯▯  ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

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                                                                ver. 2.03
▯F

                                DEVELOPED BY
                            RONALD A. SIEGEL
                        GRADUATE INSTRUCTOR IN RESEARCH
                                PURDUE UNIVERSITY


                            MICRO CONVERSION AND REVISION BY
                          Ing. C. MADIAI  and  Ing. M. PERINI
                              (C) studio I.S.G. - Firenze



                          GENERAL SOLUTION OF SLOPE STABILITY
                             PROBLEMS BY A TWO DIMENSIONAL
                             LIMITING EQUILIBRIUM METHOD



      PROBLEM DESCRIPTION ..  PARATIA DI DIAFRAMMI PLASTICI:


      COMMISSIONED BY ......  *****   CRESTA D'ONDA    *******

      LOCATION .............  CONDIZIONE DI FALDA A 0.00 M
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BOUNDARY COORDINATES

18 TOP BOUNDARIES
39 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	43.39	30.00	5
8	43.39	30.00	58.49	19.93	5
9	58.49	19.93	60.13	19.87	1
10	60.13	19.87	63.63	19.71	1
11	63.63	19.71	66.13	19.66	1
12	66.13	19.66	67.13	19.56	1
13	67.13	19.56	68.13	19.41	1
14	68.13	19.41	72.13	18.89	1
15	72.13	18.89	73.62	18.70	1
16	73.62	18.70	76.13	18.64	1
17	76.13	18.64	78.62	18.57	1
18	78.62	18.57	80.00	18.52	1
19	12.90	19.87	14.60	19.87	1
20	14.60	19.87	17.13	19.70	1
21	17.13	19.70	19.13	19.82	1
22	19.13	19.82	23.60	19.62	1
23	23.60	19.62	26.13	19.64	1
24	26.13	19.64	27.66	19.60	1
25	27.66	19.60	31.13	19.21	1
26	31.13	19.21	34.13	17.12	1
27	34.13	17.12	36.13	16.23	1
28	36.13	16.23	38.38	16.28	1
29	38.38	16.28	41.38	16.43	1
30	41.38	16.43	44.13	16.78	1
31	44.13	16.78	46.13	17.52	1
32	46.13	17.52	47.13	17.54	1
33	47.13	17.54	51.13	19.22	1
34	51.13	19.22	54.13	19.76	1
35	54.13	19.76	56.13	20.00	1
36	56.13	20.00	58.49	19.93	1
37	.00	6.98	80.00	6.98	2
38	.00	.68	80.00	.68	3
39	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

5 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	25.00
2	40.90	25.00
3	41.91	32.39
4	80.00	32.39

▯▯ ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.86 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 30.00 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 11 COORDINATE POINTS (R= 16.01 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.31	19.36
3	17.80	19.23
4	20.29	19.49
5	22.71	20.14
6	24.99	21.15
7	27.09	22.51
8	28.96	24.17
9	30.54	26.11
10	31.80	28.26
11	32.49	30.00

*** 1.320 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 18.78 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.33	19.47
3	17.83	19.40
4	20.31	19.67
5	22.74	20.26
6	25.07	21.17
7	27.26	22.38
8	29.27	23.87
9	31.06	25.62
10	32.60	27.58
11	33.87	29.74
12	33.98	30.00

*** 1.345 ***

FAILURE SURFACE SPECIFIED BY 13 COORDINATE POINTS (R= 21.38 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.32	19.42
3	17.81	19.26
4	20.31	19.39
5	22.77	19.81
6	25.17	20.52
7	27.47	21.50
8	29.64	22.74
9	31.65	24.23
10	33.47	25.94
11	35.08	27.85
12	36.46	29.94
13	36.48	30.00

*** 1.495 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 15.36 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.20	18.98
3	17.65	18.49
4	20.15	18.40
5	22.63	18.71
6	25.02	19.43
7	27.27	20.52
8	29.32	21.96
9	31.10	23.71
10	32.57	25.73
11	33.70	27.96
12	34.34	30.00

*** 1.573 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 31.48 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.33	19.50
3	17.83	19.33
4	20.33	19.36
5	22.82	19.59
6	25.28	20.01
7	27.70	20.63
8	30.07	21.44
9	32.36	22.43
10	34.57	23.60
11	36.68	24.95
12	38.67	26.45
13	40.54	28.11
14	42.27	29.92
15	42.34	30.00

*** 1.811 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 28.84 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.29	19.28
3	17.76	18.91
4	20.26	18.75
5	22.76	18.81
6	25.24	19.08
7	27.69	19.57
8	30.09	20.27
9	32.43	21.18
10	34.67	22.28
11	36.81	23.57
12	38.83	25.04
13	40.72	26.68
14	42.45	28.48
15	43.58	29.87

*** 1.894 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 17.48 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.10	18.76
3	17.48	17.98
4	19.94	17.55

5	22.44	17.47
6	24.92	17.75
7	27.34	18.38
8	29.65	19.35
9	31.79	20.64
10	33.73	22.22
11	35.42	24.05
12	36.83	26.12
13	37.94	28.36
14	38.48	30.00

*** 1.941 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 26.71 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.24	19.11
3	17.69	18.58
4	20.17	18.28
5	22.67	18.22
6	25.16	18.38
7	27.63	18.78
8	30.05	19.41
9	32.40	20.27
10	34.66	21.33
11	36.81	22.61
12	38.83	24.08
13	40.71	25.73
14	42.42	27.55
15	43.95	29.53
16	43.99	29.59

*** 1.961 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 23.58 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.19	18.97
3	17.60	18.31
4	20.07	17.92
5	22.57	17.79
6	25.07	17.93
7	27.53	18.33
8	29.95	18.99
9	32.28	19.89
10	34.49	21.05
11	36.58	22.43
12	38.51	24.02
13	40.25	25.80
14	41.80	27.77
15	43.14	29.88
16	43.19	30.00

*** 2.026 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 23.04 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.17	18.92
3	17.58	18.24
4	20.04	17.81
5	22.54	17.66
6	25.03	17.78
7	27.50	18.16

```
 8         29.92       18.81
 9         32.25       19.72
10         34.46       20.88
11         36.54       22.27
12         38.46       23.88
13         40.19       25.68
14         41.71       27.66
15         43.01       29.80
16         43.10       30.00

***    2.047 ***
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7.2.3 **Con mareggiata estrema: cavo d'onda a -2.92 m**

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▯▯  ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════

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      $   $  $$$   $$$   $$$$    $$$    $$$   $$$$$    $    $$$$   $
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      $   $  $$$   $$$   $   $   $$$    $$$     $    $   $  $$$$   $$$$$
                                                              ver. 2.03
▯F


                          DEVELOPED BY
                        RONALD A. SIEGEL
                  GRADUATE INSTRUCTOR IN RESEARCH
                          PURDUE UNIVERSITY


                     MICRO CONVERSION AND REVISION BY
                    Ing. C. MADIAI  and  Ing. M. PERINI
                        (C) studio I.S.G. - Firenze



                   GENERAL SOLUTION OF SLOPE STABILITY
                      PROBLEMS BY A TWO DIMENSIONAL
                        LIMITING EQUILIBRIUM METHOD



      PROBLEM DESCRIPTION ..  PARATIA DI DIAFRAMMI PLASTICI:

      COMMISSIONED BY ......  *****   CAVO D'ONDA   **********

      LOCATION .............  CONDIZIONE DI FALDA A 0.00 M
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BOUNDARY COORDINATES

18 TOP BOUNDARIES
39 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	43.39	30.00	5
8	43.39	30.00	58.49	19.93	5
9	58.49	19.93	60.13	19.87	1
10	60.13	19.87	63.63	19.71	1
11	63.63	19.71	66.13	19.66	1
12	66.13	19.66	67.13	19.56	1
13	67.13	19.56	68.13	19.41	1
14	68.13	19.41	72.13	18.89	1
15	72.13	18.89	73.62	18.70	1
16	73.62	18.70	76.13	18.64	1
17	76.13	18.64	78.62	18.57	1
18	78.62	18.57	80.00	18.52	1
19	12.90	19.87	14.60	19.87	1
20	14.60	19.87	17.13	19.70	1
21	17.13	19.70	19.13	19.82	1
22	19.13	19.82	23.60	19.62	1
23	23.60	19.62	26.13	19.64	1
24	26.13	19.64	27.66	19.60	1
25	27.66	19.60	31.13	19.21	1
26	31.13	19.21	34.13	17.12	1
27	34.13	17.12	36.13	16.23	1
28	36.13	16.23	38.38	16.28	1
29	38.38	16.28	41.38	16.43	1
30	41.38	16.43	44.13	16.78	1
31	44.13	16.78	46.13	17.52	1
32	46.13	17.52	47.13	17.54	1
33	47.13	17.54	51.13	19.22	1
34	51.13	19.22	54.13	19.76	1
35	54.13	19.76	56.13	20.00	1
36	56.13	20.00	58.49	19.93	1
37	.00	6.98	80.00	6.98	2
38	.00	.68	80.00	.68	3
39	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

5 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1

Analisi di stabilita' dei pendii: metodi all'equilibrio limite

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	25.00
2	40.90	25.00
3	40.91	25.08
4	80.00	25.08

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.86 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 30.00 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 28 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.74	18.22
3	16.71	16.68
4	18.76	15.25
5	20.89	13.94
6	23.08	12.74
7	25.34	11.67
8	27.66	10.72
9	30.02	9.91
10	32.42	9.22
11	34.86	8.67
12	37.33	8.25
13	39.81	7.97
14	42.31	7.83
15	44.81	7.83
16	47.30	7.96
17	49.79	8.23
18	52.26	8.64
19	54.70	9.18
20	57.10	9.85
21	59.47	10.66
22	61.79	11.60
23	64.05	12.66
24	66.25	13.85
25	68.38	15.15
26	70.44	16.58
27	72.41	18.11
28	73.16	18.76

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF Q+

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 31 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.70	18.17
3	16.61	16.57
4	18.61	15.07
5	20.69	13.67
6	22.83	12.38
7	25.03	11.20
8	27.29	10.13
9	29.61	9.18
10	31.96	8.35
11	34.36	7.65
12	36.79	7.06
13	39.25	6.60
14	41.73	6.27
15	44.22	6.06
16	46.72	5.98
17	49.22	6.02
18	51.71	6.20
19	54.19	6.50
20	56.66	6.93
21	59.09	7.48
22	61.50	8.15
23	63.87	8.95
24	66.20	9.87
25	68.47	10.90
26	70.69	12.05
27	72.85	13.31
28	74.94	14.68
29	76.96	16.16
30	78.90	17.73
31	79.79	18.53

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF M\|ᴸ

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 25 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.80	18.29
3	16.83	16.83
4	18.95	15.50
5	21.14	14.30
6	23.40	13.24
7	25.73	12.32
8	28.11	11.55
9	30.52	10.92
10	32.98	10.44
11	35.46	10.11
12	37.95	9.93
13	40.45	9.91
14	42.95	10.04
15	45.43	10.32
16	47.89	10.75
17	50.32	11.34
18	52.71	12.07
19	55.06	12.95
20	57.34	13.96
21	59.55	15.12
22	61.70	16.41
23	63.75	17.83
24	65.72	19.37
25	66.05	19.66

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ÈàX┴

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 21 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.88	18.40
3	17.00	17.07
4	19.20	15.88
5	21.47	14.84
6	23.81	13.95
7	26.20	13.22
8	28.63	12.66
9	31.10	12.25
10	33.59	12.01
11	36.09	11.93
12	38.59	12.03
13	41.07	12.28
14	43.54	12.70
15	45.97	13.29
16	48.36	14.03
17	50.69	14.94
18	52.95	15.99
19	55.15	17.19
20	57.25	18.54
21	59.11	19.91

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ╨=_├

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 26 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.64	18.11
3	16.52	16.47
4	18.51	14.95
5	20.59	13.57
6	22.76	12.32
7	25.00	11.22
8	27.31	10.26
9	29.68	9.46
10	32.10	8.81
11	34.55	8.31
12	37.02	7.98
13	39.52	7.81
14	42.02	7.79
15	44.51	7.94
16	46.99	8.25
17	49.45	8.72
18	51.87	9.35
19	54.24	10.13
20	56.56	11.06
21	58.82	12.15
22	61.00	13.37

23	63.09	14.73
24	65.10	16.23
25	67.00	17.85
26	68.55	19.36

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF

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FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 28 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.69	18.17
3	16.62	16.58
4	18.64	15.10
5	20.74	13.74
6	22.91	12.51
7	25.15	11.40
8	27.46	10.43
9	29.81	9.59
10	32.21	8.89
11	34.65	8.34
12	37.11	7.92
13	39.60	7.65
14	42.10	7.52
15	44.60	7.54
16	47.09	7.70
17	49.57	8.01
18	52.03	8.47
19	54.46	9.06
20	56.85	9.79
21	59.19	10.67
22	61.48	11.67
23	63.71	12.81
24	65.86	14.07
25	67.94	15.46
26	69.94	16.97
27	71.84	18.59
28	72.15	18.88

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ┼i
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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 25 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.03	18.63
3	17.26	17.49
4	19.53	16.46
5	21.85	15.52
6	24.21	14.70
7	26.61	13.98
8	29.03	13.37
9	31.48	12.87
10	33.95	12.48
11	36.44	12.21
12	38.93	12.05
13	41.43	12.00
14	43.93	12.06
15	46.42	12.24
16	48.91	12.53
17	51.37	12.93

18	53.82	13.45
19	56.24	14.07
20	58.63	14.81
21	60.98	15.65
22	63.30	16.59
23	65.57	17.64
24	67.79	18.80
25	68.72	19.33

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ô 6

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 30 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.72	18.19
3	16.65	16.62
4	18.67	15.14
5	20.77	13.77
6	22.93	12.52
7	25.15	11.37
8	27.43	10.35
9	29.76	9.44
10	32.14	8.66
11	34.55	8.00
12	36.99	7.47
13	39.46	7.06
14	41.94	6.79
15	44.44	6.64
16	46.94	6.62
17	49.43	6.73
18	51.92	6.98
19	54.39	7.35
20	56.84	7.85
21	59.26	8.47
22	61.65	9.23
23	63.99	10.10
24	66.28	11.09
25	68.52	12.21
26	70.70	13.43
27	72.81	14.77
28	74.85	16.22
29	76.81	17.77
30	77.75	18.59

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF â

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 22 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.04	18.65
3	17.29	17.55

4	19.59	16.57
5	21.94	15.71
6	24.33	14.98
7	26.75	14.38
8	29.21	13.91
9	31.69	13.57
10	34.18	13.36
11	36.68	13.28
12	39.17	13.34
13	41.67	13.53
14	44.15	13.85
15	46.60	14.31
16	49.04	14.89
17	51.43	15.60
18	53.79	16.44
19	56.09	17.40
20	58.35	18.49
21	60.54	19.69
22	60.78	19.84

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ¬
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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 24 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.67	18.15
3	16.61	16.56
4	18.64	15.11
5	20.78	13.82
6	23.00	12.67
7	25.30	11.69
8	27.67	10.88
9	30.08	10.23
10	32.54	9.76
11	35.02	9.46
12	37.52	9.34
13	40.02	9.40
14	42.50	9.63
15	44.97	10.04
16	47.40	10.63
17	49.78	11.38
18	52.11	12.31
19	54.36	13.39
20	56.53	14.64
21	58.60	16.03
22	60.57	17.57
23	62.43	19.24
24	62.91	19.74

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ▯▒ñ┴

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 29 COORDINATE POINTS

POINT	X-SURF	Y-SURF

NO.	(m)	(m)
1	12.86	19.87
2	14.70	18.17
3	16.62	16.58
4	18.63	15.09
5	20.72	13.72
6	22.88	12.46
7	25.10	11.31
8	27.39	10.29
9	29.72	9.40
10	32.10	8.63
11	34.52	7.99
12	36.96	7.49
13	39.44	7.11
14	41.92	6.87
15	44.42	6.77
16	46.92	6.80
17	49.42	6.97
18	51.90	7.27
19	54.36	7.70
20	56.80	8.27
21	59.20	8.97
22	61.55	9.80
23	63.87	10.75
24	66.12	11.83
25	68.32	13.03
26	70.44	14.34
27	72.49	15.77
28	74.47	17.31
29	76.00	18.64

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF WÅ┌└

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THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 25 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.20	18.99
3	17.56	18.17
4	19.95	17.43
5	22.36	16.77
6	24.79	16.17
7	27.23	15.65
8	29.69	15.20
9	32.16	14.82
10	34.65	14.52
11	37.14	14.30
12	39.63	14.15
13	42.13	14.07
14	44.63	14.07
15	47.13	14.15
16	49.62	14.30
17	52.11	14.52
18	54.60	14.82
19	57.07	15.19
20	59.53	15.64
21	61.97	16.16
22	64.40	16.76
23	66.81	17.43
24	69.20	18.17
25	71.52	18.97

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF \l,┴

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 26 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.27	19.20
3	17.69	18.58
4	20.13	18.02
5	22.57	17.50
6	25.03	17.04
7	27.50	16.63
8	29.97	16.28
9	32.45	15.97
10	34.94	15.72
11	37.43	15.52
12	39.93	15.38
13	42.43	15.28
14	44.93	15.24
15	47.43	15.26
16	49.93	15.33
17	52.42	15.44
18	54.92	15.62
19	57.41	15.84
20	59.89	16.12
21	62.37	16.45
22	64.84	16.84
23	67.30	17.27
24	69.75	17.76
25	72.19	18.30
26	73.80	18.69

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF)<.⊥

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 22 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.71	18.19
3	16.69	16.66
4	18.78	15.28
5	20.96	14.07
6	23.23	13.02
7	25.57	12.15
8	27.98	11.46
9	30.42	10.95
10	32.90	10.63
11	35.40	10.50
12	37.90	10.56
13	40.39	10.81
14	42.85	11.24
15	45.27	11.87
16	47.64	12.67
17	49.94	13.65
18	52.15	14.80
19	54.28	16.12
20	56.30	17.60
21	58.20	19.22

22	58.89	19.91

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF ò1®├

FS =

THE FACTOR OF SAFETY FOR THE TRIAL FAILURE SURFACE DEFINED
BY THE COORDINATES LISTED BELOW IS MISLEADING.

FAILURE SURFACE DEFINED BY 28 COORDINATE POINTS

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.64	18.12
3	16.53	16.47
4	18.50	14.94
5	20.57	13.53
6	22.71	12.25
7	24.93	11.09
8	27.21	10.06
9	29.54	9.18
10	31.93	8.43
11	34.36	7.82
12	36.81	7.36
13	39.29	7.04
14	41.79	6.87
15	44.29	6.85
16	46.78	6.98
17	49.27	7.25
18	51.73	7.67
19	54.17	8.23
20	56.57	8.94
21	58.92	9.78
22	61.22	10.77
23	63.45	11.89
24	65.62	13.14
25	67.71	14.51
26	69.71	16.00
27	71.62	17.61
28	72.87	18.79

THE SAFETY FACTOR FOR THE PRECEDING SPECIFIED SURFACE
HAS BEEN CALCULATED THROUGH THE METHOD OF £õ˛└

FS =

FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 11 COORDINATE POINTS (R= 16.01 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.31	19.36
3	17.80	19.23
4	20.29	19.49
5	22.71	20.14
6	24.99	21.15
7	27.09	22.51
8	28.96	24.17
9	30.54	26.11
10	31.80	28.26
11	32.49	30.00

*** 1.320 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 18.78 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.33	19.47
3	17.83	19.40
4	20.31	19.67
5	22.74	20.26
6	25.07	21.17
7	27.26	22.38
8	29.27	23.87
9	31.06	25.62
10	32.60	27.58
11	33.87	29.74
12	33.98	30.00

*** 1.345 ***

FAILURE SURFACE SPECIFIED BY 13 COORDINATE POINTS (R= 21.38 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.32	19.42
3	17.81	19.26
4	20.31	19.39
5	22.77	19.81
6	25.17	20.52
7	27.47	21.50
8	29.64	22.74
9	31.65	24.23
10	33.47	25.94
11	35.08	27.85
12	36.46	29.94
13	36.48	30.00

*** 1.495 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 15.36 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.20	18.98
3	17.65	18.49
4	20.15	18.40
5	22.63	18.71
6	25.02	19.43
7	27.27	20.52
8	29.32	21.96
9	31.10	23.71
10	32.57	25.73
11	33.70	27.96
12	34.34	30.00

*** 1.573 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 31.48 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.33	19.50
3	17.83	19.33
4	20.33	19.36
5	22.82	19.59
6	25.28	20.01
7	27.70	20.63
8	30.07	21.44
9	32.36	22.43
10	34.57	23.60
11	36.68	24.95
12	38.67	26.45
13	40.54	28.11
14	42.27	29.92
15	42.34	30.00

*** 1.840 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 17.48 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.10	18.76
3	17.48	17.98
4	19.94	17.55
5	22.44	17.47
6	24.92	17.75
7	27.34	18.38
8	29.65	19.35
9	31.79	20.64
10	33.73	22.22
11	35.42	24.05
12	36.83	26.12
13	37.94	28.36
14	38.48	30.00

*** 1.941 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 28.84 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.29	19.28
3	17.76	18.91
4	20.26	18.75
5	22.76	18.81

6	25.24	19.08
7	27.69	19.57
8	30.09	20.27
9	32.43	21.18
10	34.67	22.28
11	36.81	23.57
12	38.83	25.04
13	40.72	26.68
14	42.45	28.48
15	43.58	29.87

*** 2.004 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 23.58 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.19	18.97
3	17.60	18.31
4	20.07	17.92
5	22.57	17.79
6	25.07	17.93
7	27.53	18.33
8	29.95	18.99
9	32.28	19.89
10	34.49	21.05
11	36.58	22.43
12	38.51	24.02
13	40.25	25.80
14	41.80	27.77
15	43.14	29.88
16	43.19	30.00

*** 2.119 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 26.71 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.24	19.11
3	17.69	18.58
4	20.17	18.28
5	22.67	18.22
6	25.16	18.38
7	27.63	18.78
8	30.05	19.41
9	32.40	20.27
10	34.66	21.33
11	36.81	22.61
12	38.83	24.08
13	40.71	25.73
14	42.42	27.55
15	43.95	29.53
16	43.99	29.59

*** 2.121 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 23.04 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.17	18.92
3	17.58	18.24
4	20.04	17.81
5	22.54	17.66
6	25.03	17.78
7	27.50	18.16

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 8         29.92       18.81
 9         32.25       19.72
10         34.46       20.88
11         36.54       22.27
12         38.46       23.88
13         40.19       25.68
14         41.71       27.66
15         43.01       29.80
16         43.10       30.00

***    2.138 ***
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7.2.4 **In sismica**

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▯▯ ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

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                                                              ver. 2.03
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MICRO CONVERSION AND REVISION BY
Ing. C. MADIAI and Ing. M. PERINI
(C) studio I.S.G. - Firenze

GENERAL SOLUTION OF SLOPE STABILITY
PROBLEMS BY A TWO DIMENSIONAL
LIMITING EQUILIBRIUM METHOD

PROBLEM DESCRIPTION .. PARATIA DI DIAFRAMMI PLASTICI:

COMMISSIONED BY ..... ****** SISMICA ************

LOCATION ..... CONDIZIONE DI FALDA A -3.0 M

BOUNDARY COORDINATES

18 TOP BOUNDARIES
39 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	43.39	30.00	5
8	43.39	30.00	58.49	19.93	5
9	58.49	19.93	60.13	19.87	1
10	60.13	19.87	63.63	19.71	1
11	63.63	19.71	66.13	19.66	1
12	66.13	19.66	67.13	19.56	1
13	67.13	19.56	68.13	19.41	1
14	68.13	19.41	72.13	18.89	1
15	72.13	18.89	73.62	18.70	1
16	73.62	18.70	76.13	18.64	1
17	76.13	18.64	78.62	18.57	1
18	78.62	18.57	80.00	18.52	1
19	12.90	19.87	14.60	19.87	1
20	14.60	19.87	17.13	19.70	1
21	17.13	19.70	19.13	19.82	1
22	19.13	19.82	23.60	19.62	1
23	23.60	19.62	26.13	19.64	1
24	26.13	19.64	27.66	19.60	1
25	27.66	19.60	31.13	19.21	1
26	31.13	19.21	34.13	17.12	1
27	34.13	17.12	36.13	16.23	1
28	36.13	16.23	38.38	16.28	1
29	38.38	16.28	41.38	16.43	1
30	41.38	16.43	44.13	16.78	1
31	44.13	16.78	46.13	17.52	1
32	46.13	17.52	47.13	17.54	1
33	47.13	17.54	51.13	19.22	1
34	51.13	19.22	54.13	19.76	1
35	54.13	19.76	56.13	20.00	1
36	56.13	20.00	58.49	19.93	1
37	.00	6.98	80.00	6.98	2
38	.00	.68	80.00	.68	3
39	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

5 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	25.00
2	40.90	25.00
3	40.91	28.00
4	80.00	28.00

A HORIZONTAL EARTHQUAKE LOADING COEFFICIENT
OF .068 AS BEEN ASSIGNED

A VERTICAL EARTHQUAKE LOADING COEFFICIENT
OF-.034 AS BEEN ASSIGNED

CAVITATION PRESSURE = .0 t/mq

▯▯ ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.85 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 30.00 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 11 COORDINATE POINTS (R= 16.03 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.30	19.36
3	17.79	19.23
4	20.28	19.49
5	22.70	20.14
6	24.98	21.15
7	27.08	22.50
8	28.95	24.17
9	30.53	26.10
10	31.80	28.26
11	32.49	30.00

*** 1.107 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 18.80 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.32	19.47
3	17.82	19.40
4	20.30	19.67
5	22.73	20.26
6	25.06	21.17
7	27.25	22.38
8	29.26	23.87
9	31.05	25.61
10	32.60	27.58
11	33.87	29.73
12	33.98	30.00

*** 1.120 ***

FAILURE SURFACE SPECIFIED BY 13 COORDINATE POINTS (R= 21.39 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.31	19.42
3	17.80	19.26
4	20.30	19.39
5	22.76	19.81
6	25.16	20.51
7	27.46	21.49
8	29.63	22.74
9	31.64	24.22
10	33.47	25.93
11	35.08	27.85
12	36.45	29.93
13	36.48	30.00

*** 1.227 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 15.37 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.19	18.98
3	17.64	18.49
4	20.14	18.40
5	22.62	18.71
6	25.01	19.42
7	27.26	20.51
8	29.31	21.95
9	31.09	23.70
10	32.57	25.72
11	33.70	27.95
12	34.34	30.00

*** 1.310 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 31.50 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.32	19.50
3	17.82	19.33
4	20.32	19.36
5	22.81	19.59
6	25.27	20.01
7	27.69	20.63
8	30.06	21.43
9	32.35	22.43
10	34.56	23.60
11	36.67	24.94
12	38.67	26.45
13	40.54	28.10
14	42.27	29.91
15	42.34	30.00

*** 1.450 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 28.86 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.28	19.28
3	17.75	18.91
4	20.25	18.75
5	22.75	18.81
6	25.23	19.08
7	27.68	19.57
8	30.08	20.27
9	32.42	21.17
10	34.66	22.27
11	36.80	23.56
12	38.82	25.03
13	40.71	26.67
14	42.45	28.47
15	43.58	29.87

*** 1.559 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 17.49 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.09	18.76
3	17.47	17.98
4	19.93	17.55

5	22.43	17.47
6	24.91	17.75
7	27.33	18.38
8	29.64	19.35
9	31.78	20.63
10	33.72	22.21
11	35.41	24.05
12	36.83	26.11
13	37.94	28.35
14	38.48	30.00

*** 1.576 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 26.72 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.23	19.11
3	17.68	18.58
4	20.16	18.28
5	22.66	18.22
6	25.15	18.38
7	27.62	18.78
8	30.04	19.41
9	32.39	20.26
10	34.65	21.33
11	36.80	22.60
12	38.82	24.07
13	40.70	25.73
14	42.41	27.55
15	43.95	29.52
16	44.00	29.59

*** 1.634 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 23.60 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.18	18.97
3	17.59	18.31
4	20.06	17.92
5	22.56	17.79
6	25.06	17.93
7	27.52	18.32
8	29.94	18.98
9	32.27	19.89
10	34.49	21.04
11	36.57	22.42
12	38.50	24.01
13	40.25	25.80
14	41.80	27.76
15	43.13	29.87
16	43.19	30.00

*** 1.655 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 23.05 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.85	19.87
2	15.16	18.92
3	17.57	18.24
4	20.03	17.81
5	22.53	17.66
6	25.02	17.77
7	27.49	18.16

8	29.91	18.81
9	32.24	19.72
10	34.45	20.88
11	36.53	22.26
12	38.45	23.87
13	40.18	25.67
14	41.71	27.65
15	43.01	29.79
16	43.11	30.00

*** 1.671 ***

7.3 FASE FINALE A BREVE TERMINE (TEMPO “0”) CON RIEMPIMENTO DELLA CASSA FINO ALLA QUOTA + 3.50 M S.L.M. E FALDA LATO CASSA A QUOTA FONDALE

7.3.1 **In esercizio con carico accidentale di banchina pari a 1.3*40=52 kN/mq**

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▯▯  ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

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      $   $  $$$   $$$   $$$$    $$$    $$$   $$$$$    $    $$$$   $
      $$ $$   $   $   $  $   $  $   $  $   $    $     $ $    $  $  $
      $ $ $   $   $      $   $  $   $  $        $    $   $   $  $  $
      $ $ $   $   $      $$$$   $   $   $$$     $    $   $   $$$   $
      $   $   $   $      $ $    $   $      $    $    $$$$$   $  $  $
      $   $   $   $   $  $  $   $   $  $   $    $    $   $   $  $  $
      $   $  $$$   $$$   $   $   $$$    $$$     $    $   $  $$$$   $$$$$
                                                                ver. 2.03
▯F


                              DEVELOPED BY
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                          MICRO CONVERSION AND REVISION BY
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                            (C) studio I.S.G. - Firenze



                        GENERAL SOLUTION OF SLOPE STABILITY
                           PROBLEMS BY A TWO DIMENSIONAL
                           LIMITING EQUILIBRIUM METHOD



      PROBLEM DESCRIPTION ..  PARATIA DI DIAFRAMMI PLASTICI:

      COMMISSIONED BY ......  ***   FASE FINALE IN ESERCIZIO

      LOCATION .............  CONDIZIONE DI FALDA A 0.00 M
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BOUNDARY COORDINATES

8 TOP BOUNDARIES
41 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	30.34	31.50	6
8	30.34	31.50	80.00	31.50	6
9	28.09	30.00	43.39	30.00	5
10	43.39	30.00	58.49	19.93	5
11	58.49	19.93	60.13	19.87	1
12	60.13	19.87	63.63	19.71	1
13	63.63	19.71	66.13	19.66	1
14	66.13	19.66	67.13	19.56	1
15	67.13	19.56	68.13	19.41	1
16	68.13	19.41	72.13	18.89	1
17	72.13	18.89	73.62	18.70	1
18	73.62	18.70	76.13	18.64	1
19	76.13	18.64	78.62	18.57	1
20	78.62	18.57	80.00	18.52	1
21	12.90	19.87	14.60	19.87	1
22	14.60	19.87	17.13	19.70	1
23	17.13	19.70	19.13	19.82	1
24	19.13	19.82	23.60	19.62	1
25	23.60	19.62	26.13	19.64	1
26	26.13	19.64	27.66	19.60	1
27	27.66	19.60	31.13	19.21	1
28	31.13	19.21	34.13	17.12	1
29	34.13	17.12	36.13	16.23	1
30	36.13	16.23	38.38	16.28	1
31	38.38	16.28	41.38	16.43	1
32	41.38	16.43	44.13	16.78	1
33	44.13	16.78	46.13	17.52	1
34	46.13	17.52	47.13	17.54	1
35	47.13	17.54	51.13	19.22	1
36	51.13	19.22	54.13	19.76	1
37	54.13	19.76	56.13	20.00	1
38	56.13	20.00	58.49	19.93	1
39	.00	6.98	80.00	6.98	2
40	.00	.68	80.00	.68	3
41	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

6 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1
6	1.50	1.60	.00	20.46	.00	.00	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	28.00
2	40.90	28.00
3	40.91	18.50
4	80.00	18.50

BOUNDARY LOAD(S)

1 LOAD(S) SPECIFIED

LOAD NO.	X-LEFT (m)	X-RIGHT (m)	INTENSITY (t/mq)	DEFLECTION (DEG)
1	30.34	60.34	5.2	.0

NOTE - INTENSITY IS SPECIFIED AS A UNIFORMLY DISTRIBUTED
FORCE ACTING ON A HORIZONTALLY PROJECTED SURFACE.

Analisi di stabilita' dei pendii: metodi all'equilibrio limite

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.86 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 32.00 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 17.67 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.31	19.36
3	17.80	19.19
4	20.29	19.39
5	22.74	19.93
6	25.08	20.81
7	27.27	22.01
8	29.27	23.50
9	31.04	25.27
10	32.54	27.27
11	33.75	29.46
12	34.53	31.50

*** 1.192 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 22.73 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.32	19.42
3	17.81	19.24
4	20.31	19.34
5	22.78	19.70
6	25.20	20.34
7	27.53	21.24
8	29.75	22.40
9	31.83	23.78
10	33.75	25.39
11	35.47	27.20
12	36.99	29.19
13	38.28	31.33
14	38.36	31.50

*** 1.262 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 16.82 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.20	18.98
3	17.64	18.45
4	20.14	18.29
5	22.63	18.50
6	25.06	19.08
7	27.38	20.01
8	29.54	21.28
9	31.48	22.85
10	33.17	24.69
11	34.57	26.76
12	35.65	29.02
13	36.38	31.41
14	36.39	31.50

*** 1.395 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 18.78 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.18	18.94
3	17.61	18.33
4	20.09	18.05
5	22.59	18.10
6	25.06	18.48
7	27.46	19.18
8	29.74	20.20
9	31.87	21.51
10	33.80	23.10
11	35.51	24.92
12	36.96	26.96
13	38.13	29.17
14	38.98	31.50

*** 1.482 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 28.94 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.29	19.28
3	17.76	18.91
4	20.26	18.75
5	22.76	18.81
6	25.24	19.08
7	27.69	19.56
8	30.10	20.26
9	32.43	21.15
10	34.68	22.25
11	36.82	23.54
12	38.85	25.00
13	40.74	26.64
14	42.48	28.43
15	44.06	30.36
16	44.84	31.50

*** 1.585 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 18.71 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.10	18.76
3	17.47	17.96
4	19.92	17.48
5	22.42	17.33
6	24.91	17.52
7	27.36	18.04
8	29.71	18.87
9	31.94	20.02
10	33.99	21.45
11	35.83	23.14
12	37.43	25.06
13	38.76	27.18
14	39.79	29.45
15	40.41	31.50

*** 1.642 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 27.00 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.24	19.11
3	17.69	18.58
4	20.17	18.28
5	22.67	18.20
6	25.16	18.36
7	27.63	18.75
8	30.05	19.36
9	32.41	20.20
10	34.68	21.25
11	36.84	22.50
12	38.88	23.95
13	40.77	25.59
14	42.50	27.39
15	44.06	29.34
16	45.44	31.43
17	45.47	31.50

*** 1.682 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 24.24 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.19	18.97
3	17.60	18.31
4	20.07	17.90
5	22.56	17.75
6	25.06	17.86
7	27.54	18.22
8	29.96	18.84
9	32.31	19.70
10	34.55	20.80
11	36.67	22.12
12	38.64	23.66
13	40.45	25.39
14	42.06	27.30
15	43.47	29.36
16	44.63	31.50

*** 1.707 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 23.75 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.17	18.92
3	17.58	18.23
4	20.04	17.79
5	22.53	17.61
6	25.03	17.70
7	27.51	18.04
8	29.93	18.65
9	32.28	19.51
10	34.52	20.60
11	36.64	21.93
12	38.61	23.48
13	40.40	25.22
14	42.00	27.14
15	43.39	29.22
16	44.55	31.43
17	44.58	31.50

*** 1.727 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 14.81 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.86	18.37
3	17.08	17.22
4	19.47	16.47
5	21.94	16.13
6	24.44	16.20
7	26.89	16.70
8	29.22	17.60
9	31.37	18.88
10	33.27	20.51
11	34.87	22.43
12	36.13	24.59
13	37.00	26.93
14	37.47	29.38
15	37.51	31.50

*** 1.896 ***

7.3.2 **Con mareggiata estrema: cresta d’onda +4.39 m**

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▯▯  ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

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▯F

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                          MICRO CONVERSION AND REVISION BY
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                            (C) studio I.S.G. - Firenze



                        GENERAL SOLUTION OF SLOPE STABILITY
                           PROBLEMS BY A TWO DIMENSIONAL
                           LIMITING EQUILIBRIUM METHOD



      PROBLEM DESCRIPTION ..  PARATIA DI DIAFRAMMI PLASTICI:


      COMMISSIONED BY ......  ***   FASE FINALE CRESTA D'ONDA

      LOCATION .............  CONDIZIONE DI FALDA A 0.00 M
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BOUNDARY COORDINATES

8 TOP BOUNDARIES
41 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	30.34	31.50	6
8	30.34	31.50	80.00	31.50	6
9	28.09	30.00	43.39	30.00	5
10	43.39	30.00	58.49	19.93	5
11	58.49	19.93	60.13	19.87	1
12	60.13	19.87	63.63	19.71	1
13	63.63	19.71	66.13	19.66	1
14	66.13	19.66	67.13	19.56	1
15	67.13	19.56	68.13	19.41	1
16	68.13	19.41	72.13	18.89	1
17	72.13	18.89	73.62	18.70	1
18	73.62	18.70	76.13	18.64	1
19	76.13	18.64	78.62	18.57	1
20	78.62	18.57	80.00	18.52	1
21	12.90	19.87	14.60	19.87	1
22	14.60	19.87	17.13	19.70	1
23	17.13	19.70	19.13	19.82	1
24	19.13	19.82	23.60	19.62	1
25	23.60	19.62	26.13	19.64	1
26	26.13	19.64	27.66	19.60	1
27	27.66	19.60	31.13	19.21	1
28	31.13	19.21	34.13	17.12	1
29	34.13	17.12	36.13	16.23	1
30	36.13	16.23	38.38	16.28	1
31	38.38	16.28	41.38	16.43	1
32	41.38	16.43	44.13	16.78	1
33	44.13	16.78	46.13	17.52	1
34	46.13	17.52	47.13	17.54	1
35	47.13	17.54	51.13	19.22	1
36	51.13	19.22	54.13	19.76	1
37	54.13	19.76	56.13	20.00	1
38	56.13	20.00	58.49	19.93	1
39	.00	6.98	80.00	6.98	2
40	.00	.68	80.00	.68	3
41	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

6 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1
6	1.50	1.60	.00	20.46	.00	.00	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 5 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	32.39
2	39.00	32.39
3	40.90	18.50
4	40.91	18.50
5	80.00	18.50

▯▯ ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.86 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 32.00 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 17.67 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.31	19.36
3	17.80	19.19
4	20.29	19.39
5	22.74	19.93
6	25.08	20.81
7	27.27	22.01
8	29.27	23.50
9	31.04	25.27
10	32.54	27.27
11	33.75	29.46
12	34.53	31.50

*** 1.547 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 22.73 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.32	19.42
3	17.81	19.24
4	20.31	19.34
5	22.78	19.70
6	25.20	20.34
7	27.53	21.24
8	29.75	22.40
9	31.83	23.78
10	33.75	25.39
11	35.47	27.20
12	36.99	29.19
13	38.28	31.33
14	38.36	31.50

*** 1.695 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 16.82 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.20	18.98
3	17.64	18.45
4	20.14	18.29
5	22.63	18.50
6	25.06	19.08
7	27.38	20.01
8	29.54	21.28
9	31.48	22.85
10	33.17	24.69
11	34.57	26.76
12	35.65	29.02
13	36.38	31.41
14	36.39	31.50

*** 1.875 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 18.78 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.18	18.94
3	17.61	18.33
4	20.09	18.05
5	22.59	18.10
6	25.06	18.48
7	27.46	19.18
8	29.74	20.20
9	31.87	21.51
10	33.80	23.10
11	35.51	24.92
12	36.96	26.96
13	38.13	29.17
14	38.98	31.50

*** 2.049 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 18.71 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.10	18.76
3	17.47	17.96
4	19.92	17.48
5	22.42	17.33
6	24.91	17.52
7	27.36	18.04
8	29.71	18.87
9	31.94	20.02
10	33.99	21.45
11	35.83	23.14
12	37.43	25.06
13	38.76	27.18
14	39.79	29.45
15	40.41	31.50

*** 2.389 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 28.94 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.29	19.28
3	17.76	18.91
4	20.26	18.75
5	22.76	18.81
6	25.24	19.08
7	27.69	19.56
8	30.10	20.26
9	32.43	21.15
10	34.68	22.25
11	36.82	23.54
12	38.85	25.00
13	40.74	26.64
14	42.48	28.43
15	44.06	30.36
16	44.84	31.50

*** 2.569 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 14.81 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.86	18.37
3	17.08	17.22
4	19.47	16.47
5	21.94	16.13
6	24.44	16.20
7	26.89	16.70
8	29.22	17.60
9	31.37	18.88
10	33.27	20.51
11	34.87	22.43
12	36.13	24.59
13	37.00	26.93
14	37.47	29.38
15	37.51	31.50

*** 2.636 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 27.00 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.24	19.11
3	17.69	18.58
4	20.17	18.28
5	22.67	18.20
6	25.16	18.36
7	27.63	18.75
8	30.05	19.36
9	32.41	20.20
10	34.68	21.25
11	36.84	22.50
12	38.88	23.95
13	40.77	25.59
14	42.50	27.39
15	44.06	29.34
16	45.44	31.43
17	45.47	31.50

*** 2.833 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 24.24 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.19	18.97
3	17.60	18.31
4	20.07	17.90
5	22.56	17.75
6	25.06	17.86
7	27.54	18.22
8	29.96	18.84
9	32.31	19.70
10	34.55	20.80
11	36.67	22.12
12	38.64	23.66
13	40.45	25.39
14	42.06	27.30
15	43.47	29.36
16	44.63	31.50

*** 2.849 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 23.75 m)

POINT	X-SURF	Y-SURF

NO.	(m)	(m)
1	12.86	19.87
2	15.17	18.92
3	17.58	18.23
4	20.04	17.79
5	22.53	17.61
6	25.03	17.70
7	27.51	18.04
8	29.93	18.65
9	32.28	19.51
10	34.52	20.60
11	36.64	21.93
12	38.61	23.48
13	40.40	25.22
14	42.00	27.14
15	43.39	29.22
16	44.55	31.43
17	44.58	31.50

*** 2.888 ***

7.3.3 **Con mareggiata estrema: cavo d'onda a -2.92 m**

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  ═══  Analisi di stabilita' dei pendii: metodi all'equilibrio limite  ═══════════════════════════════

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                            MICRO CONVERSION AND REVISION BY
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                              (C) studio I.S.G. - Firenze



                          GENERAL SOLUTION OF SLOPE STABILITY
                             PROBLEMS BY A TWO DIMENSIONAL
                              LIMITING EQUILIBRIUM METHOD



      PROBLEM DESCRIPTION ..  PARATIA DI DIAFRAMMI PLASTICI:

      COMMISSIONED BY ......  ***   FASE FINALE CAVO D'ONDA

      LOCATION .............  CONDIZIONE DI FALDA A 0.00 M
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BOUNDARY COORDINATES

8 TOP BOUNDARIES
41 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	30.34	31.50	6
8	30.34	31.50	80.00	31.50	6
9	28.09	30.00	43.39	30.00	5
10	43.39	30.00	58.49	19.93	5
11	58.49	19.93	60.13	19.87	1
12	60.13	19.87	63.63	19.71	1
13	63.63	19.71	66.13	19.66	1
14	66.13	19.66	67.13	19.56	1
15	67.13	19.56	68.13	19.41	1
16	68.13	19.41	72.13	18.89	1
17	72.13	18.89	73.62	18.70	1
18	73.62	18.70	76.13	18.64	1
19	76.13	18.64	78.62	18.57	1
20	78.62	18.57	80.00	18.52	1
21	12.90	19.87	14.60	19.87	1
22	14.60	19.87	17.13	19.70	1
23	17.13	19.70	19.13	19.82	1
24	19.13	19.82	23.60	19.62	1
25	23.60	19.62	26.13	19.64	1
26	26.13	19.64	27.66	19.60	1
27	27.66	19.60	31.13	19.21	1
28	31.13	19.21	34.13	17.12	1
29	34.13	17.12	36.13	16.23	1
30	36.13	16.23	38.38	16.28	1
31	38.38	16.28	41.38	16.43	1
32	41.38	16.43	44.13	16.78	1
33	44.13	16.78	46.13	17.52	1
34	46.13	17.52	47.13	17.54	1
35	47.13	17.54	51.13	19.22	1
36	51.13	19.22	54.13	19.76	1
37	54.13	19.76	56.13	20.00	1
38	56.13	20.00	58.49	19.93	1
39	.00	6.98	80.00	6.98	2
40	.00	.68	80.00	.68	3
41	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

6 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1
6	1.50	1.60	.00	20.46	.00	.00	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	25.08
2	40.90	25.08
3	40.91	18.50
4	80.00	18.50

Analisi di stabilita' dei pendii: metodi all'equilibrio limite

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.86 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 32.00 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 17.67 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.31	19.36
3	17.80	19.19
4	20.29	19.39
5	22.74	19.93
6	25.08	20.81
7	27.27	22.01
8	29.27	23.50
9	31.04	25.27
10	32.54	27.27
11	33.75	29.46
12	34.53	31.50

*** 1.298 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 22.73 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.32	19.42
3	17.81	19.24
4	20.31	19.34
5	22.78	19.70
6	25.20	20.34
7	27.53	21.24
8	29.75	22.40
9	31.83	23.78
10	33.75	25.39
11	35.47	27.20
12	36.99	29.19
13	38.28	31.33
14	38.36	31.50

*** 1.439 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 16.82 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.20	18.98
3	17.64	18.45
4	20.14	18.29
5	22.63	18.50
6	25.06	19.08
7	27.38	20.01
8	29.54	21.28
9	31.48	22.85
10	33.17	24.69
11	34.57	26.76
12	35.65	29.02
13	36.38	31.41
14	36.39	31.50

*** 1.537 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 18.78 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.18	18.94
3	17.61	18.33
4	20.09	18.05
5	22.59	18.10
6	25.06	18.48
7	27.46	19.18
8	29.74	20.20
9	31.87	21.51
10	33.80	23.10
11	35.51	24.92
12	36.96	26.96
13	38.13	29.17
14	38.98	31.50

*** 1.675 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 28.94 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.29	19.28
3	17.76	18.91
4	20.26	18.75
5	22.76	18.81
6	25.24	19.08
7	27.69	19.56
8	30.10	20.26
9	32.43	21.15
10	34.68	22.25
11	36.82	23.54
12	38.85	25.00
13	40.74	26.64
14	42.48	28.43
15	44.06	30.36
16	44.84	31.50

*** 1.839 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 18.71 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.10	18.76
3	17.47	17.96
4	19.92	17.48
5	22.42	17.33
6	24.91	17.52
7	27.36	18.04
8	29.71	18.87
9	31.94	20.02
10	33.99	21.45
11	35.83	23.14
12	37.43	25.06
13	38.76	27.18
14	39.79	29.45
15	40.41	31.50

*** 1.864 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 27.00 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.24	19.11
3	17.69	18.58
4	20.17	18.28
5	22.67	18.20
6	25.16	18.36
7	27.63	18.75
8	30.05	19.36
9	32.41	20.20
10	34.68	21.25
11	36.84	22.50
12	38.88	23.95
13	40.77	25.59
14	42.50	27.39
15	44.06	29.34
16	45.44	31.43
17	45.47	31.50

*** 1.946 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 24.24 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.19	18.97
3	17.60	18.31
4	20.07	17.90
5	22.56	17.75
6	25.06	17.86
7	27.54	18.22
8	29.96	18.84
9	32.31	19.70
10	34.55	20.80
11	36.67	22.12
12	38.64	23.66
13	40.45	25.39
14	42.06	27.30
15	43.47	29.36
16	44.63	31.50

*** 1.972 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 23.75 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.17	18.92
3	17.58	18.23
4	20.04	17.79
5	22.53	17.61
6	25.03	17.70
7	27.51	18.04
8	29.93	18.65
9	32.28	19.51
10	34.52	20.60
11	36.64	21.93
12	38.61	23.48
13	40.40	25.22
14	42.00	27.14
15	43.39	29.22
16	44.55	31.43
17	44.58	31.50

*** 1.992 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 14.81 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.86	18.37
3	17.08	17.22
4	19.47	16.47
5	21.94	16.13
6	24.44	16.20
7	26.89	16.70
8	29.22	17.60
9	31.37	18.88
10	33.27	20.51
11	34.87	22.43
12	36.13	24.59
13	37.00	26.93
14	37.47	29.38
15	37.51	31.50

*** 2.071 ***

7.3.4 **In sismica**

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▯▯  ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

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▯F

                                DEVELOPED BY
                              RONALD A. SIEGEL
                        GRADUATE INSTRUCTOR IN RESEARCH
                              PURDUE UNIVERSITY


                          MICRO CONVERSION AND REVISION BY
                         Ing. C. MADIAI  and  Ing. M. PERINI
                             (C) studio I.S.G. - Firenze



                       GENERAL SOLUTION OF SLOPE STABILITY
                          PROBLEMS BY A TWO DIMENSIONAL
                          LIMITING EQUILIBRIUM METHOD



      PROBLEM DESCRIPTION ..  PARATIA DI DIAFRAMMI PLASTICI:

      COMMISSIONED BY ......  ***   FASE FINALE IN SIAMICA

      LOCATION .............  CONDIZIONE DI FALDA A 0.00 M
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BOUNDARY COORDINATES

8 TOP BOUNDARIES
41 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	30.34	31.50	6
8	30.34	31.50	80.00	31.50	6
9	28.09	30.00	43.39	30.00	5
10	43.39	30.00	58.49	19.93	5
11	58.49	19.93	60.13	19.87	1
12	60.13	19.87	63.63	19.71	1
13	63.63	19.71	66.13	19.66	1
14	66.13	19.66	67.13	19.56	1
15	67.13	19.56	68.13	19.41	1
16	68.13	19.41	72.13	18.89	1
17	72.13	18.89	73.62	18.70	1
18	73.62	18.70	76.13	18.64	1
19	76.13	18.64	78.62	18.57	1
20	78.62	18.57	80.00	18.52	1
21	12.90	19.87	14.60	19.87	1
22	14.60	19.87	17.13	19.70	1
23	17.13	19.70	19.13	19.82	1
24	19.13	19.82	23.60	19.62	1
25	23.60	19.62	26.13	19.64	1
26	26.13	19.64	27.66	19.60	1
27	27.66	19.60	31.13	19.21	1
28	31.13	19.21	34.13	17.12	1
29	34.13	17.12	36.13	16.23	1
30	36.13	16.23	38.38	16.28	1
31	38.38	16.28	41.38	16.43	1
32	41.38	16.43	44.13	16.78	1
33	44.13	16.78	46.13	17.52	1
34	46.13	17.52	47.13	17.54	1
35	47.13	17.54	51.13	19.22	1
36	51.13	19.22	54.13	19.76	1
37	54.13	19.76	56.13	20.00	1
38	56.13	20.00	58.49	19.93	1
39	.00	6.98	80.00	6.98	2
40	.00	.68	80.00	.68	3
41	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

6 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1
6	1.50	1.60	.00	20.46	.00	.00	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 5 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	28.00
2	39.00	28.00
3	40.90	28.00
4	40.91	18.50
5	80.00	18.50

A HORIZONTAL EARTHQUAKE LOADING COEFFICIENT
OF .069 AS BEEN ASSIGNED

A VERTICAL EARTHQUAKE LOADING COEFFICIENT
OF-.034 AS BEEN ASSIGNED

CAVITATION PRESSURE = .0 t/mq

▯▯ ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.86 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 32.00 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 17.67 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.31	19.36
3	17.80	19.19
4	20.29	19.39
5	22.74	19.93
6	25.08	20.81
7	27.27	22.01
8	29.27	23.50
9	31.04	25.27
10	32.54	27.27
11	33.75	29.46
12	34.53	31.50

*** 1.113 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 22.73 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.32	19.42
3	17.81	19.24
4	20.31	19.34
5	22.78	19.70
6	25.20	20.34
7	27.53	21.24
8	29.75	22.40
9	31.83	23.78
10	33.75	25.39
11	35.47	27.20
12	36.99	29.19
13	38.28	31.33
14	38.36	31.50

*** 1.189 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 16.82 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.20	18.98
3	17.64	18.45
4	20.14	18.29
5	22.63	18.50
6	25.06	19.08
7	27.38	20.01
8	29.54	21.28
9	31.48	22.85
10	33.17	24.69
11	34.57	26.76
12	35.65	29.02
13	36.38	31.41
14	36.39	31.50

*** 1.319 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 18.78 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.18	18.94
3	17.61	18.33
4	20.09	18.05
5	22.59	18.10
6	25.06	18.48
7	27.46	19.18
8	29.74	20.20
9	31.87	21.51
10	33.80	23.10
11	35.51	24.92
12	36.96	26.96
13	38.13	29.17
14	38.98	31.50

*** 1.407 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 28.94 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.29	19.28
3	17.76	18.91
4	20.26	18.75
5	22.76	18.81
6	25.24	19.08
7	27.69	19.56
8	30.10	20.26
9	32.43	21.15
10	34.68	22.25
11	36.82	23.54
12	38.85	25.00
13	40.74	26.64
14	42.48	28.43
15	44.06	30.36
16	44.84	31.50

*** 1.449 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 27.00 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.24	19.11
3	17.69	18.58
4	20.17	18.28
5	22.67	18.20
6	25.16	18.36
7	27.63	18.75
8	30.05	19.36
9	32.41	20.20
10	34.68	21.25
11	36.84	22.50
12	38.88	23.95
13	40.77	25.59
14	42.50	27.39
15	44.06	29.34
16	45.44	31.43
17	45.47	31.50

*** 1.547 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 18.71 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.10	18.76
3	17.47	17.96
4	19.92	17.48
5	22.42	17.33
6	24.91	17.52
7	27.36	18.04
8	29.71	18.87
9	31.94	20.02
10	33.99	21.45
11	35.83	23.14
12	37.43	25.06
13	38.76	27.18
14	39.79	29.45
15	40.41	31.50

*** 1.559 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 24.24 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.19	18.97
3	17.60	18.31
4	20.07	17.90
5	22.56	17.75
6	25.06	17.86
7	27.54	18.22
8	29.96	18.84
9	32.31	19.70
10	34.55	20.80
11	36.67	22.12
12	38.64	23.66
13	40.45	25.39
14	42.06	27.30
15	43.47	29.36
16	44.63	31.50

*** 1.585 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 23.75 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.17	18.92
3	17.58	18.23
4	20.04	17.79
5	22.53	17.61
6	25.03	17.70
7	27.51	18.04
8	29.93	18.65
9	32.28	19.51
10	34.52	20.60
11	36.64	21.93
12	38.61	23.48
13	40.40	25.22
14	42.00	27.14
15	43.39	29.22
16	44.55	31.43
17	44.58	31.50

*** 1.606 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 14.81 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.86	18.37
3	17.08	17.22
4	19.47	16.47
5	21.94	16.13
6	24.44	16.20
7	26.89	16.70
8	29.22	17.60
9	31.37	18.88
10	33.27	20.51
11	34.87	22.43
12	36.13	24.59
13	37.00	26.93
14	37.47	29.38
15	37.51	31.50

*** 1.809 ***

7.4 FASE FINALE A LUNGO TERMINE (TEMPO "∞") CON RIEMPIMENTO DELLA CASSA FINO ALLA QUOTA + 3.50 M S.L.M. E FALDA LATO CASSA A QUOTA FONDALE

7.4.1 **In esercizio con carico accidentale di banchina pari a 1.3*40=52 kN/mq**

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▯▯  ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

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      $   $  $$$   $$$   $$$$    $$$    $$$   $$$$$    $    $$$$   $
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                                                              ver. 2.03
▯F


                              DEVELOPED BY
                            RONALD A. SIEGEL
                       GRADUATE INSTRUCTOR IN RESEARCH
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                          MICRO CONVERSION AND REVISION BY
                         Ing. C. MADIAI  and  Ing. M. PERINI
                             (C) studio I.S.G. - Firenze



                        GENERAL SOLUTION OF SLOPE STABILITY
                           PROBLEMS BY A TWO DIMENSIONAL
                            LIMITING EQUILIBRIUM METHOD



      PROBLEM DESCRIPTION ..  PARATIA DI DIAFRAMMI PLASTICI:

      COMMISSIONED BY ......  *** FASE FINALE IN ESERCIZIO (To

      LOCATION .............  CONDIZIONE DI FALDA A 0.00 M
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BOUNDARY COORDINATES

8 TOP BOUNDARIES
41 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	30.34	31.50	6
8	30.34	31.50	80.00	31.50	6
9	28.09	30.00	43.39	30.00	5
10	43.39	30.00	58.49	19.93	5
11	58.49	19.93	60.13	19.87	1
12	60.13	19.87	63.63	19.71	1
13	63.63	19.71	66.13	19.66	1
14	66.13	19.66	67.13	19.56	1
15	67.13	19.56	68.13	19.41	1
16	68.13	19.41	72.13	18.89	1
17	72.13	18.89	73.62	18.70	1
18	73.62	18.70	76.13	18.64	1
19	76.13	18.64	78.62	18.57	1
20	78.62	18.57	80.00	18.52	1
21	12.90	19.87	14.60	19.87	1
22	14.60	19.87	17.13	19.70	1
23	17.13	19.70	19.13	19.82	1
24	19.13	19.82	23.60	19.62	1
25	23.60	19.62	26.13	19.64	1
26	26.13	19.64	27.66	19.60	1
27	27.66	19.60	31.13	19.21	1
28	31.13	19.21	34.13	17.12	1
29	34.13	17.12	36.13	16.23	1
30	36.13	16.23	38.38	16.28	1
31	38.38	16.28	41.38	16.43	1
32	41.38	16.43	44.13	16.78	1
33	44.13	16.78	46.13	17.52	1
34	46.13	17.52	47.13	17.54	1
35	47.13	17.54	51.13	19.22	1
36	51.13	19.22	54.13	19.76	1
37	54.13	19.76	56.13	20.00	1
38	56.13	20.00	58.49	19.93	1
39	.00	6.98	80.00	6.98	2
40	.00	.68	80.00	.68	3
41	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

6 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1
6	1.50	1.60	.00	20.46	.00	.00	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	28.00
2	40.90	28.00
3	40.91	28.00
4	80.00	28.00

BOUNDARY LOAD(S)

1 LOAD(S) SPECIFIED

LOAD NO.	X-LEFT (m)	X-RIGHT (m)	INTENSITY (t/mq)	DEFLECTION (DEG)
1	30.34	60.34	5.2	.0

NOTE - INTENSITY IS SPECIFIED AS A UNIFORMLY DISTRIBUTED
FORCE ACTING ON A HORIZONTALLY PROJECTED SURFACE.

▯▯ ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.86 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 32.00 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 17.67 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.31	19.36
3	17.80	19.19
4	20.29	19.39
5	22.74	19.93
6	25.08	20.81
7	27.27	22.01
8	29.27	23.50
9	31.04	25.27
10	32.54	27.27
11	33.75	29.46
12	34.53	31.50

*** 1.192 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 22.73 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.32	19.42
3	17.81	19.24
4	20.31	19.34
5	22.78	19.70
6	25.20	20.34
7	27.53	21.24
8	29.75	22.40
9	31.83	23.78
10	33.75	25.39
11	35.47	27.20
12	36.99	29.19
13	38.28	31.33
14	38.36	31.50

*** 1.262 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 16.82 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.20	18.98
3	17.64	18.45
4	20.14	18.29
5	22.63	18.50
6	25.06	19.08
7	27.38	20.01
8	29.54	21.28
9	31.48	22.85
10	33.17	24.69
11	34.57	26.76
12	35.65	29.02
13	36.38	31.41
14	36.39	31.50

*** 1.395 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 18.78 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.18	18.94
3	17.61	18.33
4	20.09	18.05
5	22.59	18.10
6	25.06	18.48
7	27.46	19.18
8	29.74	20.20
9	31.87	21.51
10	33.80	23.10
11	35.51	24.92
12	36.96	26.96
13	38.13	29.17
14	38.98	31.50

*** 1.482 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 28.94 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.29	19.28
3	17.76	18.91
4	20.26	18.75
5	22.76	18.81
6	25.24	19.08
7	27.69	19.56
8	30.10	20.26
9	32.43	21.15
10	34.68	22.25
11	36.82	23.54
12	38.85	25.00
13	40.74	26.64
14	42.48	28.43
15	44.06	30.36
16	44.84	31.50

*** 1.581 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 18.71 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.10	18.76
3	17.47	17.96
4	19.92	17.48
5	22.42	17.33
6	24.91	17.52
7	27.36	18.04
8	29.71	18.87
9	31.94	20.02
10	33.99	21.45
11	35.83	23.14
12	37.43	25.06
13	38.76	27.18
14	39.79	29.45
15	40.41	31.50

*** 1.642 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 27.00 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.24	19.11
3	17.69	18.58
4	20.17	18.28
5	22.67	18.20
6	25.16	18.36
7	27.63	18.75
8	30.05	19.36
9	32.41	20.20
10	34.68	21.25
11	36.84	22.50
12	38.88	23.95
13	40.77	25.59
14	42.50	27.39
15	44.06	29.34
16	45.44	31.43
17	45.47	31.50

*** 1.668 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 24.24 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.19	18.97
3	17.60	18.31
4	20.07	17.90
5	22.56	17.75
6	25.06	17.86
7	27.54	18.22
8	29.96	18.84
9	32.31	19.70
10	34.55	20.80
11	36.67	22.12
12	38.64	23.66
13	40.45	25.39
14	42.06	27.30
15	43.47	29.36
16	44.63	31.50

*** 1.697 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 23.75 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.17	18.92
3	17.58	18.23
4	20.04	17.79
5	22.53	17.61
6	25.03	17.70
7	27.51	18.04
8	29.93	18.65
9	32.28	19.51
10	34.52	20.60
11	36.64	21.93
12	38.61	23.48
13	40.40	25.22
14	42.00	27.14
15	43.39	29.22
16	44.55	31.43
17	44.58	31.50

*** 1.715 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 14.81 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.86	18.37
3	17.08	17.22
4	19.47	16.47
5	21.94	16.13
6	24.44	16.20
7	26.89	16.70
8	29.22	17.60
9	31.37	18.88
10	33.27	20.51
11	34.87	22.43
12	36.13	24.59
13	37.00	26.93
14	37.47	29.38
15	37.51	31.50

*** 1.896 ***

7.4.2 **Con mareggiata estrema: cresta d'onda +4.39 m**

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  ═══  Analisi di stabilita' dei pendii: metodi all'equilibrio limite  ═══════════════════════════════

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      $    $  $$$   $$$   $$$$    $$$    $$$   $$$$$    $    $$$$   $
      $$ $$   $   $   $  $   $  $   $  $   $    $     $ $    $  $  $
      $ $ $   $   $      $   $  $   $  $        $    $   $   $  $  $
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      $   $   $   $      $ $    $   $      $    $    $$$$$   $  $  $
      $   $   $   $   $  $  $   $   $  $   $    $    $   $   $  $  $
      $   $  $$$   $$$   $   $   $$$    $$$     $    $   $  $$$$   $$$$$
                                                                ver. 2.03
F

                                DEVELOPED BY
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                              PURDUE UNIVERSITY

                            MICRO CONVERSION AND REVISION BY
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                              (C) studio I.S.G. - Firenze



                          GENERAL SOLUTION OF SLOPE STABILITY
                             PROBLEMS BY A TWO DIMENSIONAL
                             LIMITING EQUILIBRIUM METHOD



      PROBLEM DESCRIPTION ..  PARATIA DI DIAFRAMMI PLASTICI:

      COMMISSIONED BY ......  ***   FASE FINALE CRESTA D'ONDA

      LOCATION .............  CONDIZIONE DI FALDA A 0.00 M
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BOUNDARY COORDINATES

8 TOP BOUNDARIES
41 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	30.34	31.50	6
8	30.34	31.50	80.00	31.50	6
9	28.09	30.00	43.39	30.00	5
10	43.39	30.00	58.49	19.93	5
11	58.49	19.93	60.13	19.87	1
12	60.13	19.87	63.63	19.71	1
13	63.63	19.71	66.13	19.66	1
14	66.13	19.66	67.13	19.56	1
15	67.13	19.56	68.13	19.41	1
16	68.13	19.41	72.13	18.89	1
17	72.13	18.89	73.62	18.70	1
18	73.62	18.70	76.13	18.64	1
19	76.13	18.64	78.62	18.57	1
20	78.62	18.57	80.00	18.52	1
21	12.90	19.87	14.60	19.87	1
22	14.60	19.87	17.13	19.70	1
23	17.13	19.70	19.13	19.82	1
24	19.13	19.82	23.60	19.62	1
25	23.60	19.62	26.13	19.64	1
26	26.13	19.64	27.66	19.60	1
27	27.66	19.60	31.13	19.21	1
28	31.13	19.21	34.13	17.12	1
29	34.13	17.12	36.13	16.23	1
30	36.13	16.23	38.38	16.28	1
31	38.38	16.28	41.38	16.43	1
32	41.38	16.43	44.13	16.78	1
33	44.13	16.78	46.13	17.52	1
34	46.13	17.52	47.13	17.54	1
35	47.13	17.54	51.13	19.22	1
36	51.13	19.22	54.13	19.76	1
37	54.13	19.76	56.13	20.00	1
38	56.13	20.00	58.49	19.93	1
39	.00	6.98	80.00	6.98	2
40	.00	.68	80.00	.68	3
41	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

6 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1
6	1.50	1.60	.00	20.46	.00	.00	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 5 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	32.39
2	39.00	32.39
3	40.90	28.00
4	40.91	28.00
5	80.00	28.00

▯▯ ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.86 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 32.00 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 17.67 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.31	19.36
3	17.80	19.19
4	20.29	19.39
5	22.74	19.93
6	25.08	20.81
7	27.27	22.01
8	29.27	23.50
9	31.04	25.27
10	32.54	27.27
11	33.75	29.46
12	34.53	31.50

*** 1.547 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 22.73 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.32	19.42
3	17.81	19.24
4	20.31	19.34
5	22.78	19.70
6	25.20	20.34
7	27.53	21.24
8	29.75	22.40
9	31.83	23.78
10	33.75	25.39
11	35.47	27.20
12	36.99	29.19
13	38.28	31.33
14	38.36	31.50

*** 1.695 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 16.82 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.20	18.98
3	17.64	18.45
4	20.14	18.29
5	22.63	18.50
6	25.06	19.08
7	27.38	20.01
8	29.54	21.28
9	31.48	22.85
10	33.17	24.69
11	34.57	26.76
12	35.65	29.02
13	36.38	31.41
14	36.39	31.50

*** 1.875 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 18.78 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.18	18.94
3	17.61	18.33
4	20.09	18.05
5	22.59	18.10
6	25.06	18.48
7	27.46	19.18
8	29.74	20.20
9	31.87	21.51
10	33.80	23.10
11	35.51	24.92
12	36.96	26.96
13	38.13	29.17
14	38.98	31.50

*** 2.049 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 18.71 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.10	18.76
3	17.47	17.96
4	19.92	17.48
5	22.42	17.33
6	24.91	17.52
7	27.36	18.04
8	29.71	18.87
9	31.94	20.02
10	33.99	21.45
11	35.83	23.14
12	37.43	25.06
13	38.76	27.18
14	39.79	29.45
15	40.41	31.50

*** 2.365 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 28.94 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.29	19.28
3	17.76	18.91
4	20.26	18.75
5	22.76	18.81
6	25.24	19.08
7	27.69	19.56
8	30.10	20.26
9	32.43	21.15
10	34.68	22.25
11	36.82	23.54
12	38.85	25.00
13	40.74	26.64
14	42.48	28.43
15	44.06	30.36
16	44.84	31.50

*** 2.490 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 14.81 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.86	18.37
3	17.08	17.22
4	19.47	16.47
5	21.94	16.13
6	24.44	16.20
7	26.89	16.70
8	29.22	17.60
9	31.37	18.88
10	33.27	20.51
11	34.87	22.43
12	36.13	24.59
13	37.00	26.93
14	37.47	29.38
15	37.51	31.50

*** 2.636 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 27.00 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.24	19.11
3	17.69	18.58
4	20.17	18.28
5	22.67	18.20
6	25.16	18.36
7	27.63	18.75
8	30.05	19.36
9	32.41	20.20
10	34.68	21.25
11	36.84	22.50
12	38.88	23.95
13	40.77	25.59
14	42.50	27.39
15	44.06	29.34
16	45.44	31.43
17	45.47	31.50

*** 2.715 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 24.24 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.19	18.97
3	17.60	18.31
4	20.07	17.90
5	22.56	17.75
6	25.06	17.86
7	27.54	18.22
8	29.96	18.84
9	32.31	19.70
10	34.55	20.80
11	36.67	22.12
12	38.64	23.66
13	40.45	25.39
14	42.06	27.30
15	43.47	29.36
16	44.63	31.50

*** 2.739 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 23.75 m)

POINT	X-SURF	Y-SURF

NO.	(m)	(m)
1	12.86	19.87
2	15.17	18.92
3	17.58	18.23
4	20.04	17.79
5	22.53	17.61
6	25.03	17.70
7	27.51	18.04
8	29.93	18.65
9	32.28	19.51
10	34.52	20.60
11	36.64	21.93
12	38.61	23.48
13	40.40	25.22
14	42.00	27.14
15	43.39	29.22
16	44.55	31.43
17	44.58	31.50

*** 2.775 ***

7.4.3 **Con mareggiata estrema: cavo d'onda -2.92 m**

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▯▯  ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════

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      $    $  $$$   $$$   $$$$    $$$    $$$   $$$$$    $    $$$$   $
      $$ $$   $   $   $  $   $  $   $  $   $    $     $ $    $  $  $
      $ $ $   $   $      $   $  $   $  $        $    $   $   $  $  $
      $ $ $   $   $      $$$$   $   $   $$$     $    $   $   $$$    $
      $   $   $   $      $ $    $   $      $    $    $$$$$   $  $  $
      $   $   $   $   $  $  $   $   $  $   $    $    $   $   $  $  $
      $   $  $$$   $$$   $   $   $$$    $$$     $    $   $  $$$$   $$$$$
                                                                ver. 2.03
▯F
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GENERAL SOLUTION OF SLOPE STABILITY
PROBLEMS BY A TWO DIMENSIONAL
LIMITING EQUILIBRIUM METHOD

PROBLEM DESCRIPTION .. PARATIA DI DIAFRAMMI PLASTICI:

COMMISSIONED BY ..... *** FASE FINALE CAVO D'ONDA

LOCATION ..... CONDIZIONE DI FALDA A 0.00 M

BOUNDARY COORDINATES

8 TOP BOUNDARIES
41 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	30.34	31.50	6
8	30.34	31.50	80.00	31.50	6
9	28.09	30.00	43.39	30.00	5
10	43.39	30.00	58.49	19.93	5
11	58.49	19.93	60.13	19.87	1
12	60.13	19.87	63.63	19.71	1
13	63.63	19.71	66.13	19.66	1
14	66.13	19.66	67.13	19.56	1
15	67.13	19.56	68.13	19.41	1
16	68.13	19.41	72.13	18.89	1
17	72.13	18.89	73.62	18.70	1
18	73.62	18.70	76.13	18.64	1
19	76.13	18.64	78.62	18.57	1
20	78.62	18.57	80.00	18.52	1
21	12.90	19.87	14.60	19.87	1
22	14.60	19.87	17.13	19.70	1
23	17.13	19.70	19.13	19.82	1
24	19.13	19.82	23.60	19.62	1
25	23.60	19.62	26.13	19.64	1
26	26.13	19.64	27.66	19.60	1
27	27.66	19.60	31.13	19.21	1
28	31.13	19.21	34.13	17.12	1
29	34.13	17.12	36.13	16.23	1
30	36.13	16.23	38.38	16.28	1
31	38.38	16.28	41.38	16.43	1
32	41.38	16.43	44.13	16.78	1
33	44.13	16.78	46.13	17.52	1
34	46.13	17.52	47.13	17.54	1
35	47.13	17.54	51.13	19.22	1
36	51.13	19.22	54.13	19.76	1
37	54.13	19.76	56.13	20.00	1
38	56.13	20.00	58.49	19.93	1
39	.00	6.98	80.00	6.98	2
40	.00	.68	80.00	.68	3
41	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

6 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1
6	1.50	1.60	.00	20.46	.00	.00	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	25.08
2	40.90	25.08
3	40.91	28.00
4	80.00	28.00

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.86 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 32.00 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 17.67 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.31	19.36
3	17.80	19.19
4	20.29	19.39
5	22.74	19.93
6	25.08	20.81
7	27.27	22.01
8	29.27	23.50
9	31.04	25.27
10	32.54	27.27
11	33.75	29.46
12	34.53	31.50

*** 1.298 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 22.73 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.32	19.42
3	17.81	19.24
4	20.31	19.34
5	22.78	19.70
6	25.20	20.34
7	27.53	21.24
8	29.75	22.40
9	31.83	23.78
10	33.75	25.39
11	35.47	27.20
12	36.99	29.19
13	38.28	31.33
14	38.36	31.50

*** 1.439 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 16.82 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.20	18.98
3	17.64	18.45
4	20.14	18.29
5	22.63	18.50
6	25.06	19.08
7	27.38	20.01
8	29.54	21.28
9	31.48	22.85
10	33.17	24.69
11	34.57	26.76
12	35.65	29.02
13	36.38	31.41
14	36.39	31.50

*** 1.537 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 18.78 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.18	18.94
3	17.61	18.33
4	20.09	18.05
5	22.59	18.10
6	25.06	18.48
7	27.46	19.18
8	29.74	20.20
9	31.87	21.51
10	33.80	23.10
11	35.51	24.92
12	36.96	26.96
13	38.13	29.17
14	38.98	31.50

*** 1.675 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 28.94 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.29	19.28
3	17.76	18.91
4	20.26	18.75
5	22.76	18.81
6	25.24	19.08
7	27.69	19.56
8	30.10	20.26
9	32.43	21.15
10	34.68	22.25
11	36.82	23.54
12	38.85	25.00
13	40.74	26.64
14	42.48	28.43
15	44.06	30.36
16	44.84	31.50

*** 1.834 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 18.71 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.10	18.76
3	17.47	17.96
4	19.92	17.48
5	22.42	17.33
6	24.91	17.52
7	27.36	18.04
8	29.71	18.87
9	31.94	20.02
10	33.99	21.45
11	35.83	23.14
12	37.43	25.06
13	38.76	27.18
14	39.79	29.45
15	40.41	31.50

*** 1.864 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 27.00 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.24	19.11
3	17.69	18.58
4	20.17	18.28
5	22.67	18.20
6	25.16	18.36
7	27.63	18.75
8	30.05	19.36
9	32.41	20.20
10	34.68	21.25
11	36.84	22.50
12	38.88	23.95
13	40.77	25.59
14	42.50	27.39
15	44.06	29.34
16	45.44	31.43
17	45.47	31.50

*** 1.928 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 24.24 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.19	18.97
3	17.60	18.31
4	20.07	17.90
5	22.56	17.75
6	25.06	17.86
7	27.54	18.22
8	29.96	18.84
9	32.31	19.70
10	34.55	20.80
11	36.67	22.12
12	38.64	23.66
13	40.45	25.39
14	42.06	27.30
15	43.47	29.36
16	44.63	31.50

*** 1.958 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 23.75 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.17	18.92
3	17.58	18.23
4	20.04	17.79
5	22.53	17.61
6	25.03	17.70
7	27.51	18.04
8	29.93	18.65
9	32.28	19.51
10	34.52	20.60
11	36.64	21.93
12	38.61	23.48
13	40.40	25.22
14	42.00	27.14
15	43.39	29.22
16	44.55	31.43
17	44.58	31.50

*** 1.978 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 14.81 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	14.86	18.37
3	17.08	17.22
4	19.47	16.47
5	21.94	16.13
6	24.44	16.20
7	26.89	16.70
8	29.22	17.60
9	31.37	18.88
10	33.27	20.51
11	34.87	22.43
12	36.13	24.59
13	37.00	26.93
14	37.47	29.38
15	37.51	31.50

*** 2.071 ***

7.4.4 **In sismica**

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▯▯  ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

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      $    $  $$$   $$$   $$$$    $$$    $$$   $$$$$    $    $$$$   $
      $$ $$   $   $   $  $   $  $   $  $   $    $     $ $    $  $  $
      $ $ $   $   $      $   $  $   $  $        $    $   $   $  $  $
      $ $ $   $   $      $$$$   $   $   $$$     $    $   $   $$$    $
      $   $   $   $      $ $    $   $      $    $    $$$$$   $  $  $
      $   $   $   $   $  $  $   $   $  $   $    $    $   $   $  $  $
      $   $  $$$   $$$   $   $   $$$    $$$     $    $   $  $$$$   $$$$$
                                                                ver. 2.03
▯F

                                DEVELOPED BY
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                          MICRO CONVERSION AND REVISION BY
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                            (C) studio I.S.G. - Firenze



                       GENERAL SOLUTION OF SLOPE STABILITY
                          PROBLEMS BY A TWO DIMENSIONAL
                          LIMITING EQUILIBRIUM METHOD



      PROBLEM DESCRIPTION ..  PARATIA DI DIAFRAMMI PLASTICI:

      COMMISSIONED BY ......  ***   FASE FINALE IN SIAMICA (To

      LOCATION .............  CONDIZIONE DI FALDA A 0.00 M
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BOUNDARY COORDINATES

8 TOP BOUNDARIES
41 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (m)	Y-LEFT (m)	X-RIGHT (m)	Y-RIGHT (m)	SOIL TYPE BELOW BND
1	.00	20.00	2.58	19.94	1
2	2.58	19.94	5.13	19.94	1
3	5.13	19.94	7.59	19.95	1
4	7.59	19.95	9.67	19.91	1
5	9.67	19.91	12.90	19.87	1
6	12.90	19.87	28.09	30.00	5
7	28.09	30.00	30.34	31.50	6
8	30.34	31.50	80.00	31.50	6
9	28.09	30.00	43.39	30.00	5
10	43.39	30.00	58.49	19.93	5
11	58.49	19.93	60.13	19.87	1
12	60.13	19.87	63.63	19.71	1
13	63.63	19.71	66.13	19.66	1
14	66.13	19.66	67.13	19.56	1
15	67.13	19.56	68.13	19.41	1
16	68.13	19.41	72.13	18.89	1
17	72.13	18.89	73.62	18.70	1
18	73.62	18.70	76.13	18.64	1
19	76.13	18.64	78.62	18.57	1
20	78.62	18.57	80.00	18.52	1
21	12.90	19.87	14.60	19.87	1
22	14.60	19.87	17.13	19.70	1
23	17.13	19.70	19.13	19.82	1
24	19.13	19.82	23.60	19.62	1
25	23.60	19.62	26.13	19.64	1
26	26.13	19.64	27.66	19.60	1
27	27.66	19.60	31.13	19.21	1
28	31.13	19.21	34.13	17.12	1
29	34.13	17.12	36.13	16.23	1
30	36.13	16.23	38.38	16.28	1
31	38.38	16.28	41.38	16.43	1
32	41.38	16.43	44.13	16.78	1
33	44.13	16.78	46.13	17.52	1
34	46.13	17.52	47.13	17.54	1
35	47.13	17.54	51.13	19.22	1
36	51.13	19.22	54.13	19.76	1
37	54.13	19.76	56.13	20.00	1
38	56.13	20.00	58.49	19.93	1
39	.00	6.98	80.00	6.98	2
40	.00	.68	80.00	.68	3
41	.00	.00	80.00	.00	4

ISOTROPIC SOIL PARAMETERS

6 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (t/mc)	SATURATED UNIT WT. (t/mc)	COHESION INTERCEPT (t/mq)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (t/mq)	PIEZOMETRIC SURFACE NO.
1	2.05	2.15	.00	32.01	.00	.00	1
2	1.85	1.95	.00	17.91	.00	.00	1
3	1.95	2.05	.00	29.26	.00	.00	1
4	2.00	2.10	1.92	22.18	.00	.00	1
5	2.00	2.10	.00	32.01	.00	.00	1
6	1.50	1.60	.00	20.46	.00	.00	1

Analisi di stabilita' dei pendii: metodi all'equilibrio limite

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER (t/mc) = .99

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 5 COORDINATE POINTS

POINT NO.	X-WATER (m)	Y-WATER (m)
1	.00	28.00
2	39.00	28.00
3	40.90	28.00
4	40.91	28.00
5	80.00	28.00

A HORIZONTAL EARTHQUAKE LOADING COEFFICIENT
OF .069 AS BEEN ASSIGNED

A VERTICAL EARTHQUAKE LOADING COEFFICIENT
OF-.034 AS BEEN ASSIGNED

CAVITATION PRESSURE = .0 t/mq

▯▯ ═══▯ Analisi di stabilita' dei pendii: metodi all'equilibrio limite ▯═══════════════════════════════

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM
TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED
THE SAFETY FACTOR HAS BEEN CALCULATED THROUGH THE METHOD OF BISHOP

40 TRIAL SURFACES HAVE BEEN GENERATED.

40 SURFACES INITIATE FROM EACH OF 1 POINTS EQUALLY SPACED
ALONG THE GROUND SURFACE BETWEEN X = 12.86 m
AND X = 12.86 m

EACH SURFACE TERMINATES BETWEEN X = 32.00 m
AND X = 80.00 m

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION
AT WHICH A SURFACE EXTENDS IS Y = .00 m

2.50 m LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE TEN MOST CRITICAL OF THE TRIAL
FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL
FIRST.

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS (R= 17.67 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.31	19.36
3	17.80	19.19
4	20.29	19.39
5	22.74	19.93
6	25.08	20.81
7	27.27	22.01
8	29.27	23.50
9	31.04	25.27
10	32.54	27.27
11	33.75	29.46
12	34.53	31.50

*** 1.113 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 22.73 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.32	19.42
3	17.81	19.24
4	20.31	19.34
5	22.78	19.70
6	25.20	20.34
7	27.53	21.24
8	29.75	22.40
9	31.83	23.78
10	33.75	25.39
11	35.47	27.20
12	36.99	29.19
13	38.28	31.33
14	38.36	31.50

*** 1.189 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 16.82 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.20	18.98
3	17.64	18.45
4	20.14	18.29
5	22.63	18.50
6	25.06	19.08
7	27.38	20.01
8	29.54	21.28
9	31.48	22.85
10	33.17	24.69
11	34.57	26.76
12	35.65	29.02
13	36.38	31.41
14	36.39	31.50

*** 1.319 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS (R= 18.78 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.18	18.94
3	17.61	18.33
4	20.09	18.05
5	22.59	18.10
6	25.06	18.48
7	27.46	19.18
8	29.74	20.20
9	31.87	21.51
10	33.80	23.10
11	35.51	24.92
12	36.96	26.96
13	38.13	29.17
14	38.98	31.50

*** 1.407 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 28.94 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.29	19.28
3	17.76	18.91
4	20.26	18.75
5	22.76	18.81
6	25.24	19.08
7	27.69	19.56
8	30.10	20.26
9	32.43	21.15
10	34.68	22.25
11	36.82	23.54
12	38.85	25.00
13	40.74	26.64
14	42.48	28.43
15	44.06	30.36
16	44.84	31.50

*** 1.445 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 27.00 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.24	19.11
3	17.69	18.58
4	20.17	18.28
5	22.67	18.20
6	25.16	18.36
7	27.63	18.75
8	30.05	19.36
9	32.41	20.20
10	34.68	21.25
11	36.84	22.50
12	38.88	23.95
13	40.77	25.59
14	42.50	27.39
15	44.06	29.34
16	45.44	31.43
17	45.47	31.50

*** 1.533 ***

FAILURE SURFACE SPECIFIED BY 15 COORDINATE POINTS (R= 18.71 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.10	18.76
3	17.47	17.96
4	19.92	17.48
5	22.42	17.33
6	24.91	17.52
7	27.36	18.04
8	29.71	18.87
9	31.94	20.02
10	33.99	21.45
11	35.83	23.14
12	37.43	25.06
13	38.76	27.18
14	39.79	29.45
15	40.41	31.50

*** 1.559 ***

FAILURE SURFACE SPECIFIED BY 16 COORDINATE POINTS (R= 24.24 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.19	18.97
3	17.60	18.31
4	20.07	17.90
5	22.56	17.75
6	25.06	17.86
7	27.54	18.22
8	29.96	18.84
9	32.31	19.70
10	34.55	20.80
11	36.67	22.12
12	38.64	23.66
13	40.45	25.39
14	42.06	27.30
15	43.47	29.36
16	44.63	31.50

*** 1.575 ***

FAILURE SURFACE SPECIFIED BY 17 COORDINATE POINTS (R= 23.75 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.17	18.92
3	17.58	18.23
4	20.04	17.79
5	22.53	17.61
6	25.03	17.70
7	27.51	18.04
8	29.93	18.65
9	32.26	19.51
		20.60
		21.93
		23.48
		25.22
		27.14
		29.22
		31.43
		31.50

FAILURE SURFACE SPECIFIED BY 20 COORDINATE POINTS (R= 57.64 m)

POINT NO.	X-SURF (m)	Y-SURF (m)
1	12.86	19.87
2	15.34	19.58
3	17.84	19.39
4	20.33	19.31
5	22.83	19.35
6	25.33	19.49
7	27.82	19.73
8	30.29	20.09
9	32.75	20.55
10	35.18	21.12
11	37.59	21.79
12	39.97	22.57
13	42.31	23.45
14	44.61	24.43
15	46.86	25.51
16	49.07	26.68
17	51.22	27.95
18	53.32	29.32
19	55.36	30.77
20	56.29	31.50

*** 1.730 ***