Direzione Progettazione e Realizzazione Lavori

ITINERARIO RAGUSA-CATANIA

Collegamento viario compreso tra lo Svincolo della S.S. 514 "di Chiaramonte" con la S.S. 115 e lo Svincolo della S.S. 194 "Ragusana"

LOTTO 4 - Dallo svincolo n. 8 "Francofonte" (compreso) allo svincolo della "Ragusana"(escluso)

PROGETTO ESECUTIVO

COD. PA898

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GEOTECNICA

Relazione geotecnica i calcolo: rilevati e fronti di scavo

CODICE PROGETTO	NOME FILE	REVISIONE	SCALA:
PROGETTO: LO408Z · LIV. PROG.: E · N. PROG.: 2101	T04GE00GETRE03A		
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1 PREMESSA

Nel presente elaborato vengono riportati i criteri ed i risultati delle verifiche di stabilità dei rilevati e delle trincee del Lotto 4 (ex lotti 7 e 8) del collegamento autostradale nel settore sud-orientale della Sicilia, lungo l'itinerario Ragusa-Catania, nell'ambito della progettazione esecutiva dell'opera in oggetto.

Le verifiche sono state condotte con riferimento al modello geotecnico la cui descrizione è riportata nel dettaglio nella Relazione Geotecnica generale (elaborato T04GE00GETRE01).

2 NORMATIVA DI RIFERIMENTO

Nel progetto è stato fatto riferimento alle seguenti Normative ed Istruzioni:

- D.M. 14/01/2018 "Approvazione delle nuove norme tecniche per le Costruzioni" (pubblicato sulla G.U. n. 29 – Suppl. Ordinario n.30 – del 4 febbraio 2008).
- Circolare n.617 del 02.02.200 "Istruzioni per l'applicazione delle Nuove norme tecniche per le costruzioni di cui al decreto ministeriale 14 gennaio 2008".
- D.M. 17/01/2018 "Norme Tecniche per le Costruzioni" (pubblicato sulla G.U. n. 42 – Suppl. Ordinario n. 8 – del 20 febbraio 2018).
- Circolare 21/01/2019 "Istruzione C.S.LL.PP. per l'applicazione delle Norme Tecniche per le Costruzioni" di cui al D.M. 17 gennaio 2018.
- Decreto Ministero Lavori Pubblici 11/03/1988 – "Norme tecniche riguardanti le indagini sui terreni e sulle rocce, la stabilità dei pendii naturali e delle scarpate, i criteri generali e le prescrizioni per la progettazione, l'esecuzione e il collaudo delle opere di sostegno delle terre e delle opere di fondazione."
- Circolare Ministero Lavori Pubblici n. 30483 del 24/09/1988 – D.M. 11.3.88. "Norme tecniche riguardanti le indagini sui terreni e sulle rocce, la stabilità dei pendii naturali e delle scarpate, i criteri generali e le prescrizioni per la progettazione, l'esecuzione e il collaudo delle opere di sostegno delle terre e delle opere di fondazione.

3 VITA NOMINALE, CLASSE D'USO E PERIODO DI RIFERIMENTO

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.

La costruzione in oggetto è classificabile, secondo il DM 2008, come "Opera ordinaria, ponti, opere infrastrutturali e dighe di dimensioni contenute o di importanza normale", per la quale viene prevista una vita nominale ≥ 50 anni.

In presenza di azioni sismiche, con riferimento alle conseguenze di una interruzione di operatività o di un eventuale collasso, la costruzione è definita di Classe IV, ossia afferente a "Costruzioni con funzioni pubbliche o strategiche importanti, anche con riferimento alla gestione della protezione civile in caso di calamità. Industrie con attività particolarmente pericolose per l'ambiente. Reti viarie di tipo A o B, di cui al D.M. 5 novembre 2001, n.6792, "Norme funzionali e geometriche per la costruzione delle strade", e di tipo C quando appartenenti ad itinerari di collegamento tra capoluoghi di provincia non altresì serviti da strade di tipo A o B. Ponti e reti ferroviarie di importanza critica per il mantenimento delle vie di comunicazione, particolarmente dopo un evento sismico. Dighe connesse al funzionamento di acquedotti e a impianti di produzione di energia elettrica."

Per il dimensionamento delle opere pertanto sono stati considerati i seguenti parametri di progettazione:

- Vita nominale opera V_N: 50 anni (opera di importanza ordinaria)
- Classe d'uso Opera: IV
- Coefficiente d'uso: $C_U = 2$
- Vita di riferimento: $V_R = V_N \cdot C_U = 100$ anni
- Stato limite di riferimento per l'azione sismica: SLV (salvaguardia della vita)
- Probabilità di superamento P_{VR}: 10%
- Tempo di ritorno T_R determinato con la seguente espressione:

$$T_R = -\frac{V_R}{\ln\left(1 - P_{V_R}\right)} = -\frac{100}{\ln\left(1 - 0.10\right)} = 949 \text{ anni.}$$

4 MODELLO GEOTECNICO

Nella tabella seguente è riportata la sintesi del modello geotecnico ottenuto dalla caratterizzazione, per la quale si rimanda alla Relazione Geotecnica generale (elaborato T04GE00GETRE01).

Tabella 1: Modello geotecnico.

unità geologica		unità geotecnica	litotipo	z (m)	γ (kN/m³)	σ_c (MPa)	RQD (-)	GSI (-)	c' (kPa)	φ' (°)	c_u (kPa)	E (MPa)	OCR
R	riporti antropici	R	rilevato esistente	-	17 ÷ 18	-	-	-	0	33 ÷ 35	-	20	-
		TR	terreni di riporto	-	16	-	-	-	0	29	-	10	-
ec	depositi eluvio-colluviali	ec	terreni a grana grossa	-	16	-	-	-	0	22	-	5	-
a	alluvioni fluviali	a-GF	terreni a grana fine	0 ÷ 5	17 ÷ 19	-	-	-	5÷15	23 ÷ 28	100	10	≥ 10
				≥ 5								20	≥ 5
		a-GG	terreni a grana grossa	-	19 ÷ 21	-	-	-	0	38 ÷ 44	-	40	-
ar	Terrazzi fluviali	ar	terreni a grana grossa	-	18	-	-	-	0	40÷ 45	-	25÷50	
Qcs	depositi sedimentari	Qcs	terreni a grana grossa	0 ÷ 10	19 ÷ 21	-	-	-	0	38 ÷ 42	-	50	-
				10 ÷ 40								70÷120	
				≥ 40								150	
Qa	Argille siltoso marnose grigio azzurre	Qa	terreni a grana fine	0÷5	17 ÷ 19	-	-	-	10÷50	15 ÷ 32	150	10÷20	10 ÷ 20
				5 ÷ 10									5 ÷ 10
				10 ÷ 15								15÷35	2 ÷ 5
				15 ÷ 30								20÷60	2
				≥ 30							200	40÷100	
Qc(a)	Calcareniti e sabbie	Qc(a)	terreni a grana grossa	0 ÷ 10	17.5 ÷ 18.5	-	-	-	0	38 ÷ 42	-	50	-
				10 ÷ 25								80÷100	
				≥ 25								300	

unità geologica		unità geotecnica	litotipo	z (m)	γ (kN/m³)	σ_c (MPa)	RQD (-)	GSI (-)	c' (kPa)	φ' (°)	c_u (kPa)	E (MPa)	OCR
Pvs	depositi sedimentari intercalati alle vulcaniti: sabbie e limi carbonatici	**Pvs-GG**	depositi a grana grossa	0 ÷ 10	18 ÷ 19	-	-	-	0	39 ÷ 41	-	70 ÷ 100	-
				≥ 10								100 ÷ 150	
Pv	brecce e ialoclastiti	**Pv-GG**	terreni a grana grossa	0 ÷ 15	17 ÷ 19	-	-	-	0	40 ÷ 42	-	40 ÷ 70	-
				≥ 15								≥ 100	
Pvl	colate laviche (basalti)	**Pvl-GG**	terreni a grana grossa	0-10	15.5 ÷ 20	-	-	-	0	44	-	75 ÷ 100	-
				≥ 10								≥ 150	
		Pvl-R2	roccia vulcanica	0 ÷ 5	21 ÷ 28	30 ÷ 80	40	50	-	-	-	150 ÷ 400	-
				5 ÷ 25								300 ÷ 600	
				≥ 25								≥ 700	

5 REGIME DELLE PRESSIONI INTERSTIZIALI

La campagna di indagine del 2013, dunque in fase di progettazione definitiva, ha previsto la realizzazione di un monitoraggio piezometrico mediante l'installazione di tubi aperti e un Casagrande. Su tali strumenti sono state effettuate 4 letture, tra il 06/03/2013 ed il 02/07/2013.

Anche la campagna di indagini del progetto esecutivo del 2021 ha previsto l'installazione di piezometri a tubo aperto e di tipo Casagrande. Ad ottobre del 2021 sono state effettuate le letture in corrispondenza della nuova strumentazione.

Si riportano nelle tabelle seguenti i risultati delle letture effettuate sui piezometri installati.

Tabella 2: sintesi delle misure piezometriche relative alla campagna d'indagine 2013 – Letture del 02/07/2013.

Sondaggio	*Quota p.c.*	*Profondità sondaggio*	*Quota falda Tubo Aperto*		*Quota falda Casagrande*		*NOTE*
	(m s.l.m.)	*(m da p.c.)*	*(m s.l.m.)*	*(m da p.c.)*	*(m s.l.m.)*	*(m da p.c.)*	
S177	279.5	35	255.09	253.62	-	-	-
S178	249.00	15	assente	assente	-	-	-
S180	227.72	30	213.33	14.39	-	-	-
S182	226.44	60	assente	assente	-	-	-
S183	222.50	25	-	-	assente	assente	
S189	99.90	35	79.39	20.51	-	-	-
S193	61.35	15	56.37	4.98	-	-	-
S194	56.20	15	50.9	5.33	-	-	-
S199	44.30	15	38.63	5.67	-	-	-
S200	40.80	15	33.84	6.96	-	-	-
S202	35.45	30	28.43	7.02	-	-	-
S204	34.50	30	27.22	7.28	-	-	-
S205	33.20	15	26.06	7.14	-	-	-
S207	25.15	15	18.97	6.18	-	-	-
S208bis	21.70	20	15.5	6.2	-	-	-
S210	22.50	30	16.48	6.02	-	-	-
S212	20.00	15	13.92	5.94	-	-	-
S213	21.65	30	15..57	6.08	-	-	-
S214	17.50	15	12.02	5.48	-	-	-
S216	15.80	20	10.14	5.66	-	-	-

S217	15.15	30	9.78	5.37	-	-	-
S219	31.15	35	assente	assente	-	-	-
S220	48.00	25	assente	assente	-	-	-
S220ter	47.30	20	assente	assente	-	-	-
S222	23.30	15	assente	assente	-	-	-
S223	10.66	20	2.61	8.05	-	-	-
S224	12.80	40	0.33	12.47	-	-	-
S226	10.20	40	2.04	8.16	-	-	-
S227	13.80	20	5.94	7.86	-	-	-
S228	12.90	15	assente	assente	-	-	-
S229	8.00	15	0.56	7.44	-	-	-
S230	10.20	30	1.69	8.51	-	-	-

Tabella 3: sintesi delle misure piezometriche relative alla campagna d'indagine 2021 – Letture del 04-5/10/2021.

Sondaggio	*Quota p.c. (m s.l.m.)*	*Profondità sondaggio (m da p.c.)*	*Quota falda Tubo Aperto (m da p.c.)*	*Quota falda Casagrande (m da p.c.)*	*NOTE*
SE224_AGp	287.912	20	-10.24	-	-
SE226_AGp	230.609	25	-20.02	-	-
SE227_AGp*	230.008	35	-	-26.20	-
SE228_AGp*	228.263	40	-	-17.30	-
SE229_AGp*	183.755	35	-	No falda	-
SE231_Gp	135.279	35	-	No falda	-
SE231bis_Gp	135.386	10	-	-2.07	-
SE234_Gp	133.066	30	-	-8.17	-
SE235_Gp	112.244	20	-	-9.01	-
SE236_Gp	99.46	35	-	-2.15	-
SE237_AGp	81.792	30	-	-5.77	-
SE238_Gp	49.232	20	-	-5.80	-
SE240_Gp	46.794	35	-	No falda	-
SE241_Gp	48.418	35	-	No falda	-

SE242_Gp	45.901	35	-	No falda	-
SE245_Gp	35.401	35	-	-14.07	-
SE251_Gp	28.236	30	-	-6.73	-
SE256_Gp	18.831	20	-	-6.47	-
SE257_Gp	14.121	40	-	-5.04	-
SE257bis_Gp	14.148	10	-	-4.97	-
SE258_Gp	14.108	40	-	-5.23	-
SE259_Gp	13.094	40	-	-8.58	-
SE262_AGp*	39.41	30	-	No falda	-
SE265_Gp	28.928	30	-	No falda	-
SE269_AGp	6.641	30	-	-7.40	-

Il livello di progetto della falda lungo l'intero tracciato stradale è riportato nei profili geotecnici longitudinali (elaborati T04GE00GETFG01-28).

6 VERIFICHE DI STABILITA'

6.1 CRITERIO DI VERIFICA

In aderenza alle prescrizioni della normativa vigente ("Norme Tecniche delle costruzioni" del 14/01/2008 [NTC08]) le verifiche di sicurezza relative agli stati limite ultimi (SLU) consistono, in generale, nel verificare il rispetto della condizione:

$$E_d \leq R_d$$

dove con E_d si indica il valore di progetto delle azioni, o degli effetti delle azioni, e con R_d il valore di progetto delle resistenze.

La verifica di tale condizione deve essere effettuata impiegando diverse combinazioni di gruppi di coefficienti parziali definiti rispettivamente per le azioni (A1 e A2), per i parametri geotecnici (M1 e M2) e per le resistenze (R1, R2 e R3).

Le azioni di progetto, o gli effetti delle azioni, E_d sono valutabili a partire dalle azioni caratteristiche adottando per i coefficienti parziali γ_F i valori specificati nella seguente tabella (Tabella 6.2.I delle NTC08).

Tabella 4 _ Coefficienti parziali per le azioni o gli effetti delle azioni [Tab. 6.2.I delle NTC08].

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.

Le resistenze di progetto R_d si determinano a partire dai valori caratteristici dei parametri geotecnici di resistenza, divisi per i coefficienti parziali γ_M specificati nella seguente tabella (Tabella 6.2.II delle NTC08) e tenendo conto, ove necessario, dei coefficienti parziali γ_R, specifici per ciascun tipo di opera.

Tabella 5 _ Coefficienti parziali per i parametri geotecnici del terreno [Tab. 6.2.II delle NTC08].

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

Nel caso dei rilevati e delle trincee, le verifiche di sicurezza vengono effettuate nei confronti dei meccanismi di instabilità globale (verifiche di stabilità); in particolare, deve risultare rispettata la condizione $E_d \leq R_d$ verificando che non si raggiunga una condizione di stato limite ultimo con i valori di

progetto delle azioni e dei parametri geotecnici secondo l'Approccio 1 Combinazione 2: A2+M2+R2, tenendo conto di quanto riportato nella seguente tabella (Tabella 6.8.I delle NTC08).

Tabella 6 _ Coefficiente parziale per la verifica di stabilità globale per opere di materiali sciolti [Tab. 6.2.II delle NTC08].

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

Si osserva che, in condizioni statiche, i coefficienti parziali di sicurezza del gruppo M2 sono stati cautelativamente applicati anche per le caratteristiche geotecniche del rilevato, eseguendo di fatto le analisi con un valore di progetto dell'angolo di attrito (φ_d'=29.3°) inferiore al valore caratteristico (φ_k'=35°) pur risultando quest'ultimo una prescrizione di progetto e non una stima ragionata e cautelativa del parametro.

Le analisi in presenza di sisma possono essere effettuate adottando il metodo pseudo-statico, in cui l'azione sismica è rappresentata da una azione statica equivalente proporzionale al peso *W* del volume di terreno instabile; le componenti orizzontali e verticali di tale forza possono esprimersi come $Fh=k_h*W$ e $Fv=k_v*W$, dove il coefficiente k_h è legato all'accelerazione di picco dalla relazione:

$$k_h = \beta_m \cdot \frac{a_{\max}}{g} = \beta_m \cdot \frac{S_S \cdot S_T \cdot a_g}{g}, \qquad k_v = \pm 0.5 k_h$$

con

- a_g = accelerazione orizzontale massima attesa su sito di riferimento;
- β = coefficiente di riduzione dell'accelerazione massima attesa al sito;
- S_S = coefficiente che tiene conto della amplificazione stratigrafica;
- S_T = coefficiente di amplificazione topografica.

Nella precedente espressione, il coefficiente di riduzione dell'accelerazione massima attesa al sito può essere scelto in base ai valori indicati nella seguente tab. 7.11.I delle NTC08.

Tabella 7 _ Coefficiente parziale per la verifica di stabilità globale per opere di materiali sciolti [Tab. 7.11.I delle NTC08].

Tabella 7.11.I – *Coefficienti di riduzione dell'accelerazione massima attesa al sito.*

	Categoria di sottosuolo	
	A	**B, C, D, E**
	β_s	β_s
$0,2 < a_g(g) \leq 0,4$	0,30	0,28
$0,1 < a_g(g) \leq 0,2$	0,27	0,24
$a_g(g) \leq 0,1$	0,20	0,20

Nella tabella seguente si riportano i valori delle grandezze necessarie per la determinazione dell'azione sismica, definite lungo il tracciato, considerando vita nominale V_N = 50 anni e classe d'uso IV (Cu= 2.0),

quindi vita di riferimento V_R = 100 anni. I valori dei coefficienti di intensità sismica riportati in tabella sono stati determinati considerando la categoria topografica T1, quindi assumendo S_T = 1.0.

Tabella 8 _ Riepilogo grandezze necessarie per la definizione dell'azione sismica, con VN = 50 anni e classe d'uso IV (Cu = 2.0), quindi VR = 100 anni, con ST = 1.0.

Tratto Lotto 4 [*pk Asse Dx*]		*Comune*	a_g/g	Cat. sottosuolo	S_T	S_S	a_{max}/g	β	k_h	k_v
da pk	a pk		[-]	[-]	[-]	[-]	[-]	[-]	[-]	[-]
0+000	0+160	Francofonte (SR)	0.386	E	1.0	1.011	0.390	0.28	0.109	±0.054
0+000	2+400	Francofonte (SR)	0.386	B	1.0	1.040	0.401	0.28	0.112	±0.056
2+400	2+600	Francofonte (SR)	0.386	C	1.0	1.160	0.448	0.28	0.125	±0.063
2+600	6+400	Francofonte (SR)	0.386	B	1.0	1.040	0.401	0.28	0.112	±0.056
6+400	7+040	Lentini (SR)	0.377	B	1.0	1.047	0.395	0.28	0.110	±0.055
7+040	7+340	Lentini (SR)	0.377	C	1.0	1.170	0.441	0.28	0.124	±0.062
7+340	7+740	Lentini (SR)	0.377	B	1.0	1.047	0.395	0.28	0.110	±0.055
7+740	7+880	Lentini (SR)	0.377	RSL	1.0	-	0.570	0.28	0.160	±0.080
7+880	8+020	Lentini (SR)	0.377	B	1.0	1.047	0.395	0.28	0.110	±0.055
8+020	9+300	Lentini (SR)	0.377	C	1.0	1.170	0.441	0.28	0.124	±0.062
9+300	10+100	Francofonte (SR)	0.386	C	1.0	1.160	0.448	0.28	0.125	±0.063
10+100	10+200	Francofonte (SR)	0.386	RSL	1.0	-	0.446	0.28	0.125	±0.063
10+200	11+000	Carlentini (SR)	0.377							
11+100	11+800	Carlentini (SR)	0.380	C	1.0	1.166	0.443	0.28	0.124	±0.062
11+700	12+280	Carlentini (SR)	0.380	RSL	1.0	-	0.685	0.28	0.192	±0.096
12+280	12+640	Carlentini (SR)	0.380	C	1.0	1.166	0.443	0.28	0.124	±0.062
12+640	14+980	Lentini (SR)	0.377	C	1.0	1.170	0.441	0.28	0.124	±0.062
14+980	15+400	Lentini (SR)	0.377	E	1.0	1.028	0.387	0.28	0.108	±0.054
15+400	15+450	Lentini (SR)	0.377	B	1.0	1.047	0.395	0.28	0.110	±0.055
15+450	15+560	Lentini (SR)	0.377	C	1.0	1.170	0.441	0.28	0.124	±0.062
15+560	15+650	Lentini (SR)	0.377	RSL	1.0	-	0.480	0.28	0.134	±0.068
15+650	15+940	Lentini (SR)	0.377	B	1.0	1.047	0.395	0.28	0.110	±0.055
15+940	16+500	Lentini (SR)	0.377	E	1.0	1.028	0.387	0.28	0.108	±0.054
16+500	16+740	Lentini (SR)	0.377	C	1.0	1.170	0.441	0.28	0.124	±0.062
16+740	18+820	Carlentini (SR)	0.380	C	1.0	1.166	0.443	0.28	0.124	±0.062
18+820	18+920	Carlentini (SR)	0.380	A	1.0	1.000	0.380	0.30	0.114	±0.057
18+920	20+251	Carlentini (SR)	0.380	C	1.0	1.166	0.443	0.28	0.124	±0.062

Tutte le analisi di stabilità sono state eseguite nell'ipotesi di problema piano con i tradizionali metodi dell'equilibrio limite globale, schematizzando il terreno come un mezzo rigido-plastico e adottando il criterio di rottura di *Mohr-Coulomb*. In particolare, è stato utilizzato il metodo delle strisce, nel quale la porzione di terreno delimitato dalla generica superficie *S* e dalla superficie topografica è suddivisa in settori verticali in modo da valutare, seppur in modo approssimato e discreto, la distribuzione della tensione efficace normale e della corrispondente resistenza a taglio lungo la superficie di scorrimento; in dettaglio, si è utilizzato il metodo di *Bishop* (1955). Tutte le analisi sono state effettuate con il codice di calcolo numerico *RocScience Slide*.

Per i litotipi a grana fine, le analisi di stabilità in condizioni statiche sono state eseguite sia in condizioni drenate (parametri definiti in tensioni efficaci) che non drenate (parametri definiti in tensioni totali), mentre in condizioni sismiche le analisi sono state eseguite solo in condizioni non drenate.

Per le condizioni di esercizio, in condizioni statiche è stato considerato un valore caratteristico del sovraccarico stradale q_k = 20 kPa uniformemente ripartito sulla sede stradale, al quale è stato applicato il coefficiente parziale sui carichi variabili γ_Q = 1.3, ottenendo quindi un valore di progetto $q_{d,(stat)}$ = 26 kPa; in condizioni sismiche, applicando un fattore di combinazione ψ = 0.2 ed un fattore amplificativo unitario (γ_Q = 1.0), il valore di progetto del sovraccarico stradale risulta $q_{d,(sism)}$ = 4 kPa.

Le verifiche di stabilità sono state condotte con riferimento a 2 meccanismi di rottura:

- Rottura del corpo del rilevato;
- Rottura generale.

Le verifiche del meccanismo di rottura del rilevato, condotte lungo superfici che attraversano il solo corpo del rilevato, sono state condotte al fine di dimensionare gli interventi di rinforzo necessari a garantire la stabilità dell'opera in condizioni sismiche (particolarmente gravose lungo il tracciato in oggetto).

6.2 RILEVATI - RISULTATI DELLE VERIFICHE DI STABILITA' DEL CORPO DEI RILEVATI

Nella tabella seguente sono riepilogati i risultati delle verifiche di stabilità in condizioni sismiche, nei confronti dei meccanismi di rottura che interessano il solo corpo dei rilevati, effettuate per il dimensionamento degli interventi di rinforzo; i risultati sono espressi in termini di coefficienti di sicurezza minimi ($FS = R_d / E_d$).

Nello specifico, sono stati individuati degli interventi tipologici definiti in funzione dell'altezza del rilevato e delle azioni sismiche determinate lungo il tracciato.

Per le azioni sismiche è stato generalmente utilizzato un valore del coefficiente di intensità sismica orizzontale *kh* = 0.12, eccetto per i tratti nei quali sono state effettuate analisi di risposta sismica locale (sezioni *); in tali casi, in ragione dei valori più severi degli input sismici, si è proceduto a modificare opportunamente gli interventi tipologici previsti per le medesime altezze con *kh* = 0.12.

Nelle tabelle seguenti sono riportati, per ogni sezione tipologica, le geometrie e gli inputi sismici considerati per le verifiche e le caratteristiche delle geogriglie ottenute dal dimensionamento.

Tabella 8: Riepilogo dei coefficienti di sicurezza ($FS = R_d/F_d$) ottenuti dalle verifiche di stabilità effettuate per il corpo dei rilevati.

Sezione Tipo		H_{ril} (m)	H_{cal} (m)	*kh*	*kv*	FS_{min} sismico
1	sezione corrente	2.5 < H ≤ 3.5	3.5	0.12	- 0.06 (↑)	1.117
1*	tratto pk 7+740 ÷ 7+780	2.5 < H ≤ 3.5	3.5	0.16	- 0.08 (↑)	1.102
2	sezione corrente	3.5 < H ≤ 6	6	0.12	- 0.06 (↑)	1.111
3	sezione corrente	6 < H ≤ 9	9	0.12	- 0.06 (↑)	1.129
4	sezione corrente	9 < H ≤ 11	11	0.12	- 0.06 (↑)	1.129

6.2.1 Tipologico 1 – altezza del rilevato 2.5 m < H ≤ 3.5 m, altezza di calcolo Hcal = 3.5 m

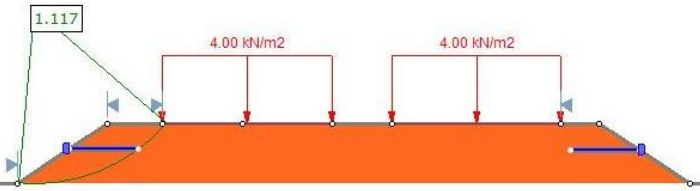
Sezione corrente – *kh* = 0.12, *kv* = -0.06 (sisma verso l'alto): $(R_d / F_d)_{min}$ = 1.117 > 1.1

È stato considerato 1 livello di geogriglie aventi le seguenti caratteristiche:

Lunghezza L = 4 m;

Resistenza a trazione nominale $Rt_{nom} \geq 20$ kN/m;

Resistenza a trazione di calcolo (a lungo termine) Rt_{cal} = 10 kN/m;



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Ru
Rilevato_rid		18	Mohr-Coulomb	0	29.3	None	0
BASE		25	Infinite strength			None	0

Support Name	Color	Type	Force Application	Material Dependent	Adhesion (kPa)	Friction Angle (deg)	Shear Strength Model	Force Orientation	Anchorage	Strip Coverage (%)	Tensile Strength (kN/m)
Geogrid Rt = 20 kN		GeoTextile	Passive (Method B)	Yes	0	29.3	Linear	Bisector of Parallel and Tangent	Slope Face	100	10

Figura 1 – Corpo del rilevato – Tipologico 1: analisi in condizioni sismiche.

Sezione tratto pk 7+740 ÷ 7+780 (TIPO 1*)

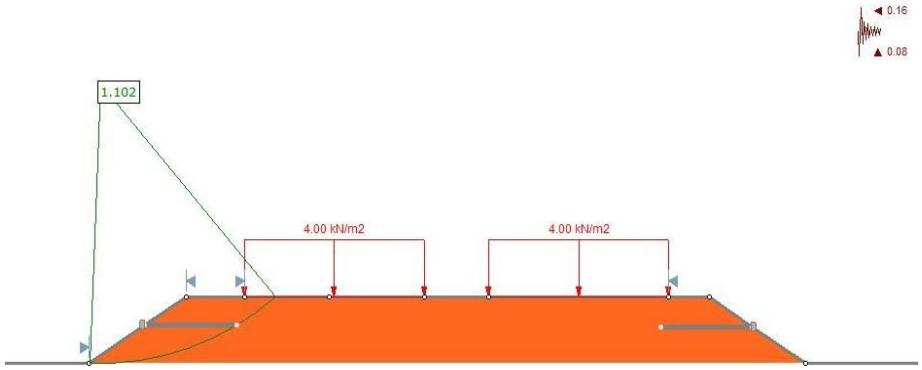
kh = 0.160, *kv* = -0.080 (sisma verso l'alto): $(R_d / F_d)_{min}$ = 1.102 > 1.1

È stato considerato 1 livello di geogriglie aventi le seguenti caratteristiche:

Lunghezza L = 5 m;

Resistenza a trazione nominale $Rt_{nom} \geq 40$ kN/m;

Resistenza a trazione di calcolo (a lungo termine) Rt_{cal} = 20 kN/m;



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Ru
Rilevato_rid		18	Mohr-Coulomb	0	29.3	None	0
BASE		25	Infinite strength			None	0

Support Name	Color	Type	Force Application	Material Dependent	Adhesion (kPa)	Friction Angle (deg)	Shear Strength Model	Force Orientation	Anchorage	Strip Coverage (%)	Tensile Strength (kN/m)
Geogrid Rt=40 kN		GeoTextile	Passive (Method B)	Yes	0	29.3	Linear	Bisector of Parallel and Tangent	Slope Face	100	20

Figura 2 – Corpo del rilevato – Tipologico 1*: analisi in condizioni sismiche.

6.2.2 Tipologico 2 – altezza del rilevato 3.5 m < H ≤ 6.0 m, altezza di calcolo Hcal = 6.0 m

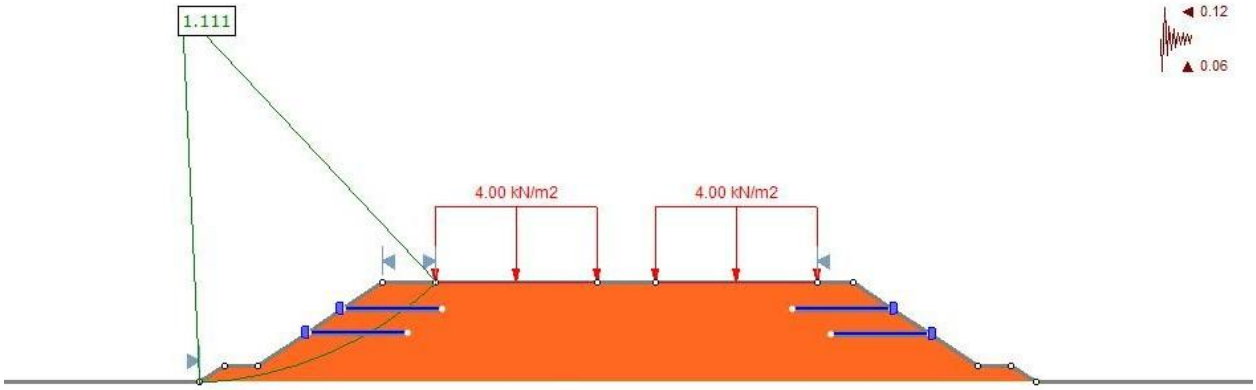
Sezione corrente – *kh* = 0.12, *kv* = -0.06 (sisma verso l'alto): $(R_d / F_d)_{min}$ = 1.111 > 1.1

Sono stati considerati 2 livelli di geogriglie aventi le seguenti caratteristiche:

Lunghezza L = 6 m;

Resistenza a trazione nominale $Rt_{nom} \geq 30$ kN/m;

Resistenza a trazione di calcolo (a lungo termine) Rt_{cal} = 15 kN/m



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Rilevato_rid		18	Mohr-Coulomb	0	29.3
BASE		25	Infinite strength		

Support Name	Color	Type	Force Application	Material Dependent	Adhesion (kPa)	Friction Angle (deg)	Shear Strength Model	Force Orientation	Anchorage	Strip Coverage (%)	Tensile Strength (kN/m)
Geogrid Rt = 30 kN		GeoTextile	Passive (Method B)	Yes	0	29.3	Linear	Bisector of Parallel and Tangent	Slope Face	100	15

Figura 3 – Corpo del rilevato – Tipologico 2 – sezione corrente: analisi in condizioni sismiche.

6.2.3 Tipologico 3 – altezza del rilevato 6.0 m < H ≤ 9.0 m, altezza di calcolo Hcal = 9.0 m

Sezione corrente – *kh* = 0.12, *kv* = -0.06 (sisma verso l'alto): $(R_d / F_d)_{min}$ = 1.129 > 1.1

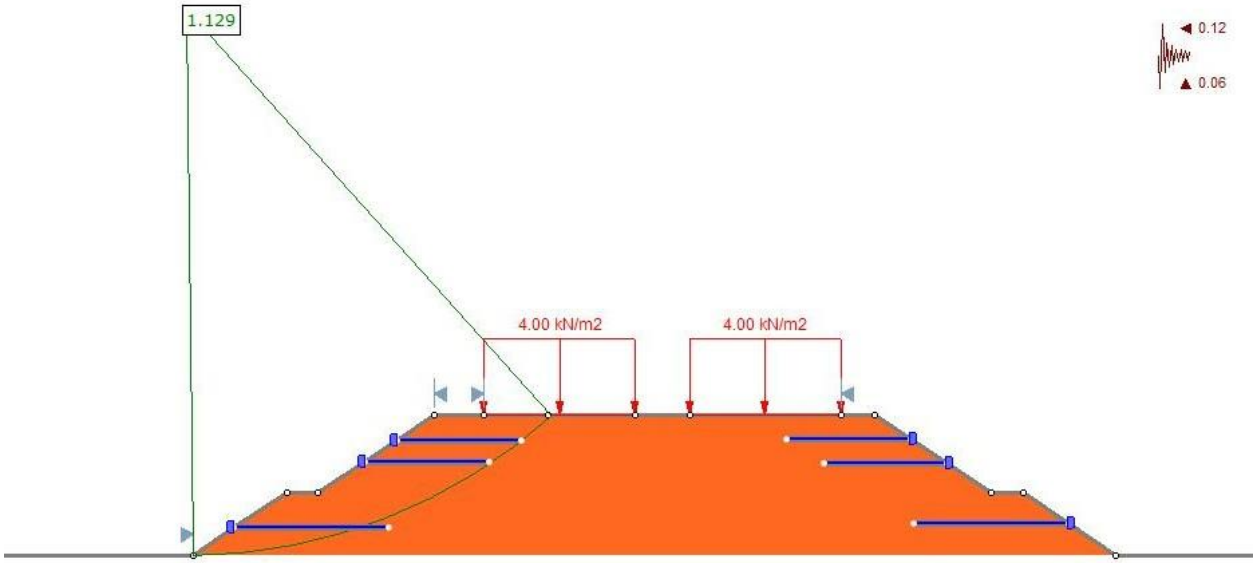
Sono stati considerati i seguenti livelli di geogriglie:

- per la banca superiore: 2 livelli di geogriglie di lunghezza di calcolo L = 8 m;
- per la banca inferiore: 1 livello di geogriglie di lunghezza di calcolo L = 10 m.

Per tutte le geogriglie:

Resistenza a trazione nominale Rt_{nom} ≥ 60 kN/m;

Resistenza a trazione di calcolo a lungo termine Rt_{cal} = 30 kN/m.



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Ru
Rilevato_rid		18	Mohr-Coulomb	0	29.3	None	0
BASE		25	Infinite strength			None	0

Support Name	Color	Type	Force Application	Material Dependent	Adhesion (kPa)	Friction Angle (deg)	Shear Strength Model	Force Orientation	Anchorage	Strip Coverage (%)	Tensile Strength (kN/m)
Geogrid Rt = 60 kN		GeoTextile	Passive (Method B)	Yes	0	29.3	Linear	Bisector of Parallel and Tangent	Slope Face	100	30

Figura 4 – Corpo del rilevato – Tipologico 3 – sezione corrente: analisi in condizioni sismiche.

6.2.4 Tipologico 4 – altezza del rilevato 9.0 m < H ≤ 11.0 m, altezza di calcolo Hcal = 11.0 m

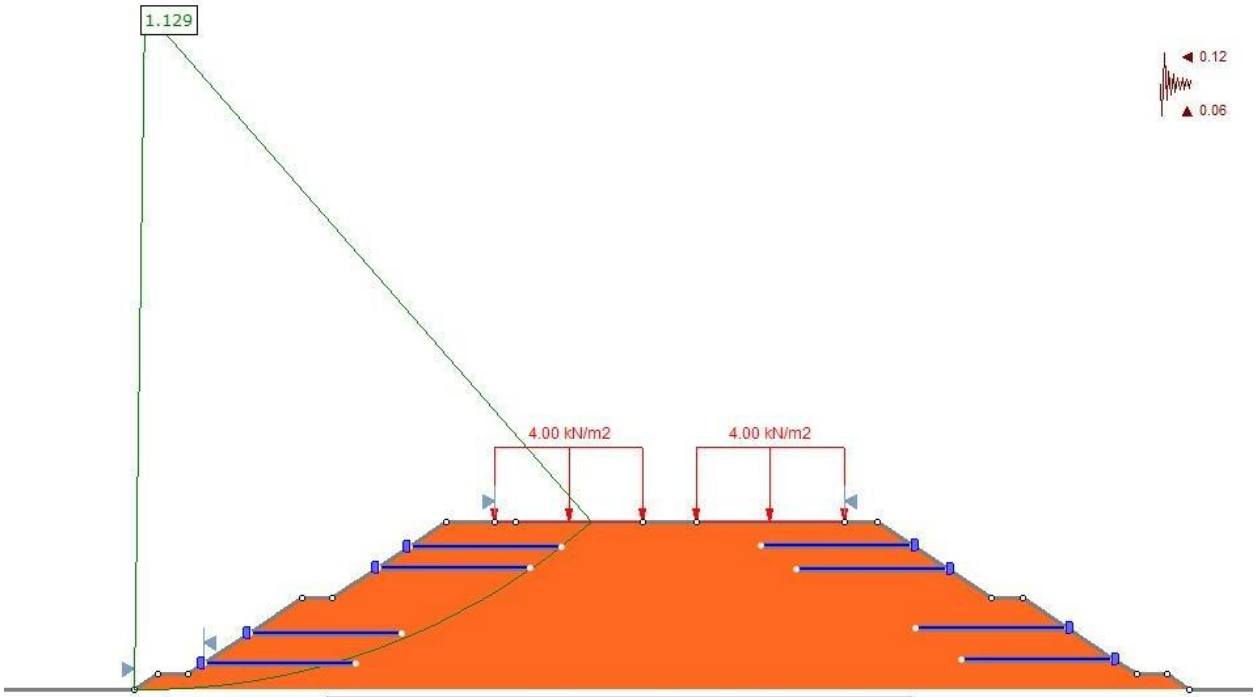
Sezione corrente – *kh* = 0.12, *kv* = -0.06 (sisma verso l'alto): $(R_d / F_d)_{min}$ = 1.129 > 1.1

Per entrambe le banche sono stati considerati 2 livelli di geogriglie aventi le seguenti caratteristiche:

Lunghezza di calcolo L = 10 m;

Resistenza a trazione nominale $Rt_{nom} \geq 60$ kN/m;

Resistenza a trazione di calcolo (a lungo termine) Rt_{cal} = 30 kN/m;



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Ru
Rilevato_rid		18	Mohr-Coulomb	0	29.3	None	0
BASE		25	Infinite strength			None	0

Support Name	Color	Type	Force Application	Material Dependent	Adhesion (kPa)	Friction Angle (deg)	Shear Strength Model	Force Orientation	Anchorage	Strip Coverage (%)	Tensile Strength (kN/m)
Geogrid Rt = 60 kN		GeoTextile	Passive (Method B)	Yes	0	29.3	Linear	Bisector of Parallel and Tangent	Slope Face	100	30

Figura 5 – Corpo del rilevato – Tipologico 4 – sezione corrente: analisi in condizioni sismiche.

6.3 RILEVATI - RISULTATI DELLE VERIFICHE DI STABILITA'

Nella tabella seguente sono riepilogati i risultati delle verifiche di stabilità, in termini di coefficienti di sicurezza minimi in condizioni statiche e sismiche, *FS* (rapporto R_d/F_d), ottenuti in corrispondenza delle sezioni di calcolo definite come maggiormente rappresentative. Nelle figure successive sono riportati i risultati delle analisi di stabilità in forma grafica. Per le analisi in condizioni sismiche si riporta solo l'output della condizione più gravosa tra k_{v+} [sisma verso il basso, ↓] e k_{v-} [sisma verso l'alto, ↑]. Per quanto riguarda le condizioni statiche che interessano terreni coesivi, si riporta la condizione più gravosa tra quella drenata e non drenata.

Tabella 9: Riepilogo dei coefficienti di sicurezza ($FS = R_d/F_d$) ottenuti dalle verifiche di stabilità in corrispondenza dei rilevati.

N° Sez.	Progressiva	Categoria suolo	*kh*	*Kv*	FS_{min} statico, in CD	FS_{min} Statico in CND	FS_{min} sismico in CD	FS_{min} sismico in CND
202	3+380	B	0.112	- 0.056 (↑)	1.2	-	1.11	-
223	3+760	B	0.112	- 0.056 (↑)	1.37	-	1.16	-
423	7+160	C	0.124	- 0.062 (↑)	1.38	2.17	-	1.95
706	12+280	RSL	0.192	- 0.096 (↑)	1.36	1.458	-	1.104
771	13+440 (*)	RSL	0.125	- 0.063 (↑)	1.25	1.73	-	1.67
1088	19+520	C	0.124	- 0.062 (↑)	1.27	-	1.10	-
1093	19+600 (dx)	C	0.124	- 0.062 (↑)	1.39	-	1.12	-
1093	19+600 (sx)	C	0.124	- 0.062 (↑)	1.39	2.09	-	1.303

(*) essendo la sezione prossima al tratto in cui si è ricorso all'analisi di RSL, lo studio è stato condotto considerando i coefficienti sismici massimizzati. Tale condizione è da ritenersi cautelativa.

Le verifiche sono in ogni caso soddisfatte, risultando i valori dei coefficienti di sicurezza $(FS = Rd / Fd)_{min}$, sempre maggiori del valore minimo richiesto dalla normativa ($\gamma_R = 1.1$).

6.3.1 Sezione 202 – prg 3+380

Lo studio di tale sezione è rappresentativo per il tratto da pk 0+000 a pk 3+680.

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.2 > 1.1$

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Rilevato		18	Mohr-Coulomb	0	29.3
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Scotico+bonifica		18	Mohr-Coulomb	0	29.3
Qc(a)		18	Mohr-Coulomb	0	34

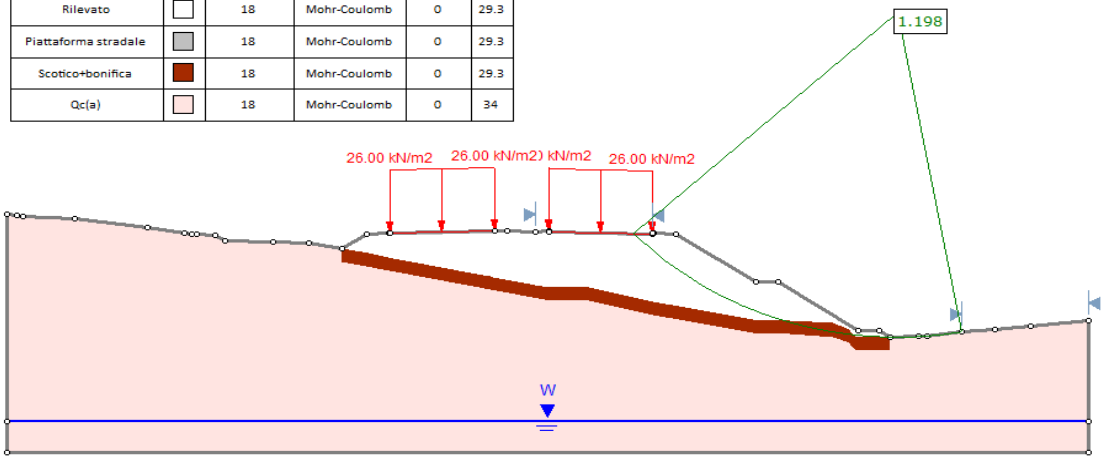


Figura 6 – Sez.202 – prg.3+340 _ in DX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.126 > 1.1$ (sisma verso l'alto ↑)

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Rilevato		18	Mohr-Coulomb	0	29.3
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Scotico+bonifica		18	Mohr-Coulomb	0	29.3
Qc(a)		18	Mohr-Coulomb	0	34

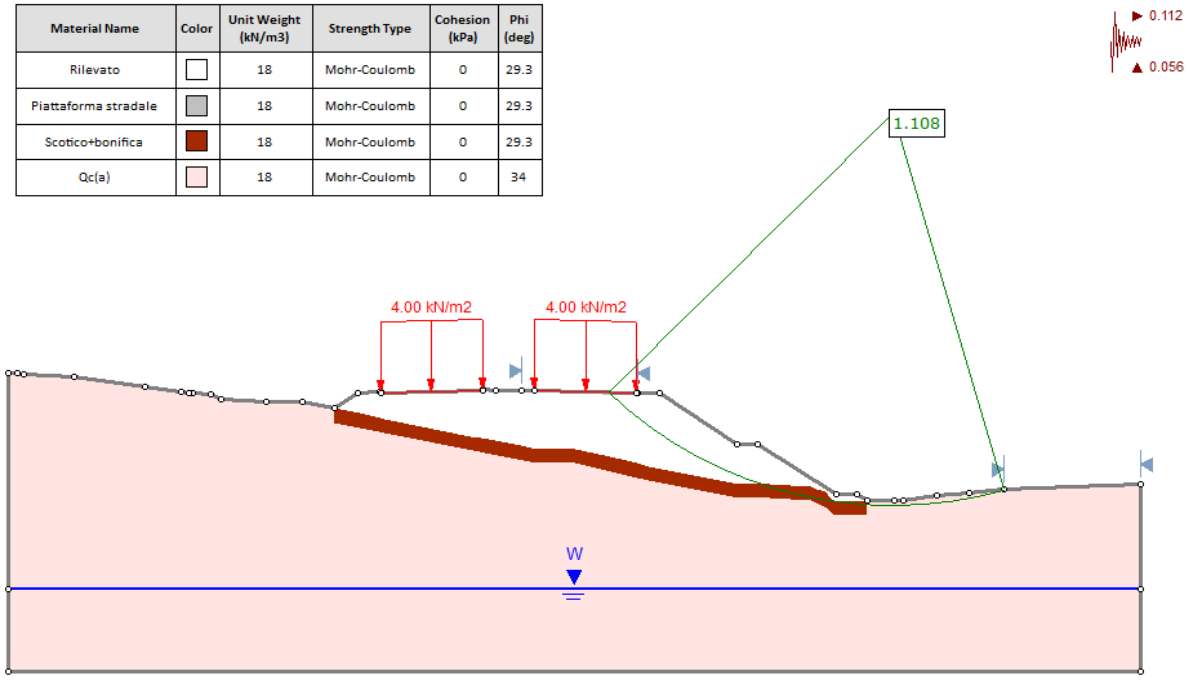


Figura 7 – Sez.202 – prg.3+340 _ in DX _ Condizioni sismiche – analisi in tensioni efficaci.

6.3.2 Sezione 223 – prg 3+760

Tale sezione è dimensionante per i tratti da pk 3+680 a pk 5+320.

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.37 > 1.1$

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Rilevato		18	Mohr-Coulomb	0	29.3
a-GG		20	Mohr-Coulomb	0	34
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Scotico+bonifica		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	16	19.6
Rilevato esistente		18.5	Mohr-Coulomb	0	28
Qc(a)		18	Mohr-Coulomb	0	34

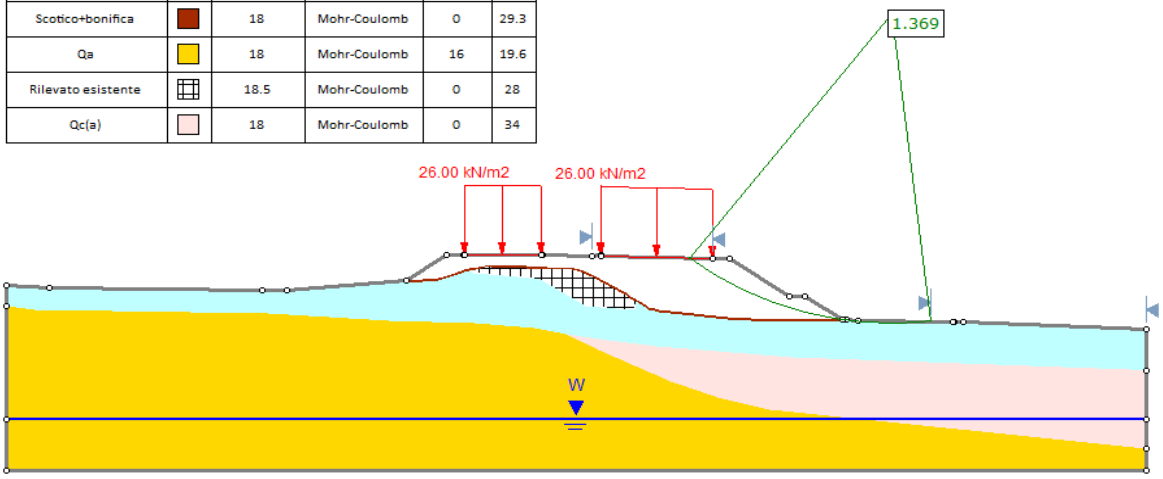


Figura 8 – Sez.223 – prg.3+760 _ in DX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.16 > 1.1$ (sisma verso l'alto ↑)

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Cohesion Type
Rilevato		18	Mohr-Coulomb	0	29.3	
a-GG		20	Mohr-Coulomb	0	34	
Piattaforma stradale		18	Mohr-Coulomb	0	29.3	
Scotico+bonifica		18	Mohr-Coulomb	0	29.3	
Qa		18	Mohr-Coulomb	16	19.6	
Rilevato esistente		18.5	Mohr-Coulomb	0	28	
Qc(a)		18	Mohr-Coulomb	0	34	

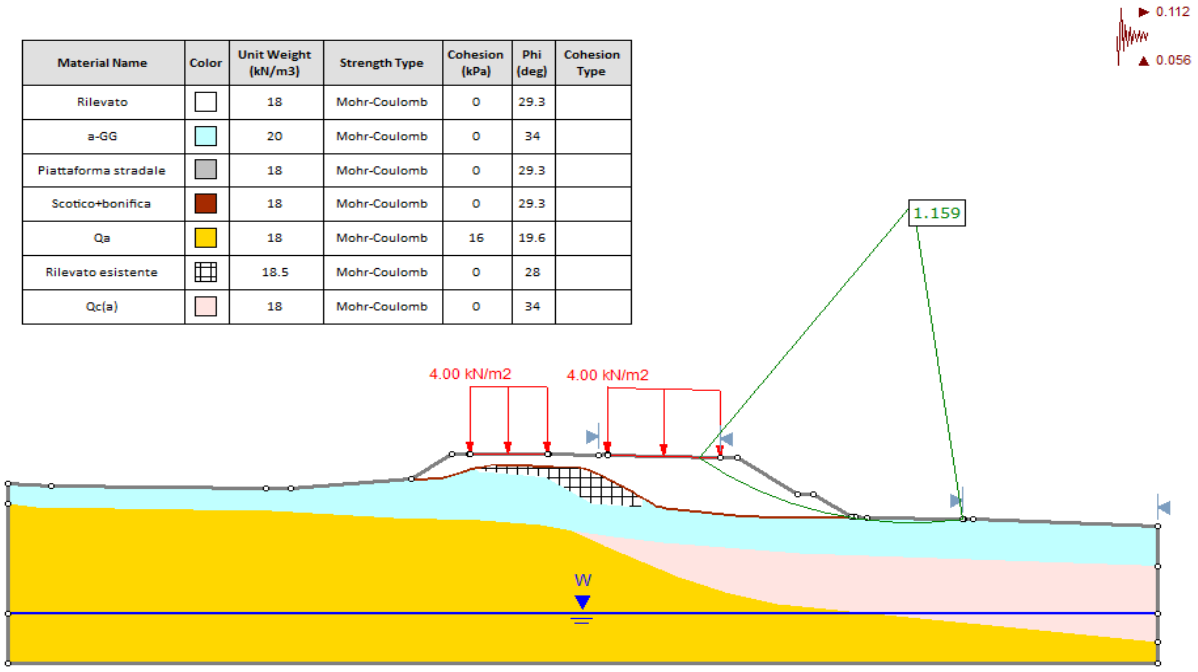


Figura 9 – Sez.223 – prg.3+760 _ in DX _ Condizioni sismiche – analisi in tensioni efficaci.

6.3.3 Sezione 423 – prg 7+160

Tale sezione è rappresentativa per il tratta da pk 6+400 a a pk 8+060.

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.38 > 1.1$

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Rilevato		18	Mohr-Coulomb	0	29.3
a-GF		18	Mohr-Coulomb	8	20
a-GG		20	Mohr-Coulomb	0	34
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Scotico+bonifica		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	16	19.6

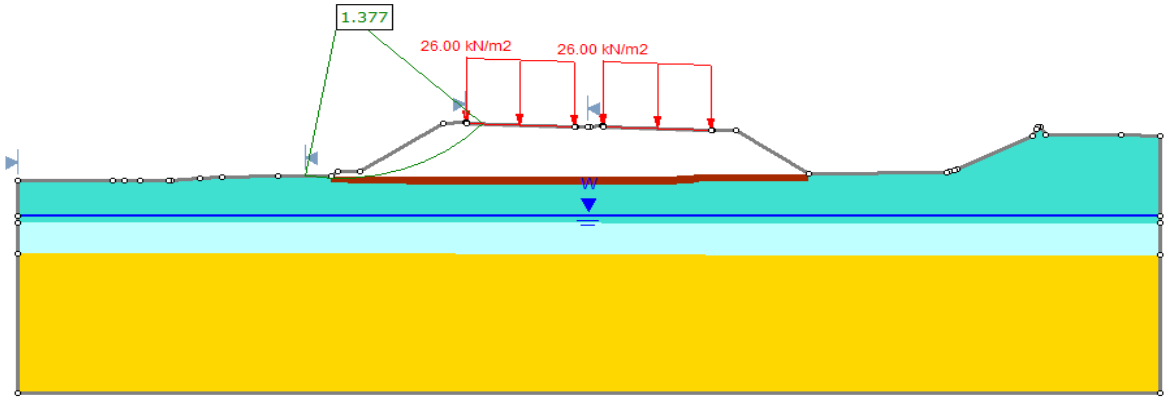


Figura 10 – Sez.423 – prg.7+160 _ in SX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.16 > 1.1$ (sisma verso l'alto ↑)

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Rilevato		18	Mohr-Coulomb	0	29.3
a-GF		18	Mohr-Coulomb	8	20
a-GG		20	Mohr-Coulomb	0	34
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Scotico+bonifica		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	16	19.6

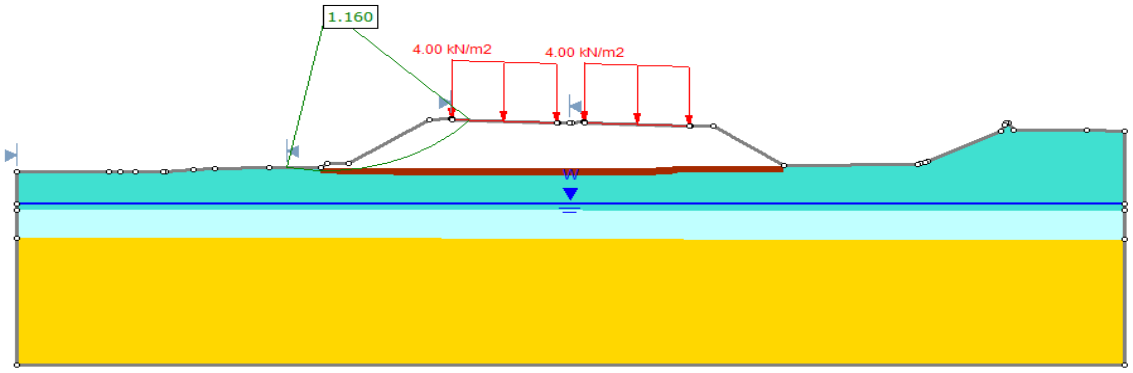


Figura 11 – Sez.423 – prg.7+160 _ in SX _ Condizioni sismiche – analisi in tensioni efficaci.

6.3.4 Sezione 706 – prg 12+280

Tale sezione è dimensionante per i tratti da pk 11+800 a pk 12+280.

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.357 > 1.1$

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kN/m2)	Phi
Rilevato		18	Mohr-Coulomb	0	29.3
ec		20	Mohr-Coulomb	0	18
a-GF		18	Mohr-Coulomb	8	20
a-GG		20	Mohr-Coulomb	0	34
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Scotico+bonifica		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	16	19.6

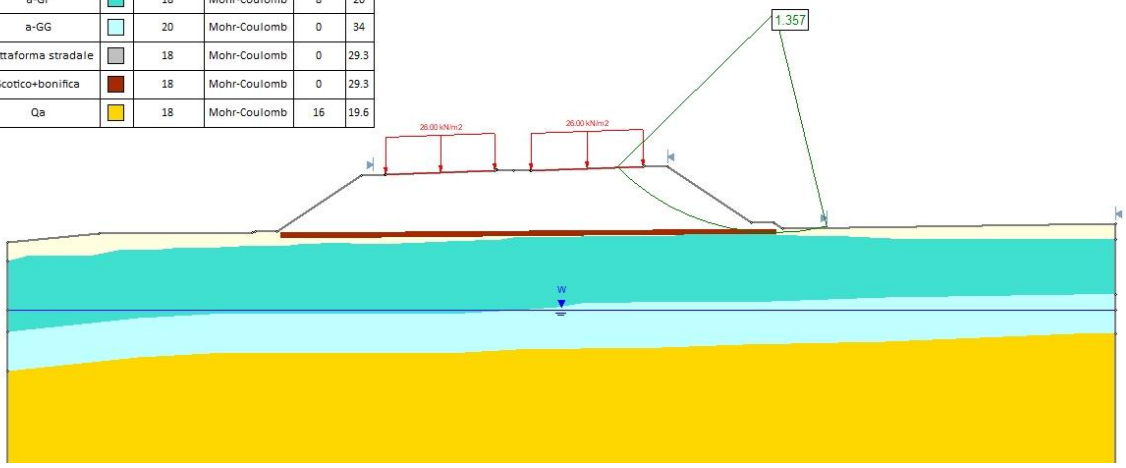


Figura 12 – Sez.706 – prg.12+280 _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche – analisi in tensioni totali: $(R_d / F_d)_{min} = 1.104 > 1.1$ (sisma verso l'alto ↑)

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kN/m2)	Phi	Cohesion Type
Rilevato		18	Mohr-Coulomb	0	29.3	
ec		20	Mohr-Coulomb	0	18	
a-GF		18	Undrained	71		Constant
a-GG		20	Mohr-Coulomb	0	34	
Piattaforma stradale		18	Mohr-Coulomb	0	29.3	
Scotico+bonifica		18	Mohr-Coulomb	0	29.3	
Qa		18	Undrained	110		Constant

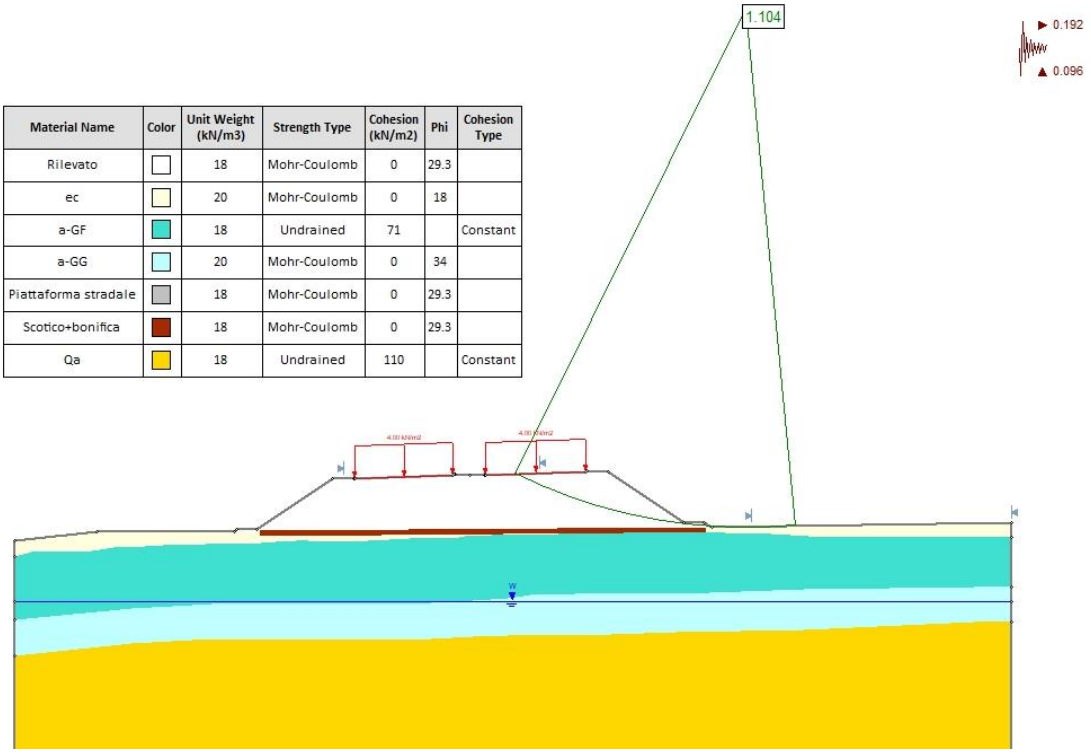


Figura 13 – Sez.706 – prg.12+280 _ Condizioni sismiche – analisi in tensioni totali.

6.3.5 Sezione 771 – prg 13+440

La sezione di studio risulta rappresentativa per i tratti da pk 8+060 a pk 11+800; da pk 12+280 a pk 18+940.

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.25 > 1.1$

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Rilevato		18	Mohr-Coulomb	0	29.3
ec		20	Mohr-Coulomb	0	18
a-GF		18	Mohr-Coulomb	8	20
a-GG		20	Mohr-Coulomb	0	34
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Scotico+bonifica		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	16	19.6

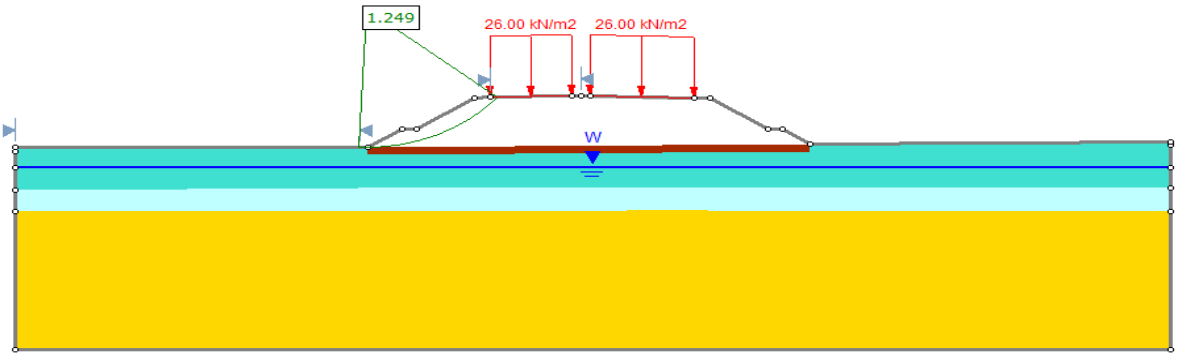


Figura 14 – Sez.771 – prg.13+440 _ in SX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche – analisi in tensioni totali: $(R_d / F_d)_{min} = 1.668 > 1.1$ (sisma verso l'alto ↑)

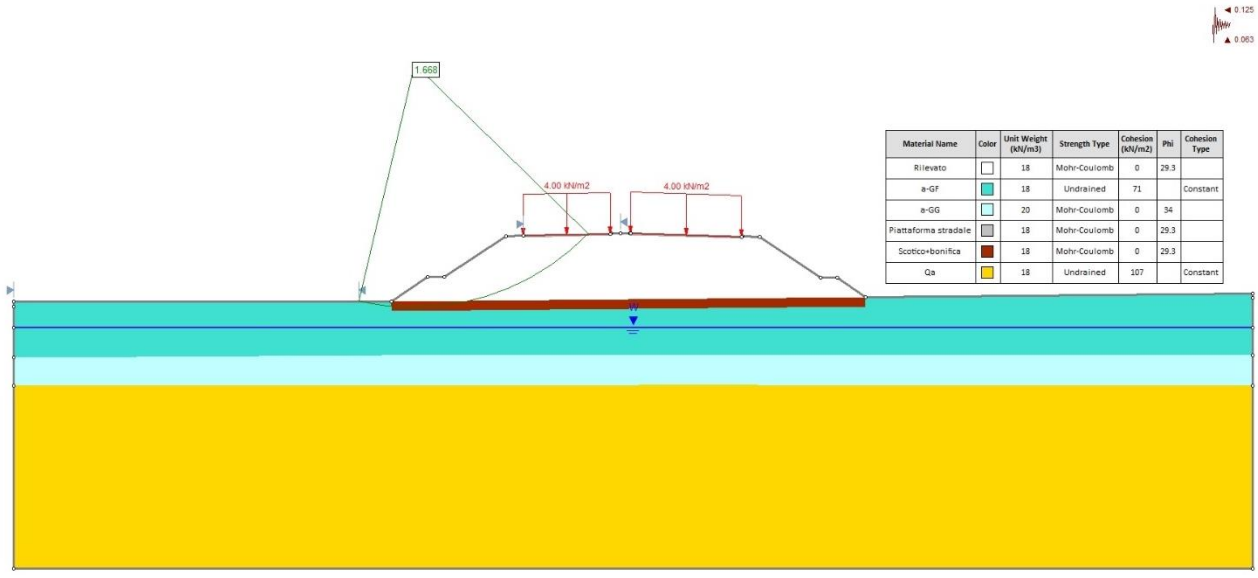


Figura 15 – Sez.771 – prg.13+440 _ in SX _ Condizioni sismiche – analisi in tensioni efficaci.

6.3.6 Sezione 1088 – prg 19+520

Tale sezione risulta dimensionante per i tratti da pk 18+940 a pk 19+560.

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.27 > 1.1$

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Rilevato		18	Mohr-Coulomb	0	29.3
a-GG		20	Mohr-Coulomb	0	34
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Scotico+bonifica		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	16	19.6
Pvs		18.5	Mohr-Coulomb	0	34
Rilevato esistente		18.5	Mohr-Coulomb	0	28

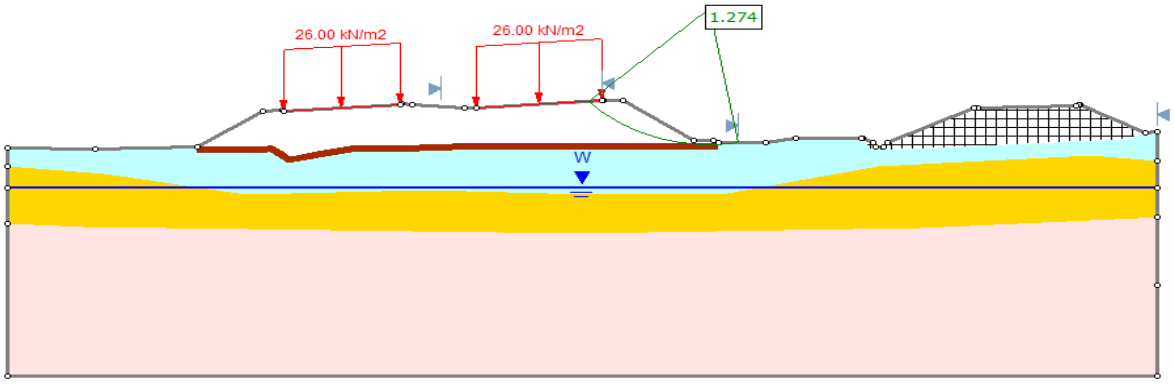


Figura 16 – Sez.1088 – prg.19+520 _ in DX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.102 > 1.1$ (sisma verso l'alto ↑)

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Rilevato		18	Mohr-Coulomb	0	29.3
a-GG		20	Mohr-Coulomb	0	34
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Scotico+bonifica		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	16	19.6
Pvs		18.5	Mohr-Coulomb	0	34
Rilevato esistente		18.5	Mohr-Coulomb	0	28

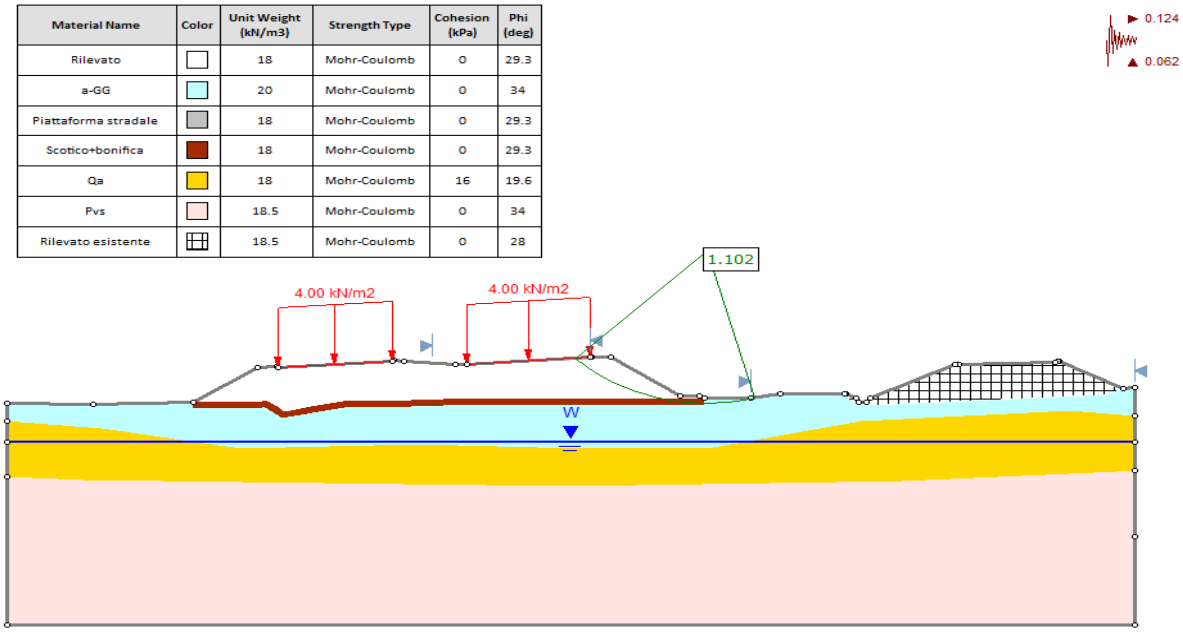


Figura 17 – Sez.1088 – prg.19+520 _ in DX _ Condizioni sismiche – analisi in tensioni efficaci.

6.3.7 Sezione 1093 – prg 19+600

Tale sezione risulta rappresentativa per il tratto da pk 19+560 a pk 19+820.

Condizioni statiche dx – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.39 > 1.1$

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Rilevato		18	Mohr-Coulomb	0	29.3
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Scotico+bonifica		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	16	19.6
Pvs		18.5	Mohr-Coulomb	0	34
Qc(a)		18	Mohr-Coulomb	0	34
Pv		18	Mohr-Coulomb	0	35

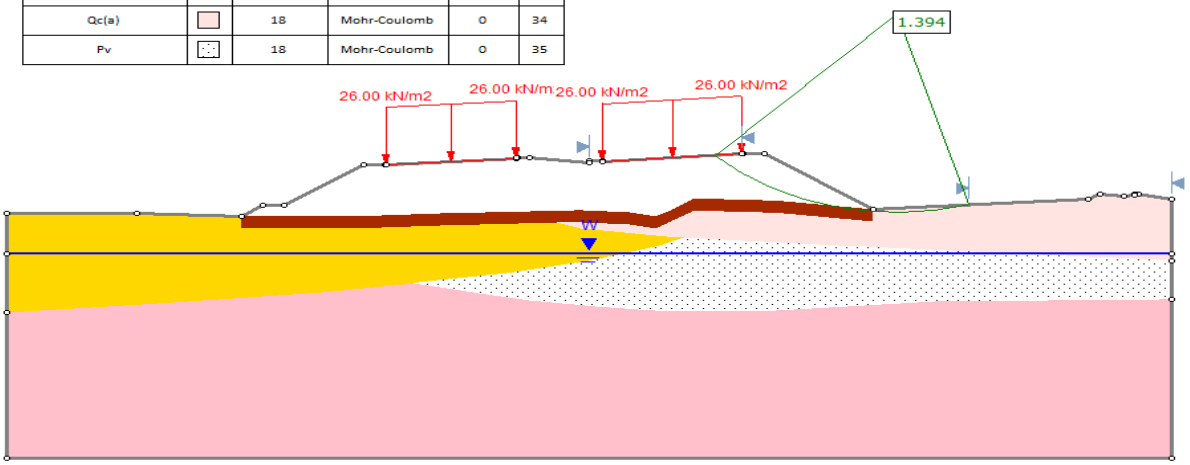


Figura 18 – Sez. 1093 – prg.19+660 _ in DX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche dx – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.16 > 1.1$ (sisma verso l'alto ↑)

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Rilevato		18	Mohr-Coulomb	0	29.3	Water Surface
Piattaforma stradale		18	Mohr-Coulomb	0	29.3	Water Surface
Scotico+bonifica		18	Mohr-Coulomb	0	29.3	Water Surface
Qa		18	Mohr-Coulomb	16	19.6	Water Surface
Pvs		18.5	Mohr-Coulomb	0	34	Water Surface
Qc(a)		18	Mohr-Coulomb	0	34	Water Surface
Pv		18	Mohr-Coulomb	0	35	Water Surface

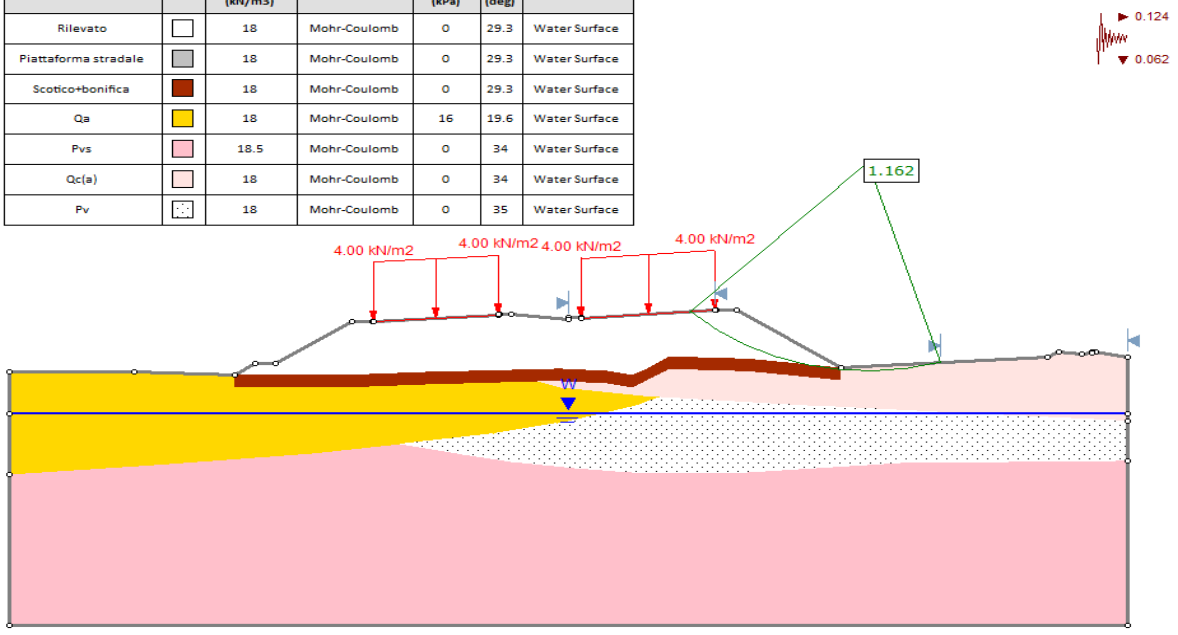
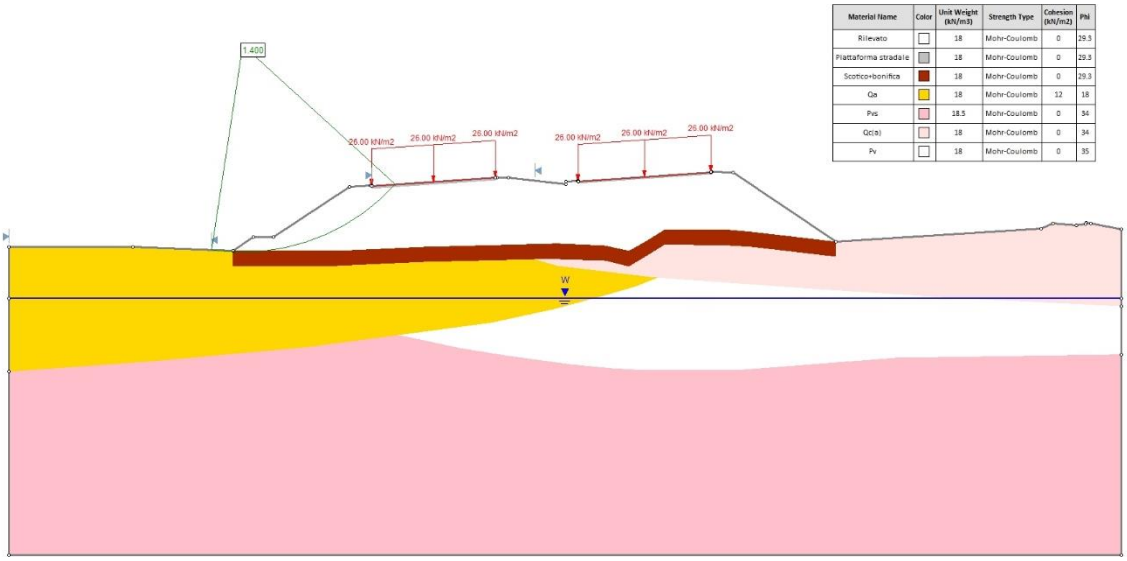


Figura 19 – Sez.1093 – prg.19+660 _ in DX _ Condizioni sismiche – analisi in tensioni efficaci.

Condizioni statiche sx – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.40 > 1.1$



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kN/m2)	Phi
Rilevato		18	Mohr-Coulomb	0	29.3
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Scotico+bonifica		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	12	18
Pvs		18.5	Mohr-Coulomb	0	34
Qc(a)		18	Mohr-Coulomb	0	34
Pv		18	Mohr-Coulomb	0	35

Figura 20 – Sez. 1093 – prg.19+660 _ in SX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche sx – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.303 > 1.1$ (sisma verso l'alto ↑)

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kN/m2)	Phi	Cohesion Type
Rilevato		18	Mohr-Coulomb	0	29.3	
Piattaforma stradale		18	Mohr-Coulomb	0	29.3	
Scotico+bonifica		18	Mohr-Coulomb	0	29.3	
Qa		18	Undrained	107		Constant
Pvs		18.5	Mohr-Coulomb	0	34	
Qc(a)		18	Mohr-Coulomb	0	34	
Pv		18	Mohr-Coulomb	0	35	

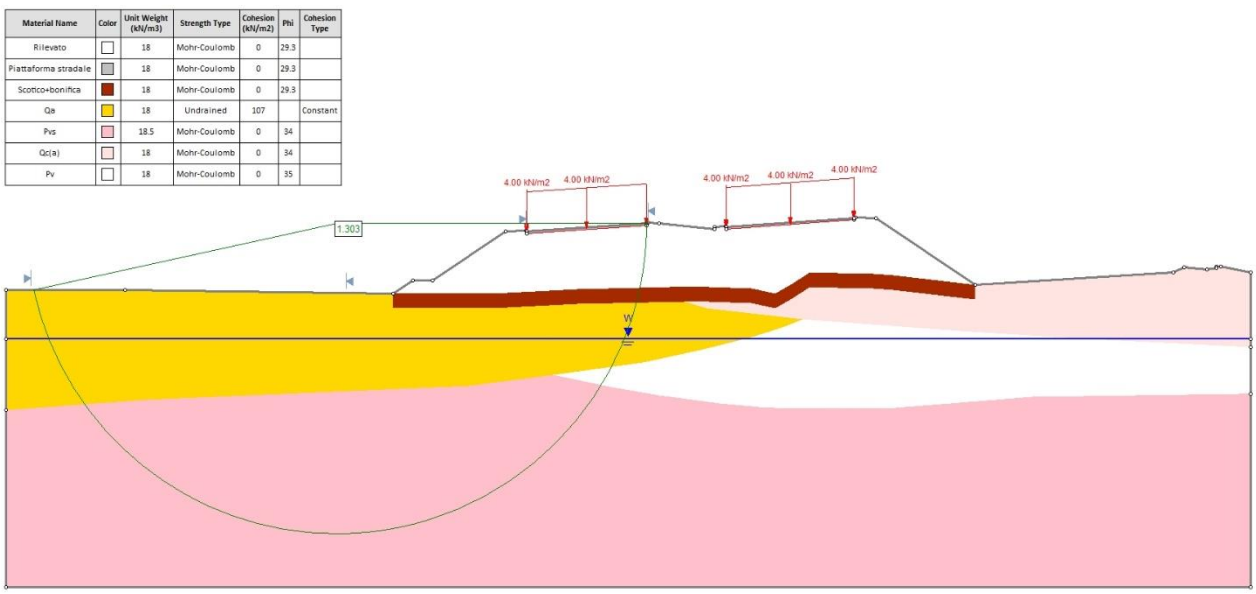


Figura 21 – Sez.1093 – prg.19+660 _ in SX _ Condizioni sismiche – analisi in tensioni efficaci.

6.4 TRINCEE - RISULTATI DELLE VERIFICHE DI STABILITA'

Nella tabella seguente sono riepilogati i risultati delle verifiche di stabilità, in termini di coefficienti di sicurezza minimi in condizioni statiche e sismiche, *FS* (rapporto R_d/F_d), ottenuti in corrispondenza delle sezioni di calcolo definite come maggiormente rappresentative. Nelle figure successive sono riportati i risultati delle analisi di stabilità in forma grafica. Per le analisi in condizioni sismiche si riporta solo l'output della condizione più gravosa tra k_{v+} [sisma verso il basso] e k_{v-} [sisma verso l'alto].

Tabella 10: Riepilogo dei coefficienti di sicurezza ($FS = R_d/F_d$) ottenuti dalle verifiche di stabilità in corrispondenza dei fronti di scavo.

N° Sez.	Progressiva	Categoria suolo	*kh*	*Kv*	FS_{min} statico, in CD	FS_{min} Statico in CND	FS_{min} sismico in CD	FS_{min} sismico in CND
152	2+557.6	C	0.125	+ 0.063 (↓)	1.53	2.19	1.11	1.49
158	2+625.78	B	0.112	- 0.056 (↑)	1.44	2.6	1.15	1.89
184	3+080	B	0.112	- 0.056 (↑)	1.46	-	1.14	-
187	3+120	B	0.112	- 0.056 (↑)	1.68	-	1.13	-
287	4+960	B	0.112	- 0.056 (↑)	1.93	-	1.47	-
293	5+040	B	0.112	- 0.056 (↑)	1.75	-	1.36	-
911	16+080	C*	0.124	+ 0.062 (↓)	1.52	1.74	1.12	1.24
931	16+391	C*	0.124	- 0.062 (↑)	1.78	-	1.29	-
943	16+620	C	0.124	+ 0.062 (↓)	1.96	4.42	1.44	2.64

Per le sezioni 911 (pk 16+080) e 931 (pk 16+391) sono stati riportati i risultati delle verifiche eseguite assumendo per i coefficienti di intensità sismica i valori determinati considerando la categoria di suolo C, assegnata all'area prima dell'aggiornamento della categoria di suolo ad E sulla base dei risultati della nuova campagna di indagini, cui corrispondono coefficienti di intensità sismica più bassi (per cat. Suolo C: kh = 0.154, kv = ±0.062, per cat. Suolo E: kh = 0.108, kv = ± 0.054).

Le verifiche sono in ogni caso soddisfatte, risultando i valori dei coefficienti di sicurezza, $(FS = Rd / Fd)_{min}$, sempre maggiori del valore minimo richiesto dalla normativa ($\gamma_R = 1.1$).

6.4.1 Sezione 152 – prg 2+557.6

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.53 > 1.1$

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	16	19.6
Qcs		20	Mohr-Coulomb	0	34

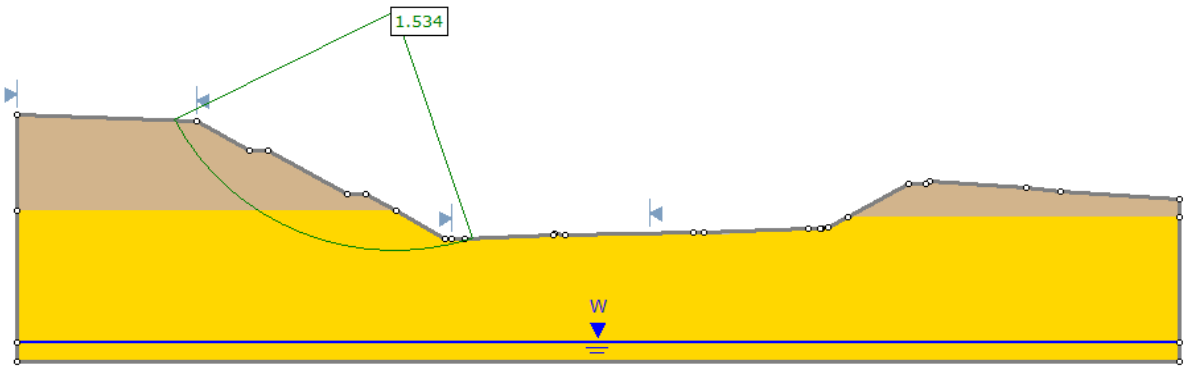


Figura 22 – Sez. 152 – prg.2+557.6 _ in SX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.11 > 1.1$ (sisma verso il basso ↓)

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	16	19.6
Qcs		20	Mohr-Coulomb	0	34

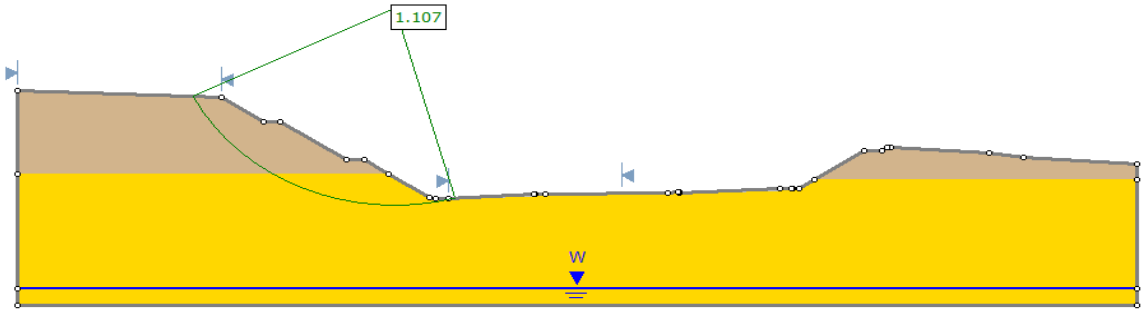


Figura 23 – Sez.152 – prg.2+557.6 _ in SX _ Condizioni sismiche – analisi in tensioni efficaci.

6.4.2 Sezione 158 – prg 2+625.78

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.44 > 1.1$

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	16	19.6
Qcs		20	Mohr-Coulomb	0	34

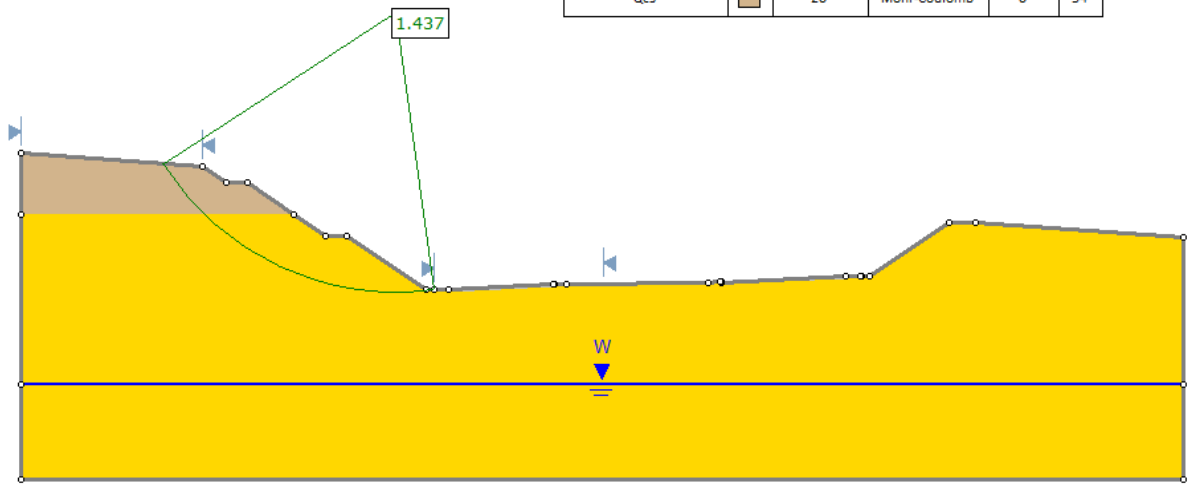


Figura 24 – Sez. 158 – prg.2+625.78 _ in SX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.13 > 1.1$ (sisma verso il basso ↓)

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	16	19.6
Qcs		20	Mohr-Coulomb	0	34

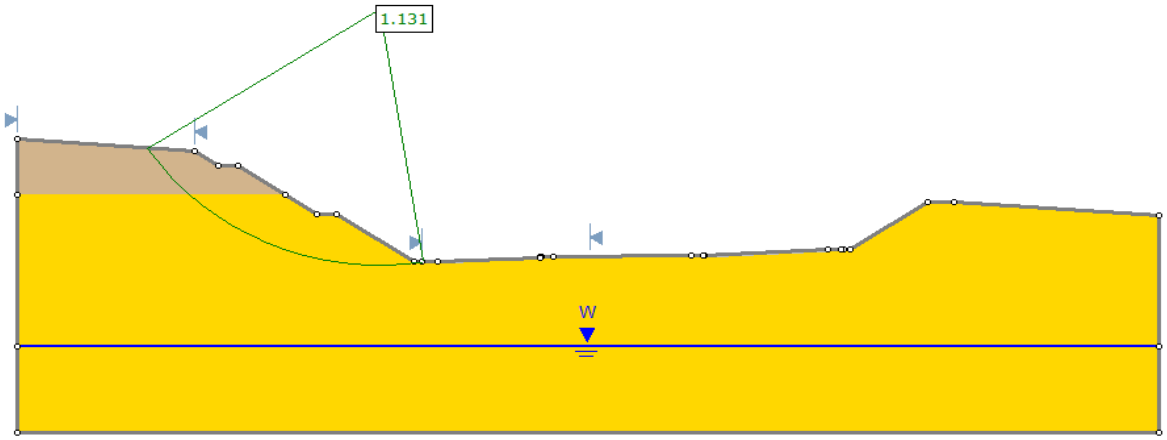


Figura 25 – Sez.158 – prg.2+625.78 _ in SX _ Condizioni sismiche – analisi in tensioni efficaci.

6.4.3 Sezione 184 – prg 3+080

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.46 > 1.1$

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
ec		20	Mohr-Coulomb	2	18
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Qc(a)		18	Mohr-Coulomb	0	34

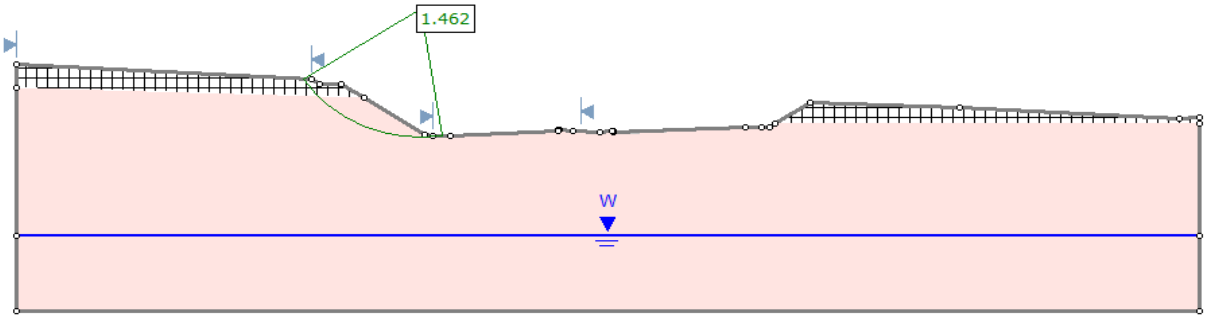


Figura 26 – Sez. 184 – prg.19+660 _ in SX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.14 > 1.1$ (sisma verso l'alto ↑)

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
ec		20	Mohr-Coulomb	2	18
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Qc(a)		18	Mohr-Coulomb	0	34

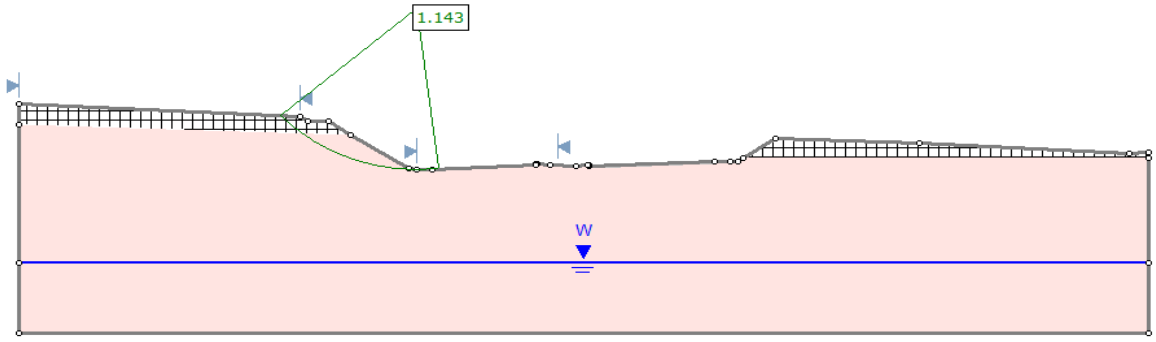


Figura 27 – Sez.184 – prg.3+080 _ in SX _ Condizioni sismiche – analisi in tensioni efficaci.

6.4.4 Sezione 187 – prg 3+120

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.68 > 1.1$

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Rilevato		18	Mohr-Coulomb	0	29.3
ec		20	Mohr-Coulomb	2.5	18
Qc(a)		18	Mohr-Coulomb	0	34

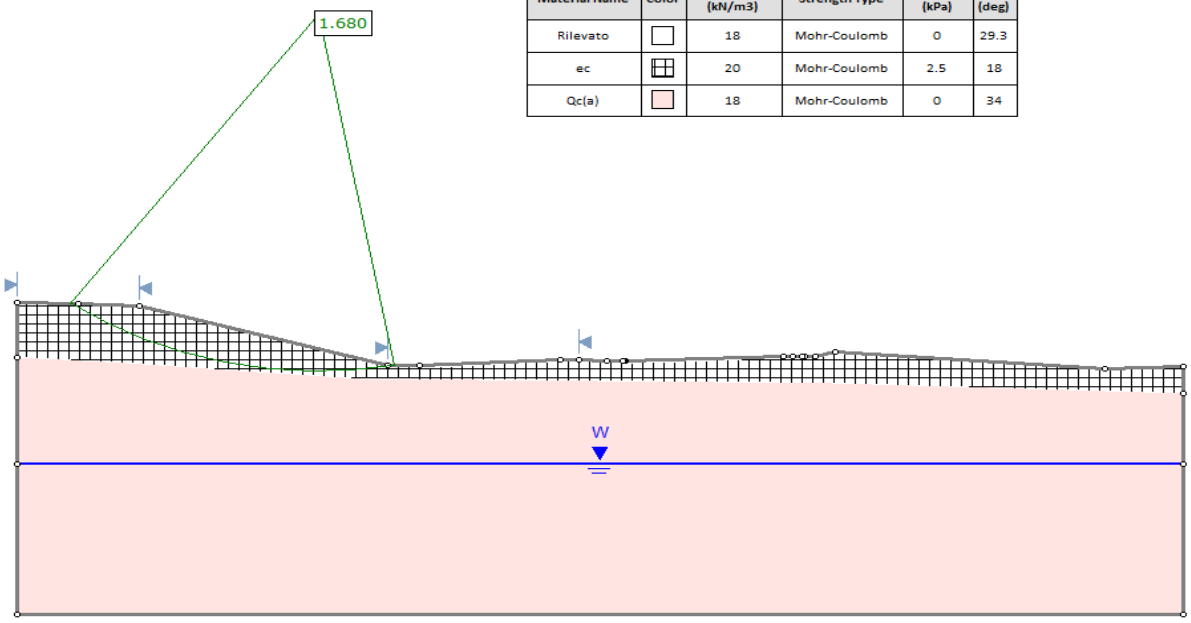


Figura 28 – Sez. 187 – prg.3+120 _ in SX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.11 > 1.1$ (sisma verso il basso ↓)

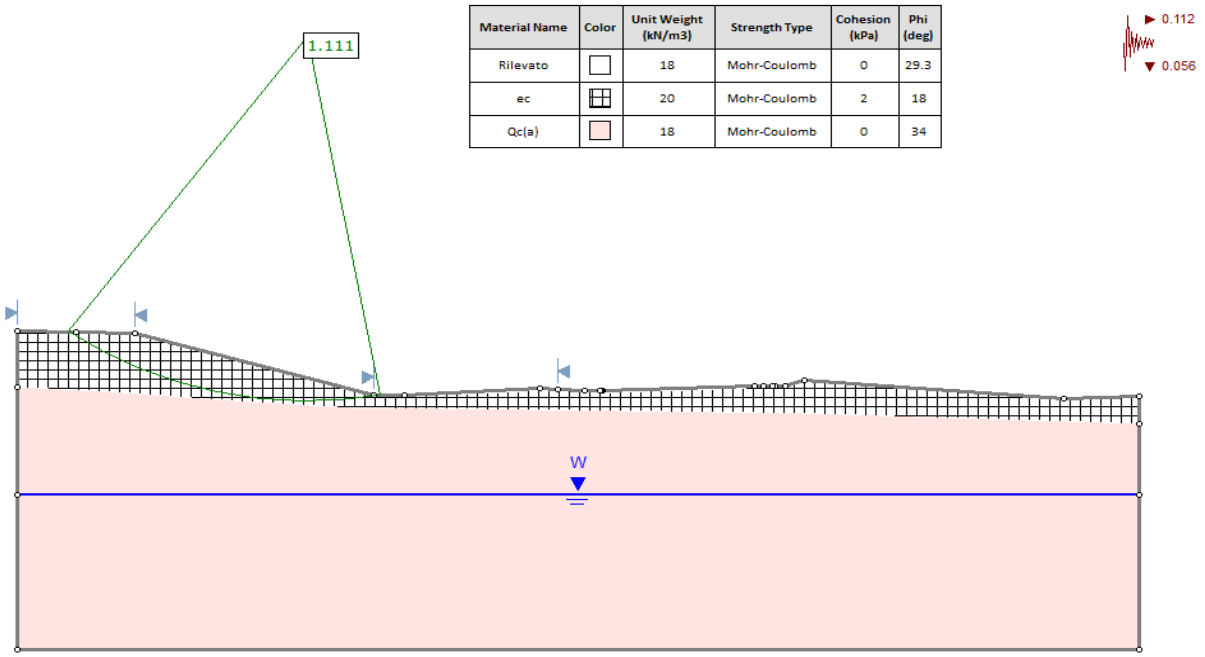


Figura 29 – Sez.187 – prg.3+120 _ in SX _ Condizioni sismiche – analisi in tensioni efficaci.

6.4.5 Sezione 287 – prg 4+960

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.93 > 1.1$

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
ec		20	Mohr-Coulomb	2	18
a-GG		20	Mohr-Coulomb	0	34
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	16	19.6

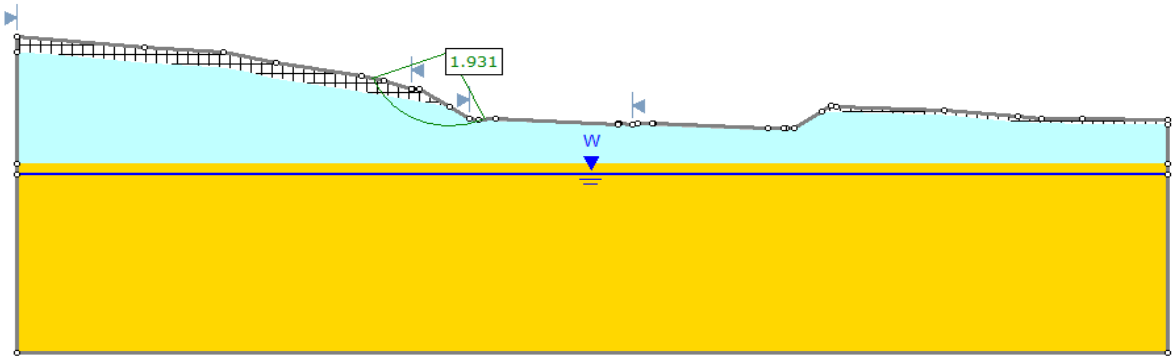


Figura 30 – Sez. 287 – prg.4+960 _ in SX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.47 > 1.1$ (sisma verso l'alto ↑)

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
ec		20	Mohr-Coulomb	2	18
a-GG		20	Mohr-Coulomb	0	34
Piattaforma stradale		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	16	19.6

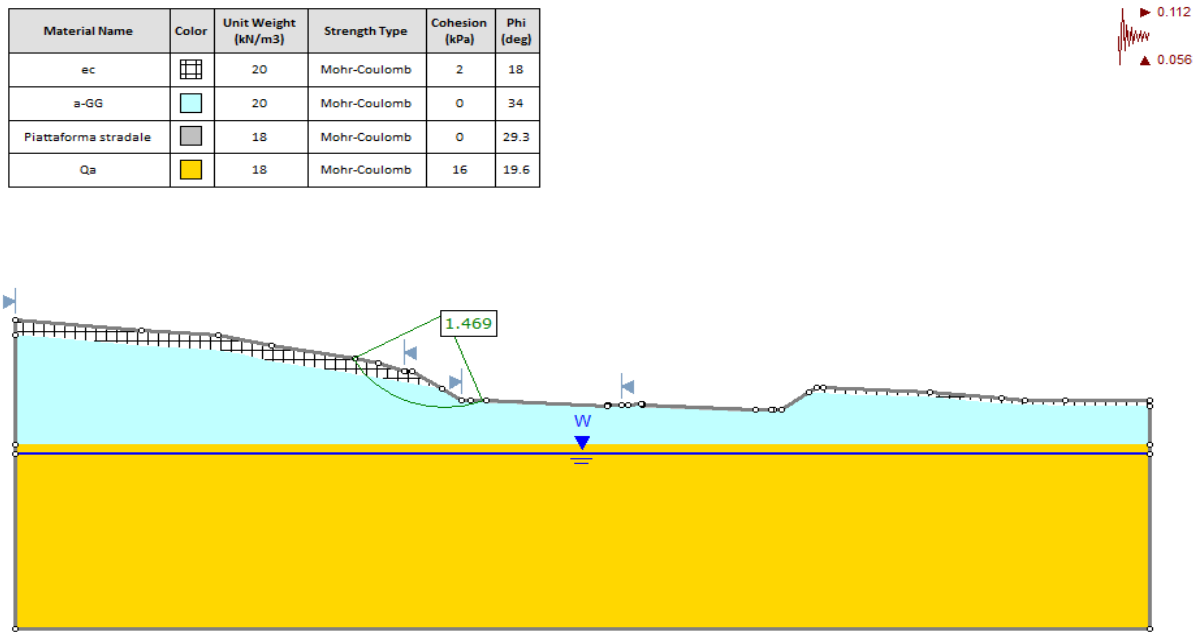


Figura 31 – Sez.287 – prg.4+960 _ in SX _ Condizioni sismiche – analisi in tensioni efficaci.

6.4.6 Sezione 293 – prg 5+040

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.75 > 1.1$

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Rilevato		18	Mohr-Coulomb	0	29.3
a-GG		20	Mohr-Coulomb	0	34
Qa		18	Mohr-Coulomb	16	19.6

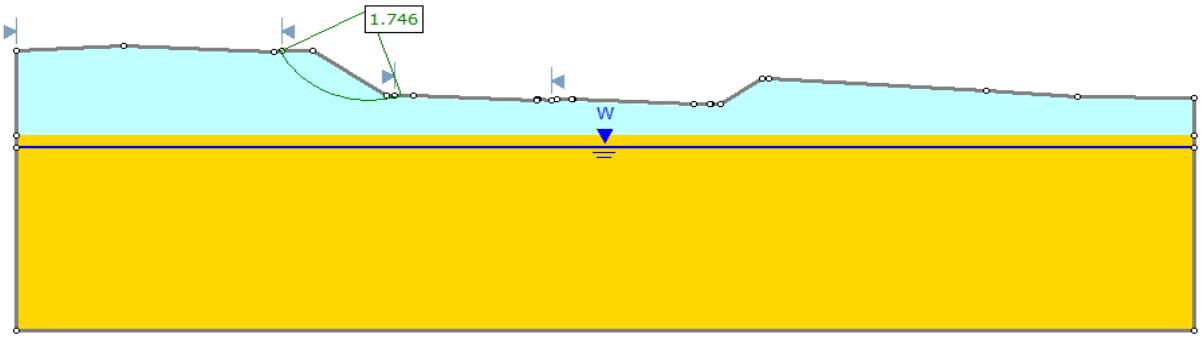


Figura 32 – Sez.293 – prg.5+040 _ in SX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.36 > 1.1$ (sisma verso l'alto ↑)

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Rilevato		18	Mohr-Coulomb	0	29.3
a-GG		20	Mohr-Coulomb	0	34
Qa		18	Mohr-Coulomb	16	19.6

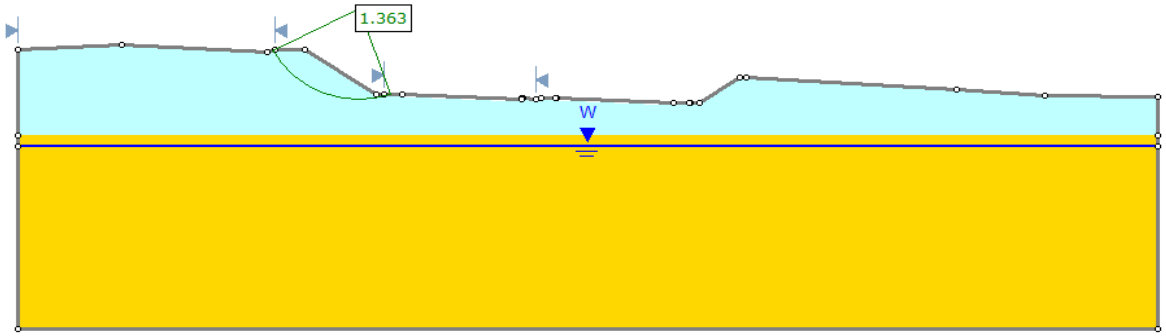


Figura 33 – Sez.293 – prg.5+040 _ in SX _ Condizioni sismiche – analisi in tensioni efficaci.

6.4.7 Sezione 911 – prg 16+080

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.52 > 1.1$

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Rilevato		18	Mohr-Coulomb	0	29.3
Qa		18	Mohr-Coulomb	16	19.6
ar		18	Mohr-Coulomb	0	34

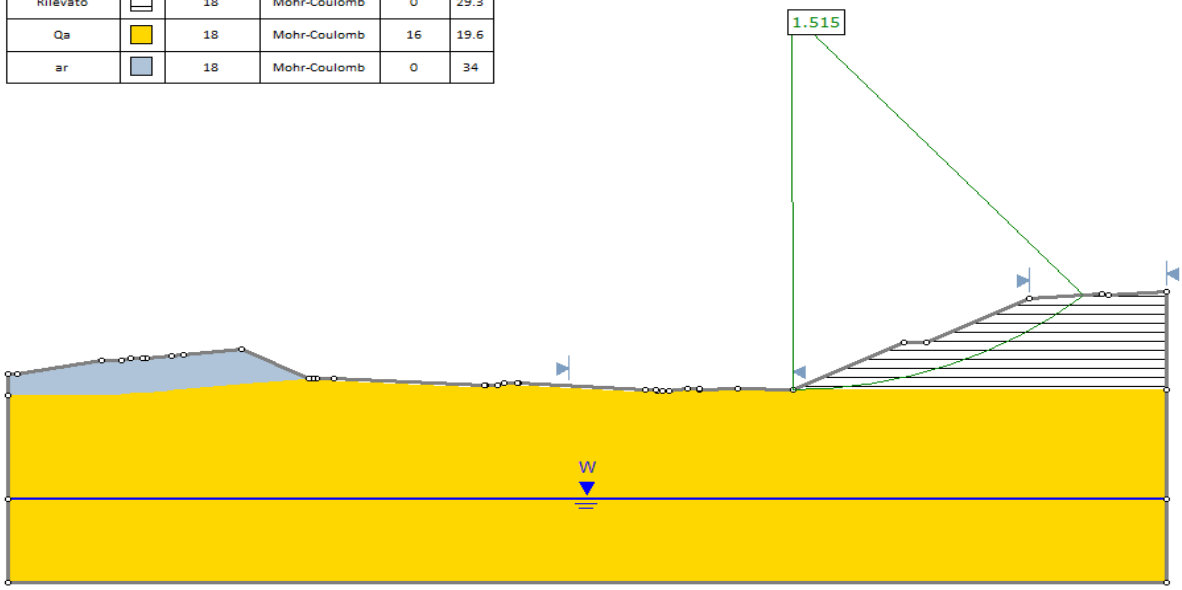


Figura 34 – Sez.911 – prg.16+080 _ in DX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.12 > 1.1$ (sisma verso il basso ↓)

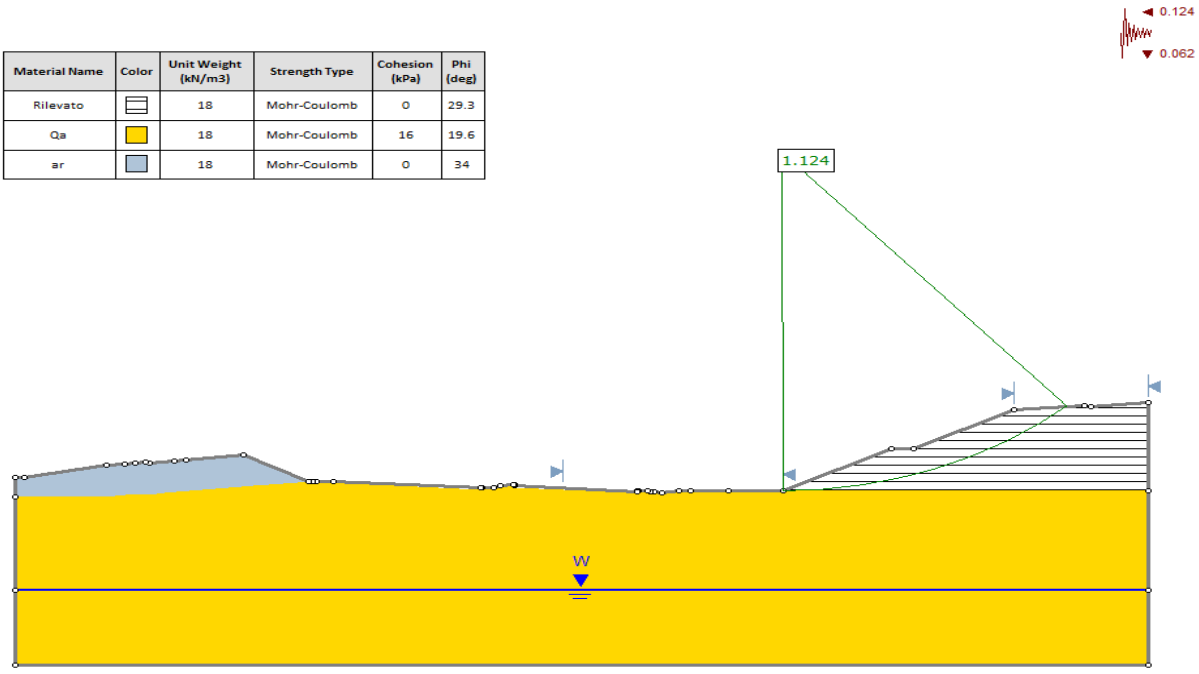


Figura 35 – Sez.911 – prg.16+080 _ in DX _ Condizioni sismiche – analisi in tensioni efficaci.

6.4.8 Sezione 931 – prg 16+391

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.78 > 1.1$

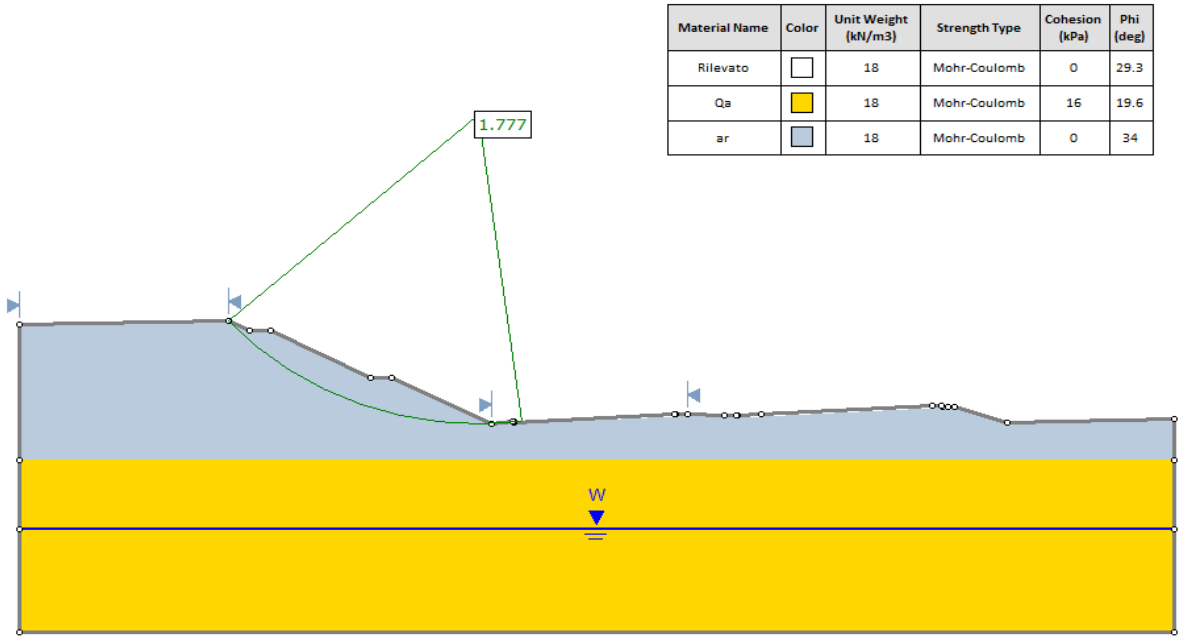


Figura 36 – Sez.931 – prg.16+391 _ in SX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.29 > 1.1$ (sisma verso l'alto ↑)

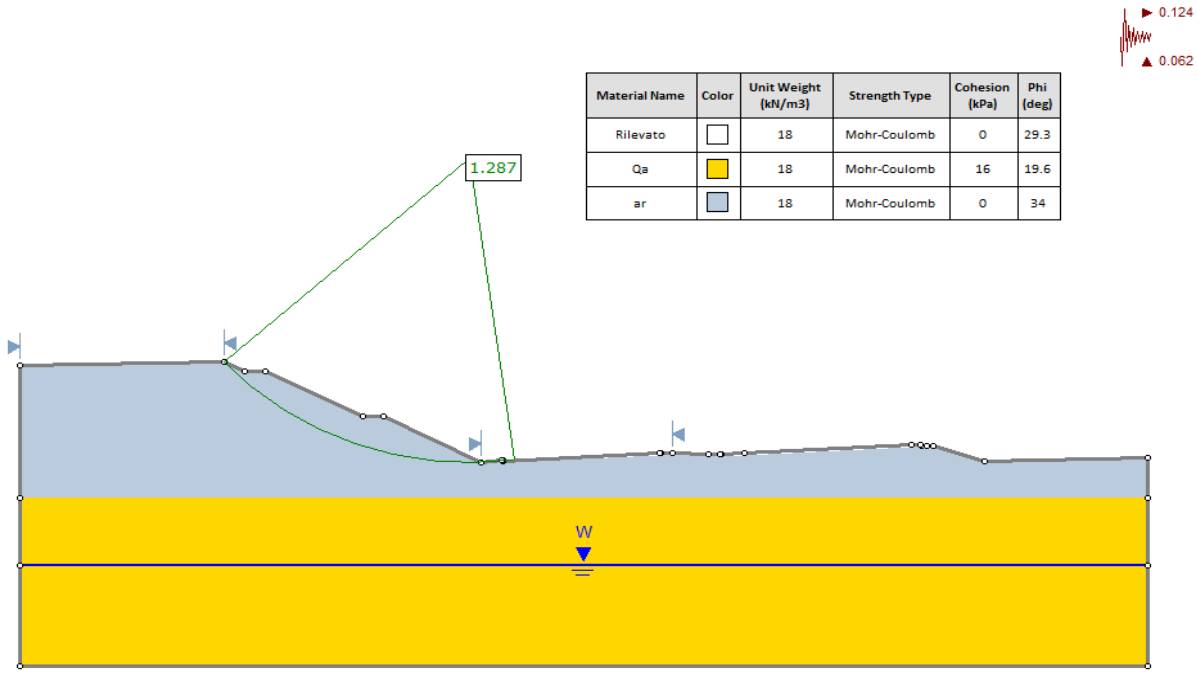


Figura 37 – Sez.931 – prg.16+391 _ in SX _ Condizioni sismiche – analisi in tensioni efficaci.

6.4.9 Sezione 943 – prg 16+620

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.96 > 1.1$

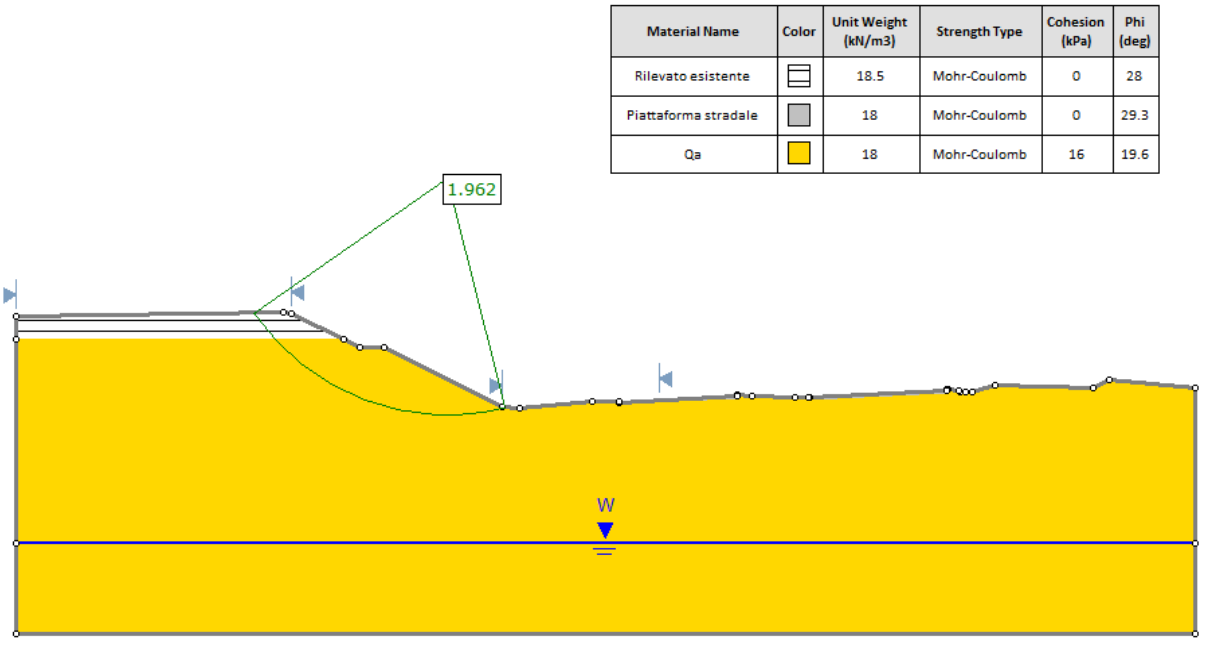


Figura 38 – Sez. 943 – prg.16+620 _ in SX _ Condizioni statiche – analisi in tensioni efficaci.

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.45 > 1.1$ (sisma verso il basso ↓)

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Rilevato esistente		18.5	Mohr-Coulomb	0	28
Qa		18	Mohr-Coulomb	16	19.6

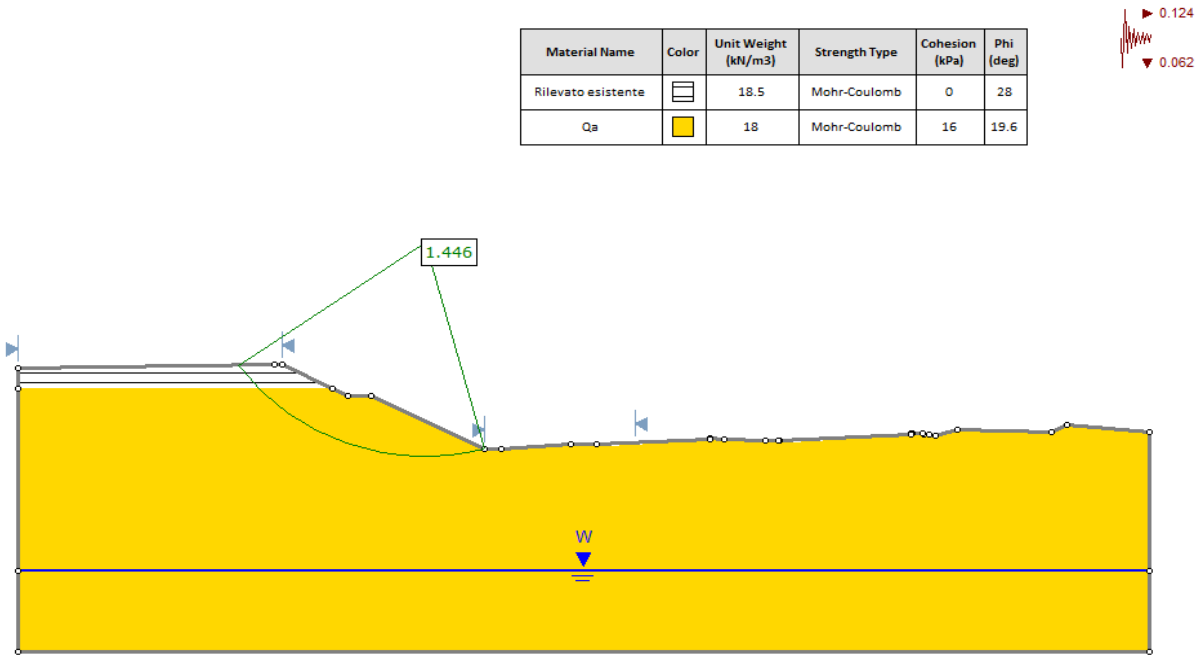


Figura 39 – Sez.943 – prg.16+620 _ in SX _ Condizioni sismiche – analisi in tensioni efficaci.

7 OUTPUT DI CALCOLO

7.1 VERIFICHE DI STABILITA' DEI RILEVATI – TABULATI DI SLIDE

Sezione 202 – prg 3+380

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.2 > 1.1$

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 3380 statica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3.5
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

- 2 Distributed Loads present

Distributed Load 1	
Distribution:	Constant
Magnitude [kPa]:	26
Orientation:	Vertical

Distributed Load 2	
Distribution:	Constant
Magnitude [kPa]:	26
Orientation:	Vertical

Material Properties

Property	Rilevato	Piattaforma stradale	Scotico+bonifica	Qc(a)
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	18	18
Cohesion [kPa]	0	0	0	0
Friction Angle [deg]	29.3	29.3	29.3	34
Water Surface	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1

Global Minimums

Method: bishop simplified

FS	1.198070
Center:	83.351, 45.772
Radius:	33.816
Left Slip Surface Endpoint:	58.590, 22.741
Right Slip Surface Endpoint:	89.317, 12.487
Resisting Moment:	19716.9 kN-m
Driving Moment:	16457.1 kN-m
Total Slice Area:	59.8079 m2
Surface Horizontal Width:	30.7271 m
Surface Average Height:	1.94642 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1330
Number of Invalid Surfaces:	0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.19807**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.176012	0.290517	-46.8551	Piattaforma stradale	0	29.3	8.64131	10.3529	18.4486	0	18.4486	27.6684	27.6684
2	0.632354	5.70702	-45.8676	Rilevato	0	29.3	11.0703	13.263	23.6345	0	23.6345	35.0452	35.0452
3	0.632354	12.7546	-44.3491	Rilevato	0	29.3	14.8415	17.7811	31.6855	0	31.6855	46.1935	46.1935
4	0.632354	19.7395	-42.8689	Rilevato	0	29.3	15.7583	18.8796	33.6431	0	33.6431	48.2708	48.2708
5	0.632354	26.3964	-41.4235	Rilevato	0	29.3	13.8389	16.58	29.5453	0	29.5453	41.756	41.756
6	0.632354	32.3048	-40.0096	Rilevato	0	29.3	17.181	20.584	36.6803	0	36.6803	51.1017	51.1017
7	0.632354	37.9131	-38.6244	Rilevato	0	29.3	20.4411	24.4899	43.6405	0	43.6405	59.9727	59.9727
8	0.632354	41.1576	-37.2655	Rilevato	0	29.3	22.4825	26.9356	47.9986	0	47.9986	65.1043	65.1043
9	0.632354	41.7088	-35.9307	Rilevato	0	29.3	23.0714	27.6411	49.2559	0	49.2559	65.9757	65.9757
10	0.632354	42.0028	-34.6181	Rilevato	0	29.3	23.5165	28.1744	50.2062	0	50.2062	66.4401	66.4401
11	0.632354	42.0551	-33.326	Rilevato	0	29.3	23.822	28.5404	50.8584	0	50.8584	66.522	66.522
12	0.632354	41.8763	-32.0527	Rilevato	0	29.3	23.9901	28.7418	51.2174	0	51.2174	66.2388	66.2388
13	0.632354	41.4764	-30.797	Rilevato	0	29.3	24.0227	28.7809	51.2869	0	51.2869	65.6056	65.6056

14	0.632354	40.8639	-29.5574	Rilevato	0	29.3	23.9213	28.6594	51.0705	0	51.0705	64.6362	64.6362
15	0.632354	40.0468	-28.3329	Rilevato	0	29.3	23.6874	28.3792	50.5712	0	50.5712	63.3431	63.3431
16	0.632354	39.0322	-27.1224	Rilevato	0	29.3	23.3223	27.9418	49.7916	0	49.7916	61.7378	61.7378
17	0.632354	37.8265	-25.9248	Rilevato	0	29.3	22.8269	27.3482	48.734	0	48.734	59.8303	59.8303
18	0.632354	36.4358	-24.7392	Rilevato	0	29.3	22.202	26.5995	47.3998	0	47.3998	57.63	57.63
19	0.632354	34.8893	-23.5649	Rilevato	0	29.3	21.4631	25.7143	45.8222	0	45.8222	55.1836	55.1836
20	0.632354	35.9999	-22.401	Rilevato	0	29.3	22.3545	26.7822	47.7254	0	47.7254	56.9397	56.9397
21	0.632354	38.8826	-21.2467	Rilevato	0	29.3	24.3679	29.1945	52.024	0	52.024	61.4986	61.4986
22	0.632354	41.599	-20.1015	Rilevato	0	29.3	26.3081	31.519	56.1662	0	56.1662	65.7944	65.7944
23	0.632354	42.0444	-18.9645	Rilevato	0	29.3	26.8294	32.1435	57.279	0	57.279	66.4985	66.4985
24	0.59457	37.3526	-17.8688	Scotico+ bonifica	0	29.3	25.5691	30.6336	54.5883	0	54.5883	62.8316	62.8316
25	0.59457	35.0976	-16.8133	Scotico+ bonifica	0	29.3	24.2245	29.0227	51.7179	0	51.7179	59.0379	59.0379
26	0.59457	32.7149	-15.7637	Scotico+ bonifica	0	29.3	22.7656	27.2748	48.6031	0	48.6031	55.0296	55.0296
27	0.59457	30.2067	-14.7195	Scotico+ bonifica	0	29.3	21.1918	25.3892	45.243	0	45.243	50.8102	50.8102
28	0.59457	27.5748	-13.6803	Scotico+ bonifica	0	29.3	19.5021	23.3649	41.6358	0	41.6358	46.3828	46.3828
29	0.59457	24.821	-12.6456	Scotico+ bonifica	0	29.3	17.696	21.2011	37.7798	0	37.7798	41.7502	41.7502
30	0.59457	21.9466	-11.6151	Scotico+ bonifica	0	29.3	15.7725	18.8965	33.6731	0	33.6731	36.9151	36.9151
31	0.59457	18.9532	-10.5885	Scotico+ bonifica	0	29.3	13.7302	16.4498	29.3131	0	29.3131	31.8798	31.8798
32	0.59457	15.8419	-9.5652	Scotico+ bonifica	0	29.3	11.568	13.8593	24.697	0	24.697	26.6463	26.6463
33	0.59457	12.6139	-8.54501	Scotico+ bonifica	0	29.3	9.28443	11.1234	19.8217	0	19.8217	21.2168	21.2168
34	0.59457	9.27025	-7.52755	Scotico+ bonifica	0	29.3	6.87779	8.24007	14.6836	0	14.6836	15.5925	15.5925
35	0.642672	6.58161	-6.4715	Rilevato	0	29.3	4.55511	5.45734	9.72486	0	9.72486	10.2416	10.2416
36	0.642672	6.5452	-5.37667	Rilevato	0	29.3	4.56912	5.47413	9.75477	0	9.75477	10.1848	10.1848
37	0.642672	7.1735	-4.2838	Rilevato	0	29.3	5.05122	6.05171	10.784	0	10.784	11.1624	11.1624
38	0.642672	7.41023	-3.1925	Rilevato	0	29.3	5.26343	6.30596	11.2371	0	11.2371	11.5307	11.5307
39	0.804476	4.19715	-1.96523	Scotico+ bonifica	0	29.3	2.40513	2.88152	5.13481	0	5.13481	5.21733	5.21733
40	0.611263	0.499438	-0.765374	Qc(a)	0	34	0.456571	0.547004	0.810967	0	0.810967	0.817066	0.817066

41	0.61 1263	0.65 6531	0.27 0392	Qc(a)	0	34	0.60 6298	0.72 6388	1.07 691	0	1.07 691	1.07 405	1.07 405
42	0.61 1263	0.69 2021	1.30 625	Qc(a)	0	34	0.64 5657	0.77 3542	1.14 682	0	1.14 682	1.13 21	1.13 21
43	0.61 1263	0.60 5817	2.34 253	Qc(a)	0	34	0.57 1119	0.68 4241	1.01 443	0	1.01 443	0.99 1065	0.99 1065
44	0.61 1263	0.43 2604	3.37 958	Qc(a)	0	34	0.41 2132	0.49 3763	0.73 2034	0	0.73 2034	0.70 7697	0.70 7697
45	0.61 1263	0.28 6183	4.41 773	Qc(a)	0	34	0.27 5558	0.33 0138	0.48 945	0	0.48 945	0.46 8161	0.46 8161
46	0.61 1263	0.41 8331	5.45 735	Qc(a)	0	34	0.40 7177	0.48 7826	0.72 3232	0	0.72 3232	0.68 4332	0.68 4332
47	0.61 1263	0.54 0167	6.49 877	Qc(a)	0	34	0.53 1569	0.63 6857	0.94 4181	0	0.94 4181	0.88 3627	0.88 3627
48	0.61 1263	0.53 8028	7.54 235	Qc(a)	0	34	0.53 5414	0.64 1463	0.95 1008	0	0.95 1008	0.88 0116	0.88 0116
49	0.61 1263	0.41 1077	8.58 846	Qc(a)	0	34	0.41 3761	0.49 5715	0.73 4928	0	0.73 4928	0.67 2438	0.67 2438
50	0.61 1263	0.15 8338	9.63 746	Qc(a)	0	34	0.16 1233	0.19 3169	0.28 6384	0	0.28 6384	0.25 9005	0.25 9005

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.19807**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	58.5904	22.7411	0	0	0
2	58.7664	22.5533	1.9452	0	0
3	59.3987	21.9015	10.3572	0	0
4	60.0311	21.2834	20.5684	0	0
5	60.6634	20.6964	30.3619	0	0
6	61.2958	20.1384	38.105	0	0
7	61.9281	19.6077	46.7215	0	0
8	62.5605	19.1024	55.8582	0	0
9	63.1928	18.6213	64.7496	0	0
10	63.8252	18.163	72.748	0	0
11	64.4576	17.7265	79.8094	0	0
12	65.0899	17.3107	85.9078	0	0
13	65.7223	16.9148	91.033	0	0
14	66.3546	16.5378	95.189	0	0
15	66.987	16.1792	98.3924	0	0
16	67.6193	15.8383	100.672	0	0
17	68.2517	15.5144	102.067	0	0
18	68.884	15.207	102.628	0	0
19	69.5164	14.9156	102.415	0	0
20	70.1487	14.6398	101.495	0	0
21	70.7811	14.3792	99.8136	0	0
22	71.4135	14.1333	97.2117	0	0
23	72.0458	13.9019	93.5916	0	0
24	72.6782	13.6846	89.0905	0	0
25	73.2727	13.4929	84.3677	0	0

26	73.8673	13.3132	79.2714	0	0
27	74.4619	13.1454	73.9075	0	0
28	75.0564	12.9892	68.3878	0	0
29	75.651	12.8444	62.8304	0	0
30	76.2456	12.711	57.3598	0	0
31	76.8402	12.5888	52.1071	0	0
32	77.4347	12.4777	47.2102	0	0
33	78.0293	12.3775	42.8139	0	0
34	78.6239	12.2882	39.0703	0	0
35	79.2184	12.2096	36.139	0	0
36	79.8611	12.1367	33.9236	0	0
37	80.5038	12.0762	31.5802	0	0
38	81.1464	12.0281	28.8565	0	0
39	81.7891	11.9922	25.8803	0	0
40	82.5936	11.9646	24.0892	0	0
41	83.2049	11.9565	23.817	0	0
42	83.8161	11.9593	23.4437	0	0
43	84.4274	11.9733	23.0335	0	0
44	85.0386	11.9983	22.6594	0	0
45	85.6499	12.0344	22.3813	0	0
46	86.2612	12.0816	22.1899	0	0
47	86.8724	12.14	21.899	0	0
48	87.4837	12.2096	21.5087	0	0
49	88.095	12.2906	21.1048	0	0
50	88.7062	12.3829	20.7843	0	0
51	89.3175	12.4867	0	0	0

List Of Coordinates

Water Table

X	Y
0	3.23482
101.135	3.23482

Distributed Load

X	Y
50.6354	23
50.6354	22.94
60.3854	22.6963
60.3854	22.7563

Distributed Load

X	Y
35.8234	22.7952
35.8234	22.7352
45.5734	22.9789
45.5734	23.0389

External Boundary

X	Y
101.135	13.6616
95.78	13.1121
92.3931	12.8162
89.3152	12.4864
86.0458	12.0848
85.2458	12.0506
82.5936	12.0001
81.5854	12.6723
79.5854	12.6723
72.0854	17.6723
70.0854	17.6723
62.5854	22.6723
60.4854	22.7563
60.3854	22.7563
60.3854	22.6963
50.6354	22.94
50.6354	23
49.3854	22.954
46.8234	22.9929

45.6734	23.0389
45.5734	23.0389
45.5734	22.9789
35.8234	22.7352
35.8234	22.7952
35.7234	22.7952
33.6234	22.7112
31.3133	21.1711
28.2278	21.7894
24.8297	21.8687
20.4197	22.024
19.4377	22.5225
17.7687	22.6879
17.3326	22.7325
16.5883	22.8287
13.0883	23.3324
6.28267	24.2695
1.43523	24.577
0.909541	24.6289
0	24.7187
0	0
101.135	0

Material Boundary

X	Y
31.3133	21.1711
31.3133	19.7737
50.75	15.7596
53.9896	15.8348
60.4933	14.3051
61.664	14.0348
63.5276	13.644
70.303	12.3036
73.3145	12.2795
77.2813	12.0172
78.782	11.3435
78.8996	11.1851
79.4227	10.569
82.5936	10.6001
82.5936	12.0001

Material Boundary

X	Y
31.3133	21.1711
33.8178	20.6692
36.2061	20.1529
45.0663	18.2903
45.2239	18.2572
45.3319	18.2348
45.4866	18.2171
49.3854	17.4324
50.75	17.1596
53.9896	17.2348
56.7874	16.5768
60.4933	15.7051
61.664	15.4348
63.5276	15.044
70.303	13.7036
73.3145	13.6795
77.2813	13.4172
77.5233	13.3086
77.799	13.1848
78.5608	12.8428
78.782	12.7435
78.8996	12.5851
79.4227	11.969
82.5936	12.0001

Material Boundary

X	Y
50.6354	22.94
50.6354	22.84
60.3854	22.4963
60.3854	22.6963

Material Boundary

X	Y
35.8234	22.7352
35.8234	22.5352
45.5734	22.7789
45.5734	22.9789

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.126 > 1.1$ (sisma verso l'alto ↑)

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name: pk 3380 sismica

Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled

Minimum Elevation:	Not Defined
Minimum Depth [m]:	3.5
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal):	0.112
Seismic Load Coefficient (Vertical):	-0.056

- 2 Distributed Loads present

Distributed Load 1

Distribution:	Constant
Magnitude [kPa]:	4
Orientation:	Vertical

Distributed Load 2

Distribution:	Constant
Magnitude [kPa]:	4
Orientation:	Vertical

Material Properties

Property	Rilevato	Piattaforma stradale	Scotico+bonifica	Qc(a)
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	18	18
Cohesion [kPa]	0	0	0	0
Friction Angle [deg]	29.3	29.3	29.3	34
Water Surface	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1

Global Minimums

Method: bishop simplified

FS	1.108350
Center:	85.014, 55.486
Radius:	38.895
Left Slip Surface Endpoint:	57.734, 27.763
Right Slip Surface Endpoint:	95.785, 18.112
Resisting Moment:	25143.9 kN-m
Driving Moment:	22685.8 kN-m
Total Slice Area:	71.6157 m2
Surface Horizontal Width:	38.0513 m

Surface Average Height: 1.88209 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1438

Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.10835**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.183386	0.288312	-44.3496	Piattaforma stradale	0	29.3	1.85794	2.05925	3.66955	0	3.66955	5.48578	5.48578
2	0.805706	7.90161	-43.3447	Rilevato	0	29.3	4.54286	5.03508	8.97242	0	8.97242	13.2601	13.2601
3	0.805706	18.3353	-41.7334	Rilevato	0	29.3	8.88903	9.85216	17.5563	0	17.5563	25.4855	25.4855
4	0.805706	28.1853	-40.1616	Rilevato	0	29.3	13.1348	14.558	25.9421	0	25.9421	37.0268	37.0268
5	0.805706	38.2808	-38.6254	Rilevato	0	29.3	16.2607	18.0225	32.1157	0	32.1157	45.1082	45.1082
6	0.805706	46.9665	-37.1215	Rilevato	0	29.3	20.1437	22.3263	39.7849	0	39.7849	55.0314	55.0314
7	0.805706	54.9558	-35.6469	Rilevato	0	29.3	23.9179	26.5094	47.2392	0	47.2392	64.3924	64.3924
8	0.805706	57.6344	-34.1991	Rilevato	0	29.3	25.4389	28.1952	50.2433	0	50.2433	67.5309	67.5309
9	0.805706	57.5766	-32.7757	Rilevato	0	29.3	25.7599	28.551	50.8773	0	50.8773	67.463	67.463
10	0.805706	57.1111	-31.3748	Rilevato	0	29.3	25.8882	28.6932	51.1307	0	51.1307	66.9173	66.9173
11	0.805706	56.2562	-29.9945	Rilevato	0	29.3	25.8261	28.6244	51.0082	0	51.0082	65.9156	65.9156
12	0.805706	55.0285	-28.6331	Rilevato	0	29.3	25.5757	28.3468	50.5134	0	50.5134	64.4769	64.4769
13	0.805706	53.4424	-27.2892	Rilevato	0	29.3	25.1383	27.862	49.6495	0	49.6495	62.6184	62.6184
14	0.805706	51.5113	-25.9613	Rilevato	0	29.3	24.5153	27.1715	48.4191	0	48.4191	60.3555	60.3555
15	0.805706	49.2469	-24.6483	Rilevato	0	29.3	23.7076	26.2763	46.8238	0	46.8238	57.7022	57.7022
16	0.805706	46.6599	-23.349	Rilevato	0	29.3	22.7157	25.177	44.8649	0	44.8649	54.6709	54.6709
17	0.805706	46.8967	-22.0623	Rilevato	0	29.3	23.0841	25.5853	45.5925	0	45.5925	54.9483	54.9483
18	0.805706	51.4414	-20.7871	Rilevato	0	29.3	25.5973	28.3708	50.5562	0	50.5562	60.2731	60.2731
19	0.805706	55.0596	-19.5227	Rilevato	0	29.3	27.6922	30.6927	54.6938	0	54.6938	64.5124	64.5124

20	0.775283	50.6899	-18.2916	Scotico+bonifica	0	29.3	26.7708	29.6714	52.8738	0	52.8738	61.723	61.723
21	0.775283	46.9287	-17.0928	Scotico+bonifica	0	29.3	25.0347	27.7472	49.4449	0	49.4449	57.1431	57.1431
22	0.775283	42.9205	-15.9016	Scotico+bonifica	0	29.3	23.1255	25.6312	45.6743	0	45.6743	52.2624	52.2624
23	0.775283	38.6698	-14.7174	Scotico+bonifica	0	29.3	21.0421	23.322	41.5593	0	41.5593	47.0864	47.0864
24	0.775283	34.1807	-13.5396	Scotico+bonifica	0	29.3	18.7828	20.8179	37.0971	0	37.0971	41.6202	41.6202
25	0.775283	29.4568	-12.3676	Scotico+bonifica	0	29.3	16.3457	18.1168	32.2838	0	32.2838	35.868	35.868
26	0.775283	24.5014	-11.2009	Scotico+bonifica	0	29.3	13.7289	15.2164	27.1154	0	27.1154	29.834	29.834
27	0.775283	19.3175	-10.0388	Scotico+bonifica	0	29.3	10.9298	12.114	21.587	0	21.587	23.5218	23.5218
28	0.775283	13.9076	-8.88093	Scotico+bonifica	0	29.3	7.94558	8.80648	15.6929	0	15.6929	16.9345	16.9345
29	0.196312	2.64135	-8.15689	Rilevato	0	29.3	5.99586	6.64551	11.8421	0	11.8421	12.7016	12.7016
30	0.749974	10.1329	-7.45371	Scotico+bonifica	0	29.3	6.05662	6.71285	11.9621	0	11.9621	12.7545	12.7545
31	0.749974	11.3577	-6.3408	Scotico+bonifica	0	29.3	6.85282	7.59532	13.5346	0	13.5346	14.2961	14.2961
32	0.749974	11.9835	-5.23029	Scotico+bonifica	0	29.3	7.29889	8.08972	14.4157	0	14.4157	15.0838	15.0838
33	0.749974	7.51294	-4.12174	Scotico+bonifica	0	29.3	4.61952	5.12004	9.1238	0	9.1238	9.45669	9.45669
34	0.775966	5.04578	-2.99558	Qc(a)	0	34	3.62039	4.01266	5.94902	0	5.94902	6.13847	6.13847
35	0.775966	5.71086	-1.85141	Qc(a)	0	34	4.14652	4.59579	6.81353	0	6.81353	6.94757	6.94757
36	0.775966	6.15933	-0.707971	Qc(a)	0	34	4.52606	5.01646	7.43721	0	7.43721	7.49314	7.49314
37	0.775966	6.43506	0.435181	Qc(a)	0	34	4.78635	5.30495	7.8649	0	7.8649	7.82855	7.82855
38	0.775966	6.81748	1.57851	Qc(a)	0	34	5.13342	5.68963	8.43523	0	8.43523	8.29376	8.29376
39	0.775966	7.65438	2.72246	Qc(a)	0	34	5.8358	6.46811	9.58937	0	9.58937	9.31187	9.31187
40	0.775966	8.36172	3.86751	Qc(a)	0	34	6.4562	7.15573	10.66088	0	10.6088	10.11723	10.11723
41	0.775966	8.8513	5.0141	Qc(a)	0	34	6.92264	7.67271	11.43753	0	11.3753	10.77679	10.77679
42	0.775966	9.11238	6.16271	Qc(a)	0	34	7.22077	8.00314	11.88651	0	11.8651	11.00855	11.00855
43	0.775966	9.03023	7.31381	Qc(a)	0	34	7.25189	8.03763	11.99163	0	11.9163	10.99855	10.99855
44	0.775966	8.68912	8.46789	Qc(a)	0	34	7.07379	7.84024	11.66236	0	11.6236	10.55705	10.55705
45	0.775966	8.12448	9.62545	Qc(a)	0	34	6.70708	7.43379	11.1021	0	11.021	9.88357	9.88357
46	0.775966	7.31938	10.787	Qc(a)	0	34	6.12948	6.79361	10.20719	0	10.0719	8.90412	8.90412

47	0.775966	6.12884	11.953	Qc(a)	0	34	5.20838	5.77271	8.5584	0	8.5584	7.45579	7.45579
48	0.775966	4.66492	13.1241	Qc(a)	0	34	4.02461	4.46068	6.61323	0	6.61323	5.67489	5.67489
49	0.775966	2.96682	14.3008	Qc(a)	0	34	2.5997	2.88138	4.27182	0	4.27182	3.60913	3.60913
50	0.775966	1.03099	15.4837	Qc(a)	0	34	0.918031	1.01175	1.5085	0	1.5085	1.25419	1.25419

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.10835**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	57.7337	27.7625	0	0	0
2	57.9171	27.5833	0.349484	0	0
3	58.7228	26.8228	4.39812	0	0
4	59.5285	26.1041	11.9091	0	0
5	60.3342	25.4242	22.1247	0	0
6	61.14	24.7804	33.989	0	0
7	61.9457	24.1706	47.285	0	0
8	62.7514	23.5928	61.4697	0	0
9	63.5571	23.0452	74.9432	0	0
10	64.3628	22.5265	87.0347	0	0
11	65.1685	22.0351	97.699	0	0
12	65.9742	21.5701	106.919	0	0
13	66.7799	21.1302	114.7	0	0
14	67.5856	20.7145	121.074	0	0
15	68.3913	20.3222	126.09	0	0
16	69.197	19.9525	129.82	0	0
17	70.0027	19.6047	132.352	0	0
18	70.8084	19.2782	133.898	0	0
19	71.6141	18.9723	134.502	0	0
20	72.4198	18.6866	133.987	0	0
21	73.1951	18.4304	132.464	0	0
22	73.9704	18.192	130.103	0	0
23	74.7457	17.9711	127.074	0	0
24	75.521	17.7674	123.558	0	0
25	76.2963	17.5807	119.754	0	0
26	77.0715	17.4107	115.871	0	0
27	77.8468	17.2572	112.137	0	0
28	78.6221	17.12	108.791	0	0
29	79.3974	16.9988	106.091	0	0
30	79.5937	16.9707	105.544	0	0
31	80.3437	16.8726	103.311	0	0
32	81.0936	16.7892	100.573	0	0
33	81.8436	16.7206	97.4319	0	0
34	82.5936	16.6665	95.3027	0	0
35	83.3696	16.6259	93.3007	0	0

36	84.1455	16.6009	90.8944	0	0
37	84.9215	16.5913	88.1443	0	0
38	85.6975	16.5972	85.1055	0	0
39	86.4734	16.6185	81.7062	0	0
40	87.2494	16.6554	77.6823	0	0
41	88.0254	16.7079	73.0537	0	0
42	88.8013	16.776	67.9001	0	0
43	89.5773	16.8598	62.3247	0	0
44	90.3532	16.9594	56.5234	0	0
45	91.1292	17.0749	50.666	0	0
46	91.9052	17.2065	44.9223	0	0
47	92.6811	17.3543	39.4978	0	0
48	93.4571	17.5186	34.7377	0	0
49	94.2331	17.6995	30.9415	0	0
50	95.009	17.8973	28.412	0	0
51	95.785	18.1123	0	0	0

List Of Coordinates

Water Table

X	Y
0	8.23482
108.855	8.23482

Distributed Load

X	Y
35.8234	27.7352
45.5734	27.9789

Distributed Load

X	Y
50.6354	27.94
60.3854	27.6963

External Boundary

X	Y
108.855	18.6616
95.78	18.1121
92.3931	17.8162
89.3152	17.4864
86.0458	17.0848
85.2458	17.0506
82.5936	17.0001
81.5854	17.6723
79.5854	17.6723
72.0854	22.6723
70.0854	22.6723
62.5854	27.6723
60.4854	27.7563
60.3854	27.7563
60.3854	27.6963
50.6354	27.94
50.6354	28
49.3854	27.954
46.8234	27.9929
45.6734	28.0389
45.5734	28.0389
45.5734	27.9789
35.8234	27.7352
35.8234	27.7952
35.7234	27.7952
33.6234	27.7112
31.3133	26.1711
28.2278	26.7894
24.8297	26.8687
20.4197	27.024
19.4377	27.5225
17.7687	27.6879
17.3326	27.7325
16.5883	27.8287
13.0883	28.3324
6.28267	29.2695
1.43523	29.577
0.909541	29.6289
0	29.7187
0	0
108.855	0

Material Boundary

X	Y
31.3133	26.1711
31.3133	24.7737
50.75	20.7596
53.9896	20.8348
60.4933	19.3051
61.664	19.0348
63.5276	18.644
70.303	17.3036
73.3145	17.2795
77.2813	17.0172
78.782	16.3435
78.8996	16.1851
79.4227	15.569
82.5936	15.6001
82.5936	17.0001

Material Boundary

X	Y
31.3133	26.1711
33.8178	25.6692
36.2061	25.1529
45.0663	23.2903
45.2239	23.2572
45.3319	23.2348
45.4866	23.2171
49.3854	22.4324
50.75	22.1596
53.9896	22.2348
56.7874	21.5768
60.4933	20.7051
61.664	20.4348
63.5276	20.044
70.303	18.7036
73.3145	18.6795
77.2813	18.4172
77.5233	18.3086
77.799	18.1848
78.5608	17.8428
78.782	17.7435
78.8996	17.5851
79.4227	16.969
82.5936	17.0001

Material Boundary

X	Y
50.6354	27.94
50.6354	27.84
60.3854	27.4963
60.3854	27.6963

Material Boundary

X	Y
35.8234	27.7352
35.8234	27.5352
45.5734	27.7789
45.5734	27.9789

Sezione 223 – prg 3+760

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.37 > 1.1$

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 3760 statica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right

Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

- 2 Distributed Loads present

Distributed Load 1	
Distribution:	Constant
Magnitude [kPa]:	26
Orientation:	Vertical

Distributed Load 2	
Distribution:	Constant
Magnitude [kPa]:	26
Orientation:	Vertical

Material Properties

Property	Rilevato	a-GG	Piattaforma stradale	Scotico+bonifica	Qa	Rilevato esistente	Qc(a)
Color							
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	20	18	18	18	18.5	18
Cohesion [kPa]	0	0	0	0	12	0	0
Friction Angle [deg]	29.3	34	29.3	29.3	18	28	34
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1	1	1

Global Minimums

Method: bishop simplified

FS	1.368700
Center:	111.805, 61.456
Radius:	41.611
Left Slip Surface Endpoint:	86.247, 28.619
Right Slip Surface Endpoint:	116.709, 20.135
Resisting Moment:	17813.8 kN-m
Driving Moment:	13015.1 kN-m
Total Slice Area:	40.0597 m2
Surface Horizontal Width:	30.4618 m
Surface Average Height:	1.31508 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1765
Number of Invalid Surfaces:	0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.3687**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.159967	0.171704	-37.7546	Piattaforma stradale	0	29.3	8.43333	11.5427	20.5689	0	20.5689	27.0997	27.0997
2	0.63911	4.04253	-37.0639	Rilevato	0	29.3	10.1287	13.8632	24.704	0	24.704	32.3543	32.3543
3	0.63911	9.2748	-35.9688	Rilevato	0	29.3	12.8116	17.5353	31.2474	0	31.2474	40.545	40.545
4	0.63911	14.2939	-34.8887	Rilevato	0	29.3	15.4327	21.1227	37.6403	0	37.6403	48.4018	48.4018
5	0.63911	19.1082	-33.8226	Rilevato	0	29.3	17.9921	24.6258	43.8827	0	43.8827	55.9376	55.9376
6	0.63911	24.2172	-32.7697	Rilevato	0	29.3	14.1561	19.3754	34.5267	0	34.5267	43.639	43.639
7	0.63911	28.7841	-31.7291	Rilevato	0	29.3	14.7383	20.1723	35.9467	0	35.9467	45.0596	45.0596
8	0.63911	32.9458	-30.7	Rilevato	0	29.3	17.0055	23.2754	41.4763	0	41.4763	51.5735	51.5735
9	0.63911	36.6672	-29.6818	Rilevato	0	29.3	19.0757	26.1089	46.5255	0	46.5255	57.398	57.398
10	0.63911	36.8822	-28.6738	Rilevato	0	29.3	19.3356	26.4646	47.1594	0	47.1594	57.7338	57.7338
11	0.63911	35.9191	-27.6755	Rilevato	0	29.3	18.9729	25.9682	46.2748	0	46.2748	56.2255	56.2255
12	0.63911	34.7934	-26.6861	Rilevato	0	29.3	18.5144	25.3406	45.1564	0	45.1564	54.4626	54.4626
13	0.63911	33.5093	-25.7053	Rilevato	0	29.3	17.9606	24.5827	43.8058	0	43.8058	52.4517	52.4517
14	0.63911	32.0708	-24.7325	Rilevato	0	29.3	17.3123	23.6953	42.2246	0	42.2246	50.1993	50.1993
15	0.63911	30.4815	-23.7673	Rilevato	0	29.3	16.57	22.6793	40.4141	0	40.4141	47.711	47.711
16	0.63911	28.7448	-22.8092	Rilevato	0	29.3	15.7334	21.5351	38.3751	0	38.3751	44.992	44.992

17	0.63911	26.8639	-21.8577	Rilevato	0	29.3	14.8047	20.2632	36.1086	0	36.1086	42.0474	42.0474
18	0.63911	24.8418	-20.9126	Rilevato	0	29.3	13.7824	18.864	33.6153	0	33.6153	38.8817	38.8817
19	0.63911	22.681	-19.9734	Rilevato	0	29.3	12.6673	17.3377	30.8955	0	30.8955	35.4993	35.4993
20	0.63911	20.3842	-19.0398	Rilevato	0	29.3	11.4594	15.6845	27.9494	0	27.9494	31.9 04	31.9 04
21	0.63911	18.8434	-18.1113	Rilevato	0	29.3	10.6622	14.5933	26.0049	0	26.0049	29.4922	29.4922
22	0.63911	20.7957	-17.1878	Rilevato	0	29.3	11.8426	16.209	28.8841	0	28.8841	32.5473	32.5473
23	0.63911	23.0056	-16.2689	Rilevato	0	29.3	13.1848	18.0461	32.1578	0	32.1578	36.0056	36.0056
24	0.63911	24.5391	-15.3542	Rilevato	0	29.3	14.1529	19.3711	34.5188	0	34.5188	38.405	38.405
25	0.63911	22.274	-14.4435	Rilevato	0	29.3	12.9274	17.6937	31.53	0	31.53	34.8596	34.8596
26	0.63911	19.2044	-13.5366	Rilevato	0	29.3	11.2156	15.3508	27.3548	0	27.3548	30.0551	30.0551
27	0.63911	16.0118	-12.6331	Rilevato	0	29.3	9.40937	12.8786	22.9494	0	22.9494	25.0584	25.0584
28	0.63911	12.6977	-11.7327	Rilevato	0	29.3	7.50807	10.2763	18.3123	0	18.3123	19.8716	19.8716
29	0.63911	9.26329	-10.8353	Rilevato	0	29.3	5.51117	7.54314	13.4417	0	13.4417	14.4966	14.4966
30	0.63911	5.70964	-9.94062	Rilevato	0	29.3	3.41786	4.67803	8.33615	0	8.33615	8.93516	8.93516
31	0.63911	2.0378	-9.04834	Rilevato	0	29.3	1.22735	1.67988	2.99351	0	2.99351	3.18896	3.18896
32	0.0230034	0.00375135	-8.58677	Scotico+ bonifica	0	29.3	0.0629733	0.0861916	0.153592	0	0.153592	0.163101	0.163101
33	0.616972	0.526138	-8.14166	a-GG	0	34	0.39264	0.537406	0.796736	0	0.796736	0.852909	0.852909
34	0.616972	1.44289	-7.28434	a-GG	0	34	1.08437	1.48418	2.2004	0	2.2004	2.33901	2.33901
35	0.616972	2.24382	-6.42866	a-GG	0	34	1.6982	2.32432	3.44594	0	3.44594	3.63728	3.63728

36	0.616972	2.92686	-5.57442	a-GG	0	34	2.2308	3.0533	4.5267	0	4.5267	4.74443	4.74443
37	0.616972	3.48945	-4.72142	a-GG	0	34	2.67845	3.666	5.43506	0	5.43506	5.65628	5.65628
38	0.616972	3.93779	-3.86946	a-GG	0	34	3.0441	4.16646	6.17703	0	6.17703	6.38292	6.38292
39	0.616972	4.27246	-3.01836	a-GG	0	34	3.32641	4.55286	6.74989	0	6.74989	6.92529	6.92529
40	0.616972	4.49376	-2.16793	a-GG	0	34	3.52383	4.82307	7.15049	0	7.15049	7.28388	7.28388
41	0.616972	4.60192	-1.31798	a-GG	0	34	3.6347	4.97481	7.37547	0	7.37547	7.45909	7.45909
42	0.616972	4.5971	-0.468312	a-GG	0	34	3.65726	5.00569	7.42124	0	7.42124	7.45113	7.45113
43	0.616972	4.47937	0.381249	a-GG	0	34	3.58967	4.91318	7.28408	0	7.28408	7.26019	7.26019
44	0.616972	4.24874	1.23089	a-GG	0	34	3.42993	4.69455	6.95996	0	6.95996	6.88626	6.88626
45	0.616972	3.90514	2.08081	a-GG	0	34	3.17598	4.34696	6.44465	0	6.44465	6.32925	6.32925
46	0.616972	3.44841	2.93118	a-GG	0	34	2.82556	3.86735	5.73359	0	5.73359	5.58891	5.58891
47	0.616972	2.87835	3.78221	a-GG	0	34	2.37633	3.25248	4.82201	0	4.82201	4.66492	4.66492
48	0.616972	2.19465	4.63406	a-GG	0	34	1.82575	2.4989	3.70476	0	3.70476	3.55677	3.55677
49	0.616972	1.39694	5.48695	a-GG	0	34	1.17112	1.60291	2.37641	0	2.37641	2.26392	2.26392
50	0.616972	0.484764	6.34106	a-GG	0	34	0.409585	0.560599	0.831121	0	0.831121	0.785606	0.785606

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.3687**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	86.247	28.619	0	0	0
2	86.407	28.4952	1.20223	0	0
3	87.0461	28.0124	6.66942	0	0
4	87.6852	27.5486	12.9938	0	0
5	88.3243	27.103	19.9289	0	0
6	88.9634	26.6747	27.2484	0	0
7	89.6025	26.2633	32.4269	0	0
8	90.2416	25.8682	37.235	0	0
9	90.8807	25.4887	42.1318	0	0
10	91.5199	25.1244	46.9173	0	0

11	92.159	24.7749	51.0725	0	0
12	92.7981	24.4397	54.4865	0	0
13	93.4372	24.1185	57.1882	0	0
14	94.0763	23.8108	59.2139	0	0
15	94.7154	23.5164	60.6066	0	0
16	95.3545	23.235	61.4161	0	0
17	95.9936	22.9662	61.6987	0	0
18	96.6327	22.7098	61.5166	0	0
19	97.2718	22.4656	60.9384	0	0
20	97.911	22.2333	60.0383	0	0
21	98.5501	22.0128	58.8964	0	0
22	99.1892	21.8037	57.5343	0	0
23	99.8283	21.606	55.6936	0	0
24	100.467	21.4195	53.2849	0	0
25	101.107	21.244	50.3189	0	0
26	101.746	21.0794	47.2668	0	0
27	102.385	20.9256	44.3248	0	0
28	103.024	20.7823	41.6129	0	0
29	103.663	20.6496	39.2565	0	0
30	104.302	20.5273	37.3869	0	0
31	104.941	20.4152	36.1414	0	0
32	105.58	20.3135	35.6636	0	0
33	105.603	20.31	35.6627	0	0
34	106.22	20.2217	35.4913	0	0
35	106.837	20.1429	34.9974	0	0
36	107.454	20.0733	34.1917	0	0
37	108.071	20.0131	33.0912	0	0
38	108.688	19.9622	31.7196	0	0
39	109.305	19.9204	30.1037	0	0
40	109.922	19.8879	28.2759	0	0
41	110.539	19.8646	26.2739	0	0
42	111.156	19.8504	24.1415	0	0
43	111.773	19.8453	21.9278	0	0
44	112.39	19.8494	19.6885	0	0
45	113.007	19.8627	17.4851	0	0
46	113.624	19.8851	15.3858	0	0
47	114.241	19.9167	13.4655	0	0
48	114.858	19.9575	11.8062	0	0
49	115.475	20.0075	10.4972	0	0
50	116.092	20.0667	9.63551	0	0
51	116.709	20.1353	0	0	0

List Of Coordinates

Water Table

X	Y
-3.6e-015	6.9855
143.903	6.9855

Distributed Load

X	Y
75.003	29.0006
75.103	28.9406
89.1041	28.5366

Distributed Load

X	Y
57.7857	29.0229
57.7912	29.0196
67.5405	29.0542

External Boundary

X	Y
143.903	0
143.903	3.06401
143.903	13.5596
143.903	19.0686
120.803	19.9849
119.698	20.1028
119.536	20.0894
107.581	20.2834
106.103	20.3056
105.603	20.3131
100.804	23.5126
98.8041	23.5126
91.3041	28.5126
89.2041	28.5966
89.1041	28.5366
75.103	28.9406
75.003	29.0006
73.853	28.9548
67.6405	29.1142
67.5405	29.0542
57.7912	29.0196
57.6912	29.0796
55.5912	28.9956
50.5005	25.6022
35.3569	24.2398
32.3443	24.2728
5.46808	24.6765
0	24.9817
0	22.2461
0	0

Material Boundary

X	Y
57.7912	29.0196
57.7912	28.8196
67.5405	28.8542
67.5405	29.0542

Material Boundary

X	Y
75.103	28.9406
75.103	28.7406
89.1041	28.4366
89.1041	28.5366

Material Boundary

X	Y
73.8444	26.3961
78.4385	23.7451
78.8697	23.4689
80.4696	22.5654
80.7482	22.3482
81.3413	21.8856
81.7457	21.8244
81.9126	21.9049
82.3884	21.6613
92.4226	20.5311
92.5112	20.5201
92.8187	20.5188
93.1975	20.4996
94.1551	20.4847
105.603	20.3131
105.603	20.0131
94.1551	20.1847
93.1975	20.1996
92.8187	20.2188
92.4479	20.2279
82.3884	21.3613
81.9126	21.6049
81.7457	21.5244
81.3413	21.5856
80.4696	22.2654
79.4255	22.855
78.8697	23.1689
78.4385	23.4451
73.853	26.0911
72.9787	26.5977
71.737	26.9164
71.2803	27.0278
71.0978	27.0334
71.0251	27.0406
65.77	27.22
61.1138	27.3668
60.5301	27.3653
58.697	26.9928
58.5006	26.9529
57.899	26.7962
54.6181	25.6714

50.5005	25.3018
50.5005	25.6022
54.6181	25.9714
56.1683	26.5029
57.899	27.0962
58.5006	27.2529
58.6459	27.2824
60.4337	27.6457
60.5301	27.6653
61.1138	27.6668
65.0812	27.5418
65.77	27.52
71.0251	27.3406
71.0978	27.3334
71.2803	27.3278
71.737	27.2164
72.9787	26.8977
73.8444	26.3961

Material Boundary

X	Y
58.697	26.9928
58.953	26.6927
64.5375	26.0444
67.3454	25.7315
73.1091	22.2444
78.8439	21.6491
79.4113	21.6479

79.4255	22.855

Material Boundary

X	Y
0	22.2461
3.59914	21.6406
33.1241	21.1952
48.4327	20.156
59.1338	19.8591
66.7198	19.2015
70.6772	18.4988
75.9638	17.56
82.178	16.8418
99.2189	15.2521
141.928	13.682
143.903	13.5596

Material Boundary

X	Y
70.6772	18.4988
74.7639	16.2896
83.9188	12.0641
89.8035	9.96865
96.3699	8.26577
143.903	3.06401

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.16 > 1.1$ (sisma verso l'alto ↑)

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 3760 sismica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal):	0.112
Seismic Load Coefficient (Vertical):	-0.056

- 2 Distributed Loads present

Distributed Load 1	
Distribution:	Constant
Magnitude [kPa]:	4
Orientation:	Vertical

Distributed Load 2	
Distribution:	Constant
Magnitude [kPa]:	4
Orientation:	Vertical

Material Properties

Property	Rilevato	a-GG	Piattaforma stradale	Scotico+bonifica	Qa	Rilevato esistente	Qc(a)
Color							
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	20	18	18	18	18.5	18
Cohesion [kPa]	0	0	0	0	12	0	0
Friction Angle [deg]	29.3	34	29.3	29.3	18	28	34
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	0	1	1

Global Minimums

Method: bishop simplified

FS	1.158980
Center:	113.256, 63.867
Radius:	44.226
Left Slip Surface Endpoint:	86.556, 28.610
Right Slip Surface Endpoint:	119.544, 20.090
Resisting Moment:	16202.6 kN-m
Driving Moment:	13980.1 kN-m
Total Slice Area:	39.3831 m2
Surface Horizontal Width:	32.9883 m
Surface Average Height:	1.19385 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1655
Number of Invalid Surfaces:	0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.15898**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.161477	0.170106	-37.0061	Piattaforma stradale	0	29.3	1.77251	2.0543	3.66072	0	3.66072	4.99067	4.99067
2	0.673355	4.30214	-36.3337	Rilevato	0	29.3	3.58266	4.15223	7.39919	0	7.39919	10.0342	10.0342
3	0.673355	9.95263	-35.2581	Rilevato	0	29.3	6.47735	7.50712	13.3775	0	13.3775	17.9566	17.9566
4	0.673355	15.3747	-34.1965	Rilevato	0	29.3	9.31181	10.7922	19.2314	0	19.2314	25.5589	25.5589
5	0.673355	20.8631	-33.1482	Rilevato	0	29.3	11.563	13.4013	23.8808	0	23.8808	31.4325	31.4325
6	0.673355	26.2565	-32.1123	Rilevato	0	29.3	13.6708	15.8442	28.2339	0	28.2339	36.8137	36.8137
7	0.673355	30.9515	-31.088	Rilevato	0	29.3	16.2641	18.8498	33.5899	0	33.5899	43.3964	43.3964
8	0.673355	35.3583	-30.0746	Rilevato	0	29.3	18.7473	21.7278	38.7185	0	38.7185	49.5749	49.5749
9	0.673355	36.2356	-29.0715	Rilevato	0	29.3	19.3821	22.4635	40.0294	0	40.0294	50.8047	50.8047
10	0.673355	35.2402	-28.0781	Rilevato	0	29.3	19.0127	22.0353	39.2665	0	39.2665	49.409	49.409
11	0.673355	34.0638	-27.0938	Rilevato	0	29.3	18.5339	21.4804	38.2778	0	38.2778	47.7595	47.7595
12	0.673355	32.7112	-26.1181	Rilevato	0	29.3	17.9463	20.7994	37.0641	0	37.0641	45.8629	45.8629
13	0.673355	31.187	-25.1505	Rilevato	0	29.3	17.2503	19.9927	35.6265	0	35.6265	43.7257	43.7257
14	0.673355	29.4951	-24.1904	Rilevato	0	29.3	16.446	19.0606	33.9657	0	33.9657	41.3535	41.3535
15	0.673355	27.6395	-23.2376	Rilevato	0	29.3	15.5339	18.0035	32.0818	0	32.0818	38.7517	38.7517
16	0.673355	25.6236	-22.2915	Rilevato	0	29.3	14.5139	16.8213	29.9752	0	29.9752	35.9253	35.9253
17	0.673355	23.4509	-21.3517	Rilevato	0	29.3	13.3861	15.5142	27.6459	0	27.6459	32.8789	32.8789
18	0.673355	21.1243	-20.418	Rilevato	0	29.3	12.1503	14.082	25.0938	0	25.0938	29.6168	29.6168
19	0.673355	18.6533	-19.4899	Rilevato	0	29.3	10.8104	12.529	22.3265	0	22.3265	26.1525	26.1525
20	0.673355	19.0112	-18.5671	Rilevato	0	29.3	11.1005	12.8652	22.9254	0	22.9254	26.654	26.654
21	0.673355	21.6802	-17.6492	Rilevato	0	29.3	12.7529	14.7804	26.3384	0	26.3384	30.3959	30.3959
22	0.673355	24.1884	-16.736	Rilevato	0	29.3	14.3334	16.6121	29.6024	0	29.6024	33.9125	33.9125
23	0.673355	23.4368	-15.8272	Rilevato	0	29.3	13.9898	16.2139	28.8928	0	28.8928	32.8586	32.8586
24	0.673355	20.2402	-14.9224	Rilevato	0	29.3	12.1697	14.1044	25.1337	0	25.1337	28.377	28.377

25	0.673355	16.9059	-14.0215	Rilevato	0	29.3	10.2385	11.8662	21.1452	0	21.1452	23.7021	23.7021
26	0.673355	13.4354	-13.124	Rilevato	0	29.3	8.19538	9.49828	16.9258	0	16.9258	18.8365	18.8365
27	0.673355	9.83046	-12.2298	Rilevato	0	29.3	6.03947	6.99962	12.4732	0	12.4732	13.7823	13.7823
28	0.673355	6.09234	-11.3387	Rilevato	0	29.3	3.76971	4.36902	7.7855	0	7.7855	8.54141	8.54141
29	0.673355	2.22236	-10.4503	Rilevato	0	29.3	1.38494	1.60512	2.86028	0	2.86028	3.11572	3.11572
30	0.0322294	0.00759821	-9.98554	Scotico+ bonifica	0	29.3	0.0992977	0.115084	0.205077	0	0.205077	0.22256	0.22256
31	0.697034	0.813165	-9.50653	a-GG	0	34	0.584032	0.676881	1.00352	0	1.00352	1.10132	1.10132
32	0.697034	2.21483	-8.59209	a-GG	0	34	1.60466	1.85977	2.75722	0	2.75722	2.99968	2.99968
33	0.697034	3.45774	-7.67984	a-GG	0	34	2.52711	2.92887	4.34224	0	4.34224	4.68301	4.68301
34	0.697034	4.536	-6.76955	a-GG	0	34	3.34429	3.87596	5.74635	0	5.74635	6.14333	6.14333
35	0.697034	5.45382	-5.86098	a-GG	0	34	4.0564	4.70129	6.96995	0	6.96995	7.38634	7.38634
36	0.697034	6.21604	-4.95388	a-GG	0	34	4.66422	5.40574	8.01434	0	8.01434	8.41862	8.41862
37	0.697034	6.82336	-4.04802	a-GG	0	34	5.16543	5.98663	8.87555	0	8.87555	9.2411	9.2411
38	0.697034	7.27635	-3.14318	a-GG	0	34	5.55759	6.44114	9.54938	0	9.54938	9.85457	9.85457
39	0.697034	7.57548	-2.23912	a-GG	0	34	5.83811	6.76625	10.0314	0	10.0314	10.2596	10.2596
40	0.697034	7.72108	-1.33562	a-GG	0	34	6.00422	6.95877	10.3168	0	10.3168	10.4568	10.4568
41	0.697034	7.71338	-0.432453	a-GG	0	34	6.05301	7.01532	10.4006	0	10.4006	10.4463	10.4463
42	0.697034	7.5525	0.470608	a-GG	0	34	5.98136	6.93228	10.2775	0	10.2775	10.2284	10.2284
43	0.697034	7.23842	1.37379	a-GG	0	34	5.78595	6.70058	9.94176	0	9.94176	9.80301	9.80301
44	0.697034	6.77105	2.27731	a-GG	0	34	5.46323	6.33178	9.38726	0	9.38726	9.17	9.17
45	0.697034	6.15013	3.18139	a-GG	0	34	5.00943	5.80583	8.6075	0	8.6075	8.32906	8.32906
46	0.697034	5.37533	4.08627	a-GG	0	34	4.42048	5.12325	7.59554	0	7.59554	7.27974	7.27974
47	0.697034	4.44619	4.99218	a-GG	0	34	3.69204	4.279	6.34388	0	6.34388	6.02138	6.02138
48	0.697034	3.36211	5.89933	a-GG	0	34	2.81945	3.26769	4.84454	0	4.84454	4.55321	4.55321
49	0.697034	2.1224	6.80798	a-GG	0	34	1.7977	2.0835	3.08892	0	3.08892	2.8743	2.8743
50	0.697034	0.726298	7.71835	a-GG	0	34	0.621456	0.720255	1.06782	0	1.06782	0.983595	0.983595

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.15898**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	86.5556	28.6101	0	0	0
2	86.7171	28.4884	0.1785	0	0
3	87.3905	27.9932	1.91336	0	0
4	88.0638	27.5172	5.03642	0	0
5	88.7372	27.0596	9.29039	0	0
6	89.4105	26.6198	14.3464	0	0
7	90.0839	26.1973	20.0174	0	0
8	90.7572	25.7912	26.1749	0	0
9	91.4306	25.4013	32.6145	0	0
10	92.104	25.027	38.6125	0	0
11	92.7773	24.6678	43.8676	0	0
12	93.4507	24.3233	48.3943	0	0
13	94.124	23.9931	52.2153	0	0
14	94.7974	23.677	55.361	0	0
15	95.4707	23.3745	57.8693	0	0
16	96.1441	23.0854	59.7853	0	0
17	96.8174	22.8093	61.161	0	0
18	97.4908	22.5461	62.0552	0	0
19	98.1641	22.2955	62.5332	0	0
20	98.8375	22.0571	62.6671	0	0
21	99.5109	21.831	62.5104	0	0
22	100.184	21.6167	61.9977	0	0
23	100.858	21.4143	61.0535	0	0
24	101.531	21.2234	59.7777	0	0
25	102.204	21.0439	58.3639	0	0
26	102.878	20.8758	56.922	0	0
27	103.551	20.7188	55.568	0	0
28	104.224	20.5728	54.4246	0	0
29	104.898	20.4378	53.6209	0	0
30	105.571	20.3136	53.2929	0	0
31	105.603	20.3079	53.2917	0	0
32	106.3	20.1912	53.093	0	0
33	106.997	20.0859	52.5134	0	0
34	107.694	19.9919	51.5481	0	0
35	108.391	19.9092	50.2016	0	0
36	109.088	19.8376	48.4849	0	0
37	109.785	19.7772	46.4156	0	0
38	110.483	19.7279	44.0188	0	0
39	111.18	19.6896	41.3271	0	0
40	111.877	19.6623	38.3814	0	0
41	112.574	19.6461	35.2305	0	0
42	113.271	19.6408	31.9318	0	0
43	113.968	19.6465	28.5515	0	0
44	114.665	19.6633	25.1648	0	0

45	115.362	19.691	21.8566	0	0
46	116.059	19.7297	18.7217	0	0
47	116.756	19.7795	15.8656	0	0
48	117.453	19.8404	13.405	0	0
49	118.15	19.9124	11.4683	0	0
50	118.847	19.9956	10.1964	0	0
51	119.544	20.0901	0	0	0

List Of Coordinates

Water Table

X	Y
-3.6e-015	6.9855
143.903	6.9855

Distributed Load

X	Y
75.003	29.0006
75.103	28.9406
89.1041	28.5366

Distributed Load

X	Y
57.7857	29.0229
57.7912	29.0196
67.5405	29.0542

External Boundary

X	Y
143.903	0
143.903	3.06401
143.903	13.5596
143.903	19.0686
120.803	19.9849
119.698	20.1028
119.536	20.0894
107.581	20.2834
106.103	20.3056
105.603	20.3131
100.804	23.5126
98.8041	23.5126
91.3041	28.5126
89.2041	28.5966
89.1041	28.5366
75.103	28.9406
75.003	29.0006
73.853	28.9548
67.6405	29.1142
67.5405	29.0542
57.7912	29.0196
57.6912	29.0796
55.5912	28.9956
50.5005	25.6022
35.3569	24.2398
32.3443	24.2728
5.46808	24.6765
0	24.9817
0	22.2461
0	0

Material Boundary

X	Y
57.7912	29.0196
57.7912	28.8196
67.5405	28.8542
67.5405	29.0542

Material Boundary

X	Y
75.103	28.9406
75.103	28.7406
89.1041	28.4366
89.1041	28.5366

Material Boundary

X	Y
73.8444	26.3961
78.4385	23.7451
78.8697	23.4689
80.4696	22.5654
80.7482	22.3482
81.3413	21.8856
81.7457	21.8244
81.9126	21.9049
82.3884	21.6613
92.4226	20.5311
92.5112	20.5201
92.8187	20.5188

93.1975	20.4996
94.1551	20.4847
105.603	20.3131
105.603	20.0131
94.1551	20.1847
93.1975	20.1996
92.8187	20.2188
92.4479	20.2279
82.3884	21.3613
81.9126	21.6049
81.7457	21.5244
81.3413	21.5856
80.4696	22.2654
79.4255	22.855
78.8697	23.1689
78.4385	23.4451
73.853	26.0911
72.9787	26.5977
71.737	26.9164
71.2803	27.0278
71.0978	27.0334
71.0251	27.0406
65.77	27.22
61.1138	27.3668
60.5301	27.3653
58.697	26.9928
58.5006	26.9529
57.899	26.7962
54.6181	25.6714
50.5005	25.3018
50.5005	25.6022
54.6181	25.9714
56.1683	26.5029
57.899	27.0962
58.5006	27.2529
58.6459	27.2824
60.4337	27.6457
60.5301	27.6653
61.1138	27.6668
65.0812	27.5418
65.77	27.52

71.0251	27.3406
71.0978	27.3334
71.2803	27.3278
71.737	27.2164
72.9787	26.8977
73.8444	26.3961

Material Boundary

X	Y
58.697	26.9928
58.953	26.6927
64.5375	26.0444
67.3454	25.7315
73.1091	22.2444
78.8439	21.6491
79.4113	21.6479
79.4255	22.855

Material Boundary

X	Y
0	22.2461
3.59914	21.6406
33.1241	21.1952
48.4327	20.156
59.1338	19.8591
66.7198	19.2015
70.6772	18.4988
75.9638	17.56
82.178	16.8418
99.2189	15.2521
141.928	13.682
143.903	13.5596

Material Boundary

X	Y
70.6772	18.4988
74.7639	16.2896
83.9188	12.0641
89.8035	9.96865
96.3699	8.26577
143.903	3.06401

Sezione 423 – prg 7+160

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.38 > 1.1$

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 7160 statica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10

Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

- 2 Distributed Loads present

Distributed Load 1	
Distribution:	Constant
Magnitude [kPa]:	26
Orientation:	Vertical

Distributed Load 2	
Distribution:	Constant
Magnitude [kPa]:	26
Orientation:	Vertical

Material Properties

Property	Rilevato	a-GF	a-GG	Piattaforma stradale	Scotico+bonifica	Qa
Color						
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	20	18	18	18
Cohesion [kPa]	0	8	0	0	0	12
Friction Angle [deg]	29.3	20	34	29.3	29.3	18
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1	1

Global Minimums

Method: bishop simplified

FS	1.376770
Center:	29.274, 39.799
Radius:	17.631
Left Slip Surface Endpoint:	26.148, 22.448

Right Slip Surface Endpoint:	42.179, 27.787
Resisting Moment:	4686.71 kN-m
Driving Moment:	3404.14 kN-m
Total Slice Area:	23.6844 m2
Surface Horizontal Width:	16.0311 m
Surface Average Height:	1.4774 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1686
Number of Invalid Surfaces:	0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.37677**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.336379	0.17253	-9.65843	a-GF	8	20	6.22573	8.57141	1.56992	0	1.56992	0.510387	0.510387
2	0.336379	0.497404	-8.55125	a-GF	8	20	6.45771	8.89078	2.44741	0	2.44741	1.47639	1.47639
3	0.336379	0.782084	-7.44729	a-GF	8	20	6.65477	9.16209	3.19283	0	3.19283	2.32294	2.32294
4	0.336379	1.02689	-6.34609	a-GF	8	20	6.81773	9.38644	3.80921	0	3.80921	3.05097	3.05097
5	0.336379	1.23211	-5.24725	a-GF	8	20	6.94731	9.56485	4.29938	0	4.29938	3.66135	3.66135
6	0.336379	1.39797	-4.15034	a-GF	8	20	7.0442	9.69824	4.46587	0	4.66587	4.15472	4.15472
7	0.336379	1.52465	-3.05495	a-GF	8	20	7.10901	9.78747	4.91106	0	4.91106	4.53165	4.53165
8	0.331714	2.25059	-1.96826	Scotico+bonifica	0	29.3	2.80467	3.86138	6.8809	0	6.88809	6.78452	6.78452
9	0.331714	3.55315	-0.889865	Scotico+bonifica	0	29.3	4.39377	6.04921	10.7795	0	10.7795	10.7113	10.7113
10	0.331714	3.87118	0.188214	Scotico+bonifica	0	29.3	4.75046	6.54029	11.6547	0	11.6547	11.6703	11.6703
11	0.331714	3.84604	1.26636	Scotico+bonifica	0	29.3	4.64838	6.44852	11.4911	0	11.4911	11.5947	11.5947
12	0.331714	3.78359	2.34496	Scotico+bonifica	0	29.3	4.57303	6.29601	11.2194	0	11.2194	11.4066	11.4066
13	0.331714	3.68378	3.42438	Scotico+bonifica	0	29.3	4.41901	6.08396	10.8415	0	10.8415	11.1059	11.1059
14	0.331714	3.5465	4.50503	Scotico+bonifica	0	29.3	4.22256	5.81349	10.3595	0	10.3595	10.6922	10.6922
15	0.331714	3.42712	5.58728	Scotico+bonifica	0	29.3	4.05005	5.57599	9.93628	0	9.93628	10.3325	10.3325

16	0.331714	4.20204	6.67154	Scotico+bonifica	0	29.3	4.92892	6.78599	12.20925	0	12.0925	12.669	12.669
17	0.331714	5.27169	7.75821	Scotico+bonifica	0	29.3	6.13769	8.45019	15.20581	0	15.0581	15.8943	15.8943
18	0.331714	6.30303	8.84769	Scotico+bonifica	0	29.3	7.28393	10.20283	17.28703	0	17.8703	19.0041	19.0041
19	0.317591	6.96565	9.91707	Rilevato	0	29.3	8.34649	11.24912	20.20477	0	20.477	21.9363	21.9363
20	0.317591	7.8414	10.9666	Rilevato	0	29.3	9.32872	12.28435	22.28869	0	22.8869	24.6945	24.6945
21	0.317591	8.68257	12.0199	Rilevato	0	29.3	10.32555	14.21194	25.21605	0	25.1605	27.3441	27.3441
22	0.317591	9.48879	13.0773	Rilevato	0	29.3	11.31271	15.23194	27.22988	0	27.2988	29.8836	29.8836
23	0.317591	10.2596	14.1393	Rilevato	0	29.3	11.39439	16.24444	29.23028	0	29.3028	32.3116	32.3116
24	0.317591	10.9946	15.2062	Rilevato	0	29.3	12.47063	17.24936	31.21731	0	31.1731	34.6268	34.6268
25	0.317591	11.6931	16.2786	Rilevato	0	29.3	13.44143	18.24684	32.29102	0	32.9102	36.8274	36.8274
26	0.317591	12.3546	17.3569	Rilevato	0	29.3	14.40681	19.23686	34.25144	0	34.5144	38.9115	38.9115
27	0.317591	12.9786	18.4416	Rilevato	0	29.3	14.4668	20.21945	35.2986	0	35.986	40.8773	40.8773
28	0.317591	13.5642	19.5331	Rilevato	0	29.3	15.42137	20.29458	37.23251	0	37.3251	42.7225	42.7225
29	0.317591	14.1107	20.6321	Rilevato	0	29.3	15.47054	21.26227	38.25312	0	38.5312	44.4445	44.4445
30	0.317591	14.6173	21.7391	Rilevato	0	29.3	16.41427	22.22248	39.20604	0	39.604	46.0408	46.0408
31	0.317591	15.0831	22.8547	Rilevato	0	29.3	16.45256	22.27519	40.25434	0	40.5434	47.5087	47.5087
32	0.317591	15.5071	23.9796	Rilevato	0	29.3	16.48537	23.22037	41.23486	0	41.3486	48.8452	48.8452
33	0.317591	15.8881	25.1143	Rilevato	0	29.3	17.41267	23.25795	42.20183	0	42.0183	50.0463	50.0463
34	0.317591	16.2251	26.2597	Rilevato	0	29.3	17.43441	23.28789	42.25517	0	42.5517	51.1086	51.1086
35	0.317591	16.5168	27.4165	Rilevato	0	29.3	17.45055	24.21011	42.29477	0	42.9477	52.0281	52.0281
36	0.317591	16.7616	28.5855	Rilevato	0	29.3	17.46103	24.22453	43.22045	0	43.2045	52.8002	52.8002
37	0.317591	16.9582	29.7677	Rilevato	0	29.3	17.46576	24.23105	43.23207	0	43.3207	53.4202	53.4202
38	0.317591	17.1046	30.9641	Rilevato	0	29.3	17.46469	24.22957	43.22943	0	43.2943	53.8825	53.8825
39	0.317591	16.8157	32.1756	Rilevato	0	29.3	17.41852	23.2266	42.21616	0	42.1616	52.9734	52.9734
40	0.317591	15.7368	33.4034	Rilevato	0	29.3	15.49262	21.29267	39.20729	0	39.0729	49.5757	49.5757
41	0.317591	14.5834	34.6489	Rilevato	0	29.3	14.46106	20.21155	35.28455	0	35.8455	45.9431	45.9431
42	0.317591	13.3712	35.9134	Rilevato	0	29.3	13.42568	18.22515	32.25239	0	32.5239	42.1249	42.1249

43	0.317591	12.0974	37.1985	Rilevato	0	29.3	11.8643	16.3344	29.1076	0	29.1076	38.1126	38.1126
44	0.317591	10.7588	38.5058	Rilevato	0	29.3	10.4328	14.3636	25.5956	0	25.5956	33.896	33.896
45	0.317591	9.35029	39.8373	Rilevato	0	29.3	8.96054	12.3366	21.9836	0	21.9836	29.4591	29.4591
46	0.317591	7.48642	41.1952	Rilevato	0	29.3	15.5543	21.4147	38.1605	0	38.1605	51.775	51.775
47	0.317591	5.75126	42.5819	Rilevato	0	29.3	13.0939	18.0273	32.1244	0	32.1244	44.1572	44.1572
48	0.317591	3.97003	44.0002	Rilevato	0	29.3	11.2738	15.5214	27.6588	0	27.6588	38.5459	38.5459
49	0.317591	2.10077	45.4533	Rilevato	0	29.3	9.41305	12.9596	23.0938	0	23.0938	32.6569	32.6569
50	0.182318	0.328172	46.6203	Piattaforma stradale	0	29.3	7.92783	10.9148	19.445	0	19.45	27.8394	27.8394

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.37677**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	26.1475	22.4481	0	0	0
2	26.4839	22.3909	2.17911	0	0
3	26.8203	22.3403	4.46999	0	0
4	27.1567	22.2963	6.84359	0	0
5	27.4931	22.2589	9.274	0	0
6	27.8294	22.228	11.7382	0	0
7	28.1658	22.2036	14.216	0	0
8	28.5022	22.1857	16.6898	0	0
9	28.8339	22.1743	17.6964	0	0
10	29.1656	22.1691	19.2059	0	0
11	29.4973	22.1702	20.7653	0	0
12	29.8291	22.1775	22.231	0	0
13	30.1608	22.1911	23.592	0	0
14	30.4925	22.211	24.8391	0	0
15	30.8242	22.2371	25.9657	0	0
16	31.1559	22.2696	26.9836	0	0
17	31.4876	22.3084	28.1455	0	0
18	31.8193	22.3535	29.4961	0	0
19	32.1511	22.4052	30.9838	0	0
20	32.4686	22.4607	32.4913	0	0
21	32.7862	22.5222	34.0385	0	0
22	33.1038	22.5899	35.5864	0	0
23	33.4214	22.6636	37.0979	0	0
24	33.739	22.7436	38.5378	0	0
25	34.0566	22.83	39.8726	0	0
26	34.3742	22.9227	41.0706	0	0
27	34.6918	23.022	42.1018	0	0
28	35.0094	23.1279	42.9381	0	0

29	35.327	23.2406	43.5529	0	0
30	35.6446	23.3601	43.9215	0	0
31	35.9621	23.4868	44.0208	0	0
32	36.2797	23.6206	43.8295	0	0
33	36.5973	23.7619	43.3283	0	0
34	36.9149	23.9108	42.4996	0	0
35	37.2325	24.0674	41.3276	0	0
36	37.5501	24.2322	39.7989	0	0
37	37.8677	24.4052	37.9018	0	0
38	38.1853	24.5869	35.6272	0	0
39	38.5029	24.7774	32.9684	0	0
40	38.8205	24.9772	29.989	0	0
41	39.138	25.1867	26.8516	0	0
42	39.4556	25.4062	23.613	0	0
43	39.7732	25.6362	20.3324	0	0
44	40.0908	25.8772	17.075	0	0
45	40.4084	26.1299	13.9131	0	0
46	40.726	26.3949	10.9275	0	0
47	41.0436	26.6729	5.24767	0	0
48	41.3612	26.9647	0.0206752	0	0
49	41.6788	27.2714	-4.89023	0	0
50	41.9964	27.5941	-9.35917	0	0
51	42.1787	27.787	0	0	0

List Of Coordinates

Water Table

X	Y
0	18.2348
103.67	18.2348

Distributed Load

X	Y
40.7597	27.902
40.7597	27.842
50.5	27.4644

Distributed Load

X	Y
53.1697	27.5583
53.1697	27.4983
62.9292	27.1199

External Boundary

X	Y
103.67	0
103.67	14.2508
103.67	17.527
103.67	26.5493
100.112	26.5997
93.2543	26.704
92.8208	27.504
92.5538	27.4958
92.4269	27.1855
92.1499	26.5082
85.3049	23.0785
84.9995	22.9394
84.5432	22.833
84.3706	22.7504
71.7911	22.6547
65.1292	27.0959
63.0292	27.1799
62.9292	27.1799
62.9292	27.1199
53.1697	27.4983
53.1697	27.5583
53.0697	27.5583
51.9197	27.5123
51.75	27.4784
50.6	27.5244
50.5	27.5244
50.5	27.4644

40.7597	27.842
40.7597	27.902
40.6597	27.902
38.5597	27.818
31.0597	22.818
29.0597	22.818
28.5022	22.4463
23.6386	22.4501
18.5151	22.2563
16.5748	22.1807
13.8858	21.9839
13.6601	21.9197
11.0386	21.9537
9.63341	21.9193
8.59589	21.9156
0	21.9083
0	17.5989
0	14.3178
0	0

Material Boundary

X	Y
40.7597	27.842
40.7597	27.642
50.5	27.2644
50.5	27.4644

Material Boundary

X	Y
53.1697	27.4983
53.1697	27.2983
62.9292	26.9199
62.9292	27.1199

Material Boundary

X	Y
0	14.3178
30.1071	14.5124
49.3062	14.2716
52.976	14.2463
62.5141	14.2314
67.3596	14.1792
80.5165	14.1836
103.67	14.2508

Material Boundary

X	Y
0	17.5989
24.2115	17.5953
31.526	17.5865
49.3062	17.5716
51.7927	17.56
52.976	17.5463
71.9611	17.4517
103.67	17.527

Material Boundary

X	Y
28.5022	22.4463
40.5572	22.3104
45.0277	22.3141
46.3401	22.2849
47.3391	22.2977
48.6144	22.2738
50.2533	22.3225
51.9197	22.3086
54.0274	22.2911
58.3869	22.289
61.353	22.5213
61.8641	22.5725
64.077	22.5707
66.3327	22.5711
71.7911	22.6547
71.7911	21.8547
66.3327	21.7711
64.077	21.7707
61.8641	21.7725
61.353	21.7213
58.3869	21.489
51.9197	21.5086
50.2533	21.5225
48.6144	21.4738
47.3391	21.4977
46.3401	21.4849
45.0277	21.5141
40.5572	21.5104
30.043	21.6451
28.5022	21.652
28.5022	22.4463

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.16 > 1.1$ (sisma verso l'alto ↑)

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 7160 sismica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10

Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal):	0.124
Seismic Load Coefficient (Vertical):	-0.062

- 2 Distributed Loads present

Distributed Load 1

Distribution:	Constant
Magnitude [kPa]:	4
Orientation:	Vertical

Distributed Load 2

Distribution:	Constant
Magnitude [kPa]:	4
Orientation:	Vertical

Material Properties

Property	Rilevato	a-GF	a-GG	Piattaforma stradale	Scotico+bonifica	Qa
Color						
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	20	18	18	18
Cohesion [kPa]	0	8	0	0	0	12
Friction Angle [deg]	29.3	20	34	29.3	29.3	18
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1	1

Global Minimums

Method: bishop simplified

FS	**1.159540**
Center:	29.018, 40.483

Radius:	18.420
Left Slip Surface Endpoint:	25.270, 22.449
Right Slip Surface Endpoint:	42.356, 27.780
Resisting Moment:	4582.29 kN-m
Driving Moment:	3951.84 kN-m
Total Slice Area:	25.3208 m2
Surface Horizontal Width:	17.0858 m
Surface Average Height:	1.48198 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1645
Number of Invalid Surfaces:	0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.15954**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.359079	0.228237	-11.1693	a-GF	8	20	7.55444	8.75968	2.08719	0	2.08719	0.595582	0.595582
2	0.359079	0.660887	-10.0329	a-GF	8	20	7.87852	9.13546	3.11966	0	3.11966	1.7258	1.7258
3	0.359079	1.04614	-8.90042	a-GF	8	20	8.15792	9.45944	4.00979	0	4.00979	2.73223	2.73223
4	0.359079	1.38446	-7.77146	a-GF	8	20	8.39392	9.73309	4.76162	0	4.76162	3.61606	3.61606
5	0.359079	1.67625	-6.64554	a-GF	8	20	8.58768	9.95776	5.37888	0	5.37888	4.37834	4.37834
6	0.359079	1.92186	-5.52219	a-GF	8	20	8.74027	10.1347	5.865	0	5.865	5.01999	5.01999
7	0.359079	2.12158	-4.40096	a-GF	8	20	8.85267	10.265	6.22312	0	6.22312	5.54179	5.54179
8	0.359079	2.27565	-3.28142	a-GF	8	20	8.9258	10.3498	6.45608	0	6.45608	5.94432	5.94432
9	0.359079	2.38423	-2.16314	a-GF	8	20	8.96045	10.39	6.56648	0	6.56648	6.22803	6.22803
10	0.335406	2.96129	-1.0825	Scotico+bonifica	0	29.3	4.04495	4.69028	8.35797	0	8.35797	8.28154	8.28154

1 1	0.33 5406	4.25 409	-0.0390 765	Scotico+bonifica	0	29.3	5.7 5962	6.6 7851	11.901	0	11.9 01	11.8 97	11.8 97
1 2	0.33 5406	4.53 301	1.0 0433	Scotico+bonifica	0	29.3	6.0 8365	7.0 5423	12.5705	0	12.5 705	12.6 771	12.6 771
1 3	0.33 5406	4.47 906	2.0 4807	Scotico+bonifica	0	29.3	5.9 5911	6.9 0983	12.3132	0	12.3 132	12.5 263	12.5 263
1 4	0.33 5406	4.38 815	3.0 9249	Scotico+bonifica	0	29.3	5.7 879	6.7 113	11.9594	0	11.9 594	12.2 721	12.2 721
1 5	0.33 5406	4.26 02	4.1 3795	Scotico+bonifica	0	29.3	5.5 7102	6.4 5982	11.5113	0	11.5 113	11.9 143	11.9 143
1 6	0.33 5406	4.09 508	5.1 8478	Scotico+bonifica	0	29.3	5.3 0945	6.1 5652	10.9708	0	10.9 708	11.4 526	11.4 526
1 7	0.33 5406	3.98 748	6.2 3335	Scotico+bonifica	0	29.3	5.1 2603	5.9 4384	10.5918	0	10.5 918	11.1 517	11.1 517
1 8	0.33 5406	4.83 368	7.2 8403	Scotico+bonifica	0	29.3	6.1 612	7.1 4416	12.7307	0	12.7 307	13.5 183	13.5 183
1 9	0.33 5406	5.90 586	8.3 3717	Scotico+bonifica	0	29.3	7.4 6416	8.6 5499	15.423	0	15.4 23	16.5 169	16.5 169
2 0	0.33 5406	6.93 995	9.3 9316	Scotico+bonifica	0	29.3	8.6 9698	10.0845	17.9703	0	17.9 703	19.4 09	19.4 09
2 1	0.33 5406	7.93 565	10.4524	Scotico+bonifica	0	29.3	9.8 6055	11.4337	20.3746	0	20.3 746	22.1 937	22.1 937
2 2	0.34 439	9.14 337	11.5295	Rilevato	0	29.3	10.9698	12.7199	22.6666	0	22.6 666	24.9 044	24.9 044
2 3	0.34 439	10.1 098	12.6251	Rilevato	0	29.3	12.0234	13.9416	24.8437	0	24.8 437	27.5 367	27.5 367
2 4	0.34 439	11.0 332	13.7254	Rilevato	0	29.3	13.0066	15.0817	26.8753	0	26.8 753	30.0 521	30.0 521
2 5	0.34 439	11.9 131	14.8309	Rilevato	0	29.3	13.9202	16.141	28.7628	0	28.7 628	32.4 487	32.4 487
2 6	0.34 439	12.7 488	15.942	Rilevato	0	29.3	14.7646	17.1201	30.5077	0	30.5 077	34.7 252	34.7 252
2 7	0.34 439	13.5 396	17.0594	Rilevato	0	29.3	15.5403	18.0196	32.1105	0	32.1 105	36.8 793	36.8 793
2 8	0.34 439	14.2 847	18.1835	Rilevato	0	29.3	16.2476	18.8398	33.5721	0	33.5 721	38.9 088	38.9 088
2 9	0.34 439	14.9 832	19.3148	Rilevato	0	29.3	16.8869	19.581	34.893	0	34.8 93	40.8 116	40.8 116
3 0	0.34 439	15.6 342	20.4541	Rilevato	0	29.3	17.4582	20.2435	36.0735	0	36.0 735	42.5 849	42.5 849
3 1	0.34 439	16.2 367	21.6019	Rilevato	0	29.3	17.9617	20.8273	37.1139	0	37.1 139	44.2 261	44.2 261
3 2	0.34 439	16.7 894	22.7589	Rilevato	0	29.3	18.3973	21.3324	38.014	0	38.0 14	45.7 32	45.7 32
3 3	0.34 439	17.2 913	23.9257	Rilevato	0	29.3	18.7649	21.7587	38.7736	0	38.7 736	47.0 991	47.0 991
3 4	0.34 439	17.7 408	25.1032	Rilevato	0	29.3	19.0643	22.1058	39.3921	0	39.3 921	48.3 238	48.3 238
3 5	0.34 439	18.1 366	26.2922	Rilevato	0	29.3	19.2951	22.3734	39.8689	0	39.8 689	49.4 018	49.4 018
3 6	0.34 439	18.4 77	27.4935	Rilevato	0	29.3	19.4569	22.5611	40.2034	0	40.2 034	50.3 292	50.3 292
3 7	0.34 439	18.7 601	28.708	Rilevato	0	29.3	19.5492	22.6681	40.3942	0	40.3 942	51.1 006	51.1 006

38	0.34439	18.984	29.9368	Rilevato	0	29.3	19.5714	22.6938	40.4399	0	40.4399	51.7107	51.7107
39	0.34439	18.905	31.181	Rilevato	0	29.3	19.3635	22.4527	40.0101	0	40.0101	51.7283	51.7283
40	0.34439	17.9301	32.4418	Rilevato	0	29.3	18.0761	20.96	37.3502	0	37.3502	48.8402	48.8402
41	0.34439	16.6245	33.7205	Rilevato	0	29.3	16.5651	19.2079	34.2281	0	34.2281	45.2842	45.2842
42	0.34439	15.2495	35.0185	Rilevato	0	29.3	15.0124	17.4075	31.0199	0	31.0199	41.5389	41.5389
43	0.34439	13.8018	36.3375	Rilevato	0	29.3	13.4181	15.5588	27.7255	0	27.7255	37.5956	37.5956
44	0.34439	12.2776	37.6792	Rilevato	0	29.3	11.7818	13.6615	24.3445	0	24.3445	33.4438	33.4438
45	0.34439	10.6308	39.0457	Rilevato	0	29.3	10.4384	12.1037	21.5686	0	21.5686	30.0352	30.0352
46	0.34439	8.48588	40.4392	Rilevato	0	29.3	9.29205	10.7745	19.1999	0	19.1999	27.119	27.119
47	0.34439	6.53692	41.8622	Rilevato	0	29.3	7.36247	8.53708	15.2129	0	15.2129	21.8101	21.8101
48	0.34439	4.49115	43.3176	Rilevato	0	29.3	5.39593	6.2568	11.1495	0	11.1495	16.2375	16.2375
49	0.34439	2.34152	44.8089	Rilevato	0	29.3	3.32932	3.93455	7.01129	0	7.01129	10.3819	10.3819
50	0.186289	0.33532	45.9808	Piattaforma stradale	0	29.3	1.83554	2.12838	3.79274	0	3.79274	5.69222	5.69222

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.15954**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	25.2705	22.4488	0	0	0
2	25.6296	22.3779	2.83118	0	0
3	25.9886	22.3144	5.77524	0	0
4	26.3477	22.2581	8.79911	0	0
5	26.7068	22.2091	11.8736	0	0
6	27.0659	22.1673	14.9731	0	0
7	27.425	22.1326	18.0756	0	0
8	27.784	22.1049	21.1619	0	0
9	28.1431	22.0844	24.2164	0	0
10	28.5022	22.0708	27.226	0	0
11	28.8376	22.0645	28.2679	0	0
12	29.173	22.0642	29.6741	0	0
13	29.5084	22.0701	31.0777	0	0
14	29.8438	22.0821	32.3725	0	0
15	30.1792	22.1002	33.5521	0	0
16	30.5146	22.1245	34.6123	0	0
17	30.85	22.1549	35.5507	0	0
18	31.1854	22.1916	36.3868	0	0
19	31.5209	22.2344	37.3073	0	0

20	31.8563	22.2836	38.3193	0	0
21	32.1917	22.3391	39.3775	0	0
22	32.5271	22.4009	40.4387	0	0
23	32.8715	22.4712	41.4888	0	0
24	33.2158	22.5483	42.4578	0	0
25	33.5602	22.6324	43.3065	0	0
26	33.9046	22.7236	43.9983	0	0
27	34.249	22.822	44.4989	0	0
28	34.5934	22.9277	44.7762	0	0
29	34.9378	23.0408	44.8004	0	0
30	35.2822	23.1615	44.544	0	0
31	35.6266	23.29	43.9817	0	0
32	35.971	23.4263	43.0905	0	0
33	36.3154	23.5708	41.8496	0	0
34	36.6597	23.7236	40.2408	0	0
35	37.0041	23.885	38.2479	0	0
36	37.3485	24.0551	35.8575	0	0
37	37.6929	24.2343	33.0587	0	0
38	38.0373	24.4229	29.8434	0	0
39	38.3817	24.6213	26.2064	0	0
40	38.7261	24.8297	22.1787	0	0
41	39.0705	25.0486	18.0017	0	0
42	39.4149	25.2784	13.7751	0	0
43	39.7593	25.5198	9.5667	0	0
44	40.1036	25.7731	5.45078	0	0
45	40.448	26.0391	1.50914	0	0
46	40.7924	26.3184	-2.24061	0	0
47	41.1368	26.6119	-5.72939	0	0
48	41.4812	26.9205	-8.70007	0	0
49	41.8256	27.2452	-11.0201	0	0
50	42.17	27.5873	-12.5409	0	0
51	42.3563	27.7801	0	0	0

List Of Coordinates

Water Table

X	Y
0	18.2348
103.67	18.2348

Distributed Load

X	Y
40.7597	27.902
40.7597	27.842
50.5	27.4644

Distributed Load

X	Y
53.1697	27.5583
53.1697	27.4983
62.9292	27.1199

External Boundary

X	Y
103.67	0
103.67	14.2508
103.67	17.527
103.67	26.5493
100.112	26.5997
93.2543	26.704
92.8208	27.504
92.5538	27.4958
92.4269	27.1855

92.1499	26.5082
85.3049	23.0785
84.9995	22.9394
84.5432	22.833
84.3706	22.7504
71.7911	22.6547
65.1292	27.0959
63.0292	27.1799
62.9292	27.1799
62.9292	27.1199
53.1697	27.4983
53.1697	27.5583
53.0697	27.5583
51.9197	27.5123
51.75	27.4784
50.6	27.5244
50.5	27.5244
50.5	27.4644
40.7597	27.842
40.7597	27.902
40.6597	27.902
38.5597	27.818
31.0597	22.818
29.0597	22.818
28.5022	22.4463
23.6386	22.4501
18.5151	22.2563
16.5748	22.1807
13.8858	21.9839
13.6601	21.9197
11.0386	21.9537
9.63341	21.9193
8.59589	21.9156
0	21.9083
0	17.5989
0	14.3178
0	0

Material Boundary

X	Y
40.7597	27.842
40.7597	27.642
50.5	27.2644
50.5	27.4644

Material Boundary

X	Y
53.1697	27.4983
53.1697	27.2983
62.9292	26.9199
62.9292	27.1199

Material Boundary

X	Y
0	14.3178
30.1071	14.5124
49.3062	14.2716
52.976	14.2463
62.5141	14.2314
67.3596	14.1792
80.5165	14.1836
103.67	14.2508

Material Boundary

X	Y
0	17.5989
24.2115	17.5953
31.526	17.5865
49.3062	17.5716
51.7927	17.56
52.976	17.5463
71.9611	17.4517
103.67	17.527

Material Boundary

X	Y
28.5022	22.4463
40.5572	22.3104
45.0277	22.3141
46.3401	22.2849
47.3391	22.2977
48.6144	22.2738
50.2533	22.3225
51.9197	22.3086
54.0274	22.2911
58.3869	22.289
61.353	22.5213
61.8641	22.5725
64.077	22.5707
66.3327	22.5711
71.7911	22.6547
71.7911	21.8547
66.3327	21.7711
64.077	21.7707
61.8641	21.7725
61.353	21.7213

58.3869	21.489
51.9197	21.5086
50.2533	21.5225
48.6144	21.4738
47.3391	21.4977
46.3401	21.4849

45.0277	21.5141
40.5572	21.5104
30.043	21.6451
28.5022	21.652
28.5022	22.4463

Sezione 706 – prg 12+280

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.357 > 1.1$

Slide Analysis Information

Project Summary

- File Name: pk 12280 statica CD.slim

General Settings

- Units of Measurement: Metric Units
- Time Units: days
- Permeability Units: meters/second
- Failure Direction: Left to Right
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Bishop simplified
- Janbu simplified

- Number of slices: 50
- Tolerance: 0.005
- Maximum number of iterations: 75
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 9.81 kN/m3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Auto Refine Search
- Divisions along slope: 10
- Circles per division: 10
- Number of iterations: 10
- Divisions to use in next iteration: 50%
- Composite Surfaces: Disabled
- Minimum Elevation: Not Defined
- Minimum Depth: 3.5

Loading

- 2 Distributed Loads present

Distributed Load 1

- Distribution: Constant
- Magnitude [kN/m2]: 26
- Orientation: Vertical

Distributed Load 2

- Distribution: Constant
- Magnitude [kN/m2]: 26
- Orientation: Vertical

Material Properties

Property	Rilevato	ec	a-GF	a-GG	Piattaforma stradale	Scotico+bonifica	Qa
Color							
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	20	18	20	18	18	18
Cohesion [kPa]	0	0	8	0	0	0	16
Friction Angle [deg]	29.3	18	20	34	29.3	29.3	19.6
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1	1	1

Global Minimums

Method: bishop simplified

- FS: 1.356890
- Center: 68.486, 56.035
- Radius: 19.763
- Left Slip Surface Endpoint: 54.370, 42.203
- Right Slip Surface Endpoint: 73.147, 36.830
- Resisting Moment=6432.93 kN-m
- Driving Moment=4740.92 kN-m

Method: janbu simplified

- FS: 1.289340
- Center: 68.486, 56.035
- Radius: 19.763
- Left Slip Surface Endpoint: 54.370, 42.203
- Right Slip Surface Endpoint: 73.147, 36.830
- Resisting Horizontal Force=288.839 kN
- Driving Horizontal Force=224.02 kN

Valid / Invalid Surfaces

Method: bishop simplified

- Number of Valid Surfaces: 1546
- Number of Invalid Surfaces: 1

Error Codes:

  - Error Code -112 reported for 1 surface

Method: janbu simplified

- Number of Valid Surfaces: 1545
- Number of Invalid Surfaces: 2

Error Codes:

  - Error Code -112 reported for 2 surfaces

Error Codes

The following errors were encountered during the computation:

- -112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.35689**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]
1	0.0949178	0.085426	Piattaforma stradale	0	29.3	7.85067	10.6525	18.9825	0	18.9825
2	0.375978	1.97466	Rilevato	0	29.3	9.20922	12.4959	22.2674	0	22.2674
3	0.375978	4.50646	Rilevato	0	29.3	11.3601	15.4144	27.4682	0	27.4682
4	0.375978	6.91475	Rilevato	0	29.3	13.4625	18.2671	32.5516	0	32.5516
5	0.375978	9.20789	Rilevato	0	29.3	15.5164	21.0541	37.518	0	37.518
6	0.375978	11.3931	Rilevato	0	29.3	17.5224	23.776	42.3684	0	42.3684
7	0.375978	13.4796	Rilevato	0	29.3	18.9681	25.7376	45.8639	0	45.8639
8	0.375978	15.7495	Rilevato	0	29.3	13.3444	18.1069	32.2662	0	32.2662
9	0.375978	17.4762	Rilevato	0	29.3	14.9734	20.3172	36.205	0	36.205
10	0.375978	19.0827	Rilevato	0	29.3	16.5263	22.4244	39.9598	0	39.9598
11	0.375978	20.6064	Rilevato	0	29.3	18.0322	24.4677	43.6008	0	43.6008
12	0.375978	22.0509	Rilevato	0	29.3	19.4913	26.4475	47.1289	0	47.1289
13	0.375978	23.3837	Rilevato	0	29.3	20.8721	28.3212	50.4678	0	50.4678
14	0.375978	23.58	Rilevato	0	29.3	21.2484	28.8317	51.3776	0	51.3776
15	0.375978	23.21	Rilevato	0	29.3	21.1097	28.6435	51.0421	0	51.0421
16	0.375978	22.7717	Rilevato	0	29.3	20.8993	28.3581	50.5336	0	50.5336
17	0.375978	22.2672	Rilevato	0	29.3	20.6182	27.9766	49.8536	0	49.8536
18	0.375978	21.6984	Rilevato	0	29.3	20.2667	27.4997	49.0039	0	49.0039
19	0.375978	21.0671	Rilevato	0	29.3	19.8456	26.9283	47.9858	0	47.9858

20	0.375978	20.3749	Rilevato	0	29.3	19.3552	26.2629	46.7999	0	46.7999
21	0.375978	19.6233	Rilevato	0	29.3	18.7958	25.5039	45.4474	0	45.4474
22	0.375978	18.8135	Rilevato	0	29.3	18.1676	24.6515	43.9284	0	43.9284
23	0.375978	17.9468	Rilevato	0	29.3	17.4708	23.706	42.2436	0	42.2436
24	0.375978	17.0243	Rilevato	0	29.3	16.7053	22.6673	40.3927	0	40.3927
25	0.375978	16.047	Rilevato	0	29.3	15.8711	21.5353	38.3755	0	38.3755
26	0.375978	15.0158	Rilevato	0	29.3	14.9678	20.3097	36.1914	0	36.1914
27	0.375978	13.9315	Rilevato	0	29.3	13.9953	18.9901	33.8399	0	33.8399
28	0.397163	13.4805	Scotico+bonifica	0	29.3	12.9221	17.5339	31.245	0	31.245
29	0.397163	12.1513	Scotico+bonifica	0	29.3	11.743	15.934	28.394	0	28.394
30	0.397163	10.7621	Scotico+bonifica	0	29.3	10.4849	14.2269	25.3521	0	25.3521
31	0.397163	9.31333	Scotico+bonifica	0	29.3	9.14709	12.4116	22.1173	0	22.1173
32	0.397163	7.80568	Scotico+bonifica	0	29.3	7.72848	10.4867	18.6871	0	18.6871
33	0.397163	6.54657	Scotico+bonifica	0	29.3	6.53439	8.86645	15.7998	0	15.7998
34	0.397163	6.63993	Scotico+bonifica	0	29.3	6.6814	9.06593	16.1553	0	16.1553
35	0.397163	6.85102	Scotico+bonifica	0	29.3	6.94997	9.43034	16.8047	0	16.8047
36	0.397163	7.00467	Scotico+bonifica	0	29.3	7.16397	9.72072	17.3221	0	17.3221
37	0.397163	7.10108	Scotico+bonifica	0	29.3	7.32232	9.93558	17.705	0	17.705
38	0.397163	6.87078	Scotico+bonifica	0	29.3	7.14352	9.69297	17.2727	0	17.2727
39	0.378147	5.33936	ec	0	18	3.39396	4.60523	14.1734	0	14.1734
40	0.378147	3.86085	ec	0	18	2.46547	3.34537	10.296	0	10.296
41	0.378147	3.62636	ec	0	18	2.32648	3.15678	9.71558	0	9.71558
42	0.378147	3.48233	ec	0	18	2.24454	3.04559	9.37337	0	9.37337
43	0.378147	3.28311	ec	0	18	2.12613	2.88493	8.8789	0	8.8789
44	0.378147	3.02846	ec	0	18	1.97058	2.67386	8.2293	0	8.2293
45	0.378147	2.71803	ec	0	18	1.77712	2.41136	7.42141	0	7.42141
46	0.378147	2.35144	ec	0	18	1.54494	2.09632	6.45182	0	6.45182

47	0.378147	1.92821	ec	0	18	1.27315	1.72753	5.31677	0	5.31677
48	0.378147	1.44782	ec	0	18	0.960771	1.30366	4.01226	0	4.01226
49	0.378147	0.90965	ec	0	18	0.606727	0.823262	2.53374	0	2.53374
50	0.378147	0.313021	ec	0	18	0.209868	0.284768	0.876424	0	0.876424

- **Global Minimum Query (janbu simplified) - Safety Factor: 1.28934**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]
1	0.0949178	0.085426	Piattaforma stradale	0	29.3	8.13083	10.4834	18.6812	0	18.6812
2	0.375978	1.97466	Rilevato	0	29.3	9.54147	12.3022	21.9222	0	21.9222
3	0.375978	4.50646	Rilevato	0	29.3	11.7766	15.1841	27.0578	0	27.0578
4	0.375978	6.91475	Rilevato	0	29.3	13.9638	18.0041	32.0829	0	32.0829
5	0.375978	9.20789	Rilevato	0	29.3	16.1028	20.762	36.9975	0	36.9975
6	0.375978	11.3931	Rilevato	0	29.3	18.194	23.4582	41.802	0	41.802
7	0.375978	13.4796	Rilevato	0	29.3	19.7047	25.4061	45.273	0	45.273
8	0.375978	15.7495	Rilevato	0	29.3	13.8693	17.8822	31.8659	0	31.8659
9	0.375978	17.4762	Rilevato	0	29.3	15.5696	20.0745	35.7724	0	35.7724
10	0.375978	19.0827	Rilevato	0	29.3	17.1922	22.1666	39.5003	0	39.5003
11	0.375978	20.6064	Rilevato	0	29.3	18.767	24.1971	43.1186	0	43.1186
12	0.375978	22.0509	Rilevato	0	29.3	20.2944	26.1664	46.628	0	46.628
13	0.375978	23.3837	Rilevato	0	29.3	21.7415	28.0322	49.9526	0	49.9526
14	0.375978	23.58	Rilevato	0	29.3	22.1426	28.5494	50.8746	0	50.8746
15	0.375978	23.21	Rilevato	0	29.3	22.0072	28.3748	50.5633	0	50.5633
16	0.375978	22.7717	Rilevato	0	29.3	21.7968	28.1035	50.0799	0	50.0799
17	0.375978	22.2672	Rilevato	0	29.3	21.5122	27.7365	49.4259	0	49.4259
18	0.375978	21.6984	Rilevato	0	29.3	21.154	27.2747	48.603	0	48.603
19	0.375978	21.0671	Rilevato	0	29.3	20.7226	26.7185	47.6118	0	47.6118

20	0.375978	20.3749	Rilevato	0	29.3	20.2185	26.0685	46.4533	0	46.4533
21	0.375978	19.6233	Rilevato	0	29.3	19.6418	25.3249	45.1286	0	45.1286
22	0.375978	18.8135	Rilevato	0	29.3	18.9927	24.488	43.6371	0	43.6371
23	0.375978	17.9468	Rilevato	0	29.3	18.2712	23.5578	41.9795	0	41.9795
24	0.375978	17.0243	Rilevato	0	29.3	17.4774	22.5343	40.1556	0	40.1556
25	0.375978	16.047	Rilevato	0	29.3	16.6109	21.4171	38.1648	0	38.1648
26	0.375978	15.0158	Rilevato	0	29.3	15.6716	20.206	36.0067	0	36.0067
27	0.375978	13.9315	Rilevato	0	29.3	14.6591	18.9005	33.6802	0	33.6802
28	0.397163	13.4805	Scotico+bonifica	0	29.3	13.5403	17.458	31.1097	0	31.1097
29	0.397163	12.1513	Scotico+bonifica	0	29.3	12.3098	15.8715	28.2827	0	28.2827
30	0.397163	10.7621	Scotico+bonifica	0	29.3	10.9955	14.177	25.2632	0	25.2632
31	0.397163	9.31333	Scotico+bonifica	0	29.3	9.59654	12.3732	22.0488	0	22.0488
32	0.397163	7.80568	Scotico+bonifica	0	29.3	8.11159	10.4586	18.637	0	18.637
33	0.397163	6.54657	Scotico+bonifica	0	29.3	6.86117	8.84638	15.7641	0	15.7641
34	0.397163	6.63993	Scotico+bonifica	0	29.3	7.01853	9.04927	16.1256	0	16.1256
35	0.397163	6.85102	Scotico+bonifica	0	29.3	7.30377	9.41704	16.781	0	16.781
36	0.397163	7.00467	Scotico+bonifica	0	29.3	7.53195	9.71124	17.3052	0	17.3052
37	0.397163	7.10108	Scotico+bonifica	0	29.3	7.70183	9.93028	17.6956	0	17.6956
38	0.397163	6.87078	Scotico+bonifica	0	29.3	7.51713	9.69214	17.2712	0	17.2712
39	0.378147	5.33936	ec	0	18	3.57251	4.60618	14.1764	0	14.1764
40	0.378147	3.86085	ec	0	18	2.59584	3.34692	10.3008	0	10.3008
41	0.378147	3.62636	ec	0	18	2.45013	3.15905	9.72255	0	9.72255
42	0.378147	3.48233	ec	0	18	2.36444	3.04857	9.38254	0	9.38254
43	0.378147	3.28311	ec	0	18	2.2403	2.88851	8.88993	0	8.88993
44	0.378147	3.02846	ec	0	18	2.07695	2.67789	8.2417	0	8.2417
45	0.378147	2.71803	ec	0	18	1.87356	2.41565	7.43462	0	7.43462
46	0.378147	2.35144	ec	0	18	1.62923	2.10063	6.46508	0	6.46508

47	0.378147	1.92821	ec	0	18	1.34299	1.73157	5.32923	0	5.32923
48	0.378147	1.44782	ec	0	18	1.01376	1.30708	4.0228	0	4.0228
49	0.378147	0.90965	ec	0	18	0.64038	0.825668	2.54115	0	2.54115
50	0.378147	0.313021	ec	0	18	0.221575	0.285686	0.87925	0	0.87925

List Of Coordinates

Water Table

X	Y
0	29.4354
98.8901	29.4354

Line Load

X	Y
46.7474	41.8982
56.6974	42.2961

Line Load

X	Y
33.7373	41.5465
43.4873	41.9349

External Boundary

X	Y
0	0
98.8901	0
98.8901	27.3396
98.8901	30.8396
98.8901	35.752
98.8901	37.1759
69.1416	36.776
68.3974	37.2721
66.3974	37.2721
58.8974	42.2721
56.7974	42.3561
56.6974	42.2961
46.7474	41.8982
46.6474	41.9582
45.1084	41.9489
43.6765	41.9922
43.5873	41.9949

43.4873	41.9349
33.7373	41.5465
33.6373	41.6065
31.5373	41.5225
24.0373	36.5225
22.0373	36.5225
21.8019	36.3656
8.1564	36.2731
0	35.4748
0	33.8681
0	27.5627
0	24.0627

Material Boundary

X	Y
0	27.5627
11.5992	28.7429
19.5826	29.2206
25.9407	29.1251
33.733	29.1251
39.2373	29.1251
45.4472	29.4728
48.9941	29.699
51.1974	30.0449
55.6926	30.1882
65.6764	30.1669
78.389	30.5798
95.2068	30.8396
98.8901	30.8396

Material Boundary

X	Y
0	24.0627
11.5992	25.2429
19.5826	25.7206
25.9407	25.6251
33.733	25.6251
39.2373	25.6251
45.4472	25.9728
48.9941	25.9894
51.1974	26.0449
55.9454	26.0449
65.6929	26.4086
78.4056	26.6183
95.2068	27.3396
98.8901	27.3396

Material Boundary

X	Y
0	33.8681
1.6808	34.2709
3.17818	34.2997
5.33786	34.2997
7.69911	34.386
9.8695	34.7891
11.7988	34.7891
12.9794	34.8466
14.7072	34.9617
16.147	35.0192
19.0265	35.048
20.6391	35.1343
22.3669	35.1343
24.4977	35.1919
25.9375	35.3358
27.982	35.4221
29.1626	35.4796
32.071	35.3645
35.1367	35.461
39.2373	35.6022
44.1271	35.8043
45.1261	35.9657
46.5344	35.987
47.3493	36.037
48.3049	35.9443
49.4288	35.9443
51.1974	36.0449
58.7536	36.0449
60.432	36.1979
61.4474	36.2904
64.6615	36.2904
66.2778	36.2904
67.4854	36.2904
68.3769	36.268

Material Boundary

X	Y
21.8019	36.3656
24.3592	36.3878
68.6097	36.7714
69.1416	36.776

Material Boundary

X	Y
46.7474	41.8982

46.7474	41.7982
56.6974	42.1961
56.6974	42.2961

Material Boundary

X	Y
33.7373	41.5465
33.7373	41.4465
43.4873	41.8349
43.4873	41.9349

Material Boundary

X	Y
24.3592	36.3878
24.3636	35.8795
60.432	36.1979
68.3769	36.268
68.609	36.2564
68.6097	36.7714

Material Boundary

X	Y
68.609	36.2564
70.5323	36.1604
71.4055	36.0449
73.2633	36.0449
75.1026	36.0449
80.6065	35.7892
84.8609	35.7892
87.4991	35.752
98.8901	35.752

Condizioni sismiche – analisi in tensioni totali: $(R_d / F_d)_{min} = 1.104 > 1.1$

Slide Analysis Information

Project Summary

- File Name: pk 12280 statica CND.slim

General Settings

- Units of Measurement: Metric Units
- Time Units: days
- Permeability Units: meters/second
- Failure Direction: Left to Right
- Data Output: Standard

- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Bishop simplified
- Janbu simplified

- Number of slices: 50
- Tolerance: 0.005
- Maximum number of iterations: 75
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 9.81 kN/m3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Auto Refine Search
- Divisions along slope: 10
- Circles per division: 10
- Number of iterations: 10
- Divisions to use in next iteration: 50%
- Composite Surfaces: Disabled
- Minimum Elevation: Not Defined
- Minimum Depth: 3.5

Loading

- 2 Distributed Loads present

Distributed Load 1

- Distribution: Constant
- Magnitude [kN/m2]: 26
- Orientation: Vertical

Distributed Load 2

- Distribution: Constant
- Magnitude [kN/m2]: 26
- Orientation: Vertical

Material Properties

Property	Rilevato	ec	a-GF	a-GG	Piattaforma stradale	Scotico+bonifica	Qa
Color							
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Undrained	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Undrained
Unit Weight [kN/m3]	18	20	18	20	18	18	18
Cohesion [kPa]	0	0		0	0	0	
Friction Angle [deg]	29.3	18		34	29.3	29.3	
Cohesion Type			71				110
Water Surface	Water Table	Water Table	None	Water Table	Water Table	Water Table	None
Hu Value	1	1		1	1	1	
Ru Value			0				0

Global Minimums

Method: bishop simplified

- FS: 1.458330
- Center: 69.327, 63.947
- Radius: 27.386
- Left Slip Surface Endpoint: 52.763, 42.139
- Right Slip Surface Endpoint: 73.151, 36.830
- Resisting Moment=9756.02 kN-m
- Driving Moment=6689.87 kN-m

Method: janbu simplified

- FS: 1.421530
- Center: 69.327, 63.947
- Radius: 27.386

- Left Slip Surface Endpoint: 52.763, 42.139
- Right Slip Surface Endpoint: 73.151, 36.830
- Resisting Horizontal Force=326.157 kN
- Driving Horizontal Force=229.44 kN

Valid / Invalid Surfaces

Method: bishop simplified

- Number of Valid Surfaces: 1504
- Number of Invalid Surfaces: 2

Error Codes:

- Error Code -112 reported for 2 surfaces

Method: janbu simplified

- Number of Valid Surfaces: 1503
- Number of Invalid Surfaces: 3

Error Codes:

- Error Code -108 reported for 1 surface
- Error Code -112 reported for 2 surfaces

Error Codes

The following errors were encountered during the computation:

- -108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
- -112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.45833**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]

1	0.125789	0.11321	Piattaforma stradale	0	29.3	8.03268	11.7143	20.8746	0	20.8746
2	0.41355	1.9387	Rilevato	0	29.3	9.2152	13.4388	23.9476	0	23.9476
3	0.41355	4.28371	Rilevato	0	29.3	11.0101	16.0563	28.6121	0	28.6121
4	0.41355	6.5432	Rilevato	0	29.3	12.7686	18.6208	33.1818	0	33.1818
5	0.41355	8.72039	Rilevato	0	29.3	14.4908	21.1323	37.6574	0	37.6574
6	0.41355	10.8182	Rilevato	0	29.3	16.1768	23.5911	42.039	0	42.039
7	0.41355	12.8394	Rilevato	0	29.3	17.8269	25.9975	46.3271	0	46.3271
8	0.41355	14.7863	Rilevato	0	29.3	19.4411	28.3516	50.5219	0	50.5219
9	0.41355	16.6614	Rilevato	0	29.3	21.0197	30.6537	54.6244	0	54.6244
10	0.41355	18.4666	Rilevato	0	29.3	22.5629	32.9041	58.6344	0	58.6344
11	0.41355	20.4464	Rilevato	0	29.3	17.6366	25.72	45.8325	0	45.8325
12	0.41355	22.0336	Rilevato	0	29.3	17.245	25.1489	44.8147	0	44.8147
13	0.41355	23.3943	Rilevato	0	29.3	18.4328	26.8811	47.9016	0	47.9016
14	0.41355	24.6921	Rilevato	0	29.3	19.5838	28.5596	50.8924	0	50.8924
15	0.41355	25.9285	Rilevato	0	29.3	20.6979	30.1843	53.7878	0	53.7878
16	0.41355	26.89	Rilevato	0	29.3	21.6027	31.5039	56.1392	0	56.1392
17	0.41355	26.3473	Rilevato	0	29.3	21.3003	31.0628	55.3533	0	55.3533
18	0.41355	25.4779	Rilevato	0	29.3	20.7256	30.2248	53.8599	0	53.8599
19	0.41355	24.5518	Rilevato	0	29.3	20.0952	29.3054	52.2215	0	52.2215
20	0.41355	23.5701	Rilevato	0	29.3	19.4091	28.3048	50.4385	0	50.4385
21	0.41355	22.5336	Rilevato	0	29.3	18.6673	27.2231	48.5112	0	48.5112
22	0.41355	21.4433	Rilevato	0	29.3	17.8701	26.0605	46.4393	0	46.4393
23	0.41355	20.2999	Rilevato	0	29.3	17.0173	24.8169	44.2231	0	44.2231
24	0.41355	19.1042	Rilevato	0	29.3	16.109	23.4922	41.8626	0	41.8626
25	0.41355	17.8567	Rilevato	0	29.3	15.1449	22.0863	39.3572	0	39.3572
26	0.41355	16.5583	Rilevato	0	29.3	14.1251	20.599	36.7069	0	36.7069
27	0.41355	15.2094	Rilevato	0	29.3	13.0492	19.03	33.911	0	33.911

28	0.41355	13.8106	Rilevato	0	29.3	11.9171	17.379	30.9689	0	30.9689
29	0.41355	12.3623	Rilevato	0	29.3	10.7284	15.6455	27.8799	0	27.8799
30	0.41355	10.865	Rilevato	0	29.3	9.48276	13.829	24.6429	0	24.6429
31	0.41355	9.3192	Rilevato	0	29.3	8.17984	11.9289	21.2571	0	21.2571
32	0.41355	7.72515	Rilevato	0	29.3	6.8192	9.94464	17.7211	0	17.7211
33	0.41355	6.08321	Rilevato	0	29.3	5.40029	7.8754	14.0338	0	14.0338
34	0.414415	4.51852	Scotico+bonifica	0	29.3	4.02563	5.87069	10.4614	0	10.4614
35	0.414415	4.38308	Scotico+bonifica	0	29.3	3.92718	5.72712	10.2056	0	10.2056
36	0.414415	4.65229	Scotico+bonifica	0	29.3	4.19214	6.11352	10.8942	0	10.8942
37	0.414415	4.87426	Scotico+bonifica	0	29.3	4.41724	6.4418	11.4792	0	11.4792
38	0.414415	5.04917	Scotico+bonifica	0	29.3	4.60195	6.71116	11.9591	0	11.9591
39	0.414415	4.90745	Scotico+bonifica	0	29.3	4.49848	6.56027	11.6903	0	11.6903
40	0.41284	3.33519	ec	0	18	1.79251	2.61407	8.04528	0	8.04528
41	0.41284	1.85847	ec	0	18	1.00219	1.46152	4.49809	0	4.49809
42	0.41284	1.80357	ec	0	18	0.975842	1.4231	4.37986	0	4.37986
43	0.41284	1.78459	ec	0	18	0.968827	1.41287	4.34837	0	4.34837
44	0.41284	1.71416	ec	0	18	0.933739	1.3617	4.1909	0	4.1909
45	0.41284	1.5922	ec	0	18	0.870263	1.26913	3.90598	0	3.90598
46	0.41284	1.41859	ec	0	18	0.778027	1.13462	3.49199	0	3.49199
47	0.41284	1.1932	ec	0	18	0.656664	0.957633	2.94728	0	2.94728
48	0.41284	0.915817	ec	0	18	0.505761	0.737567	2.27	0	2.27
49	0.41284	0.586232	ec	0	18	0.324881	0.473784	1.45816	0	1.45816
50	0.41284	0.204179	ec	0	18	0.113552	0.165597	0.509657	0	0.509657

- **Global Minimum Query (janbu simplified) - Safety Factor: 1.42153**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]

1	0.125789	0.11321	Piattaforma stradale	0	29.3	8.18745	11.6387	20.7399	0	20.7399
2	0.41355	1.9387	Rilevato	0	29.3	9.39396	13.3538	23.7961	0	23.7961
3	0.41355	4.28371	Rilevato	0	29.3	11.2258	15.9578	28.4366	0	28.4366
4	0.41355	6.5432	Rilevato	0	29.3	13.0212	18.51	32.9845	0	32.9845
5	0.41355	8.72039	Rilevato	0	29.3	14.7802	21.0105	37.4401	0	37.4401
6	0.41355	10.8182	Rilevato	0	29.3	16.5029	23.4593	41.804	0	41.804
7	0.41355	12.8394	Rilevato	0	29.3	18.1894	25.8568	46.0762	0	46.0762
8	0.41355	14.7863	Rilevato	0	29.3	19.84	28.2031	50.2574	0	50.2574
9	0.41355	16.6614	Rilevato	0	29.3	21.4546	30.4984	54.3475	0	54.3475
10	0.41355	18.4666	Rilevato	0	29.3	23.0335	32.7428	58.347	0	58.347
11	0.41355	20.4464	Rilevato	0	29.3	18.0075	25.5982	45.6154	0	45.6154
12	0.41355	22.0336	Rilevato	0	29.3	17.6105	25.0339	44.6099	0	44.6099
13	0.41355	23.3943	Rilevato	0	29.3	18.8265	26.7625	47.6903	0	47.6903
14	0.41355	24.6921	Rilevato	0	29.3	20.0053	28.4382	50.6762	0	50.6762
15	0.41355	25.9285	Rilevato	0	29.3	21.1468	30.0608	53.5676	0	53.5676
16	0.41355	26.89	Rilevato	0	29.3	22.0747	31.3799	55.9183	0	55.9183
17	0.41355	26.3473	Rilevato	0	29.3	21.7691	30.9454	55.144	0	55.144
18	0.41355	25.4779	Rilevato	0	29.3	21.1851	30.1153	53.6648	0	53.6648
19	0.41355	24.5518	Rilevato	0	29.3	20.5439	29.2038	52.0405	0	52.0405
20	0.41355	23.5701	Rilevato	0	29.3	19.8455	28.211	50.2713	0	50.2713
21	0.41355	22.5336	Rilevato	0	29.3	19.0901	27.1371	48.3576	0	48.3576
22	0.41355	21.4433	Rilevato	0	29.3	18.2776	25.9821	46.2996	0	46.2996
23	0.41355	20.2999	Rilevato	0	29.3	17.408	24.746	44.0967	0	44.0967
24	0.41355	19.1042	Rilevato	0	29.3	16.4813	23.4286	41.7494	0	41.7494
25	0.41355	17.8567	Rilevato	0	29.3	15.4973	22.0299	39.2569	0	39.2569
26	0.41355	16.5583	Rilevato	0	29.3	14.4559	20.5495	36.6189	0	36.6189
27	0.41355	15.2094	Rilevato	0	29.3	13.3569	18.9872	33.8347	0	33.8347

28	0.41355	13.8106	Rilevato	0	29.3	12.2	17.3426	30.904	0	30.904
29	0.41355	12.3623	Rilevato	0	29.3	10.9847	15.6151	27.8257	0	27.8257
30	0.41355	10.865	Rilevato	0	29.3	9.7108	13.8042	24.5989	0	24.5989
31	0.41355	9.3192	Rilevato	0	29.3	8.37787	11.9094	21.2223	0	21.2223
32	0.41355	7.72515	Rilevato	0	29.3	6.98536	9.9299	17.6949	0	17.6949
33	0.41355	6.08321	Rilevato	0	29.3	5.53274	7.86495	14.0152	0	14.0152
34	0.414415	4.51852	Scotico+bonifica	0	29.3	4.125	5.86381	10.4492	0	10.4492
35	0.414415	4.38308	Scotico+bonifica	0	29.3	4.02476	5.72132	10.1953	0	10.1953
36	0.414415	4.65229	Scotico+bonifica	0	29.3	4.29699	6.1083	10.8849	0	10.8849
37	0.414415	4.87426	Scotico+bonifica	0	29.3	4.52844	6.43732	11.4712	0	11.4712
38	0.414415	5.04917	Scotico+bonifica	0	29.3	4.71856	6.70758	11.9528	0	11.9528
39	0.414415	4.90745	Scotico+bonifica	0	29.3	4.61323	6.55785	11.686	0	11.686
40	0.41284	3.33519	ec	0	18	1.83869	2.61376	8.04431	0	8.04431
41	0.41284	1.85847	ec	0	18	1.0281	1.46148	4.49799	0	4.49799
42	0.41284	1.80357	ec	0	18	1.00118	1.42321	4.38018	0	4.38018
43	0.41284	1.78459	ec	0	18	0.994077	1.41311	4.34912	0	4.34912
44	0.41284	1.71416	ec	0	18	0.958172	1.36207	4.19204	0	4.19204
45	0.41284	1.5922	ec	0	18	0.893115	1.26959	3.9074	0	3.9074
46	0.41284	1.41859	ec	0	18	0.798541	1.13515	3.49363	0	3.49363
47	0.41284	1.1932	ec	0	18	0.674048	0.95818	2.94897	0	2.94897
48	0.41284	0.915817	ec	0	18	0.519204	0.738064	2.27153	0	2.27153
49	0.41284	0.586232	ec	0	18	0.333551	0.474153	1.45929	0	1.45929
50	0.41284	0.204179	ec	0	18	0.116595	0.165743	0.510106	0	0.510106

List Of Coordinates

Water Table

X	Y
0	29.4354

98.8901	29.4354

Line Load

X	Y
46.7474	41.8982
56.6974	42.2961

Line Load

X	Y
33.7373	41.5465
43.4873	41.9349

External Boundary

X	Y
0	0
98.8901	0
98.8901	27.3396
98.8901	30.8396
98.8901	35.752
98.8901	37.1759
69.1416	36.776
68.3974	37.2721
66.3974	37.2721
58.8974	42.2721
56.7974	42.3561
56.6974	42.2961
46.7474	41.8982
46.6474	41.9582
45.1084	41.9489
43.6765	41.9922
43.5873	41.9949
43.4873	41.9349
33.7373	41.5465
33.6373	41.6065
31.5373	41.5225
24.0373	36.5225
22.0373	36.5225
21.8019	36.3656
8.1564	36.2731
0	35.4748
0	33.8681
0	27.5627
0	24.0627

Material Boundary

X	Y
0	27.5627
11.5992	28.7429
19.5826	29.2206
25.9407	29.1251
33.733	29.1251
39.2373	29.1251
45.4472	29.4728
48.9941	29.699
51.1974	30.0449
55.6926	30.1882
65.6764	30.1669
78.389	30.5798
95.2068	30.8396
98.8901	30.8396

Material Boundary

X	Y
0	24.0627
11.5992	25.2429
19.5826	25.7206
25.9407	25.6251
33.733	25.6251
39.2373	25.6251
45.4472	25.9728
48.9941	25.9894
51.1974	26.0449
55.9454	26.0449
65.6929	26.4086
78.4056	26.6183
95.2068	27.3396
98.8901	27.3396

Material Boundary

X	Y
0	33.8681
1.6808	34.2709
3.17818	34.2997
5.33786	34.2997
7.69911	34.386
9.8695	34.7891
11.7988	34.7891
12.9794	34.8466
14.7072	34.9617
16.147	35.0192
19.0265	35.048
20.6391	35.1343

22.3669	35.1343
24.4977	35.1919
25.9375	35.3358
27.982	35.4221
29.1626	35.4796
32.071	35.3645
35.1367	35.461
39.2373	35.6022
44.1271	35.8043
45.1261	35.9657
46.5344	35.987
47.3493	36.037
48.3049	35.9443
49.4288	35.9443
51.1974	36.0449
58.7536	36.0449
60.432	36.1979
61.4474	36.2904
64.6615	36.2904
66.2778	36.2904
67.4854	36.2904
68.3769	36.268

Material Boundary

X	Y
21.8019	36.3656
24.3592	36.3878
68.6097	36.7714
69.1416	36.776

Material Boundary

X	Y
46.7474	41.8982
46.7474	41.7982
56.6974	42.1961
56.6974	42.2961

Material Boundary

X	Y
33.7373	41.5465
33.7373	41.4465
43.4873	41.8349
43.4873	41.9349

Material Boundary

X	Y
24.3592	36.3878
24.3636	35.8795
60.432	36.1979
68.3769	36.268
68.609	36.2564
68.6097	36.7714

Material Boundary

X	Y
68.609	36.2564
70.5323	36.1604
71.4055	36.0449
73.2633	36.0449
75.1026	36.0449
80.6065	35.7892
84.8609	35.7892
87.4991	35.752
98.8901	35.752

Sezione 771 – prg 13+440

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.25 > 1.1$

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 13440 statica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used

	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

- 2 Distributed Loads present

Distributed Load 1

Distribution:	Constant
Magnitude [kPa]:	26
Orientation:	Vertical

Distributed Load 2

Distribution: Constant
Magnitude [kPa]: 26
Orientation: Vertical

Material Properties

Property	Rilevato	a-GF	a-GG	Piattaforma stradale	Scotico+bonifica	Qa
Color						
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	20	18	18	18
Cohesion [kPa]	0	8	0	0	0	12
Friction Angle [deg]	29.3	20	34	29.3	29.3	18
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1	1

Global Minimums

Method: bishop simplified

FS	1.249060
Center:	45.976, 54.862
Radius:	22.215
Left Slip Surface Endpoint:	45.103, 32.664
Right Slip Surface Endpoint:	63.109, 40.720
Resisting Moment:	7860.74 kN-m
Driving Moment:	6293.31 kN-m
Total Slice Area:	35.433 m2
Surface Horizontal Width:	18.0065 m
Surface Average Height:	1.96779 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1582
Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.24906**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.364573	0.0390325	-1.78377	a-GF	8	20	6.49487	8.11248	0.309031	0	0.309031	0.106764	0.106764
2	0.364573	0.0974499	-0.84321	a-GF	8	20	6.51059	8.13211	0.362978	0	0.362978	0.267156	0.267156

3	0.364573	0.116586	0.0971225	a-GF	8	20	6.4948	8.11239	0.308794	0	0.308794	0.319803	0.319803
4	0.430551	1.21694	1.1226	Scotico+ bonifica	0	29.3	1.2588	1.57232	2.80185	0	2.80185	2.82651	2.82651
5	0.430551	3.34367	2.23358	Scotico+ bonifica	0	29.3	3.4291	4.28315	7.63248	0	7.63248	7.76622	7.76622
6	0.359836	4.38031	3.25401	Rilevato	0	29.3	5.33307	6.66132	11.8703	0	11.8703	12.1735	12.1735
7	0.359836	5.78259	4.18406	Rilevato	0	29.3	6.9905	8.73155	15.5594	0	15.5594	16.0708	16.0708
8	0.359836	7.1468	5.11522	Rilevato	0	29.3	8.57869	10.7153	19.0945	0	19.0945	19.8624	19.8624
9	0.359836	8.4728	6.04773	Rilevato	0	29.3	10.0988	12.614	22.478	0	22.478	23.5479	23.5479
10	0.359836	9.76041	6.98186	Rilevato	0	29.3	11.5518	14.4289	25.712	0	25.712	27.1267	27.1267
11	0.359836	11.0094	7.91786	Rilevato	0	29.3	12.9386	16.1611	28.7989	0	28.7989	30.5983	30.5983
12	0.359836	12.2195	8.85599	Rilevato	0	29.3	14.2601	17.8117	31.74	0	31.74	33.9619	33.9619
13	0.359836	13.3905	9.79651	Rilevato	0	29.3	15.5169	19.3816	34.5377	0	34.5377	37.217	37.217
14	0.359836	14.5221	10.7397	Rilevato	0	29.3	16.7099	20.8717	37.1928	0	37.1928	40.3622	40.3622
15	0.359836	15.6097	11.6859	Rilevato	0	29.3	17.8349	22.2768	39.6966	0	39.6966	43.3854	43.3854
16	0.359836	15.7756	12.6353	Rilevato	0	29.3	17.897	22.3544	39.835	0	39.835	43.847	43.847
17	0.359836	15.2327	13.5882	Rilevato	0	29.3	17.1584	21.4319	38.1912	0	38.1912	42.3385	42.3385
18	0.359836	14.6487	14.545	Rilevato	0	29.3	16.3829	20.4632	36.4651	0	36.4651	40.7157	40.7157
19	0.359836	14.023	15.506	Rilevato	0	29.3	15.5707	19.4487	34.6571	0	34.6571	38.9769	38.9769
20	0.359836	13.3552	16.4714	Rilevato	0	29.3	14.722	18.3887	32.7683	0	32.7683	37.1212	37.1212
21	0.359836	12.8501	17.4417	Rilevato	0	29.3	14.0622	17.5645	31.2996	0	31.2996	35.7177	35.7177
22	0.359836	13.4666	18.4172	Rilevato	0	29.3	14.6287	18.2721	32.5604	0	32.5604	37.4316	37.4316
23	0.359836	14.222	19.3982	Rilevato	0	29.3	15.3347	19.154	34.132	0	34.132	39.5317	39.5317
24	0.359836	14.9324	20.3852	Rilevato	0	29.3	15.9801	19.9601	35.5684	0	35.5684	41.5067	41.5067
25	0.359836	15.597	21.3786	Rilevato	0	29.3	16.5648	20.6904	36.8698	0	36.8698	43.3543	43.3543
26	0.359836	16.2148	22.3787	Rilevato	0	29.3	17.0887	21.3448	38.0359	0	38.0359	45.0719	45.0719
27	0.359836	16.7848	23.3861	Rilevato	0	29.3	17.5518	21.9232	39.0668	0	39.0668	46.657	46.657
28	0.359836	17.306	24.4012	Rilevato	0	29.3	17.9537	22.4253	39.9614	0	39.9614	48.1061	48.1061
29	0.359836	17.7771	25.4246	Rilevato	0	29.3	18.2945	22.8509	40.7198	0	40.7198	49.4163	49.4163

30	0.359836	18.1971	26.4567	Rilevato	0	29.3	18.5736	23.1996	41.3411	0	41.3411	50.5841	50.5841
31	0.359836	18.5643	27.4981	Rilevato	0	29.3	18.7908	23.4708	41.8246	0	41.8246	51.6057	51.6057
32	0.359836	18.8775	28.5495	Rilevato	0	29.3	18.9455	23.6641	42.169	0	42.169	52.4768	52.4768
33	0.359836	19.1349	29.6115	Rilevato	0	29.3	19.0373	23.7787	42.3731	0	42.3731	53.1929	53.1929
34	0.359836	19.3349	30.6849	Rilevato	0	29.3	19.0655	23.8139	42.4358	0	42.4358	53.7493	53.7493
35	0.359836	19.4755	31.7703	Rilevato	0	29.3	19.0294	23.7689	42.3557	0	42.3557	54.1408	54.1408
36	0.359836	19.5546	32.8685	Rilevato	0	29.3	18.9283	23.6426	42.1306	0	42.1306	54.3611	54.3611
37	0.359836	19.5699	33.9806	Rilevato	0	29.3	18.7613	23.434	41.7589	0	41.7589	54.4043	54.4043
38	0.359836	19.519	35.1074	Rilevato	0	29.3	18.5275	23.142	41.2384	0	41.2384	54.2634	54.2634
39	0.359836	19.3991	36.2501	Rilevato	0	29.3	18.2258	22.7651	40.567	0	40.567	53.9307	53.9307
40	0.359836	19.2071	37.4097	Rilevato	0	29.3	17.855	22.302	39.7417	0	39.7417	53.3977	53.3977
41	0.359836	18.9398	38.5875	Rilevato	0	29.3	17.4139	21.751	38.7598	0	38.7598	52.655	52.655
42	0.359836	18.6229	39.7851	Rilevato	0	29.3	16.6007	20.7353	36.9499	0	36.9499	50.7737	50.7737
43	0.359836	16.4473	41.0038	Rilevato	0	29.3	14.7734	18.4529	32.8826	0	32.8826	45.7267	45.7267
44	0.359836	14.4648	42.2455	Rilevato	0	29.3	12.832	16.028	28.5616	0	28.5616	40.2156	40.2156
45	0.359836	12.3891	43.5122	Rilevato	0	29.3	10.8482	13.5501	24.146	0	24.146	34.445	34.445
46	0.359836	10.2142	44.8061	Rilevato	0	29.3	8.82207	11.0193	19.6362	0	19.6362	28.3988	28.3988
47	0.359836	7.9335	46.1297	Rilevato	0	29.3	6.75377	8.43587	15.0325	0	15.0325	22.058	22.058
48	0.359836	5.5326	47.486	Rilevato	0	29.3	9.01342	11.2583	20.0621	0	20.0621	29.8937	29.8937
49	0.359836	2.9757	48.8783	Rilevato	0	29.3	10.1719	12.7053	22.6406	0	22.6406	34.292	34.292
50	0.218881	0.505942	50.0232	Piattaforma stradale	0	29.3	8.28751	10.3516	18.4463	0	18.4463	28.331	28.331

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.24906**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	45.1026	32.6639	0	0	0
2	45.4672	32.6526	2.36785	0	0
3	45.8318	32.6472	4.73986	0	0
4	46.1964	32.6478	7.10399	0	0

5	46.6269	32.6563	7.62153	0	0
6	47.0575	32.6731	8.96757	0	0
7	47.4173	32.6935	10.6409	0	0
8	47.7771	32.7198	12.743	0	0
9	48.137	32.752	15.2103	0	0
10	48.4968	32.7902	17.9819	0	0
11	48.8566	32.8342	20.9995	0	0
12	49.2165	32.8843	24.2071	0	0
13	49.5763	32.9403	27.5513	0	0
14	49.9361	33.0025	30.9807	0	0
15	50.296	33.0707	34.4462	0	0
16	50.6558	33.1452	37.8998	0	0
17	51.0157	33.2258	41.1169	0	0
18	51.3755	33.3128	43.9603	0	0
19	51.7353	33.4062	46.4423	0	0
20	52.0952	33.506	48.577	0	0
21	52.455	33.6124	50.3803	0	0
22	52.8148	33.7254	51.8944	0	0
23	53.1747	33.8453	53.249	0	0
24	53.5345	33.972	54.4341	0	0
25	53.8943	34.1057	55.4197	0	0
26	54.2542	34.2465	56.1779	0	0
27	54.614	34.3947	56.6826	0	0
28	54.9738	34.5503	56.9098	0	0
29	55.3337	34.7135	56.8374	0	0
30	55.6935	34.8846	56.4454	0	0
31	56.0534	35.0637	55.7161	0	0
32	56.4132	35.251	54.6338	0	0
33	56.773	35.4467	53.1852	0	0
34	57.1329	35.6513	51.3596	0	0
35	57.4927	35.8648	49.1487	0	0
36	57.8525	36.0876	46.5471	0	0
37	58.2124	36.3201	43.5524	0	0
38	58.5722	36.5627	40.1654	0	0
39	58.932	36.8156	36.3904	0	0
40	59.2919	37.0795	32.2356	0	0
41	59.6517	37.3547	27.7136	0	0
42	60.0115	37.6418	22.8415	0	0
43	60.3714	37.9415	17.7344	0	0
44	60.7312	38.2543	12.7554	0	0
45	61.0911	38.5811	8.03208	0	0
46	61.4509	38.9227	3.68118	0	0
47	61.8107	39.2801	-0.16717	0	0
48	62.1706	39.6545	-3.3674	0	0
49	62.5304	40.047	-8.00321	0	0
50	62.8902	40.4591	-13.6802	0	0
51	63.1091	40.7202	0	0	0

List Of Coordinates

Water Table

X	Y
0	29.4377
151.443	29.4377

Distributed Load

X	Y
62.3297	40.7051
72.9463	40.9105

Distributed Load

X	Y
75.4463	40.9305
88.9463	40.533

External Boundary

X	Y
0	32.5968
0	32.0007
0	25.8223
0	22.3068
0	0
151.443	0
151.443	22.3575
151.443	26.0425
151.443	33.0299
151.443	33.6
104.154	33.1705
100.646	35.509
98.6463	35.509
91.1463	40.509
89.0463	40.593
88.9463	40.533
75.4463	40.9305
75.3463	40.9305
74.1963	40.9245
73.0463	40.9705
72.9463	40.9105
62.3297	40.7051
60.1297	40.6211
52.6297	35.6211
50.6297	35.6211
46.1964	32.6656

Material Boundary

X	Y
62.3297	40.7051
62.3297	40.4451
72.9463	40.7105
72.9463	40.9105

Material Boundary

X	Y
75.4463	40.9305
75.4463	40.6705
88.9463	40.333
88.9463	40.533

Material Boundary

X	Y
104.154	33.1705
46.1964	32.6656
46.1964	32.0698
46.2009	31.4698
104.159	31.9749
104.16	32.5749
104.154	33.1705

Material Boundary

X	Y
0	25.8223
45.0399	26.0612
47.6744	26.0717
51.8359	26.0883
55.0867	26.0609
65.4782	26.0504
72.9939	26.0428
85.8873	26.0878
104.26	26.0207
151.443	26.0425

Material Boundary

X	Y
0	22.3068
45.0399	22.3068
47.6744	22.3662
51.8359	22.3662
55.0867	22.3695
63.0856	22.3977
67.3995	22.379
69.2282	22.3704
73.8817	22.3768
76.4782	22.3859
80.2282	22.399

85.8873	22.4036
90.9782	22.4035
98.7182	22.3809
100.718	22.3809
104.26	22.3809
106.241	22.3502
151.443	22.3575

Material Boundary

X	Y
0	32.0007
46.1964	32.0698

Material Boundary

X	Y
104.16	32.5749
151.443	33.0299

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.11 > 1.1$ (sisma verso l'alto ↑)

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Slide Analysis Information

Project Summary

- File Name: pk 13440 sisma - CND.slim
- Slide Modeler Version: 6.005

General Settings

- Units of Measurement: Metric Units
- Time Units: days
- Permeability Units: meters/second
- Failure Direction: Right to Left
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Bishop simplified
- Janbu simplified

- Number of slices: 50
- Tolerance: 0.005
- Maximum number of iterations: 75
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 9.81 kN/m3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Auto Refine Search
- Divisions along slope: 10
- Circles per division: 10
- Number of iterations: 10
- Divisions to use in next iteration: 50%
- Composite Surfaces: Disabled
- Minimum Elevation: Not Defined
- Minimum Depth: 2.5

Loading

- Seismic Load Coefficient (Horizontal): 0.125
- Seismic Load Coefficient (Vertical): -0.063
- 2 Distributed Loads present

Distributed Load 1

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Distributed Load 2

- Distribution: Constant
- Magnitude [kN/m2]: 4

- Orientation: Vertical

Material Properties

Property	Rilevato	a-GF	a-GG	Piattaforma stradale	Scotico+bonifica	Qa
Color						
Strength Type	Mohr-Coulomb	Undrained	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Undrained
Unit Weight [kN/m3]	18	18	20	18	18	18
Cohesion [kPa]	0		0	0	0	
Friction Angle [deg]	29.3		34	29.3	29.3	
Cohesion Type		71				107
Water Surface	Water Table	None	Water Table	Water Table	Water Table	None
Hu Value	1		1	1	1	
Ru Value		0				0

Global Minimums

Method: bishop simplified

- FS: 1.667940
- Center: 48.948, 61.619
- Radius: 29.751
- Left Slip Surface Endpoint: 42.129, 32.660
- Right Slip Surface Endpoint: 70.258, 40.859
- Resisting Moment=35105.1 kN-m
- Driving Moment=21047 kN-m

Method: janbu simplified

- FS: 1.517120
- Center: 54.932, 43.102
- Radius: 17.005
- Left Slip Surface Endpoint: 41.512, 32.659
- Right Slip Surface Endpoint: 71.793, 40.888
- Resisting Horizontal Force=1997.46 kN
- Driving Horizontal Force=1316.61 kN

Valid / Invalid Surfaces

Method: bishop simplified

- Number of Valid Surfaces: 1453
- Number of Invalid Surfaces: 0

Method: janbu simplified

- Number of Valid Surfaces: 1453
- Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.66794**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [deg]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]

					res]							
	0.581204	0.688353	a-GF	1	(	4	2.567	5	71	1	0.663	5 1 0.6635
	0.581204	2.00152	a-GF	1	(	4	2.567	5	71	1	1.892	8 1 1.8928
	0.581204	3.18836	a-GF	1	(	4	2.567	5	71	1	2.929	3 1 2.9293
	0.581204	4.25035	a-GF	1	(	4	2.567	5	71	1	3.773	9 1 3.7739
	0.581204	5.18876	a-GF	1	(	4	2.567	5	71	1	4.427	7 1 4.4277
	0.581204	6.00471	a-GF	1	(	4	2.567	5	71	1	4.891	3 1 4.8913
	0.581204	6.69915	a-GF	1	(	4	2.567	5	71	1	5.165	1 1 5.1651
	0.552908	8.74214	Scotico+bonifica	2	(9.3	5	.12818	8	.5535	1	5.242	2 1 5.2422
	0.552908	1 2.8183	Scotico+bonifica	2	(9.3	7	.47089	1	2.461	2	2.205	4 2 2.2054
0	0.552908	1 6.7915	Scotico+bonifica	2	(9.3	9	.72433	1	6.219	6	2	8.903 2 8.903
1	0.552908	2 0.6622	Scotico+bonifica	2	(9.3	1	1.8904	1	9.832	5	3	5.341 1 3 5.3411
2	0.552908	2 4.4304	Scotico+bonifica	2	(9.3	1	3.9708	2	3.302	5	4	1.524 7 4 1.5247
3	0.552908	2 8.0963	Scotico+bonifica	2	(9.3	1	5.9674	2	6.632	6	4	7.458 7 4 7.4587
4	0.552908	3 1.6599	Scotico+bonifica	2	(9.3	1	7.8813	2	9.824	9	5	3.147 4 5 3.1474
5	0.552908	3 5.1211	Scotico+bonifica	2	(9.3	1	9.7141	3	2.8819	5	8.594	7 5 8.5947
6	0.552908	3 6.708	Scotico+bonifica	2	(9.3	2	0.4784	3	4.1567	6	0.866	7 6 0.8667
7	0.552908	3 6.2957	Scotico+bonifica	2	(9.3	2	0.1245	3	3.5664	5	9.814	7 5 9.8147
8	0.552908	3 5.7794	Scotico+bonifica	2	(9.3	1	9.717	3	2.8868	5	8.603	7 5 8.6037
9	0.552908	3 5.4044	Scotico+bonifica	2	(9.3	1	9.3912	3	2.3433	5	7.635	2 5 7.6352
0	0.552908	3 7.6098	Scotico+bonifica	2	(9.3	2	0.4732	3	4.1481	6	0.851	1 6 0.8511
1	0.552908	4 0.4482	Scotico+bonifica	2	(9.3	2	1.8835	3	6.5003	6	5.042	8 6 5.0428
2	0.552908	4 3.1803	Scotico+bonifica	2	(9.3	2	3.2181	3	8.7264	6	9.009	7 6 9.0097
3	0.552908	4 5.8051	Scotico+bonifica	2	(9.3	2	4.4776	4	0.8272	7	2.753	2 7 2.7532
4	0.552908	4 8.3215	Scotico+bonifica	2	(9.3	2	5.6623	4	2.8031	7	6.274	3 7 6.2743
5	0.552908	5 0.7281	Scotico+bonifica	2	(9.3	2	6.7723	4	4.6546	7	9.573	6 7 9.5736
6	0.578831	5 5.563	Rilevato	2	(9.3	2	7.8306	4	6.4197	8	2.718	8 8 2.7188
7	0.578831	5 7.9492	Rilevato	2	(9.3	2	8.8331	4	8.0919	8	5.698	6 8 5.6986
8	0.578831	6 0.2037	Rilevato	2	(9.3	2	9.7539	4	9.6278	8	8.435	7 8 8.4357

9	0.578831	62.3242	Rilevato	(	9.3	30.5929	51.0272	90.9295	(	90.9295
0	0.578831	64.3081	Rilevato	(	9.3	31.3498	52.2896	93.179	(	93.179
1	0.578831	66.1525	Rilevato	(	9.3	32.0239	53.414	95.1826	(	95.1826
2	0.578831	67.8255	Rilevato	(	9.3	32.6011	54.3766	96.8979	(	96.8979
3	0.578831	67.0473	Rilevato	(	9.3	31.9945	53.3649	95.0951	(	95.0951
4	0.578831	64.6627	Rilevato	(	9.3	30.6296	51.0883	91.0383	(	91.0383
5	0.578831	62.124	Rilevato	(	9.3	29.206	48.7138	86.8071	(	86.8071
6	0.578831	59.4206	Rilevato	(	9.3	28.0923	46.8562	83.4968	(	83.4968
7	0.578831	56.4718	Rilevato	(	9.3	27.281	45.5031	81.0856	(	81.0856
8	0.578831	53.3274	Rilevato	(	9.3	25.6168	42.7273	76.1391	(	76.1391
9	0.578831	50.0073	Rilevato	(	9.3	23.892	39.8504	71.0125	(	71.0125
0	0.578831	46.5048	Rilevato	(	9.3	22.1059	36.8713	65.7039	(	65.7039
1	0.578831	42.812	Rilevato	(	9.3	20.2577	33.7886	60.2107	(	60.2107
2	0.578831	38.9207	Rilevato	(	9.3	18.3465	30.6008	54.53	(	54.53
3	0.578831	34.8211	Rilevato	(	9.3	16.3713	27.3064	48.6594	(	48.6594
4	0.578831	30.5028	Rilevato	(	9.3	14.3313	23.9038	42.5961	(	42.5961
5	0.578831	25.9537	Rilevato	(	9.3	12.2254	20.3912	36.3367	(	36.3367
6	0.578831	21.1603	Rilevato	(	9.3	10.0526	16.7671	29.8786	(	29.8786
7	0.578831	16.1069	Rilevato	(	9.3	7.81185	13.0297	23.2188	(	23.2188
8	0.578831	10.7759	Rilevato	(	9.3	5.50238	9.17764	16.3544	(	16.3544
9	0.578831	5.14673	Rilevato	(	9.3	3.12327	5.20943	9.2831	(	9.2831
0	0.217168	0.422991	Piattaforma stradale	(	9.3	1.46159	2.43784	4.34419	(	4.34419

- **Global Minimum Query (janbu simplified) - Safety Factor: 1.51712**

lice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]
	0.618964	4.18393	a-GF	1	(	46.7992	71	63.0333	(	63.0333
	0.618964	12.1092	a-GF	1	(	46.7992	71	69.025	(	69.025

	0.61896	19.2206	a-GF	1	(	46.7992	71	74.754		74.544
	0.61896	25.6415	a-GF	1	(	46.7992	71	80.139		80.398
	0.61896	31.4622	a-GF	1	(	46.7992	71	85.143		85.143
	0.61896	36.7514	a-GF	1	(	46.7992	71	89.748		89.481
	0.61896	41.5629	a-GF	1	(	46.7992	71	93.950		93.502
	0.61896	46.3666	a-GF	1	(	46.7992	71	98.398		98.398
	0.61896	54.1885	a-GF	1	(	46.7992	71	107.624		107.624
0	0.61896	62.3783	a-GF	1	(	46.7992	71	117.581		117.581
1	0.61896	70.2188	a-GF	1	(	46.7992	71	127.151		127.151
2	0.61896	77.7292	a-GF	1	(	46.7992	71	136.341		136.341
3	0.61896	84.9258	a-GF	1	(	46.7992	71	145.156		145.156
4	0.61896	91.8221	a-GF	1	(	46.7992	71	153.601		153.601
5	0.61896	98.2629	a-GF	1	(	46.7992	71	161.426		161.426
6	0.61896	101.221	a-GF	1	(	46.7992	71	164.038		164.038
7	0.61896	102.68	a-GF	1	(	46.7992	71	164.426		164.426
8	0.61896	103.877	a-GF	1	(	46.7992	71	164.458		164.458
9	0.61896	107.28	a-GF	1	(	46.7992	71	167.859		167.859
0	0.61896	112.555	a-GF	1	(	46.7992	71	174.116		174.116
1	0.61896	117.575	a-GF	1	(	46.7992	71	180.004		180.004
2	0.61896	122.344	a-GF	1	(	46.7992	71	185.517		185.517
3	0.61896	126.862	a-GF	1	(	46.7992	71	190.652		190.652
4	0.61896	131.128	a-GF	1	(	46.7992	71	195.401		195.401
5	0.61896	135.141	a-GF	1	(	46.7992	71	199.755		199.755
6	0.61896	138.899	a-GF	1	(	46.7992	71	203.702		203.702
7	0.61896	142.398	a-GF	1	(	46.7992	71	207.231		207.231
8	0.61896	145.634	a-GF	1	(	46.7992	71	210.324		210.324
9	0.61896	148.601	a-GF	1	(	46.7992	71	212.967		212.967
0	0.61896	151.291	a-GF	1	(	46.7992	71	215.138		215.138

1	0.61896 4	151.858	a-GF	1	(9.3)	46.7992	71	214.028		214.028
2	0.61896 4	149.646	a-GF	1	(9.3)	46.7992	71	208.633		208.633
3	0.61896 4	147.113	a-GF	1	(9.3)	46.7992	71	202.657		202.657
4	0.61896 4	144.247	a-GF	1	(9.3)	46.7992	71	197.533		197.533
5	0.61896 4	140.943	a-GF	1	(9.3)	46.7992	71	192.68		192.68
6	0.61896 4	137.251	a-GF	1	(9.3)	46.7992	71	184.542		184.542
7	0.61896 4	133.168	a-GF	1	(9.3)	46.7992	71	175.619		175.619
8	0.61896 4	128.663	a-GF	1	(9.3)	46.7992	71	165.817		165.817
9	0.61896 4	123.697	a-GF	1	(9.3)	46.7992	71	155.023		155.023
0	0.61896 4	118.221	a-GF	1	(9.3)	46.7992	71	143.085		143.085
1	0.61896 4	112.172	a-GF	1	(9.3)	46.7992	71	129.802		129.802
2	0.61896 4	105.468	a-GF	1	(9.3)	46.7992	71	114.898		114.898
3	0.49943 6	79.7185	Scotico+bonifica		(9.3)	39.861	60.4739	107.763		107.763
4	0.49943 6	74.3917	Scotico+bonifica		(9.3)	36.2064	54.9295	97.8832		97.832
5	0.65140 8	88.0344	Rilevato		(9.3)	31.672	48.0503	85.6245		85.645
6	0.65140 8	76.421	Rilevato		(9.3)	26.1231	39.6319	70.6233		70.633
7	0.65140 8	62.5791	Rilevato		(9.3)	19.9701	30.2971	53.9887		53.9887
8	0.65140 8	45.1118	Rilevato		(9.3)	12.9733	19.6821	35.0732		35.0732
9	0.65140 8	18.8255	Rilevato		(9.3)	4.42964	6.72029	11.9754		11.9754
0	0.02850 5	0.05302 27	Piattaforma stradale		(9.3)	0.57602 9	0.87390 5	1.55728		1.55728

List Of Coordinates

Water Table

X	Y
0	29.4377
151.443	29.4377

Line Load

X	Y
62.3297	40.7051
72.9463	40.9105

Line Load

X	Y
75.4463	40.9305
88.9463	40.533

External Boundary

X	Y
0	32.5968
0	32.0007
0	25.8223
0	22.3068

0	0
151.443	0
151.443	22.3575
151.443	26.0425
151.443	33.0299
151.443	33.6
104.154	33.1705
100.646	35.509
98.6463	35.509
91.1463	40.509
89.0463	40.593
88.9463	40.533
75.4463	40.9305
75.3463	40.9305
74.1963	40.9245
73.0463	40.9705
72.9463	40.9105
62.3297	40.7051
60.1297	40.6211
52.6297	35.6211
50.6297	35.6211
46.1964	32.6656

Material Boundary

X	Y
62.3297	40.7051
62.3297	40.4451
72.9463	40.7105
72.9463	40.9105

Material Boundary

X	Y
75.4463	40.9305
75.4463	40.6705
88.9463	40.333
88.9463	40.533

Material Boundary

X	Y
104.154	33.1705
46.1964	32.6656
46.1964	32.0698
46.2009	31.4698
104.159	31.9749
104.16	32.5749
104.154	33.1705

Material Boundary

X	Y
0	25.8223
45.0399	26.0612
47.6744	26.0717
51.8359	26.0883
55.0867	26.0609
65.4782	26.0504
72.9939	26.0428
85.8873	26.0878
104.26	26.0207
151.443	26.0425

Material Boundary

X	Y
0	22.3068
45.0399	22.3068
47.6744	22.3662
51.8359	22.3662
55.0867	22.3695
63.0856	22.3977
67.3995	22.379
69.2282	22.3704
73.8817	22.3768
76.4782	22.3859
80.2282	22.399
85.8873	22.4036
90.9782	22.4035
98.7182	22.3809
100.718	22.3809
104.26	22.3809
106.241	22.3502
151.443	22.3575

Material Boundary

X	Y
0	32.0007
46.1964	32.0698

Material Boundary

X	Y
104.16	32.5749
151.443	33.0299

Sezione 1088 – prg 19+520

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.27 > 1.1$

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 19520 statica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

- 2 Distributed Loads present

Distributed Load 1	
Distribution:	Constant
Magnitude [kPa]:	26
Orientation:	Vertical

Distributed Load 2	
Distribution:	Constant
Magnitude [kPa]:	26
Orientation:	Vertical

Material Properties

Property	Rilevato	a-GG	Piattaforma stradale	Scotico+bonifica	Qa	Pvs	Rilevato esistente
Color							
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	20	18	18	18	18.5	18.5
Cohesion [kPa]	0	0	0	0	12	0	0
Friction Angle [deg]	29.3	34	29.3	29.3	18	34	28

Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1	1	1

Global Minimums

Method: bishop simplified

FS	1.274410
Center:	73.655, 46.758
Radius:	17.335
Left Slip Surface Endpoint:	60.929, 34.987
Right Slip Surface Endpoint:	76.602, 29.675
Resisting Moment:	4279.13 kN-m
Driving Moment:	3357.73 kN-m
Total Slice Area:	23.9218 m2
Surface Horizontal Width:	15.6731 m
Surface Average Height:	1.5263 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1462
Number of Invalid Surfaces:	0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.27441**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.170616	0.317128	-46.808	Piattaforma stradale	0	29.3	8.35642	10.6495	18.9772	0	18.9772	27.8784	27.8784
2	0.312698	2.08732	-45.6434	Rilevato	0	29.3	9.94499	12.674	22.5849	0	22.5849	32.7558	32.7558
3	0.312698	3.96582	-44.1835	Rilevato	0	29.3	11.9541	15.2344	27.1475	0	27.1475	38.7656	38.7656
4	0.312698	5.75805	-42.759	Rilevato	0	29.3	13.9249	17.746	31.6229	0	31.6229	44.499	44.499
5	0.312698	7.47062	-41.3666	Rilevato	0	29.3	15.5369	19.8004	35.2839	0	35.2839	48.9655	48.9655
6	0.312698	9.318	-40.0033	Rilevato	0	29.3	9.58538	12.2157	21.7681	0	21.7681	29.8121	29.8121
7	0.312698	10.7348	-38.6668	Rilevato	0	29.3	11.1828	14.2515	25.3958	0	25.3958	34.3443	34.3443
8	0.312698	12.0403	-37.3548	Rilevato	0	29.3	12.6951	16.1788	28.8304	0	28.8304	38.5207	38.5207
9	0.312698	13.2825	-36.0654	Rilevato	0	29.3	14.1683	18.0562	32.1759	0	32.1759	42.4945	42.4945
10	0.312698	14.4646	-34.7968	Rilevato	0	29.3	15.6024	19.8839	35.4327	0	35.4327	46.2753	46.2753

1 1	0.31 2698	15.5 892	- 33.5474	Rilevato	0	29 .3	16.9 98	21.6 624	38.6 019	0	38.6 019	49.8 728	49.8 728
1 2	0.31 2698	16.6 59	- 32.3158	Rilevato	0	29 .3	18.3 551	23.3 919	41.6 839	0	41.6 839	53.2 946	53.2 946
1 3	0.31 2698	17.1 211	- 31.1008	Rilevato	0	29 .3	19.0 562	24.2 854	43.2 761	0	43.2 761	54.7 719	54.7 719
1 4	0.31 2698	16.9 847	- 29.9011	Rilevato	0	29 .3	19.0 915	24.3 304	43.3 563	0	43.3 563	54.3 349	54.3 349
1 5	0.31 2698	16.7 995	- 28.7157	Rilevato	0	29 .3	19.0 654	24.2 971	43.2 969	0	43.2 969	53.7 416	53.7 416
1 6	0.31 2698	16.5 672	- 27.5436	Rilevato	0	29 .3	18.9 786	24.1 865	43.0 998	0	43.0 998	52.9 978	52.9 978
1 7	0.31 2698	16.2 893	- 26.3839	Rilevato	0	29 .3	18.8 319	23.9 996	42.7 667	0	42.7 667	52.1 084	52.1 084
1 8	0.31 2698	15.9 673	- 25.2357	Rilevato	0	29 .3	18.6 258	23.7 369	42.2 986	0	42.2 986	51.0 775	51.0 775
1 9	0.31 2698	15.6 023	- 24.0983	Rilevato	0	29 .3	18.3 608	23.3 992	41.6 97	0	41.6 97	49.9 095	49.9 095
2 0	0.31 2698	15.1 956	- 22.9709	Rilevato	0	29 .3	18.0 374	22.9 87	40.9 623	0	40.9 623	48.6 079	48.6 079
2 1	0.31 2698	14.7 482	- 21.8528	Rilevato	0	29 .3	17.6 556	22.5 005	40.0 954	0	40.0 954	47.1 76	47.1 76
2 2	0.31 2698	14.2 61	- 20.7434	Rilevato	0	29 .3	17.2 16	21.9 402	39.0 971	0	39.0 971	45.6 173	45.6 173
2 3	0.31 2698	13.7 351	- 19.6421	Rilevato	0	29 .3	16.7 185	21.3 062	37.9 673	0	37.9 673	43.9 343	43.9 343
2 4	0.31 2698	13.1 711	- 18.5483	Rilevato	0	29 .3	16.1 633	20.5 987	36.7 064	0	36.7 064	42.1 298	42.1 298
2 5	0.31 2698	12.5 698	- 17.4615	Rilevato	0	29 .3	15.5 504	19.8 176	35.3 145	0	35.3 145	40.2 06	40.2 06
2 6	0.31 2698	11.9 319	- 16.3811	Rilevato	0	29 .3	14.8 797	18.9 628	33.7 915	0	33.7 915	38.1 655	38.1 655
2 7	0.31 2698	11.2 581	- 15.3066	Rilevato	0	29 .3	14.1 51	18.0 342	32.1 365	0	32.1 365	36.0 096	36.0 096
2 8	0.31 2698	10.5 489	- 14.2377	Rilevato	0	29 .3	13.3 642	17.0 315	30.3 499	0	30.3 499	33.7 409	33.7 409
2 9	0.31 2698	9.80 485	- 13.1738	Rilevato	0	29 .3	12.5 19	15.9 543	28.4 303	0	28.4 303	31.3 605	31.3 605
3 0	0.31 2698	9.02 636	- 12.1145	Rilevato	0	29 .3	11.6 149	14.8 022	26.3 772	0	26.3 772	28.8 703	28.8 703
3 1	0.31 2698	8.21 39	- 11.0594	Rilevato	0	29 .3	10.6 516	13.5 745	24.1 894	0	24.1 894	26.2 714	26.2 714
3 2	0.31 2698	7.36 785	- 10.0081	Rilevato	0	29 .3	9.62 846	12.2 706	21.8 659	0	21.8 659	23.5 65	23.5 65
3 3	0.31 878	6.60 572	- 8.94997	Scotico+ bonifica	0	29 .3	8.53 383	10.8 756	19.3 801	0	19.3 801	20.7 241	20.7 241
3 4	0.31 878	5.65 697	- 7.88479	Scotico+ bonifica	0	29 .3	7.36 569	9.38 691	16.7 273	0	16.7 273	17.7 474	17.7 474
3 5	0.31 878	4.67 36	- 6.82233	Scotico+ bonifica	0	29 .3	6.13 32	7.81 621	13.9 283	0	13.9 283	14.6 621	14.6 621
3 6	0.31 878	3.66 129	- 5.76224	Scotico+ bonifica	0	29 .3	4.84 262	6.17 148	10.9 975	0	10.9 975	11.4 861	11.4 861
3 7	0.31 878	3.32 88	- 4.70411	Scotico+ bonifica	0	29 .3	4.43 764	5.65 537	10.0 778	0	10.0 778	10.4 429	10.4 429

38	0.31878	3.46236	-3.6476	Scotico+ bonifica	0	29.3	4.65229	5.92892	10.5652	0	10.5652	10.8618	10.8618
39	0.31878	3.56208	-2.59232	Scotico+ bonifica	0	29.3	4.82437	6.14823	10.956	0	10.956	11.1744	11.1744
40	0.31878	3.62804	-1.53793	Scotico+ bonifica	0	29.3	4.95305	6.31222	11.2482	0	11.2482	11.3812	11.3812
41	0.31878	3.66032	-0.484054	Scotico+ bonifica	0	29.3	5.03074	6.41971	11.4398	0	11.4398	11.4823	11.4823
42	0.31878	3.65896	0.569657	Scotico+ bonifica	0	29.3	5.07064	6.46942	11.5284	0	11.5284	11.4779	11.4779
43	0.31878	3.21347	1.62356	Scotico+ bonifica	0	29.3	4.49486	5.72083	10.2077	0	10.2077	10.0803	10.0803
44	0.31878	1.94518	2.67801	Scotico+ bonifica	0	29.3	2.74335	3.49615	6.23005	0	6.23005	6.10174	6.10174
45	0.329649	1.41761	3.75139	a-GG	0	34	2.35774	3.00473	4.4547	0	4.4547	4.3001	4.3001
46	0.329649	1.25358	4.8441	a-GG	0	34	2.10704	2.68523	3.98104	0	3.98104	3.80247	3.80247
47	0.329649	1.04776	5.93859	a-GG	0	34	1.78007	2.26854	3.36324	0	3.36324	3.17807	3.17807
48	0.329649	0.799922	7.03525	a-GG	0	34	1.37391	1.75093	2.59586	0	2.59586	2.4263	2.4263
49	0.329649	0.509801	8.13451	a-GG	0	34	0.885382	1.12834	1.67284	0	1.67284	1.54628	1.54628
50	0.329649	0.177065	9.2368	a-GG	0	34	0.311014	0.396359	0.587625	0	0.587625	0.537047	0.537047

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.27441**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	60.9289	34.9873	0	0	0
2	61.1051	34.7997	2.0916	0	0
3	61.4178	34.4799	6.20962	0	0
4	61.7305	34.176	10.7282	0	0
5	62.0432	33.8868	15.5248	0	0
6	62.3559	33.6115	20.3902	0	0
7	62.6686	33.349	23.1101	0	0
8	62.9813	33.0988	25.9737	0	0
9	63.294	32.8601	28.8919	0	0
10	63.6067	32.6324	31.7964	0	0
11	63.9194	32.4151	34.6253	0	0
12	64.2321	32.2078	37.3227	0	0
13	64.5448	32.01	39.8377	0	0
14	64.8575	31.8213	42.0523	0	0
15	65.1702	31.6415	43.8886	0	0
16	65.4828	31.4702	45.3539	0	0
17	65.7955	31.3071	46.458	0	0
18	66.1082	31.152	47.2129	0	0

19	66.4209	31.0046	47.6324	0	0
20	66.7336	30.8647	47.7325	0	0
21	67.0463	30.7322	47.531	0	0
22	67.359	30.6068	47.0475	0	0
23	67.6717	30.4884	46.3033	0	0
24	67.9844	30.3768	45.3215	0	0
25	68.2971	30.2718	44.1269	0	0
26	68.6098	30.1735	42.746	0	0
27	68.9225	30.0816	41.207	0	0
28	69.2352	29.996	39.5397	0	0
29	69.5479	29.9166	37.7758	0	0
30	69.8606	29.8434	35.9485	0	0
31	70.1733	29.7763	34.093	0	0
32	70.486	29.7152	32.2462	0	0
33	70.7987	29.66	30.4471	0	0
34	71.1175	29.6098	28.7041	0	0
35	71.4363	29.5657	27.0985	0	0
36	71.755	29.5275	25.6778	0	0
37	72.0738	29.4954	24.4904	0	0
38	72.3926	29.4691	23.3425	0	0
39	72.7114	29.4488	22.0766	0	0
40	73.0302	29.4344	20.6994	0	0
41	73.349	29.4258	19.2193	0	0
42	73.6677	29.4231	17.647	0	0
43	73.9865	29.4263	15.9949	0	0
44	74.3053	29.4353	14.4721	0	0
45	74.6241	29.4502	13.5062	0	0
46	74.9537	29.4719	12.6339	0	0
47	75.2834	29.4998	11.8293	0	0
48	75.613	29.5341	11.1282	0	0
49	75.9427	29.5748	10.5704	0	0
50	76.2723	29.6219	10.2002	0	0
51	76.602	29.6755	0	0	0

List Of Coordinates

Water Table

X	Y
0	23.9412
120.602	23.9412

Distributed Load

X	Y
49.2437	34.1694
62.3437	35.0864

Distributed Load

X	Y
41.2335	34.5692
28.9335	33.7344

External Boundary

X	Y
0	0
120.602	0
120.602	11.5857
120.602	20.2455
120.602	27.434
120.602	31.0582
119.425	31.0346
112.516	34.5039
112.41	34.5046

112.134	34.4565
101.814	34.1093
101.395	34.1822
92.2797	29.7709
91.9678	29.2401
91.1448	29.2423
90.8499	29.7747
89.6951	30.2962
89.6265	30.3271
82.671	30.342
79.4964	29.6746
74.6231	29.6761
74.0437	30.0624
72.0437	30.0624
64.5437	35.0624
62.4437	35.1464
62.3437	35.0864
49.2437	34.1694
47.9937	34.1834
42.4835	34.5832
41.3335	34.6292
41.2335	34.5692
28.9335	33.7344
28.8335	33.7944
26.7335	33.7104
19.9035	29.1572
9.14684	28.9638
0	29.0002
0	26.6775
0	19.3865

Material Boundary

X	Y
28.9335	33.7344
28.9335	33.5344
41.2335	34.3692
41.2335	34.5692

Material Boundary

X	Y
49.2437	34.1694
49.2437	33.9694
62.3437	34.8864
62.3437	35.0864

Material Boundary

X	Y
0	26.6775

10.2247	25.8021
24.9466	23.1574
43.909	23.6442
60.9798	23.086
74.821	23.0841
91.3297	26.7625
113.673	28.1393
120.602	27.434

Material Boundary

X	Y
0	19.3865
8.1021	19.0508
42.4192	18.4771
60.2353	18.2055
95.7911	18.9222
118.755	20.1866
120.602	20.2455

Material Boundary

X	Y
89.6951	30.2962
90.7123	28.7105
92.5716	28.7105
117.625	30.1906
119.425	31.0346

Material Boundary

X	Y
19.9035	29.1572
27.3263	29.268
27.4394	29.2841
27.6208	29.2887
27.8528	29.2947
29.2417	28.3273
29.6483	27.9846
32.4943	28.572
35.9786	29.3391
39.7111	29.3481
46.6795	29.5681
52.7374	29.5943
61.2422	29.6198
74.6231	29.6761
74.6265	28.8761
61.2451	28.8198
52.7403	28.7943
46.6939	28.7682
39.7247	28.5481

36.0666	28.5393
32.6612	27.7896
29.4298	27.1226
28.7542	27.6918
27.611	28.4882

27.5062	28.4855
27.3889	28.4688
19.9155	28.3572
19.9035	29.1572

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min}$ = 1.102 > 1.1 (sisma verso l'alto ↑)

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 19520 sismica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal):	0.124
Seismic Load Coefficient (Vertical):	-0.062

- 2 Distributed Loads present

Distributed Load 1

Distribution:	Constant
Magnitude [kPa]:	4
Orientation:	Vertical

Distributed Load 2

Distribution:	Constant
Magnitude [kPa]:	4
Orientation:	Vertical

Material Properties

Property	Rilevato	a-GG	Piattaforma stradale	Scotico+bonifica	Qa	Pvs	Rilevato esistente
Color							
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	20	18	18	18	18.5	18.5

Cohesion [kPa]	0	0	0	0	12	0	0
Friction Angle [deg]	29.3	34	29.3	29.3	18	34	28
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1	1	1

Global Minimums

Method: bishop simplified

FS	1.101820
Center:	74.902, 48.976
Radius:	19.856
Left Slip Surface Endpoint:	60.818, 34.980
Right Slip Surface Endpoint:	79.901, 29.760
Resisting Moment:	4773.13 kN-m
Driving Moment:	4332.06 kN-m
Total Slice Area:	26.5507 m2
Surface Horizontal Width:	19.0828 m
Surface Average Height:	1.39134 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1257
Number of Invalid Surfaces:	0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.10182**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.18816	0.338687	-44.7967	Piattaforma stradale	0	29.3	1.92757	2.12383	3.78464	0	3.78464	5.69857	5.69857
2	0.387712	2.78065	-43.6411	Rilevato	0	29.3	3.681	4.05 58	7.22736	0	7.22736	10.7378	10.7378
3	0.387712	5.48327	-42.1139	Rilevato	0	29.3	6.02512	6.63 86	11.8298	0	11.8298	17.2766	17.2766
4	0.387712	8.0562	-40.6228	Rilevato	0	29.3	8.33035	9.17855	16.356	0	16.356	23.5017	23.5017
5	0.387712	10.6511	-39.1643	Rilevato	0	29.3	9.9263	10.937	19.4895	0	19.4895	27.5749	27.5749
6	0.387712	12.9806	-37.7354	Rilevato	0	29.3	11.4734	12.6416	22.5271	0	22.5271	31.406	31.406
7	0.387712	14.9144	-36.3336	Rilevato	0	29.3	13.3701	14.7314	26.2511	0	26.2511	36.0845	36.0845
8	0.387712	16.7469	-34.9567	Rilevato	0	29.3	15.2181	16.7676	29.8796	0	29.8796	40.5183	40.5183

9	0.387712	18.4834	-33.6025	Rilevato	0	29.3	17.0173	18.75	33.4122	0	33.4122	44.7195	44.7195
10	0.387712	20.1284	-32.2693	Rilevato	0	29.3	18.7677	20.6786	36.849	0	36.849	48.6993	48.6993
11	0.387712	21.0359	-30.9553	Rilevato	0	29.3	19.8559	21.8776	38.9855	0	38.9855	50.8951	50.8951
12	0.387712	20.8271	-29.6593	Rilevato	0	29.3	19.8943	21.9199	39.0609	0	39.0609	50.3896	50.3896
13	0.387712	20.5245	-28.3797	Rilevato	0	29.3	19.8339	21.8534	38.9424	0	38.9424	49.6575	49.6575
14	0.387712	20.1443	-27.1154	Rilevato	0	29.3	19.6881	21.6927	38.6561	0	38.6561	48.7376	48.7376
15	0.387712	19.6892	-25.8652	Rilevato	0	29.3	19.4573	21.4384	38.2028	0	38.2028	47.6362	47.6362
16	0.387712	19.1614	-24.6282	Rilevato	0	29.3	19.1421	21.0912	37.584	0	37.584	46.3593	46.3593
17	0.387712	18.5633	-23.4032	Rilevato	0	29.3	18.7429	20.6513	36.8002	0	36.8002	44.9122	44.9122
18	0.387712	17.8968	-22.1895	Rilevato	0	29.3	18.2599	20.1191	35.8519	0	35.8519	43.2997	43.2997
19	0.387712	17.1637	-20.9862	Rilevato	0	29.3	17.6931	19.4946	34.7389	0	34.7389	41.5258	41.5258
20	0.387712	16.3657	-19.7925	Rilevato	0	29.3	17.0426	18.7779	33.4618	0	33.4618	39.5951	39.5951
21	0.387712	15.5042	-18.6078	Rilevato	0	29.3	16.3083	17.9688	32.02	0	32.02	37.5108	37.5108
22	0.387712	14.5807	-17.4312	Rilevato	0	29.3	15.4897	17.0669	30.4129	0	30.4129	35.2763	35.2763
23	0.387712	13.5962	-16.2621	Rilevato	0	29.3	14.5865	16.0717	28.6396	0	28.6396	32.8945	32.8945
24	0.387712	12.552	-15.1	Rilevato	0	29.3	13.5982	14.9828	26.6989	0	26.6989	30.368	30.368
25	0.387712	11.4491	-13.9442	Rilevato	0	29.3	12.5241	13.7993	24.5901	0	24.5901	27.6998	27.6998
26	0.392208	10.4006	-12.7875	Scotico+bonifica	0	29.3	11.3562	12.5125	22.297	0	22.297	24.8744	24.8744
27	0.392208	9.15381	-11.6295	Scotico+bonifica	0	29.3	10.0923	11.1199	19.8155	0	19.8155	21.8925	21.8925
28	0.392208	7.84881	-10.4762	Scotico+bonifica	0	29.3	8.73769	9.62736	17.1558	0	17.1558	18.7714	18.7714
29	0.392208	6.48627	-9.32727	Scotico+bonifica	0	29.3	7.29096	8.03333	14.3152	0	14.3152	15.5127	15.5127
30	0.392208	5.37999	-8.18209	Scotico+bonifica	0	29.3	6.10614	6.72787	11.9889	0	11.9889	12.8669	12.8669
31	0.392208	5.58916	-7.04019	Scotico+bonifica	0	29.3	6.4052	7.05738	12.5761	0	12.5761	13.3671	13.3671
32	0.392208	5.90323	-5.90109	Scotico+bonifica	0	29.3	6.83103	7.52656	13.4122	0	13.4122	14.1182	14.1182
33	0.392208	6.16171	-4.76433	Scotico+bonifica	0	29.3	7.19984	7.93293	14.1363	0	14.1363	14.7364	14.7364
34	0.392208	6.36491	-3.62945	Scotico+bonifica	0	29.3	7.51034	8.27504	14.746	0	14.746	15.2224	15.2224
35	0.392208	6.29759	-2.49599	Scotico+bonifica	0	29.3	7.50435	8.26844	14.7342	0	14.7342	15.0613	15.0613

36	0.392208	4.79281	-1.36351	Scotico+ bonifica	0	29.3	5.76808	6.35539	11.3252	0	11.3252	11.4625	11.4625
37	0.376802	4.18224	-0.253792	a-GG	0	34	6.35624	7.00343	10.383	0	10.383	10.4112	10.4112
38	0.376802	4.16697	0.833594	a-GG	0	34	6.40726	7.05965	10.4664	0	10.4664	10.3731	10.3731
39	0.376802	4.09779	1.92128	a-GG	0	34	6.37568	7.02485	10.4148	0	10.4148	10.2009	10.2009
40	0.376802	3.97461	3.00966	a-GG	0	34	6.25846	6.8957	10.2233	0	10.2233	9.89423	9.89423
41	0.376802	3.79732	4.09913	a-GG	0	34	6.05235	6.6686	9.8866	0	9.8866	9.45285	9.45285
42	0.376802	3.5657	5.19008	a-GG	0	34	5.75379	6.33964	9.3989	0	9.3989	8.87627	8.87627
43	0.376802	3.27952	6.28293	a-GG	0	34	5.35891	5.90455	8.75386	0	8.75386	8.16385	8.16385
44	0.376802	2.93846	7.37808	a-GG	0	34	4.86347	5.35867	7.94457	0	7.94457	7.31481	7.31481
45	0.376802	2.54213	8.47594	a-GG	0	34	4.26287	4.69691	6.96344	0	6.96344	6.32818	6.32818
46	0.376802	2.0901	9.57696	a-GG	0	34	3.55199	3.91365	5.80223	0	5.80223	5.20293	5.20293
47	0.376802	1.58185	10.6815	a-GG	0	34	2.72525	3.00274	4.45174	0	4.45174	3.93771	3.93771
48	0.376802	1.01679	11.7902	a-GG	0	34	1.77649	1.95737	2.90191	0	2.90191	2.5311	2.5311
49	0.376802	0.395865	12.9033	a-GG	0	34	0.701657	0.7731	1.14617	0	1.14617	0.985424	0.985424
50	0.376802	0.0560769	14.0214	a-GG	0	34	0.100876	0.111147	0.164783	0	0.164783	0.139591	0.139591

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.10182**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	60.8179	34.9796	0	0	0
2	61.0061	34.7927	0.386454	0	0
3	61.3938	34.423	1.97663	0	0
4	61.7815	34.0725	4.46732	0	0
5	62.1692	33.7399	7.67676	0	0
6	62.5569	33.4241	11.3046	0	0
7	62.9446	33.1241	15.2258	0	0
8	63.3323	32.8389	19.378	0	0
9	63.7201	32.5679	23.6542	0	0
10	64.1078	32.3103	27.9572	0	0
11	64.4955	32.0654	32.199	0	0
12	64.8832	31.8329	36.1767	0	0
13	65.2709	31.6121	39.6714	0	0
14	65.6586	31.4027	42.6849	0	0
15	66.0463	31.2041	45.2254	0	0

16	66.434	31.0162	47.3056	0	0
17	66.8218	30.8384	48.9416	0	0
18	67.2095	30.6706	50.1532	0	0
19	67.5972	30.5125	50.9638	0	0
20	67.9849	30.3637	51.4001	0	0
21	68.3726	30.2242	51.4919	0	0
22	68.7603	30.0937	51.2726	0	0
23	69.148	29.9719	50.7784	0	0
24	69.5357	29.8589	50.0491	0	0
25	69.9235	29.7542	49.1275	0	0
26	70.3112	29.658	48.0595	0	0
27	70.7034	29.569	46.8809	0	0
28	71.0956	29.4882	45.6579	0	0
29	71.4878	29.4157	44.4491	0	0
30	71.88	29.3513	43.3165	0	0
31	72.2722	29.2949	42.2653	0	0
32	72.6644	29.2465	41.0558	0	0
33	73.0566	29.2059	39.6528	0	0
34	73.4488	29.1732	38.0557	0	0
35	73.841	29.1484	36.2668	0	0
36	74.2332	29.1313	34.3569	0	0
37	74.6255	29.1219	32.7951	0	0
38	75.0023	29.1203	30.9364	0	0
39	75.3791	29.1257	28.9819	0	0
40	75.7559	29.1384	26.9565	0	0
41	76.1327	29.1582	24.8891	0	0
42	76.5095	29.1852	22.8129	0	0
43	76.8863	29.2194	20.7658	0	0
44	77.2631	29.2609	18.7904	0	0
45	77.6399	29.3097	16.9349	0	0
46	78.0167	29.3659	15.2532	0	0
47	78.3935	29.4294	13.8054	0	0
48	78.7703	29.5005	12.6584	0	0
49	79.1471	29.5791	11.887	0	0
50	79.5239	29.6655	11.5728	0	0
51	79.9007	29.7596	0	0	0

List Of Coordinates

Water Table

X	Y
0	23.9412
120.602	23.9412

Distributed Load

X	Y
49.2437	34.1694
62.3437	35.0864

Distributed Load

X	Y
41.2335	34.5692
28.9335	33.7344

External Boundary

X	Y
0	0

120.602	0
120.602	11.5857
120.602	20.2455
120.602	27.434
120.602	31.0582
119.425	31.0346
112.516	34.5039
112.41	34.5046
112.134	34.4565
101.814	34.1093
101.395	34.1822
92.2797	29.7709
91.9678	29.2401
91.1448	29.2423
90.8499	29.7747
89.6951	30.2962
89.6265	30.3271
82.671	30.342
79.4964	29.6746
74.6231	29.6761
74.0437	30.0624
72.0437	30.0624
64.5437	35.0624
62.4437	35.1464
62.3437	35.0864
49.2437	34.1694
47.9937	34.1834
42.4835	34.5832
41.3335	34.6292
41.2335	34.5692
28.9335	33.7344
28.8335	33.7944
26.7335	33.7104
19.9035	29.1572
9.14684	28.9638
0	29.0002
0	26.6775
0	19.3865

Material Boundary

X	Y
28.9335	33.7344
28.9335	33.5344
41.2335	34.3692
41.2335	34.5692

Material Boundary

X	Y

49.2437	34.1694
49.2437	33.9694
62.3437	34.8864
62.3437	35.0864

Material Boundary

X	Y
0	26.6775
10.2247	25.8021
24.9466	23.1574
43.909	23.6442
60.9798	23.086
74.821	23.0841
91.3297	26.7625
113.673	28.1393
120.602	27.434

Material Boundary

X	Y
0	19.3865
8.1021	19.0508
42.4192	18.4771
60.2353	18.2055
95.7911	18.9222
118.755	20.1866
120.602	20.2455

Material Boundary

X	Y
89.6951	30.2962
90.7123	28.7105
92.5716	28.7105
117.625	30.1906
119.425	31.0346

Material Boundary

X	Y
19.9035	29.1572
27.3263	29.268
27.4394	29.2841
27.6208	29.2887
27.8528	29.2947
29.2417	28.3273
29.6483	27.9846
32.4943	28.572
35.9786	29.3391
39.7111	29.3481
46.6795	29.5681
52.7374	29.5943

61.2422	29.6198
74.6231	29.6761
74.6265	28.8761
61.2451	28.8198
52.7403	28.7943
46.6939	28.7682
39.7247	28.5481
36.0666	28.5393

32.6612	27.7896
29.4298	27.1226
28.7542	27.6918
27.611	28.4882
27.5062	28.4855
27.3889	28.4688
19.9155	28.3572
19.9035	29.1572

Sezione 1093 – prg 19+600

Condizioni statiche_dx – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.39 > 1.1$

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 19600 statica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3.5
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

- 2 Distributed Loads present

Distributed Load 1	
Distribution:	Constant
Magnitude [kPa]:	26
Orientation:	Vertical

Distributed Load 2	
Distribution:	Constant
Magnitude [kPa]:	26
Orientation:	Vertical

Material Properties

Property	Rilevato	Piattaforma stradale	Scotico+bonifica	Qa	Pvs	Qc(a)	Pv
Color							

Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	18	18	18.5	18	18
Cohesion [kPa]	0	0	0	12	0	0	0
Friction Angle [deg]	29.3	29.3	29.3	18	34	34	35
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1	1	1

Global Minimums

Method: bishop simplified

FS	1.393920
Center:	84.244, 55.061
Radius:	24.498
Left Slip Surface Endpoint:	67.059, 37.601
Right Slip Surface Endpoint:	91.022, 31.519
Resisting Moment:	10050.6 kN-m
Driving Moment:	7210.29 kN-m
Total Slice Area:	38.1367 m2
Surface Horizontal Width:	23.9625 m
Surface Average Height:	1.59151 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1579
Number of Invalid Surfaces: 1

Error Codes:

- Error Code -112 reported for 1 surface

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.39392**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.191651	0.344972	-44.2326	Piattaforma stradale	0	29.3	8.06438	11.2411	20.0314	0	20.0314	27.8826	27.8826
2	0.479173	3.80693	-43.1517	Rilevato	0	29.3	9.94648	13.8646	24.7064	0	24.7064	34.031	34.031
3	0.479173	7.87036	-41.6339	Rilevato	0	29.3	12.6053	17.5708	31.3108	0	31.3108	42.5156	42.5156
4	0.479173	11.7398	-40.151	Rilevato	0	29.3	15.2049	21.1944	37.768	0	37.768	50.5948	50.5948

5	0.479173	15.4279	-38.6999	Rilevato	0	29.3	17.7454	24.7356	44.0783	0	44.0783	58.295	58.295
6	0.479173	19.1008	-37.2777	Rilevato	0	29.3	18.6527	26.0004	46.3321	0	46.3321	60.5302	60.5302
7	0.479173	22.476	-35.8819	Rilevato	0	29.3	14.6325	20.3966	36.3463	0	36.3463	46.9315	46.9315
8	0.479173	25.2264	-34.5103	Rilevato	0	29.3	16.6084	23.1508	41.2542	0	41.2542	52.6732	52.6732
9	0.479173	27.8321	-33.1609	Rilevato	0	29.3	18.5229	25.8195	46.0098	0	46.0098	58.1128	58.1128
10	0.479173	30.2998	-31.832	Rilevato	0	29.3	20.3767	28.4035	50.6145	0	50.6145	63.2643	63.2643
11	0.479173	31.9241	-30.5219	Rilevato	0	29.3	21.6868	30.2297	53.8686	0	53.8686	66.6543	66.6543
12	0.479173	31.6345	-29.2293	Rilevato	0	29.3	21.7015	30.2502	53.9053	0	53.9053	66.0485	66.0485
13	0.479173	31.1372	-27.9529	Rilevato	0	29.3	21.5647	30.0595	53.5655	0	53.5655	65.0089	65.0089
14	0.479173	30.5225	-26.6913	Rilevato	0	29.3	21.3361	29.7408	52.9975	0	52.9975	63.7244	63.7244
15	0.479173	29.7944	-25.4436	Rilevato	0	29.3	21.0166	29.2955	52.2039	0	52.2039	62.203	62.203
16	0.479173	28.9564	-24.2087	Rilevato	0	29.3	20.6074	28.725	51.1874	0	51.1874	60.4525	60.4525
17	0.479173	28.0119	-22.9857	Rilevato	0	29.3	20.109	28.0304	49.9496	0	49.9496	58.4794	58.4794
18	0.479173	26.9636	-21.7736	Rilevato	0	29.3	19.5223	27.2125	48.4922	0	48.4922	56.2901	56.2901
19	0.479173	25.8144	-20.5717	Rilevato	0	29.3	18.8476	26.2721	46.8163	0	46.8163	53.89	53.89
20	0.479173	24.5666	-19.3792	Rilevato	0	29.3	18.0853	25.2095	44.9228	0	44.9228	51.2843	51.2843
21	0.479173	23.2225	-18.1953	Rilevato	0	29.3	17.2356	24.0251	42.8122	0	42.8122	48.4774	48.4774
22	0.479173	21.7841	-17.0195	Rilevato	0	29.3	16.2987	22.7191	40.485	0	40.485	45.4741	45.4741
23	0.479173	20.2532	-15.851	Rilevato	0	29.3	15.2744	21.2913	37.9406	0	37.9406	42.2775	42.2775
24	0.514173	19.9251	-14.647	Scotico+ bonifica	0	29.3	14.119	19.6807	35.0707	0	35.0707	38.7608	38.7608
25	0.514173	17.9475	-13.4074	Scotico+ bonifica	0	29.3	12.8248	17.8767	31.856	0	31.856	34.913	34.913
26	0.514173	15.8614	-12.1742	Scotico+ bonifica	0	29.3	11.4289	15.931	28.3887	0	28.3887	30.8543	30.8543
27	0.514173	13.6682	-10.9466	Scotico+ bonifica	0	29.3	9.93056	13.8424	24.6669	0	24.6669	26.5876	26.5876
28	0.514173	11.3695	-9.72416	Scotico+ bonifica	0	29.3	8.32889	11.6098	20.6885	0	20.6885	22.1158	22.1158
29	0.514173	8.9665	-8.50616	Scotico+ bonifica	0	29.3	6.62278	9.23163	16.4506	0	16.4506	17.4411	17.4411
30	0.514173	6.46018	-7.29201	Scotico+ bonifica	0	29.3	4.81095	6.70608	11.9501	0	11.9501	12.5657	12.5657
31	0.514173	3.85149	-6.08115	Scotico+ bonifica	0	29.3	2.89191	4.03109	7.18332	0	7.18332	7.49142	7.49142

32	0.479773	2.66102	-4.91335	Qc(a)	0	34	2.57693	3.59204	5.32543	0	5.32543	5.54695	5.54695
33	0.479773	3.23622	-3.78796	Qc(a)	0	34	3.16293	4.40887	6.53641	0	6.53641	6.74583	6.74583
34	0.479773	3.72973	-2.66403	Qc(a)	0	34	3.67912	5.1284	7.60316	0	7.60316	7.77435	7.77435
35	0.479773	4.14181	-1.54112	Qc(a)	0	34	4.12382	5.74827	8.52218	0	8.52218	8.63312	8.63312
36	0.479773	4.47264	-0.418803	Qc(a)	0	34	4.49519	6.26593	9.28962	0	9.28962	9.32248	9.32248
37	0.479773	4.7223	0.703351	Qc(a)	0	34	4.79125	6.67862	9.90146	0	9.90146	9.84264	9.84264
38	0.479773	4.89078	1.82578	Qc(a)	0	34	5.00987	6.98336	10.3533	0	10.3533	10.1936	10.1936
39	0.479773	4.97798	2.9489	Qc(a)	0	34	5.14877	7.17697	10.6403	0	10.6403	10.3751	10.3751
40	0.479773	4.98369	4.07316	Qc(a)	0	34	5.20543	7.25595	10.7574	0	10.7574	10.3867	10.3867
41	0.479773	4.90763	5.199	Qc(a)	0	34	5.17717	7.21656	10.699	0	10.699	10.299	10.299
42	0.479773	4.74939	6.32685	Qc(a)	0	34	5.06105	7.0547	10.459	0	10.459	9.89788	9.89788
43	0.479773	4.50848	7.45717	Qc(a)	0	34	4.85389	6.76594	10.0309	0	10.0309	9.39559	9.39559
44	0.479773	4.18432	8.59042	Qc(a)	0	34	4.55222	6.34543	9.40747	0	9.40747	8.71979	8.71979
45	0.479773	3.7762	9.72707	Qc(a)	0	34	4.15223	5.78787	8.58087	0	8.58087	7.8691	7.8691
46	0.479773	3.28332	10.8676	Qc(a)	0	34	3.64975	5.08746	7.54247	0	7.54247	6.84178	6.84178
47	0.479773	2.70474	12.0125	Qc(a)	0	34	3.04025	4.23786	6.28288	0	6.28288	5.63596	5.63596
48	0.479773	2.03941	13.1623	Qc(a)	0	34	2.31868	3.23205	4.79171	0	4.79171	4.24948	4.24948
49	0.479773	1.28618	14.3175	Qc(a)	0	34	1.4795	2.0623	3.05748	0	3.05748	2.67988	2.67988
50	0.479773	0.443712	15.4787	Qc(a)	0	34	0.516578	0.720068	1.06754	0	1.06754	0.924491	0.924491

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.39392**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	67.059	37.601	0	0	0
2	67.2506	37.4144	2.19574	0	0
3	67.7298	36.9652	8.53961	0	0
4	68.209	36.5392	15.8505	0	0
5	68.6882	36.135	23.8493	0	0
6	69.1673	35.7511	32.2879	0	0
7	69.6465	35.3864	40.2707	0	0

8	70.1257	35.0397	45.8749	0	0
9	70.6048	34.7103	51.5272	0	0
10	71.084	34.3972	57.0783	0	0
11	71.5632	34.0997	62.3942	0	0
12	72.0424	33.8172	67.2456	0	0
13	72.5215	33.5491	71.3252	0	0
14	73.0007	33.2948	74.6373	0	0
15	73.4799	33.0539	77.2058	0	0
16	73.9591	32.8259	79.0608	0	0
17	74.4382	32.6105	80.2378	0	0
18	74.9174	32.4073	80.7779	0	0
19	75.3966	32.2159	80.7273	0	0
20	75.8757	32.036	80.1373	0	0
21	76.3549	31.8675	79.0638	0	0
22	76.8341	31.71	77.5679	0	0
23	77.3133	31.5633	75.715	0	0
24	77.7924	31.4272	73.5756	0	0
25	78.3066	31.2929	71.0464	0	0
26	78.8208	31.1703	68.3726	0	0
27	79.335	31.0594	65.6594	0	0
28	79.8491	30.9599	63.0188	0	0
29	80.3633	30.8718	60.5695	0	0
30	80.8775	30.7949	58.4375	0	0
31	81.3916	30.7291	56.7561	0	0
32	81.9058	30.6743	55.6663	0	0
33	82.3856	30.6331	54.6525	0	0
34	82.8654	30.6013	53.3464	0	0
35	83.3451	30.579	51.7552	0	0
36	83.8249	30.5661	49.8915	0	0
37	84.3047	30.5626	47.7726	0	0
38	84.7845	30.5685	45.4211	0	0
39	85.2642	30.5838	42.865	0	0
40	85.744	30.6085	40.1378	0	0
41	86.2238	30.6427	37.2789	0	0
42	86.7035	30.6863	34.3339	0	0
43	87.1833	30.7395	31.3553	0	0
44	87.6631	30.8023	28.4022	0	0
45	88.1429	30.8748	25.5416	0	0
46	88.6226	30.957	22.8486	0	0
47	89.1024	31.0491	20.4071	0	0
48	89.5822	31.1512	18.3106	0	0
49	90.062	31.2634	16.6632	0	0
50	90.5417	31.3859	15.5807	0	0
51	91.0215	31.5187	0	0	0

List Of Coordinates

Water Table

X	Y

0	25.3539
110.144	25.3539

Distributed Load

X	Y
35.9029	36.4578
35.9029	36.3978
48.2029	37.2326
48.2029	37.2926

Distributed Load

X	Y
56.3868	36.9139
56.3868	36.8539
69.4868	37.7709
69.4868	37.8309

External Boundary

X	Y
103.364	32.7673
102.211	32.2207
81.9058	30.9468
71.6868	37.7469
69.5868	37.8309
69.4868	37.8309
69.4868	37.7709
56.3868	36.8539
56.3868	36.9139
56.2868	36.9139
55.1368	36.8679
55.1368	36.6205
49.4529	37.2466
48.3029	37.2926
48.2029	37.2926
48.2029	37.2326
35.9029	36.3978
35.9029	36.4578
35.8029	36.4578
33.7029	36.3738
26.2029	31.3738
24.2029	31.3738
22.1721	30.0199
12.2368	30.406
0	30.406
0	18.1059
0	0
110.144	-1.42e-014
110.144	19.7673

110.144	24.5633
110.144	32.2002
107.087	32.777
106.632	32.7836
106.609	32.6534
105.653	32.5349

Material Boundary

X	Y
35.9029	36.3978
35.9029	36.1978
48.2029	37.0326
48.2029	37.2326

Material Boundary

X	Y
56.3868	36.8539
56.3868	36.6539
69.4868	37.5709
69.4868	37.7709

Material Boundary

X	Y
0	18.1059
14.3132	19.1729
29.8786	20.5612
38.5766	21.7251
47.812	22.9609
54.0214	24.3136
59.0807	25.6409
62.147	26.5598
64.1977	27.3979

Material Boundary

X	Y
38.5766	21.7251
40.4193	21.3201
44.6549	20.4535
49.4346	19.6319
55.6662	18.8016
59.7041	18.4317
62.984	18.2555
66.1757	18.2379
72.8074	18.2991
87.7728	19.4862
108.997	19.783
110.144	19.7673

Material Boundary

X	Y
52.0701	29.2264
54.3115	28.5548
63.4485	27.4515
64.1977	27.3979
80.4343	26.2365
92.438	25.4736
110.144	24.5633

Material Boundary

X	Y
73.5512	30.4226
71.4731	30.5802
71.4075	30.5806
70.9663	30.5829
70.4718	30.5851
69.8404	30.5882
67.8332	30.6056
66.1276	30.6179
65.4037	30.6266
65.0606	30.6324
64.8439	30.6357
62.9724	29.4637
61.3935	28.5195
58.9863	29.0429
54.6252	29.23
53.7569	29.2683
52.0701	29.2264
41.0635	28.9533
32.5561	28.5504
22.1721	28.5199
22.1721	30.0199
32.5561	30.0504
41.0635	30.4533
53.7569	30.7683
54.6252	30.73
58.9863	30.5429
61.3935	30.0195
62.9724	30.9637
64.8439	32.1357
65.0606	32.1324
65.4037	32.1266
66.1276	32.1179
67.8332	32.1056
69.8404	32.0882
70.4718	32.0851
70.9663	32.0829
71.4075	32.0806
71.4731	32.0802
73.5512	31.9226
81.9058	30.9468
81.9058	29.4468
73.5512	30.4226

Condizioni sismiche dx – analisi in tensioni efficaci: $(R_d / F_d)_{min}$ = 1.16 > 1.1 (sisma verso l'alto ↑)

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 19600 sismica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3.5
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal):	0.124
Seismic Load Coefficient (Vertical):	0.062

- 2 Distributed Loads present

Distributed Load 1	
Distribution:	Constant
Magnitude [kPa]:	4
Orientation:	Vertical

Distributed Load 2	
Distribution:	Constant
Magnitude [kPa]:	4
Orientation:	Vertical

Material Properties

Property	Rilevato	Piattaforma stradale	Scotico+bonifica	Qa	Pvs	Qc(a)	Pv
Color							
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	18	18	18.5	18	18
Cohesion [kPa]	0	0	0	12	0	0	0
Friction Angle [deg]	29.3	29.3	29.3	18	34	34	35
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1	1	1

Global Minimums

Method: bishop simplified

FS	1.161850
Center:	84.528, 55.542
Radius:	25.043
Left Slip Surface Endpoint:	67.057, 37.601
Right Slip Surface Endpoint:	91.755, 31.565
Resisting Moment:	10136.8 kN-m
Driving Moment:	8724.71 kN-m
Total Slice Area:	39.0167 m2
Surface Horizontal Width:	24.6982 m
Surface Average Height:	1.57974 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1545
Number of Invalid Surfaces:	0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.16185**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.193532	0.348358	-43.9327	Piattaforma stradale	0	29.3	1.95206	2.268	4.04154	0	4.04154	5.9222	5.9222
2	0.500529	4.0509	-42.8443	Rilevato	0	29.3	4.20519	4.8858	8.70639	0	8.70639	12.6065	12.6065
3	0.500529	8.43867	-41.3011	Rilevato	0	29.3	7.43227	8.63518	15.3877	0	15.3877	21.9174	21.9174
4	0.500529	12.6134	-39.7937	Rilevato	0	29.3	10.6002	12.3158	21.9465	0	21.9465	30.7762	30.7762
5	0.500529	16.5892	-38.3186	Rilevato	0	29.3	13.7074	15.926	28.3798	0	28.3798	39.2125	39.2125
6	0.500529	20.6109	-36.873	Rilevato	0	29.3	16.3423	18.9873	33.835	0	33.835	46.0931	46.0931
7	0.500529	24.0553	-35.4543	Rilevato	0	29.3	18.3451	21.3143	37.9816	0	37.9816	51.045	51.045
8	0.500529	27.0048	-34.0602	Rilevato	0	29.3	20.8647	24.2417	43.1983	0	43.1983	57.3036	57.3036
9	0.500529	29.7956	-32.6886	Rilevato	0	29.3	23.3123	27.0854	48.2656	0	48.2656	63.2253	63.2253
10	0.500529	32.4088	-31.3379	Rilevato	0	29.3	25.6672	29.8214	53.141	0	53.141	68.7702	68.7702
11	0.500529	33.1345	-30.0062	Rilevato	0	29.3	26.5532	30.8508	54.9756	0	54.9756	70.3099	70.3099
12	0.500529	32.6699	-28.6923	Rilevato	0	29.3	26.4827	30.7689	54.8295	0	54.8295	69.3237	69.3237
13	0.500529	32.0716	-27.3946	Rilevato	0	29.3	26.2896	30.5446	54.4298	0	54.4298	68.0539	68.0539
14	0.500529	31.3444	-26.112	Rilevato	0	29.3	25.9752	30.1793	53.7789	0	53.7789	66.5107	66.5107
15	0.500529	30.4927	-24.8433	Rilevato	0	29.3	25.5403	29.674	52.8784	0	52.8784	64.7031	64.7031
16	0.500529	29.5203	-23.5875	Rilevato	0	29.3	24.9857	29.0296	51.7301	0	51.7301	62.6395	62.6395
17	0.500529	28.4308	-22.3436	Rilevato	0	29.3	24.3117	28.2466	50.3348	0	50.3348	60.3274	60.3274
18	0.500529	27.2272	-21.1107	Rilevato	0	29.3	23.5188	27.3253	48.6931	0	48.6931	57.7733	57.7733
19	0.500529	25.9126	-19.888	Rilevato	0	29.3	22.607	26.266	46.8054	0	46.8054	54.9837	54.9837
20	0.500529	24.4896	-18.6747	Rilevato	0	29.3	21.5763	25.0684	44.6714	0	44.6714	51.9639	51.9639
21	0.500529	22.9605	-17.47	Rilevato	0	29.3	20.4264	23.7324	42.2905	0	42.2905	48.7192	48.7192
22	0.500529	21.3275	-16.2732	Rilevato	0	29.3	19.1568	22.2573	39.662	0	39.662	45.2541	45.2541
23	0.51804	20.2448	-15.063	Scotico+bonifica	0	29.3	17.7406	20.6119	36.7299	0	36.7299	41.5044	41.5044
24	0.51804	18.2753	-13.8389	Scotico+bonifica	0	29.3	16.1722	18.7897	33.4828	0	33.4828	37.4667	37.4667

25	0.51804	16.1967	-12.6213	Scotico+ bonifica	0	29.3	14.4728	16.8152	29.9645	0	29.9645	33.2052	33.2052
26	0.51804	14.0105	-11.4094	Scotico+ bonifica	0	29.3	12.641	14.687	26.1721	0	26.1721	28.7231	28.7231
27	0.51804	11.7181	-10.2026	Scotico+ bonifica	0	29.3	10.6753	12.4031	22.102	0	22.102	24.0233	24.0233
28	0.51804	9.32092	-9.00047	Scotico+ bonifica	0	29.3	8.57364	9.96128	17.7508	0	17.7508	19.1088	19.1088
29	0.51804	6.81998	-7.80229	Scotico+ bonifica	0	29.3	6.33391	7.35905	13.1137	0	13.1137	13.9816	13.9816
30	0.51804	4.21626	-6.60752	Scotico+ bonifica	0	29.3	3.95369	4.59359	8.18569	0	8.18569	8.64367	8.64367
31	0.492463	3.09118	-5.445	Qc(a)	0	34	3.66716	4.26069	6.31674	0	6.31674	6.66629	6.66629
32	0.492463	3.73777	-4.31411	Qc(a)	0	34	4.48326	5.20887	7.72248	0	7.72248	8.06069	8.06069
33	0.492463	4.29777	-3.18489	Qc(a)	0	34	5.2123	6.05591	8.97826	0	8.97826	9.26683	9.2683
34	0.492463	4.7715	-2.05692	Qc(a)	0	34	5.85174	6.79884	10.0797	0	10.0797	10.2899	10.2899
35	0.492463	5.15919	-0.929737	Qc(a)	0	34	6.39881	7.43446	11.022	0	11.022	11.1259	11.1259
36	0.492463	5.46099	0.197082	Qc(a)	0	34	6.85059	7.95936	11.8002	0	11.8002	11.7767	11.7767
37	0.492463	5.67693	1.32398	Qc(a)	0	34	7.20386	8.36981	12.4087	0	12.4087	12.2423	12.2423
38	0.492463	5.80692	2.45139	Qc(a)	0	34	7.45521	8.66184	12.8417	0	12.8417	12.5225	12.5225
39	0.492463	5.85082	3.57974	Qc(a)	0	34	7.6009	8.8311	13.0926	0	13.0926	12.6171	12.6171
40	0.492463	5.80834	4.7095	Qc(a)	0	34	7.63686	8.87289	13.1546	0	13.1546	12.5255	12.5255
41	0.492463	5.67912	5.84109	Qc(a)	0	34	7.55873	8.78211	13.02	0	13.02	12.2468	12.2468
42	0.492463	5.46269	6.97497	Qc(a)	0	34	7.36167	8.55316	12.6806	0	12.6806	11.778	11.78
43	0.492463	5.15845	8.1116	Qc(a)	0	34	7.04045	8.17995	12.1273	0	12.1273	11.1238	11.1238
44	0.492463	4.76571	9.25146	Qc(a)	0	34	6.5893	7.65578	11.3502	0	11.3502	10.2769	10.2769
45	0.492463	4.28367	10.395	Qc(a)	0	34	6.00188	6.97328	10.3383	0	10.3383	9.2373	9.2373
46	0.492463	3.71139	11.5428	Qc(a)	0	34	5.27121	6.12435	9.07971	0	9.07971	8.00317	8.00317
47	0.492463	3.0478	12.6953	Qc(a)	0	34	4.38953	5.09998	7.56103	0	7.56103	6.57219	6.57219
48	0.492463	2.29173	13.853	Qc(a)	0	34	3.3483	3.89022	5.76748	0	5.76748	4.94177	4.94177
49	0.492463	1.44183	15.0166	Qc(a)	0	34	2.13792	2.48394	3.68259	0	3.68259	3.10908	3.10908
50	0.492463	0.496626	16.1865	Qc(a)	0	34	0.747698	0.868713	1.28792	0	1.28792	1.07089	1.07089

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.16185**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	67.0569	37.6008	0	0	0
2	67.2504	37.4144	0.419124	0	0
3	67.7509	36.9502	2.85913	0	0
4	68.2515	36.5104	6.95367	0	0
5	68.752	36.0935	12.3645	0	0
6	69.2525	35.6979	18.7893	0	0
7	69.753	35.3225	25.8717	0	0
8	70.2536	34.9661	33.2136	0	0
9	70.7541	34.6277	40.7405	0	0
10	71.2546	34.3065	48.2742	0	0
11	71.7552	34.0017	55.6475	0	0
12	72.2557	33.7127	62.362	0	0
13	72.7562	33.4387	68.1835	0	0
14	73.2567	33.1793	73.1258	0	0
15	73.7573	32.934	77.2105	0	0
16	74.2578	32.7023	80.4672	0	0
17	74.7583	32.4837	82.9324	0	0
18	75.2589	32.278	84.6495	0	0
19	75.7594	32.0847	85.6685	0	0
20	76.2599	31.9037	86.0461	0	0
21	76.7604	31.7345	85.845	0	0
22	77.261	31.577	85.1344	0	0
23	77.7615	31.4309	83.9897	0	0
24	78.2795	31.2914	82.4344	0	0
25	78.7976	31.1638	80.5992	0	0
26	79.3156	31.0478	78.5891	0	0
27	79.8337	30.9433	76.5167	0	0
28	80.3517	30.85	74.5025	0	0
29	80.8697	30.768	72.6752	0	0
30	81.3878	30.697	71.1719	0	0
31	81.9058	30.637	70.1386	0	0
32	82.3983	30.5901	69.0133	0	0
33	82.8907	30.5529	67.5567	0	0
34	83.3832	30.5255	65.7699	0	0
35	83.8757	30.5078	63.6593	0	0
36	84.3681	30.4998	61.2373	0	0
37	84.8606	30.5015	58.5222	0	0
38	85.3531	30.5129	55.5388	0	0
39	85.8455	30.534	52.3183	0	0
40	86.338	30.5648	48.8988	0	0
41	86.8304	30.6054	45.3261	0	0
42	87.3229	30.6557	41.6536	0	0
43	87.8154	30.716	37.9431	0	0

44	88.3078	30.7862	34.2659	0	0
45	88.8003	30.8664	30.7028	0	0
46	89.2928	30.9567	27.3455	0	0
47	89.7852	31.0573	24.2978	0	0
48	90.2777	31.1682	21.6761	0	0
49	90.7701	31.2897	19.6116	0	0
50	91.2626	31.4218	18.2515	0	0
51	91.7551	31.5647	0	0	0

List Of Coordinates

Water Table

X	Y
0	25.3539
110.144	25.3539

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X	Y
35.9029	36.4578
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56.2868	36.9139
55.1368	36.8679
55.1368	36.6205
49.4529	37.2466
48.3029	37.2926
48.2029	37.2926
48.2029	37.2326
35.9029	36.3978
35.9029	36.4578
35.8029	36.4578
33.7029	36.3738
26.2029	31.3738
24.2029	31.3738
22.1721	30.0199
12.2368	30.406
0	30.406
0	18.1059
0	0
110.144	-1.42e-014
110.144	19.7673
110.144	24.5633
110.144	32.2002
107.087	32.777
106.632	32.7836
106.609	32.6534
105.653	32.5349

Material Boundary

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X	Y
56.3868	36.8539
56.3868	36.6539
69.4868	37.5709
69.4868	37.7709

Material Boundary

X	Y
0	18.1059

14.3132	19.1729
29.8786	20.5612
38.5766	21.7251
47.812	22.9609
54.0214	24.3136
59.0807	25.6409
62.147	26.5598
64.1977	27.3979

Material Boundary

X	Y
38.5766	21.7251
40.4193	21.3201
44.6549	20.4535
49.4346	19.6319
55.6662	18.8016
59.7041	18.4317
62.984	18.2555
66.1757	18.2379
72.8074	18.2991
87.7728	19.4862
108.997	19.783
110.144	19.7673

Material Boundary

X	Y
52.0701	29.2264
54.3115	28.5548
63.4485	27.4515
64.1977	27.3979
80.4343	26.2365
92.438	25.4736
110.144	24.5633

Material Boundary

X	Y
73.5512	30.4226
71.4731	30.5802
71.4075	30.5806
70.9663	30.5829

70.4718	30.5851
69.8404	30.5882
67.8332	30.6056
66.1276	30.6179
65.4037	30.6266
65.0606	30.6324
64.8439	30.6357
62.9724	29.4637
61.3935	28.5195
58.9863	29.0429
54.6252	29.23
53.7569	29.2683
52.0701	29.2264
41.0635	28.9533
32.5561	28.5504
22.1721	28.5199
22.1721	30.0199
32.5561	30.0504
41.0635	30.4533
53.7569	30.7683
54.6252	30.73
58.9863	30.5429
61.3935	30.0195
62.9724	30.9637
64.8439	32.1357
65.0606	32.1324
65.4037	32.1266
66.1276	32.1179
67.8332	32.1056
69.8404	32.0882
70.4718	32.0851
70.9663	32.0829
71.4075	32.0806
71.4731	32.0802
73.5512	31.9226
81.9058	30.9468
81.9058	29.4468
73.5512	30.4226

Condizioni statiche_sx – analisi in tensioni efficaci: $(R_d / F_d)_{min}$ = 1.40 > 1.1

Slide Analysis Information

Project Summary

- File Name: pk 19600 statica CD.slim
- Slide Modeler Version: 7.038

General Settings

- Units of Measurement: Metric Units
- Time Units: days
- Permeability Units: meters/second
- Failure Direction: Right to Left
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Bishop simplified
- Janbu simplified

- Number of slices: 50
- Tolerance: 0.005
- Maximum number of iterations: 75
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 9.81 kN/m3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Auto Refine Search
- Divisions along slope: 10
- Circles per division: 10
- Number of iterations: 10
- Divisions to use in next iteration: 50%
- Composite Surfaces: Disabled
- Minimum Elevation: Not Defined
- Minimum Depth: 3.5

Loading

- 2 Distributed Loads present

Distributed Load 1

- Distribution: Constant

- Magnitude [kN/m2]: 26
- Orientation: Vertical

Distributed Load 2

- Distribution: Constant
- Magnitude [kN/m2]: 26
- Orientation: Vertical

Material Properties

Property	Rilevato	Piattaforma stradale	Scotico+bonifica	Qa	Pvs	Qc(a)	Pv
Color							
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	18	18	18.5	18	18
Cohesion [kPa]	0	0	0	12	0	0	0
Friction Angle [deg]	29.3	29.3	29.3	18	34	34	35
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1	1	1

Global Minimums

Method: bishop simplified

- FS: 1.399840
- Center: 23.159, 50.330
- Radius: 20.463
- Left Slip Surface Endpoint: 20.070, 30.102
- Right Slip Surface Endpoint: 38.295, 36.560
- Resisting Moment=7894.57 kN-m
- Driving Moment=5639.62 kN-m

Method: janbu simplified

- FS: 1.303530

- Center: 23.986, 45.615
- Radius: 16.010
- Left Slip Surface Endpoint: 20.019, 30.104
- Right Slip Surface Endpoint: 37.135, 36.481
- Resisting Horizontal Force=331.466 kN
- Driving Horizontal Force=254.284 kN

Valid / Invalid Surfaces

Method: bishop simplified

- Number of Valid Surfaces: 1506
- Number of Invalid Surfaces: 0

Method: janbu simplified

- Number of Valid Surfaces: 1506
- Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.39984**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]
1	0.350391	0.116034	Qa	12	18	8.94729	12.5248	1.61507	0	1.61507
2	0.350391	0.328659	Qa	12	18	9.05483	12.6753	2.07841	0	2.07841
3	0.350391	0.502527	Qa	12	18	9.13539	12.7881	2.42549	0	2.42549
4	0.350391	0.637872	Qa	12	18	9.18943	12.8637	2.65829	0	2.65829
5	0.350391	0.734892	Qa	12	18	9.21737	12.9028	2.77867	0	2.77867
6	0.350391	0.793752	Qa	12	18	9.21961	12.906	2.78833	0	2.78833
7	0.356644	1.63661	Scotico+bonifica	0	29.3	1.86917	2.61654	4.66261	0	4.66261
8	0.356644	3.23348	Scotico+bonifica	0	29.3	3.66695	5.13315	9.14718	0	9.14718
9	0.356644	4.79042	Scotico+bonifica	0	29.3	5.39467	7.55167	13.4569	0	13.4569

10	0.356644	6.30744	Scotico+bonifica	0	29.3	7.05379	9.87418	17.5956	0	17.5956
11	0.356644	7.78454	Scotico+bonifica	0	29.3	8.6457	12.1026	21.5665	0	21.5665
12	0.356644	9.1503	Scotico+bonifica	0	29.3	10.0929	14.1284	25.1765	0	25.1765
13	0.356644	9.38882	Scotico+bonifica	0	29.3	10.2853	14.3978	25.6565	0	25.6565
14	0.356644	9.21941	Scotico+bonifica	0	29.3	10.031	14.0418	25.0222	0	25.0222
15	0.356644	9.00966	Scotico+bonifica	0	29.3	9.73626	13.6292	24.287	0	24.287
16	0.356644	8.75941	Scotico+bonifica	0	29.3	9.40172	13.1609	23.4524	0	23.4524
17	0.374547	8.88472	Rilevato	0	29.3	9.01739	12.6229	22.4937	0	22.4937
18	0.374547	9.00267	Rilevato	0	29.3	9.07211	12.6995	22.6302	0	22.6302
19	0.374547	10.2213	Rilevato	0	29.3	10.2267	14.3158	25.5104	0	25.5104
20	0.374547	11.44	Rilevato	0	29.3	11.3643	15.9082	28.3481	0	28.3481
21	0.374547	12.6098	Rilevato	0	29.3	12.4366	17.4092	31.0229	0	31.0229
22	0.374547	13.7301	Rilevato	0	29.3	13.444	18.8195	33.5361	0	33.5361
23	0.374547	14.8005	Rilevato	0	29.3	14.3871	20.1397	35.8885	0	35.8885
24	0.374547	15.8201	Rilevato	0	29.3	15.2661	21.3701	38.081	0	38.081
25	0.374547	16.7882	Rilevato	0	29.3	16.0811	22.511	40.1141	0	40.1141
26	0.374547	17.704	Rilevato	0	29.3	16.8325	23.5628	41.9883	0	41.9883
27	0.374547	18.5665	Rilevato	0	29.3	17.5201	24.5253	43.7037	0	43.7037
28	0.374547	19.3748	Rilevato	0	29.3	18.1439	25.3986	45.2598	0	45.2598
29	0.374547	20.1276	Rilevato	0	29.3	18.704	26.1826	46.657	0	46.657
30	0.374547	20.8239	Rilevato	0	29.3	19.2001	26.877	47.8941	0	47.8941
31	0.374547	21.4623	Rilevato	0	29.3	19.6317	27.4813	48.971	0	48.971
32	0.374547	22.0414	Rilevato	0	29.3	19.9987	27.995	49.8866	0	49.8866
33	0.374547	22.5595	Rilevato	0	29.3	20.3005	28.4175	50.6393	0	50.6393
34	0.374547	23.0149	Rilevato	0	29.3	20.5366	28.748	51.2283	0	51.2283
35	0.374547	23.4058	Rilevato	0	29.3	20.7063	28.9855	51.6516	0	51.6516
36	0.374547	23.7301	Rilevato	0	29.3	20.8088	29.129	51.9073	0	51.9073

37	0.374547	23.9856	Rilevato	0	29.3	20.8433	29.1773	51.9932	0	51.9932
38	0.374547	23.7409	Rilevato	0	29.3	20.4396	28.6122	50.9863	0	50.9863
39	0.374547	22.3235	Rilevato	0	29.3	19.036	26.6473	47.4849	0	47.4849
40	0.374547	20.7737	Rilevato	0	29.3	17.54	24.5532	43.7533	0	43.7533
41	0.374547	19.1433	Rilevato	0	29.3	15.9987	22.3956	39.9085	0	39.9085
42	0.374547	17.4285	Rilevato	0	29.3	14.4117	20.1741	35.9498	0	35.9498
43	0.374547	15.6243	Rilevato	0	29.3	12.7778	17.8869	31.874	0	31.874
44	0.374547	13.3798	Rilevato	0	29.3	18.8821	26.4319	47.101	0	47.101
45	0.374547	11.3974	Rilevato	0	29.3	16.9	23.6573	42.1567	0	42.1567
46	0.374547	9.36775	Rilevato	0	29.3	15.0864	21.1185	37.6328	0	37.6328
47	0.374547	7.2265	Rilevato	0	29.3	13.2199	18.5057	32.9767	0	32.9767
48	0.374547	4.96577	Rilevato	0	29.3	11.2995	15.8175	28.1865	0	28.1865
49	0.374547	2.57642	Rilevato	0	29.3	9.32485	13.0533	23.2607	0	23.2607
50	0.196877	0.354379	Piattaforma stradale	0	29.3	7.79203	10.9076	19.4371	0	19.4371

- **Global Minimum Query (janbu simplified) - Safety Factor: 1.30353**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]
1	0.358907	0.23725	Qa	12	18	9.97557	13.0035	3.08833	0	3.08833
2	0.358907	0.683644	Qa	12	18	10.2398	13.3479	4.1483	0	4.1483
3	0.358907	1.07424	Qa	12	18	10.4609	13.6361	5.03543	0	5.03543
4	0.358907	1.40984	Qa	12	18	10.6403	13.8699	5.75497	0	5.75497
5	0.358907	1.69112	Qa	12	18	10.779	14.0508	6.31164	0	6.31164
6	0.358907	1.91868	Qa	12	18	10.8783	14.1801	6.70979	0	6.70979
7	0.344162	2.75671	Scotico+bonifica	0	29.3	3.6083	4.70353	8.38159	0	8.38159
8	0.344162	4.37464	Scotico+bonifica	0	29.3	5.67046	7.39161	13.1717	0	13.1717
9	0.344162	5.94627	Scotico+bonifica	0	29.3	7.63391	9.95103	17.7325	0	17.7325

10	0.344162	7.47181	Scotico+bonifica	0	29.3	9.50189	12.386	22.0716	0	22.0716
11	0.344162	8.9514	Scotico+bonifica	0	29.3	11.2774	14.7004	26.1957	0	26.1957
12	0.344162	10.3781	Scotico+bonifica	0	29.3	12.9541	16.8861	30.0907	0	30.0907
13	0.344162	10.9212	Scotico+bonifica	0	29.3	13.5073	17.6072	31.3757	0	31.3757
14	0.344162	10.8418	Scotico+bonifica	0	29.3	13.2874	17.3205	30.8647	0	30.8647
15	0.344162	10.7164	Scotico+bonifica	0	29.3	13.0151	16.9656	30.2323	0	30.2323
16	0.344162	10.5449	Scotico+bonifica	0	29.3	12.6917	16.544	29.4811	0	29.4811
17	0.344162	10.3269	Scotico+bonifica	0	29.3	12.318	16.0569	28.6131	0	28.6131
18	0.344162	10.1212	Scotico+bonifica	0	29.3	11.9647	15.5963	27.7922	0	27.7922
19	0.344162	10.8705	Scotico+bonifica	0	29.3	12.7356	16.6012	29.583	0	29.583
20	0.344162	11.9325	Scotico+bonifica	0	29.3	13.8546	18.0599	32.1824	0	32.1824
21	0.344162	12.9464	Scotico+bonifica	0	29.3	14.8969	19.4185	34.6034	0	34.6034
22	0.344162	13.9116	Scotico+bonifica	0	29.3	15.8632	20.6781	36.8481	0	36.8481
23	0.344751	14.8536	Rilevato	0	29.3	16.7549	21.8405	38.9192	0	38.9192
24	0.344751	15.7221	Rilevato	0	29.3	17.5723	22.906	40.8179	0	40.8179
25	0.344751	16.5393	Rilevato	0	29.3	18.315	23.8741	42.5433	0	42.5433
26	0.344751	17.3042	Rilevato	0	29.3	18.9831	24.7451	44.0953	0	44.0953
27	0.344751	18.0157	Rilevato	0	29.3	19.5769	25.5191	45.4744	0	45.4744
28	0.344751	18.6725	Rilevato	0	29.3	20.0963	26.1961	46.6807	0	46.6807
29	0.344751	19.2734	Rilevato	0	29.3	20.5409	26.7757	47.7138	0	47.7138
30	0.344751	19.8167	Rilevato	0	29.3	20.9106	27.2576	48.5725	0	48.5725
31	0.344751	20.3007	Rilevato	0	29.3	21.2049	27.6412	49.2559	0	49.2559
32	0.344751	20.7237	Rilevato	0	29.3	21.423	27.9255	49.7626	0	49.7626
33	0.344751	21.0835	Rilevato	0	29.3	21.5642	28.1096	50.0907	0	50.0907
34	0.344751	21.3779	Rilevato	0	29.3	21.6277	28.1923	50.2379	0	50.2379
35	0.344751	21.6041	Rilevato	0	29.3	21.612	28.1719	50.2017	0	50.2017
36	0.344751	21.7594	Rilevato	0	29.3	21.516	28.0468	49.9788	0	49.9788

37	0.344751	21.8404	Rilevato	0	29.3	21.3382	27.815	49.5656	0	49.5656
38	0.344751	21.8436	Rilevato	0	29.3	21.0766	27.474	48.958	0	48.958
39	0.344751	21.7648	Rilevato	0	29.3	20.7293	27.0213	48.1513	0	48.1513
40	0.344751	21.4138	Rilevato	0	29.3	20.1198	26.2267	46.7355	0	46.7355
41	0.344751	19.9662	Rilevato	0	29.3	18.4939	24.1074	42.9589	0	42.9589
42	0.344751	18.2696	Rilevato	0	29.3	16.67	21.7298	38.7219	0	38.7219
43	0.344751	16.4677	Rilevato	0	29.3	14.7883	19.277	34.3512	0	34.3512
44	0.344751	14.5519	Rilevato	0	29.3	12.8482	16.748	29.8446	0	29.8446
45	0.344751	12.5125	Rilevato	0	29.3	10.8486	14.1415	25.1998	0	25.1998
46	0.344751	10.2774	Rilevato	0	29.3	11.1675	14.5572	25.9407	0	25.9407
47	0.344751	7.65456	Rilevato	0	29.3	13.8475	18.0506	32.1659	0	32.1659
48	0.344751	5.22266	Rilevato	0	29.3	11.5499	15.0557	26.8289	0	26.8289
49	0.344751	2.60181	Rilevato	0	29.3	9.17762	11.9633	21.3182	0	21.3182
50	0.148423	0.267161	Piattaforma stradale	0	29.3	7.45473	9.71746	17.3163	0	17.3163

List Of Coordinates

Water Table

X	Y
0	25.3539
110.144	25.3539

Line Load

X	Y
35.9029	36.4578
35.9029	36.3978
48.2029	37.2326
48.2029	37.2926

Line Load

X	Y
56.3868	36.9139
56.3868	36.8539
69.4868	37.7709

69.4868	37.8309

External Boundary

X	Y
103.364	32.7673
102.211	32.2207
81.9058	30.9468
71.6868	37.7469
69.5868	37.8309
69.4868	37.8309
69.4868	37.7709
56.3868	36.8539
56.3868	36.9139
56.2868	36.9139
55.1368	36.8679
55.1368	36.6205
49.4529	37.2466
48.3029	37.2926
48.2029	37.2926
48.2029	37.2326
35.9029	36.3978
35.9029	36.4578
35.8029	36.4578
33.7029	36.3738
26.2029	31.3738
24.2029	31.3738
22.1721	30.0199
12.2368	30.406
0	30.406
0	18.1059
0	0
110.144	-1.42e-014
110.144	19.7673
110.144	24.5633
110.144	32.2002
107.087	32.777
106.632	32.7836
106.609	32.6534
105.653	32.5349

Material Boundary

X	Y
35.9029	36.3978
35.9029	36.1978
48.2029	37.0326
48.2029	37.2326

Material Boundary

X	Y
56.3868	36.8539
56.3868	36.6539
69.4868	37.5709
69.4868	37.7709

Material Boundary

X	Y
0	18.1059
14.3132	19.1729
29.8786	20.5612
38.5766	21.7251
47.812	22.9609
54.0214	24.3136
59.0807	25.6409
62.147	26.5598
64.1977	27.3979

Material Boundary

X	Y
38.5766	21.7251
40.4193	21.3201
44.6549	20.4535
49.4346	19.6319
55.6662	18.8016
59.7041	18.4317
62.984	18.2555
66.1757	18.2379
72.8074	18.2991
87.7728	19.4862
108.997	19.783
110.144	19.7673

Material Boundary

X	Y
52.0701	29.2264
54.3115	28.5548
63.4485	27.4515
64.1977	27.3979
80.4343	26.2365
92.438	25.4736
110.144	24.5633

Material Boundary

X	Y
73.5512	30.4226
71.4731	30.5802
71.4075	30.5806
70.9663	30.5829
70.4718	30.5851
69.8404	30.5882
67.8332	30.6056
66.1276	30.6179
65.4037	30.6266
65.0606	30.6324
64.8439	30.6357
62.9724	29.4637
61.3935	28.5195
58.9863	29.0429
54.6252	29.23
53.7569	29.2683
52.0701	29.2264
41.0635	28.9533
32.5561	28.5504
22.1721	28.5199
22.1721	30.0199
32.5561	30.0504
41.0635	30.4533
53.7569	30.7683
54.6252	30.73
58.9863	30.5429
61.3935	30.0195
62.9724	30.9637
64.8439	32.1357
65.0606	32.1324
65.4037	32.1266
66.1276	32.1179
67.8332	32.1056
69.8404	32.0882
70.4718	32.0851
70.9663	32.0829
71.4075	32.0806
71.4731	32.0802
73.5512	31.9226
81.9058	30.9468
81.9058	29.4468
73.5512	30.4226

Condizioni sismiche_sx – analisi in tensioni totale: $(R_d / F_d)_{min} = 2.09 > 1.1$ (sisma verso l'alto)

Slide Analysis Information

Project Summary

- File Name: pk 19600 sismia - CND.slim
- Slide Modeler Version: 6.005

General Settings

- Units of Measurement: Metric Units
- Time Units: days
- Permeability Units: meters/second
- Failure Direction: Right to Left
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Bishop simplified
- Janbu simplified

- Number of slices: 50
- Tolerance: 0.005
- Maximum number of iterations: 75
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 9.81 kN/m3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Auto Refine Search
- Divisions along slope: 10
- Circles per division: 10
- Number of iterations: 10
- Divisions to use in next iteration: 50%
- Composite Surfaces: Disabled
- Minimum Elevation: Not Defined
- Minimum Depth: 3.5

Loading

- Seismic Load Coefficient (Horizontal): 0.124
- Seismic Load Coefficient (Vertical): -0.62
- 2 Distributed Loads present

Distributed Load 1

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Distributed Load 2

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Material Properties

Property	Rilevato	Piattaforma stradale	Scotico+bonifica	Qa	Pvs	Qc(a)	Pv
Color							
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Undrained	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	18	18	18.5	18	18
Cohesion [kPa]	0	0	0		0	0	0
Friction Angle [deg]	29.3	29.3	29.3		34	34	35
Cohesion Type				107			
Water Surface	Water Table	Water Table	Water Table	None	Water Table	Water Table	Water Table
Hu Value	1	1	1		1	1	1
Ru Value				0			

Global Minimums

Method: bishop simplified

- FS: 1.302750
- Center: 33.920, 37.251
- Radius: 31.834
- Left Slip Surface Endpoint: 2.831, 30.406

- Right Slip Surface Endpoint: 65.755, 37.251
- Resisting Moment=85666.4 kN-m
- Driving Moment=65758.1 kN-m

Method: janbu simplified

- FS: 2.088330
- Center: 34.799, 46.059
- Radius: 31.091
- Left Slip Surface Endpoint: 7.936, 30.406
- Right Slip Surface Endpoint: 64.587, 37.155
- Resisting Horizontal Force=2341.1 kN
- Driving Horizontal Force=1121.04 kN

Valid / Invalid Surfaces

Method: bishop simplified

- Number of Valid Surfaces: 1776
- Number of Invalid Surfaces: 0

Method: janbu simplified

- Number of Valid Surfaces: 1227
- Number of Invalid Surfaces: 549

Error Codes:

- Error Code -108 reported for 549 surfaces

Error Codes

The following errors were encountered during the computation:

- -108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.30275**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]
1	1.30374	51.5095	Qa	107	0	82.1339	107	290.731	0	290.731
2	1.30374	138.038	Qa	107	0	82.1339	107	227.683	0	227.683
3	1.30374	200.707	Qa	107	0	82.1339	107	206.505	0	206.505
4	1.30374	251.466	Qa	107	0	82.1339	107	196.99	0	196.99
5	1.29396	292.699	Pvs	0	34	19.6813	25.6398	111.491	73.4782	38.0127
6	1.29396	330.593	Pvs	0	34	10.2147	13.3072	108.711	88.9819	19.7289
7	1.29396	364.015	Pvs	0	34	4.60786	6.00289	111.552	102.653	8.89931
8	1.29396	393.643	Pvs	0	34	0.760389	0.990597	116.288	114.819	1.46863
9	1.29396	419.868	Pvs	0	34	0	0	123.304	125.71	-2.40639
10	1.29396	443.357	Pvs	0	34	0	0	130.202	135.491	-5.28906
11	1.29396	464.435	Pvs	0	34	0	0	136.391	144.288	-7.89651
12	1.29396	483.348	Pvs	0	34	0	0	141.946	152.198	-10.2521
13	1.29396	500.285	Pvs	0	34	0	0	146.92	159.298	-12.378
14	1.29396	515.393	Pvs	0	34	0	0	151.357	165.648	-14.291
15	1.29396	528.795	Pvs	0	34	0	0	155.292	171.3	-16.0075
16	1.29396	540.59	Pvs	0	34	0	0	158.756	176.293	-17.5367
17	1.29396	550.858	Pvs	0	34	0	0	161.771	180.66	-18.8885
18	1.29396	559.667	Pvs	0	34	0	0	164.358	184.429	-20.0706
19	1.29396	567.07	Pvs	0	34	0	0	166.533	187.622	-21.0892
20	1.29396	573.112	Pvs	0	34	0	0	168.307	190.257	-21.95
21	1.29396	577.827	Pvs	0	34	0	0	169.692	192.349	-22.657
22	1.29396	581.242	Pvs	0	34	0	0	170.695	193.908	-23.2128
23	1.29396	583.378	Pvs	0	34	0	0	171.322	194.942	-23.62
24	1.29396	584.246	Pvs	0	34	0	0	171.577	195.457	-23.8798
25	1.29396	583.853	Pvs	0	34	0	0	171.462	195.455	-23.9932

26	1.29396	582.199	Pvs	0	34	0	0	170.976	194.937	-23.9613
27	1.29396	579.277	Pvs	0	34	0	0	170.117	193.899	-23.7816
28	1.29396	575.075	Pvs	0	34	0	0	168.884	192.336	-23.452
29	1.29396	572.586	Pvs	0	34	0	0	168.153	190.241	-22.0883
30	1.29396	584.121	Pvs	0	34	0	0	171.54	187.601	-16.0608
31	1.29396	586.945	Pvs	0	34	0	0	172.37	184.404	-12.0343
32	1.29396	579.611	Pvs	0	34	0	0	170.216	180.631	-10.4151
33	1.29396	585.771	Pvs	0	34	0	0	172.025	176.259	-4.23414
34	1.29396	593.703	Pvs	0	34	1.31633	1.71485	173.804	171.262	2.54228
35	1.29396	600.041	Pvs	0	34	4.41656	5.75367	174.136	165.606	8.53032
36	1.29396	604.729	Pvs	0	34	7.45937	9.7177	173.657	159.25	14.4072
37	1.29396	607.595	Pvs	0	34	10.4323	13.5907	172.294	152.145	20.1485
38	1.29396	604.725	Pvs	0	34	12.8996	16.805	169.143	144.228	24.915
39	1.29396	585.848	Pvs	0	34	13.771	17.9402	162.022	135.425	26.5973
40	1.29396	562.2	Pvs	0	34	15.985	20.8244	156.51	125.636	30.8735
41	1.29396	537.713	Pvs	0	34	16.6501	21.6909	146.896	114.737	32.1587
42	1.29396	510.048	Pvs	0	34	17.4172	22.6902	136.201	102.561	33.6399
43	1.29396	478.525	Pvs	0	34	18.1278	23.616	123.891	88.8787	35.012
44	1.29396	442.53	Pvs	0	34	18.7639	24.4447	109.601	73.3604	36.2408
45	1.29396	400.824	Pvs	0	34	19.26	25.0909	92.6997	55.501	37.1987
46	1.05083	290.342	Pv	0	35	19.9185	25.9488	73.8413	36.7824	37.0589
47	1.27287	300.626	Qa	107	0	82.1339	107	-83.4423	0	-83.4423
48	1.27287	227.339	Qa	107	0	82.1339	107	-173.59	0	-173.59
49	0.360304	47.4446	Scotico+bonifica	0	29.3	8.31909	10.8377	19.3126	0	19.3126
50	0.699511	41.2859	Rilevato	0	29.3	2.22946	2.90443	5.17562	0	5.17562

- **Global Minimum Query (janbu simplified) - Safety Factor: 2.08833**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]
1	1.09258	17.1113	Qa	107	0	51.2371	107	87.5114	0	87.5114
2	1.09258	49.1515	Qa	107	0	51.2371	107	88.2523	0	88.2523
3	1.09258	77.3181	Qa	107	0	51.2371	107	89.9884	0	89.9884
4	1.09258	102.42	Qa	107	0	51.2371	107	92.176	0	92.176
5	1.09258	124.829	Qa	107	0	51.2371	107	94.4779	0	94.4779
6	1.09258	144.96	Qa	107	0	51.2371	107	96.7499	0	96.7499
7	1.09258	163.227	Qa	107	0	51.2371	107	98.9479	0	98.9479
8	1.09258	179.844	Qa	107	0	51.2371	107	101.016	0	101.016
9	1.09258	194.977	Qa	107	0	51.2371	107	102.92	0	102.92
10	1.09258	208.76	Qa	107	0	51.2371	107	104.636	0	104.636
11	1.16288	236.133	Pvs	0	34	5.99565	12.5209	80.5676	62.0044	18.5632
12	1.16288	249.346	Pvs	0	34	5.15177	10.7586	84.1228	68.1726	15.9502
13	1.16288	261.227	Pvs	0	34	4.41403	9.21796	87.3992	73.7334	13.6658
14	1.16288	271.855	Pvs	0	34	3.76887	7.87065	90.3916	78.7228	11.6688
15	1.16288	281.296	Pvs	0	34	3.20564	6.69443	93.0957	83.1709	9.92476
16	1.16288	289.604	Pvs	0	34	2.71584	5.67156	95.5113	87.1026	8.40867
17	1.16288	296.825	Pvs	0	34	2.29261	4.78772	97.637	90.5386	7.09841
18	1.16288	302.997	Pvs	0	34	1.93034	4.03118	99.4723	93.4961	5.97625
19	1.16288	308.151	Pvs	0	34	1.62437	3.39223	101.018	95.9896	5.02884
20	1.16288	312.313	Pvs	0	34	1.37085	2.86279	102.275	98.0303	4.24442
21	1.16288	315.502	Pvs	0	34	1.16651	2.43606	103.24	99.6276	3.61199
22	1.16288	317.734	Pvs	0	34	1.0086	2.1063	103.911	100.788	3.12327
23	1.16288	319.019	Pvs	0	34	0.894801	1.86864	104.289	101.518	2.77057
24	1.16288	319.366	Pvs	0	34	0.823127	1.71896	104.367	101.819	2.5485
25	1.16288	318.775	Pvs	0	34	0.791901	1.65375	104.145	101.693	2.45171

26	1.16288	317.247	Pvs	0	34	0.799687	1.67001	103.615	101.139	2.47596
27	1.16288	314.776	Pvs	0	34	0.845283	1.76523	102.772	100.155	2.61708
28	1.16288	311.414	Pvs	0	34	0.933904	1.9503	101.629	98.7374	2.89125
29	1.16288	316.679	Pvs	0	34	2.01444	4.20681	103.116	96.8792	6.23648
30	1.16288	326.938	Pvs	0	34	3.69592	7.71831	106.015	94.5724	11.4427
31	1.16288	324.435	Pvs	0	34	4.23109	8.83591	104.907	91.8064	13.1001
32	1.16288	320.482	Pvs	0	34	4.75119	9.92206	103.278	88.5682	14.7098
33	1.16288	327.395	Pvs	0	34	6.42887	13.4256	104.746	84.8418	19.9042
34	1.16288	334.366	Pvs	0	34	8.2113	17.1479	106.031	80.6079	25.4231
35	1.16288	340.18	Pvs	0	34	9.98482	20.8516	106.757	75.8434	30.9134
36	1.16288	344.815	Pvs	0	34	11.7509	24.5398	106.902	70.5205	36.3816
37	1.16288	348.162	Pvs	0	34	13.5033	28.1994	106.413	64.6058	41.807
38	1.16288	349.901	Pvs	0	34	15.2179	31.78	105.175	58.059	47.1161
39	1.16288	340.361	Pvs	0	34	16.06	33.5385	100.554	50.831	49.7232
40	1.16288	323.544	Pvs	0	34	16.8931	35.2783	95.1637	42.8617	52.302
41	1.17475	308.18	Qa	107	0	51.2371	107	62.3112	0	62.3112
42	1.17475	288.727	Qa	107	0	51.2371	107	51.6376	0	51.6376
43	1.17475	266.994	Qa	107	0	51.2371	107	39.5841	0	39.5841
44	1.17475	242.613	Qa	107	0	51.2371	107	25.8046	0	25.8046
45	1.17475	215.075	Qa	107	0	51.2371	107	9.77711	0	9.77711
46	1.17475	183.64	Qa	107	0	51.2371	107	-9.34259	0	-9.34259
47	0.937508	120.828	Scotico+bonifica	0	29.3	9.91242	20.7004	36.8877	0	36.8877
48	1.39558	128.53	Rilevato	0	29.3	6.87837	14.3643	25.5969	0	25.5969
49	1.39558	50.276	Rilevato	0	29.3	2.77875	5.80294	10.3407	0	10.3407
50	0.0617966	0.111234	Piattaforma stradale	0	29.3	0.0973898	0.203382	0.362422	0	0.362422

List Of Coordinates

Water Table

X	Y
0	25.3539
127.665	25.3539

Line Load

X	Y
53.4244	36.3978
53.4244	36.1978
65.7244	37.0326

Line Load

X	Y
73.9083	36.8539
73.9083	36.6539
87.0083	37.5709
87.0083	37.7709

External Boundary

X	Y
120.886	32.7673
119.732	32.2207
99.4273	30.9468
89.2083	37.7469
87.1083	37.8309
87.0083	37.7709
73.9083	36.8539
73.8083	36.9139
72.6583	36.8679
72.6583	36.6205
66.9744	37.2466
65.8244	37.2926
65.7244	37.2326
53.4244	36.3978
53.3244	36.4578
51.2244	36.3738
43.7244	31.3738
41.7244	31.3738
39.6936	30.0199
12.2368	30.406
0	30.406
0	18.1059
0	0
127.665	-1.42e-014
127.665	19.7673
127.665	24.5633

127.665	32.2002
124.608	32.777
124.153	32.7836
124.13	32.6534
123.174	32.5349

Material Boundary

X	Y
53.4244	36.3978
53.4244	36.1978
65.7244	37.0326
65.7244	37.2326

Material Boundary

X	Y
73.9083	36.8539
73.9083	36.6539
87.0083	37.5709
87.0083	37.7709

Material Boundary

X	Y
0	18.1059
14.3132	19.1729
47.4001	20.5612
56.098	21.7251
65.3335	22.9609
71.5428	24.3136
76.6022	25.6409
79.6685	26.5598
81.7192	27.3979

Material Boundary

X	Y
56.098	21.7251
57.9407	21.3201
62.1763	20.4535
66.9561	19.6319
73.1877	18.8016
77.2256	18.4317
80.5055	18.2555
83.6972	18.2379
90.3289	18.2991
105.294	19.4862
126.519	19.783

127.665	19.7673

Material Boundary

X	Y
69.5916	29.2264
71.833	28.5548
80.9699	27.4515
81.7192	27.3979
97.9557	26.2365
109.959	25.4736
127.665	24.5633

Material Boundary

X	Y
91.0726	30.4226
88.9945	30.5802
88.929	30.5806
88.4878	30.5829
87.9933	30.5851
87.3618	30.5882
85.3547	30.6056
83.649	30.6179
82.9252	30.6266
82.5821	30.6324
82.3654	30.6357
80.4939	29.4637
78.9149	28.5195
76.5077	29.0429
72.1467	29.23
71.2783	29.2683
69.5916	29.2264
58.5849	28.9533
50.0776	28.5504
39.6936	28.5199
39.6936	30.0199
50.0776	30.0504
58.5849	30.4533
71.2783	30.7683
72.1467	30.73
76.5077	30.5429
78.9149	30.0195
80.4939	30.9637
82.3654	32.1357
82.5821	32.1324
82.9252	32.1266
83.649	32.1179
85.3547	32.1056

87.3618	32.0882
87.9933	32.0851
88.4878	32.0829
88.929	32.0806
88.9945	32.0802
91.0726	31.9226
99.4273	30.9468
99.4273	29.4468
91.0726	30.4226

7.2 VERIFICHE DI STABILITA' DELLE TRINCEE – TABULATI DI SLIDE

Sezione 152 – prg 2+557.6

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.38 > 1.1$

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 2557.6 statica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Piattaforma stradale	Qa	Qcs
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	20
Cohesion [kPa]	0	16	0
Friction Angle [deg]	29.3	19.6	34
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Global Minimums

Method: bishop simplified

FS	1.533800
Center:	41.431, 39.783
Radius:	27.127
Left Slip Surface Endpoint:	17.278, 27.433
Right Slip Surface Endpoint:	49.961, 14.032
Resisting Moment:	45850.4 kN-m
Driving Moment:	29893.3 kN-m
Total Slice Area:	155.976 m2
Surface Horizontal Width:	32.6831 m
Surface Average Height:	4.77237 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1379
Number of Invalid Surfaces:	0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.5338**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.660619	7.86865	-61.4579	Qcs	0	34	2.90035	4.44855	6.59524	0	6.59524	11.9277	11.9277
2	0.660619	22.7477	-58.6563	Qcs	0	34	8.80499	13.5051	20.0222	0	20.0222	34.479	34.479
3	0.660619	36.089	-56.0652	Qcs	0	34	14.5464	22.3112	33.0778	0	33.0778	54.6967	54.6967
4	0.660619	47.8517	-53.6386	Qcs	0	34	19.9655	30.6231	45.4006	0	45.4006	72.5194	72.5194
5	0.660619	55.1417	-51.3448	Qcs	0	34	23.7113	36.3684	53.9183	0	53.9183	83.5624	83.5624
6	0.660619	60.6592	-49.161	Qcs	0	34	26.7916	41.093	60.9229	0	60.9229	91.9186	91.9186
7	0.660619	65.412	-47.0697	Qcs	0	34	29.5961	45.3945	67.3002	0	67.3002	99.1156	99.1156
8	0.660619	69.4888	-45.0577	Qcs	0	34	32.1395	49.2956	73.0837	0	73.0837	105.288	105.288
9	0.660619	72.9601	-43.1143	Qcs	0	34	34.4348	52.8161	78.3031	0	78.3031	110.543	110.543
10	0.660619	75.8832	-41.2309	Qcs	0	34	36.4934	55.9736	82.9843	0	82.9843	114.967	114.967
11	0.660619	78.3051	-39.4003	Qcs	0	34	38.3253	58.7834	87.1501	0	87.1501	118.631	118.631
12	0.660619	80.2651	-37.6167	Qcs	0	34	39.9393	61.2589	90.8201	0	90.8201	121.596	121.596
13	0.660619	82.6139	-35.8749	Qcs	0	34	41.756	64.0454	94.9511	0	94.9511	125.15	125.15
14	0.660619	88.2769	-34.1706	Qcs	0	34	45.287	69.4612	102.98	0	102.98	133.724	133.724
15	0.647463	91.8276	-32.5165	Qa	16	19.6	37.7835	57.9524	117.816	0	117.816	141.902	141.902
16	0.647463	95.8551	-30.9086	Qa	16	19.6	39.3498	60.3547	124.562	0	124.562	148.121	148.121
17	0.647463	96.005	-29.3274	Qa	16	19.6	39.6946	60.8836	126.048	0	126.048	148.348	148.348
18	0.647463	95.3204	-27.7703	Qa	16	19.6	39.7642	60.9904	126.348	0	126.348	147.287	147.287
19	0.647463	94.3755	-26.2352	Qa	16	19.6	39.7389	60.9516	126.239	0	126.239	145.823	145.823
20	0.647463	93.1809	-24.7202	Qa	16	19.6	39.6215	60.7715	125.733	0	125.733	143.974	143.974
21	0.647463	91.7457	-23.2234	Qa	16	19.6	39.4145	60.4539	124.841	0	124.841	141.753	141.753
22	0.647463	90.0783	-21.7432	Qa	16	19.6	39.1198	60.002	123.572	0	123.572	139.174	139.174
23	0.647463	88.1861	-20.2781	Qa	16	19.6	38.7395	59.4187	121.934	0	121.934	136.247	136.247

24	0.647463	86.0755	-18.8267	Qa	16	19.6	38.2752	58.7065	119.934	0	119.934	132.983	132.983
25	0.647463	83.7523	-17.3877	Qa	16	19.6	37.7281	57.8673	117.577	0	117.577	129.392	129.392
26	0.647463	81.2218	-15.96	Qa	16	19.6	37.0994	56.9031	114.869	0	114.869	125.479	125.479
27	0.647463	78.4886	-14.5425	Qa	16	19.6	36.3902	55.8153	111.814	0	111.814	121.254	121.254
28	0.647463	75.5567	-13.1339	Qa	16	19.6	35.6012	54.6051	108.416	0	108.416	116.722	116.722
29	0.647463	72.4297	-11.7334	Qa	16	19.6	34.7329	53.2733	104.675	0	104.675	111.889	111.889
30	0.647463	71.5117	-10.34	Qa	16	19.6	34.6117	53.0875	104.154	0	104.154	110.469	110.469
31	0.647463	72.7944	-8.95273	Qa	16	19.6	35.2481	54.0635	106.895	0	106.895	112.448	112.448
32	0.647463	73.8903	-7.57074	Qa	16	19.6	35.8242	54.9471	109.376	0	109.376	114.138	114.138
33	0.647463	72.808	-6.19317	Qa	16	19.6	35.6429	54.6691	108.595	0	108.595	112.463	112.463
34	0.647463	68.763	-4.81919	Qa	16	19.6	34.4162	52.7875	103.311	0	103.311	106.213	106.213
35	0.647463	64.5175	-3.44798	Qa	16	19.6	33.1037	50.7745	97.6583	0	97.6583	99.6528	99.6528
36	0.647463	60.0908	-2.07875	Qa	16	19.6	31.7117	48.6394	91.6621	0	91.6621	92.8131	92.8131
37	0.647463	55.4836	-0.710707	Qa	16	19.6	30.2393	46.381	85.3199	0	85.3199	85.695	85.695
38	0.647463	50.8351	0.656932	Qa	16	19.6	28.7356	44.0746	78.8427	0	78.8427	78.5132	78.5132
39	0.647463	46.333	2.02495	Qa	16	19.6	27.2682	41.8239	72.5219	0	72.5219	71.5578	71.5578
40	0.647463	41.664	3.39412	Qa	16	19.6	25.724	39.4554	65.8704	0	65.8704	64.3448	64.3448
41	0.647463	36.8138	4.76523	Qa	16	19.6	24.0967	36.9595	58.861	0	58.861	56.8523	56.8523
42	0.647463	31.7817	6.13909	Qa	16	19.6	22.3847	34.3336	51.4865	0	51.4865	49.0789	49.0789
43	0.647463	26.5662	7.5165	Qa	16	19.6	20.5859	31.5747	43.7389	0	43.7389	41.0227	41.0227
44	0.647463	21.1658	8.8983	Qa	16	19.6	18.6985	28.6797	35.6087	0	35.6087	32.6812	32.6812
45	0.647463	15.5786	10.2853	Qa	16	19.6	16.7197	25.6447	27.0856	0	27.0856	24.0515	24.0515
46	0.647463	10.1197	11.6785	Qa	16	19.6	14.7666	22.6489	18.6723	0	18.6723	15.6201	15.6201
47	0.647463	7.44969	13.0787	Qa	16	19.6	13.8473	21.239	14.7129	0	14.7129	11.4959	11.4959
48	0.647463	5.52788	14.4869	Qa	16	19.6	13.2032	20.2511	11.9385	0	11.9385	8.52709	8.52709
49	0.647463	3.47797	15.9041	Qa	16	19.6	12.5032	19.1774	8.92316	0	8.92316	5.36056	5.36056

50	0.773177	1.43474	17.4711	Piattaforma stradale	0	29.3	0.766971	1.17638	2.09629	0	2.09629	1.85489	1.85489

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.5338**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	17.278	27.4332	0	0	0
2	17.9386	26.2186	6.10043	0	0
3	18.5992	25.1339	22.0192	0	0
4	19.2598	24.1521	44.9159	0	0
5	19.9205	23.2548	72.5059	0	0
6	20.5811	22.4289	101.422	0	0
7	21.2417	21.6646	130.341	0	0
8	21.9023	20.9544	158.644	0	0
9	22.5629	20.2925	185.856	0	0
10	23.2236	19.674	211.61	0	0
11	23.8842	19.095	235.622	0	0
12	24.5448	18.5524	257.674	0	0
13	25.2054	18.0433	277.604	0	0
14	25.866	17.5656	295.47	0	0
15	26.5267	17.1171	311.828	0	0
16	27.1741	16.7043	336.069	0	0
17	27.8216	16.3167	358.955	0	0
18	28.469	15.953	379.184	0	0
19	29.1165	15.612	396.596	0	0
20	29.764	15.2929	411.228	0	0
21	30.4114	14.9949	423.133	0	0
22	31.0589	14.7171	432.376	0	0
23	31.7064	14.4588	439.035	0	0
24	32.3538	14.2196	443.2	0	0
25	33.0013	13.9989	444.972	0	0
26	33.6488	13.7961	444.459	0	0
27	34.2962	13.6109	441.784	0	0
28	34.9437	13.443	437.076	0	0
29	35.5911	13.2919	430.477	0	0
30	36.2386	13.1574	422.135	0	0
31	36.8861	13.0393	412.099	0	0
32	37.5335	12.9373	400.252	0	0
33	38.181	12.8512	386.542	0	0
34	38.8285	12.781	371.166	0	0
35	39.4759	12.7264	354.592	0	0
36	40.1234	12.6874	337.035	0	0
37	40.7708	12.6639	318.722	0	0
38	41.4183	12.6559	299.889	0	0
39	42.0658	12.6633	280.757	0	0

40	42.7132	12.6862	261.497	0	0
41	43.3607	12.7246	242.364	0	0
42	44.0082	12.7785	223.634	0	0
43	44.6556	12.8482	205.601	0	0
44	45.3031	12.9336	188.577	0	0
45	45.9505	13.035	172.899	0	0
46	46.598	13.1525	158.925	0	0
47	47.2455	13.2863	146.895	0	0
48	47.8929	13.4367	135.744	0	0
49	48.5404	13.604	125.225	0	0
50	49.1879	13.7885	115.509	0	0
51	49.961	14.0319	0	0	0

List Of Coordinates

Water Table

X	Y
0	2.19468
127.648	2.19468

External Boundary

X	Y
127.648	18.4807
114.671	19.3424
110.769	19.8627
100.27	20.5154
99.8428	20.2306
97.8428	20.2306
91.2544	16.4658
89.0928	15.2306
88.3928	15.2026
88.2428	15.2026
86.8928	15.2026
75.4668	14.6807
75.4668	14.7447
75.3668	14.7407
74.2168	14.6947
60.1886	14.4775
59.0386	14.5235
58.9386	14.4635
49.1879	13.9947
47.6879	13.9947
46.9879	14.0227
41.5727	17.1171
38.2379	19.0227
36.2379	19.0227
27.4879	24.0227
25.4879	24.0227
19.6682	27.3482
0	28.0473
0	17.1171
0	0
127.648	0
127.648	16.4658

Material Boundary

X	Y
49.1879	13.9947
49.1879	13.7847
58.9386	14.2635
58.9386	14.4635

Material Boundary

X	Y
75.4668	14.6807
75.4668	14.4807
86.8928	15.0026
86.8928	15.2026

Material Boundary

X	Y
0	17.1171
41.5727	17.1171

Material Boundary

X	Y
91.2544	16.4658
127.648	16.4658

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min}$ = 1.16 > 1.1 (sisma verso l'alto ↑)

Slide Analysis Information

SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 2557.6 sismica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	5
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal):	0.125
Seismic Load Coefficient (Vertical):	0.063

Material Properties

Property	Piattaforma stradale	Qa	Qcs
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	20
Cohesion [kPa]	0	16	0
Friction Angle [deg]	29.3	19.6	34
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Probabilistic Analysis Input

General Settings

Sensitivity Analysis: On
Probabilistic Analysis: Off

Variables

Material	Property	Distribution	Mean	Min	Max
Qa	Phi	Normal	19.6	4.6	47.6

Global Minimums

Method: bishop simplified

FS	1.106540
Center:	43.000, 38.760
Radius:	25.682
Left Slip Surface Endpoint:	19.999, 27.336
Right Slip Surface Endpoint:	49.927, 14.030
Resisting Moment:	38712.3 kN-m
Driving Moment:	34985.1 kN-m
Total Slice Area:	135.57 m2
Surface Horizontal Width:	29.9285 m
Surface Average Height:	4.52979 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1131
Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.10654**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.611746	6.94343	-62.1281	Qcs	0	34	3.41695	3.78099	5.60555	0	5.60555	12.0667	12.0667
2	0.611746	20.0643	-59.3304	Qcs	0	34	10.4813	11.598	17.1948	0	17.1948	34.8687	34.8687
3	0.611746	31.8162	-56.7479	Qcs	0	34	17.4662	19.327	28.6534	0	28.6534	55.2916	55.2916

4	0.61 1746	42.4 721	- 54.3329	Qcs	0	34	24.3 286	26.9 206	39.9 114	0	39.9 114	73.8 093	73.8 093
5	0.61 1746	52.2 194	- 52.0527	Qcs	0	34	31.0 475	34.3 553	50.9 338	0	50.9 338	90.7 482	90.7 482
6	0.61 1746	59.7 264	- 49.8838	Qcs	0	34	36.7 103	40.6 214	60.2 236	0	60.2 236	103. 793	103. 793
7	0.61 1746	63.4 125	- 47.8086	Qcs	0	34	40.1 645	44.4 436	65.8 903	0	65.8 903	110. 199	110. 199
8	0.61 1746	66.4 013	- 45.8134	Qcs	0	34	43.2 292	47.8 348	70.9 181	0	70.9 181	115. 392	115. 392
9	0.61 1746	68.8 614	- 43.8874	Qcs	0	34	45.9 832	50.8 822	75.4 36	0	75.4 36	119. 667	119. 667
10	0.61 1746	70.8 436	- 42.0219	Qcs	0	34	48.4 383	53.5 989	79.4 637	0	79.4 637	123. 111	123. 111
11	0.61 1746	72.3 896	- 40.2097	Qcs	0	34	50.6 05	55.9 965	83.0 182	0	83.0 182	125. 798	125. 798
12	0.61 1746	73.5 343	- 38.4448	Qcs	0	34	52.4 925	58.0 85	86.1 146	0	86.1 146	127. 786	127. 786
13	0.61 1746	74.3 071	- 36.7221	Qcs	0	34	54.1 083	59.8 73	88.7 654	0	88.7 654	129. 129	129. 129
14	0.61 1746	76.9 415	- 35.0373	Qcs	0	34	57.0 983	63.1 815	93.6 705	0	93.6 705	133. 707	133. 707
15	0.61 1746	82.0 232	- 33.3865	Qcs	0	34	61.9 846	68.5 884	101. 686	0	101. 686	142. 537	142. 537
16	0.58 8609	83.2 271	- 31.7967	Qa	16	19 .6	52.3 799	57.9 605	117. 839	0	117. 839	150. 312	150. 312
17	0.58 8609	86.0 938	- 30.2639	Qa	16	19 .6	54.2 996	60.0 847	123. 804	0	123. 804	155. 489	155. 489
18	0.58 8609	85.3 396	- 28.7548	Qa	16	19 .6	54.4 436	60.2 44	124. 251	0	124. 251	154. 126	154. 126
19	0.58 8609	84.0 382	- 27.2671	Qa	16	19 .6	54.2 954	60.0 8	123. 791	0	123. 791	151. 776	151. 776
20	0.58 8609	82.5 332	- 25.7992	Qa	16	19 .6	54.0 224	59.7 779	122. 943	0	122. 943	149. 057	149. 057
21	0.58 8609	80.8 322	- 24.3492	Qa	16	19 .6	53.6 275	59.3 41	121. 716	0	121. 716	145. 985	145. 985
22	0.58 8609	78.9 42	- 22.9156	Qa	16	19 .6	53.1 133	58.7 72	120. 118	0	120. 118	142. 571	142. 571
23	0.58 8609	76.8 687	- 21.497	Qa	16	19 .6	52.4 821	58.0 735	118. 156	0	118. 156	138. 826	138. 826
24	0.58 8609	74.6 18	- 20.0922	Qa	16	19 .6	51.7 356	57.2 475	115. 836	0	115. 836	134. 761	134. 761
25	0.58 8609	72.1 945	- 18.6999	Qa	16	19 .6	50.8 754	56.2 957	113. 164	0	113. 164	130. 384	130. 384
26	0.58 8609	69.6 028	- 17.3189	Qa	16	19 .6	49.9 03	55.2 197	110. 142	0	110. 142	125. 703	125. 703
27	0.58 8609	66.8 467	- 15.9482	Qa	16	19 .6	48.8 194	54.0 206	106. 774	0	106. 774	120. 725	120. 725
28	0.58 8609	63.9 297	- 14.5869	Qa	16	19 .6	47.6 251	52.6 991	103. 063	0	103. 063	115. 457	115. 457
29	0.58 8609	60.8 55	- 13.2339	Qa	16	19 .6	46.3 21	51.2 56	99.0 104	0	99.0 104	109. 904	109. 904
30	0.58 8609	59.4 033	- 11.8884	Qa	16	19 .6	45.8 749	50.7 624	97.6 242	0	97.6 242	107. 282	107. 282

31	0.58609	60.6057	-10.5495	Qa	16	19.6	46.8724	51.8662	100.724	0	100.724	109.453	109.453
32	0.58609	61.6923	-9.21643	Qa	16	19.6	47.8162	52.9105	103.657	0	103.657	111.415	111.415
33	0.58609	62.0992	-7.88837	Qa	16	19.6	48.3916	53.5472	105.445	0	105.445	112.15	112.15
34	0.58609	58.8962	-6.56457	Qa	16	19.6	46.9491	51.9511	100.962	0	100.962	106.365	106.365
35	0.58609	54.9218	-5.24428	Qa	16	19.6	45.0473	49.8466	95.0525	0	95.0525	99.1872	99.1872
36	0.58609	50.8026	-3.92678	Qa	16	19.6	43.0333	47.6181	88.7938	0	88.7938	91.7477	91.7477
37	0.58609	46.5394	-2.61135	Qa	16	19.6	40.9058	45.2639	82.1826	0	82.1826	84.0483	84.0483
38	0.58609	42.2225	-1.29731	Qa	16	19.6	38.7152	42.8399	75.3752	0	75.3752	76.252	76.252
39	0.58609	38.1019	0.0160572	Qa	16	19.6	36.6059	40.5059	68.8206	0	68.8206	68.8103	68.8103
40	0.58609	33.8711	1.32943	Qa	16	19.6	34.4007	38.0658	61.9678	0	61.9678	61.1694	61.1694
41	0.58609	29.4973	2.6435	Qa	16	19.6	32.0785	35.4961	54.7514	0	54.7514	53.2703	53.2703
42	0.58609	24.98	3.95897	Qa	16	19.6	29.6366	32.7941	47.1632	0	47.1632	45.1122	45.1122
43	0.58609	20.3187	5.27653	Qa	16	19.6	27.0721	29.9564	39.1943	0	39.1943	36.6941	36.6941
44	0.58609	15.5126	6.5969	Qa	16	19.6	24.3819	26.9795	30.8341	0	30.8341	28.0144	28.0144
45	0.58609	10.5606	7.92079	Qa	16	19.6	21.562	23.8592	22.0713	0	22.0713	19.0713	19.0713
46	0.58609	6.52467	9.24896	Qa	16	19.6	19.2604	21.3124	14.9189	0	14.9189	11.7825	11.7825
47	0.58609	5.0879	10.5822	Qa	16	19.6	18.5301	20.5043	12.6496	0	12.6496	9.18772	9.18772
48	0.58609	3.82157	11.9212	Qa	16	19.6	17.8959	19.8026	10.6789	0	10.6789	6.90072	6.90072
49	0.58609	2.42803	13.2669	Qa	16	19.6	17.1732	19.0029	8.43308	0	8.43308	4.38397	4.38397
50	0.739568	1.06348	14.7948	Piattaforma stradale	0	29.3	0.895058	0.990418	1.7649	0	1.7649	1.5285	1.5285

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.10654**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	19.999	27.3364	0	0	0
2	20.6107	26.1797	5.26239	0	0
3	21.2225	25.1481	19.0971	0	0
4	21.8342	24.2151	39.1252	0	0
5	22.446	23.3628	63.5738	0	0

6	23.0577	22.5783	91.0692	0	0
7	23.6694	21.8522	119.808	0	0
8	24.2812	21.1774	147.637	0	0
9	24.8929	20.548	174.132	0	0
10	25.5047	19.9596	199.005	0	0
11	26.1164	19.4083	222.039	0	0
12	26.7282	18.8912	243.07	0	0
13	27.3399	18.4055	261.978	0	0
14	27.9517	17.9492	278.681	0	0
15	28.5634	17.5203	293.557	0	0
16	29.1752	17.1171	306.896	0	0
17	29.7638	16.7522	329.475	0	0
18	30.3524	16.4087	350.805	0	0
19	30.941	16.0857	369.565	0	0
20	31.5296	15.7824	385.673	0	0
21	32.1182	15.4978	399.181	0	0
22	32.7068	15.2315	410.148	0	0
23	33.2954	14.9826	418.649	0	0
24	33.884	14.7508	424.765	0	0
25	34.4726	14.5355	428.587	0	0
26	35.0612	14.3363	430.219	0	0
27	35.6499	14.1527	429.768	0	0
28	36.2385	13.9845	427.355	0	0
29	36.8271	13.8313	423.107	0	0
30	37.4157	13.6929	417.161	0	0
31	38.0043	13.569	409.687	0	0
32	38.5929	13.4594	400.721	0	0
33	39.1815	13.3639	390.194	0	0
34	39.7701	13.2823	378.078	0	0
35	40.3587	13.2146	364.651	0	0
36	40.9473	13.1606	350.142	0	0
37	41.5359	13.1202	334.756	0	0
38	42.1246	13.0933	318.708	0	0
39	42.7132	13.08	302.208	0	0
40	43.3018	13.0801	285.417	0	0
41	43.8904	13.0938	268.561	0	0
42	44.479	13.121	251.883	0	0
43	45.0676	13.1617	235.644	0	0
44	45.6562	13.2161	220.122	0	0
45	46.2448	13.2841	205.614	0	0
46	46.8334	13.366	192.437	0	0
47	47.422	13.4619	180.489	0	0
48	48.0106	13.5719	168.829	0	0
49	48.5993	13.6961	157.449	0	0
50	49.1879	13.8349	146.476	0	0
51	49.9274	14.0302	0	0	0

List Of Coordinates

Water Table

X	Y
0	2.19468
127.648	2.19468

External Boundary

X	Y
0	0
127.648	0
127.648	16.4658
127.648	18.4807
114.671	19.3424
110.769	19.8627
99.6214	20.5558
99.1305	20.5891
98.5928	20.2306
96.5928	20.2306
90.9456	16.4658
89.0928	15.2306
88.3928	15.2026
88.2428	15.2026
86.8928	15.2026
75.4668	14.6807
75.4668	14.7447
75.3668	14.7407
74.2168	14.6947
60.1886	14.4775
59.0386	14.5235
58.9386	14.4635
49.1879	13.9947
47.6879	13.9947
46.9879	14.0227
42.3463	17.1171
39.4879	19.0227
37.4879	19.0227
29.9879	24.0227
27.9879	24.0227
23.1872	27.2231
0	28.0473
0	17.1171

Material Boundary

X	Y
49.1879	13.9947
49.1879	13.7847
58.9386	14.2635
58.9386	14.4635

Material Boundary

X	Y
75.4668	14.6807
75.4668	14.4807
86.8928	15.0026
86.8928	15.2026

Material Boundary

X	Y
0	17.1171
42.3463	17.1171

Material Boundary

X	Y
90.9456	16.4658
127.648	16.4658

Sezione 158 – prg 2+625.78

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.43 > 1.1$

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 2625.78 statica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program

Date Created: 15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3

Minimum Area: Not Defined
Minimum Weight: Not Defined

Seismic

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Material Properties

Property	Piattaforma stradale	Qa	Qcs
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	20
Cohesion [kPa]	0	16	0
Friction Angle [deg]	29.3	19.6	34
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Global Minimums

Method: bishop simplified

FS	1.437450
Center:	35.576, 43.767
Radius:	26.215
Left Slip Surface Endpoint:	13.506, 29.619
Right Slip Surface Endpoint:	39.218, 17.806
Resisting Moment:	28183.4 kN-m
Driving Moment:	19606.5 kN-m
Total Slice Area:	100.154 m2
Surface Horizontal Width:	25.7122 m
Surface Average Height:	3.89519 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1257
Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.43745**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.489142	3.41744	-56.3723	Qcs	0	34	1.92372	2.76525	4.09966	0	4.09966	6.99205	6.99205

2	0.489142	10.0076	-54.4868	Qcs	0	34	5.79634	8.33195	12.3526	0	12.3526	20.4748	20.4748
3	0.489142	16.1394	-52.6847	Qcs	0	34	9.58997	13.7851	20.4374	0	20.4374	33.0191	33.0191
4	0.489142	21.8683	-50.9543	Qcs	0	34	13.2992	19.1169	28.342	0	28.342	44.7384	44.7384
5	0.489142	27.2385	-49.2862	Qcs	0	34	16.921	24.3231	36.0605	0	36.0605	55.7234	55.7234
6	0.489142	32.2859	-47.6729	Qcs	0	34	20.4542	29.4019	43.5901	0	43.5901	66.0476	66.0476
7	0.489142	37.0399	-46.108	Qcs	0	34	23.8984	34.3528	50.9301	0	50.9301	75.7711	75.7711
8	0.489142	41.0984	-44.5864	Qcs	0	34	26.9739	38.7737	57.4843	0	57.4843	84.0716	84.0716
9	0.519026	45.1939	-43.0595	Qa	16	19.6	26.5635	38.1837	62.299	0	62.299	87.1215	87.1215
10	0.519026	46.0146	-41.5256	Qa	16	19.6	27.1485	39.0246	64.6605	0	64.6605	88.7011	88.7011
11	0.519026	46.606	-40.0272	Qa	16	19.6	27.6357	39.725	66.6277	0	66.6277	89.8392	89.8392
12	0.519026	47.0246	-38.5611	Qa	16	19.6	28.0465	40.3155	68.2859	0	68.2859	90.644	90.644
13	0.519026	49.5002	-37.1243	Qa	16	19.6	29.2767	42.0838	73.2519	0	73.2519	95.4132	95.4132
14	0.519026	53.0785	-35.7143	Qa	16	19.6	30.9604	44.504	80.0487	0	80.0487	102.308	102.308
15	0.519026	56.4773	-34.3289	Qa	16	19.6	32.5844	46.8384	86.6043	0	86.6043	108.856	108.856
16	0.519026	59.5456	-32.966	Qa	16	19.6	34.0848	48.9952	92.6612	0	92.6612	114.767	114.767
17	0.519026	59.9034	-31.6238	Qa	16	19.6	34.4728	49.5529	94.2277	0	94.2277	115.455	115.455
18	0.519026	59.2213	-30.3008	Qa	16	19.6	34.4223	49.4803	94.0235	0	94.0235	114.139	114.139
19	0.519026	58.3899	-28.9953	Qa	16	19.6	34.2991	49.3032	93.5264	0	93.5264	112.535	112.535
20	0.519026	57.415	-27.7062	Qa	16	19.6	34.1053	49.0247	92.7441	0	92.7441	110.654	110.654
21	0.519026	56.3016	-26.4321	Qa	16	19.6	33.8427	48.6472	91.6839	0	91.6839	108.507	108.507
22	0.519026	55.0544	-25.172	Qa	16	19.6	33.5128	48.173	90.3524	0	90.3524	106.102	106.102
23	0.519026	53.6776	-23.9247	Qa	16	19.6	33.1172	47.6043	88.7551	0	88.7551	103.448	103.448
24	0.519026	52.1751	-22.6894	Qa	16	19.6	32.6569	46.9427	86.8973	0	86.8973	100.551	100.551
25	0.519026	50.637	-21.4652	Qa	16	19.6	32.171	46.2442	84.9356	0	84.9356	97.5855	97.5855
26	0.519026	49.2354	-20.2511	Qa	16	19.6	31.7349	45.6173	83.1751	0	83.1751	94.8834	94.8834
27	0.519026	47.7343	-19.0465	Qa	16	19.6	31.2462	44.9148	81.2022	0	81.2022	91.9895	91.9895
28	0.519026	46.1195	-17.8505	Qa	16	19.6	30.6983	44.1272	78.9903	0	78.9903	88.8763	88.8763

29	0.519026	44.3932	-16.6626	Qa	16	19.6	30.0918	43.2555	76.5423	0	76.5423	85.5489	85.5489
30	0.519026	42.5578	-15.482	Qa	16	19.6	29.4274	42.3004	73.8599	0	73.8599	82.0109	82.0109
31	0.519026	41.7778	-14.3081	Qa	16	19.6	29.2273	42.0128	73.0523	0	73.0523	80.5066	80.5066
32	0.519026	42.9248	-13.1402	Qa	16	19.6	29.8924	42.9689	75.7376	0	75.7376	82.7159	82.7159
33	0.519026	44.0052	-11.978	Qa	16	19.6	30.5319	43.8881	78.319	0	78.319	84.7965	84.7965
34	0.519026	44.983	-10.8207	Qa	16	19.6	31.1291	44.7465	80.7295	0	80.7295	86.6794	86.6794
35	0.519026	44.2599	-9.66782	Qa	16	19.6	30.9514	44.4911	80.0122	0	80.0122	85.285	85.285
36	0.519026	41.8035	-8.51892	Qa	16	19.6	29.9727	43.0842	76.0611	0	76.0611	80.5507	80.5507
37	0.519026	39.2477	-7.37346	Qa	16	19.6	28.937	41.5955	71.8805	0	71.8805	75.6251	75.6251
38	0.519026	36.5935	-6.23095	Qa	16	19.6	27.8444	40.025	67.4699	0	67.4699	70.51	70.51
39	0.519026	33.8416	-5.09093	Qa	16	19.6	26.6946	38.3722	62.8284	0	62.8284	65.2066	65.2066
40	0.519026	30.9925	-3.95293	Qa	16	19.6	25.4874	36.6368	57.9549	0	57.9549	59.7161	59.7161
41	0.519026	28.0466	-2.81649	Qa	16	19.6	24.2222	34.8182	52.8477	0	52.8477	54.0394	54.0394
42	0.519026	25.0044	-1.68115	Qa	16	19.6	22.8987	32.9157	47.5049	0	47.5049	48.177	48.177
43	0.519026	21.866	-0.546479	Qa	16	19.6	21.5162	30.9285	41.9241	0	41.9241	42.1294	42.1294
44	0.519026	18.6316	0.58798	Qa	16	19.6	20.0742	28.8557	36.1029	0	36.1029	35.8968	35.8968
45	0.519026	15.3012	1.72267	Qa	16	19.6	18.5718	26.6961	30.0381	0	30.0381	29.4796	29.4796
46	0.519026	11.8746	2.85804	Qa	16	19.6	17.0082	24.4485	23.7261	0	23.7261	22.877	22.877
47	0.519026	8.35157	3.99453	Qa	16	19.6	15.3824	22.1115	17.163	0	17.163	16.0888	16.0888
48	0.519026	4.73185	5.1326	Qa	16	19.6	13.6933	19.6835	10.3444	0	10.3444	9.11446	9.11446
49	0.519026	1.46558	6.2727	Qa	16	19.6	12.1608	17.4806	4.15789	0	4.15789	2.82119	2.82119
50	0.519026	0.378243	7.4153	Qa	16	19.6	11.6874	16.8001	2.24699	0	2.24699	0.725879	0.725879

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.43745**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	13.5061	29.6188	0	0	0
2	13.9952	28.8833	2.07588	0	0

3	14.4843	28.1979	7.71272	0	0
4	14.9735	27.5562	16.1461	0	0
5	15.4626	26.9531	26.745	0	0
6	15.9518	26.3847	38.9808	0	0
7	16.4409	25.8477	52.4047	0	0
8	16.93	25.3392	66.6318	0	0
9	17.4192	24.8571	81.1776	0	0
10	17.9382	24.3721	97.632	0	0
11	18.4572	23.9125	113.286	0	0
12	18.9763	23.4766	128.015	0	0
13	19.4953	23.0628	141.739	0	0
14	20.0143	22.6699	155.352	0	0
15	20.5333	22.2968	169.184	0	0
16	21.0524	21.9423	183	0	0
17	21.5714	21.6057	196.534	0	0
18	22.0904	21.2861	208.791	0	0
19	22.6094	20.9828	219.477	0	0
20	23.1285	20.6951	228.611	0	0
21	23.6475	20.4226	236.221	0	0
22	24.1665	20.1646	242.345	0	0
23	24.6856	19.9206	247.023	0	0
24	25.2046	19.6904	250.304	0	0
25	25.7236	19.4734	252.243	0	0
26	26.2426	19.2693	252.911	0	0
27	26.7617	19.0778	252.398	0	0
28	27.2807	18.8986	250.762	0	0
29	27.7997	18.7315	248.062	0	0
30	28.3187	18.5761	244.363	0	0
31	28.8378	18.4324	239.737	0	0
32	29.3568	18.3	234.266	0	0
33	29.8758	18.1788	227.957	0	0
34	30.3948	18.0687	220.764	0	0
35	30.9139	17.9695	212.647	0	0
36	31.4329	17.8811	203.687	0	0
37	31.9519	17.8033	194.073	0	0
38	32.4709	17.7362	183.91	0	0
39	32.99	17.6795	173.309	0	0
40	33.509	17.6333	162.385	0	0
41	34.028	17.5974	151.26	0	0
42	34.547	17.5719	140.062	0	0
43	35.0661	17.5566	128.923	0	0
44	35.5851	17.5517	117.984	0	0
45	36.1041	17.557	107.392	0	0
46	36.6231	17.5726	97.3022	0	0
47	37.1422	17.5985	87.8764	0	0
48	37.6612	17.6348	79.2856	0	0
49	38.1802	17.6814	71.7096	0	0
50	38.6992	17.7384	65.1725	0	0

51	39.2183	17.806	0	0	0

List Of Coordinates

Water Table

X	Y
0	8.917
110.244	8.917

External Boundary

X	Y
80.4812	19.0986
79.7812	19.0706
79.6312	19.0706
78.2812	19.0706
66.3836	18.4659
66.3836	18.5259
66.2836	18.5259
65.1336	18.4799
51.75	18.2951
50.6	18.3411
50.5	18.3411
50.5	18.2811
40.6166	17.806
39.1166	17.806
38.4166	17.834
30.9166	22.834
28.9166	22.834
25.8819	24.8571
21.4166	27.834
19.4166	27.834
17.1505	29.3447
0	30.6346
0	24.8571
0	0
110.244	0
110.244	22.6671
90.5011	24.0986
87.9812	24.0986

Material Boundary

X	Y
40.6166	17.806
40.6166	17.606
50.5	18.0811
50.5	18.2811

Material Boundary

X	Y
66.3836	18.4659
66.3836	18.2659
78.2812	18.8706
78.2812	19.0706

Material Boundary

X	Y
0	24.8571
25.8819	24.8571

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min}$ = 1.13 > 1.1 (sisma verso il basso ↓)

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 2625.78 sismica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days

Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No

Staged pseudostatic analysis: No

Loading

Seismic Load Coefficient (Horizontal): 0.112
Seismic Load Coefficient (Vertical): 0.056

Material Properties

Property	Piattaforma stradale	Qa	Qcs
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	20
Cohesion [kPa]	0	16	0
Friction Angle [deg]	29.3	19.6	34
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Global Minimums

Method: bishop simplified

FS	1.131320
Center:	35.119, 44.238
Radius:	26.753
Left Slip Surface Endpoint:	12.672, 29.681
Right Slip Surface Endpoint:	39.252, 17.806
Resisting Moment:	31080.1 kN-m
Driving Moment:	27472.3 kN-m
Total Slice Area:	109.568 m2
Surface Horizontal Width:	26.5798 m
Surface Average Height:	4.12223 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1248
Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.13132**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.500517	3.53641	-56.0768	Qcs	0	34	2.35833	2.66803	3.95551	0	3.95551	7.46201	7.46201
2	0.500517	10.3579	-54.2001	Qcs	0	34	7.13354	8.07032	11.9647	0	11.9647	21.8557	21.8557

3	0.500517	16.7083	-52.4052	Qcs	0	34	11.8463	13.402	19.8693	0	19.8693	35.255	35.255
4	0.500517	22.6437	-50.6807	Qcs	0	34	16.4859	18.6508	27.6509	0	27.6509	47.7789	47.7789
5	0.500517	28.2091	-49.0176	Qcs	0	34	21.0449	23.8085	35.2975	0	35.2975	59.5219	59.5219
6	0.500517	33.4411	-47.4083	Qcs	0	34	25.5189	28.87	42.8016	0	42.8016	70.5612	70.5612
7	0.500517	38.3698	-45.8469	Qcs	0	34	29.905	33.8321	50.1582	0	50.1582	80.9606	80.9606
8	0.500517	43.0204	-44.3281	Qcs	0	34	34.2015	38.6928	57.3644	0	57.3644	90.773	90.773
9	0.537516	50.7926	-42.7944	Qa	16	19.6	35.274	39.9062	67.1365	0	67.1365	99.7942	99.7942
10	0.537516	52.9569	-41.2445	Qa	16	19.6	36.7495	41.5754	71.8241	0	71.8241	104.046	104.046
11	0.537516	53.5457	-39.7305	Qa	16	19.6	37.4569	42.3757	74.0717	0	74.0717	105.203	105.203
12	0.537516	53.9044	-38.2491	Qa	16	19.6	38.0388	43.0341	75.9207	0	75.9207	105.907	105.907
13	0.537516	54.047	-36.7973	Qa	16	19.6	38.5006	43.5565	77.3878	0	77.3878	106.187	106.187
14	0.537516	55.5541	-35.3726	Qa	16	19.6	39.6394	44.8449	81.0059	0	81.0059	109.148	109.148
15	0.537516	59.1339	-33.9726	Qa	16	19.6	41.8377	47.3318	87.9899	0	87.9899	116.181	116.181
16	0.537516	62.5487	-32.5953	Qa	16	19.6	43.9725	49.747	94.7728	0	94.7728	122.889	122.889
17	0.537516	65.7251	-31.2388	Qa	16	19.6	46.0038	52.045	101.226	0	101.226	129.129	129.129
18	0.537516	66.2358	-29.9016	Qa	16	19.6	46.6571	52.7841	103.302	0	103.302	130.133	130.133
19	0.537516	65.2955	-28.5821	Qa	16	19.6	46.5399	52.6515	102.929	0	102.929	128.285	128.285
20	0.537516	64.2008	-27.279	Qa	16	19.6	46.3246	52.408	102.246	0	102.246	126.134	126.134
21	0.537516	62.9572	-25.991	Qa	16	19.6	46.0135	52.056	101.257	0	101.257	123.69	123.69
22	0.537516	61.5696	-24.717	Qa	16	19.6	45.6084	51.5977	99.9701	0	99.9701	120.964	120.964
23	0.537516	60.0424	-23.4559	Qa	16	19.6	45.1111	51.0351	98.3899	0	98.3899	117.963	117.963
24	0.537516	58.3799	-22.2067	Qa	16	19.6	44.5229	50.3697	96.5214	0	96.5214	114.697	114.697
25	0.537516	56.5857	-20.9686	Qa	16	19.6	43.8453	49.6031	94.3685	0	94.3685	111.172	111.172
26	0.537516	54.8102	-19.7406	Qa	16	19.6	43.1612	48.8291	92.1948	0	92.1948	107.683	107.683
27	0.537516	53.1443	-18.522	Qa	16	19.6	42.5221	48.1061	90.1644	0	90.1644	104.41	104.41
28	0.537516	51.3589	-17.3121	Qa	16	19.6	41.8009	47.2902	87.8731	0	87.8731	100.902	100.902
29	0.537516	49.4534	-16.11	Qa	16	19.6	40.9965	46.3802	85.3176	0	85.3176	97.1584	97.1584

30	0.537516	47.43	-14.9152	Qa	16	19.6	40.1095	45.3767	82.4993	0	82.4993	93.183	93.183
31	0.537516	45.3811	-13.727	Qa	16	19.6	39.1919	44.3386	79.584	0	79.584	89.1576	89.1576
32	0.537516	45.5629	-12.5448	Qa	16	19.6	39.5478	44.7412	80.7146	0	80.7146	89.5145	89.5145
33	0.537516	46.6643	-11.368	Qa	16	19.6	40.4395	45.75	83.5476	0	83.5476	91.6782	91.6782
34	0.537516	47.6548	-10.196	Qa	16	19.6	41.2744	46.6946	86.2004	0	86.2004	93.6239	93.6239
35	0.537516	48.089	-9.02837	Qa	16	19.6	41.7895	47.2773	87.8368	0	87.8368	94.4768	94.4768
36	0.537516	45.8145	-7.86448	Qa	16	19.6	40.7032	46.0484	84.3857	0	84.3857	90.0081	90.0081
37	0.537516	43.0123	-6.70385	Qa	16	19.6	39.2866	44.4457	79.8848	0	79.8848	84.5026	84.5026
38	0.537516	40.1033	-5.54598	Qa	16	19.6	37.7864	42.7485	75.1184	0	75.1184	78.7875	78.7875
39	0.537516	37.0884	-4.39037	Qa	16	19.6	36.202	40.956	70.0846	0	70.0846	72.8641	72.8641
40	0.537516	33.968	-3.23655	Qa	16	19.6	34.5326	39.0674	64.7808	0	64.7808	66.7336	66.7336
41	0.537516	30.7426	-2.08405	Qa	16	19.6	32.7773	37.0816	59.204	0	59.204	60.3968	60.3968
42	0.537516	27.4124	-0.932388	Qa	16	19.6	30.935	34.9974	53.3507	0	53.3507	53.8542	53.8542
43	0.537516	23.9777	0.218897	Qa	16	19.6	29.0044	32.8133	47.2172	0	47.2172	47.1064	47.1064
44	0.537516	20.4385	1.37027	Qa	16	19.6	26.9841	30.5277	40.7986	0	40.7986	40.1531	40.1531
45	0.537516	16.7947	2.5222	Qa	16	19.6	24.8726	28.1389	34.09	0	34.09	32.9944	32.9944
46	0.537516	13.046	3.67515	Qa	16	19.6	22.668	25.6448	27.0857	0	27.0857	25.6297	25.6297
47	0.537516	9.19219	4.82959	Qa	16	19.6	20.3684	23.0432	19.7795	0	19.7795	18.0585	18.0585
48	0.537516	5.23273	5.986	Qa	16	19.6	17.9715	20.3315	12.1642	0	12.1642	10.2797	10.2797
49	0.537516	1.66816	7.14486	Qa	16	19.6	15.7974	17.8719	5.25702	0	5.25702	3.27679	3.27679
50	0.537516	0.437808	8.30667	Qa	16	19.6	15.1076	17.0915	3.06536	0	3.06536	0.859602	0.859602

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.13132**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	12.6723	29.6815	0	0	0
2	13.1729	28.9373	2.15965	0	0
3	13.6734	28.2433	8.05347	0	0
4	14.1739	27.5933	16.913	0	0

5	14.6744	26.9822	28.0969	0	0
6	15.1749	26.406	41.0616	0	0
7	15.6754	25.8616	55.3414	0	0
8	16.176	25.346	70.5327	0	0
9	16.6765	24.8571	86.2829	0	0
10	17.214	24.3595	106.426	0	0
11	17.7515	23.8882	126.459	0	0
12	18.289	23.4414	145.418	0	0
13	18.8265	23.0177	163.183	0	0
14	19.3641	22.6156	179.662	0	0
15	19.9016	22.234	195.495	0	0
16	20.4391	21.8718	211.503	0	0
17	20.9766	21.5281	227.451	0	0
18	21.5141	21.2021	243.093	0	0
19	22.0516	20.893	257.369	0	0
20	22.5892	20.6002	269.815	0	0
21	23.1267	20.323	280.452	0	0
22	23.6642	20.0609	289.311	0	0
23	24.2017	19.8135	296.432	0	0
24	24.7392	19.5803	301.862	0	0
25	25.2767	19.3608	305.654	0	0
26	25.8143	19.1548	307.869	0	0
27	26.3518	18.9619	308.597	0	0
28	26.8893	18.7819	307.935	0	0
29	27.4268	18.6143	305.946	0	0
30	27.9643	18.4591	302.699	0	0
31	28.5018	18.3159	298.268	0	0
32	29.0394	18.1846	292.739	0	0
33	29.5769	18.065	286.243	0	0
34	30.1144	17.9569	278.767	0	0
35	30.6519	17.8602	270.257	0	0
36	31.1894	17.7748	260.688	0	0
37	31.7269	17.7006	250.211	0	0
38	32.2645	17.6374	238.963	0	0
39	32.802	17.5852	227.069	0	0
40	33.3395	17.544	214.661	0	0
41	33.877	17.5136	201.877	0	0
42	34.4145	17.494	188.864	0	0
43	34.952	17.4852	175.777	0	0
44	35.4896	17.4873	162.779	0	0
45	36.0271	17.5002	150.042	0	0
46	36.5646	17.5238	137.75	0	0
47	37.1021	17.5584	126.094	0	0
48	37.6396	17.6038	115.279	0	0
49	38.1771	17.6601	105.522	0	0
50	38.7147	17.7275	96.8655	0	0
51	39.2522	17.806	0	0	0

List Of Coordinates

Water Table

X	Y
0	8.917
110.244	8.917

External Boundary

X	Y
80.4812	19.0986
79.7812	19.0706
79.6312	19.0706
78.2812	19.0706
66.3836	18.4659
66.3836	18.5259
66.2836	18.5259
65.1336	18.4799
51.75	18.2951
50.6	18.3411
50.5	18.3411
50.5	18.2811
40.6166	17.806
39.1166	17.806
38.4166	17.834
30.9166	22.834
28.9166	22.834
25.8819	24.8571
21.4166	27.834
19.4166	27.834
17.1505	29.3447
0	30.6346
0	24.8571
0	0
110.244	0
110.244	22.6671
90.5011	24.0986
87.9812	24.0986

Material Boundary

X	Y
40.6166	17.806
40.6166	17.606
50.5	18.0811
50.5	18.2811

Material Boundary

X	Y
66.3836	18.4659
66.3836	18.2659
78.2812	18.8706
78.2812	19.0706

Material Boundary

X	Y
0	24.8571
25.8819	24.8571

Sezione 184 – prg 3+080

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.46 > 1.1$

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 3080 statica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right

Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	ec	Piattaforma stradale	Qc(a)
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	20	18	18
Cohesion [kPa]	2	0	0
Friction Angle [deg]	18	29.3	34
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Global Minimums

Method: bishop simplified

FS	1.462110
Center:	36.225, 29.690
Radius:	12.578
Left Slip Surface Endpoint:	25.678, 22.838
Right Slip Surface Endpoint:	38.200, 17.268
Resisting Moment:	3032.59 kN-m
Driving Moment:	2074.11 kN-m
Total Slice Area:	20.9591 m2
Surface Horizontal Width:	12.5223 m
Surface Average Height:	1.67374 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1184
Number of Invalid Surfaces: 9

Error Codes:

- Error Code -112 reported for 9 surfaces

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.46211**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.23246	0.773937	-56.0404	ec	2	18	1.58516	2.31767	0.977694	0	0.977694	3.33136	3.33136
2	0.23246	2.26836	-54.1876	ec	2	18	2.70424	3.9539	6.01348	0	6.01348	9.7613	9.7613
3	0.23246	3.66248	-52.4146	ec	2	18	3.779	5.52532	10.8498	0	10.8498	15.7595	15.7595
4	0.23246	4.73178	-50.7103	ec	2	18	4.63385	6.7752	14.6965	0	14.6965	20.3601	20.3601

5	0.23246	5.30289	-49.066	ec	2	18	5.12519	7.49359	16.9075	0	16.9075	22.8171	22.8171
6	0.23246	5.79466	-47.4745	ec	2	18	5.56113	8.13099	18.8693	0	18.8693	24.9327	24.9327
7	0.252899	6.89316	-45.864	Qc(a)	0	34	8.5246	12.4639	18.4785	0	18.4785	27.2641	27.2641
8	0.252899	7.99354	-44.2328	Qc(a)	0	34	10.0648	14.7159	21.8172	0	21.8172	31.616	31.616
9	0.252899	9.08813	-42.6457	Qc(a)	0	34	11.6376	17.0155	25.2265	0	25.2265	35.945	35.945
10	0.252899	10.1244	-41.0982	Qc(a)	0	34	13.1723	19.2593	28.5532	0	28.5532	40.0433	40.0433
11	0.252899	11.1065	-39.5863	Qc(a)	0	34	14.6691	21.4479	31.7979	0	31.7979	43.9274	43.9274
12	0.252899	12.038	-38.1068	Qc(a)	0	34	16.1285	23.5817	34.9612	0	34.9612	47.6106	47.6106
13	0.252899	12.9218	-36.6566	Qc(a)	0	34	17.5509	25.6614	38.0445	0	38.0445	51.106	51.106
14	0.252899	13.7608	-35.2334	Qc(a)	0	34	18.9368	27.6877	41.0486	0	41.0486	54.4235	54.4235
15	0.252899	14.3279	-33.8347	Qc(a)	0	34	19.967	29.194	43.2818	0	43.2818	56.6661	56.6661
16	0.252899	14.2446	-32.4585	Qc(a)	0	34	20.0934	29.3787	43.5557	0	43.5557	56.3362	56.3362
17	0.252899	14.0898	-31.1031	Qc(a)	0	34	20.1096	29.4025	43.5911	0	43.5911	55.7235	55.7235
18	0.252899	13.898	-29.7667	Qc(a)	0	34	20.063	29.3343	43.49	0	43.49	54.9647	54.9647
19	0.252899	13.6708	-28.448	Qc(a)	0	34	19.9545	29.1757	43.2548	0	43.2548	54.0657	54.0657
20	0.252899	13.4096	-27.1455	Qc(a)	0	34	19.7852	28.9282	42.8878	0	42.8878	53.0323	53.0323
21	0.252899	13.1155	-25.858	Qc(a)	0	34	19.5558	28.5928	42.3904	0	42.3904	51.8685	51.8685
22	0.252899	12.7896	-24.5844	Qc(a)	0	34	19.2671	28.1706	41.7647	0	41.7647	50.5796	50.5796
23	0.252899	12.4693	-23.3237	Qc(a)	0	34	18.9749	27.7434	41.1311	0	41.1311	49.3123	49.3123
24	0.252899	12.1881	-22.0748	Qc(a)	0	34	18.7316	27.3876	40.6039	0	40.6039	48.2004	48.2004
25	0.252899	11.8795	-20.8368	Qc(a)	0	34	18.4358	26.9552	39.9627	0	39.9627	46.9794	46.9794
26	0.252899	11.5426	-19.609	Qc(a)	0	34	18.0855	26.443	39.2034	0	39.2034	45.6465	45.6465
27	0.252899	11.1779	-18.3905	Qc(a)	0	34	17.6807	25.8511	38.3257	0	38.3257	44.204	44.204
28	0.252899	10.7861	-17.1805	Qc(a)	0	34	17.2213	25.1794	37.33	0	37.33	42.6544	42.6544
29	0.252899	10.3678	-15.9784	Qc(a)	0	34	16.7073	24.4279	36.2159	0	36.2159	40.9998	40.9998
30	0.252899	9.92339	-14.7834	Qc(a)	0	34	16.1386	23.5964	34.9832	0	34.9832	39.2422	39.2422
31	0.252899	9.45338	-13.595	Qc(a)	0	34	15.5149	22.6845	33.6312	0	33.6312	37.3832	37.3832

32	0.25 2899	8.958 15	-12.4126	Q c(a)	0	34	14.8 359	21.6 917	32.1 593	0	32.1 593	35.4 246	35.4 246
33	0.25 2899	8.438 06	-11.2355	Q c(a)	0	34	14.1 011	20.6 174	30.5 665	0	30.5 665	33.3 677	33.3 677
34	0.25 2899	7.893 43	-10.0631	Q c(a)	0	34	13.3 1	19.4 607	28.8 517	0	28.8 517	31.2 138	31.2 138
35	0.25 2899	7.324 54	-8.89505	Q c(a)	0	34	12.4 621	18.2 209	27.0 136	0	27.0 136	28.9 64	28.9 64
36	0.25 2899	6.731 65	-7.73069	Q c(a)	0	34	11.5 564	16.8 967	25.0 505	0	25.0 505	26.6 192	26.6 192
37	0.25 2899	6.114 96	-6.56953	Q c(a)	0	34	10.5 923	15.4 871	22.9 606	0	22.9 606	24.1 805	24.1 805
38	0.25 2899	5.474 65	-5.41108	Q c(a)	0	34	9.56 877	13.9 906	20.7 419	0	20.7 419	21.6 483	21.6 483
39	0.25 2899	4.810 87	-4.25484	Q c(a)	0	34	8.48 479	12.4 057	18.3 922	0	18.3 922	19.0 234	19.0 234
40	0.25 2899	4.123 75	-3.10034	Q c(a)	0	34	7.33 912	10.7 306	15.9 087	0	15.9 087	16.3 062	16.3 062
41	0.25 2899	3.413 37	-1.9471	Q c(a)	0	34	6.13 042	8.96 335	13.2 887	0	13.2 887	13.4 971	13.4 971
42	0.25 2899	2.679 79	-0.794641	Q c(a)	0	34	4.85 729	7.10 189	10.5 29	0	10.5 29	10.5 964	10.5 964
43	0.25 2899	1.923 06	0.35 7492	Q c(a)	0	34	3.51 807	5.14 38	7.62 597	0	7.62 597	7.60 402	7.60 402
44	0.25 2899	1.144 88	1.50 977	Q c(a)	0	34	2.11 41	3.09 105	4.58 268	0	4.58 268	4.52 696	4.52 696
45	0.25 2899	0.747 009	2.66 266	Q c(a)	0	34	1.39 25	2.03 599	3.01 849	0	3.01 849	2.95 373	2.95 373
46	0.25 2899	0.635 789	3.81 663	Q c(a)	0	34	1.19 657	1.74 951	2.59 376	0	2.59 376	2.51 393	2.51 393
47	0.25 2899	0.503 348	4.97 215	Q c(a)	0	34	0.95 6535	1.39 856	2.07 346	0	2.07 346	1.99 024	1.99 024
48	0.25 2899	0.380 198	6.12 971	Q c(a)	0	34	0.72 9658	1.06 684	1.58 165	0	1.58 165	1.50 329	1.50 329
49	0.25 2899	0.244 736	7.28 978	Q c(a)	0	34	0.47 4406	0.69 3634	1.02 835	0	1.02 835	0.96 7666	0.96 7666
50	0.25 2899	0.085 5481	8.45 287	Q c(a)	0	34	0.16 7528	0.24 4944	0.36 3145	0	0.36 3145	0.33 8248	0.33 8248

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.46211**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	25.6775	22.8376	0	0	0
2	25.91	22.4924	-0.0307069	0	0
3	26.1424	22.1703	1.27855	0	0
4	26.3749	21.8683	3.67764	0	0
5	26.6074	21.5841	6.7769	0	0
6	26.8398	21.3161	10.1184	0	0

7	27.0723	21.0626	13.6093	0	0
8	27.3252	20.802	16.2716	0	0
9	27.5781	20.5558	19.1002	0	0
10	27.831	20.3229	22.0355	0	0
11	28.0839	20.1023	25.006	0	0
12	28.3368	19.8931	27.9488	0	0
13	28.5897	19.6948	30.8078	0	0
14	28.8426	19.5066	33.5333	0	0
15	29.0955	19.328	36.0805	0	0
16	29.3484	19.1584	38.3725	0	0
17	29.6013	18.9976	40.3015	0	0
18	29.8542	18.845	41.8712	0	0
19	30.1071	18.7004	43.0921	0	0
20	30.36	18.5634	43.9765	0	0
21	30.6129	18.4337	44.5384	0	0
22	30.8658	18.3111	44.7929	0	0
23	31.1187	18.1954	44.7567	0	0
24	31.3716	18.0864	44.4471	0	0
25	31.6245	17.9838	43.8784	0	0
26	31.8774	17.8876	43.0665	0	0
27	32.1303	17.7975	42.0288	0	0
28	32.3832	17.7134	40.7837	0	0
29	32.6361	17.6352	39.3511	0	0
30	32.889	17.5628	37.752	0	0
31	33.1419	17.496	36.0089	0	0
32	33.3948	17.4349	34.1454	0	0
33	33.6477	17.3792	32.1867	0	0
34	33.9006	17.329	30.1592	0	0
35	34.1535	17.2841	28.0909	0	0
36	34.4064	17.2445	26.0111	0	0
37	34.6593	17.2102	23.9511	0	0
38	34.9122	17.181	21.9433	0	0
39	35.1651	17.1571	20.0223	0	0
40	35.418	17.1383	18.2245	0	0
41	35.6709	17.1246	16.5879	0	0
42	35.9237	17.116	15.1531	0	0
43	36.1766	17.1125	13.9627	0	0
44	36.4295	17.1141	13.0617	0	0
45	36.6824	17.1207	12.497	0	0
46	36.9353	17.1325	12.1096	0	0
47	37.1882	17.1494	11.7635	0	0
48	37.4411	17.1714	11.4762	0	0
49	37.694	17.1985	11.2489	0	0
50	37.9469	17.2309	11.0957	0	0
51	38.1998	17.2684	0	0	0

List Of Coordinates

Water Table

X	Y
1.42e-014	7.41351
106.093	7.41351

External Boundary

X	Y
0	0
106.093	0
106.093	18.4544
106.093	18.9957
104.287	18.8939
84.6283	20.0539
71.13	20.5146
68.0397	18.4544
67.5397	18.1211
66.8397	18.0931
65.3397	18.0931
53.5432	17.5944
53.5432	17.6544
53.4432	17.6544
52.2932	17.6083
49.8725	17.7515
48.7225	17.7975
48.6225	17.7975
48.6225	17.7375
38.865	17.2684
37.365	17.2685
36.665	17.2965
31.163	20.934
29.165	22.2965
27.165	22.2965
26.4112	22.799
1.42e-014	24.1883
1.42e-014	21.914

Material Boundary

X	Y
38.865	17.2684
38.865	17.0685
48.6225	17.5375
48.6225	17.7375

Material Boundary

X	Y
53.5432	17.5944
53.5432	17.3944
65.3397	17.8931
65.3397	18.0931

Material Boundary

X	Y
1.42e-014	21.914
31.163	20.934

Material Boundary

X	Y
68.0397	18.4544
106.093	18.4544

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.14 > 1.1$ (sisma verso l'alto ↑)

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 3080 sismica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20

Maximum Support Properties: 20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal):	0.112

Seismic Load Coefficient (Vertical): -0.056

Material Properties

Property	ec	Piattaforma stradale	Qc(a)
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	20	18	18
Cohesion [kPa]	2	0	0
Friction Angle [deg]	18	29.3	34
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Global Minimums

Method: bishop simplified

FS	1.143450
Center:	37.402, 34.199
Radius:	17.030
Left Slip Surface Endpoint:	24.669, 22.891
Right Slip Surface Endpoint:	39.503, 17.299
Resisting Moment:	3774.39 kN-m
Driving Moment:	3300.87 kN-m
Total Slice Area:	21.6144 m2
Surface Horizontal Width:	14.8342 m
Surface Average Height:	1.45707 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1354
Number of Invalid Surfaces: 12

Error Codes:

- Error Code -112 reported for 12 surfaces

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.14345**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.312616	1.01931	-47.6119	ec	2	18	2.00112	2.28818	0.886935	0	0.886935	3.07936	3.07936
2	0.312616	3.00183	-46.0737	ec	2	18	3.3401	3.81924	5.59903	0	5.59903	9.06673	9.06673

3	0.312616	4.87662	-44.5774	ec	2	18	4.63623	5.3013	10.1603	0	10.1603	14.7287	14.7287
4	0.312616	6.65191	-43.1186	ec	2	18	5.89048	6.73547	14.5743	0	14.5743	20.0901	20.0901
5	0.312616	8.33477	-41.6939	ec	2	18	7.10385	8.1229	18.8443	0	18.8443	25.1723	25.1723
6	0.312616	9.8222	-40.3	ec	2	18	8.20188	9.37844	22.7085	0	22.7085	29.6642	29.6642
7	0.293346	9.62402	-38.9757	Qc(a)	0	34	12.3693	14.1437	20.9689	0	20.9689	30.9768	30.9768
8	0.293346	9.70763	-37.7172	Qc(a)	0	34	12.6572	14.4729	21.457	0	21.457	31.2457	31.2457
9	0.293346	10.1862	-36.4796	Qc(a)	0	34	13.4664	15.3982	22.8287	0	22.8287	32.7859	32.7859
10	0.293346	11.3042	-35.2615	Qc(a)	0	34	15.1457	17.3184	25.6756	0	25.6756	36.3841	36.3841
11	0.293346	12.3808	-34.0615	Qc(a)	0	34	16.8047	19.2153	28.4878	0	28.4878	39.8489	39.8489
12	0.293346	13.4104	-32.8783	Qc(a)	0	34	18.4328	21.077	31.2479	0	31.2479	43.1627	43.1627
13	0.293346	14.395	-31.7106	Qc(a)	0	34	20.0299	22.9032	33.9553	0	33.9553	46.3312	46.3312
14	0.293346	15.3361	-30.5575	Qc(a)	0	34	21.5959	24.6938	36.6102	0	36.6102	49.3603	49.3603
15	0.293346	16.2329	-29.4179	Qc(a)	0	34	23.1269	26.4444	39.2055	0	39.2055	52.2463	52.2463
16	0.293346	16.4293	-28.291	Qc(a)	0	34	23.6754	27.0716	40.1352	0	40.1352	52.8783	52.8783
17	0.293346	16.0756	-27.1758	Qc(a)	0	34	23.4261	26.7866	39.7128	0	39.7128	51.7398	51.7398
18	0.293346	15.684	-26.0718	Qc(a)	0	34	23.1075	26.4223	39.1727	0	39.1727	50.4788	50.4788
19	0.293346	15.2555	-24.978	Qc(a)	0	34	22.72	25.9792	38.5157	0	38.5157	49.0996	49.0996
20	0.293346	14.7912	-23.8939	Qc(a)	0	34	22.2636	25.4573	37.7421	0	37.7421	47.6051	47.6051
21	0.293346	14.292	-22.8188	Qc(a)	0	34	21.7384	24.8568	36.8517	0	36.8517	45.9981	45.9981
22	0.293346	13.7634	-21.7521	Qc(a)	0	34	21.1517	24.1859	35.857	0	35.857	44.2966	44.2966
23	0.293346	13.301	-20.6933	Qc(a)	0	34	20.6506	23.6129	35.0077	0	35.0077	42.8082	42.8082
24	0.293346	12.8459	-19.6419	Qc(a)	0	34	20.1464	23.0364	34.1529	0	34.1529	41.3433	41.3433
25	0.293346	12.3589	-18.5973	Qc(a)	0	34	19.5772	22.3856	33.1882	0	33.1882	39.7756	39.7756
26	0.293346	11.8405	-17.559	Qc(a)	0	34	18.9429	21.6603	32.1128	0	32.1128	38.1069	38.1069
27	0.293346	11.2913	-16.5267	Qc(a)	0	34	18.243	20.86	30.9262	0	30.9262	36.3393	36.3393
28	0.293346	10.7118	-15.4999	Qc(a)	0	34	17.4768	19.9839	29.6274	0	29.6274	34.4741	34.4741
29	0.293346	10.1025	-14.4781	Qc(a)	0	34	16.6439	19.0315	28.2154	0	28.2154	32.513	32.513

30	0.293346	9.46382	-13.461	Qc(a)	0	34	15.7435	18.0019	26.689	0	26.689	30.4573	30.4573
31	0.293346	8.79611	-12.4483	Qc(a)	0	34	14.7748	16.8943	25.0468	0	25.0468	28.3083	28.3083
32	0.293346	8.09973	-11.4395	Qc(a)	0	34	13.7369	15.7075	23.2873	0	23.2873	26.067	26.067
33	0.293346	7.37502	-10.4342	Qc(a)	0	34	12.6289	14.4405	21.4089	0	21.4089	23.7346	23.7346
34	0.293346	6.62225	-9.43223	Qc(a)	0	34	11.4496	13.0921	19.4098	0	19.4098	21.3118	21.3118
35	0.293346	5.84167	-8.43314	Qc(a)	0	34	10.1979	11.6608	17.2878	0	17.2878	18.7997	18.7997
36	0.293346	5.03353	-7.43662	Qc(a)	0	34	8.87236	10.1451	15.0407	0	15.0407	16.1988	16.1988
37	0.293346	4.19802	-6.44236	Qc(a)	0	34	7.47169	8.5435	12.6663	0	12.6663	13.5099	13.5099
38	0.293346	3.33531	-5.45004	Qc(a)	0	34	5.99423	6.8541	10.1616	0	10.1616	10.7335	10.7335
39	0.293346	2.44555	-4.45937	Qc(a)	0	34	4.4383	5.07497	7.52397	0	7.52397	7.87011	7.87011
40	0.293346	1.52886	-3.47002	Qc(a)	0	34	2.80205	3.204	4.75012	0	4.75012	4.92003	4.92003
41	0.293346	0.705438	-2.48171	Qc(a)	0	34	1.30576	1.49307	2.21357	0	2.21357	2.27016	2.27016
42	0.293346	0.576829	-1.49414	Qc(a)	0	34	1.0784	1.2331	1.82815	0	1.82815	1.85627	1.85627
43	0.293346	0.542324	-0.507019	Qc(a)	0	34	1.02415	1.17106	1.73616	0	1.73616	1.74523	1.74523
44	0.293346	0.518332	0.479956	Qc(a)	0	34	0.988823	1.13067	1.67629	0	1.67629	1.66801	1.66801
45	0.293346	0.491996	1.46707	Qc(a)	0	34	0.948271	1.0843	1.60754	0	1.60754	1.58325	1.58325
46	0.293346	0.438949	2.45463	Qc(a)	0	34	0.854855	0.977484	1.44918	0	1.44918	1.41253	1.41253
47	0.293346	0.359143	3.44291	Qc(a)	0	34	0.706825	0.808219	1.19823	0	1.19823	1.15571	1.15571
48	0.293346	0.252506	4.43222	Qc(a)	0	34	0.50228	0.574332	0.851481	0	0.851481	0.812549	0.812549
49	0.318967	0.165678	5.46619	Piattaforma stradale	0	29.3	0.252492	0.288712	0.51448	0	0.51448	0.490318	0.490318
50	0.318967	0.0610384	6.54531	Piattaforma stradale	0	29.3	0.0939429	0.107419	0.191418	0	0.191418	0.180639	0.180639

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.14345**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	24.6688	22.8907	0	0	0
2	24.9814	22.5482	-0.207253	0	0

3	25.294	22.2236	0.902653	0	0
4	25.6066	21.9156	3.13015	0	0
5	25.9192	21.6228	6.30121	0	0
6	26.2318	21.3444	10.2629	0	0
7	26.5445	21.0792	14.821	0	0
8	26.8378	20.8419	17.2495	0	0
9	27.1311	20.615	19.4939	0	0
10	27.4245	20.3981	21.6386	0	0
11	27.7178	20.1907	23.7897	0	0
12	28.0112	19.9924	25.8997	0	0
13	28.3045	19.8028	27.9229	0	0
14	28.5979	19.6215	29.8176	0	0
15	28.8912	19.4483	31.5446	0	0
16	29.1846	19.2829	33.0679	0	0
17	29.4779	19.125	34.3042	0	0
18	29.7713	18.9744	35.2179	0	0
19	30.0646	18.8309	35.8227	0	0
20	30.358	18.6943	36.134	0	0
21	30.6513	18.5643	36.1685	0	0
22	30.9446	18.4409	35.9448	0	0
23	31.238	18.3238	35.4823	0	0
24	31.5313	18.213	34.7971	0	0
25	31.8247	18.1083	33.9054	0	0
26	32.118	18.0096	32.8262	0	0
27	32.4114	17.9168	31.5798	0	0
28	32.7047	17.8298	30.1881	0	0
29	32.9981	17.7484	28.6745	0	0
30	33.2914	17.6727	27.0638	0	0
31	33.5848	17.6024	25.3823	0	0
32	33.8781	17.5377	23.658	0	0
33	34.1715	17.4783	21.9203	0	0
34	34.4648	17.4243	20.2005	0	0
35	34.7581	17.3756	18.5315	0	0
36	35.0515	17.3321	16.948	0	0
37	35.3448	17.2938	15.4866	0	0
38	35.6382	17.2607	14.1859	0	0
39	35.9315	17.2327	13.0866	0	0
40	36.2249	17.2098	12.2315	0	0
41	36.5182	17.192	11.6658	0	0
42	36.8116	17.1793	11.3901	0	0
43	37.1049	17.1717	11.1526	0	0
44	37.3983	17.1691	10.9176	0	0
45	37.6916	17.1715	10.6816	0	0
46	37.9849	17.179	10.4467	0	0
47	38.2783	17.1916	10.227	0	0
48	38.5716	17.2093	10.0388	0	0
49	38.865	17.232	9.90052	0	0
50	39.184	17.2625	9.82288	0	0

51	39.5029	17.2991	0	0	0

List Of Coordinates

Water Table

X	Y
1.42e-014	7.41351
106.093	7.41351

External Boundary

X	Y
0	0
106.093	0
106.093	18.4544
106.093	18.9957
104.287	18.8939
84.6283	20.0539
71.13	20.5146
68.0397	18.4544
67.5397	18.1211
66.8397	18.0931
65.3397	18.0931
53.5432	17.5944
53.5432	17.6544
53.4432	17.6544
52.2932	17.6083
49.8725	17.7515
48.7225	17.7975
48.6225	17.7975
48.6225	17.7375
38.865	17.2684
37.365	17.2685
36.665	17.2965
31.163	20.934
29.165	22.2965
27.165	22.2965
26.4112	22.799
1.42e-014	24.1883
1.42e-014	21.914

Material Boundary

X	Y
38.865	17.2684
38.865	17.0685
48.6225	17.5375
48.6225	17.7375

Material Boundary

X	Y
53.5432	17.5944
53.5432	17.3944
65.3397	17.8931
65.3397	18.0931

Material Boundary

X	Y
1.42e-014	21.914
31.163	20.934

Material Boundary

X	Y
68.0397	18.4544
106.093	18.4544

Sezione 187 – prg 3+120

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.68 > 1.1$

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 3120 statica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Material Properties

Property	Rilevato	ec	Qc(a)
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	20	18
Cohesion [kPa]	0	2.5	0
Friction Angle [deg]	29.3	18	34
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Global Minimums

Method: bishop simplified

FS	1.680150
Center:	20.744, 48.965
Radius:	29.130
Left Slip Surface Endpoint:	3.643, 25.383
Right Slip Surface Endpoint:	25.993, 20.311
Resisting Moment:	10154.4 kN-m
Driving Moment:	6043.78 kN-m
Total Slice Area:	45.0161 m2
Surface Horizontal Width:	22.3503 m
Surface Average Height:	2.01412 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1215
Number of Invalid Surfaces: 45

Error Codes:

- Error Code -112 reported for 45 surfaces

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.68015**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]

1	0.447005	1.39245	-35.4096	ec	2.5	18	1.8379	3.08795	1.80952	0	1.80952	3.11611	3.11611
2	0.447005	4.09178	-34.3378	ec	2.5	18	2.87825	4.83589	7.18913	0	7.18913	9.15532	9.15532
3	0.447005	6.60619	-33.2796	ec	2.5	18	3.85682	6.48004	12.2493	0	12.2493	14.7808	14.7808
4	0.447005	9.01188	-32.234	ec	2.5	18	4.8017	8.06757	17.1352	0	17.1352	20.163	20.163
5	0.447005	11.3162	-31.2004	ec	2.5	18	5.71488	9.60185	21.8572	0	21.8572	25.3183	25.3183
6	0.447005	13.5225	-30.1779	ec	2.5	18	6.59692	11.0838	26.4182	0	26.4182	30.2543	30.2543
7	0.447005	15.6338	-29.1659	ec	2.5	18	7.44832	12.5143	30.8209	0	30.8209	34.9778	34.9778
8	0.447005	17.6529	-28.1639	ec	2.5	18	8.26962	13.8942	35.0678	0	35.0678	39.4952	39.4952
9	0.447005	19.5826	-27.1711	ec	2.5	18	9.06121	15.2242	39.1611	0	39.1611	43.8122	43.8122
10	0.447005	21.4251	-26.187	ec	2.5	18	9.82353	16.505	43.103	0	43.103	47.934	47.934
11	0.447005	23.1119	-25.2113	ec	2.5	18	10.529	17.6903	46.7508	0	46.7508	51.7079	51.7079
12	0.447005	23.9978	-24.2432	ec	2.5	18	10.9199	18.3471	48.7723	0	48.7723	53.6898	53.6898
13	0.447005	24.6157	-23.2825	ec	2.5	18	11.2057	18.8272	50.25	0	50.25	55.0718	55.0718
14	0.447005	25.1543	-22.3287	ec	2.5	18	11.4609	19.256	51.5698	0	51.5698	56.2769	56.2769
15	0.447005	25.6155	-21.3814	ec	2.5	18	11.6859	19.634	52.7332	0	52.7332	57.3085	57.3085
16	0.447005	26.0007	-20.4401	ec	2.5	18	11.881	19.9619	53.7422	0	53.7422	58.1701	58.1701
17	0.447005	26.3114	-19.5046	ec	2.5	18	12.0465	20.24	54.598	0	54.598	58.865	58.865
18	0.447005	26.5488	-18.5745	ec	2.5	18	12.1827	20.4687	55.302	0	55.302	59.3959	59.3959
19	0.447005	26.7142	-17.6494	ec	2.5	18	12.2897	20.6486	55.8557	0	55.8557	59.7659	59.7659
20	0.447005	26.8088	-16.7291	ec	2.5	18	12.3679	20.7799	56.2597	0	56.2597	59.9771	59.9771
21	0.447005	26.8335	-15.8131	ec	2.5	18	12.4173	20.863	56.5153	0	56.5153	60.0322	60.0322
22	0.447005	26.7893	-14.9013	ec	2.5	18	12.4382	20.8981	56.6234	0	56.6234	59.9333	59.9333
23	0.447005	26.6772	-13.9934	ec	2.5	18	12.4307	20.8854	56.5844	0	56.5844	59.6822	59.6822
24	0.447005	26.4979	-13.089	ec	2.5	18	12.3948	20.8252	56.3992	0	56.3992	59.2811	59.2811
25	0.447005	26.2522	-12.1879	ec	2.5	18	12.3308	20.7176	56.068	0	56.068	58.7313	58.7313
26	0.447005	25.9409	-11.2899	ec	2.5	18	12.2386	20.5627	55.5914	0	55.5914	58.0347	58.0347
27	0.447005	25.5646	-10.3947	ec	2.5	18	12.1184	20.3607	54.9696	0	54.9696	57.1926	57.1926

28	0.447005	25.1237	-9.50201	ec	2.5	18	11.9701	20.1115	54.2026	0	54.2026	56.2062	56.2062
29	0.447005	24.619	-8.61167	ec	2.5	18	11.7937	19.8152	53.2908	0	53.2908	55.0769	55.0769
30	0.447005	24.0508	-7.72342	ec	2.5	18	11.5893	19.4718	52.2337	0	52.2337	53.8055	53.8055
31	0.447005	23.4196	-6.83704	ec	2.5	18	11.3568	19.0812	51.0317	0	51.0317	52.3933	52.3933
32	0.447005	22.7257	-5.9523	ec	2.5	18	11.0962	18.6433	49.6838	0	49.6838	50.8407	50.8407
33	0.447005	21.9695	-5.06897	ec	2.5	18	10.8074	18.158	48.1903	0	48.1903	49.149	49.149
34	0.447005	21.1512	-4.18686	ec	2.5	18	10.4902	17.6251	46.5503	0	46.5503	47.3182	47.3182
35	0.447005	20.2711	-3.30574	ec	2.5	18	10.1446	17.0444	44.7631	0	44.7631	45.3491	45.3491
36	0.447005	19.3293	-2.4254	ec	2.5	18	9.77044	16.4158	42.8284	0	42.8284	43.2423	43.2423
37	0.447005	18.3261	-1.54564	ec	2.5	18	9.3675	15.7388	40.7449	0	40.7449	40.9976	40.9976
38	0.447005	17.2615	-0.666237	ec	2.5	18	8.93569	15.0133	38.5119	0	38.5119	38.6158	38.6158
39	0.447005	16.1355	0.213007	ec	2.5	18	8.47472	14.2388	36.1284	0	36.1284	36.0969	36.0969
40	0.447005	14.9482	1.0923	ec	2.5	18	7.98441	13.415	33.5928	0	33.5928	33.4406	33.4406
41	0.447005	13.6995	1.97185	ec	2.5	18	7.46439	12.5413	30.9039	0	30.9039	30.6469	30.6469
42	0.447005	12.3893	2.85187	ec	2.5	18	6.91451	11.6174	28.0604	0	28.0604	27.716	27.716
43	0.447005	11.0177	3.73256	ec	2.5	18	6.33437	10.6427	25.0605	0	25.0605	24.6473	24.6473
44	0.447005	9.58425	4.61414	ec	2.5	18	5.72365	9.61659	21.9026	0	21.9026	21.4407	21.4407
45	0.447005	8.08891	5.49681	ec	2.5	18	5.08196	8.53845	18.5844	0	18.5844	18.0954	18.0954
46	0.447005	6.53139	6.38079	ec	2.5	18	4.4089	7.40761	15.1041	0	15.1041	14.611	14.611
47	0.447005	4.91137	7.2663	ec	2.5	18	3.70403	6.22332	11.4592	0	11.4592	10.9869	10.9869
48	0.447005	3.22853	8.15356	ec	2.5	18	2.96685	4.98476	7.6473	0	7.6473	7.22222	7.22222
49	0.447005	1.49378	9.04279	ec	2.5	18	2.20193	3.69957	3.69191	0	3.69191	3.34147	3.34147
50	0.447005	0.375392	9.93423	ec	2.5	18	1.70818	2.87	1.13873	0	1.13873	0.839553	0.839553

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.68015**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]

1	3.64268	25.3826	0	0	0
2	4.08968	25.0648	-0.245859	0	0
3	4.53669	24.7594	0.663845	0	0
4	4.98369	24.466	2.53515	0	0
5	5.4307	24.1842	5.22031	0	0
6	5.8777	23.9134	8.58497	0	0
7	6.32471	23.6535	12.5054	0	0
8	6.77171	23.404	16.8677	0	0
9	7.21872	23.1647	21.5665	0	0
10	7.66572	22.9353	26.5046	0	0
11	8.11273	22.7154	31.5922	0	0
12	8.55973	22.505	36.7283	0	0
13	9.00674	22.3037	41.6687	0	0
14	9.45374	22.1113	46.3292	0	0
15	9.90075	21.9277	50.678	0	0
16	10.3478	21.7527	54.6875	0	0
17	10.7948	21.5861	58.3341	0	0
18	11.2418	21.4278	61.5983	0	0
19	11.6888	21.2776	64.464	0	0
20	12.1358	21.1354	66.9188	0	0
21	12.5828	21.001	68.9535	0	0
22	13.0298	20.8744	70.5622	0	0
23	13.4768	20.7555	71.742	0	0
24	13.9238	20.6441	72.4932	0	0
25	14.3708	20.5401	72.8187	0	0
26	14.8178	20.4436	72.7244	0	0
27	15.2648	20.3544	72.2189	0	0
28	15.7118	20.2724	71.3137	0	0
29	16.1588	20.1975	70.0227	0	0
30	16.6058	20.1298	68.3626	0	0
31	17.0528	20.0692	66.3529	0	0
32	17.4998	20.0156	64.0155	0	0
33	17.9468	19.969	61.375	0	0
34	18.3938	19.9294	58.4586	0	0
35	18.8409	19.8966	55.2965	0	0
36	19.2879	19.8708	51.9212	0	0
37	19.7349	19.8519	48.3681	0	0
38	20.1819	19.8398	44.6756	0	0
39	20.6289	19.8346	40.8847	0	0
40	21.0759	19.8363	37.0395	0	0
41	21.5229	19.8448	33.187	0	0
42	21.9699	19.8602	29.3774	0	0
43	22.4169	19.8825	25.6642	0	0
44	22.8639	19.9116	22.1042	0	0
45	23.3109	19.9477	18.7576	0	0
46	23.7579	19.9907	15.6883	0	0
47	24.2049	20.0407	12.964	0	0
48	24.6519	20.0977	10.6565	0	0

49	25.0989	20.1618	8.84162	0	0
50	25.5459	20.2329	7.59549	0	0
51	25.9929	20.3112	0	0	0

List Of Coordinates

Water Table

X	Y
0	12.3149
80.3205	12.3149

External Boundary

X	Y
54.9494	21.0494
54.2494	21.0214
54.0994	21.0214
53.4072	21.0214
52.7494	21.0214
41.939	20.6516
41.8457	20.6484
41.8457	20.7084
41.7457	20.7084
40.5957	20.6622
38.6861	20.7661
37.4361	20.8121
27.6815	20.2897
25.4815	20.3177
8.38954	25.2011
4.20583	25.3747
0	25.4337
8.88178e-016	20.9342
0	0
80.3205	0
80.3205	18.0348
80.3205	20.2288
74.9434	20.0581
56.3674	21.4546

Material Boundary

X	Y
27.6815	20.2897
27.6815	20.0897
37.4393	20.5588
37.4361	20.8121

Material Boundary

X	Y
41.939	20.6516

41.939	20.4313
53.4072	20.8699
53.4072	21.0214

Material Boundary

X	Y
8.88178e-016	20.9342
7.58971	20.4647
15.3089	19.8478
23.6683	19.2582
56.2207	18.8652
80.3205	18.0348

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min}$ = 1.13 > 1.1 (sisma verso l'alto ↑)

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 3120 sismica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal):	0.112
Seismic Load Coefficient (Vertical):	0.056

Material Properties

Property	Rilevato	ec	Qc(a)
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	20	18
Cohesion [kPa]	0	2	0
Friction Angle [deg]	29.3	18	34
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Global Minimums

Method: bishop simplified

FS	1.110850
Center:	20.726, 48.917

Radius:	29.078
Left Slip Surface Endpoint:	3.648, 25.382
Right Slip Surface Endpoint:	25.949, 20.312
Resisting Moment:	10042 kN-m
Driving Moment:	9039.92 kN-m
Total Slice Area:	44.9465 m2
Surface Horizontal Width:	22.3011 m
Surface Average Height:	2.01543 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1304
Number of Invalid Surfaces:	5

Error Codes:

- Error Code -112 reported for 5 surfaces

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.11085**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.446023	1.38728	-35.4277	ec	2	18	2.28558	2.53893	1.65866	0	1.65866	3.2846	3.2846
2	0.446023	4.07598	-34.3561	ec	2	18	3.85277	4.27985	7.01665	0	7.01665	9.65037	9.65037
3	0.446023	6.58097	-33.2981	ec	2	18	5.33325	5.92444	12.0782	0	12.0782	15.5812	15.5812
4	0.446023	8.97793	-32.2527	ec	2	18	6.76854	7.51883	16.9852	0	16.9852	21.2563	21.2563
5	0.446023	11.2739	-31.2193	ec	2	18	8.16107	9.06572	21.746	0	21.746	26.6923	26.6923
6	0.446023	13.4723	-30.1971	ec	2	18	9.51127	10.5656	26.3621	0	26.3621	31.8972	31.8972
7	0.446023	15.5761	-29.1853	ec	2	18	10.8196	12.0189	30.835	0	30.835	36.8782	36.8782
8	0.446023	17.5882	-28.1835	ec	2	18	12.0863	13.4261	35.1659	0	35.1659	41.642	41.642
9	0.446023	19.5111	-27.1909	ec	2	18	13.3119	14.7875	39.3559	0	39.3559	46.1946	46.1946
10	0.446023	21.3472	-26.2071	ec	2	18	14.4966	16.1036	43.4063	0	43.4063	50.5418	50.5418
11	0.446023	23.033	-25.2316	ec	2	18	15.6008	17.3301	47.1814	0	47.1814	54.5331	54.5331
12	0.446023	23.9243	-24.2638	ec	2	18	16.2287	18.0277	49.328	0	49.328	56.6433	56.6433

13	0.446023	24.5411	-23.3034	ec	2	18	16.6924	18.5428	50.9137	0	50.9137	58.1037	58.1037
14	0.446023	25.0792	-22.3498	ec	2	18	17.1105	19.0072	52.3426	0	52.3426	59.3775	59.3775
15	0.446023	25.54	-21.4027	ec	2	18	17.483	19.421	53.6163	0	53.6163	60.4688	60.4688
16	0.446023	25.9253	-20.4617	ec	2	18	17.8103	19.7846	54.7354	0	54.7354	61.3808	61.3808
17	0.446023	26.2363	-19.5265	ec	2	18	18.0927	20.0983	55.7007	0	55.7007	62.1171	62.1171
18	0.446023	26.4744	-18.5966	ec	2	18	18.3303	20.3622	56.5131	0	56.5131	62.6807	62.6807
19	0.446023	26.6408	-17.6718	ec	2	18	18.5234	20.5767	57.1732	0	57.1732	63.0747	63.0747
20	0.446023	26.7366	-16.7517	ec	2	18	18.672	20.7418	57.6814	0	57.6814	63.3016	63.3016
21	0.446023	26.7629	-15.8361	ec	2	18	18.7763	20.8577	58.038	0	58.038	63.3639	63.3639
22	0.446023	26.7206	-14.9245	ec	2	18	18.8364	20.9244	58.2431	0	58.2431	63.2637	63.2637
23	0.446023	26.6107	-14.0169	ec	2	18	18.8521	20.9419	58.2973	0	58.2973	63.0035	63.0035
24	0.446023	26.434	-13.1128	ec	2	18	18.8238	20.9104	58.2002	0	58.2002	62.5851	62.5851
25	0.446023	26.1911	-12.212	ec	2	18	18.7511	20.8297	57.9519	0	57.9519	62.0101	62.0101
26	0.446023	25.8829	-11.3142	ec	2	18	18.6342	20.6998	57.5521	0	57.5521	61.2804	61.2804
27	0.446023	25.51	-10.4193	ec	2	18	18.4729	20.5206	57.0006	0	57.0006	60.3974	60.3974
28	0.446023	25.0729	-9.52697	ec	2	18	18.2671	20.292	56.2968	0	56.2968	59.3625	59.3625
29	0.446023	24.5722	-8.63694	ec	2	18	18.0166	20.0137	55.4404	0	55.4404	58.177	58.177
30	0.446023	24.0083	-7.749	ec	2	18	17.7211	19.6855	54.4305	0	54.4305	56.842	56.842
31	0.446023	23.3816	-6.86294	ec	2	18	17.3807	19.3073	53.2664	0	53.2664	55.3583	55.3583
32	0.446023	22.6926	-5.97852	ec	2	18	16.9948	18.8787	51.9471	0	51.9471	53.7269	53.7269
33	0.446023	21.9416	-5.09552	ec	2	18	16.5633	18.3993	50.4718	0	50.4718	51.9487	51.9487
34	0.446023	21.1287	-4.21374	ec	2	18	16.0857	17.8688	48.8391	0	48.8391	50.0242	50.0242
35	0.446023	20.2544	-3.33296	ec	2	18	15.5618	17.2868	47.0479	0	47.0479	47.9542	47.9542
36	0.446023	19.3187	-2.45297	ec	2	18	14.991	16.6528	45.0967	0	45.0967	45.7389	45.7389
37	0.446023	18.3218	-1.57356	ec	2	18	14.373	15.9662	42.9836	0	42.9836	43.3784	43.3784
38	0.446023	17.2638	-0.694512	ec	2	18	13.7072	15.2266	40.7075	0	40.7075	40.8736	40.8736
39	0.446023	16.1447	0.184368	ec	2	18	12.993	14.4333	38.2658	0	38.2658	38.224	38.224

40	0.446023	14.9646	1.06329	ec	2	18	12.23	13.5857	35.6571	0	35.6571	35.4301	35.4301
41	0.446023	13.7234	1.94246	ec	2	18	11.4173	12.6829	32.8787	0	32.8787	32.4915	32.4915
42	0.446023	12.4211	2.8221	ec	2	18	10.5544	11.7243	29.9283	0	29.9283	29.408	29.408
43	0.446023	11.0575	3.70239	ec	2	18	9.64036	10.709	26.8036	0	26.8036	26.1797	26.1797
44	0.446023	9.63254	4.58357	ec	2	18	8.67447	9.63604	23.5014	0	23.5014	22.806	22.806
45	0.446023	8.14592	5.46583	ec	2	18	7.65583	8.50448	20.0187	0	20.0187	19.2862	19.2862
46	0.446023	6.59742	6.3494	ec	2	18	6.58348	7.31326	16.3525	0	16.3525	15.6199	15.6199
47	0.446023	4.98674	7.23448	ec	2	18	5.45639	6.06123	12.4992	0	12.4992	11.8065	11.8065
48	0.446023	3.31355	8.1213	ec	2	18	4.27346	4.74717	8.45492	0	8.45492	7.8451	7.8451
49	0.446023	1.57866	9.01009	ec	2	18	3.0344	3.37076	4.21876	0	4.21876	3.73761	3.73761
50	0.446023	0.372557	9.90107	ec	2	18	2.16916	2.40962	1.26067	0	1.26067	0.882045	0.882045

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.11085**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	3.64753	25.3825	0	0	0
2	4.09356	25.0652	-0.337708	0	0
3	4.53958	24.7603	0.539814	0	0
4	4.9856	24.4673	2.43668	0	0
5	5.43162	24.1859	5.20391	0	0
6	5.87765	23.9156	8.70527	0	0
7	6.32367	23.656	12.8147	0	0
8	6.76969	23.4069	17.4154	0	0
9	7.21572	23.1679	22.3991	0	0
10	7.66174	22.9388	27.665	0	0
11	8.10776	22.7192	33.1198	0	0
12	8.55378	22.509	38.6582	0	0
13	8.99981	22.308	44.0171	0	0
14	9.44583	22.1159	49.1023	0	0
15	9.89185	21.9325	53.8784	0	0
16	10.3379	21.7577	58.3146	0	0
17	10.7839	21.5912	62.384	0	0
18	11.2299	21.4331	66.0636	0	0
19	11.6759	21.283	69.3346	0	0
20	12.122	21.1409	72.1813	0	0
21	12.568	21.0066	74.5919	0	0
22	13.014	20.8801	76.5577	0	0

23	13.46	20.7612	78.0735	0	0
24	13.9061	20.6499	79.1369	0	0
25	14.3521	20.546	79.7489	0	0
26	14.7981	20.4495	79.9135	0	0
27	15.2441	20.3602	79.6374	0	0
28	15.6902	20.2782	78.9305	0	0
29	16.1362	20.2034	77.8056	0	0
30	16.5822	20.1356	76.2783	0	0
31	17.0282	20.0749	74.3671	0	0
32	17.4742	20.0212	72.0935	0	0
33	17.9203	19.9745	69.4818	0	0
34	18.3663	19.9348	66.5594	0	0
35	18.8123	19.9019	63.3565	0	0
36	19.2583	19.8759	59.9065	0	0
37	19.7044	19.8568	56.2458	0	0
38	20.1504	19.8446	52.4141	0	0
39	20.5964	19.8392	48.4543	0	0
40	21.0424	19.8406	44.4127	0	0
41	21.4884	19.8489	40.339	0	0
42	21.9345	19.864	36.2865	0	0
43	22.3805	19.886	32.3124	0	0
44	22.8265	19.9148	28.4776	0	0
45	23.2725	19.9506	24.8473	0	0
46	23.7186	19.9933	21.4907	0	0
47	24.1646	20.0429	18.4818	0	0
48	24.6106	20.0995	15.8991	0	0
49	25.0566	20.1632	13.8261	0	0
50	25.5027	20.2339	12.3512	0	0
51	25.9487	20.3117	0	0	0

List Of Coordinates

Water Table

X	Y
0	12.3149
80.3205	12.3149

External Boundary

X	Y
54.9494	21.0494
54.2494	21.0214
54.0994	21.0214
53.4072	21.0214
52.7494	21.0214
41.939	20.6516
41.8457	20.6484
41.8457	20.7084
41.7457	20.7084
40.5957	20.6622
38.6861	20.7661
37.4361	20.8121
27.6815	20.2897
25.4815	20.3177
8.38954	25.2011
4.20583	25.3747
0	25.4337
8.88178e-016	20.9342
0	0
80.3205	0
80.3205	18.0348
80.3205	20.2288
74.9434	20.0581
56.3674	21.4546

Material Boundary

X	Y
27.6815	20.2897
27.6815	20.0897
37.4393	20.5588
37.4361	20.8121

Material Boundary

X	Y
41.939	20.6516
41.939	20.4313

53.4072	20.8699
53.4072	21.0214

Material Boundary

X	Y
8.88178e-016	20.9342
7.58971	20.4647
15.3089	19.8478
23.6683	19.2582
56.2207	18.8652
80.3205	18.0348

Sezione 287 – prg 4+960

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.93 > 1.1$

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 4960 statica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	ec	a-GG	Piattaforma stradale	Qa
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	20	20	18	18
Cohesion [kPa]	2	0	0	16
Friction Angle [deg]	18	34	29.3	19.6
Water Surface	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1

Global Minimums

Method: bishop simplified

FS	1.930550
Center:	36.677, 28.182
Radius:	6.954
Left Slip Surface Endpoint:	30.156, 25.768

Right Slip Surface Endpoint:	39.626, 21.884
Resisting Moment:	1554.31 kN-m
Driving Moment:	805.113 kN-m
Total Slice Area:	16.7056 m2
Surface Horizontal Width:	9.4703 m
Surface Average Height:	1.764 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	807
Number of Invalid Surfaces:	5

Error Codes:

- Error Code -112 reported for 5 surfaces

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.93055**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.181504	0.733229	-67.7169	ec	2	18	1.21664	2.34877	1.07342	0	1.07342	4.04238	4.04238
2	0.181504	2.07229	-64.0362	ec	2	18	2.1984	4.24413	6.90671	0	6.90671	11.4214	11.4214
3	0.181504	3.19677	-60.7953	ec	2	18	3.07519	5.9368	12.1162	0	12.1162	17.6176	17.6176
4	0.181504	4.16901	-57.8569	ec	2	18	3.86694	7.46533	16.8206	0	16.8206	22.9747	22.9747
5	0.181504	5.02489	-55.1429	ec	2	18	4.58781	8.85699	21.1037	0	21.1037	27.6906	27.6906
6	0.190284	6.07281	-52.5452	a-GG	0	34	7.66005	14.7881	21.9242	0	21.9242	31.9233	31.9233
7	0.190284	6.73613	-50.0354	a-GG	0	34	8.73145	16.8565	24.9909	0	24.9909	35.4097	35.4097
8	0.190284	7.31119	-47.651	a-GG	0	34	9.70687	18.7396	27.7826	0	27.7826	38.432	38.432
9	0.190284	7.821	-45.3712	a-GG	0	34	10.6088	20.4808	30.3641	0	30.3641	41.1113	41.1113
10	0.190284	8.27335	-43.1801	a-GG	0	34	11.4426	22.0906	32.7506	0	32.7506	43.4885	43.4885
11	0.190284	8.67437	-41.0652	a-GG	0	34	12.2128	23.5775	34.955	0	34.955	45.5959	45.5959
12	0.190284	9.02899	-39.0163	a-GG	0	34	12.9232	24.9489	36.9883	0	36.9883	47.4594	47.4594
13	0.190284	9.34124	-37.0253	a-GG	0	34	13.5771	26.2112	38.8597	0	38.8597	49.1002	49.1002
14	0.190284	9.61444	-35.0853	a-GG	0	34	14.1772	27.3697	40.5772	0	40.5772	50.5357	50.5357

15	0.190284	9.8514	-33.1904	a-GG	0	34	14.7259	28.4291	42.1478	0	42.1478	51.7806	51.7806
16	0.190284	10.0545	-31.3357	a-GG	0	34	15.2254	29.3933	43.5774	0	43.5774	52.8475	52.8475
17	0.190284	10.2257	-29.517	a-GG	0	34	15.6773	30.2659	44.8711	0	44.8711	53.747	53.747
18	0.190284	10.3873	-27.7304	a-GG	0	34	16.1152	31.1112	46.1242	0	46.1242	54.5958	54.5958
19	0.190284	10.5484	-25.9727	a-GG	0	34	16.573	32.3812	48.0069	0	48.0069	56.1778	56.1778
20	0.190284	10.9995	-24.2408	a-GG	0	34	17.4532	33.6943	49.954	0	49.954	57.8127	57.8127
21	0.190284	11.2844	-22.5323	a-GG	0	34	18.0986	34.9402	51.8009	0	51.8009	59.3095	59.3095
22	0.190284	11.3252	-20.8447	a-GG	0	34	18.355	35.4353	52.5351	0	52.5351	59.5239	59.5239
23	0.190284	11.1064	-19.1758	a-GG	0	34	18.1851	35.1073	52.049	0	52.049	58.3731	58.3731
24	0.190284	10.8639	-17.5236	a-GG	0	34	17.9671	34.6864	51.4247	0	51.4247	57.0978	57.0978
25	0.190284	10.5985	-15.8864	a-GG	0	34	17.7016	34.1739	50.6651	0	50.6651	55.703	55.703
26	0.190284	10.3109	-14.2624	a-GG	0	34	17.3891	33.5705	49.7703	0	49.7703	54.1906	54.1906
27	0.190284	10.0014	-12.65	a-GG	0	34	17.0297	32.8767	48.7417	0	48.7417	52.5639	52.5639
28	0.190284	9.6706	-11.0478	a-GG	0	34	16.6236	32.0927	47.5794	0	47.5794	50.8251	50.8251
29	0.190284	9.3191	-9.45427	a-GG	0	34	16.1708	31.2185	46.2833	0	46.2833	48.9761	48.9761
30	0.190284	8.9465	-7.86809	a-GG	0	34	15.671	30.2536	44.8528	0	44.8528	47.0185	47.0185
31	0.190284	8.5537	-6.28797	a-GG	0	34	15.1243	29.1976	43.2873	0	43.2873	44.9538	44.9538
32	0.190284	8.1407	-4.71263	a-GG	0	34	14.5293	28.0496	41.5852	0	41.5852	42.7829	42.7829
33	0.190284	7.7069	-3.14086	a-GG	0	34	13.8864	26.8083	39.7449	0	39.7449	40.5069	40.5069
34	0.190284	7.2546	-1.57146	a-GG	0	34	13.1943	25.4723	37.7643	0	37.7643	38.1262	38.1262
35	0.190284	6.7819	-0.0032329	a-GG	0	34	12.4524	24.0399	35.6406	0	35.6406	35.6413	35.6413
36	0.190284	6.2893	1.56499	a-GG	0	34	11.6593	22.5089	33.3707	0	33.3707	33.0522	33.0522
37	0.190284	5.7769	3.13439	a-GG	0	34	10.8139	20.8767	30.951	0	30.951	30.3589	30.3589
38	0.190284	5.2454	4.70614	a-GG	0	34	9.91458	19.1406	28.3771	0	28.3771	27.5609	27.5609
39	0.190284	4.6924	6.28146	a-GG	0	34	8.95967	17.2971	25.644	0	25.644	24.6577	24.6577
40	0.190284	4.1195	7.86156	a-GG	0	34	7.94711	15.3423	22.7458	0	22.7458	21.6485	21.6485
41	0.190284	3.5265	9.44771	a-GG	0	34	6.87457	13.2717	19.6761	0	19.6761	18.5322	18.5322

42	0.190284	2.91293	11.0412	a-GG	0	34	5.73945	11.0803	16.4272	0	16.4272	15.3073	15.3073
43	0.190284	2.27832	12.6434	a-GG	0	34	4.5387	8.76219	12.9905	0	12.9905	11.9723	11.9723
44	0.190284	1.79506	14.2557	a-GG	0	34	3.61675	6.98232	10.3517	0	10.3517	9.43279	9.43279
45	0.190284	1.56741	15.8797	a-GG	0	34	3.19527	6.16863	9.14536	0	9.14536	8.23639	8.23639
46	0.190284	1.32116	17.5168	a-GG	0	34	2.72619	5.26304	7.80277	0	7.80277	6.94232	6.94232
47	0.190284	1.05204	19.1689	a-GG	0	34	2.19847	4.24426	6.29236	0	6.29236	5.52811	5.52811
48	0.190284	0.761871	20.8377	a-GG	0	34	1.61324	3.11444	4.61734	0	4.61734	4.00331	4.00331
49	0.190284	0.471209	22.5253	a-GG	0	34	1.01167	1.95307	2.89554	0	2.89554	2.47597	2.47597
50	0.190284	0.161342	24.2337	a-GG	0	34	0.35147	0.67853 1	1.00596	0	1.00596	0.847758	0.847758

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.93055**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	30.1562	25.7679	0	0	0
2	30.3377	25.3249	0.254817	0	0
3	30.5192	24.9522	2.43054	0	0
4	30.7007	24.6275	5.80702	0	0
5	30.8822	24.3386	9.96456	0	0
6	31.0637	24.078	14.6321	0	0
7	31.254	23.8297	18.6215	0	0
8	31.4443	23.6026	22.6359	0	0
9	31.6346	23.3938	26.5904	0	0
10	31.8248	23.2011	30.4267	0	0
11	32.0151	23.0225	34.0993	0	0
12	32.2054	22.8567	37.5728	0	0
13	32.3957	22.7025	40.8187	0	0
14	32.586	22.559	43.8147	0	0
15	32.7763	22.4254	46.543	0	0
16	32.9665	22.3009	48.9896	0	0
17	33.1568	22.185	51.1438	0	0
18	33.3471	22.0773	52.9974	0	0
19	33.5374	21.9773	54.5474	0	0
20	33.7277	21.8846	55.8087	0	0
21	33.918	21.7989	56.7706	0	0
22	34.1082	21.7199	57.4192	0	0
23	34.2985	21.6475	57.7359	0	0
24	34.4888	21.5813	57.7229	0	0
25	34.6791	21.5212	57.3968	0	0
26	34.8694	21.4671	56.7752	0	0

27	35.0597	21.4187	55.8767	0	0
28	35.2499	21.376	54.7207	0	0
29	35.4402	21.3389	53.328	0	0
30	35.6305	21.3072	51.7203	0	0
31	35.8208	21.2809	49.9204	0	0
32	36.0111	21.2599	47.9528	0	0
33	36.2014	21.2442	45.8428	0	0
34	36.3917	21.2338	43.6178	0	0
35	36.5819	21.2286	41.3065	0	0
36	36.7722	21.2285	38.9395	0	0
37	36.9625	21.2337	36.5495	0	0
38	37.1528	21.2442	34.1711	0	0
39	37.3431	21.2598	31.8416	0	0
40	37.5334	21.2808	29.6012	0	0
41	37.7236	21.307	27.4927	0	0
42	37.9139	21.3387	25.5627	0	0
43	38.1042	21.3758	23.8616	0	0
44	38.2945	21.4185	22.4442	0	0
45	38.4848	21.4669	21.2562	0	0
46	38.6751	21.521	20.1537	0	0
47	38.8653	21.5811	19.1667	0	0
48	39.0556	21.6472	18.3326	0	0
49	39.2459	21.7196	17.6914	0	0
50	39.4362	21.7986	17.2706	0	0
51	39.6265	21.8842	0	0	0

List Of Coordinates

Water Table

X	Y
0	16.7367
97.446	16.7367

External Boundary

X	Y
0	0
97.446	0
97.446	17.7367
97.4392	21.3743
97.446	21.8742
90.1716	21.9226
86.7815	21.9226
84.7786	22.1209
78.5657	22.7486
69.4225	23.1016
68.9162	23.1246
68.2137	22.6562
65.8495	21.0801
65.1495	21.0521
64.9995	21.0521
63.6495	21.0521
53.896	21.4891
53.896	21.5491
53.796	21.5491
52.646	21.5031
52.1601	21.4367
51.0101	21.4827
50.9101	21.4827
50.9101	21.4227
40.5188	21.8882
39.1713	21.8821
38.3188	21.9162
36.6338	23.0395
34.1118	24.7207
33.5376	24.7432
33.4564	24.7463

31.1608	25.5523
29.22	25.9688
22.0226	27.2172
17.5281	28.2261
10.8526	28.6497
0	29.6516
0	28.1594
0	17.7367

Material Boundary

X	Y
40.5188	21.8882
40.5188	21.6882
50.9101	21.2227
50.9101	21.4227

Material Boundary

X	Y
53.896	21.4891
53.896	21.3891
53.896	21.2891
63.6495	20.8521
63.6495	21.0521

Material Boundary

X	Y
0	17.7367
97.446	17.7367

Material Boundary

X	Y
68.2137	22.6562
71.7714	22.4947
78.5657	22.2484
79.7704	22.1344
82.5757	21.8207
82.6997	21.8168
82.8119	21.8155
84.7786	21.6207
84.8679	21.6119
85.7449	21.5583
86.7846	21.4597
86.8704	21.4506
88.7951	21.4451
90.1716	21.4224
97.4392	21.3743

Material Boundary

X	Y
0	28.1594
2.99936	28.0066
10.7228	27.1547
17.3521	26.734
19.3523	26.3877
21.6972	25.7511
28.9484	24.4933
29.2761	24.4295
30.2505	24.2297
36.6338	23.0395

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.47 > 1.1$ (sisma verso l'alto ↑)

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 4960 sismica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard

Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.112
Seismic Load Coefficient (Vertical): -0.056

Material Properties

Property	ec	a-GG	Piattaforma stradale	Qa
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	20	20	18	18
Cohesion [kPa]	2	0	0	16
Friction Angle [deg]	18	34	29.3	19.6
Water Surface	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1

Global Minimums

Method: bishop simplified

FS	1.469200
Center:	36.911, 30.153
Radius:	8.886
Left Slip Surface Endpoint:	29.056, 25.997
Right Slip Surface Endpoint:	40.172, 21.887
Resisting Moment:	2042.96 kN-m
Driving Moment:	1390.52 kN-m
Total Slice Area:	19.1247 m2
Surface Horizontal Width:	11.1161 m
Surface Average Height:	1.72045 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 963
Number of Invalid Surfaces: 16

Error Codes:

- Error Code -112 reported for 16 surfaces

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.4692**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.206269	0.68539	-60.7562	ec	2	18	1.47429	2.16602	0.510955	0	0.510955	3.14415	3.14415
2	0.206269	1.95826	-58.1352	ec	2	18	2.46776	3.62564	5.00321	0	5.00321	8.97327	8.97327

3	0.20 6269	3.08 374	- 55.6955	ec	2	18	3.38 747	4.97 687	9.16 188	0	9.16 188	14.1 269	14.1 269
4	0.20 6269	4.09 764	- 53.4002	ec	2	18	4.24 735	6.24 021	13.0 5	0	13.0 5	18.7 691	18.7 691
5	0.20 6269	5.01 754	- 51.223	ec	2	18	5.05 264	7.42 334	16.6 913	0	16.6 913	22.9 807	22.9 807
6	0.20 6269	5.85 649	- 49.1446	ec	2	18	5.80 783	8.53 287	20.1 061	0	20.1 061	26.8 214	26.8 214
7	0.22 451	7.24 406	- 47.0654	a-GG	0	34	9.37 211	13.7 695	20.4 142	0	20.4 142	30.4 876	30.4 876
8	0.22 451	8.07 318	- 44.9796	a-GG	0	34	10.6 926	15.7 096	23.2 905	0	23.2 905	33.9 755	33.9 755
9	0.22 451	8.83 002	- 42.9672	a-GG	0	34	11.9 497	17.5 565	26.0 285	0	26.0 285	37.1 59	37.1 59
10	0.22 451	9.52 033	- 41.0187	a-GG	0	34	13.1 437	19.3 107	28.6 293	0	28.6 293	40.0 625	40.0 625
11	0.22 451	10.0 661	- 39.1264	a-GG	0	34	14.1 587	20.8 02	30.8 402	0	30.8 402	42.3 575	42.3 575
12	0.22 451	10.5 06	- 37.2836	a-GG	0	34	15.0 387	22.0 949	32.7 571	0	32.7 571	44.2 068	44.2 068
13	0.22 451	10.8 951	- 35.485	a-GG	0	34	15.8 567	23.2 966	34.5 386	0	34.5 386	45.8 428	45.8 428
14	0.22 451	11.2 371	- 33.7259	a-GG	0	34	16.6 142	24.4 096	36.1 886	0	36.1 886	47.2 798	47.2 798
15	0.22 451	11.5 346	- 32.0021	a-GG	0	34	17.3 13	25.4 363	37.7 109	0	37.7 109	48.5 302	48.5 302
16	0.22 451	11.7 904	- 30.3102	a-GG	0	34	17.9 547	26.3 79	39.1 084	0	39.1 084	49.6 046	49.6 046
17	0.22 451	12.0 065	- 28.6471	a-GG	0	34	18.5 402	27.2 393	40.3 84	0	40.3 84	50.5 123	50.5 123
18	0.22 451	12.1 848	- 27.0099	a-GG	0	34	19.0 709	28.0 19	41.5 399	0	41.5 399	51.2 612	51.2 612
19	0.22 451	12.3 272	- 25.3963	a-GG	0	34	19.5 475	28.7 192	42.5 78	0	42.5 78	51.8 583	51.8 583
20	0.22 451	12.4 349	- 23.804	a-GG	0	34	19.9 709	29.3 412	43.5 002	0	43.5 002	52.3 101	52.3 101
21	0.22 451	12.6 402	- 22.231	a-GG	0	34	20.5 542	30.1 983	44.7 709	0	44.7 709	53.1 719	53.1 719
22	0.22 451	12.9 957	- 20.6754	a-GG	0	34	21.3 91	31.4 277	46.5 934	0	46.5 934	54.6 659	54.6 659
23	0.22 451	13.3 214	- 19.1357	a-GG	0	34	22.1 904	32.6 021	48.3 346	0	48.3 346	56.0 342	56.0 342
24	0.22 451	13.3 049	- 17.6102	a-GG	0	34	22.4 249	32.9 466	48.8 455	0	48.8 455	55.9 634	55.9 634
25	0.22 451	12.9 384	- 16.0975	a-GG	0	34	22.0 613	32.4 124	48.0 532	0	48.0 532	54.4 198	54.4 198
26	0.22 451	12.5 431	- 14.5962	a-GG	0	34	21.6 337	31.7 843	47.1 224	0	47.1 224	52.7 56	52.7 56
27	0.22 451	12.1 197	- 13.1052	a-GG	0	34	21.1 423	31.0 622	46.0 514	0	46.0 514	50.9 734	50.9 734
28	0.22 451	11.6 687	- 11.6231	a-GG	0	34	20.5 864	30.2 455	44.8 409	0	44.8 409	49.0 753	49.0 753
29	0.22 451	11.1 906	- 10.1489	a-GG	0	34	19.9 658	29.3 338	43.4 891	0	43.4 891	47.0 631	47.0 631

30	0.22451	10.6857	-8.68139	a-GG	0	34	19.2798	28.3259	41.9949	0	41.9949	44.9387	44.9387
31	0.22451	10.1545	-7.21963	a-GG	0	34	18.5276	27.2208	40.3564	0	40.3564	42.7035	42.7035
32	0.22451	9.59725	-5.7626	a-GG	0	34	17.7082	26.0169	38.5716	0	38.5716	40.3586	40.3586
33	0.22451	9.01409	-4.30929	a-GG	0	34	16.8203	24.7124	36.6377	0	36.6377	37.9051	37.9051
34	0.22451	8.40523	-2.85876	a-GG	0	34	15.8626	23.3053	34.5516	0	34.5516	35.3437	35.3437
35	0.22451	7.77079	-1.41006	a-GG	0	34	14.8334	21.7932	32.3098	0	32.3098	32.6749	32.6749
36	0.22451	7.11085	0.037 7314	a-GG	0	34	13.7307	20.1732	29.908	0	29.908	29.899	29.899
37	0.22451	6.42543	1.485 55	a-GG	0	34	12.5525	18.4422	27.3416	0	27.3416	27.0161	27.0161
38	0.22451	5.71451	2.934 32	a-GG	0	34	11.2962	16.5964	24.6052	0	24.6052	24.0262	24.0262
39	0.22451	4.97801	4.384 97	a-GG	0	34	9.95903	14.6318	21.6926	0	21.6926	20.9289	20.9289
40	0.22451	4.2158	5.838 45	a-GG	0	34	8.53778	12.5437	18.5968	0	18.5968	17.7237	17.7237
41	0.22451	3.42771	7.295 71	a-GG	0	34	7.02872	10.3266	15.3099	0	15.3099	14.41	14.41
42	0.22451	2.63397	8.757 73	a-GG	0	34	5.47036	8.03705	11.9154	0	11.9154	11.0727	11.0727
43	0.22451	2.24953	10.22 55	a-GG	0	34	4.73332	6.9542	10.31	0	10.31	9.4562	9.4562
44	0.22451	2.01389	11.70 01	a-GG	0	34	4.29475	6.30984	9.35474	0	9.35474	8.46533	8.46533
45	0.22451	1.75112	13.18 27	a-GG	0	34	3.78633	5.56288	8.2473	0	8.2473	7.36043	7.36043
46	0.22451	1.46543	14.67 42	a-GG	0	34	3.21415	4.72223	7.00098	0	7.00098	6.1593	6.1593
47	0.22451	1.18517	16.17 61	a-GG	0	34	2.63817	3.876	5.74641	0	5.74641	4.98114	4.98114
48	0.22451	0.882768	17.68 94	a-GG	0	34	1.99543	2.93168	4.3464	0	4.3464	3.70998	3.70998
49	0.22451	0.550892	19.21 56	a-GG	0	34	1.26533	1.85902	2.75611	0	2.75611	2.31509	2.31509
50	0.22451	0.188746	20.75 61	a-GG	0	34	0.440837	0.647678	0.960223	0	0.960223	0.793151	0.793151

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.4692**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	29.0559	25.9972	0	0	0
2	29.2622	25.6288	-0.0382349	0	0
3	29.4684	25.297	1.33376	0	0
4	29.6747	24.9947	3.75228	0	0

5	29.881	24.7169	6.96216	0	0
6	30.0873	24.4602	10.7705	0	0
7	30.2935	24.2217	15.0271	0	0
8	30.518	23.9803	18.6664	0	0
9	30.7425	23.756	22.402	0	0
10	30.9671	23.5469	26.1587	0	0
11	31.1916	23.3516	29.8736	0	0
12	31.4161	23.169	33.4634	0	0
13	31.6406	22.998	36.8724	0	0
14	31.8651	22.838	40.0707	0	0
15	32.0896	22.6881	43.0336	0	0
16	32.3141	22.5478	45.7403	0	0
17	32.5386	22.4165	48.1741	0	0
18	32.7631	22.2939	50.321	0	0
19	32.9876	22.1795	52.1701	0	0
20	33.2122	22.0729	53.7128	0	0
21	33.4367	21.9738	54.9427	0	0
22	33.6612	21.8821	55.8651	0	0
23	33.8857	21.7973	56.4793	0	0
24	34.1102	21.7194	56.7687	0	0
25	34.3347	21.6482	56.7193	0	0
26	34.5592	21.5834	56.3428	0	0
27	34.7837	21.5249	55.6593	0	0
28	35.0082	21.4727	54.6905	0	0
29	35.2328	21.4265	53.4593	0	0
30	35.4573	21.3863	51.9905	0	0
31	35.6818	21.352	50.3106	0	0
32	35.9063	21.3236	48.4478	0	0
33	36.1308	21.3009	46.4321	0	0
34	36.3553	21.284	44.2958	0	0
35	36.5798	21.2728	42.0733	0	0
36	36.8043	21.2673	39.8013	0	0
37	37.0288	21.2674	37.5193	0	0
38	37.2533	21.2732	35.2696	0	0
39	37.4779	21.2847	33.0975	0	0
40	37.7024	21.3019	31.0519	0	0
41	37.9269	21.3249	29.1858	0	0
42	38.1514	21.3537	27.5561	0	0
43	38.3759	21.3882	26.2143	0	0
44	38.6004	21.4287	24.989	0	0
45	38.8249	21.4752	23.8181	0	0
46	39.0494	21.5278	22.7329	0	0
47	39.2739	21.5866	21.7658	0	0
48	39.4984	21.6517	20.9337	0	0
49	39.723	21.7233	20.2746	0	0
50	39.9475	21.8016	19.8374	0	0
51	40.172	21.8867	0	0	0

List Of Coordinates

Water Table

X	Y
0	16.7367
97.446	16.7367

External Boundary

X	Y
0	0
97.446	0
97.446	17.7367
97.4392	21.3743
97.446	21.8742
90.1716	21.9226
86.7815	21.9226
84.7786	22.1209
78.5657	22.7486
69.4225	23.1016
68.9162	23.1246
68.2137	22.6562
65.8495	21.0801
65.1495	21.0521
64.9995	21.0521
63.6495	21.0521
53.896	21.4891
53.896	21.5491
53.796	21.5491
52.646	21.5031
52.1601	21.4367
51.0101	21.4827
50.9101	21.4827
50.9101	21.4227
40.5188	21.8882
39.1713	21.8821
38.3188	21.9162
36.6338	23.0395
34.1118	24.7207
33.5376	24.7432
33.4564	24.7463
31.1608	25.5523
29.22	25.9688
22.0226	27.2172
17.5281	28.2261
10.8526	28.6497
0	29.6516
0	28.1594
0	17.7367

Material Boundary

X	Y
40.5188	21.8882
40.5188	21.6882
50.9101	21.2227
50.9101	21.4227

Material Boundary

X	Y
53.896	21.4891
53.896	21.3891
53.896	21.2891
63.6495	20.8521
63.6495	21.0521

Material Boundary

X	Y
0	17.7367
97.446	17.7367

Material Boundary

X	Y
68.2137	22.6562
71.7714	22.4947
78.5657	22.2484
79.7704	22.1344
82.5757	21.8207
82.6997	21.8168
82.8119	21.8155
84.7786	21.6207
84.8679	21.6119
85.7449	21.5583
86.7846	21.4597
86.8704	21.4506
88.7951	21.4451
90.1716	21.4224
97.4392	21.3743

Material Boundary

X	Y
0	28.1594
2.99936	28.0066
10.7228	27.1547
17.3521	26.734
19.3523	26.3877
21.6972	25.7511
28.9484	24.4933

29.2761	24.4295
30.2505	24.2297

36.6338	23.0395

Sezione 293 – prg 5+040

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.75 > 1.1$

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 5040 statica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Rilevato	a-GG	Qa
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	20	18
Cohesion [kPa]	0	0	16
Friction Angle [deg]	29.3	34	19.6
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Global Minimums

Method: bishop simplified

FS	1.746480
Center:	28.482, 28.662
Radius:	8.101
Left Slip Surface Endpoint:	21.280, 24.954
Right Slip Surface Endpoint:	31.115, 21.001
Resisting Moment:	1876.33 kN-m
Driving Moment:	1074.35 kN-m
Total Slice Area:	17.6189 m2
Surface Horizontal Width:	9.83479 m
Surface Average Height:	1.79148 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1076
Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.74648**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.196696	0.783915	-61.3104	a-GG	0	34	0.902799	1.57672	2.33758	0	2.33758	3.98729	3.98729
2	0.196696	2.20398	-58.5288	a-GG	0	34	2.65452	4.63607	6.87327	0	6.87327	11.2099	11.2099
3	0.196696	3.40933	-55.9537	a-GG	0	34	4.26126	7.44221	11.0335	0	11.0335	17.3401	17.3401
4	0.196696	4.50619	-53.5406	a-GG	0	34	5.81289	10.1521	15.0511	0	15.0511	22.9184	22.9184
5	0.196696	5.51267	-51.2584	a-GG	0	34	7.30956	12.766	18.9264	0	18.9264	28.0366	28.0366
6	0.196696	6.44191	-49.0847	a-GG	0	34	8.75269	15.2864	22.6631	0	22.6631	32.762	32.762
7	0.196696	7.30388	-47.0026	a-GG	0	34	10.1442	17.7166	26.2659	0	26.2659	37.1452	37.1452
8	0.196696	8.10632	-44.9988	a-GG	0	34	11.4859	20.0599	29.7401	0	29.7401	41.2255	41.2255
9	0.196696	8.85542	-43.0629	a-GG	0	34	12.7799	22.3199	33.0906	0	33.0906	45.0344	45.0344
10	0.196696	9.55617	-41.1865	a-GG	0	34	14.0282	24.4999	36.3225	0	36.3225	48.5974	48.5974
11	0.196696	10.2127	-39.3624	a-GG	0	34	15.2322	26.6028	39.4405	0	39.4405	51.9357	51.9357
12	0.196696	10.8285	-37.5849	a-GG	0	34	16.3939	28.6317	42.4484	0	42.4484	55.0665	55.0665
13	0.196696	11.4065	-35.8489	a-GG	0	34	17.5147	30.589	45.3501	0	45.3501	58.0048	58.0048
14	0.196696	11.9247	-34.1502	a-GG	0	34	18.5579	32.411	48.0514	0	48.0514	60.6397	60.6397
15	0.196696	12.0417	-32.485	a-GG	0	34	18.9814	33.1507	49.1481	0	49.1481	61.2336	61.2336
16	0.196696	12.0032	-30.8501	a-GG	0	34	19.1545	33.453	49.5962	0	49.5962	61.0373	61.0373
17	0.196696	11.9351	-29.2426	a-GG	0	34	19.2721	33.6583	49.9002	0	49.9002	60.6898	60.6898
18	0.196696	11.8386	-27.66	a-GG	0	34	19.3355	33.769	50.0646	0	50.0646	60.1988	60.1988
19	0.196696	11.7151	-26.1	a-GG	0	34	19.3462	33.7877	50.0925	0	50.0925	59.5701	59.5701
20	0.196696	11.5655	-24.5606	a-GG	0	34	19.3053	33.7163	49.9864	0	49.9864	58.809	58.809

21	0.196696	11.391	-23.0399	a-GG	0	34	19.2138	33.5566	49.7498	0	49.7498	57.9214	57.9214
22	0.196696	11.1924	-21.5362	a-GG	0	34	19.0726	33.3099	49.3837	0	49.3837	56.9105	56.9105
23	0.196696	10.9704	-20.0479	a-GG	0	34	18.8822	32.9774	48.8908	0	48.8908	55.7812	55.7812
24	0.196696	10.7258	-18.5736	a-GG	0	34	18.6432	32.56	48.2724	0	48.2724	54.537	54.537
25	0.196696	10.459	-17.1119	a-GG	0	34	18.3561	32.0585	47.5287	0	47.5287	53.18	53.18
26	0.196696	10.1707	-15.6617	a-GG	0	34	18.021	31.4734	46.6613	0	46.6613	51.7137	51.7137
27	0.196696	9.86142	-14.2216	a-GG	0	34	17.6383	30.8049	45.6702	0	45.6702	50.1404	50.1404
28	0.196696	9.53145	-12.7907	a-GG	0	34	17.2079	30.0532	44.5556	0	44.5556	48.4622	48.4622
29	0.196696	9.18121	-11.3679	a-GG	0	34	16.7297	29.218	43.3175	0	43.3175	46.681	46.681
30	0.196696	8.81103	-9.95211	a-GG	0	34	16.2036	28.2992	41.9553	0	41.9553	44.7984	44.7984
31	0.196696	8.42117	-8.54246	a-GG	0	34	15.6292	27.2961	40.4682	0	40.4682	42.8158	42.8158
32	0.196696	8.01188	-7.13801	a-GG	0	34	15.0063	26.2082	38.8552	0	38.8552	40.7345	40.7345
33	0.196696	7.58335	-5.73786	a-GG	0	34	14.3342	25.0344	37.115	0	37.115	38.5553	38.5553
34	0.196696	7.13574	-4.34114	a-GG	0	34	13.6123	23.7736	35.2459	0	35.2459	36.2792	36.2792
35	0.196696	6.66917	-2.947	a-GG	0	34	12.8399	22.4246	33.2458	0	33.2458	33.9068	33.9068
36	0.196696	6.18373	-1.5546	a-GG	0	34	12.0159	20.9855	31.1123	0	31.1123	31.4384	31.4384
37	0.196696	5.67948	-0.163128	a-GG	0	34	11.1394	19.4547	28.8428	0	28.8428	28.8745	28.8745
38	0.196696	5.15643	1.22825	a-GG	0	34	10.209	17.8299	26.4339	0	26.4339	26.215	26.215
39	0.196696	4.61457	2.62036	a-GG	0	34	9.22352	16.1087	23.8821	0	23.8821	23.46	23.46
40	0.196696	4.05386	4.01401	a-GG	0	34	8.1812	14.2883	21.1832	0	21.1832	20.6091	20.6091
41	0.196696	3.47421	5.41005	a-GG	0	34	7.08024	12.3655	18.3327	0	18.3327	17.6621	17.6621
42	0.196696	2.87552	6.80932	a-GG	0	34	5.91871	10.3369	15.3251	0	15.3251	14.6183	14.6183
43	0.196696	2.25762	8.21269	a-GG	0	34	4.69418	8.1983	12.1545	0	12.1545	11.477	11.477
44	0.196696	1.62098	9.62104	a-GG	0	34	3.40548	5.94761	8.81772	0	8.81772	8.24044	8.24044
45	0.196696	1.2308	11.0353	a-GG	0	34	2.61328	4.56404	6.76647	0	6.76647	6.25683	6.25683
46	0.196696	1.03894	12.4564	a-GG	0	34	2.22998	3.89461	5.774	0	5.774	5.28141	5.28141
47	0.196696	0.826884	13.8853	a-GG	0	34	1.79473	3.13446	4.64703	0	4.64703	4.20337	4.20337

48	0.196696	0.598037	15.3231	a-GG	0	34	1.31303	2.29318	3.39978	0	3.39978	3.04001	3.04001
49	0.196696	0.371447	16.7709	a-GG	0	34	0.825277	1.44133	2.13686	0	2.13686	1.88815	1.88815
50	0.196696	0.127426	18.2297	a-GG	0	34	0.286617	0.500571	0.742128	0	0.742128	0.647728	0.647728

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.74648**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	21.2798	24.9541	0	0	0
2	21.4765	24.5947	0.662813	0	0
3	21.6732	24.2734	2.34993	0	0
4	21.8699	23.9822	4.72463	0	0
5	22.0666	23.716	7.58935	0	0
6	22.2633	23.4709	10.793	0	0
7	22.46	23.2439	14.2167	0	0
8	22.6567	23.033	17.7645	0	0
9	22.8534	22.8363	21.3573	0	0
10	23.0501	22.6525	24.9293	0	0
11	23.2468	22.4804	28.4247	0	0
12	23.4435	22.319	31.7957	0	0
13	23.6402	22.1676	35.0011	0	0
14	23.8369	22.0255	38.0049	0	0
15	24.0336	21.8921	40.77	0	0
16	24.2303	21.7668	43.1958	0	0
17	24.4269	21.6493	45.2593	0	0
18	24.6236	21.5392	46.968	0	0
19	24.8203	21.4361	48.3304	0	0
20	25.017	21.3398	49.3563	0	0
21	25.2137	21.2499	50.0566	0	0
22	25.4104	21.1662	50.4434	0	0
23	25.6071	21.0886	50.5295	0	0
24	25.8038	21.0168	50.3289	0	0
25	26.0005	20.9507	49.8566	0	0
26	26.1972	20.8902	49.1282	0	0
27	26.3939	20.835	48.1608	0	0
28	26.5906	20.7852	46.972	0	0
29	26.7873	20.7405	45.5808	0	0
30	26.984	20.701	44.0069	0	0
31	27.1807	20.6665	42.2713	0	0
32	27.3774	20.6369	40.3962	0	0
33	27.5741	20.6123	38.405	0	0
34	27.7708	20.5925	36.3222	0	0
35	27.9675	20.5776	34.1741	0	0
36	28.1642	20.5675	31.988	0	0

37	28.3609	20.5621	29.7933	0	0
38	28.5576	20.5616	27.6209	0	0
39	28.7543	20.5658	25.5036	0	0
40	28.9509	20.5748	23.4764	0	0
41	29.1476	20.5886	21.5766	0	0
42	29.3443	20.6072	19.8441	0	0
43	29.541	20.6307	18.3213	0	0
44	29.7377	20.6591	17.0539	0	0
45	29.9344	20.6924	16.0908	0	0
46	30.1311	20.7308	15.3178	0	0
47	30.3278	20.7742	14.6288	0	0
48	30.5245	20.8229	14.0502	0	0
49	30.7212	20.8768	13.609	0	0
50	30.9179	20.936	13.3202	0	0
51	31.1146	21.0008	0	0	0

List Of Coordinates

Water Table

X	Y
0	16.3382
95.2378	16.3382

External Boundary

X	Y
0	0
95.2378	0
95.2378	17.3782
95.2378	20.808
85.8283	20.8733
78.4671	21.4211
60.8463	22.5196
60.3102	22.5196
56.9487	20.282
56.2487	20.254
56.0987	20.254
54.7487	20.254
44.9957	20.659
44.9957	20.7189
44.8957	20.7189
43.7457	20.6729
43.3196	20.6264
42.1617	20.6727
42.0617	20.6727
42.0617	20.6127
32.1243	21.0008
30.6243	21.0008
29.9243	21.0288
23.9732	24.9963
21.4814	24.9942
20.8122	24.8611
8.65773	25.5057
0	25.0077
0	17.3782

Material Boundary

X	Y
32.1243	21.0008
32.1243	20.8008
42.0617	20.4127
42.0617	20.6127

Material Boundary

X	Y
44.9957	20.659
44.9957	20.4589
54.7487	20.054
54.7487	20.254

Material Boundary

X	Y
0	17.3782
95.2378	17.3782

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.36 > 1.1$ (sisma verso l'alto ↑)

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 5040 sismica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10

Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal):	0.112
Seismic Load Coefficient (Vertical):	-0.056

Material Properties

Property	Rilevato	a-GG	Qa
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	20	18
Cohesion [kPa]	0	0	16
Friction Angle [deg]	29.3	34	19.6
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Global Minimums

Method: bishop simplified

FS	1.362880
Center:	28.511, 28.686
Radius:	8.137
Left Slip Surface Endpoint:	21.280, 24.954
Right Slip Surface Endpoint:	31.185, 21.001
Resisting Moment:	1719.19 kN-m
Driving Moment:	1261.44 kN-m
Total Slice Area:	17.6916 m2
Surface Horizontal Width:	9.90542 m
Surface Average Height:	1.78605 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1066
Number of Invalid Surfaces:	0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.36288**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.198108	0.793499	-61.2525	a-GG	0	34	0.984958	1.34238	1.99017	0	1.99017	3.7857	3.7857
2	0.198108	2.22969	-58.4684	a-GG	0	34	2.9139	3.9713	5.88771	0	5.88771	10.6369	10.6369
3	0.198108	3.4495	-55.8907	a-GG	0	34	4.70542	6.41292	9.50755	0	9.50755	16.455	16.455
4	0.198108	4.55953	-53.4749	a-GG	0	34	6.45227	8.79367	13.0371	0	13.0371	21.7489	21.7489
5	0.198108	5.57804	-51.19	a-GG	0	34	8.15163	11.1097	16.4709	0	16.4709	26.6058	26.6058
6	0.198108	6.51835	-49.0136	a-GG	0	34	9.80284	13.3601	19.8072	0	19.8072	31.0895	31.0895
7	0.198108	7.39053	-46.9287	a-GG	0	34	11.4061	15.5452	23.0467	0	23.0467	35.2478	35.2478
8	0.198108	8.20241	-44.9223	a-GG	0	34	12.9623	17.6661	26.1911	0	26.1911	39.1183	39.1183
9	0.198108	8.96024	-42.9837	a-GG	0	34	14.4726	19.7244	29.2426	0	29.2426	42.7309	42.7309
10	0.198108	9.66909	-41.1046	a-GG	0	34	15.9381	21.7217	32.2037	0	32.2037	46.1097	46.1097
11	0.198108	10.3331	-39.2779	a-GG	0	34	17.3601	23.6597	35.0769	0	35.0769	49.2747	49.2747
12	0.198108	10.9559	-37.4976	a-GG	0	34	18.7397	25.5399	37.8645	0	37.8645	52.2427	52.2427
13	0.198108	11.5403	-35.759	a-GG	0	34	20.0781	27.364	40.5687	0	40.5687	55.0276	55.0276
14	0.198108	12.046	-34.0575	a-GG	0	34	21.3004	29.0299	43.0384	0	43.0384	57.4368	57.4368
15	0.198108	12.1298	-32.3896	a-GG	0	34	21.784	29.689	44.0157	0	44.0157	57.8347	57.8347
16	0.198108	12.089	-30.752	a-GG	0	34	22.0369	30.0337	44.5267	0	44.5267	57.6383	57.6383
17	0.198108	12.018	-29.1418	a-GG	0	34	22.2251	30.2901	44.907	0	44.907	57.2986	57.2986
18	0.198108	11.9183	-27.5565	a-GG	0	34	22.3499	30.4602	45.1592	0	45.1592	56.8218	56.8218
19	0.198108	11.7912	-25.9937	a-GG	0	34	22.4125	30.5456	45.2857	0	45.2857	56.214	56.214
20	0.198108	11.6377	-24.4515	a-GG	0	34	22.4142	30.5478	45.289	0	45.289	55.4808	55.4808
21	0.198108	11.4589	-22.928	a-GG	0	34	22.3556	30.468	45.1706	0	45.1706	54.6269	54.6269
22	0.198108	11.2556	-21.4214	a-GG	0	34	22.2374	30.3069	44.9319	0	44.9319	53.6562	53.6562

23	0.198108	11.0286	-19.9302	a-GG	0	34	22.0602	30.0654	44.5738	0	44.5738	52.5726	52.5726
24	0.198108	10.7786	-18.453	a-GG	0	34	21.8242	29.7438	44.097	0	44.097	51.3794	51.3794
25	0.198108	10.5061	-16.9884	a-GG	0	34	21.5297	29.3424	43.5019	0	43.5019	50.0794	50.0794
26	0.198108	10.2119	-15.5351	a-GG	0	34	21.1767	28.8613	42.7885	0	42.7885	48.6754	48.6754
27	0.198108	9.89619	-14.0921	a-GG	0	34	20.765	28.3002	41.9567	0	41.9567	47.1695	47.1695
28	0.198108	9.55957	-12.6581	a-GG	0	34	20.2944	27.6588	41.0058	0	41.0058	45.5637	45.5637
29	0.198108	9.20236	-11.2321	a-GG	0	34	19.7644	26.9365	39.935	0	39.935	43.86	43.86
30	0.198108	8.82489	-9.81315	a-GG	0	34	19.1745	26.1326	38.7432	0	38.7432	42.0598	42.0598
31	0.198108	8.42744	-8.40025	a-GG	0	34	18.5241	25.2461	37.4289	0	37.4289	40.1644	40.1644
32	0.198108	8.01024	-6.99248	a-GG	0	34	17.8121	24.2758	35.9903	0	35.9903	38.175	38.175
33	0.198108	7.57349	-5.58894	a-GG	0	34	17.0375	23.2201	34.4253	0	34.4253	36.0925	36.0925
34	0.198108	7.11735	-4.18876	a-GG	0	34	16.1992	22.0775	32.7313	0	32.7313	33.9177	33.9177
35	0.198108	6.64193	-2.79109	a-GG	0	34	15.2956	20.846	30.9055	0	30.9055	31.6512	31.6512
36	0.198108	6.14733	-1.39507	a-GG	0	34	14.325	19.5233	28.9445	0	28.9445	29.2934	29.2934
37	0.198108	5.6336	0.00010646	a-GG	0	34	13.2857	18.1068	26.8445	0	26.8445	26.8445	26.8445
38	0.198108	5.10074	1.3953	a-GG	0	34	12.1755	16.5937	24.6012	0	24.6012	24.3046	24.3046
39	0.198108	4.54876	2.79131	a-GG	0	34	10.9919	14.9806	22.2097	0	22.2097	21.6738	21.6738
40	0.198108	3.97758	4.18898	a-GG	0	34	9.73218	13.2638	19.6644	0	19.6644	18.9516	18.9516
41	0.198108	3.38714	5.58916	a-GG	0	34	8.39333	11.4391	16.9592	0	16.9592	16.1378	16.1378
42	0.198108	2.7773	6.9927	a-GG	0	34	6.97183	9.50177	14.087	0	14.087	13.2318	13.2318
43	0.198108	2.14791	8.40047	a-GG	0	34	5.46372	7.44639	11.0397	0	11.0397	10.2329	10.2329
44	0.198108	1.53149	9.81337	a-GG	0	34	3.94889	5.38187	7.97896	0	7.97896	7.29591	7.29591
45	0.198108	1.25501	11.2323	a-GG	0	34	3.28138	4.47213	6.6302	0	6.6302	5.97855	5.97855
46	0.198108	1.05753	12.6583	a-GG	0	34	2.80495	3.82281	5.66755	0	5.66755	5.03758	5.03758
47	0.198108	0.839459	14.0923	a-GG	0	34	2.25973	3.07974	4.5659	0	4.5659	3.99862	3.99862
48	0.198108	0.611283	15.5354	a-GG	0	34	1.67088	2.27721	3.3761	0	3.3761	2.91161	2.91161
49	0.198108	0.381829	16.9886	a-GG	0	34	1.06039	1.44518	2.14257	0	2.14257	1.81861	1.81861

50	0.198108	0.130962	18.4532	a-GG	0	34	0.369755	0.503932	0.747112	0	0.747112	0.623729	0.623729

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.36288**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	21.2798	24.9541	0	0	0
2	21.4779	24.593	0.612977	0	0
3	21.676	24.2701	2.18796	0	0
4	21.8741	23.9776	4.4255	0	0
5	22.0722	23.7101	7.14842	0	0
6	22.2704	23.4638	10.2193	0	0
7	22.4685	23.2358	13.5285	0	0
8	22.6666	23.0239	16.9864	0	0
9	22.8647	22.8263	20.5184	0	0
10	23.0628	22.6417	24.0613	0	0
11	23.2609	22.4688	27.5613	0	0
12	23.459	22.3068	30.9715	0	0
13	23.6571	22.1548	34.2511	0	0
14	23.8552	22.0121	37.3639	0	0
15	24.0533	21.8782	40.2677	0	0
16	24.2514	21.7525	42.8533	0	0
17	24.4495	21.6347	45.1013	0	0
18	24.6477	21.5242	47.0159	0	0
19	24.8458	21.4208	48.6028	0	0
20	25.0439	21.3242	49.8692	0	0
21	25.242	21.2342	50.8233	0	0
22	25.4401	21.1504	51.4745	0	0
23	25.6382	21.0726	51.8333	0	0
24	25.8363	21.0008	51.9113	0	0
25	26.0344	20.9347	51.7211	0	0
26	26.2325	20.8742	51.2765	0	0
27	26.4306	20.8191	50.5922	0	0
28	26.6287	20.7694	49.684	0	0
29	26.8269	20.7249	48.5691	0	0
30	27.025	20.6855	47.2654	0	0
31	27.2231	20.6513	45.7925	0	0
32	27.4212	20.622	44.1711	0	0
33	27.6193	20.5977	42.4231	0	0
34	27.8174	20.5783	40.5721	0	0
35	28.0155	20.5638	38.6432	0	0
36	28.2136	20.5542	36.6632	0	0
37	28.4117	20.5493	34.6607	0	0
38	28.6098	20.5493	32.6665	0	0
39	28.8079	20.5542	30.7132	0	0
40	29.006	20.5638	28.8361	0	0

41	29.2042	20.5783	27.0732	0	0
42	29.4023	20.5977	25.4653	0	0
43	29.6004	20.622	24.0564	0	0
44	29.7985	20.6513	22.8944	0	0
45	29.9966	20.6856	22.0122	0	0
46	30.1947	20.7249	21.2435	0	0
47	30.3928	20.7694	20.5556	0	0
48	30.5909	20.8191	19.976	0	0
49	30.789	20.8742	19.5284	0	0
50	30.9871	20.9347	19.2319	0	0
51	31.1852	21.0008	0	0	0

List Of Coordinates

Water Table

X	Y
0	16.3382
95.2378	16.3382

External Boundary

X	Y
0	0
95.2378	0
95.2378	17.3782
95.2378	20.808
85.8283	20.8733
78.4671	21.4211
60.8463	22.5196
60.3102	22.5196
56.9487	20.282
56.2487	20.254
56.0987	20.254
54.7487	20.254
44.9957	20.659
44.9957	20.7189
44.8957	20.7189
43.7457	20.6729
43.3196	20.6264
42.1617	20.6727
42.0617	20.6727
42.0617	20.6127
32.1243	21.0008
30.6243	21.0008
29.9243	21.0288
23.9732	24.9963
21.4814	24.9942
20.8122	24.8611
8.65773	25.5057
0	25.0077
0	17.3782

Material Boundary

X	Y
32.1243	21.0008
32.1243	20.8008
42.0617	20.4127
42.0617	20.6127

Material Boundary

X	Y
44.9957	20.659
44.9957	20.4589
54.7487	20.054
54.7487	20.254

Material Boundary

X	Y
0	17.3782
95.2378	17.3782

Sezione 911 – prg 16+080

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.51 > 1.1$

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 16080 statica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10

Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Rilevato	Qa	ar
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	18
Cohesion [kPa]	0	16	0
Friction Angle [deg]	29.3	19.6	34
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Global Minimums

Method: bishop simplified

FS	1.515180
Center:	70.771, 60.165
Radius:	39.779
Left Slip Surface Endpoint:	70.934, 20.386
Right Slip Surface Endpoint:	97.100, 30.346
Resisting Moment:	25985.3 kN-m
Driving Moment:	17150 kN-m
Total Slice Area:	68.0129 m2
Surface Horizontal Width:	26.166 m
Surface Average Height:	2.59928 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1628
Number of Invalid Surfaces:	0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.51518**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.52332	1.20396	0.61148	Rilevato	0	29.3	0.848718	1.28596	2.29156	0	2.29156	2.30062	2.30062
2	0.52332	3.57943	1.36537	Rilevato	0	29.3	2.5111	3.80477	6.78002	0	6.78002	6.83987	6.83987
3	0.52332	5.88998	2.1195	Rilevato	0	29.3	4.11216	6.23066	11.1029	0	11.1029	11.2551	11.2551
4	0.52332	8.13555	2.874	Rilevato	0	29.3	5.65269	8.56484	15.2624	0	15.2624	15.5461	15.5461
5	0.52332	10.316	3.629	Rilevato	0	29.3	7.13341	10.8084	19.2604	0	19.2604	19.7128	19.7128
6	0.52332	12.4312	4.38462	Rilevato	0	29.3	8.555 09	12.9625	23.0989	0	23.0989	23.7549	23.7549
7	0.52332	14.481	5.14102	Rilevato	0	29.3	9.91823	15.0279	26.7794	0	26.7794	27.6717	27.6717
8	0.52332	16.4651	5.89831	Rilevato	0	29.3	11.2236	17.0057	30.3038	0	30.3038	31.4633	31.4633
9	0.52332	18.3834	6.65664	Rilevato	0	29.3	12.4716	18.8967	33.6734	0	33.6734	35.129	35.129
10	0.52332	20.2354	7.41614	Rilevato	0	29.3	13.6627	20.7015	36.8897	0	36.8897	38.6681	38.6681
11	0.52332	22.0209	8.17695	Rilevato	0	29.3	14.7976	22.4211	39.9538	0	39.9538	42.0801	42.0801
12	0.52332	23.7396	8.93922	Rilevato	0	29.3	15.8766	24.0559	42.8672	0	42.8672	45.3645	45.3645
13	0.52332	25.391	9.70309	Rilevato	0	29.3	16.9	25.6066	45.6304	0	45.6304	48.5201	48.5201
14	0.52332	26.9746	10.4687	Rilevato	0	29.3	17.8684	27.0738	48.2449	0	48.2449	51.5465	51.5465
15	0.52332	28.4901	11.2362	Rilevato	0	29.3	18.7818	28.4578	50.7113	0	50.7113	54.4426	54.4426
16	0.52332	29.9368	12.0058	Rilevato	0	29.3	19.6407	29.7592	53.0304	0	53.0304	57.2073	57.2073
17	0.52332	31.3142	12.7775	Rilevato	0	29.3	20.4453	30.9783	55.2028	0	55.2028	59.8394	59.8394
18	0.52332	32.6216	13.5517	Rilevato	0	29.3	21.1958	32.1155	57.229	0	57.229	62.3379	62.3379
19	0.52332	33.8585	14.3283	Rilevato	0	29.3	21.8924	33.1709	59.1098	0	59.1098	64.7017	64.7017
20	0.52332	34.0117	15.1077	Rilevato	0	29.3	21.8839	33.158	59.0868	0	59.0868	64.9947	64.9947
21	0.52332	32.6518	15.8899	Rilevato	0	29.3	20.9054	31.6754	56.4449	0	56.4449	62.396	62.396
22	0.52332	31.2082	16.6752	Rilevato	0	29.3	19.8821	30.1249	53.6819	0	53.6819	59.6374	59.6374
23	0.52332	29.6994	17.4637	Rilevato	0	29.3	18.8264	28.5254	50.8316	0	50.8316	56.7545	56.7545
24	0.52332	29.5372	18.2557	Rilevato	0	29.3	18.6293	28.2267	50.2994	0	50.2994	56.4445	56.4445

25	0.5233	30.3335	19.0512	Rilevato	0	29.3	19.0344	28.8405	51.3932	0	51.3932	57.9663	57.9663
26	0.5233	31.0531	19.8506	Rilevato	0	29.3	19.3861	29.3734	52.3427	0	52.3427	59.3414	59.3414
27	0.5233	31.6947	20.6541	Rilevato	0	29.3	19.6842	29.8251	53.1477	0	53.1477	60.5677	60.5677
28	0.5233	32.2571	21.4618	Rilevato	0	29.3	19.9287	30.1955	53.8077	0	53.8077	61.6425	61.6425
29	0.5233	32.739	22.2741	Rilevato	0	29.3	20.1194	30.4845	54.3227	0	54.3227	62.5636	62.5636
30	0.5233	33.1391	23.0911	Rilevato	0	29.3	20.2562	30.6918	54.6921	0	54.6921	63.3284	63.3284
31	0.5233	33.4559	23.913	Rilevato	0	29.3	20.3389	30.8171	54.9154	0	54.9154	63.9338	63.9338
32	0.5233	33.6877	24.7403	Rilevato	0	29.3	20.3672	30.866	54.9918	0	54.9918	64.377	64.377
33	0.5233	33.833	25.5731	Rilevato	0	29.3	20.3409	30.8201	54.9209	0	54.9209	64.6548	64.6548
34	0.5233	33.8899	26.4117	Rilevato	0	29.3	20.2596	30.697	54.7014	0	54.7014	64.7636	64.7636
35	0.5233	33.8565	27.2564	Rilevato	0	29.3	20.1232	30.4902	54.3328	0	54.3328	64.6998	64.6998
36	0.5233	33.7307	28.1077	Rilevato	0	29.3	19.931	30.1991	53.8141	0	53.8141	64.4597	64.4597
37	0.5233	33.5105	28.9657	Rilevato	0	29.3	19.6828	29.8234	53.1439	0	53.1439	64.0389	64.0389
38	0.5233	33.1933	29.8309	Rilevato	0	29.3	19.378	29.3612	52.3211	0	52.3211	63.4329	63.4329
39	0.5233	32.7768	30.7037	Rilevato	0	29.3	19.0163	28.8131	51.3443	0	51.3443	62.637	62.637
40	0.5233	32.2582	31.5845	Rilevato	0	29.3	18.597	28.1778	50.2123	0	50.2123	61.6462	61.6462
41	0.5233	31.4687	32.4736	Rilevato	0	29.3	18.0245	27.3103	48.6664	0	48.6664	60.1376	60.1376
42	0.5233	29.0141	33.3716	Rilevato	0	29.3	16.5085	25.0133	44.5732	0	44.5732	55.4468	55.4468
43	0.5233	26.0654	34.279	Rilevato	0	29.3	14.7301	22.3188	39.7716	0	39.7716	49.8119	49.8119
44	0.5233	23.0016	35.1963	Rilevato	0	29.3	12.9082	19.5583	34.8525	0	34.8525	43.957	43.957
45	0.5233	19.819	36.1241	Rilevato	0	29.3	11.0426	16.7316	29.8154	0	29.8154	37.8749	37.8749
46	0.5233	16.5132	37.063	Rilevato	0	29.3	9.1331	13.8383	24.6597	0	24.6597	31.5577	31.5577
47	0.5233	13.0798	38.0137	Rilevato	0	29.3	7.1791	10.878	19.3843	0	19.3843	24.9962	24.9962
48	0.5233	9.5136	38.9768	Rilevato	0	29.3	5.1808	7.8502	13.989	0	13.989	18.1811	18.1811
49	0.5233	5.8093	39.9533	Rilevato	0	29.3	3.1382	4.7549	8.4731	0	8.4731	11.102	11.102
50	0.5233	1.9698	40.9439	Rilevato	0	29.3	1.0504	1.5916	2.8362	0	2.8362	3.7757	3.7757

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.51518**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	70.9341	20.3862	0	0	0
2	71.4574	20.3918	0.431166	0	0
3	71.9807	20.4042	1.66015	0	0
4	72.5041	20.4236	3.59619	0	0
5	73.0274	20.4499	6.15214	0	0
6	73.5507	20.4831	9.24438	0	0
7	74.074	20.5232	12.7927	0	0
8	74.5974	20.5703	16.7201	0	0
9	75.1207	20.6243	20.9528	0	0
10	75.644	20.6854	25.42	0	0
11	76.1673	20.7535	30.0542	0	0
12	76.6906	20.8287	34.7905	0	0
13	77.214	20.9111	39.5668	0	0
14	77.7373	21.0005	44.3242	0	0
15	78.2606	21.0972	49.006	0	0
16	78.7839	21.2012	53.5587	0	0
17	79.3072	21.3125	57.931	0	0
18	79.8306	21.4312	62.0745	0	0
19	80.3539	21.5573	65.9433	0	0
20	80.8772	21.691	69.4941	0	0
21	81.4005	21.8322	72.5939	0	0
22	81.9238	21.9812	75.1208	0	0
23	82.4472	22.138	77.1062	0	0
24	82.9705	22.3026	78.5854	0	0
25	83.4938	22.4752	79.6476	0	0
26	84.0171	22.656	80.3169	0	0
27	84.5404	22.8449	80.5686	0	0
28	85.0638	23.0422	80.3811	0	0
29	85.5871	23.2479	79.7355	0	0
30	86.1104	23.4622	78.6157	0	0
31	86.6337	23.6854	77.0089	0	0
32	87.157	23.9174	74.9053	0	0
33	87.6804	24.1586	72.2983	0	0
34	88.2037	24.409	69.1848	0	0
35	88.727	24.6689	65.5651	0	0
36	89.2503	24.9385	61.4433	0	0
37	89.7736	25.218	56.8273	0	0
38	90.297	25.5077	51.729	0	0
39	90.8203	25.8078	46.165	0	0
40	91.3436	26.1185	40.1561	0	0
41	91.8669	26.4403	33.7283	0	0
42	92.3902	26.7733	26.9484	0	0
43	92.9136	27.118	20.2198	0	0
44	93.4369	27.4747	13.7384	0	0

45	93.9602	27.8439	7.62627	0	0
46	94.4835	28.2258	2.01472	0	0
47	95.0068	28.6211	-2.95453	0	0
48	95.5302	29.0301	-7.12845	0	0
49	96.0535	29.4536	-10.3415	0	0
50	96.5768	29.8919	-12.4145	0	0
51	97.1001	30.346	0	0	0

List Of Coordinates

Water Table

X	Y
0	8.80944
104.585	8.80944

External Boundary

X	Y
0	0
104.585	-1.42e-014
104.585	20.381
104.585	30.7561
99.3503	30.3413
98.7488	30.4646
92.1824	29.992
82.9266	25.3721
80.9262	25.3736
70.9237	20.381
65.9225	20.4722
62.4217	20.4076
62.4217	20.4976
61.303	20.4785
59.6887	20.2067
59.0637	20.2817
58.6137	20.2817
58.4637	20.3817
57.5887	20.4167
57.4887	20.4167
57.4887	20.3567
46.0855	21.0416
46.0855	21.1016
45.9855	21.1016
44.8348	21.0556
44.2236	20.8094
43.0736	20.8554
42.9736	20.8554
42.9736	20.7954
29.3762	21.5434
27.8762	21.5434
27.5262	21.5574
27.1762	21.5714
21.1008	24.6091
15.8149	24.0934
14.7114	23.9043
12.447	23.7093
12.1305	23.7673
11.0704	23.6808
10.1824	23.5071
8.44289	23.4609
0.865189	22.0323
0	22.0323
0	19.7336

Material Boundary

X	Y
29.3762	21.5434
29.3762	21.3434
42.9736	20.5954
42.9736	20.7954

Material Boundary

X	Y
46.0855	21.0416
46.0855	20.8416
57.4887	20.1567
57.4887	20.3567

Material Boundary

X	Y
0	19.7336
7.60216	19.7336
9.3417	19.7797
9.74101	19.8312
10.2297	19.9535
11.1048	20.0117
11.2898	20.04
11.6062	19.982

13.2108	20.1325
13.8707	20.177
14.9742	20.3661
22.1227	21.0635
27.5262	21.5574

Material Boundary

X	Y
70.9237	20.381
104.585	20.381

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min}$ = 1.14 > 1.1 (sisma verso l'alto ↑)

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 16080 sismica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Right to Left
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal):	0.124
Seismic Load Coefficient (Vertical):	0.062

Material Properties

Property	Rilevato	Qa	ar
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	18
Cohesion [kPa]	0	16	0
Friction Angle [deg]	29.3	19.6	34
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Global Minimums

Method: bishop simplified

FS	1.123780
Center:	70.771, 60.165
Radius:	39.779
Left Slip Surface Endpoint:	70.934, 20.386
Right Slip Surface Endpoint:	97.100, 30.346
Resisting Moment:	26461.3 kN-m
Driving Moment:	23546.7 kN-m
Total Slice Area:	68.0129 m2

Surface Horizontal Width: 26.166 m
Surface Average Height: 2.59928 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 1625
Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.12378**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.52332	1.20396	0.611481	Rilevato	0	29.3	1.21 36	1.36382	2.43 03	0	2.43 03	2.44326	2.44326
2	0.52332	3.57943	1.365 37	Rilevato	0	29.3	3.58467	4.02838	7.17 85	0	7.17 85	7.26394	7.26394
3	0.52332	5.88998	2.119 5	Rilevato	0	29.3	5.86052	6.58594	11.7 36	0	11.7 36	11.9529	11.9529
4	0.52332	8.13555	2.874	Rilevato	0	29.3	8.04285	9.03839	16.1 062	0	16.1 062	16.5 1	16.5 1
5	0.52332	10.3 16	3.629	Rilevato	0	29.3	10.1 332	11.3875	20.2 923	0	20.2 923	20.9 35	20.9 35
6	0.52332	12.4312	4.384 62	Rilevato	0	29.3	12.1 332	13.6 35	24.2 973	0	24.2 973	25.2 276	25.2 276
7	0.52332	14.4 81	5.141 02	Rilevato	0	29.3	14.0 44	15.7824	28.1 238	0	28.1 238	29.3873	29.3873
8	0.52332	16.4651	5.898 31	Rilevato	0	29.3	15.8672	17.8312	31.7 748	0	31.7 748	33.4 14	33.4 14
9	0.52332	18.3834	6.656 64	Rilevato	0	29.3	17.6038	19.7828	35.2 524	0	35.2 524	37.3069	37.3069
10	0.52332	20.2354	7.416 14	Rilevato	0	29.3	19.2 55	21.6384	38.5 591	0	38.5 591	41.0654	41.0654
11	0.52332	22.0209	8.176 95	Rilevato	0	29.3	20.8 22	23.3994	41.6 972	0	41.6 972	44.6891	44.6891
12	0.52332	23.7396	8.939 22	Rilevato	0	29.3	22.3057	25.0667	44.6 684	0	44.6 684	48.1 77	48.1 77
13	0.52332	25.3 91	9.703 09	Rilevato	0	29.3	23.7071	26.6416	47.4 748	0	47.4 748	51.5284	51.5284
14	0.52332	26.9746	10.46 87	Rilevato	0	29.3	25.0271	28.1249	50.1 179	0	50.1 179	54.7423	54.7423
15	0.52332	28.4901	11.23 62	Rilevato	0	29.3	26.2664	29.5176	52.5 998	0	52.5 998	57.8 18	57.8 18
16	0.52332	29.9368	12.00 58	Rilevato	0	29.3	27.4257	30.8205	54.9 216	0	54.9 216	60.7 54	60.7 54
17	0.52332	31.3142	12.77 75	Rilevato	0	29.3	28.5059	32.0344	57.0 848	0	57.0 848	63.5494	63.5494
18	0.52332	32.6216	13.55 17	Rilevato	0	29.3	29.5076	33.1601	59.0 906	0	59.0 906	66.2029	66.2029

19	0.52332	33.8585	14.3283	Rilevato	0	29.3	30.4313	34.1981	60.9402	0	60.9402	68.713	68.713
20	0.52332	34.0117	15.1077	Rilevato	0	29.3	30.3735	34.1331	60.8245	0	60.8245	69.0242	69.0242
21	0.52332	32.6518	15.8899	Rilevato	0	29.3	28.9716	32.5577	58.0172	0	58.0172	66.2645	66.2645
22	0.52332	31.2082	16.6752	Rilevato	0	29.3	27.5119	30.9173	55.094	0	55.094	63.335	63.335
23	0.52332	29.6994	17.4637	Rilevato	0	29.3	26.0117	29.2314	52.0897	0	52.0897	60.2731	60.2731
24	0.52332	29.5372	18.2557	Rilevato	0	29.3	25.7004	28.8816	51.4663	0	51.4663	59.9438	59.9438
25	0.52332	30.3335	19.0512	Rilevato	0	29.3	26.2195	29.4649	52.5058	0	52.5058	61.5602	61.5602
26	0.52332	31.0531	19.8506	Rilevato	0	29.3	26.6632	29.9636	53.3945	0	53.3945	63.0204	63.0204
27	0.52332	31.6947	20.6541	Rilevato	0	29.3	27.032	30.378	54.1329	0	54.1329	64.3227	64.3227
28	0.52332	32.2571	21.4618	Rilevato	0	29.3	27.3258	30.7082	54.7212	0	54.7212	65.4641	65.4641
29	0.52332	32.739	22.2741	Rilevato	0	29.3	27.5449	30.9544	55.16	0	55.16	66.4424	66.4424
30	0.52332	33.1391	23.0911	Rilevato	0	29.3	27.6892	31.1166	55.4492	0	55.4492	67.2546	67.2546
31	0.52332	33.4559	23.913	Rilevato	0	29.3	27.759	31.195	55.5889	0	55.5889	67.8976	67.8976
32	0.52332	33.6877	24.7403	Rilevato	0	29.3	27.7541	31.1895	55.5791	0	55.5791	68.3682	68.3682
33	0.52332	33.833	25.5731	Rilevato	0	29.3	27.6745	31.1001	55.4197	0	55.4197	68.6631	68.6631
34	0.52332	33.8899	26.4117	Rilevato	0	29.3	27.5202	30.9266	55.1105	0	55.1105	68.7786	68.7786
35	0.52332	33.8565	27.2564	Rilevato	0	29.3	27.2908	30.6689	54.6513	0	54.6513	68.7109	68.7109
36	0.52332	33.7307	28.1077	Rilevato	0	29.3	26.9865	30.3269	54.0418	0	54.0418	68.4559	68.4559
37	0.52332	33.5105	28.9657	Rilevato	0	29.3	26.6067	29.9001	53.2815	0	53.2815	68.009	68.009
38	0.52332	33.1933	29.8309	Rilevato	0	29.3	26.1515	29.3885	52.3697	0	52.3697	67.3656	67.3656
39	0.52332	32.7768	30.7037	Rilevato	0	29.3	25.6202	28.7915	51.3059	0	51.3059	66.5203	66.5203
40	0.52332	32.2582	31.5845	Rilevato	0	29.3	25.0127	28.1088	50.0894	0	50.0894	65.4679	65.4679
41	0.52332	31.4687	32.4736	Rilevato	0	29.3	24.2009	27.1965	48.4637	0	48.4637	63.8658	63.8658
42	0.52332	29.0141	33.3716	Rilevato	0	29.3	22.1268	24.8656	44.3101	0	44.3101	58.8843	58.8843
43	0.52332	26.0654	34.279	Rilevato	0	29.3	19.7081	22.1476	39.4665	0	39.4665	52.9	52.9
44	0.52332	23.0016	35.1963	Rilevato	0	29.3	17.2393	19.3732	34.5227	0	34.5227	46.682	46.682
45	0.52332	19.819	36.1241	Rilevato	0	29.3	14.7207	16.5428	29.479	0	29.479	40.223	40.223

46	0.52332	16.5132	37.063	Rilevato	0	29.3	12.1523	13.6565	24.3356	0	24.3356	33.514	33.514
47	0.52332	13.0798	38.0137	Rilevato	0	29.3	9.53434	10.7145	19.093	0	19.093	26.5457	26.5457
48	0.52332	9.51362	38.9768	Rilevato	0	29.3	6.86716	7.71718	13.7519	0	13.7519	19.3082	19.3082
49	0.52332	5.80934	39.9533	Rilevato	0	29.3	4.15111	4.66493	8.31282	0	8.31282	11.7902	11.7902
50	0.52332	1.96098	40.9439	Rilevato	0	29.3	1.38666	1.5583	2.77685	0	2.77685	3.97987	3.97987

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.12378**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	70.9341	20.3862	0	0	0
2	71.4574	20.3918	0.472042	0	0
3	71.9807	20.4042	1.81401	0	0
4	72.5041	20.4236	3.92234	0	0
5	73.0274	20.4499	6.69807	0	0
6	73.5507	20.4831	10.0467	0	0
7	74.074	20.5232	13.8778	0	0
8	74.5974	20.5703	18.1053	0	0
9	75.1207	20.6243	22.6467	0	0
10	75.644	20.6854	27.4237	0	0
11	76.1673	20.7535	32.3614	0	0
12	76.6906	20.8287	37.3886	0	0
13	77.214	20.9111	42.4373	0	0
14	77.7373	21.0005	47.4433	0	0
15	78.2606	21.0972	52.3454	0	0
16	78.7839	21.2012	57.0856	0	0
17	79.3072	21.3125	61.6092	0	0
18	79.8306	21.4312	65.8646	0	0
19	80.3539	21.5573	69.8032	0	0
20	80.8772	21.691	73.3794	0	0
21	81.4005	21.8322	76.4589	0	0
22	81.9238	21.9812	78.9239	0	0
23	82.4472	22.138	80.8108	0	0
24	82.9705	22.3026	82.1604	0	0
25	83.4938	22.4752	83.0589	0	0
26	84.0171	22.656	83.5258	0	0
27	84.5404	22.8449	83.5365	0	0
28	85.0638	23.0422	83.0697	0	0
29	85.5871	23.2479	82.1073	0	0
30	86.1104	23.4622	80.6342	0	0
31	86.6337	23.6854	78.6391	0	0
32	87.157	23.9174	76.1138	0	0
33	87.6804	24.1586	73.0536	0	0

34	88.2037	24.409	69.4577	0	0
35	88.727	24.6689	65.3289	0	0
36	89.2503	24.9385	60.674	0	0
37	89.7736	25.218	55.504	0	0
38	90.297	25.5077	49.8341	0	0
39	90.8203	25.8078	43.6843	0	0
40	91.3436	26.1185	37.079	0	0
41	91.8669	26.4403	30.0482	0	0
42	92.3902	26.7733	22.6661	0	0
43	92.9136	27.118	15.3707	0	0
44	93.4369	27.4747	8.37121	0	0
45	93.9602	27.8439	1.79519	0	0
46	94.4835	28.2258	-4.22058	0	0
47	95.0068	28.6211	-9.52938	0	0
48	95.5302	29.0301	-13.9736	0	0
49	96.0535	29.4536	-17.3835	0	0
50	96.5768	29.8919	-19.5765	0	0
51	97.1001	30.346	0	0	0

List Of Coordinates

Water Table

X	Y
0	8.80944
104.585	8.80944

External Boundary

X	Y
0	0
104.585	-1.42e-014
104.585	20.381
104.585	30.7561
99.3503	30.3413
98.7488	30.4646
92.1824	29.992
82.9266	25.3721
80.9262	25.3736
70.9237	20.381
65.9225	20.4722
62.4217	20.4076
62.4217	20.4976
61.303	20.4785
59.6887	20.2067
59.0637	20.2817
58.6137	20.2817
58.4637	20.3817
57.5887	20.4167
57.4887	20.4167
57.4887	20.3567
46.0855	21.0416
46.0855	21.1016
45.9855	21.1016
44.8348	21.0556
44.2236	20.8094
43.0736	20.8554
42.9736	20.8554
42.9736	20.7954
29.3762	21.5434
27.8762	21.5434
27.5262	21.5574
27.1762	21.5714
21.1008	24.6091
15.8149	24.0934
14.7114	23.9043
12.447	23.7093
12.1305	23.7673
11.0704	23.6808
10.1824	23.5071
8.44289	23.4609
0.865189	22.0323
0	22.0323
0	19.7336

Material Boundary

X	Y

29.3762	21.5434
29.3762	21.3434
42.9736	20.5954
42.9736	20.7954

Material Boundary

X	Y
46.0855	21.0416
46.0855	20.8416
57.4887	20.1567
57.4887	20.3567

Material Boundary

X	Y
0	19.7336
7.60216	19.7336
9.3417	19.7797

9.74101	19.8312
10.2297	19.9535
11.1048	20.0117
11.2898	20.04
11.6062	19.982
13.2108	20.1325
13.8707	20.177
14.9742	20.3661
22.1227	21.0635
27.5262	21.5574

Material Boundary

X	Y
70.9237	20.381
104.585	20.381

Sezione 931 – prg 16+391

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.78 > 1.1$

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 16391 statica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75

Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Rilevato	Qa	ar
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	18
Cohesion [kPa]	0	16	0
Friction Angle [deg]	29.3	19.6	34
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Global Minimums

Method: bishop simplified

FS	1.776550
Center:	45.576, 55.784
Radius:	33.361
Left Slip Surface Endpoint:	20.672, 33.586
Right Slip Surface Endpoint:	49.831, 22.696
Resisting Moment:	26962.3 kN-m
Driving Moment:	15176.8 kN-m
Total Slice Area:	69.7734 m2
Surface Horizontal Width:	29.1588 m
Surface Average Height:	2.39288 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1252
Number of Invalid Surfaces:	0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.77655**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.579032	1.82459	-47.5513	ar	0	34	0.845723	1.50247	2.22751	0	2.22751	3.15211	3.15211
2	0.579032	5.24161	-46.0975	ar	0	34	2.46539	4.37989	6.49346	0	6.49346	9.05515	9.05515
3	0.579032	8.34358	-44.6811	ar	0	34	3.97867	7.06 83	10.4792	0	10.4792	14.4138	14.4138
4	0.579032	11.2463	-43.2985	ar	0	34	5.43272	9.65149	14.3089	0	14.3089	19.4282	19.4282
5	0.579032	15.9483	-41.9468	ar	0	34	7.79905	13.8554	20.5415	0	20.5415	27.5506	27.5506
6	0.579032	21.2486	-40.6231	ar	0	34	10.5127	18.6763	27.6888	0	27.6888	36.7066	36.7066
7	0.579032	26.309	-39.3252	ar	0	34	13.1616	23.3823	34.6657	0	34.6657	45.448	45.448
8	0.579032	30.192	-38.0509	ar	0	34	15.2654	27.1197	40.2067	0	40.2067	52.1552	52.1552
9	0.579032	31.8577	-36.7985	ar	0	34	16.2726	28.909	42.8593	0	42.8593	55.0321	55.0321
10	0.579032	33.2551	-35.5663	ar	0	34	17.1536	30.4743	45.18	0	45.18	57.4455	57.4455
11	0.579032	34.4577	-34.3527	ar	0	34	17.9428	31.8763	47.2585	0	47.2585	59.5224	59.5224
12	0.579032	35.474	-33.1564	ar	0	34	18.6416	33.1177	49.099	0	49.099	61.2775	61.2775
13	0.579032	36.3116	-31.9763	ar	0	34	19.2515	34.2012	50.7054	0	50.7054	62.724	62.724

14	0.579032	36.9775	-30.8112	ar	0	34	19.7737	35.129	52.081	0	52.081	63.8737	63.8737
15	0.579032	37.4779	-29.66	ar	0	34	20.2096	35.9034	53.229	0	53.229	64.7377	64.7377
16	0.579032	37.8187	-28.5219	ar	0	34	20.5602	36.5262	54.1523	0	54.1523	65.3258	65.3258
17	0.579032	38.0049	-27.3959	ar	0	34	20.8264	36.9991	54.8534	0	54.8534	65.6469	65.6469
18	0.579032	38.0413	-26.2813	ar	0	34	21.0091	37.3237	55.3346	0	55.3346	65.7094	65.7094
19	0.579032	37.9324	-25.1773	ar	0	34	21.1091	37.5013	55.5979	0	55.5979	65.5208	65.5208
20	0.579032	37.6821	-24.0832	ar	0	34	21.1269	37.533	55.6449	0	55.6449	65.0879	65.0879
21	0.579032	37.2941	-22.9983	ar	0	34	21.0632	37.4199	55.4772	0	55.4772	64.4173	64.4173
22	0.579032	36.7717	-21.9222	ar	0	34	20.9185	37.1628	55.0961	0	55.0961	63.5147	63.5147
23	0.579032	36.1181	-20.8541	ar	0	34	20.6931	36.7623	54.5023	0	54.5023	62.3852	62.3852
24	0.579032	35.3361	-19.7935	ar	0	34	20.3873	36.219	53.6969	0	53.6969	61.0341	61.0341
25	0.579032	34.842	-18.74	ar	0	34	20.2416	35.9602	53.3132	0	53.3132	60.1803	60.1803
26	0.579032	36.4861	-17.693	ar	0	34	21.3419	37.915	56.2114	0	56.2114	63.0196	63.0196
27	0.579032	38.3512	-16.652	ar	0	34	22.585	40.1234	59.4855	0	59.4855	66.2407	66.2407
28	0.579032	40.0899	-15.6167	ar	0	34	23.7675	42.2241	62.5998	0	62.5998	69.2433	69.2433
29	0.579032	40.007	-14.5866	ar	0	34	23.8762	42.4173	62.8862	0	62.8862	69.0996	69.0996
30	0.579032	38.5026	-13.5613	ar	0	34	23.1303	41.0921	60.9215	0	60.9215	66.5008	66.5008
31	0.579032	36.8841	-12.5404	ar	0	34	22.3035	39.6233	58.744	0	58.744	63.7051	63.7051
32	0.579032	35.153	-11.5236	ar	0	34	21.3956	38.0103	56.3526	0	56.3526	60.7147	60.7147
33	0.579032	33.3106	-10.5104	ar	0	34	20.406	36.2523	53.7463	0	53.7463	57.5322	57.5322
34	0.579032	31.3579	-9.50051	ar	0	34	19.3343	34.3484	50.9235	0	50.9235	54.1591	54.1591
35	0.579032	29.296	-8.4936	ar	0	34	18.1798	32.2974	47.8827	0	47.8827	50.5977	50.5977
36	0.579032	27.1258	-7.48933	ar	0	34	16.9418	30.0979	44.622	0	44.622	46.8493	46.8493
37	0.579032	24.8481	-6.48736	ar	0	34	15.6194	27.7486	41.139	0	41.139	42.9151	42.9151
38	0.579032	22.4636	-5.48739	ar	0	34	14.2117	25.2478	37.4313	0	37.4313	38.7966	38.7966
39	0.579032	19.9729	-4.48909	ar	0	34	12.7176	22.5935	33.4963	0	33.4963	34.4947	34.4947
40	0.579032	17.3765	-3.49216	ar	0	34	11.1361	19.7838	29.3307	0	29.3307	30.0103	30.0103

41	0.579032	14.6747	-2.49629	ar	0	34	9.46571	16.8163	24.9312	0	24.9312	25.3439	25.3439
42	0.579032	11.8678	-1.50116	ar	0	34	7.70516	13.6886	20.2942	0	20.2942	20.4961	20.4961
43	0.579032	8.95603	-0.506495	ar	0	34	5.85286	10.3979	15.4156	0	15.4156	15.4673	15.4673
44	0.579032	5.9395	0.488021	ar	0	34	3.90717	6.94129	10.2909	0	10.2909	10.2576	10.2576
45	0.579032	2.81819	1.48268	ar	0	34	1.86622	3.31543	4.91532	0	4.91532	4.86701	4.86701
46	0.579032	0.749124	2.47779	ar	0	34	0.499399	0.887207	1.31534	0	1.31534	1.29373	1.29373
47	0.579032	0.96606	3.47365	ar	0	34	0.648375	1.15187	1.70772	0	1.70772	1.66836	1.66836
48	0.579032	1.15047	4.47056	ar	0	34	0.777423	1.38113	2.04761	0	2.04761	1.98683	1.98683
49	0.579032	1.22015	5.46883	ar	0	34	0.830205	1.47049	2.18663	0	2.18663	2.10715	2.10715
50	0.786237	0.347899	6.6481	Rilevato	0	29.3	0.145109	0.257793	0.459382	0	0.459382	0.442469	0.442469

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.77655**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	20.6722	33.5864	0	0	0
2	21.2512	32.9533	0.920931	0	0
3	21.8303	32.3517	3.40173	0	0
4	22.4093	31.7791	7.10108	0	0
5	22.9883	31.2334	11.7661	0	0
6	23.5674	30.7131	17.9446	0	0
7	24.1464	30.2164	25.617	0	0
8	24.7254	29.742	34.4481	0	0
9	25.3045	29.2888	43.841	0	0
10	25.8835	28.8556	52.9933	0	0
11	26.4625	28.4416	61.7775	0	0
12	27.0416	28.0458	70.1028	0	0
13	27.6206	27.6676	77.8936	0	0
14	28.1996	27.3061	85.0878	0	0
15	28.7787	26.9607	91.6355	0	0
16	29.3577	26.631	97.4979	0	0
17	29.9367	26.3163	102.646	0	0
18	30.5158	26.0162	107.061	0	0
19	31.0948	25.7303	110.732	0	0
20	31.6738	25.4581	113.655	0	0
21	32.2529	25.1993	115.837	0	0
22	32.8319	24.9535	117.288	0	0
23	33.4109	24.7205	118.028	0	0

24	33.9899	24.4999	118.081	0	0
25	34.569	24.2915	117.479	0	0
26	35.148	24.0951	116.244	0	0
27	35.727	23.9104	114.283	0	0
28	36.3061	23.7372	111.522	0	0
29	36.8851	23.5753	107.907	0	0
30	37.4641	23.4247	103.572	0	0
31	38.0432	23.285	98.7026	0	0
32	38.6222	23.1562	93.3683	0	0
33	39.2012	23.0381	87.6456	0	0
34	39.7803	22.9307	81.6165	0	0
35	40.3593	22.8338	75.368	0	0
36	40.9383	22.7473	68.9932	0	0
37	41.5174	22.6712	62.5907	0	0
38	42.0964	22.6054	56.2652	0	0
39	42.6754	22.5498	50.1272	0	0
40	43.2545	22.5043	44.2941	0	0
41	43.8335	22.469	38.8894	0	0
42	44.4125	22.4437	34.0437	0	0
43	44.9916	22.4285	29.895	0	0
44	45.5706	22.4234	26.5886	0	0
45	46.1496	22.4284	24.2779	0	0
46	46.7287	22.4433	23.1248	0	0
47	47.3077	22.4684	22.803	0	0
48	47.8867	22.5035	22.3679	0	0
49	48.4657	22.5488	21.8256	0	0
50	49.0448	22.6043	21.2242	0	0
51	49.831	22.6959	0	0	0

List Of Coordinates

Water Table

X	Y
0	11.1521
114.498	11.1521

External Boundary

X	Y
0	33.176
0	18.5759
0	0
114.498	0
114.498	18.5759
114.461	22.9735
97.9129	22.6532
92.6765	24.2692
92.0515	24.3442
91.6015	24.3442
91.4515	24.4442
90.5765	24.4792
90.4765	24.4792
90.4765	24.4192
73.509	23.5078
71.209	23.3843
71.209	23.4443
71.109	23.4443
69.9589	23.3983
66.2604	23.5299
65.1104	23.5759
65.0104	23.5759
65.0104	23.5159
49.0448	22.6534
49.0448	22.7134

48.9448	22.7134
46.8448	22.5034
36.8448	27.5034
34.8448	27.5034
24.8448	32.5034
22.8448	32.5034
20.6786	33.5865

Material Boundary

X	Y
49.0448	22.6534
49.0448	22.4534
65.0104	23.3159

65.0104	23.5159

Material Boundary

X	Y
71.209	23.3843
71.209	23.1843
90.4765	24.2192
90.4765	24.4192

Material Boundary

X	Y
0	18.5759
114.498	18.5759

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min}$ = 1.29 > 1.1 (sisma verso l'alto ↑)

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 16391 sismica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal):	0.124
Seismic Load Coefficient (Vertical):	-0.062

Material Properties

Property	Rilevato	Qa	ar
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18	18	18
Cohesion [kPa]	0	16	0
Friction Angle [deg]	29.3	19.6	34
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

Global Minimums

Method: bishop simplified

FS	1.286600
Center:	45.703, 56.028
Radius:	33.616
Left Slip Surface Endpoint:	20.675, 33.586
Right Slip Surface Endpoint:	50.220, 22.717
Resisting Moment:	24200.1 kN-m
Driving Moment:	18809.4 kN-m
Total Slice Area:	69.5446 m2
Surface Horizontal Width:	29.5453 m
Surface Average Height:	2.35383 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1279
Number of Invalid Surfaces:	0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.2866**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.591037	1.86385	-47.3751	ar	0	34	0.988613	1.27195	1.88575	0	1.88575	2.95992	2.95992
2	0.591037	5.38111	-45.9074	ar	0	34	2.90696	3.74009	5.5449	0	5.5449	8.54542	8.54542
3	0.591037	8.56941	-44.4776	ar	0	34	4.70975	6.05956	8.98367	0	8.98367	13.6083	13.6083
4	0.591037	11.6228	-43.082	ar	0	34	6.49277	8.3536	12.3847	0	12.3847	18.4567	18.4567
5	0.591037	16.6578	-41.7176	ar	0	34	9.45049	12.159	18.0265	0	18.0265	26.4517	26.4517
6	0.591037	22.1346	-40.3815	ar	0	34	12.7441	16.3966	24.3089	0	24.3089	35.1479	35.1479
7	0.591037	27.3609	-39.0715	ar	0	34	15.9769	20.5559	30.4753	0	30.4753	43.4462	43.4462
8	0.591037	30.947	-37.7853	ar	0	34	18.317	23.5666	34.939	0	34.939	49.1395	49.1395
9	0.591037	32.5734	-36.5212	ar	0	34	19.5322	25.1301	37.2569	0	37.2569	51.7211	51.7211
10	0.591037	33.9818	-35.2774	ar	0	34	20.6342	26.548	39.359	0	39.359	53.9567	53.9567
11	0.591037	35.1868	-34.0525	ar	0	34	21.627	27.8253	41.2528	0	41.2528	55.8692	55.8692
12	0.591037	36.1973	-32.845	ar	0	34	22.5116	28.9634	42.9399	0	42.9399	57.4726	57.4726
13	0.591037	37.0212	-31.6537	ar	0	34	23.2887	29.9633	44.4225	0	44.4225	58.7799	58.7799

14	0.591037	37.6658	-30.4776	ar	0	34	23.9595	30.8263	45.7019	0	45.7019	59.8025	59.8025
15	0.591037	38.1375	-29.3154	ar	0	34	24.5244	31.5531	46.7794	0	46.7794	60.5505	60.5505
16	0.591037	38.4424	-28.1664	ar	0	34	24.9841	32.1445	47.6562	0	47.6562	61.0337	61.0337
17	0.591037	38.5858	-27.0296	ar	0	34	25.339	32.6011	48.3332	0	48.3332	61.2605	61.2605
18	0.591037	38.5727	-25.9042	ar	0	34	25.5895	32.9234	48.8109	0	48.8109	61.2388	61.2388
19	0.591037	38.4077	-24.7894	ar	0	34	25.7358	33.1117	49.0901	0	49.0901	60.9759	60.9759
20	0.591037	38.0948	-23.6846	ar	0	34	25.7781	33.1661	49.1709	0	49.1709	60.4784	60.4784
21	0.591037	37.638	-22.589	ar	0	34	25.7165	33.0868	49.0533	0	49.0533	59.7522	59.7522
22	0.591037	37.0406	-21.5021	ar	0	34	25.5508	32.8736	48.7372	0	48.7372	58.803	58.803
23	0.591037	36.3059	-20.4232	ar	0	34	25.2808	32.5263	48.2223	0	48.2223	57.6358	57.6358
24	0.591037	35.4378	-19.3519	ar	0	34	24.907	32.0454	47.5093	0	47.5093	56.2569	56.2569
25	0.591037	36.0884	-18.2875	ar	0	34	25.5989	32.9356	48.829	0	48.829	57.2889	57.2889
26	0.591037	38.1024	-17.2297	ar	0	34	27.2753	35.0924	52.0267	0	52.0267	60.4853	60.4853
27	0.591037	39.9894	-16.1779	ar	0	34	28.8864	37.1653	55.0997	0	55.0997	63.4799	63.4799
28	0.591037	41.1044	-15.1316	ar	0	34	29.9599	38.5464	57.1473	0	57.1473	65.2488	65.2488
29	0.591037	39.8016	-14.0905	ar	0	34	29.2707	37.6597	55.8328	0	55.8328	63.1799	63.1799
30	0.591037	38.1758	-13.0541	ar	0	34	28.3259	36.4441	54.0305	0	54.0305	60.5983	60.5983
31	0.591037	36.4304	-12.0221	ar	0	34	27.2714	35.0874	52.0192	0	52.0192	57.8269	57.8269
32	0.591037	34.5667	-10.994	ar	0	34	26.106	33.588	49.7963	0	49.7963	54.8679	54.8679
33	0.591037	32.5862	-9.96944	ar	0	34	24.8284	31.9442	47.3592	0	47.3592	51.7235	51.7235
34	0.591037	30.49	-8.94812	ar	0	34	23.437	30.154	44.7051	0	44.7051	48.3954	48.3954
35	0.591037	28.279	-7.92967	ar	0	34	21.93	28.2152	41.8307	0	41.8307	44.8854	44.8854
36	0.591037	25.9542	-6.91373	ar	0	34	20.3058	26.1254	38.7326	0	38.7326	41.1948	41.1948
37	0.591037	23.5164	-5.89996	ar	0	34	18.5622	23.8821	35.4067	0	35.4067	37.3249	37.3249
38	0.591037	20.9662	-4.88805	ar	0	34	16.697	21.4823	31.8489	0	31.8489	33.2768	33.2768
39	0.591037	18.3043	-3.87767	ar	0	34	14.7078	18.923	28.0545	0	28.0545	29.0514	29.0514
40	0.591037	15.531	-2.86849	ar	0	34	12.5919	16.2007	24.0184	0	24.0184	24.6494	24.6494

41	0.591037	12.6467	-1.86021	ar	0	34	10.3464	13.3117	19.7354	0	19.7354	20.0714	20.0714
42	0.591037	9.65165	-0.852495	ar	0	34	7.96829	10.252	15.1992	0	15.1992	15.3178	15.3178
43	0.591037	6.54601	0.154951	ar	0	34	5.45411	7.01726	10.4035	0	10.4035	10.3888	10.3888
44	0.591037	3.32979	1.16245	ar	0	34	2.80018	3.60271	5.34124	0	5.34124	5.28442	5.28442
45	0.591037	0.986995	2.1703	ar	0	34	0.837813	1.07793	1.59809	0	1.59809	1.56634	1.56634
46	0.591037	1.17653	3.17883	ar	0	34	1.00819	1.29714	1.92309	0	1.92309	1.8671	1.8671
47	0.591037	1.40047	4.18834	ar	0	34	1.21165	1.55891	2.31118	0	2.31118	2.22245	2.22245
48	0.591037	1.50395	5.19916	ar	0	34	1.31387	1.69043	2.50617	0	2.50617	2.38662	2.38662
49	0.587773	0.621875	6.20881	Rilevato	0	29.3	0.454385	0.584612	1.04177	0	1.04177	0.992334	0.992334
50	0.587773	0.225793	7.21759	Rilevato	0	29.3	0.166337	0.214009	0.381361	0	0.381361	0.360296	0.360296

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.2866**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	20.675	33.5864	0	0	0
2	21.266	32.9443	0.858861	0	0
3	21.8571	32.3342	3.19381	0	0
4	22.4481	31.7538	6.69151	0	0
5	23.0392	31.2011	11.1476	0	0
6	23.6302	30.6742	17.1361	0	0
7	24.2212	30.1715	24.5817	0	0
8	24.8123	29.6917	33.1716	0	0
9	25.4033	29.2334	42.2119	0	0
10	25.9943	28.7958	51.0342	0	0
11	26.5854	28.3776	59.5313	0	0
12	27.1764	27.9782	67.6134	0	0
13	27.7674	27.5966	75.2045	0	0
14	28.3585	27.2323	82.2416	0	0
15	28.9495	26.8844	88.6734	0	0
16	29.5406	26.5525	94.4589	0	0
17	30.1316	26.2361	99.5673	0	0
18	30.7226	25.9345	103.977	0	0
19	31.3137	25.6475	107.673	0	0
20	31.9047	25.3745	110.652	0	0
21	32.4957	25.1153	112.915	0	0
22	33.0868	24.8694	114.472	0	0
23	33.6778	24.6365	115.339	0	0

24	34.2689	24.4165	115.538	0	0
25	34.8599	24.2089	115.1	0	0
26	35.4509	24.0136	114.009	0	0
27	36.042	23.8303	112.178	0	0
28	36.633	23.6588	109.542	0	0
29	37.224	23.499	106.097	0	0
30	37.8151	23.3506	102.047	0	0
31	38.4061	23.2136	97.4731	0	0
32	38.9972	23.0877	92.4485	0	0
33	39.5882	22.9729	87.0505	0	0
34	40.1792	22.869	81.3632	0	0
35	40.7703	22.7759	75.477	0	0
36	41.3613	22.6936	69.4891	0	0
37	41.9523	22.622	63.5033	0	0
38	42.5434	22.5609	57.6306	0	0
39	43.1344	22.5103	51.9894	0	0
40	43.7254	22.4703	46.7058	0	0
41	44.3165	22.4407	41.9141	0	0
42	44.9075	22.4215	37.757	0	0
43	45.4986	22.4127	34.3863	0	0
44	46.0896	22.4143	31.9636	0	0
45	46.6806	22.4263	30.6604	0	0
46	47.2717	22.4487	30.2527	0	0
47	47.8627	22.4815	29.7406	0	0
48	48.4537	22.5248	29.0994	0	0
49	49.0448	22.5785	28.376	0	0
50	49.6326	22.6425	28.1199	0	0
51	50.2203	22.7169	0	0	0

List Of Coordinates

Water Table

X	Y
0	11.1521
114.498	11.1521

External Boundary

X	Y
0	33.176
0	18.5759
0	0
114.498	0
114.498	18.5759
114.461	22.9735
97.9129	22.6532
92.6765	24.2692
92.0515	24.3442
91.6015	24.3442
91.4515	24.4442
90.5765	24.4792
90.4765	24.4792
90.4765	24.4192
73.509	23.5078
71.209	23.3843
71.209	23.4443
71.109	23.4443
69.9589	23.3983
66.2604	23.5299
65.1104	23.5759
65.0104	23.5759
65.0104	23.5159
49.0448	22.6534
49.0448	22.7134
48.9448	22.7134
46.8448	22.5034

36.8448	27.5034
34.8448	27.5034
24.8448	32.5034
22.8448	32.5034
20.6786	33.5865

Material Boundary

X	Y
49.0448	22.6534
49.0448	22.4534
65.0104	23.3159
65.0104	23.5159

Material Boundary

X	Y
71.209	23.3843
71.209	23.1843
90.4765	24.2192
90.4765	24.4192

Material Boundary

X	Y
0	18.5759
114.498	18.5759

Sezione 943 – prg 16+620

Condizioni statiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.96 > 1.1$

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 16620 statica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1

Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Rilevato esistente	Piattaforma stradale	Qa
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18.5	18	18
Cohesion [kPa]	0	0	16
Friction Angle [deg]	28	29.3	19.6
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	0

Global Minimums

Method: bishop simplified

FS	1.962250
Center:	36.440, 38.265
Radius:	19.807

Left Slip Surface Endpoint:	20.170, 26.970
Right Slip Surface Endpoint:	41.335, 19.072
Resisting Moment:	15516.5 kN-m
Driving Moment:	7907.48 kN-m
Total Slice Area:	68.1727 m2
Surface Horizontal Width:	21.1646 m
Surface Average Height:	3.22108 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1757
Number of Invalid Surfaces:	5

Error Codes:

- Error Code -112 reported for 5 surfaces

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.96225**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.440327	2.50275	-54.1439	Rilevato esistente	0	28	1.12021	2.19814	4.13411	0	4.13411	5.68412	5.68412
2	0.440327	7.32399	-52.0215	Rilevato esistente	0	28	3.34591	6.56552	12.3479	0	12.3479	16.6338	16.6338
3	0.440327	11.8007	-49.9957	Rilevato esistente	0	28	5.48972	10.7722	20.2596	0	20.2596	26.801	26.801
4	0.440327	15.9756	-48.0521	Rilevato esistente	0	28	7.55403	14.8229	27.8777	0	27.8777	36.2827	36.2827
5	0.42181	18.9259	-46.2175	Qa	16	19.6	13.702	26.8868	30.5738	0	30.5738	44.8709	44.8709
6	0.42181	22.2019	-44.4806	Qa	16	19.6	15.0278	29.4883	37.8796	0	37.8796	52.6374	52.6374
7	0.42181	25.2022	-42.794	Qa	16	19.6	16.2642	31.9144	44.6928	0	44.6928	59.7504	59.7504
8	0.42181	27.6056	-41.1523	Qa	16	19.6	17.2887	33.9247	50.3385	0	50.3385	65.4481	65.4481
9	0.42181	28.7466	-39.5507	Qa	16	19.6	17.8469	35.0201	53.4148	0	53.4148	68.1532	68.1532
10	0.42181	29.6736	-37.9853	Qa	16	19.6	18.3238	35.9558	56.0423	0	56.0423	70.3509	70.3509

1 1	0.421 81	30.46 11	-36.4527	Qa	16	19. 6	18.7 462	36.7 847	58.3 703	0	58.3 703	72.2 178	72.2 178
1 2	0.421 81	31.11 74	-34.9498	Qa	16	19. 6	19.1 168	37.5 12	60.4 126	0	60.4 126	73.7 734	73.7 734
1 3	0.421 81	31.64 96	-33.474	Qa	16	19. 6	19.4 379	38.1 42	62.1 82	0	62.1 82	75.0 35	75.0 35
1 4	0.421 81	32.06 42	-32.023	Qa	16	19. 6	19.7 115	38.6 789	63.6 897	0	63.6 897	76.0 178	76.0 178
1 5	0.421 81	32.36 67	-30.5946	Qa	16	19. 6	19.9 394	39.1 26	64.9 455	0	64.9 455	76.7 35	76.7 35
1 6	0.421 81	32.56 22	-29.1869	Qa	16	19. 6	20.1 231	39.4 866	65.9 58	0	65.9 58	77.1 984	77.1 984
1 7	0.421 81	32.65 51	-27.7984	Qa	16	19. 6	20.2 641	39.7 633	66.7 352	0	66.7 352	77.4 185	77.4 185
1 8	0.421 81	32.65 11	-26.4274	Qa	16	19. 6	20.3 644	39.9 601	67.2 878	0	67.2 878	77.4 089	77.4 089
1 9	0.421 81	32.58 33	-25.0725	Qa	16	19. 6	20.4 368	40.1 022	67.6 868	0	67.6 868	77.2 481	77.2 481
2 0	0.421 81	32.43 52	-23.7324	Qa	16	19. 6	20.4 747	40.1 764	67.8 953	0	67.8 953	76.8 969	76.8 969
2 1	0.421 81	32.19 81	-22.406	Qa	16	19. 6	20.4 743	40.1 757	67.8 933	0	67.8 933	76.3 347	76.3 347
2 2	0.421 81	32.58 78	-21.0921	Qa	16	19. 6	20.7 233	40.6 643	69.2 653	0	69.2 653	77.2 585	77.2 585
2 3	0.421 81	33.77 91	-19.7898	Qa	16	19. 6	21.2 958	41.7 876	72.4 2	0	72.4 2	80.0 826	80.0 826
2 4	0.421 81	34.89 1	-18.498	Qa	16	19. 6	21.8 388	42.8 531	75.4 122	0	75.4 122	82.7 185	82.7 185
2 5	0.421 81	35.92 29	-17.2159	Qa	16	19. 6	22.3 517	43.8 596	78.2 391	0	78.2 391	85.1 649	85.1 649
2 6	0.421 81	36.84 37	-15.9427	Qa	16	19. 6	22.8 216	44.7 817	80.8 285	0	80.8 285	87.3 478	87.3 478
2 7	0.421 81	36.62 88	-14.6775	Qa	16	19. 6	22.8 272	44.7 927	80.8 593	0	80.8 593	86.8 383	86.8 383
2 8	0.421 81	35.82 9	-13.4196	Qa	16	19. 6	22.5 9	44.3 273	79.5 522	0	79.5 522	84.9 42	84.9 42
2 9	0.421 81	34.95 51	-12.1682	Qa	16	19. 6	22.3 188	43.7 95	78.0 576	0	78.0 576	82.8 701	82.8 701
3 0	0.421 81	34.00 81	-10.9227	Qa	16	19. 6	22.0 138	43.1 965	76.3 766	0	76.3 766	80.6 248	80.6 248
3 1	0.421 81	32.98 9	-9.68237	Qa	16	19. 6	21.6 752	42.5 321	74.5 106	0	74.5 106	78.2 088	78.2 088
3 2	0.421 81	31.89 87	-8.44664	Qa	16	19. 6	21.3 031	41.8 02	72.4 604	0	72.4 604	75.6 239	75.6 239
3 3	0.421 81	30.73 79	-7.21486	Qa	16	19. 6	20.8 977	41.0 065	70.2 264	0	70.2 264	72.8 719	72.8 719
3 4	0.421 81	29.50 72	-5.98642	Qa	16	19. 6	20.4 59	40.1 456	67.8 089	0	67.8 089	69.9 543	69.9 543
3 5	0.421 81	28.20 72	-4.76074	Qa	16	19. 6	19.9 87	39.2 194	65.2 075	0	65.2 075	66.8 721	66.8 721
3 6	0.421 81	26.83 83	-3.53724	Qa	16	19. 6	19.4 815	38.2 276	62.4 223	0	62.4 223	63.6 265	63.6 265
3 7	0.421 81	25.40 07	-2.31535	Qa	16	19. 6	18.9 426	37.1 701	59.4 526	0	59.4 526	60.2 185	60.2 185

38	0.42181	23.8947	-1.09451	Qa	16	19.6	18.37	36.0465	56.2971	0	56.2971	56.648	56.648
39	0.42181	22.3205	0.125824	Qa	16	19.6	17.7635	34.8564	52.955	0	52.955	52.916	52.916
40	0.42181	20.678	1.34622	Qa	16	19.6	17.1228	33.5993	49.4245	0	49.4245	49.0221	49.0221
41	0.42181	18.9673	2.56722	Qa	16	19.6	16.4476	32.2744	45.7038	0	45.7038	44.9664	44.9664
42	0.42181	17.1881	3.7894	Qa	16	19.6	15.7375	30.881	41.7908	0	41.7908	40.7484	40.7484
43	0.42181	15.3403	5.0133	Qa	16	19.6	14.9921	29.4182	37.6828	0	37.6828	36.3676	36.3676
44	0.42181	13.4234	6.23951	Qa	16	19.6	14.2107	27.885	33.3769	0	33.3769	31.8232	31.8232
45	0.42181	11.4371	7.46859	Qa	16	19.6	13.3928	26.2801	28.8699	0	28.8699	27.1142	27.1142
46	0.42181	9.38085	8.70114	Qa	16	19.6	12.5378	24.6023	24.1579	0	24.1579	22.2391	22.2391
47	0.42181	7.25392	9.93776	Qa	16	19.6	11.6448	22.85	19.237	0	19.237	17.1968	17.1968
48	0.42181	5.05559	11.1791	Qa	16	19.6	10.713	21.0216	14.1023	0	14.1023	11.9851	11.9851
49	0.42181	2.785	12.4257	Qa	16	19.6	9.74148	19.1152	8.7485	0	8.7485	6.60211	6.60211
50	0.42181	0.626302	13.6784	Qa	16	19.6	8.81248	17.2923	3.62916	0	3.62916	1.48443	1.48443

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.96225**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	20.1701	26.9697	0	0	0
2	20.6104	26.3605	2.02561	0	0
3	21.0507	25.7964	7.51716	0	0
4	21.4911	25.2718	15.7301	0	0
5	21.9314	24.7818	26.0625	0	0
6	22.3532	24.3417	33.7403	0	0
7	22.775	23.9275	43.0934	0	0
8	23.1968	23.537	53.6876	0	0
9	23.6186	23.1683	64.9534	0	0
10	24.0404	22.82	76.0332	0	0
11	24.4622	22.4906	86.7646	0	0
12	24.8841	22.179	97.0459	0	0
13	25.3059	21.8842	106.794	0	0
14	25.7277	21.6053	115.939	0	0
15	26.1495	21.3415	124.428	0	0
16	26.5713	21.0921	132.217	0	0
17	26.9931	20.8565	139.271	0	0
18	27.4149	20.6341	145.565	0	0
19	27.8367	20.4244	151.083	0	0

20	28.2585	20.2271	155.822	0	0
21	28.6803	20.0417	159.778	0	0
22	29.1022	19.8677	162.95	0	0
23	29.524	19.705	165.48	0	0
24	29.9458	19.5533	167.49	0	0
25	30.3676	19.4122	168.922	0	0
26	30.7894	19.2814	169.721	0	0
27	31.2112	19.161	169.836	0	0
28	31.633	19.0505	169.143	0	0
29	32.0548	18.9498	167.622	0	0
30	32.4766	18.8589	165.309	0	0
31	32.8984	18.7775	162.242	0	0
32	33.3203	18.7055	158.463	0	0
33	33.7421	18.6429	154.017	0	0
34	34.1639	18.5895	148.954	0	0
35	34.5857	18.5452	143.325	0	0
36	35.0075	18.5101	137.187	0	0
37	35.4293	18.484	130.598	0	0
38	35.8511	18.467	123.623	0	0
39	36.2729	18.4589	116.33	0	0
40	36.6947	18.4598	108.789	0	0
41	37.1165	18.4698	101.078	0	0
42	37.5384	18.4887	93.277	0	0
43	37.9602	18.5166	85.4724	0	0
44	38.382	18.5536	77.7553	0	0
45	38.8038	18.5997	70.2229	0	0
46	39.2256	18.655	62.9782	0	0
47	39.6474	18.7196	56.131	0	0
48	40.0692	18.7935	49.7983	0	0
49	40.491	18.8768	44.1047	0	0
50	40.9128	18.9698	39.1833	0	0
51	41.3346	19.0724	0	0	0

List Of Coordinates

Water Table

X	Y
0.0681709	7.62033
99.6827	7.62033

External Boundary

X	Y
0.0681709	0
99.6827	0
99.6827	20.7022
92.3816	21.3472
91.1121	20.7141
82.8109	20.9359
80.9141	20.3229
80.2891	20.3979
79.8391	20.3979
79.6891	20.4979
78.8141	20.5329
78.7141	20.5329
78.7141	20.4729
67.1641	19.8525
67.1641	19.9125
67.0641	19.9125
65.9141	19.8665
62.2081	20.0373
61.0581	20.0833

60.9581	20.0833
60.9581	20.0233
51.0081	19.4858
51.0081	19.5358
48.707	19.5358
42.6262	19.038
41.1262	19.078
31.1259	24.0781
29.1259	24.0781
27.7184	24.7818
23.3184	26.9818
22.6391	26.9989
0.0681709	26.7323
0.0681709	24.7818

Material Boundary

X	Y

51.0081	19.4858
51.0081	19.2858
60.9581	19.8233
60.9581	20.0233

Material Boundary

X	Y
67.1641	19.8525
67.1641	19.6525
78.7141	20.2729
78.7141	20.4729

Material Boundary

X	Y
0.0681709	24.7818
27.7184	24.7818

Condizioni sismiche – analisi in tensioni efficaci: $(R_d / F_d)_{min} = 1.45 > 1.1$ (sisma verso il basso ↓)

Slide Analysis Information
SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	pk 16620 sismica
Slide Modeler Version:	7.038
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	15/06/2021, 16:40:19

General Settings

Units of Measurement:	Metric Units
Time Units:	days
Permeability Units:	meters/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes

Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [kN/m3]:	9.81
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [kPa]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [m]:	3
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal):	0.124
Seismic Load Coefficient (Vertical):	0.062

Material Properties

Property	Rilevato esistente	Qa
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	18.5	18
Cohesion [kPa]	0	16
Friction Angle [deg]	28	19.6
Water Surface	Water Table	Water Table

Hu Value	1	1

Global Minimums

Method: bishop simplified

FS	1.446420
Center:	35.936, 38.483
Radius:	20.089
Left Slip Surface Endpoint:	19.479, 26.962
Right Slip Surface Endpoint:	41.132, 19.078
Resisting Moment:	16986.7 kN-m
Driving Moment:	11743.9 kN-m
Total Slice Area:	74.3403 m2
Surface Horizontal Width:	21.6531 m
Surface Average Height:	3.43323 m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces:	1437
Number of Invalid Surfaces:	0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.44642**

Slice Number	Width [m]	Weight [kN]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]	Base Vertical Stress [kPa]	Effective Vertical Stress [kPa]
1	0.441278	2.49446	-53.9341	Rilevato esistente	0	28	1.46704	2.12195	3.99081	0	3.99081	6.00514	6.00514
2	0.441278	7.30296	-51.8465	Rilevato esistente	0	28	4.40267	6.36811	11.9767	0	11.9767	17.5808	17.5808
3	0.441278	11.7736	-49.8518	Rilevato esistente	0	28	7.25661	10.4961	19.7402	0	19.7402	28.343	28.343
4	0.441278	15.9476	-47.9364	Rilevato esistente	0	28	10.0277	14.5042	27.2784	0	27.2784	38.3904	38.3904
5	0.432348	19.3704	-46.1078	Qa	16	19.6	18.1382	26.2355	28.7444	0	28.7444	47.598	47.598
6	0.432348	22.8048	-44.3562	Qa	16	19.6	20.0342	28.9778	36.446	0	36.446	56.0348	56.0348
7	0.432348	26.0406	-42.6555	Qa	16	19.6	21.8561	31.6131	43.8468	0	43.8468	63.9836	63.9836

8	0.432348	29.0557	-41.0002	Qa	16	19.6	23.5887	34.1192	50.8846	0	50.8846	71.3901	71.3901
9	0.432348	31.7822	-39.3855	Qa	16	19.6	25.1937	36.4406	57.4039	0	57.4039	78.0875	78.0875
10	0.432348	33.2627	-37.8074	Qa	16	19.6	26.1802	37.8675	61.4109	0	61.4109	81.7237	81.7237
11	0.432348	34.073	-36.2623	Qa	16	19.6	26.8261	38.8018	64.0349	0	64.0349	83.7135	83.7135
12	0.432348	34.745	-34.7473	Qa	16	19.6	27.3982	39.6293	66.3587	0	66.3587	85.3636	85.3636
13	0.432348	35.2863	-33.2596	Qa	16	19.6	27.8993	40.3541	68.3944	0	68.3944	86.6926	86.6926
14	0.432348	35.7036	-31.7968	Qa	16	19.6	28.3322	40.9802	70.1525	0	70.1525	87.717	87.717
15	0.432348	36.0028	-30.3569	Qa	16	19.6	28.699	41.5108	71.6426	0	71.6426	88.4512	88.4512
16	0.432348	36.1892	-28.9378	Qa	16	19.6	29.002	41.9491	72.8735	0	72.8735	88.9084	88.9084
17	0.432348	36.2675	-27.538	Qa	16	19.6	29.243	42.2976	73.8524	0	73.8524	89.1	89.1
18	0.432348	36.2418	-26.1557	Qa	16	19.6	29.4236	42.5589	74.5861	0	74.5861	89.036	89.036
19	0.432348	36.116	-24.7897	Qa	16	19.6	29.5454	42.7351	75.0807	0	75.0807	88.7262	88.7262
20	0.432348	35.9178	-23.4386	Qa	16	19.6	29.623	42.8473	75.396	0	75.396	88.2387	88.2387
21	0.432348	35.6479	-22.1011	Qa	16	19.6	29.6565	42.8958	75.5321	0	75.5321	87.575	87.575
22	0.432348	35.287	-20.7762	Qa	16	19.6	29.635	42.8646	75.4448	0	75.4448	86.6879	86.6879
23	0.432348	35.3356	-19.4629	Qa	16	19.6	29.8364	43.1559	76.2626	0	76.2626	86.8065	86.8065
24	0.432348	36.4372	-18.1601	Qa	16	19.6	30.6251	44.2968	79.4666	0	79.4666	89.512	89.512
25	0.432348	37.499	-16.8669	Qa	16	19.6	31.3966	45.4127	82.6004	0	82.6004	92.1197	92.1197
26	0.432348	38.4782	-15.5826	Qa	16	19.6	32.1265	46.4684	85.565	0	85.565	94.5244	94.5244
27	0.432348	39.3591	-14.3062	Qa	16	19.6	32.8051	47.45	88.3217	0	88.3217	96.6874	96.6874
28	0.432348	39.1124	-13.037	Qa	16	19.6	32.8431	47.5049	88.476	0	88.476	96.0808	96.0808
29	0.432348	38.1703	-11.7744	Qa	16	19.6	32.4787	46.9779	86.996	0	86.996	93.766	93.766
30	0.432348	37.151	-10.5175	Qa	16	19.6	32.0634	46.3771	85.3087	0	85.3087	91.2614	91.2614
31	0.432348	36.0554	-9.26568	Qa	16	19.6	31.5971	45.7027	83.4148	0	83.4148	88.5696	88.5696
32	0.432348	34.8846	-8.01833	Qa	16	19.6	31.0801	44.9549	81.3148	0	81.3148	85.693	85.693
33	0.432348	33.6391	-6.7748	Qa	16	19.6	30.5122	44.1335	79.0081	0	79.0081	82.6328	82.6328
34	0.432348	32.3196	-5.53447	Qa	16	19.6	29.8935	43.2385	76.4946	0	76.4946	79.3912	79.3912

35	0.432348	30.9267	-4.29674	Qa	16	19.6	29.2235	42.2695	73.7734	0	73.7734	75.9691	75.9691
36	0.432348	29.4608	-3.06101	Qa	16	19.6	28.5022	41.2262	70.8432	0	70.8432	72.3674	72.3674
37	0.432348	27.9221	-1.82671	Qa	16	19.6	27.7291	40.1079	67.7029	0	67.7029	68.5872	68.5872
38	0.432348	26.3108	-0.593259	Qa	16	19.6	26.9037	38.9141	64.3505	0	64.3505	64.629	64.629
39	0.432348	24.6271	0.63992	Qa	16	19.6	26.0256	37.644	60.7833	0	60.7833	60.4926	60.4926
40	0.432348	22.871	1.8734	Qa	16	19.6	25.094	36.2965	56.9992	0	56.9992	56.1785	56.1785
41	0.432348	21.0423	3.10774	Qa	16	19.6	24.1083	34.8707	52.9951	0	52.9951	51.6862	51.6862
42	0.432348	19.1409	4.34353	Qa	16	19.6	23.0674	33.3652	48.7673	0	48.7673	47.0153	47.0153
43	0.432348	17.1664	5.58135	Qa	16	19.6	21.9706	31.7787	44.3118	0	44.3118	42.1648	42.1648
44	0.432348	15.1184	6.82179	Qa	16	19.6	20.8166	30.1095	39.6242	0	39.6242	37.1339	37.1339
45	0.432348	12.9965	8.06546	Qa	16	19.6	19.6042	28.3559	34.6994	0	34.6994	31.9214	31.9214
46	0.432348	10.7999	9.31296	Qa	16	19.6	18.332	26.5158	29.5317	0	29.5317	26.5254	26.5254
47	0.432348	8.52789	10.5649	Qa	16	19.6	16.9985	24.587	24.1151	0	24.1151	20.9447	20.9447
48	0.432348	6.17967	11.822	Qa	16	19.6	15.6019	22.5669	18.4421	0	18.4421	15.1764	15.1764
49	0.432348	3.7542	13.0849	Qa	16	19.6	14.1404	20.4529	12.5053	0	12.5053	9.21861	9.21861
50	0.432348	1.25049	14.3544	Qa	16	19.6	12.6118	18.2419	6.29611	0	6.29611	3.06866	3.06866

Interslice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.44642**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	19.4788	26.9616	0	0	0
2	19.9201	26.3557	2.08058	0	0
3	20.3614	25.794	7.77246	0	0
4	20.8027	25.2708	16.3601	0	0
5	21.2439	24.7818	27.2558	0	0
6	21.6763	24.3324	34.7407	0	0
7	22.1086	23.9097	44.3219	0	0
8	22.541	23.5114	55.5761	0	0
9	22.9733	23.1355	68.1142	0	0
10	23.4057	22.7806	81.5485	0	0
11	23.838	22.4451	94.9651	0	0
12	24.2704	22.128	107.912	0	0

13	24.7027	21.8281	120.286	0	0
14	25.1351	21.5445	132.005	0	0
15	25.5674	21.2765	142.997	0	0
16	25.9998	21.0233	153.207	0	0
17	26.4321	20.7842	162.587	0	0
18	26.8645	20.5588	171.101	0	0
19	27.2968	20.3465	178.722	0	0
20	27.7292	20.1468	185.43	0	0
21	28.1615	19.9593	191.221	0	0
22	28.5939	19.7838	196.092	0	0
23	29.0262	19.6197	200.042	0	0
24	29.4586	19.467	203.188	0	0
25	29.8909	19.3251	205.747	0	0
26	30.3233	19.1941	207.663	0	0
27	30.7556	19.0735	208.874	0	0
28	31.1879	18.9632	209.322	0	0
29	31.6203	18.8631	208.843	0	0
30	32.0526	18.773	207.387	0	0
31	32.485	18.6927	204.992	0	0
32	32.9173	18.6222	201.698	0	0
33	33.3497	18.5613	197.551	0	0
34	33.782	18.5099	192.601	0	0
35	34.2144	18.468	186.9	0	0
36	34.6467	18.4356	180.509	0	0
37	35.0791	18.4124	173.488	0	0
38	35.5114	18.3986	165.907	0	0
39	35.9438	18.3942	157.836	0	0
40	36.3761	18.399	149.355	0	0
41	36.8085	18.4131	140.545	0	0
42	37.2408	18.4366	131.497	0	0
43	37.6732	18.4694	122.305	0	0
44	38.1055	18.5117	113.072	0	0
45	38.5379	18.5634	103.905	0	0
46	38.9702	18.6247	94.9228	0	0
47	39.4026	18.6956	86.2497	0	0
48	39.8349	18.7762	78.0201	0	0
49	40.2673	18.8667	70.3782	0	0
50	40.6996	18.9672	63.4792	0	0
51	41.132	19.0779	0	0	0

List Of Coordinates

Water Table

X	Y
0.0681709	7.62033
99.6827	7.62033

External Boundary

X	Y
0.0681709	0
99.6827	0
99.6827	20.7022
92.3816	21.3472
91.1121	20.7141

82.8109	20.9359
80.9141	20.3229
80.2891	20.3979
79.8391	20.3979
79.6891	20.4979
78.8141	20.5329
78.7141	20.5329
78.7141	20.4729
67.1641	19.8525
67.1641	19.9125
67.0641	19.9125
65.9141	19.8665
62.2081	20.0373
61.0581	20.0833
60.9581	20.0833
60.9581	20.0233
51.0081	19.4858
51.0081	19.5358
48.707	19.5358
42.6262	19.038
41.1262	19.078
31.1259	24.0781
29.1259	24.0781
27.7184	24.7818
23.3184	26.9818
22.6391	26.9989
0.0681709	26.7323
0.0681709	24.7818

Material Boundary

X	Y
51.0081	19.4858
51.0081	19.2858
60.9581	19.8233
60.9581	20.0233

Material Boundary

X	Y
67.1641	19.8525
67.1641	19.6525
78.7141	20.2729
78.7141	20.4729

Material Boundary

X	Y
0.0681709	24.7818
27.7184	24.7818

7.3 VERIFICHE DI STABILITA' DEI RILEVATI CON GEOGRIGLIE – TABULATI DI SLIDE

Sezione Tipo 1 – Altezza rilevato h_{ril} = 2.5 m ÷ 3.5 m, altezza di calcolo h_{ril} = 3.5 m

Sezione corrente – condizioni sismiche, analisi in tensioni efficaci: $(R_d / F_d)_{min}$ = 1.117 > 1.1 (sisma verso l'alto ↑)

Slide Analysis Information

Project Summary

- File Name: RIL H=3.5m_pend=2su3_L=4m Rt=20 kN_NTC08_SISM-_kh=0.12
- Slide Modeler Version: 6.005

General Settings

- Units of Measurement: Metric Units
- Time Units: days
- Permeability Units: meters/second
- Failure Direction: Right to Left
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Bishop simplified

- Number of slices: 25
- Tolerance: 0.005
- Maximum number of iterations: 50
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 9.81 kN/m3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Auto Refine Search
- Divisions along slope: 10
- Circles per division: 10
- Number of iterations: 10
- Divisions to use in next iteration: 50%
- Composite Surfaces: Disabled
- Minimum Elevation: Not Defined
- Minimum Depth: 2.5

Loading

- Seismic Load Coefficient (Horizontal): 0.12
- Seismic Load Coefficient (Vertical): -0.06
- 2 Distributed Loads present

Distributed Load 1

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Distributed Load 2

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Material Properties

Property	Rilevato_rid	BASE
Color		
Strength Type	Mohr-Coulomb	Infinite strength
Unit Weight [kN/m3]	18	25
Cohesion [kPa]	0	
Friction Angle [deg]	29.3	
Water Surface	None	None
Ru Value	0	0

Support Properties

Geogrid Rt = 20 kN

- Support Type: GeoTextile
- Force Application: Passive
- Force Orientation: Bisector of Parallel and Tangent
- Anchorage: Slope Face
- Shear Strength Model: Linear
- Strip Coverage: 100 percent
- Tensile Strength: 10 kN/m
- Pullout Strength Adhesion: 0 kN/m2
- Pullout Strength Friction Angle: 29.3 degrees
- and Material Dependent

Global Minimums

Method: bishop simplified

- FS: 1.116870
- Center: 1.004, 10.101
- Radius: 10.095
- Left Slip Surface Endpoint: 0.074, 0.049
- Right Slip Surface Endpoint: 8.642, 3.500
- Resisting Moment=1130.53 kN-m
- Driving Moment=1012.23 kN-m

Valid / Invalid Surfaces

Method: bishop simplified

- Number of Valid Surfaces: 272
- Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.11687**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]
1	0.342702	0.784372	Rilevato_rid	0	29.3	1.12356	1.25487	2.23616	0	2.23616
2	0.342702	2.31704	Rilevato_rid	0	29.3	3.2609	3.642	6.48997	0	6.48997
3	0.342702	3.7777	Rilevato_rid	0	29.3	5.22547	5.83617	10.3999	0	10.3999
4	0.342702	5.16654	Rilevato_rid	0	29.3	7.02626	7.84742	13.9839	0	13.9839
5	0.342702	6.48347	Rilevato_rid	0	29.3	8.67087	9.68423	17.2571	0	17.2571
6	0.342702	7.7282	Rilevato_rid	0	29.3	10.1657	11.3538	20.2322	0	20.2322
7	0.342702	8.90012	Rilevato_rid	0	29.3	11.5162	12.8621	22.92	0	22.92
8	0.342702	9.9984	Rilevato_rid	0	29.3	12.7269	14.2143	25.3295	0	25.3295
9	0.342702	11.0219	Rilevato_rid	0	29.3	13.8013	15.4143	27.4679	0	27.4679
10	0.342702	11.9692	Rilevato_rid	0	29.3	14.7424	16.4654	29.341	0	29.341
11	0.342702	12.8386	Rilevato_rid	0	29.3	15.5526	17.3702	30.9532	0	30.9532
12	0.342702	13.6278	Rilevato_rid	0	29.3	16.2332	18.1304	32.3078	0	32.3078
13	0.342702	14.3345	Rilevato_rid	0	29.3	16.7853	18.747	33.4069	0	33.4069
14	0.342702	14.9555	Rilevato_rid	0	29.3	17.2093	19.2205	34.2505	0	34.2505
15	0.342702	15.4873	Rilevato_rid	0	29.3	17.5048	19.5506	34.8387	0	34.8387
16	0.342702	15.3591	Rilevato_rid	0	29.3	17.0423	19.034	33.918	0	33.918
17	0.342702	14.2974	Rilevato_rid	0	29.3	15.5633	17.3822	30.9749	0	30.9749
18	0.342702	13.1239	Rilevato_rid	0	29.3	14.0037	15.6403	27.8706	0	27.8706
19	0.342702	11.8392	Rilevato_rid	0	29.3	12.3711	13.8169	24.6214	0	24.6214
20	0.342702	10.4349	Rilevato_rid	0	29.3	10.665	11.9114	21.2259	0	21.2259
21	0.342702	8.90072	Rilevato_rid	0	29.3	8.88503	9.92342	17.6833	0	17.6833

22	0.342702	7.22428	Rilevato_rid	0	29.3	7.03096	7.85267	13.9933	0	13.9933
23	0.342702	5.38993	Rilevato_rid	0	29.3	5.10306	5.69945	10.1563	0	10.1563
24	0.342702	3.37786	Rilevato_rid	0	29.3	3.10245	3.46503	6.17461	0	6.17461
25	0.342702	1.16231	Rilevato_rid	0	29.3	1.94465	2.17192	3.87032	0	3.87032

List Of Coordinates

Line Load

X	Y
8.4	3.5
13	3.5
18.2	3.5

Line Load

X	Y
21.7	3.5
31.45	3.5

External Boundary

X	Y
0	0
-46.75	0
-46.75	-16.75
83.65	-16.75
83.65	0
38.9	0
36	1.93333
33.65	3.5
31.45	3.5
21.7	3.5
18.2	3.5
13	3.5
8.4	3.5
5.25	3.5
3	2

Material Boundary

X	Y
0	0
38.9	0

Material Boundary

X	Y
13	3.192
13	3.5

Material Boundary

X	Y
8.4	3.5
8.4	3.192

Material Boundary

X	Y
18.2	3.1752
18.2	3.5

Material Boundary

X	Y
21.7	3.08383
21.7	3.5

Material Boundary

X	Y
31.45	3.1495
31.45	3.5

Material Boundary

X	Y
3	2
7	2

Material Boundary

X	Y
32	1.93333
36	1.93333

Sezione tratto da pk 7+740 a pk 7+880 del lotto 4 – condizioni sismiche, analisi in tensioni efficaci: $(R_d / F_d)_{min}$ = 1.102 > 1.1 (sisma verso l'alto ↑)

Slide Analysis Information

Project Summary

- File Name: RIL H=3.5m_pend=2su3_L=5m_Rt=40kN_NTC08_SISM-_kh=0.16 (pk 7740-7880)
- Slide Modeler Version: 6.005

General Settings

- Units of Measurement: Metric Units
- Time Units: days
- Permeability Units: meters/second
- Failure Direction: Right to Left
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Bishop simplified

- Number of slices: 25
- Tolerance: 0.005
- Maximum number of iterations: 50
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 9.81 kN/m3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Auto Refine Search
- Divisions along slope: 10
- Circles per division: 10
- Number of iterations: 10
- Divisions to use in next iteration: 50%
- Composite Surfaces: Disabled
- Minimum Elevation: Not Defined
- Minimum Depth: 2

Loading

- Seismic Load Coefficient (Horizontal): 0.16
- Seismic Load Coefficient (Vertical): -0.08
- 2 Distributed Loads present

Distributed Load 1

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Distributed Load 2

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Material Properties

Property	Rilevato_rid	BASE
Color		
Strength Type	Mohr-Coulomb	Infinite strength
Unit Weight [kN/m3]	18	25
Cohesion [kPa]	0	
Friction Angle [deg]	29.3	
Water Surface	None	None
Ru Value	0	0

Support Properties

Geogrid Rt=40 kN

- Support Type: GeoTextile
- Force Application: Active
- Force Orientation: Bisector of Parallel and Tangent
- Anchorage: Slope Face
- Shear Strength Model: Linear
- Strip Coverage: 100 percent
- Tensile Strength: 20 kN/m
- Pullout Strength Adhesion: 0 kN/m2
- Pullout Strength Friction Angle: 29.3 degrees
- and Material Dependent

Global Minimums

Method: bishop simplified

- FS: 1.101550
- Center: 0.593, 14.726
- Radius: 14.725
- Left Slip Surface Endpoint: 0.017, 0.011
- Right Slip Surface Endpoint: 10.124, 3.500
- Resisting Moment=2013.51 kN-m
- Driving Moment=1827.89 kN-m

Valid / Invalid Surfaces

Method: bishop simplified

- Number of Valid Surfaces: 594
- Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.10155**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]
1	0.404265	1.01798	Rilevato_rid	0	29.3	1.19568	1.3171	2.34704	0	2.34704
2	0.404265	3.01354	Rilevato_rid	0	29.3	3.49013	3.84455	6.85089	0	6.85089
3	0.404265	4.9283	Rilevato_rid	0	29.3	5.62902	6.20065	11.0494	0	11.0494
4	0.404265	6.76215	Rilevato_rid	0	29.3	7.61836	8.392	14.9544	0	14.9544
5	0.404265	8.51481	Rilevato_rid	0	29.3	9.4633	10.4243	18.576	0	18.576
6	0.404265	10.1858	Rilevato_rid	0	29.3	11.1685	12.3027	21.9232	0	21.9232
7	0.404265	11.7744	Rilevato_rid	0	29.3	12.7379	14.0314	25.0038	0	25.0038
8	0.404265	13.2799	Rilevato_rid	0	29.3	14.1748	15.6143	27.8244	0	27.8244
9	0.404265	14.701	Rilevato_rid	0	29.3	15.4822	17.0544	30.3907	0	30.3907
10	0.404265	16.0365	Rilevato_rid	0	29.3	16.6625	18.3546	32.7075	0	32.7075
11	0.404265	17.2849	Rilevato_rid	0	29.3	17.7177	19.5169	34.7787	0	34.7787
12	0.404265	18.4443	Rilevato_rid	0	29.3	18.6494	20.5432	36.6074	0	36.6074
13	0.404265	19.5096	Rilevato_rid	0	29.3	19.4556	21.4313	38.19	0	38.19
14	0.404265	19.3976	Rilevato_rid	0	29.3	19.0747	21.0117	37.4425	0	37.4425
15	0.404265	18.3151	Rilevato_rid	0	29.3	17.7553	19.5584	34.8527	0	34.8527
16	0.404265	17.1331	Rilevato_rid	0	29.3	16.3698	18.0322	32.1329	0	32.1329
17	0.404265	15.8481	Rilevato_rid	0	29.3	14.9186	16.4336	29.2843	0	29.2843
18	0.404265	14.4559	Rilevato_rid	0	29.3	13.402	14.763	26.3074	0	26.3074
19	0.404265	12.9518	Rilevato_rid	0	29.3	11.8203	13.0206	23.2025	0	23.2025
20	0.404265	11.3304	Rilevato_rid	0	29.3	10.1738	11.2069	19.9705	0	19.9705
21	0.404265	9.58535	Rilevato_rid	0	29.3	8.87217	9.77314	17.4155	0	17.4155
22	0.404265	7.70945	Rilevato_rid	0	29.3	8.21247	9.04645	16.1206	0	16.1206
23	0.404265	5.69425	Rilevato_rid	0	29.3	6.34607	6.99051	12.4569	0	12.4569

24	0.404265	3.52983	Rilevato_rid	0	29.3	4.41603	4.86448	8.66841	0	8.66841
25	0.404265	1.20449	Rilevato_rid	0	29.3	2.42339	2.66948	4.75695	0	4.75695

List Of Coordinates

Line Load

X	Y
8.4	3.5
13	3.5
18.2	3.5

Line Load

X	Y
21.7	3.5
31.45	3.5

External Boundary

X	Y
0	0
-46.75	0
-46.75	-16.75
83.65	-16.75
83.65	0
38.9	0
36	1.93333
33.65	3.5
31.45	3.5
21.7	3.5
18.2	3.5
13	3.5
8.4	3.5
5.25	3.5
3	2

Material Boundary

X	Y
0	0
38.9	0

Material Boundary

X	Y
13	3.192
13	3.5

Material Boundary

X	Y
8.4	3.5
8.4	3.192

Material Boundary

X	Y
18.2	3.1752
18.2	3.5

Material Boundary

X	Y
21.7	3.08383
21.7	3.5

Material Boundary

X	Y
31.45	3.1495
31.45	3.5

Material Boundary

X	Y
3	2
8	2

Material Boundary

X	Y
31	1.93333
36	1.93333

Sezione Tipo 2 – Altezza rilevato h_{ril} = 3.6 m ÷ 6 m, altezza di calcolo h_{ril} = 6 m

Sezione corrente – condizioni sismiche, analisi in tensioni efficaci: $(R_d / F_d)_{min}$ = 1.111 > 1.1 (sisma verso l'alto ↑)

Slide Analysis Information

Project Summary

- File Name: RIL H=6m_pend=2su3_NTC08_SISM-_kh=0.12
- Slide Modeler Version: 6.005

General Settings

- Units of Measurement: Metric Units
- Time Units: days
- Permeability Units: meters/second
- Failure Direction: Right to Left
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Bishop simplified

- Number of slices: 25
- Tolerance: 0.005
- Maximum number of iterations: 50
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 9.81 kN/m3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Auto Refine Search
- Divisions along slope: 10
- Circles per division: 10
- Number of iterations: 10
- Divisions to use in next iteration: 50%
- Composite Surfaces: Disabled
- Minimum Elevation: Not Defined
- Minimum Depth: 2.5

Loading

- Seismic Load Coefficient (Horizontal): 0.12
- Seismic Load Coefficient (Vertical): -0.06
- 2 Distributed Loads present

Distributed Load 1

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Distributed Load 2

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Material Properties

Property	Rilevato_rid	BASE
Color		
Strength Type	Mohr-Coulomb	Infinite strength
Unit Weight [kN/m3]	18	25
Cohesion [kPa]	0	
Friction Angle [deg]	29.3	
Water Surface	None	None
Ru Value	0	0

Support Properties

Geogrid Rt = 30 kN

- Support Type: GeoTextile
- Force Application: Passive
- Force Orientation: Bisector of Parallel and Tangent
- Anchorage: Slope Face
- Shear Strength Model: Linear
- Strip Coverage: 100 percent
- Tensile Strength: 15 kN/m
- Pullout Strength Adhesion: 0 kN/m2
- Pullout Strength Friction Angle: 29.3 degrees
- and Material Dependent

Global Minimums

Method: bishop simplified

- FS: 1.111070
- Center: 39.964, 39.184
- Radius: 22.458
- Left Slip Surface Endpoint: 41.001, 16.750
- Right Slip Surface Endpoint: 55.269, 22.750
- Resisting Moment=4423.05 kN-m
- Driving Moment=3980.88 kN-m

Valid / Invalid Surfaces

Method: bishop simplified

- Number of Valid Surfaces: 592
- Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.11107**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]
1	0.570749	1.78157	Rilevato_rid	0	29.3	1.43911	1.59895	2.8493	0	2.8493
2	0.570749	5.26961	Rilevato_rid	0	29.3	4.20387	4.67079	8.32324	0	8.32324
3	0.570749	8.33493	Rilevato_rid	0	29.3	6.56725	7.29667	13.0025	0	13.0025
4	0.570749	8.37962	Rilevato_rid	0	29.3	6.52136	7.24569	12.9117	0	12.9117
5	0.570749	7.50285	Rilevato_rid	0	29.3	5.76743	6.40802	11.419	0	11.419
6	0.570749	6.47104	Rilevato_rid	0	29.3	4.91327	5.45899	9.72781	0	9.72781
7	0.570749	6.75771	Rilevato_rid	0	29.3	5.06786	5.63075	10.0339	0	10.0339
8	0.570749	9.2845	Rilevato_rid	0	29.3	6.87683	7.64064	13.6155	0	13.6155
9	0.570749	11.6823	Rilevato_rid	0	29.3	8.54529	9.49441	16.9189	0	16.9189
10	0.570749	13.9142	Rilevato_rid	0	29.3	10.0502	11.1665	19.8985	0	19.8985
11	0.570749	15.9763	Rilevato_rid	0	29.3	11.3933	12.6588	22.5577	0	22.5577
12	0.570749	17.8644	Rilevato_rid	0	29.3	12.5761	13.9729	24.8994	0	24.8994
13	0.570749	19.5735	Rilevato_rid	0	29.3	13.5992	15.1097	26.9253	0	26.9253
14	0.570749	21.0981	Rilevato_rid	0	29.3	14.4634	16.0699	28.6362	0	28.6362
15	0.570749	22.4318	Rilevato_rid	0	29.3	15.1687	16.8535	30.0325	0	30.0325
16	0.570749	23.5675	Rilevato_rid	0	29.3	15.7148	17.4602	31.1136	0	31.1136
17	0.570749	24.4972	Rilevato_rid	0	29.3	16.1009	17.8892	31.8782	0	31.8782
18	0.570749	25.2117	Rilevato_rid	0	29.3	13.7034	15.2254	27.1313	0	27.1313
19	0.570749	25.7005	Rilevato_rid	0	29.3	16.3884	18.2087	32.4475	0	32.4475
20	0.570749	24.915	Rilevato_rid	0	29.3	15.6356	17.3723	30.9571	0	30.9571
21	0.570749	21.1501	Rilevato_rid	0	29.3	13.0535	14.5034	25.8447	0	25.8447
22	0.570749	16.9735	Rilevato_rid	0	29.3	7.27591	8.08404	14.4056	0	14.4056
23	0.570749	12.5112	Rilevato_rid	0	29.3	7.44966	8.27709	14.7497	0	14.7497
24	0.570749	7.74137	Rilevato_rid	0	29.3	4.52055	5.02265	8.95026	0	8.95026

25	0.570749	2.63832	Rilevato_rid	0	29.3	1.67789	1.86425	3.32205	0	3.32205

List Of Coordinates

Line Load

X	Y
55.2	22.75
64.95	22.75

Line Load

X	Y
68.45	22.75
78.2	22.75

External Boundary

X	Y
0	0
128.15	0
128.15	16.75
91.4	16.75
89.9	17.75
87.9	17.75
85.05	19.65
82.7	21.2167
80.4	22.75
78.2	22.75
68.45	22.75
64.95	22.75
55.2	22.75
52	22.75
49.6	21.15
47.5	19.75
44.5	17.75
42.5	17.75
41	16.75
0	16.75

Material Boundary

X	Y
49.6	21.15
55.6	21.15

Material Boundary

X	Y
47.5	19.75
53.5	19.75

Material Boundary

X	Y
76.7	21.2167
82.7	21.2167

Material Boundary

X	Y
79.05	19.65
85.05	19.65

Material Boundary

X	Y
41	16.75
91.4	16.75

Material Boundary

X	Y
55.2	22.442
55.2	22.75

Material Boundary

X	Y
68.45	22.442
68.45	22.75

Material Boundary

X	Y
64.95	22.442
64.95	22.75

Material Boundary

X	Y
78.2	22.442
78.2	22.75

Sezione Tipo 3 – Altezza rilevato h_{ril} = 6.1 m ÷ 9 m, altezza di calcolo h_{ril} = 9 m

Sezione corrente – condizioni sismiche, analisi in tensioni efficaci: $(R_d / F_d)_{min}$ = 1.129 > 1.1 (sisma verso l'alto ↑)

Slide Analysis Information

Project Summary

- File Name: RIL H=9m_pend=2su3_geog L1=10m L2=8m_Rt=60 kN_NTC08_SISM-_kh=0.12
- Slide Modeler Version: 6.005

General Settings

- Units of Measurement: Metric Units
- Time Units: days
- Permeability Units: meters/second
- Failure Direction: Right to Left
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Bishop simplified

- Number of slices: 25
- Tolerance: 0.005
- Maximum number of iterations: 50
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 9.81 kN/m3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Auto Refine Search
- Divisions along slope: 10
- Circles per division: 10
- Number of iterations: 10
- Divisions to use in next iteration: 50%
- Composite Surfaces: Disabled
- Minimum Elevation: Not Defined
- Minimum Depth: 1

Loading

- Seismic Load Coefficient (Horizontal): 0.12
- Seismic Load Coefficient (Vertical): -0.06
- 2 Distributed Loads present

Distributed Load 1

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Distributed Load 2

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Material Properties

Property	Rilevato_rid	BASE
Color		
Strength Type	Mohr-Coulomb	Infinite strength
Unit Weight [kN/m3]	18	25
Cohesion [kPa]	0	
Friction Angle [deg]	29.3	
Water Surface	None	None
Ru Value	0	0

Support Properties

Geogrid Rt = 60 kN

- Support Type: GeoTextile
- Force Application: Passive
- Force Orientation: Bisector of Parallel and Tangent
- Anchorage: Slope Face
- Shear Strength Model: Linear
- Strip Coverage: 100 percent
- Tensile Strength: 30 kN/m
- Pullout Strength Adhesion: 0 kN/m2
- Pullout Strength Friction Angle: 29.3 degrees
- and Material Dependent

Global Minimums

Method: bishop simplified

- FS: 1.128610
- Center: 36.032, 48.867
- Radius: 35.118
- Left Slip Surface Endpoint: 36.503, 13.752
- Right Slip Surface Endpoint: 59.509, 22.750
- Resisting Moment=22504.3 kN-m
- Driving Moment=19940 kN-m

Valid / Invalid Surfaces

Method: bishop simplified

- Number of Valid Surfaces: 1011
- Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.12861**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]
1	0.920219	4.8785	Rilevato_rid	0	29.3	2.44559	2.76012	4.91847	0	4.91847
2	0.920219	14.4353	Rilevato_rid	0	29.3	7.14434	8.06317	14.3684	0	14.3684
3	0.920219	23.5908	Rilevato_rid	0	29.3	11.5283	13.011	23.1852	0	23.1852
4	0.920219	32.343	Rilevato_rid	0	29.3	15.6072	17.6144	31.3885	0	31.3885
5	0.920219	40.6889	Rilevato_rid	0	29.3	19.3894	21.8831	38.9951	0	38.9951
6	0.920219	48.6247	Rilevato_rid	0	29.3	22.8823	25.8252	46.02	0	46.02
7	0.920219	54.9582	Rilevato_rid	0	29.3	25.5406	28.8254	51.3662	0	51.3662
8	0.920219	53.2526	Rilevato_rid	0	29.3	24.4388	27.5819	49.1505	0	49.1505
9	0.920219	50.2517	Rilevato_rid	0	29.3	22.7723	25.701	45.7986	0	45.7986
10	0.920219	54.0695	Rilevato_rid	0	29.3	24.1928	27.3042	48.6555	0	48.6555
11	0.920219	59.8616	Rilevato_rid	0	29.3	26.4427	29.8435	53.1805	0	53.1805
12	0.920219	65.1983	Rilevato_rid	0	29.3	26.2097	29.5805	52.7118	0	52.7118
13	0.920219	70.0677	Rilevato_rid	0	29.3	30.1516	34.0294	60.6397	0	60.6397
14	0.920219	74.4558	Rilevato_rid	0	29.3	31.6133	35.6791	63.5794	0	63.5794
15	0.920219	78.3473	Rilevato_rid	0	29.3	32.8138	37.034	65.9938	0	65.9938
16	0.920219	81.7242	Rilevato_rid	0	29.3	33.7527	38.0936	67.8819	0	67.8819
17	0.920219	84.4369	Rilevato_rid	0	29.3	34.3759	38.797	69.1354	0	69.1354
18	0.920219	80.1472	Rilevato_rid	0	29.3	32.1507	36.2856	64.6602	0	64.6602
19	0.920219	71.6867	Rilevato_rid	0	29.3	28.3209	31.9632	56.9578	0	56.9578
20	0.920219	62.6126	Rilevato_rid	0	29.3	24.3471	27.4784	48.966	0	48.966
21	0.920219	52.8903	Rilevato_rid	0	29.3	21.2519	23.9851	42.741	0	42.741
22	0.920219	42.4801	Rilevato_rid	0	29.3	17.4421	19.6853	35.0788	0	35.0788

23	0.920219	31.3355	Rilevato_rid	0	29.3	12.9869	14.6571	26.1187	0	26.1187
24	0.920219	19.4021	Rilevato_rid	0	29.3	8.44456	9.53061	16.9833	0	16.9833
25	0.920219	6.61541	Rilevato_rid	0	29.3	3.73669	4.21727	7.51509	0	7.51509

List Of Coordinates

Line Load

X	Y
55.2	22.75
59.3	22.75
64.95	22.75

Line Load

X	Y
68.45	22.75
78.2	22.75

External Boundary

X	Y
0	0
54.9	0
87.15	0
128.15	0
128.15	13.75
95.9	13.75
92.9	15.75
89.9	17.75
87.9	17.75
85.05	19.65
82.7	21.2167
80.4	22.75
78.2	22.75
68.45	22.75
64.95	22.75
59.3	22.75
55.2	22.75
52	22.75
49.6	21.15
47.5	19.75
44.5	17.75
42.5	17.75
39.1	15.4833
36.5	13.75
0	13.75

Material Boundary

X	Y
36.5	13.75
95.9	13.75

Material Boundary

X	Y
55.2	22.442
55.2	22.75

Material Boundary

X	Y
59.3	22.442
59.3	22.75

Material Boundary

X	Y
49.6	21.15
57.6	21.15

Material Boundary

X	Y
47.5	19.75
55.5	19.75

Material Boundary

X	Y
74.7	21.2167
82.7	21.2167

Material Boundary

X	Y
77.05	19.65
85.05	19.65

Material Boundary

X	Y
39.1	15.4833

48.1	15.4833

Material Boundary

X	Y
82.9	15.75
92.9	15.75

Material Boundary

X	Y
64.95	22.442
64.95	22.75

Material Boundary

X	Y
68.45	22.442
68.45	22.75

Material Boundary

X	Y
78.2	22.442
78.2	22.75

Sezione Tipo 4 – Altezza rilevato h_{ril} = 9.1 m ÷ 11 m, altezza di calcolo h_{ril} = 11 m

Sezione corrente – condizioni sismiche, analisi in tensioni efficaci: $(R_d / F_d)_{min}$ = 1.129 > 1.1 (sisma verso l'alto ↑)

Slide Analysis Information

Project Summary

- File Name: RIL H=11m_pend=2su3_geog L=10m_Rt=60 kN_NTC08_SISM-_kh=0.12
- Slide Modeler Version: 6.005

General Settings

- Units of Measurement: Metric Units
- Time Units: days
- Permeability Units: meters/second
- Failure Direction: Right to Left
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Bishop simplified

- Number of slices: 25
- Tolerance: 0.005
- Maximum number of iterations: 50
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 9.81 kN/m3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Auto Refine Search
- Divisions along slope: 10
- Circles per division: 10
- Number of iterations: 10
- Divisions to use in next iteration: 50%
- Composite Surfaces: Disabled
- Minimum Elevation: Not Defined
- Minimum Depth: 2.5

Loading

- Seismic Load Coefficient (Horizontal): 0.12
- Seismic Load Coefficient (Vertical): -0.06
- 2 Distributed Loads present

Distributed Load 1

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Distributed Load 2

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Material Properties

Property	Rilevato_rid	BASE
Color		
Strength Type	Mohr-Coulomb	Infinite strength
Unit Weight [kN/m3]	18	25
Cohesion [kPa]	0	
Friction Angle [deg]	29.3	
Water Surface	None	None
Ru Value	0	0

Support Properties

Geogrid Rt = 60 kN

- Support Type: GeoTextile
- Force Application: Passive
- Force Orientation: Bisector of Parallel and Tangent
- Anchorage: Slope Face
- Shear Strength Model: Linear
- Strip Coverage: 100 percent
- Tensile Strength: 30 kN/m
- Pullout Strength Adhesion: 0 kN/m2
- Pullout Strength Friction Angle: 29.3 degrees
- and Material Dependent

Global Minimums

Method: bishop simplified

- FS: 1.129320
- Center: 32.198, 56.435
- Radius: 44.680
- Left Slip Surface Endpoint: 31.516, 11.761
- Right Slip Surface Endpoint: 61.550, 22.750
- Resisting Moment=43521 kN-m
- Driving Moment=38537.5 kN-m

Valid / Invalid Surfaces

Method: bishop simplified

- Number of Valid Surfaces: 730
- Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.12932**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]
1	1.20136	8.6831	Rilevato_rid	0	29.3	3.3791	3.81608	6.80018	0	6.80018
2	1.20136	20.6305	Rilevato_rid	0	29.3	7.92259	8.94714	15.9436	0	15.9436
3	1.20136	20.1936	Rilevato_rid	0	29.3	7.65359	8.64335	15.4023	0	15.4023
4	1.20136	28.8002	Rilevato_rid	0	29.3	10.7744	12.1677	21.6825	0	21.6825
5	1.20136	43.7104	Rilevato_rid	0	29.3	16.1422	18.2297	32.4849	0	32.4849
6	1.20136	57.9098	Rilevato_rid	0	29.3	21.1123	23.8425	42.4869	0	42.4869
7	1.20136	71.3915	Rilevato_rid	0	29.3	25.6949	29.0178	51.7091	0	51.7091
8	1.20136	84.1468	Rilevato_rid	0	29.3	29.8987	33.7652	60.1689	0	60.1689
9	1.20136	96.1651	Rilevato_rid	0	29.3	33.7312	38.0933	67.8815	0	67.8815
10	1.20136	101.068	Rilevato_rid	0	29.3	34.9944	39.5199	70.4236	0	70.4236
11	1.20136	94.7508	Rilevato_rid	0	29.3	30.9114	34.9089	62.2068	0	62.2068
12	1.20136	98.8296	Rilevato_rid	0	29.3	33.3327	37.6433	67.0796	0	67.0796
13	1.20136	107.753	Rilevato_rid	0	29.3	35.8599	40.4973	72.1654	0	72.1654
14	1.20136	115.853	Rilevato_rid	0	29.3	38.0361	42.9549	76.5448	0	76.5448
15	1.20136	123.105	Rilevato_rid	0	29.3	39.8623	45.0173	80.2198	0	80.2198
16	1.20136	129.48	Rilevato_rid	0	29.3	41.3389	46.6849	83.1917	0	83.1917
17	1.20136	134.945	Rilevato_rid	0	29.3	42.4649	47.9565	85.4574	0	85.4574
18	1.20136	131.651	Rilevato_rid	0	29.3	40.817	46.0954	82.1411	0	82.1411
19	1.20136	117.879	Rilevato_rid	0	29.3	35.9908	40.6451	72.4288	0	72.4288
20	1.20136	103.045	Rilevato_rid	0	29.3	31.4051	35.4664	63.2004	0	63.2004
21	1.20136	87.1142	Rilevato_rid	0	29.3	27.2601	30.7854	54.859	0	54.859
22	1.20136	70.0199	Rilevato_rid	0	29.3	21.8272	24.6499	43.9256	0	43.9256
23	1.20136	51.6859	Rilevato_rid	0	29.3	16.2043	18.2998	32.61	0	32.61
24	1.20136	32.0225	Rilevato_rid	0	29.3	10.3801	11.7225	20.8893	0	20.8893
25	1.20136	10.9231	Rilevato_rid	0	29.3	4.39761	4.96631	8.84987	0	8.84987

List Of Coordinates

Line Load

X	Y
55.2	22.75
56.6	22.75
64.95	22.75

Line Load

X	Y
68.45	22.75
78.2	22.75

External Boundary

X	Y
0	0
128.15	0
128.15	11.75
100.9	11.75
99.4	12.75
97.4	12.75
95.9	13.75
92.9	15.75
89.9	17.75
87.9	17.75
85.05	19.65
82.7	21.2167
80.4	22.75
78.2	22.75
68.45	22.75
64.95	22.75
56.6	22.75
55.2	22.75
52	22.75
49.6	21.15
47.5	19.75
44.5	17.75
42.5	17.75
39.1	15.4833
36.05	13.45
35	12.75
33	12.75
31.5	11.75
0	11.75

Material Boundary

X	Y
55.2	22.442
55.2	22.75

Material Boundary

X	Y
56.6	22.442
56.6	22.75

Material Boundary

X	Y
49.6	21.15
59.6	21.15

Material Boundary

X	Y
47.5	19.75
57.5	19.75

Material Boundary

X	Y
72.7	21.2167
82.7	21.2167

Material Boundary

X	Y
75.05	19.65
85.05	19.65

Material Boundary

X	Y
39.1	15.4833
49.1	15.4833

Material Boundary

X	Y
82.9	15.75
92.9	15.75

Material Boundary

X	Y
36.05	13.45
46.05	13.45

Material Boundary

X	Y

85.9	13.75
95.9	13.75

Material Boundary

X	Y
31.5	11.75
100.9	11.75

Material Boundary

X	Y
64.95	22.442

64.95	22.75

Material Boundary

X	Y
68.45	22.442
68.45	22.75

Material Boundary

X	Y
78.2	22.442
78.2	22.75

Sezione Tipo 5 – Altezza rilevato h_{ril} = 11.1 m ÷ 13 m, altezza di calcolo h_{ril} = 13 m

Sezione corrente – condizioni sismiche, analisi in tensioni efficaci: $(R_d / F_d)_{min}$ = 1.108 > 1.1 (sisma verso l'alto ↑)

Slide Analysis Information

Project Summary

- File Name: RIL H=13m_pend=2su3_geog L1=13m L2=12m L3=10_Rt=60 kN_NTC08_SISM-_kh=0.12
- Slide Modeler Version: 6.005

General Settings

- Units of Measurement: Metric Units
- Time Units: days
- Permeability Units: meters/second
- Failure Direction: Right to Left
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Bishop simplified

- Number of slices: 25
- Tolerance: 0.005
- Maximum number of iterations: 50
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 9.81 kN/m3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Auto Refine Search
- Divisions along slope: 10
- Circles per division: 10
- Number of iterations: 10
- Divisions to use in next iteration: 50%
- Composite Surfaces: Disabled
- Minimum Elevation: Not Defined
- Minimum Depth: 3

Loading

- Seismic Load Coefficient (Horizontal): 0.12
- Seismic Load Coefficient (Vertical): -0.06
- 2 Distributed Loads present

Distributed Load 1

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Distributed Load 2

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Material Properties

Property	Rilevato_rid	BASE
Color		
Strength Type	Mohr-Coulomb	Infinite strength
Unit Weight [kN/m3]	18	25
Cohesion [kPa]	0	
Friction Angle [deg]	29.3	
Water Surface	None	None
Ru Value	0	0

Support Properties

Geogrid Rt = 60 kN

- Support Type: GeoTextile
- Force Application: Passive
- Force Orientation: Bisector of Parallel and Tangent
- Anchorage: Slope Face
- Shear Strength Model: Linear
- Strip Coverage: 100 percent
- Tensile Strength: 30 kN/m
- Pullout Strength Adhesion: 0 kN/m2
- Pullout Strength Friction Angle: 29.3 degrees
- and Material Dependent

Global Minimums

Method: bishop simplified

- FS: 1.108020
- Center: 32.872, 47.786
- Radius: 38.018
- Left Slip Surface Endpoint: 28.842, 9.982
- Right Slip Surface Endpoint: 61.486, 22.754
- Resisting Moment=52546.5 kN-m
- Driving Moment=47423.8 kN-m

Valid / Invalid Surfaces

Method: bishop simplified

- Number of Valid Surfaces: 949
- Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.10802**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]
1	1.30577	11.5989	Rilevato_rid	0	29.3	4.4289	4.90731	8.74471	0	8.74471
2	1.30577	34.2653	Rilevato_rid	0	29.3	12.848	14.2358	25.3679	0	25.3679
3	1.30577	55.8721	Rilevato_rid	0	29.3	20.5806	22.8037	40.6357	0	40.6357
4	1.30577	69.6206	Rilevato_rid	0	29.3	25.2019	27.9242	49.7604	0	49.7604
5	1.30577	69.8286	Rilevato_rid	0	29.3	24.8474	27.5314	49.0604	0	49.0604
6	1.30577	83.0184	Rilevato_rid	0	29.3	29.0445	32.1819	57.3474	0	57.3474
7	1.30577	100.39	Rilevato_rid	0	29.3	34.5367	38.2674	68.1916	0	68.1916
8	1.30577	116.684	Rilevato_rid	0	29.3	39.4765	43.7407	77.9453	0	77.9453
9	1.30577	131.886	Rilevato_rid	0	29.3	43.8798	48.6197	86.6396	0	86.6396
10	1.30577	145.976	Rilevato_rid	0	29.3	47.76	52.919	94.3007	0	94.3007
11	1.30577	155.946	Rilevato_rid	0	29.3	50.1671	55.5862	99.0533	0	99.0533
12	1.30577	149.436	Rilevato_rid	0	29.3	47.2584	52.3632	93.3105	0	93.3105
13	1.30577	149.96	Rilevato_rid	0	29.3	46.6094	51.6442	92.0289	0	92.0289
14	1.30577	159.298	Rilevato_rid	0	29.3	48.6436	53.8981	96.0456	0	96.0456
15	1.30577	167.339	Rilevato_rid	0	29.3	50.1813	55.6019	99.0815	0	99.0815
16	1.30577	174.024	Rilevato_rid	0	29.3	51.2209	56.7538	101.134	0	101.134
17	1.30577	179.283	Rilevato_rid	0	29.3	51.7585	57.3494	102.195	0	102.195
18	1.30577	182.313	Rilevato_rid	0	29.3	51.5844	57.1566	101.852	0	101.852
19	1.30577	169.521	Rilevato_rid	0	29.3	46.9632	52.0362	92.7274	0	92.7274
20	1.30577	149.465	Rilevato_rid	0	29.3	40.4946	44.8688	79.9551	0	79.9551
21	1.30577	127.532	Rilevato_rid	0	29.3	34.9389	38.713	68.9859	0	68.9859
22	1.30577	103.541	Rilevato_rid	0	29.3	28.1388	31.1783	55.5591	0	55.5591
23	1.30577	77.2707	Rilevato_rid	0	29.3	20.7799	23.0245	41.0292	0	41.0292
24	1.30577	48.4363	Rilevato_rid	0	29.3	13.1396	14.5589	25.9437	0	25.9437
25	1.30577	16.6692	Rilevato_rid	0	29.3	5.22787	5.79259	10.3223	0	10.3223

List Of Coordinates

Line Load

X	Y
68.45	22.7539
78.2	22.7539

Line Load

X	Y
55.2	22.7539
56.6	22.7539
64.95	22.7539

External Boundary

X	Y
0	0
128.15	0.00392569
128.15	9.75393
103.9	9.75393
101.1	11.6206
99.4	12.7539
97.4	12.7539
95.9	13.7539
92.9	15.7539
89.9	17.7539
87.9	17.7539
85.05	19.6539
82.7	21.2206
80.4	22.7539
78.2	22.7539
68.45	22.7539
64.95	22.7539
56.6	22.7539
55.2	22.7539
52	22.7539
49.6	21.1539
47.5	19.7539
44.5	17.7539
42.5	17.7539
39.1	15.4873
36.05	13.4539
35	12.7539
33	12.7539
31.05	11.4539
28.5	9.75393
0	9.75393

Material Boundary

X	Y
55.2	22.4459
55.2	22.7539

Material Boundary

X	Y
56.6	22.4459
56.6	22.7539

Material Boundary

X	Y
49.6	21.1539
59.6	21.1539

Material Boundary

X	Y
47.5	19.7539
57.5	19.7539

Material Boundary

X	Y
72.7	21.2206
82.7	21.2206

Material Boundary

X	Y
75.05	19.6539
85.05	19.6539

Material Boundary

X	Y
39.1	15.4873
51.1	15.4873

Material Boundary

X	Y
80.9	15.7539
92.9	15.7539

Material Boundary

X	Y
36.05	13.4539
48.05	13.4539

Material Boundary

X	Y
83.9	13.7539
95.9	13.7539

Material Boundary

X	Y
31.05	11.4539
43.05	11.4539

Material Boundary

X	Y
88.1	11.6206
101.1	11.6206

Material Boundary

X	Y
28.5	9.75393
103.9	9.75393

Material Boundary

X	Y
64.95	22.4459
64.95	22.7539

Material Boundary

X	Y
68.45	22.4459
68.45	22.7539

Material Boundary

X	Y
78.2	22.4459
78.2	22.7539

Sezione Tipo 6 – Altezza rilevato h_{ril} = 13.1 m ÷ 13 m, altezza di calcolo h_{ril} = 14.5 m

Sezione corrente – condizioni sismiche, analisi in tensioni efficaci: $(R_d / F_d)_{min}$ = 1.121 > 1.1 (sisma verso l'alto ↑)

Slide Analysis Information

Project Summary

- File Name: RIL H=14m_pend=2su3_L1=13 L2=12 L3=10_Rt=60 kN_NTC08_SISM-_kh=0.12
- Slide Modeler Version: 6.005

General Settings

- Units of Measurement: Metric Units
- Time Units: days
- Permeability Units: meters/second
- Failure Direction: Right to Left
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Bishop simplified

- Number of slices: 25
- Tolerance: 0.005
- Maximum number of iterations: 50
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 9.81 kN/m3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Auto Refine Search
- Divisions along slope: 10
- Circles per division: 10
- Number of iterations: 10
- Divisions to use in next iteration: 50%
- Composite Surfaces: Disabled
- Minimum Elevation: Not Defined
- Minimum Depth: 1

Loading

- Seismic Load Coefficient (Horizontal): 0.11
- Seismic Load Coefficient (Vertical): -0.055
- 2 Distributed Loads present

Distributed Load 1

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Distributed Load 2

- Distribution: Constant
- Magnitude [kN/m2]: 4
- Orientation: Vertical

Material Properties

Property	Rilevato_rid	BASE
Color		
Strength Type	Mohr-Coulomb	Infinite strength
Unit Weight [kN/m3]	18	25
Cohesion [kPa]	0	
Friction Angle [deg]	29.3	
Water Surface	None	None
Ru Value	0	0

Support Properties

Geogrid Rt = 60 kN

- Support Type: GeoTextile
- Force Application: Passive
- Force Orientation: Bisector of Parallel and Tangent
- Anchorage: Slope Face

- Shear Strength Model: Linear
- Strip Coverage: 100 percent
- Tensile Strength: 30 kN/m
- Pullout Strength Adhesion: 0 kN/m2
- Pullout Strength Friction Angle: 29.3 degrees
- and Material Dependent

Global Minimums

Method: bishop simplified

- FS: 1.120910
- Center: 30.107, 48.467
- Radius: 39.697
- Left Slip Surface Endpoint: 27.190, 8.877
- Right Slip Surface Endpoint: 60.348, 22.750
- Resisting Moment=57746.1 kN-m
- Driving Moment=51517.4 kN-m

Valid / Invalid Surfaces

Method: bishop simplified

- Number of Valid Surfaces: 1039
- Number of Invalid Surfaces: 0

Slice Data

- **Global Minimum Query (bishop simplified) - Safety Factor: 1.12091**

Slice Number	Width [m]	Weight [kN]	Base Material	Base Cohesion [kPa]	Base Friction Angle [degrees]	Shear Stress [kPa]	Shear Strength [kPa]	Base Normal Stress [kPa]	Pore Pressure [kPa]	Effective Normal Stress [kPa]
1	1.32633	11.4554	Rilevato_rid	0	29.3	4.20591	4.71445	8.40102	0	8.40102
2	1.32633	33.8357	Rilevato_rid	0	29.3	12.2122	13.6888	24.3932	0	24.3932
3	1.32633	55.1565	Rilevato_rid	0	29.3	19.5761	21.9431	39.1021	0	39.1021
4	1.32633	75.4185	Rilevato_rid	0	29.3	26.3289	29.5123	52.5902	0	52.5902
5	1.32633	90.5661	Rilevato_rid	0	29.3	31.1049	34.8658	62.1302	0	62.1302
6	1.32633	89.2472	Rilevato_rid	0	29.3	30.1598	33.8064	60.2423	0	60.2423
7	1.32633	97.9727	Rilevato_rid	0	29.3	32.5794	36.5186	65.0754	0	65.0754
8	1.32633	113.934	Rilevato_rid	0	29.3	37.2826	41.7904	74.4698	0	74.4698
9	1.32633	128.785	Rilevato_rid	0	29.3	41.4682	46.4821	82.8303	0	82.8303
10	1.32633	142.502	Rilevato_rid	0	29.3	45.1469	50.6056	90.1782	0	90.1782
11	1.32633	155.058	Rilevato_rid	0	29.3	46.9411	52.6167	93.7621	0	93.7621
12	1.32633	164.216	Rilevato_rid	0	29.3	50.3384	56.4248	100.547	0	100.547
13	1.32633	156.346	Rilevato_rid	0	29.3	47.1231	52.8207	94.1253	0	94.1253
14	1.32633	153.593	Rilevato_rid	0	29.3	45.5001	51.0015	90.8835	0	90.8835
15	1.32633	161.08	Rilevato_rid	0	29.3	46.8786	52.5467	93.6368	0	93.6368
16	1.32633	167.195	Rilevato_rid	0	29.3	47.7753	53.5518	95.4282	0	95.4282
17	1.32633	171.836	Rilevato_rid	0	29.3	48.177	54.0021	96.2305	0	96.2305
18	1.32633	174.913	Rilevato_rid	0	29.3	48.0765	53.8894	96.0294	0	96.0294
19	1.32633	175.405	Rilevato_rid	0	29.3	47.2173	52.9263	94.3137	0	94.3137
20	1.32633	159.158	Rilevato_rid	0	29.3	41.9094	46.9767	83.7118	0	83.7118

21	1.32633	135.701	Rilevato_rid	0	29.3	34.9023	39.1223	69.715	0	69.715
22	1.32633	110.099	Rilevato_rid	0	29.3	28.8508	32.3391	57.6275	0	57.6275
23	1.32633	82.1153	Rilevato_rid	0	29.3	21.4017	23.9894	42.7485	0	42.7485
24	1.32633	51.4464	Rilevato_rid	0	29.3	11.0362	12.3706	22.0442	0	22.0442
25	1.32633	17.6992	Rilevato_rid	0	29.3	5.33241	5.97715	10.6511	0	10.6511

List Of Coordinates

Line Load

X	Y
55.2	22.75
56.6	22.75
64.95	22.75

Line Load

X	Y
68.45	22.75
78.2	22.75

External Boundary

X	Y
0	0
128.15	0
128.15	8.75
105.5	8.75
103.5	10.0615
101.109	11.6297
99.4	12.75
97.4	12.75
95.9	13.75
92.9	15.75
89.9	17.75
87.9	17.75
85.05	19.65
82.7	21.2167
80.4	22.75
78.2	22.75
68.45	22.75
64.95	22.75
56.6	22.75
55.2	22.75
52	22.75
49.6	21.15
47.5	19.75
44.5	17.75
42.5	17.75
39.1	15.4833
36.05	13.45
35	12.75
33	12.75
31.05	11.45
29.25	10.25
27	8.75
0	8.75

Material Boundary

X	Y
55.2	22.442
55.2	22.75

Material Boundary

X	Y
56.6	22.442
56.6	22.75

Material Boundary

X	Y
49.6	21.15
59.6	21.15

Material Boundary

X	Y
47.5	19.75
57.5	19.75

Material Boundary

X	Y
72.7	21.2167
82.7	21.2167

Material Boundary

X	Y
75.05	19.65
85.05	19.65

Material Boundary

X	Y
39.1	15.4833
50.1	15.4833

Material Boundary

X	Y
80.9	15.75
92.9	15.75

Material Boundary

X	Y
36.05	13.45
47.05	13.45

Material Boundary

X	Y
83.9	13.75
95.9	13.75

Material Boundary

X	Y
31.05	11.45
42.05	11.45

Material Boundary

X	Y
88.109	11.6167
101.109	11.6297

Material Boundary

X	Y
29.25	10.25
40.25	10.25

Material Boundary

X	Y
90.5	10.0615
103.5	10.0615

Material Boundary

X	Y
27	8.75
105.5	8.75

Material Boundary

X	Y
64.95	22.442
64.95	22.75

Material Boundary

X	Y
68.45	22.442
68.45	22.75

Material Boundary

X	Y
78.2	22.442
78.2	22.75