



*Discarica di rifiuti non pericolosi  
Baricella (Bo)*

Valutazione di impatto ambientale

L.R. 9 del 18 maggio 1999 e s.m.i.

**Documentazione Integrativa[I3]**

**PROGETTO ESECUTIVO**  
Progetto di ampliamento



**ELABORATO 2**

Tabulati di calcolo verifiche di stabilità

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<b>Redatto</b>	V. Bretti – L. Manzone		
<b>Rev.</b>	00	<b>Data</b>	15/11/2017
<b>Cod. Doc.</b>	DS 02 BO VA 01 I3 RG 02.00	<b>Pagine</b>	



# Slide Analysis Information

## HERA - Discarica di Baricella

### Project Summary

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File Name: UNDRAINED-SEISMIC\_UP\_sez\_1\_100\_anni\_taglione\_NoOptim.slim  
 Slide Modeler Version: 6.039  
 Project Title: HERA - Discarica di Baricella  
 Analysis: Sisma verso l'alto  
 Author: Cesare Castiglia  
 Company: Golder Associates  
 Date Created: 10/07/2015, 11:47:59

### General Settings

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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

### Design Standard

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Selected Type: Eurocode 7 (User Defined)  
 Name: NTC Opere in Terra

Type	Partial Factor
Permanent Actions: Unfavourable	1
Permanent Actions: Favourable	1
Variable Actions: Unfavourable	1.3
Variable Actions: Favourable	0
Effective cohesion	1.25
Coefficient of shearing resistance	1.25
Undrained strength	1.4
Weight density	1
Shear strength (other models)	1.25
Earth resistance	1
Tensile and plate strength	1.1
Shear strength	1.1
Compressive strength	1.1
Bond strength	1.1
Seismic Coefficient	1

### Analysis Options

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#### Analysis Methods Used

GLE/Morgenstern-Price with interslice force function: Half Sine

Number of slices: 30  
 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/m<sup>3</sup>  
 Advanced Groundwater Method: Excess Pore Pressure

## 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: 20  
 Circles per division: 10  
 Number of iterations: 10  
 Divisions to use in next iteration: 50%  
 Composite Surfaces: Disabled  
 Minimum Elevation: Not Defined  
 Minimum Depth: Not Defined








## Loading

Seismic Load Coefficient (Horizontal): 0.118  
 Seismic Load Coefficient (Vertical): -0.059

## Material Properties

Property	1	2A	2B	3sup	4	5	3inf	Rifiuti
Color								
Strength Type	Undrained	Undrained	Undrained	Undrained	Mohr-Coulomb	Mohr-Coulomb	Undrained	Undrained
Unit Weight [kN/m <sup>3</sup> ]	18	18	19	19	19.5	18.5	19	17
Cohesion [kPa]					0	0		
Friction Angle [deg]					30	26		
Cohesion Type	60	80						110
Cohesion Type			Function Of Depth					
Cohesion (Top) [kPa]			30					
Cohesion Change [kPa/m]			5.7					
				Function			Function	

Cohesion Type				Of Depth Below a Datum				Of Depth Below a Datum	
Cohesion (Top) [kPa]				100				50	
Cohesion Change [kPa/m]				7				7	
Water Surface	None	None	None	None	None	None	None	None	None
Ru Value	0	0	0	0	0	0	0	0	0.05
Material Weight Causes Excess Pore Pressure									
B_bar value	0	0	0	0	0	0	0	0	0

Property	Copertura	Argilla per argini	Ghiaia	Scorie per argini	2B - Argini	2B - Versante	2B - Top
Color							
Strength Type	Mohr-Coulomb	Undrained	Mohr-Coulomb	Mohr-Coulomb	Undrained	Undrained	Undrained
Unit Weight [kN/m3]	19	18	15	20	19	19	19
Cohesion [kPa]	8		0	0			
Friction Angle [deg]	18		35	42			
Cohesion Type		70					
Cohesion Type					Function Of Depth Below a Datum	Function Of Depth Below a Datum	Function Of Depth Below a Datum
Cohesion (Top) [kPa]					40	57	102
Cohesion Change [kPa/m]					5.7	5.7	5.7
Water Surface	None	None	None	None	None	None	None
Ru Value	0	0	0	0	0	0	0
Material Weight Causes Excess Pore Pressure							
B_bar value	0	0	0	0	0	0	0

## Global Minimums

### Method: gle/morgenstern-price

FS: 1.190100  
 Center: 107.833, 44.986  
 Radius: 44.494  
 Left Slip Surface Endpoint: 83.863, 7.500  
 Right Slip Surface Endpoint: 146.111, 22.303  
 Resisting Moment=183336 kN-m  
 Driving Moment=154050 kN-m  
 Resisting Horizontal Force=3520.23 kN  
 Driving Horizontal Force=2957.92 kN  
 Total Slice Area=619.124 m2

## Valid / Invalid Surfaces

### Method: gle/morgenstern-price

Number of Valid Surfaces: 8044  
 Number of Invalid Surfaces: 0

### Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.1901

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	1.64088	14.7679	1	42.8571	0	36.0113	42.8571	31.3571	0	31.3571
2	2.80195	88.1264	2A	57.1429	0	48.0152	57.1429	59.5147	0	59.5147
3	2.80195	157.359	2A	57.1429	0	48.0152	57.1429	82.8006	0	82.8006
4	2.01198	150.153	2B - Argini	31.1179	0	26.1473	31.1179	89.4879	0	89.4879
5	2.01198	184.507	2B - Argini	33.9918	0	28.5621	33.9918	106.6	0	106.6
6	2.01198	241.448	2B - Argini	36.4347	0	30.6148	36.4347	133.773	0	133.773
7	2.45448	369.085	2B - Versante	50.7816	0	42.67	50.7816	165.695	0	165.695
8	2.45448	438.33	2B - Versante	52.6667	0	44.254	52.6667	190.058	0	190.058
9	2.45448	460.344	2B - Versante	53.9781	0	45.3559	53.9781	194.845	0	194.845
10	2.45448	476.113	2B - Versante	54.7283	0	45.9863	54.7283	196.162	0	196.162
11	1.74258	376.102	2B - Versante	54.9643	0	46.1846	54.9643	211.644	0	211.644
12	2.11144	503.12	2B - Versante	54.7779	0	46.028	54.7779	227.307	0	227.307
13	2.11144	551.076	2B - Versante	54.1997	0	45.5421	54.1997	242.129	0	242.129
14	2.11144	566.227	2B - Versante	53.2078	0	44.7087	53.2078	242.65	0	242.65
15	2.11144	550.623	2B - Versante	51.7953	0	43.5218	51.7953	230.354	0	230.354
16	2.11144	556.211	2B - Versante	49.9521	0	41.973	49.9521	227.351	0	227.351
17	2.11144	579.958	2B - Versante	47.6644	0	40.0508	47.6644	232.363	0	232.363
18	2.11144	600.51	2B - Versante	44.9144	0	37.74	44.9144	236.717	0	236.717
19	2.17432	594.723	2A	57.1429	0	48.0152	57.1429	221.289	0	221.289
20	2.17432	562.421	2A	57.1429	0	48.0152	57.1429	204.544	0	204.544
21	1.43355	370.974	1	42.8571	0	36.0113	42.8571	205.944	0	205.944
22	1.74702	453.413	Argilla per argini	50	0	42.0133	50	202.731	0	202.731
23	0.799995	208.131	Ghiaia	0	29.2561	85.681	101.969	182.034	0	182.034
24	2.27629	557.134	Rifiuti	78.5714	0	66.0208	78.5714	174.572	12.2377	162.335
25	2.27629	489.663	Rifiuti	78.5714	0	66.0208	78.5714	144.254	10.7557	133.498
26	2.27629	405.651	Rifiuti	78.5714	0	66.0208	78.5714	106.576	8.91035	97.6656
27	2.27629	318.721	Rifiuti	78.5714	0	66.0208	78.5714	65.5194	7.00089	58.5185
28	2.27629	221.895	Rifiuti	78.5714	0	66.0208	78.5714	16.5407	4.87405	11.6666
29	2.27629	107.195	Rifiuti	78.5714	0	66.0208	78.5714	-47.1451	2.35459	-49.4997
30	0.640142	6.28761	Copertura	6.4	14.5708	5.4514	6.48771	0.337435	0	0.337435

### Interslice Data

**Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.1901**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	83.8627	7.5	0	0	0
2	85.5036	6.5	88.8439	1.46056	0.941836
3	88.3056	5.00535	302.251	13.3565	2.53026
4	91.1075	3.75458	522.1	37.0996	4.06452
5	93.1195	2.99453	625.129	55.9531	5.11471
6	95.1315	2.34281	730.431	78.18	6.10926
7	97.1434	1.79453	837.026	103.336	7.0379
8	99.5979	1.26013	987.001	139.911	8.06813
9	102.052	0.868524	1118.58	176.601	8.97178
10	104.507	0.615937	1225.06	210.202	9.73629
11	106.961	0.5	1304.76	238.329	10.3516
12	108.704	0.5	1341.05	253.236	10.6935
13	110.815	0.591557	1358.29	263.988	10.9985
14	112.927	0.784049	1343.04	265.476	11.1814
15	115.038	1.0788	1299.32	258.229	11.2406
16	117.15	1.4779	1234.53	243.892	11.1754
17	119.261	1.98424	1142.61	221.821	10.9865
18	121.373	2.60167	1015.47	191.426	10.6755
19	123.484	3.33513	850.86	153.789	10.2453
20	125.658	4.21831	689.89	117.701	9.68192
21	127.833	5.23983	519.226	82.255	9.0019
22	129.266	5.9942	371.838	55.5263	8.49318
23	131.013	7.00683	186.616	25.6038	7.81223
24	131.813	7.50683	139.745	18.3465	7.47933
25	134.09	9.06481	-47.3414	-5.36458	6.465
26	136.366	10.8449	-211.276	-19.8291	5.36173
27	138.642	12.8841	-325.836	-23.8363	4.18398
28	140.918	15.2357	-366.879	-18.8906	2.94756
29	143.195	17.9809	-287.835	-8.38952	1.66953
30	145.471	21.2563	4.56815	0.0293259	0.367813
31	146.111	22.3034	0	0	0

**List Of Coordinates**

**Water Table**

X	Y
110.833	8.51266
182.852	8.51266

**External Boundary**

X	Y
93.8489	7.5
89.5729	7.5
0	7.5
0	6.5
0	4.5

0	0.5
0	-5
0	-7
0	-10.5
0	-17
0	-29.78
182.852	-29.78
182.852	-17
182.852	-10.5
182.852	-7
182.852	-5
182.852	-0.5
182.852	1.8404
182.852	4.50683
182.852	5.99702
182.852	7.00683
182.852	7.50683
182.852	22.1176
182.852	23.0602
131.383	22
126.583	19
122.583	19
116.983	15.5
112.983	15.5
105.849	11
100.849	11
95.0031	8.07711

**Material Boundary**

X	Y
111.876	7.00683
109.849	5.99317
106.849	6
103.849	4.5
99.8489	4.5
95.8489	6.5
93.8489	7.5
112.849	7.50683
182.852	7.50683

**Material Boundary**

X	Y
134.349	21
138.149	18
125.549	18
130.149	14.5
115.949	14.5
120.549	11
106.349	11
111.949	14.5
115.949	14.5
121.549	18

125.549	18
130.349	21
134.349	21
182.852	22.1176

**Material Boundary**

X	Y
0	4.5
87.8631	3.78112
90.1116	3.76273
98.795	3.69168
99.0386	3.68969
121.396	3.50677
123.488	3.33881
142.152	1.8404
182.852	1.8404

**Material Boundary**

X	Y
0	0.5
82.5819	0.5
86.8489	0.5
94.6338	0.5
95.8489	0.5
118.484	0.5
120.561	0.412245
142.152	-0.5
182.852	-0.5

**Material Boundary**

X	Y
0	-5
73.7292	-5
81.3489	-5
87.463	-5
90.3489	-5
113.159	-5
115.149	-5
142.152	-5
182.852	-5

**Material Boundary**

X	Y
0	-7
142.152	-7
182.852	-7

**Material Boundary**

X	Y
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0	-10.5
142.152	-10.5
182.852	-10.5

**Material Boundary**

X	Y
0	-17
142.152	-17
182.852	-17

**Material Boundary**

X	Y
105.849	11
112.849	7.50683
113.851	7.00683

**Material Boundary**

X	Y
111.876	7.00683
113.851	7.00683
182.852	7.00683

**Material Boundary**

X	Y
109.849	5.99317
112.849	5.99333
182.852	5.99702

**Material Boundary**

X	Y
142.152	4.50683
182.852	4.50683

**Material Boundary**

X	Y
112.849	5.99333
125.508	5.35884
142.152	4.50683

**Material Boundary**

X	Y
0	6.5
92.2393	6.5
92.8489	6.5
95.8489	6.5

**Material Boundary**

X	Y
81.3489	-5
86.8489	0.5
90.1116	3.76273
92.8489	6.5
93.8489	7.5

**Material Boundary**

X	Y
90.3489	-5
95.8489	0.5
99.0386	3.68969
99.8489	4.5

**Material Boundary**

X	Y
115.149	-5
120.561	0.412245
123.488	3.33881
125.508	5.35884

**Material Boundary**

X	Y
105.849	11
106.349	11

# Slide Analysis Information

## HERA - Discarica di Baricella

### Project Summary

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File Name: UNDRAINED-SEISMIC\_DOWN\_sez\_1\_100\_anni\_taglione\_NoOptim.slim  
 Slide Modeler Version: 6.039  
 Project Title: HERA - Discarica di Baricella  
 Analysis: Sisma verso il basso  
 Author: Cesare Castiglia  
 Company: Golder Associates  
 Date Created: 10/07/2015, 11:47:59

### 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

### Design Standard

---

Selected Type: Eurocode 7 (User Defined)  
 Name: NTC Opere in Terra

Type	Partial Factor
Permanent Actions: Unfavourable	1
Permanent Actions: Favourable	1
Variable Actions: Unfavourable	1.3
Variable Actions: Favourable	0
Effective cohesion	1.25
Coefficient of shearing resistance	1.25
Undrained strength	1.4
Weight density	1
Shear strength (other models)	1.25
Earth resistance	1
Tensile and plate strength	1.1
Shear strength	1.1
Compressive strength	1.1
Bond strength	1.1
Seismic Coefficient	1

### Analysis Options

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#### Analysis Methods Used

GLE/Morgenstern-Price with interslice force function: Half Sine

Number of slices: 30  
 Tolerance: 0.01  
 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/m<sup>3</sup>  
 Advanced Groundwater Method: Excess Pore Pressure

## 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: 20  
 Circles per division: 10  
 Number of iterations: 10  
 Divisions to use in next iteration: 50%  
 Composite Surfaces: Disabled  
 Minimum Elevation: Not Defined  
 Minimum Depth: Not Defined








## Loading

Seismic Load Coefficient (Horizontal): 0.118  
 Seismic Load Coefficient (Vertical): 0.059

## Material Properties

Property	1	2A	2B	3sup	4	5	3inf	Rifiuti	
Color									
Strength Type	Undrained	Undrained	Undrained	Undrained	Mohr-Coulomb	Mohr-Coulomb	Undrained	Undrained	
Unit Weight [kN/m <sup>3</sup> ]	18	18	19	19	19.5	18.5	19	17	
Cohesion [kPa]					0	0			
Friction Angle [deg]					30	26			
Cohesion Type	60	80						110	
Cohesion Type			Function Of Depth						
Cohesion (Top) [kPa]			30						
Cohesion Change [kPa/m]			5.7						
			Function				Function		

Cohesion Type				Of Depth Below a Datum			Of Depth Below a Datum	
Cohesion (Top) [kPa]				100			50	
Cohesion Change [kPa/m]				7			7	
Water Surface	None	None	None	None	None	None	None	None
Ru Value	0	0	0	0	0	0	0	0.05
Material Weight Causes Excess Pore Pressure								
B_bar value	0	0	0	0	0	0	0	0

Property	Copertura	Argilla per argini	Ghiaia	Scorie per argini	2B - Argini	2B - Versante	2B - Top
Color							
Strength Type	Mohr-Coulomb	Undrained	Mohr-Coulomb	Mohr-Coulomb	Undrained	Undrained	Undrained
Unit Weight [kN/m3]	19	18	15	20	19	19	19
Cohesion [kPa]	8		0	0			
Friction Angle [deg]	18		35	42			
Cohesion Type		70					
Cohesion Type					Function Of Depth Below a Datum	Function Of Depth Below a Datum	Function Of Depth Below a Datum
Cohesion (Top) [kPa]					40	57	102
Cohesion Change [kPa/m]					5.7	5.7	5.7
Water Surface	None	None	None	None	None	None	None
Ru Value	0	0	0	0	0	0	0
Material Weight Causes Excess Pore Pressure							
B_bar value	0	0	0	0	0	0	0

## Global Minimums

### Method: gle/morgenstern-price

FS: 1.101170  
 Center: 108.011, 44.904  
 Radius: 44.357  
 Left Slip Surface Endpoint: 84.168, 7.500  
 Right Slip Surface Endpoint: 146.179, 22.305  
 Resisting Moment=183391 kN-m  
 Driving Moment=166542 kN-m  
 Resisting Horizontal Force=3516.62 kN  
 Driving Horizontal Force=3193.53 kN  
 Total Slice Area=617.099 m2

## Valid / Invalid Surfaces

### Method: gle/morgenstern-price

Number of Valid Surfaces: 8166  
 Number of Invalid Surfaces: 0

## Slice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.10117

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	1.64655	14.8189	1	42.8571	0	38.9196	42.8571	34.2458	0	34.2458
2	1.88071	51.2402	2A	57.1429	0	51.8929	57.1429	61.3034	0	61.3034
3	1.88071	84.0911	2A	57.1429	0	51.8929	57.1429	79.9801	0	79.9801
4	1.88071	113.222	2A	57.1429	0	51.8929	57.1429	96.6343	0	96.6343
5	1.92342	142.957	2B - Argini	31.053	0	28.2	31.053	100.134	0	100.134
6	1.92342	177.034	2B - Argini	33.7925	0	30.6878	33.7925	120.168	0	120.168
7	1.92342	230.351	2B - Argini	36.1368	0	32.8167	36.1368	150.307	0	150.307
8	2.38674	356.058	2B - Versante	50.4316	0	45.7982	50.4316	185.427	0	185.427
9	2.38674	422.217	2B - Versante	52.3081	0	47.5023	52.3081	212.71	0	212.71
10	2.38674	443.866	2B - Versante	53.6392	0	48.7111	53.6392	218.563	0	218.563
11	2.38674	457.671	2B - Versante	54.4369	0	49.4355	54.4369	219.717	0	219.717
12	2.38674	516.16	2B - Versante	54.7085	0	49.6822	54.7085	239.286	0	239.286
13	2.38674	582.293	2B - Versante	54.4563	0	49.4531	54.4563	260.946	0	260.946
14	2.38674	635.336	2B - Versante	53.678	0	48.7463	53.678	276.087	0	276.087
15	2.38674	629.848	2B - Versante	52.3667	0	47.5555	52.3667	266.218	0	266.218
16	2.38674	620.706	2B - Versante	50.5106	0	45.8699	50.5106	255.275	0	255.275
17	2.38674	649.659	2B - Versante	48.0921	0	43.6736	48.0921	260.771	0	260.771
18	2.38674	677.37	2B - Versante	45.0872	0	40.9448	45.0872	266.611	0	266.611
19	2.19211	599.723	2A	57.1429	0	51.8929	57.1429	249.713	0	249.713
20	2.19211	567.452	2A	57.1429	0	51.8929	57.1429	230.948	0	230.948
21	1.44355	374.132	1	42.8571	0	38.9196	42.8571	232.399	0	232.399
22	1.75372	456.044	Argilla per argini	50	0	45.4062	50	229.063	0	229.063
23	0.802611	209.024	Ghiaia	0	29.2561	102.881	113.29	202.244	0	202.244
24	2.27913	557.922	Rifiuti	78.5714	0	71.3527	78.5714	197.764	12.2398	185.524
25	2.27913	490.174	Rifiuti	78.5714	0	71.3527	78.5714	163.898	10.7535	153.144
26	2.27913	406.139	Rifiuti	78.5714	0	71.3527	78.5714	121.983	8.90996	113.073
27	2.27913	319.36	Rifiuti	78.5714	0	71.3527	78.5714	76.4568	7.00618	69.4506
28	2.27913	222.376	Rifiuti	78.5714	0	71.3527	78.5714	22.0143	4.87853	17.1358
29	2.27913	107.409	Rifiuti	78.5714	0	71.3527	78.5714	-48.8959	2.35637	-51.2522
30	0.63958	6.28107	Copertura	6.4	14.5708	5.96455	6.56798	0.646237	0	0.646237

## Interslice Data

**Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.10117**

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	84.1676	7.5	0	0	0
2	85.8142	6.5	96.7578	1.66666	0.986826
3	87.6949	5.47276	251.55	9.24353	2.10446
4	89.5756	4.5592	412.561	23.0762	3.20145
5	91.4563	3.75172	575.096	42.9106	4.2672
6	93.3798	3.02926	684.961	63.7137	5.31425
7	95.3032	2.40602	798.154	88.227	6.3078
8	97.2266	1.87768	913.681	116.047	7.2384
9	99.6133	1.3489	1079.33	157.321	8.29292
10	102	0.955894	1226.79	199.204	9.22309
11	104.387	0.69504	1348.01	238.095	10.0167
12	106.774	0.564005	1441.11	271.356	10.6637
13	109.16	0.561638	1499.68	295.76	11.1564
14	111.547	0.68792	1516.38	308.211	11.4891
15	113.934	0.943959	1487.38	306.887	11.6581
16	116.321	1.33204	1423.56	293.802	11.6613
17	118.707	1.85574	1326.42	269.833	11.4987
18	121.094	2.52008	1181.04	233.261	11.1724
19	123.481	3.3318	982.695	185.429	10.6857
20	125.673	4.21471	805.524	143.521	10.1024
21	127.865	5.23818	616.269	101.963	9.3946
22	129.308	5.9942	452.76	70.6096	8.86409
23	131.062	7.00683	246.843	35.3719	8.15481
24	131.865	7.50683	203.859	27.9534	7.80778
25	134.144	9.0624	-6.53971	-0.774197	6.75148
26	136.423	10.8408	-192.781	-18.906	5.60108
27	138.702	12.8791	-326.269	-24.9433	4.37176
28	140.981	15.2308	-380.684	-20.4855	3.08025
29	143.26	17.9779	-304.328	-9.2691	1.74455
30	145.54	21.2578	6.44666	0.0431761	0.383729
31	146.179	22.3048	0	0	0

**List Of Coordinates**

**Water Table**

X	Y
110.833	8.51266
182.852	8.51266

**External Boundary**

X	Y
93.8489	7.5
89.5729	7.5
0	7.5
0	6.5
0	4.5
0	0.5

0	-5
0	-7
0	-10.5
0	-17
0	-29.78
182.852	-29.78
182.852	-17
182.852	-10.5
182.852	-7
182.852	-5
182.852	-0.5
182.852	1.8404
182.852	4.50683
182.852	5.99702
182.852	7.00683
182.852	7.50683
182.852	22.1176
182.852	23.0602
131.383	22
126.583	19
122.583	19
116.983	15.5
112.983	15.5
105.849	11
100.849	11
95.0031	8.07711

**Material Boundary**

X	Y
111.876	7.00683
109.849	5.99317
106.849	6
103.849	4.5
99.8489	4.5
95.8489	6.5
93.8489	7.5
112.849	7.50683
182.852	7.50683

**Material Boundary**

X	Y
134.349	21
138.149	18
125.549	18
130.149	14.5
115.949	14.5
120.549	11
106.349	11
111.949	14.5
115.949	14.5
121.549	18
125.549	18



130.349	21
134.349	21
182.852	22.1176

**Material Boundary**

X	Y
0	4.5
87.8631	3.78112
90.1116	3.76273
98.795	3.69168
99.0386	3.68969
121.396	3.50677
123.488	3.33881
142.152	1.8404
182.852	1.8404

**Material Boundary**

X	Y
0	0.5
82.5819	0.5
86.8489	0.5
94.6338	0.5
95.8489	0.5
118.484	0.5
120.561	0.412245
142.152	-0.5
182.852	-0.5

**Material Boundary**

X	Y
0	-5
73.7292	-5
81.3489	-5
87.463	-5
90.3489	-5
113.159	-5
115.149	-5
142.152	-5
182.852	-5

**Material Boundary**

X	Y
0	-7
142.152	-7
182.852	-7

**Material Boundary**

X	Y
0	-10.5

142.152	-10.5
182.852	-10.5

**Material Boundary**

X	Y
0	-17
142.152	-17
182.852	-17

**Material Boundary**

X	Y
105.849	11
112.849	7.50683
113.851	7.00683

**Material Boundary**

X	Y
111.876	7.00683
113.851	7.00683
182.852	7.00683

**Material Boundary**

X	Y
109.849	5.99317
112.849	5.99333
182.852	5.99702

**Material Boundary**

X	Y
142.152	4.50683
182.852	4.50683

**Material Boundary**

X	Y
112.849	5.99333
125.508	5.35884
142.152	4.50683

**Material Boundary**

X	Y
0	6.5
92.2393	6.5
92.8489	6.5
95.8489	6.5

**Material Boundary**

X	Y
81.3489	-5
86.8489	0.5
90.1116	3.76273
92.8489	6.5
93.8489	7.5

**Material Boundary**

X	Y
90.3489	-5
95.8489	0.5
99.0386	3.68969
99.8489	4.5

**Material Boundary**

X	Y
115.149	-5
120.561	0.412245
123.488	3.33881
125.508	5.35884

**Material Boundary**

X	Y
105.849	11
106.349	11

## Slide Analysis Information

### HERA - Discarica di Baricella

#### Project Summary

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File Name: DELTAU\_sez\_1\_chiusura\_taglione.slim  
 Slide Modeler Version: 6.039  
 Project Title: HERA - Discarica di Baricella  
 Analysis: Profilo di Abbandono - Statica  
 Author: Cesare Castiglia  
 Company: Golder Associates  
 Date Created: 10/07/2015, 11:47:59

#### General Settings

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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

#### Design Standard

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Selected Type: Eurocode 7 (User Defined)  
 Name: NTC Opere in Terra

Type	Partial Factor
Permanent Actions: Unfavourable	1
Permanent Actions: Favourable	1
Variable Actions: Unfavourable	1.3
Variable Actions: Favourable	0
Effective cohesion	1.25
Coefficient of shearing resistance	1.25
Undrained strength	1.4
Weight density	1
Shear strength (other models)	1.25
Earth resistance	1
Tensile and plate strength	1.1
Shear strength	1.1
Compressive strength	1.1
Bond strength	1.1
Seismic Coefficient	1

#### Analysis Options

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##### Analysis Methods Used

GLE/Morgenstern-Price with interslice force function: Half Sine

Number of slices: 34  
 Tolerance: 0.005  
 Maximum number of iterations: 50  
 Check  $\alpha < 0.2$ : Yes  
 Initial trial value of FS: 1  
 Steffensen Iteration: Yes

#### Groundwater Analysis

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Groundwater Method: Grid (Pore Pressure)  
 Pore Fluid Unit Weight: 9.81 kN/m<sup>3</sup>  
 Grid Interpolation: Modified Chugh  
 Advanced Groundwater Method: None

### Random Numbers

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

### Surface Options

Search Method: Auto Refine Search  
 Divisions along slope: 15  
 Circles per division: 15  
 Number of iterations: 20  
 Divisions to use in next iteration: 50%  
 Number of vertices per surface: 17  
 Minimum Elevation: Not Defined  
 Minimum Depth: Not Defined

### Loading

4 Distributed Loads present

#### Distributed Load 1

Distribution: Constant  
 Magnitude [kPa]: 20  
 Orientation: Vertical  
 Load Action: Variable

#### Distributed Load 2

Distribution: Constant  
 Magnitude [kPa]: 20  
 Orientation: Vertical  
 Load Action: Variable









#### Distributed Load 3

Distribution: Constant  
 Magnitude [kPa]: 20  
 Orientation: Vertical  
 Load Action: Variable





#### Distributed Load 4

Distribution: Constant  
 Magnitude [kPa]: 20  
 Orientation: Vertical  
 Load Action: Variable

### Material Properties

Property	1	2A	2B	3sup	4	5	3inf	Rifiuti
Color								
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m <sup>3</sup> ]	18	18	19	19	19.5	18.5	19	17
Cohesion [kPa]	7	6	7	10	0	0	0	10
Friction								

Angle [deg]									
Water Surface	None	None	None	None	None	None	None	None	None
Grid (Pore Pressure)	On	On	On	On	On	On	On	On	Off
Ru Value									0.1

Property	Copertura	Argilla per argini	Ghiaia	Scorie per argini
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [kN/m3]	19	18	15	20
Cohesion [kPa]	8	10	0	0
Friction Angle [deg]	18	22	35	42
Water Surface	None	None	None	None
Grid (Pore Pressure)	On	On	On	On

## Global Minimums

### Method: gle/morgenstern-price

FS: 1.297810  
 Axis Location: 102.541, 39.520  
 Left Slip Surface Endpoint: 88.136, 7.500  
 Right Slip Surface Endpoint: 131.385, 19.500  
 Resisting Moment=60113.2 kN-m  
 Driving Moment=46319.1 kN-m  
 Resisting Horizontal Force=1543.92 kN  
 Driving Horizontal Force=1189.64 kN  
 Total Slice Area=236.568 m2

## Global Minimum Coordinates

### Method: gle/morgenstern-price

X	Y
88.1363	7.5
90.8394	6.41639
93.5424	5.58176
96.2455	4.97805
98.9485	4.59329
101.652	4.42027
104.355	4.45586
107.058	4.7007
109.761	5.15926
112.464	5.84027
115.167	6.7576
117.87	7.93184
120.573	9.393
123.276	11.1854
125.979	13.3772
128.682	16.0801
131.385	19.5

## Valid / Invalid Surfaces

### Method: gle/morgenstern-price

Number of Valid Surfaces: 15887  
 Number of Invalid Surfaces: 15613

#### Error Codes:

Error Code -105 reported for 3505 surfaces  
 Error Code -106 reported for 4865 surfaces  
 Error Code -108 reported for 2874 surfaces  
 Error Code -111 reported for 30 surfaces  
 Error Code -112 reported for 3 surfaces  
 Error Code -116 reported for 195 surfaces  
 Error Code -123 reported for 4115 surfaces  
 Error Code -1000 reported for 26 surfaces

**Error Codes**

The following errors were encountered during the computation:

- 105 = More than two surface / slope intersections with no valid slip surface.
- 106 = Average slice width is less than 0.0001 \* (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
- 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).
- 111 = safety factor equation did not converge
- 112 = The coefficient  $M\text{-}\alpha = \cos(\alpha)(1 + \tan(\alpha)\tan(\phi)/F) < 0.2$  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.
- 116 = Not enough slices to analyze the surface Increase the number of slices in the job control in the modeler.
- 123 = Surface radius equal or less than the internal cutoff of 0.01.
- 1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

**Slice Data**

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.29781

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	2.49449	22.4504	1	5.6	14.5708	6.80386	8.83012	12.4266	0	12.4266
2	0.208555	3.91091	2A	4.8	14.5708	8.50736	11.0409	24.0096	0	24.0096
3	2.70304	73.027	2A	4.8	14.5708	10.4256	13.5305	33.5871	0	33.5871
4	1.35152	55.2516	2A	4.8	14.5708	13.6404	17.7027	49.6379	0	49.6379
5	1.35152	78.6117	2A	4.8	14.5708	17.8641	23.1842	70.726	0	70.726
6	1.35152	101.063	2A	4.8	14.5708	21.3223	27.6723	87.9921	0	87.9921
7	1.35152	122.183	2A	4.8	14.5708	25.1293	32.613	107	0	107
8	0.818642	83.8064	2A	4.8	14.5708	27.1087	35.1819	116.882	0	116.882
9	0.638785	70.1198	Argilla per argini	8	17.9119	38.1628	49.5281	128.482	0	128.482
10	1.24561	145.797	2B	5.6	17.9119	38.389	49.8216	136.815	0	136.815
11	2.70304	319.437	2B	5.6	17.9119	39.7416	51.5771	142.247	0	142.247
12	0.495885	58.2228	2B	5.6	17.9119	42.303	54.9013	152.531	0	152.531
13	2.20716	262.918	2A	4.8	14.5708	31.2018	40.494	137.318	0	137.318
14	1.35152	181.169	2A	4.8	14.5708	30.4004	39.4539	133.317	0	133.317
15	1.35152	197.799	2A	4.8	14.5708	32.567	42.2658	144.134	0	144.134
16	2.70304	432.289	2A	4.8	14.5708	35.3509	45.8787	158.034	0	158.034
17	1.94398	297.221	2A	4.8	14.5708	35.3072	45.822	157.816	0	157.816
18	0.759062	108.562	1	5.6	14.5708	33.9936	44.1172	148.179	0	148.179
19	1.79245	250.376	1	5.6	14.5708	28.2548	36.6693	119.527	0	119.527
20	0.910593	130.466	Argilla per argini	8	17.9119	35.5023	46.0753	117.8	0	117.8
21	0.674681	97.8598	Argilla per argini	8	17.9119	34.382	44.6213	113.301	0	113.301
22	1.03761	153.057	Ghiaia	0	29.2561	49.472	64.2052	114.618	0	114.618
23	0.99075	142.045	Rifiuti	8	20.4579	40.4052	52.4383	133.46	14.3371	119.123
24	1.35152	177.321	Rifiuti	8	20.4579	36.2384	47.0305	117.746	13.1201	104.626
25	1.35152	155.936	Rifiuti	8	20.4579	33.3885	43.3319	106.25	11.5378	94.7118
26	2.70304	272.141	Rifiuti	8	20.4579	24.1401	31.3293	72.6054	10.068	62.5374
27	0.122792	11.7821	Rifiuti	8	20.4579	21.995	28.5453	64.6693	9.59523	55.0741
28	0.0181556	1.73343	Scorie per argini	0	35.7661	31.5489	40.9445	56.8418	0	56.8418
29	2.482	213.13	Rifiuti	8	20.4579	23.1718	30.0726	67.7555	8.587	59.1685

30	0.0800914	5.46216	Scorie per arigini	0	35.7661	32.442	42.1035	58.4509	0	58.4509
31	1.76529	79.4947	Scorie per arigini	0	35.7661	22.4272	29.1063	40.4071	0	40.4071
32	0.147374	3.06794	Rifiuti	8	20.4579	13.7763	17.879	28.5637	2.08174	26.482
33	0.435119	6.05223	Scorie per arigini	0	35.7661	12.8618	16.6922	23.1733	0	23.1733
34	0.355264	1.51701	Copertura	6.4	14.5708	8.74805	11.3533	19.0559	0	19.0559

### Interslice Data

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.29781

Slice Number	X coordinate [m]	Y coordinate - Bottom [m]	Interslice Normal Force [kN]	Interslice Shear Force [kN]	Interslice Force Angle [degrees]
1	88.1363	7.5	0	0	0
2	90.6308	6.5	29.428	1.73116	3.36666
3	90.8394	6.41639	33.2127	2.11513	3.64392
4	93.5424	5.58176	89.475	11.1774	7.12062
5	94.8939	5.27991	122.926	18.9159	8.74808
6	96.2455	4.97805	168.46	30.5515	10.2793
7	97.597	4.78567	214.255	44.3698	11.6999
8	98.9485	4.59329	268.861	62.0599	12.9977
9	99.7671	4.54089	297.217	72.561	13.7195
10	100.406	4.5	326.89	83.0051	14.2476
11	101.652	4.42027	385.699	104.687	15.1855
12	104.355	4.45586	488.245	147.248	16.7826
13	104.85	4.50078	502.407	153.681	17.0083
14	107.058	4.7007	543.94	174.15	17.7532
15	108.409	4.92998	554.531	180.147	17.9971
16	109.761	5.15926	565.574	184.624	18.0786
17	112.464	5.84027	553.671	177.265	17.7531
18	114.408	6.5	518.31	159.646	17.1195
19	115.167	6.7576	505.986	152.599	16.7826
20	116.959	7.53626	463.648	131.126	15.7916
21	117.87	7.93184	449.433	121.986	15.1855
22	118.544	8.29654	431.349	113.104	14.6928
23	119.582	8.85744	418.481	103.292	13.865
24	120.573	9.393	387.106	89.3536	12.9976
25	121.924	10.2892	330.64	68.4718	11.6999
26	123.276	11.1854	280.62	50.8926	10.2793
27	125.979	13.3772	186.85	23.3415	7.12056
28	126.102	13.5	181.615	22.1981	6.96848
29	126.12	13.5182	181.157	22.0698	6.94594
30	128.602	16	70.6096	4.62818	3.75015
31	128.682	16.0801	68.5313	4.36438	3.64393
32	130.447	18.3135	17.9423	0.398663	1.27286
33	130.595	18.5	14.6501	0.274419	1.07311
34	131.03	19.0505	7.49892	0.0631651	0.482604
35	131.385	19.5	0	0	0

### List Of Coordinates

#### Distributed Load

X	Y
100.849	11
103.429	11
105.849	11



**Distributed Load**

X	Y
111.449	14.5
113.001	14.5
115.449	14.5

**Distributed Load**

X	Y
119.449	17
123.449	17

**Distributed Load**

X	Y
127.449	19.5
131.449	19.5

**External Boundary**

X	Y
93.8489	7.5
0	7.5
0	6.5
0	4.5
0	0.5
0	-5
0	-7
0	-10.5
0	-17
0	-92.6319
328.518	-92.6319
328.518	-17
328.518	-10.5
328.518	-7
328.518	-5
328.518	0.5
328.518	4.5
328.518	6.5
328.518	7.5
328.518	8.12654
328.518	9.09829
328.518	9.59829
328.518	24.4686
328.518	25.364
326.015	25.3639
315.4	25.3633
301.015	25.3624
290.328	25.3618
276.014	25.361
265.257	25.3604
251.014	25.3596
240.185	25.359
226.014	25.3582
217.769	25.3577
206.862	25.3571
205.482	25.3526
202.546	25.3524
201.102	25.3404
199.369	25.3367
197.378	25.3254

195.014	25.3047
192.095	25.2716
188.306	25.2198
187.201	25.2066
182.516	25.1302
179.536	25.0756
176.869	25.0111
142.194	22.589
138.146	22
136.798	22
135.449	22
132.038	19.8685
131.449	19.5
127.449	19.5
127.279	19.394
123.449	17
119.449	17
115.449	14.5
113.001	14.5
111.449	14.5
105.849	11
103.429	11
100.849	11
95.0031	8.07711

**Material Boundary**

X	Y
105.849	11
106.149	11
110.149	13.5
111.454	13.5
114.149	13.5
116.214	14.7906
118.149	16
122.149	16
126.149	18.5
130.149	18.5
134.149	21
138.149	21
142.149	18.5

**Material Boundary**

X	Y
314.195	9.16349
316.78	9.16556

**Material Boundary**

X	Y
314.608	8.16229
316.364	8.16793

**Material Boundary**

X	Y
313.989	9.66409
316.989	9.66437
316.212	10.4406
315.989	10.6705
315.769	10.6705

314.989	10.6705
314.765	10.4402
313.989	9.66409

**Material Boundary**

X	Y
93.8489	7.5
110.849	7.5
116.147	7.5
328.518	7.5

**Material Boundary**

X	Y
106.149	11
118.149	11
116.413	12.0847
114.149	13.5
126.149	13.5
123.137	15.3824
122.149	16
134.149	16
133.861	16.1801
130.149	18.5
131.776	18.5
132.465	18.5
142.149	18.5
155.061	18.5
213.989	18.5
217.621	17.5921
223.989	16
230.498	16
243.989	16
250.448	14.3851
253.989	13.5
260.784	13.5
273.989	13.5
277.837	12.5379
283.989	11
291.018	11
303.989	11
313.989	9.66409

**Material Boundary**

X	Y
116.147	7.5
142.19	8.66345
314.608	8.16229

**Material Boundary**

X	Y
114.271	8.12967
116.237	8.16298
142.163	9.66354
314.195	9.16349

**Material Boundary**

X	Y
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316.364	8.16793
328.518	8.12654

**Material Boundary**

X	Y
316.78	9.16556
328.518	9.09829

**Material Boundary**

X	Y
316.989	9.66437
328.518	9.59829

**Material Boundary**

X	Y
105.849	11
112.853	8.60574
116.218	8.66273
142.149	10.1636
313.989	9.66409

**Material Boundary**

X	Y
138.149	21
142.173	21.6775
178.149	24.0756
193.462	24.4584
198.809	24.4592
201.055	24.4595
206.836	24.46
226.031	24.4613
231.723	24.4617
251.031	24.4631
270.478	24.4645
276.031	24.4649
281.545	24.4653
301.031	24.4667
320.643	24.4681
326.015	24.4685
328.518	24.4686

**Material Boundary**

X	Y
112.853	8.60574
114.271	8.12967
116.147	7.5

**Material Boundary**

X	Y
0	6.5
95.8489	6.5
108.849	6.5
114.142	6.5
328.518	6.5

**Material Boundary**

X	Y
0	4.5
99.8489	4.5

**Material Boundary**

X	Y
0	0.5
328.518	0.5

**Material Boundary**

X	Y
0	-5
328.518	-5

**Material Boundary**

X	Y
0	-7
328.518	-7

**Material Boundary**

X	Y
0	-10.5
328.518	-10.5

**Material Boundary**

X	Y
0	-17
328.518	-17

**Material Boundary**

X	Y
93.8489	7.5
95.8489	6.5
99.8489	4.5
104.849	4.5
108.849	6.5
110.849	7.5

**Material Boundary**

X	Y
104.849	4.5
328.518	4.5

**Material Boundary**

X	Y
114.142	6.5
116.147	7.5