



# REGIONE UMBRIA

PROVINCIA DI PERUGIA



## COMUNE DI MASSA MARTANA

### INTERVENTI PER IL CONSOLIDAMENTO DELLA RUPE DI MASSA MARTANA

OPERA:

COMPLETAMENTO DEGLI INTERVENTI IN PARETE  
E DEL CIGLIO SUPERIORE NEL TRATTO COMPRESO  
TRA VIA DELLE PIAGGE E VIA DEL MATTATOIO VECCHIO

DESCRIZIONE:

### PROGETTO ESECUTIVO

PROGETTISTI:

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dott. ing. Giuseppe Federici  
dott. geol. Luca Domenico Venanti

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REGIONE UMBRIA:

TAVOLA:

### ALLEGATO B ALLA RELAZIONE GEOTECNICA: VERIFICHE SISMICHE

REVISIONE	DATA	DESCRIZIONE	REDATTO	CONTR.	APPROV.
0	SETT_2014	1° EMISSIONE	FF	CC	CC

-	-	<b>C_RGT_03</b>	<b>2014_04</b>	<b>E0</b>	<b>A</b>	<b>PE</b>
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P. Gen. CIV	Tipo doc REL	Formato A4	scala /	Redatto ING F. FORLANI	Controllato ING. C.COMASTRI	Approvato ING. C. COMASTRI	Responsabile GF	ELABORATO_n.c19
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**REGIONE UMBRIA  
PROVINCIA DI PERUGIA**

**COMUNE DI MASSA MARTANA**

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**CONSOLIDAMENTO DELLA RUPE DI MASSA MARTANA**

**PROGETTO PER IL CONSOLIDAMENTO DEL VERSANTE N-NW  
AL PIEDE DELLA RUPE DI MASSA MARTANA**

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**ALLEGATO B**



**THESISENGINEERING**

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A		Prima emissione	F.Forlani	E.Comastri	C.Comastri
Rev.	Data	Descrizione	Redazione	Controllo	Approvazione

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## SEZIONE 48

### 1 Project Settings

Length(L) Units: [meters](#)  
Time(t) Units: [Seconds](#)  
Force(F) Units: [kN](#)  
Pressure(p) Units: [kPa](#)  
Strength Units: [kPa](#)  
Unit Weight of Water: [9.807 kN/m<sup>3</sup>](#)  
View: [2D](#)

### 2 Analysis Settings

#### 2.1 SLOPE/W Analysis

Kind: [SLOPE/W](#)  
Method: [Morgenstern-Price](#)  
Settings  
    Apply Phreatic Correction: [No](#)  
    Side Function  
        Interslice force function option: [Half-Sine](#)  
    PWP Conditions Source: [Piezometric Line](#)  
    Use Staged Rapid Drawdown: [No](#)  
Slip Surface  
    Direction of movement: [Right to Left](#)  
    Use Passive Mode: [No](#)  
    Slip Surface Option: [Entry and Exit](#)  
    Critical slip surfaces saved: [1](#)  
    Optimize Critical Slip Surface Location: [No](#)  
Tension Crack  
    Tension Crack Option: [\(none\)](#)  
FOS Distribution  
    FOS Calculation Option: [Constant](#)  
Advanced  
    Number of Slices: [30](#)  
    Optimization Tolerance: [0.01](#)  
    Minimum Slip Surface Depth: [0.1 m](#)  
    Optimization Maximum Iterations: [2000](#)  
    Optimization Convergence Tolerance: [1e-007](#)  
    Starting Optimization Points: [8](#)  
    Ending Optimization Points: [16](#)  
    Complete Passes per Insertion: [1](#)  
    Driving Side Maximum Convex Angle: [5 °](#)



Resisting Side Maximum Convex Angle: 1 °

## 3 Materials

### 3.1 cfr

Model: [Mohr-Coulomb](#)  
Unit Weight: 20 kN/m<sup>3</sup>  
Cohesion: 5 kPa  
Phi: 23 °  
Phi-B: 0 °  
Pore Water Pressure  
Piezometric Line: 1

### 3.2 UA

Model: [Mohr-Coulomb](#)  
Unit Weight: 20 kN/m<sup>3</sup>  
Cohesion: 30 kPa  
Phi: 30 °  
Phi-B: 0 °  
Pore Water Pressure  
Piezometric Line: 1

### 3.3 USMC

Model: [Mohr-Coulomb](#)  
Unit Weight: 20 kN/m<sup>3</sup>  
Cohesion: 30 kPa  
Phi: 28 °  
Phi-B: 0 °  
Pore Water Pressure  
Piezometric Line: 1

### 3.4 dt1

Model: [Mohr-Coulomb](#)  
Unit Weight: 19 kN/m<sup>3</sup>  
Cohesion: 22 kPa  
Phi: 25 °  
Phi-B: 0 °  
Pore Water Pressure  
Piezometric Line: 1

### 3.5 muro

Model: [Mohr-Coulomb](#)  
Unit Weight: 25 kN/m<sup>3</sup>



Cohesion: 14170 kPa  
Phi: 45 °  
Phi-B: 0 °  
Pore Water Pressure  
Piezometric Line: 1

### 3.6 cuscino ghiaia

Model: Mohr-Coulomb  
Unit Weight: 20 kN/m<sup>3</sup>  
Cohesion: 10 kPa  
Phi: 30 °  
Phi-B: 0 °  
Pore Water Pressure  
Piezometric Line: 1

## 4 Slip Surface Entry and Exit

Left Projection: Range  
Left-Zone Left Coordinate: (267.5, 131.0171) m  
Left-Zone Right Coordinate: (282.5, 140.14319) m  
Left-Zone Increment: 4  
Right Projection: Range  
Right-Zone Left Coordinate: (300, 154.5) m  
Right-Zone Right Coordinate: (314.79711, 156) m  
Right-Zone Increment: 4  
Radius Increments: 4

## 5 Slip Surface Limits

Left Coordinate: (208.63073, 110.11479) m  
Right Coordinate: (347.9971, 156.24498) m

## 6 Piezometric Lines

### 6.1 Piezometric Line 1

#### 6.1.1 Coordinates

	X (m)	Y (m)
	208.63075	101.5
	225.5	101.5
	238.5	106.97727



	254	112.33836
	269.3766	119
	278	123.06809
	287.21576	130.04088
	304	142
	315.5	147.5
	341.5	148
	350	148

## 7 Surcharge Loads

### 7.1 Surcharge Load 1

Surcharge (Unit Weight): 5 kN/m<sup>3</sup>

Direction: Vertical

#### 7.1.1 Coordinates

	X (m)	Y (m)
	290.26464	154.14899
	290.5	155.5
	305.5	156

## 8 Seismic Loads

Horz Seismic Load: 0.1

Vert Seismic Load: 0.05

Ignore seismic load in strength: No

## 9 Reinforcements

### 9.1 Reinforcement 1

Type: Nail

Outside Point: (289.26464, 153.48571) m

Inside Point: (310.51501, 147.79169) m

Slip Surface Intersection: (312.93, 147.14) m

Total Length: 22.000002 m

Reinforcement Direction: 165 °

Applied Load Option: Variable

F of S Dependent: No



Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 344 kPa  
Bond Resistance: 137.6 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: Conc. in 1 slice  
Shear Capacity: 760 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 0 kN  
Resisting Force Used: 137.6 kN/m  
Available Bond Length: 0 m  
Required Bond Length: 0 m  
Governing Component: Bond

## 9.2 Reinforcement 2

Type: Nail  
Outside Point: (289.5, 153) m  
Inside Point: (310.75037, 147.30598) m  
Slip Surface Intersection: (312.85, 146.74) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °  
Applied Load Option: Variable  
F of S Dependent: No  
Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: Conc. in 1 slice  
Shear Capacity: 900 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 360 kN  
Applied Load: 304 kN  
Nail Load Used: 0 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 0 m  
Required Bond Length: 0 m  
Governing Component: Bond



### 9.3 Reinforcement 3

Type: **Nail**  
Outside Point: (289, 151) m  
Inside Point: (310.25037, 145.30598) m  
Slip Surface Intersection: (312.15, 144.8) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °  
Applied Load Option: **Variable**  
F of S Dependent: **No**  
Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: **Conc. in 1 slice**  
Shear Capacity: 760 kN  
Shear Safety Factor: 1  
Shear Option: **Parallel to Slip**  
Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 0 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 0 m  
Required Bond Length: 0 m  
Governing Component: **Bond**

### 9.4 Reinforcement 4

Type: **Nail**  
Outside Point: (289, 147.5) m  
Inside Point: (310.25037, 141.80598) m  
Slip Surface Intersection: (310.58, 141.72) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °  
Applied Load Option: **Variable**  
F of S Dependent: **No**  
Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: **Conc. in 1 slice**





Shear Capacity: 760 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 0 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 0 m  
Required Bond Length: 0 m  
Governing Component: Bond

## 9.5 Reinforcement 5

Type: Nail  
Outside Point: (288.5, 146) m  
Inside Point: (309.75037, 140.30598) m  
Slip Surface Intersection: (309.67, 140.33) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °  
Applied Load Option: Variable  
F of S Dependent: No  
Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: Conc. in 1 slice  
Shear Capacity: 760 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 11.516 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 0.08345 m  
Required Bond Length: 0.08345 m  
Governing Component: Bond

## 9.6 Reinforcement 6

Type: Nail  
Outside Point: (288.5, 144.5) m  
Inside Point: (309.75037, 138.80598) m  
Slip Surface Intersection: (308.81, 139.06) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °



Applied Load Option: Variable  
F of S Dependent: No  
Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: Conc. in 1 slice  
Shear Capacity: 760 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 134.09 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 0.97165 m  
Required Bond Length: 0.97165 m  
Governing Component: Bond

## 9.7 Reinforcement 7

Type: Anchor  
Outside Point: (288.5254, 143) m  
Inside Point: (317.50317, 135.23543) m  
Slip Surface Intersection: (307.82, 137.83) m  
Total Length: 29.999995 m  
Reinforcement Direction: 165 °  
Applied Load Option: Variable  
F of S Dependent: No  
Bond Length: 18 m  
Bond Diameter: 0.2 m  
Bond Safety Factor: 1  
Bond Skin Friction: 55 kPa  
Bond Resistance: 13.823008 kN/m  
Anchor Spacing: 2.5 m  
Bar Capacity: 900 kN  
Bar Safety Factor: 1  
Bar Load: 360 kN  
Load Distribution: Conc. in 1 slice  
Shear Capacity: 0 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 0 kN  
Applied Load: 248.81414 kN  
Anchor Load Used: 138.53 kN  
Resisting Force Used: 13.823 kN/m



Available Bond Length: 10.022 m  
Required Bond Length: 10.022 m  
Governing Component: Bond

## 9.8 Reinforcement 8

Type: Pile  
Outside Point: (284, 141.6496) m  
Inside Point: (284, 110.1496) m  
Slip Surface Intersection: (284, 126.38) m  
Total Length: 31.5 m  
Reinforcement Direction: 90 °  
Applied Load Option: Variable  
F of S Dependent: No  
Pile Spacing: 2.5 m  
Shear Capacity: 500 kN  
Shear Safety Factor: 1  
Shear Load Used: 200 kN  
Shear Option: Perp. to Reinf.  
Resisting Force Used: 0 kN/m

## 9.9 Reinforcement 9

Type: Pile  
Outside Point: (288, 141.6496) m  
Inside Point: (288, 110.1496) m  
Slip Surface Intersection: (288, 126.67) m  
Total Length: 31.5 m  
Reinforcement Direction: 90 °  
Applied Load Option: Variable  
F of S Dependent: No  
Pile Spacing: 2.5 m  
Shear Capacity: 500 kN  
Shear Safety Factor: 1  
Shear Load Used: 200 kN  
Shear Option: Perp. to Reinf.  
Resisting Force Used: 0 kN/m

## 10 Regions

	Material	Points	Area (m <sup>2</sup> )
Region 1	UA	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17	1492.3802
Region 2	dt1	18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33	150.72685
Region 3	USMC	17,16,34,35,36,32,31,37,38	4526.5645
Region 4	cfr	34,16,15,39,40,41,42,43,44,45,46,18,33,32,36,35	626.6631
Region 5	muro	47,48,49,50,51,52,53,42,41,40	21.078869
Region 6	cuscino ghiaia	40,39,15,14,13,50,49,48,47	57.870313



## 11 Points

	X (m)	Y (m)
Point 1	350	156.25279
Point 2	319.31895	156.13317
Point 3	318.10196	156.09094
Point 4	312.08171	155.92528
Point 5	311.99001	155.92278
Point 6	310.66784	155.92278
Point 7	310.34255	155.91723
Point 8	308.62424	155.49757
Point 9	306.35296	154.94459
Point 10	306.19216	154.78721
Point 11	306.06853	154.70474
Point 12	305.62306	154.77202
Point 13	300	154.5
Point 14	294	147.5
Point 15	291	144
Point 16	287.21576	130.04088
Point 17	350	130.04088
Point 18	238.09407	115.2085
Point 19	230.96605	112.23244
Point 20	226.18155	110.46722
Point 21	225.92537	110.39527
Point 22	225.26635	110.15034
Point 23	220.09259	108.42914
Point 24	219.11265	108.26378
Point 25	214.73023	108.01739
Point 26	213.81266	108.16537
Point 27	212.39162	108.3764
Point 28	210.58442	108.95701
Point 29	210.44888	108.9665
Point 30	208.63073	110.11479
Point 31	208.63075	103.30608
Point 32	224.13517	102.13654
Point 33	232.49413	108.94505
Point 34	277.26828	122.51446
Point 35	261.55071	115.51484
Point 36	252.35333	111.64563
Point 37	208.63075	87.84275
Point 38	350	87.84275



Point 39	290	142.5
Point 40	289.39535	141.6496
Point 41	289.39535	140.1496
Point 42	282.59535	140.1496
Point 43	282.17532	140.12138
Point 44	279.02512	138.28931
Point 45	247.46854	118.37748
Point 46	244.26122	117.0434
Point 47	290.09535	148.6496
Point 48	289.79684	148.67945
Point 49	290.26464	153.34899
Point 50	290.26464	154.14899
Point 51	289.6403	154.14899
Point 52	288.39036	141.6496
Point 53	282.59535	141.6496

## 12 Critical Slip Surfaces

	Slip Surface	FOS	Center (m)	Radius (m)	Entry (m)	Exit (m)
1	25	1.679	(283.817, 157.389)	31.011	(314.797, 156)	(267.5, 131.017)

### 12.1 Slices of Slip Surface: 25

	Slip Surface	X (m)	Y (m)	PWP (kPa)	Base Normal Stress (kPa)	Frictional Strength (kPa)	Cohesive Strength (kPa)
1	25	268.4383	130.48085	-116.57866	32.266168	13.696176	5
2	25	270.23895	129.5244	-99.221179	92.705815	39.351284	5
3	25	271.96365	128.7473	-83.625452	151.81055	64.439753	5
4	25	273.6883	128.0923	-69.222431	209.16879	88.786885	5
5	25	275.41295	127.5513	-55.933144	261.64455	111.06152	5
6	25	277.13765	127.11815	-43.708285	306.42115	130.06806	5
7	25	278.51255	126.8389	-33.176768	335.56408	142.4385	5
8	25	279.81265	126.6473	-21.651279	355.40684	150.86125	5
9	25	281.38775	126.4828	-8.3502273	371.02908	157.4925	5
10	25	282.2955	126.415	-0.94988283	375.25045	159.28437	5
11	25	282.50555	126.4053	0.70363421	402.32145	213.54398	30
12	25	283.36545	126.3903	7.2310589	530.55898	278.25839	30
13	25	284.90555	126.40615	18.503822	415.66115	211.1723	30
14	25	286.4457	126.49875	29.023668	384.15505	188.82671	30



15	25	287.8031	126.64045	37.452646	472.68346	231.41633	30
16	25	288.8929	126.79995	43.503057	462.23103	222.64161	30
17	25	289.51785	126.9062	46.826369	589.69362	288.64764	30
18	25	289.71855	126.9443	47.857002	604.04806	295.73203	30
19	25	289.8984	126.9798	48.76363	584.21754	284.70589	30
20	25	290.0477	127.0099	49.513571	564.68937	273.92383	30
21	25	290.18	127.03745	50.168121	551.71289	266.67609	30
22	25	290.3823	127.08065	51.158754	540.94569	260.42433	30
23	25	290.75	127.16345	52.913766	533.50425	255.5345	30
24	25	291.75	127.41935	57.393261	504.76811	237.87343	30
25	25	293.25	127.85745	63.575306	464.25024	213.04264	30
26	25	294.73975	128.37555	68.910202	427.17493	190.49274	30
27	25	296.21925	128.977	73.348815	393.67767	170.32187	30
28	25	297.6988	129.6704	76.884167	363.45627	152.37309	30
29	25	299.2193	130.4879	79.49335	335.36379	147.72687	30
30	25	300.66665	131.3666	80.991107	310.91394	132.74601	30
31	25	302	132.2811	81.335876	290.39155	120.69835	30
32	25	303.33335	133.3041	80.623075	271.2667	110.06815	30
33	25	304.75	134.53115	76.765788	251.6201	100.95218	30
34	25	305.56155	135.2785	73.244411	236.78999	94.423085	30
35	25	305.8458	135.56385	71.77611	232.24936	92.649271	30
36	25	306.13035	135.85275	70.277554	228.23494	91.196738	30
37	25	306.2726	136.0012	69.490909	227.66186	91.320041	30
38	25	307.4886	137.43265	61.155414	231.50517	98.351477	30
39	25	309.4834	140.05165	44.826864	54.35188	5.4992708	30
40	25	310.5052	141.5985	34.449588	146.06363	64.440394	30
41	25	311.3289	143.1508	23.088841	123.20491	57.802041	30
42	25	312.03585	144.5288	12.890671	102.38825	51.671448	30
43	25	312.40575	145.40225	6.0595104	88.285324	47.473096	30
44	25	313.76345	151.08755	-43.328513	6.1203939	3.5336111	30



## 13 Analysis Settings

### 13.1 SLOPE/W Analysis

Kind: **SLOPE/W**

Method: **Bishop, Ordinary and Janbu**

Settings

Apply Phreatic Correction: **No**

PWP Conditions Source: **Piezometric Line**

Use Staged Rapid Drawdown: **No**

Slip Surface

Direction of movement: **Right to Left**

Use Passive Mode: **No**

Slip Surface Option: **Entry and Exit**

Critical slip surfaces saved: **1**

Optimize Critical Slip Surface Location: **No**

Tension Crack

Tension Crack Option: **(none)**

FOS Distribution

FOS Calculation Option: **Constant**

Advanced

Number of Slices: **30**

Optimization Tolerance: **0.01**

Minimum Slip Surface Depth: **0.1 m**

Optimization Maximum Iterations: **2000**

Optimization Convergence Tolerance: **1e-007**

Starting Optimization Points: **8**

Ending Optimization Points: **16**

Complete Passes per Insertion: **1**

Driving Side Maximum Convex Angle: **5 °**

Resisting Side Maximum Convex Angle: **1 °**

## 14 Materials

### 14.1 cfr

Model: **Mohr-Coulomb**

Unit Weight: **20 kN/m<sup>3</sup>**

Cohesion: **5 kPa**

Phi: **23 °**

Phi-B: **0 °**

Pore Water Pressure

Piezometric Line: **1**



## 14.2 UA

Model: [Mohr-Coulomb](#)  
Unit Weight: [20 kN/m<sup>3</sup>](#)  
Cohesion: [30 kPa](#)  
Phi: [30 °](#)  
Phi-B: [0 °](#)  
Pore Water Pressure  
Piezometric Line: [1](#)

## 14.3 USMC

Model: [Mohr-Coulomb](#)  
Unit Weight: [20 kN/m<sup>3</sup>](#)  
Cohesion: [30 kPa](#)  
Phi: [28 °](#)  
Phi-B: [0 °](#)  
Pore Water Pressure  
Piezometric Line: [1](#)

## 14.4 dt1

Model: [Mohr-Coulomb](#)  
Unit Weight: [19 kN/m<sup>3</sup>](#)  
Cohesion: [22 kPa](#)  
Phi: [25 °](#)  
Phi-B: [0 °](#)  
Pore Water Pressure  
Piezometric Line: [1](#)

## 14.5 muro

Model: [Mohr-Coulomb](#)  
Unit Weight: [25 kN/m<sup>3</sup>](#)  
Cohesion: [14170 kPa](#)  
Phi: [45 °](#)  
Phi-B: [0 °](#)  
Pore Water Pressure  
Piezometric Line: [1](#)

## 14.6 cuscino ghiaia

Model: [Mohr-Coulomb](#)  
Unit Weight: [20 kN/m<sup>3</sup>](#)  
Cohesion: [10 kPa](#)  
Phi: [30 °](#)  
Phi-B: [0 °](#)  
Pore Water Pressure  
Piezometric Line: [1](#)





## 15 Slip Surface Entry and Exit

Left Projection: [Range](#)  
Left-Zone Left Coordinate: (267.5, 131.0171) m  
Left-Zone Right Coordinate: (282.5, 140.14319) m  
Left-Zone Increment: 4  
Right Projection: [Range](#)  
Right-Zone Left Coordinate: (300, 154.5) m  
Right-Zone Right Coordinate: (314.79711, 156) m  
Right-Zone Increment: 4  
Radius Increments: 4

## 16 Slip Surface Limits

Left Coordinate: (208.63073, 110.11479) m  
Right Coordinate: (347.9971, 156.24498) m

## 17 Piezometric Lines

### 17.1 Piezometric Line 1

#### 17.1.1 Coordinates

	X (m)	Y (m)
	208.63075	101.5
	225.5	101.5
	238.5	106.97727
	254	112.33836
	269.3766	119
	278	123.06809
	287.21576	130.04088
	304	142
	315.5	147.5
	341.5	148
	350	148



## 18 Surcharge Loads

### 18.1 Surcharge Load 1

Surcharge (Unit Weight): 5 kN/m<sup>3</sup>

Direction: Vertical

#### 18.1.1 Coordinates

	X (m)	Y (m)
	290.26464	154.14899
	290.5	155.5
	305.5	156

## 19 Seismic Loads

Horz Seismic Load: 0.1

Vert Seismic Load: 0.05

Ignore seismic load in strength: No

## 20 Reinforcements

### 20.1 Reinforcement 1

Type: Nail

Outside Point: (289.26464, 153.48571) m

Inside Point: (310.51501, 147.79169) m

Slip Surface Intersection: (312.93, 147.14) m

Total Length: 22.000002 m

Reinforcement Direction: 165 °

Applied Load Option: Variable

F of S Dependent: No

Bond Diameter: 0.31830989 m

Bond Safety Factor: 1

Bond Skin Friction: 344 kPa

Bond Resistance: 137.6 kN/m

Nail Spacing: 2.5 m

Bar Capacity: 760 kN

Bar Safety Factor: 1

Bar Load: 304 kN

Load Distribution: Conc. in 1 slice

Shear Capacity: 760 kN

Shear Safety Factor: 1

Shear Option: Parallel to Slip



Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 0 kN  
Resisting Force Used: 137.6 kN/m  
Available Bond Length: 0 m  
Required Bond Length: 0 m  
Governing Component: Bond

## 20.2 Reinforcement 2

Type: Nail  
Outside Point: (289.5, 153) m  
Inside Point: (310.75037, 147.30598) m  
Slip Surface Intersection: (312.85, 146.74) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °  
Applied Load Option: Variable  
F of S Dependent: No  
Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: Conc. in 1 slice  
Shear Capacity: 900 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 360 kN  
Applied Load: 304 kN  
Nail Load Used: 0 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 0 m  
Required Bond Length: 0 m  
Governing Component: Bond

## 20.3 Reinforcement 3

Type: Nail  
Outside Point: (289, 151) m  
Inside Point: (310.25037, 145.30598) m  
Slip Surface Intersection: (312.15, 144.8) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °  
Applied Load Option: Variable  
F of S Dependent: No  
Bond Diameter: 0.31830989 m



Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: Conc. in 1 slice  
Shear Capacity: 760 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 0 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 0 m  
Required Bond Length: 0 m  
Governing Component: Bond

## 20.4 Reinforcement 4

Type: Nail  
Outside Point: (289, 147.5) m  
Inside Point: (310.25037, 141.80598) m  
Slip Surface Intersection: (310.58, 141.72) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °  
Applied Load Option: Variable  
F of S Dependent: No  
Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: Conc. in 1 slice  
Shear Capacity: 760 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 0 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 0 m  
Required Bond Length: 0 m  
Governing Component: Bond



## 20.5 Reinforcement 5

Type: **Nail**  
Outside Point: (288.5, 146) m  
Inside Point: (309.75037, 140.30598) m  
Slip Surface Intersection: (309.67, 140.33) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °  
Applied Load Option: **Variable**  
F of S Dependent: **No**  
Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: **Conc. in 1 slice**  
Shear Capacity: 760 kN  
Shear Safety Factor: 1  
Shear Option: **Parallel to Slip**  
Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 11.516 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 0.08345 m  
Required Bond Length: 0.08345 m  
Governing Component: **Bond**

## 20.6 Reinforcement 6

Type: **Nail**  
Outside Point: (288.5, 144.5) m  
Inside Point: (309.75037, 138.80598) m  
Slip Surface Intersection: (308.81, 139.06) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °  
Applied Load Option: **Variable**  
F of S Dependent: **No**  
Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: **Conc. in 1 slice**



Shear Capacity: 760 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 134.09 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 0.97165 m  
Required Bond Length: 0.97165 m  
Governing Component: Bond

## 20.7 Reinforcement 7

Type: Anchor  
Outside Point: (288.5254, 143) m  
Inside Point: (317.50317, 135.23543) m  
Slip Surface Intersection: (307.82, 137.83) m  
Total Length: 29.999995 m  
Reinforcement Direction: 165 °  
Applied Load Option: Variable  
F of S Dependent: No  
Bond Length: 18 m  
Bond Diameter: 0.2 m  
Bond Safety Factor: 1  
Bond Skin Friction: 55 kPa  
Bond Resistance: 13.823008 kN/m  
Anchor Spacing: 2.5 m  
Bar Capacity: 900 kN  
Bar Safety Factor: 1  
Bar Load: 360 kN  
Load Distribution: Conc. in 1 slice  
Shear Capacity: 0 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 0 kN  
Applied Load: 248.81414 kN  
Anchor Load Used: 138.53 kN  
Resisting Force Used: 13.823 kN/m  
Available Bond Length: 10.022 m  
Required Bond Length: 10.022 m  
Governing Component: Bond

## 20.8 Reinforcement 8

Type: Pile  
Outside Point: (284, 141.6496) m  
Inside Point: (284, 110.1496) m  
Slip Surface Intersection: (284, 126.38) m  
Total Length: 31.5 m



Reinforcement Direction: 90 °  
Applied Load Option: Variable  
F of S Dependent: No  
Pile Spacing: 2.5 m  
Shear Capacity: 500 kN  
Shear Safety Factor: 1  
Shear Load Used: 200 kN  
Shear Option: Perp. to Reinf.  
Resisting Force Used: 0 kN/m

## 20.9 Reinforcement 9

Type: Pile  
Outside Point: (288, 141.6496) m  
Inside Point: (288, 110.1496) m  
Slip Surface Intersection: (288, 126.67) m  
Total Length: 31.5 m  
Reinforcement Direction: 90 °  
Applied Load Option: Variable  
F of S Dependent: No  
Pile Spacing: 2.5 m  
Shear Capacity: 500 kN  
Shear Safety Factor: 1  
Shear Load Used: 200 kN  
Shear Option: Perp. to Reinf.  
Resisting Force Used: 0 kN/m

## 21 Regions

	Material	Points	Area (m <sup>2</sup> )
Region 1	UA	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17	1492.3802
Region 2	dt1	18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33	150.72685
Region 3	USMC	17,16,34,35,36,32,31,37,38	4526.5645
Region 4	cfr	34,16,15,39,40,41,42,43,44,45,46,18,33,32,36,35	626.6631
Region 5	muro	47,48,49,50,51,52,53,42,41,40	21.078869
Region 6	cuscono ghiaia	40,39,15,14,13,50,49,48,47	57.870313

## 22 Points

	X (m)	Y (m)
Point 1	350	156.25279
Point 2	319.31895	156.13317
Point 3	318.10196	156.09094
Point 4	312.08171	155.92528



Point 5	311.99001	155.92278
Point 6	310.66784	155.92278
Point 7	310.34255	155.91723
Point 8	308.62424	155.49757
Point 9	306.35296	154.94459
Point 10	306.19216	154.78721
Point 11	306.06853	154.70474
Point 12	305.62306	154.77202
Point 13	300	154.5
Point 14	294	147.5
Point 15	291	144
Point 16	287.21576	130.04088
Point 17	350	130.04088
Point 18	238.09407	115.2085
Point 19	230.96605	112.23244
Point 20	226.18155	110.46722
Point 21	225.92537	110.39527
Point 22	225.26635	110.15034
Point 23	220.09259	108.42914
Point 24	219.11265	108.26378
Point 25	214.73023	108.01739
Point 26	213.81266	108.16537
Point 27	212.39162	108.3764
Point 28	210.58442	108.95701
Point 29	210.44888	108.9665
Point 30	208.63073	110.11479
Point 31	208.63075	103.30608
Point 32	224.13517	102.13654
Point 33	232.49413	108.94505
Point 34	277.26828	122.51446
Point 35	261.55071	115.51484
Point 36	252.35333	111.64563
Point 37	208.63075	87.84275
Point 38	350	87.84275
Point 39	290	142.5
Point 40	289.39535	141.6496
Point 41	289.39535	140.1496
Point 42	282.59535	140.1496
Point 43	282.17532	140.12138
Point 44	279.02512	138.28931
Point 45	247.46854	118.37748





Point 46	244.26122	117.0434
Point 47	290.09535	148.6496
Point 48	289.79684	148.67945
Point 49	290.26464	153.34899
Point 50	290.26464	154.14899
Point 51	289.6403	154.14899
Point 52	288.39036	141.6496
Point 53	282.59535	141.6496

## 23 Critical Slip Surfaces

	Slip Surface	FOS	Center (m)	Radius (m)	Entry (m)	Exit (m)
1	25	1.386	(283.817, 157.389)	31.011	(314.797, 156)	(267.5, 131.017)

### 23.1 Slices of Slip Surface: 25

	Slip Surface	X (m)	Y (m)	PWP (kPa)	Base Normal Stress (kPa)	Frictional Strength (kPa)	Cohesive Strength (kPa)
1	25	268.4383	130.48085	-116.57866	31.244636	13.262561	5
2	25	270.23895	129.5244	-99.221179	81.614059	34.643113	5
3	25	271.96365	128.7473	-83.625452	124.07469	52.666581	5
4	25	273.6883	128.0923	-69.222431	161.85511	68.703417	5
5	25	275.41295	127.5513	-55.933144	195.56509	83.012454	5
6	25	277.13765	127.11815	-43.708285	225.66987	95.791177	5
7	25	278.51255	126.8389	-33.176768	247.4874	105.05217	5
8	25	279.81265	126.6473	-21.651279	265.17796	112.56137	5
9	25	281.38775	126.4828	-8.3502273	283.92545	120.5192	5
10	25	282.2955	126.415	0.94988283	292.59216	124.198	5
11	25	282.50555	126.4053	0.70363421	294.19798	156.05371	30
12	25	283.36545	126.3903	7.2310589	330.44861	171.85782	30
13	25	284.90555	126.40615	18.503822	323.1096	161.96176	30
14	25	286.4457	126.49875	29.023668	314.84036	151.97143	30
15	25	287.8031	126.64045	37.452646	306.82295	143.22673	30
16	25	288.8929	126.79995	43.503057	423.75186	202.18187	30
17	25	289.51785	126.9062	46.826369	558.27273	271.94085	30
18	25	289.71855	126.9443	47.857002	576.34104	280.99995	30
19	25	289.8984	126.9798	48.76363	560.66349	272.18198	30
20	25	290.0477	127.0099	49.513571	544.52189	263.20059	30
21	25	290.18	127.03745	50.168121	534.38623	257.46334	30



22	25	290.3823	127.08065	51.158754	527.4916	253.27067	30
23	25	290.75	127.16345	52.913766	526.97386	252.06222	30
24	25	291.75	127.41935	57.393261	516.63924	244.18542	30
25	25	293.25	127.85745	63.575306	500.44835	232.28952	30
26	25	294.73975	128.37555	68.910202	483.1368	220.24819	30
27	25	296.21925	128.977	73.348815	464.59205	208.02772	30
28	25	297.6988	129.6704	76.884167	444.59499	195.51531	30
29	25	299.2193	130.4879	79.49335	417.10249	194.91873	30
30	25	300.66665	131.3666	80.991107	394.24696	180.85835	30
31	25	302	132.2811	81.335876	371.56342	167.56295	30
32	25	303.33335	133.3041	80.623075	347.07663	153.83703	30
33	25	304.75	134.53115	76.765788	318.18421	139.38299	30
34	25	305.56155	135.2785	73.244411	296.32642	128.79646	30
35	25	305.8458	135.56385	71.77611	289.14255	125.49657	30
36	25	306.13035	135.85275	70.277554	282.45836	122.50265	30
37	25	306.2726	136.0012	69.490909	280.74293	121.96641	30
38	25	307.4886	137.43265	61.155414	263.40531	116.76903	30
39	25	309.4834	140.05165	44.826864	32.800065	-6.9436757	30
40	25	310.5052	141.5985	34.449588	169.06237	77.718725	30
41	25	311.3289	143.1508	23.088841	135.53514	64.9209	30
42	25	312.03585	144.5288	12.890671	106.18241	53.862012	30
43	25	312.40575	145.40225	6.0595104	87.897506	47.249189	30
44	25	313.76345	151.08755	-43.328513	-0.19098529	-0.11026541	30





## SEZIONE 52

### 24 Project Settings

Length(L) Units: [meters](#)  
Time(t) Units: [Seconds](#)  
Force(F) Units: [kN](#)  
Pressure(p) Units: [kPa](#)  
Strength Units: [kPa](#)  
Unit Weight of Water: [9.807 kN/m<sup>3</sup>](#)  
View: [2D](#)

### 25 Analysis Settings

#### 25.1 SLOPE/W Analysis

Kind: [SLOPE/W](#)  
Method: [Morgenstern-Price](#)  
Settings  
    Apply Phreatic Correction: [No](#)  
    Side Function  
        Interslice force function option: [Half-Sine](#)  
    PWP Conditions Source: [Piezometric Line](#)  
    Use Staged Rapid Drawdown: [No](#)  
Slip Surface  
    Direction of movement: [Right to Left](#)  
    Use Passive Mode: [No](#)  
    Slip Surface Option: [Entry and Exit](#)  
    Critical slip surfaces saved: [1](#)  
    Optimize Critical Slip Surface Location: [No](#)  
    Tension Crack  
        Tension Crack Option: [\(none\)](#)  
FOS Distribution  
    FOS Calculation Option: [Constant](#)  
Advanced  
    Number of Slices: [30](#)  
    Optimization Tolerance: [0.01](#)  
    Minimum Slip Surface Depth: [0.1 m](#)  
    Optimization Maximum Iterations: [2000](#)  
    Optimization Convergence Tolerance: [1e-007](#)  
    Starting Optimization Points: [8](#)  
    Ending Optimization Points: [16](#)  
    Complete Passes per Insertion: [1](#)



Driving Side Maximum Convex Angle: 5 °  
Resisting Side Maximum Convex Angle: 1 °

## 26 Materials

### 26.1 cfr

Model: [Mohr-Coulomb](#)  
Unit Weight: 20 kN/m<sup>3</sup>  
Cohesion: 5 kPa  
Phi: 23 °  
Phi-B: 0 °  
Pore Water Pressure  
Piezometric Line: 1

### 26.2 UA

Model: [Mohr-Coulomb](#)  
Unit Weight: 20 kN/m<sup>3</sup>  
Cohesion: 30 kPa  
Phi: 30 °  
Phi-B: 0 °  
Pore Water Pressure  
Piezometric Line: 1

### 26.3 USMC

Model: [Mohr-Coulomb](#)  
Unit Weight: 20 kN/m<sup>3</sup>  
Cohesion: 30 kPa  
Phi: 28 °  
Phi-B: 0 °  
Pore Water Pressure  
Piezometric Line: 1

### 26.4 dt1

Model: [Mohr-Coulomb](#)  
Unit Weight: 19 kN/m<sup>3</sup>  
Cohesion: 22 kPa  
Phi: 25 °  
Phi-B: 0 °  
Pore Water Pressure  
Piezometric Line: 1

### 26.5 muro

Model: [Mohr-Coulomb](#)



Unit Weight: 25 kN/m<sup>3</sup>  
Cohesion: 14170 kPa  
Phi: 45 °  
Phi-B: 0 °  
Pore Water Pressure  
Piezometric Line: 1

## 26.6 cuscino ghiaia

Model: Mohr-Coulomb  
Unit Weight: 20 kN/m<sup>3</sup>  
Cohesion: 10 kPa  
Phi: 30 °  
Phi-B: 0 °  
Pore Water Pressure  
Piezometric Line: 1

## 27 Slip Surface Entry and Exit

Left Projection: Range  
Left-Zone Left Coordinate: (-117.92495, 147.5) m  
Left-Zone Right Coordinate: (-101.95163, 155.22591) m  
Left-Zone Increment: 4  
Right Projection: Range  
Right-Zone Left Coordinate: (-67.27677, 173.55602) m  
Right-Zone Right Coordinate: (-55.99688, 175.8652) m  
Right-Zone Increment: 4  
Radius Increments: 4

## 28 Slip Surface Limits

Left Coordinate: (-142.52094, 140.05379) m  
Right Coordinate: (-55.265053, 175.87156) m

## 29 Piezometric Lines

### 29.1 Piezometric Line 1

#### 29.1.1 Coordinates

	X (m)	Y (m)
	-142.52094	132.5
	-131	132.5



	-120.5	137
	-104	143.5
	-88	152.5
	-75.5	159
	-64	162
	-53	166
	-40.30392	166

## 30 Seismic Loads

Horz Seismic Load: 0.1

Vert Seismic Load: 0.05

Ignore seismic load in strength: No

## 31 Reinforcements

### 31.1 Reinforcement 1

Type: Nail

Outside Point: (-78, 172.8504) m

Inside Point: (-56.74963, 167.15638) m

Slip Surface Intersection: (-59.116, 167.79) m

Total Length: 22.000002 m

Reinforcement Direction: 165 °

Applied Load Option: Variable

F of S Dependent: No

Bond Diameter: 0.31830989 m

Bond Safety Factor: 1

Bond Skin Friction: 345 kPa

Bond Resistance: 138 kN/m

Nail Spacing: 2.5 m

Bar Capacity: 760 kN

Bar Safety Factor: 1

Bar Load: 304 kN

Load Distribution: Conc. in 1 slice

Shear Capacity: 760 kN

Shear Safety Factor: 1

Shear Option: Parallel to Slip

Shear Load: 304 kN

Applied Load: 304 kN

Nail Load Used: 304 kN

Resisting Force Used: 138 kN/m

Available Bond Length: 2.4496 m

Required Bond Length: 2.2029 m



Governing Component: Bar

### 31.2 Reinforcement 2

Type: Nail  
Outside Point: (-78, 171.3504) m  
Inside Point: (-56.74963, 165.65638) m  
Slip Surface Intersection: (-59.811, 166.48) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °  
Applied Load Option: Variable  
F of S Dependent: No  
Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: Conc. in 1 slice  
Shear Capacity: 760 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 304 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 3.1692 m  
Required Bond Length: 2.2029 m  
Governing Component: Bar

### 31.3 Reinforcement 3

Type: Nail  
Outside Point: (-78, 169.3504) m  
Inside Point: (-56.74963, 163.65638) m  
Slip Surface Intersection: (-60.803, 164.74) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °  
Applied Load Option: Variable  
F of S Dependent: No  
Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1





Bar Load: 304 kN  
Load Distribution: Conc. in 1 slice  
Shear Capacity: 760 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 304 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 4.1962 m  
Required Bond Length: 2.2029 m  
Governing Component: Bar

### 31.4 Reinforcement 4

Type: Nail  
Outside Point: (-78.5, 166.8504) m  
Inside Point: (-57.24963, 161.15638) m  
Slip Surface Intersection: (-62.246, 162.5) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °  
Applied Load Option: Variable  
F of S Dependent: No  
Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: Conc. in 1 slice  
Shear Capacity: 760 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 304 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 5.1731 m  
Required Bond Length: 2.2029 m  
Governing Component: Bar

### 31.5 Reinforcement 5

Type: Anchor  
Outside Point: (-78.4746, 164.8504) m  
Inside Point: (-49.49683, 157.08583) m  
Slip Surface Intersection: (-63.47, 160.83) m



Total Length: 29.999995 m  
Reinforcement Direction: 165 °  
Applied Load Option: Variable  
F of S Dependent: No  
Bond Length: 18 m  
Bond Diameter: 0.2 m  
Bond Safety Factor: 1  
Bond Skin Friction: 55 kPa  
Bond Resistance: 13.823008 kN/m  
Anchor Spacing: 2.5 m  
Bar Capacity: 900 kN  
Bar Safety Factor: 1  
Bar Load: 360 kN  
Load Distribution: Conc. in 1 slice  
Shear Capacity: 0 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 0 kN  
Applied Load: 248.81414 kN  
Anchor Load Used: 199.97 kN  
Resisting Force Used: 13.823 kN/m  
Available Bond Length: 14.466 m  
Required Bond Length: 14.466 m  
Governing Component: Bond

### 31.6 Reinforcement 6

Type: Pile  
Outside Point: (-83, 164.5) m  
Inside Point: (-83, 133) m  
Slip Surface Intersection: (-83, 146.18) m  
Total Length: 31.5 m  
Reinforcement Direction: 90 °  
Applied Load Option: Variable  
F of S Dependent: No  
Pile Spacing: 2.5 m  
Shear Capacity: 500 kN  
Shear Safety Factor: 1  
Shear Load Used: 200 kN  
Shear Option: Perp. to Reinf.  
Resisting Force Used: 0 kN/m

### 31.7 Reinforcement 7

Type: Pile  
Outside Point: (-79, 164.5) m  
Inside Point: (-79, 133) m  
Slip Surface Intersection: (-79, 147.94) m  
Total Length: 31.5 m



Reinforcement Direction: 90 °  
Applied Load Option: Variable  
F of S Dependent: No  
Pile Spacing: 2.5 m  
Shear Capacity: 500 kN  
Shear Safety Factor: 1  
Shear Load Used: 200 kN  
Shear Option: Perp. to Reinf.  
Resisting Force Used: 0 kN/m

## 32 Regions

	Material	Points	Area (m <sup>2</sup> )
Region 1	dt1	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	104.38986
Region 2	USMC	17,18,19,20,21,22,23,1,16,15,24,25	3387.3302
Region 3	UA	42,43,44,45,46,47,48,28,27,26,18,17	788.14976
Region 4	cfr	2,41,40,39,38,37,36,35,34,33,32,31,30,29,28,27,26,18,19,20,21,22,23,1	936.08454
Region 5	muro	51,31,30,29,50,49,53,52	19.063976
Region 6	cuscinoghiaia	49,50,29,28,48	40.837285

## 33 Points

	X (m)	Y (m)
Point 1	-129.85017	137.23696
Point 2	-118.87924	147.09768
Point 3	-121.7583	146.21577
Point 4	-121.99236	146.03738
Point 5	-122.56036	145.99772
Point 6	-124.61185	144.24241
Point 7	-125.85903	143.31684
Point 8	-127.05586	142.39193
Point 9	-129.45612	140.86356
Point 10	-132.34559	140.81594
Point 11	-132.50931	140.80511
Point 12	-133.09425	140.61674
Point 13	-135.31503	140.48405



Point 14	-142.52094	140.05379
Point 15	-142.52094	133.54013
Point 16	-133.30025	133.54013
Point 17	-40	150.5
Point 18	-74.44762	150.41625
Point 19	-82.06496	144.90097
Point 20	-89.30255	140.04252
Point 21	-97.08536	135.8203
Point 22	-110.87638	133.69697
Point 23	-124.7034	135.02855
Point 24	-142.52094	108.82885
Point 25	-40	108.5
Point 26	-72.50319	157.43402
Point 27	-71.27913	166.88443
Point 28	-70.70601	170.60772
Point 29	-77.49807	164.67918
Point 30	-77.49807	163.17918
Point 31	-84.29807	163.17918
Point 32	-85.05487	163.08441
Point 33	-92.52094	159.61202
Point 34	-104.1277	154.21384
Point 35	-105.70589	153.48061
Point 36	-106.8808	153.05112
Point 37	-110.88547	150.68051
Point 38	-112.59347	149.53671
Point 39	-114.43719	148.88182
Point 40	-115.81246	148.14091
Point 41	-118.11058	147.44368
Point 42	-40.5	176
Point 43	-59.20631	175.83728
Point 44	-60.35886	175.63395
Point 45	-61.57157	175.41322
Point 46	-64.91642	175.34715
Point 47	-65.22455	175.33308
Point 48	-67.31953	173.519
Point 49	-76.61602	173.49917
Point 50	-76.68607	172.79917
Point 51	-84.29807	164.67918
Point 52	-78.50305	164.67918
Point 53	-77.62106	173.49917



## 34 Critical Slip Surfaces

	Slip Surface	FOS	Center (m)	Radius (m)	Entry (m)	Exit (m)
1	24	1.391	(-98.899, 187.747)	44.517	(-55.9969, 175.865)	(-117.925, 147.5)

### 34.1 Slices of Slip Surface: 24

	Slip Surface	X (m)	Y (m)	PWP (kPa)	Base Normal Stress (kPa)	Frictional Strength (kPa)	Cohesive Strength (kPa)
1	24	-116.8687	147.0338	-84.370534	20.91854	8.8793933	5
2	24	-115.12485	146.29845	-70.425015	54.364238	23.07625	5
3	24	-113.51535	145.70875	-58.42273	83.622783	35.495765	5
4	24	-111.7395	145.1309	-45.894734	116.29387	49.363818	5
5	24	-109.8843	144.6186	-33.703341	152.50229	64.733383	5
6	24	-107.88195	144.1573	-21.443361	186.79726	79.290733	5
7	24	-106.29335	143.85205	-12.312604	209.02891	88.727507	5
8	24	-104.9168	143.6454	-4.9678148	224.04388	95.100984	5
9	24	-104.06385	143.53025	-0.5435174	233.7205	99.208464	5
10	24	-103.98315	143.52085	0.11185224	234.5976	99.580773	5
11	24	-103.01255	143.4304	6.1296694	244.41946	101.14801	5
12	24	-101.105	143.29455	17.985122	262.70844	103.87889	5
13	24	-99.197415	143.24085	29.034791	279.11919	106.15453	5
14	24	-97.28985	143.269	39.282004	293.69037	107.98995	5
15	24	-95.382285	143.3791	48.724647	306.43584	109.39191	5
16	24	-93.47472	143.5718	57.360113	317.35378	110.36076	5
17	24	-91.390705	143.8824	65.80769	327.11114	110.91673	5
18	24	-89.130235	144.3302	73.884812	335.29781	110.96324	5
19	24	-86.527435	145.0108	80.957373	341.15467	110.4472	5
20	24	-84.67647	145.5647	84.963404	341.34611	108.828	5



21	24	- 83.332235	146.0529	87.030492	365.94516	118.39225	5
22	24	-81.40056	146.8265	89.295872	347.57799	109.63426	5
23	24	- 79.468885	147.70825	90.497969	327.46656	100.5872	5
24	24	- 78.062055	148.4106	90.785173	411.57508	136.16724	5
25	24	- 77.559565	148.67775	90.730374	504.56506	175.6624	5
26	24	-77.09207	148.93945	90.544477	473.18038	162.4193	5
27	24	- 76.651045	149.1878	90.357651	447.49764	151.59693	5
28	24	-76.05801	149.54165	89.912648	437.6195	147.5928	5
29	24	-74.95182	150.22515	87.457617	421.54187	141.81035	5
30	24	- 73.453415	151.23725	81.364724	369.39619	166.29505	30
31	24	- 72.345825	152.01645	76.555627	350.81089	158.34135	30
32	24	- 71.733795	152.48365	73.54043	339.8811	153.77186	30
33	24	-70.99257	153.0645	69.740371	326.42115	148.19472	30
34	24	-69.85939	154.02415	63.230186	304.56462	139.3345	30
35	24	-68.16615	155.5616	52.481544	270.27547	125.74338	30
36	24	-66.27204	157.49995	38.31864	241.38991	117.24325	30
37	24	- 65.070485	158.81	28.544745	226.16822	114.09796	30
38	24	-64.45821	159.5498	22.857103	210.56379	108.37251	30
39	24	- 63.051815	161.39955	9.2702359	133.75385	71.870649	30
40	24	-61.8376	163.08945	-2.9726889	139.42092	80.494707	30
41	24	- 60.965215	164.4778	-13.477319	28.665927	16.550281	30
42	24	- 59.782585	166.5287	-29.372853	-5.6415768	-3.2571659	30
43	24	-58.40395	169.358	-52.204151	-18.132961	-10.46907	30
44	24	- 56.799235	173.49505	-87.052643	-6.2982585	-3.6363012	30



## 35 Project Settings

Length(L) Units: [meters](#)  
Time(t) Units: [Seconds](#)  
Force(F) Units: [kN](#)  
Pressure(p) Units: [kPa](#)  
Strength Units: [kPa](#)  
Unit Weight of Water: [9.807 kN/m<sup>3</sup>](#)  
View: [2D](#)

## 36 Analysis Settings

### 36.1 SLOPE/W Analysis

Kind: [SLOPE/W](#)  
Method: [Bishop, Ordinary and Janbu](#)  
Settings  
    Apply Phreatic Correction: [No](#)  
    PWP Conditions Source: [Piezometric Line](#)  
    Use Staged Rapid Drawdown: [No](#)  
Slip Surface  
    Direction of movement: [Right to Left](#)  
    Use Passive Mode: [No](#)  
    Slip Surface Option: [Entry and Exit](#)  
    Critical slip surfaces saved: [1](#)  
    Optimize Critical Slip Surface Location: [No](#)  
Tension Crack  
    Tension Crack Option: [\(none\)](#)  
FOS Distribution  
    FOS Calculation Option: [Constant](#)  
Advanced  
    Number of Slices: [30](#)  
    Optimization Tolerance: [0.01](#)  
    Minimum Slip Surface Depth: [0.1 m](#)  
    Optimization Maximum Iterations: [2000](#)  
    Optimization Convergence Tolerance: [1e-007](#)  
    Starting Optimization Points: [8](#)  
    Ending Optimization Points: [16](#)  
    Complete Passes per Insertion: [1](#)  
    Driving Side Maximum Convex Angle: [5 °](#)  
    Resisting Side Maximum Convex Angle: [1 °](#)



## 37 Materials

### 37.1 cfr

Model: [Mohr-Coulomb](#)  
Unit Weight: [20 kN/m<sup>3</sup>](#)  
Cohesion: [5 kPa](#)  
Phi: [23 °](#)  
Phi-B: [0 °](#)  
Pore Water Pressure  
Piezometric Line: [1](#)

### 37.2 UA

Model: [Mohr-Coulomb](#)  
Unit Weight: [20 kN/m<sup>3</sup>](#)  
Cohesion: [30 kPa](#)  
Phi: [30 °](#)  
Phi-B: [0 °](#)  
Pore Water Pressure  
Piezometric Line: [1](#)

### 37.3 USMC

Model: [Mohr-Coulomb](#)  
Unit Weight: [20 kN/m<sup>3</sup>](#)  
Cohesion: [30 kPa](#)  
Phi: [28 °](#)  
Phi-B: [0 °](#)  
Pore Water Pressure  
Piezometric Line: [1](#)

### 37.4 dt1

Model: [Mohr-Coulomb](#)  
Unit Weight: [19 kN/m<sup>3</sup>](#)  
Cohesion: [22 kPa](#)  
Phi: [25 °](#)  
Phi-B: [0 °](#)  
Pore Water Pressure  
Piezometric Line: [1](#)

### 37.5 muro

Model: [Mohr-Coulomb](#)  
Unit Weight: [25 kN/m<sup>3</sup>](#)  
Cohesion: [14170 kPa](#)  
Phi: [45 °](#)  
Phi-B: [0 °](#)





Pore Water Pressure  
Piezometric Line: 1

### 37.6 cuscino ghiaia

Model: [Mohr-Coulomb](#)  
Unit Weight: [20 kN/m<sup>3</sup>](#)  
Cohesion: [10 kPa](#)  
Phi: [30 °](#)  
Phi-B: [0 °](#)  
Pore Water Pressure  
Piezometric Line: 1

## 38 Slip Surface Entry and Exit

Left Projection: [Range](#)  
Left-Zone Left Coordinate: [\(-117.92495, 147.5\) m](#)  
Left-Zone Right Coordinate: [\(-101.95163, 155.22591\) m](#)  
Left-Zone Increment: [4](#)  
Right Projection: [Range](#)  
Right-Zone Left Coordinate: [\(-67.27677, 173.55602\) m](#)  
Right-Zone Right Coordinate: [\(-55.99688, 175.8652\) m](#)  
Right-Zone Increment: [4](#)  
Radius Increments: [4](#)

## 39 Slip Surface Limits

Left Coordinate: [\(-142.52094, 140.05379\) m](#)  
Right Coordinate: [\(-55.265053, 175.87156\) m](#)

## 40 Piezometric Lines

### 40.1 Piezometric Line 1

#### 40.1.1 Coordinates

	X (m)	Y (m)
	<a href="#">-142.52094</a>	<a href="#">132.5</a>
	<a href="#">-131</a>	<a href="#">132.5</a>
	<a href="#">-120.5</a>	<a href="#">137</a>
	<a href="#">-104</a>	<a href="#">143.5</a>
	<a href="#">-88</a>	<a href="#">152.5</a>



	-75.5	159
	-64	162
	-53	166
	-40.30392	166

## 41 Seismic Loads

Horz Seismic Load: 0.1

Vert Seismic Load: 0.05

Ignore seismic load in strength: No

## 42 Reinforcements

### 42.1 Reinforcement 1

Type: Nail

Outside Point: (-78, 172.8504) m

Inside Point: (-56.74963, 167.15638) m

Slip Surface Intersection: (-67.858, 170.13) m

Total Length: 22.000002 m

Reinforcement Direction: 165 °

Applied Load Option: Variable

F of S Dependent: No

Bond Diameter: 0.31830989 m

Bond Safety Factor: 1

Bond Skin Friction: 345 kPa

Bond Resistance: 138 kN/m

Nail Spacing: 2.5 m

Bar Capacity: 760 kN

Bar Safety Factor: 1

Bar Load: 304 kN

Load Distribution: Conc. in 1 slice

Shear Capacity: 760 kN

Shear Safety Factor: 1

Shear Option: Parallel to Slip

Shear Load: 304 kN

Applied Load: 304 kN

Nail Load Used: 304 kN

Resisting Force Used: 138 kN/m

Available Bond Length: 11.5 m

Required Bond Length: 2.2029 m

Governing Component: Bar



## 42.2 Reinforcement 2

Type: **Nail**  
Outside Point: (-78, 171.3504) m  
Inside Point: (-56.74963, 165.65638) m  
Slip Surface Intersection: (-68.145, 168.71) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °  
Applied Load Option: **Variable**  
F of S Dependent: **No**  
Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: **Conc. in 1 slice**  
Shear Capacity: 760 kN  
Shear Safety Factor: 1  
Shear Option: **Parallel to Slip**  
Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 304 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 11.797 m  
Required Bond Length: 2.2029 m  
Governing Component: **Bar**

## 42.3 Reinforcement 3

Type: **Nail**  
Outside Point: (-78, 169.3504) m  
Inside Point: (-56.74963, 163.65638) m  
Slip Surface Intersection: (-68.527, 166.81) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °  
Applied Load Option: **Variable**  
F of S Dependent: **No**  
Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: **Conc. in 1 slice**



Shear Capacity: 760 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 304 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 12.193 m  
Required Bond Length: 2.2029 m  
Governing Component: Bar

#### 42.4 Reinforcement 4

Type: Nail  
Outside Point: (-78.5, 166.8504) m  
Inside Point: (-57.24963, 161.15638) m  
Slip Surface Intersection: (-69.049, 164.32) m  
Total Length: 22.000002 m  
Reinforcement Direction: 165 °  
Applied Load Option: Variable  
F of S Dependent: No  
Bond Diameter: 0.31830989 m  
Bond Safety Factor: 1  
Bond Skin Friction: 345 kPa  
Bond Resistance: 138 kN/m  
Nail Spacing: 2.5 m  
Bar Capacity: 760 kN  
Bar Safety Factor: 1  
Bar Load: 304 kN  
Load Distribution: Conc. in 1 slice  
Shear Capacity: 760 kN  
Shear Safety Factor: 1  
Shear Option: Parallel to Slip  
Shear Load: 304 kN  
Applied Load: 304 kN  
Nail Load Used: 304 kN  
Resisting Force Used: 138 kN/m  
Available Bond Length: 12.216 m  
Required Bond Length: 2.2029 m  
Governing Component: Bar

#### 42.5 Reinforcement 5

Type: Anchor  
Outside Point: (-78.4746, 164.8504) m  
Inside Point: (-49.49683, 157.08583) m  
Slip Surface Intersection: (-69.804, 162.53) m  
Total Length: 29.999995 m  
Reinforcement Direction: 165 °



Applied Load Option: **Variable**  
F of S Dependent: **No**  
Bond Length: **18 m**  
Bond Diameter: **0.2 m**  
Bond Safety Factor: **1**  
Bond Skin Friction: **55 kPa**  
Bond Resistance: **13.823008 kN/m**  
Anchor Spacing: **2.5 m**  
Bar Capacity: **900 kN**  
Bar Safety Factor: **1**  
Bar Load: **360 kN**  
Load Distribution: **Conc. in 1 slice**  
Shear Capacity: **0 kN**  
Shear Safety Factor: **1**  
Shear Option: **Parallel to Slip**  
Shear Load: **0 kN**  
Applied Load: **248.81414 kN**  
Anchor Load Used: **248.81 kN**  
Resisting Force Used: **13.823 kN/m**  
Available Bond Length: **18 m**  
Required Bond Length: **18 m**  
Governing Component: **Bond**

## 42.6 Reinforcement 6

Type: **Pile**  
Outside Point: **(-83, 164.5) m**  
Inside Point: **(-83, 133) m**  
Slip Surface Intersection: **(-83, 147.02) m**  
Total Length: **31.5 m**  
Reinforcement Direction: **90 °**  
Applied Load Option: **Variable**  
F of S Dependent: **No**  
Pile Spacing: **2.5 m**  
Shear Capacity: **500 kN**  
Shear Safety Factor: **1**  
Shear Load Used: **200 kN**  
Shear Option: **Perp. to Reinf.**  
Resisting Force Used: **0 kN/m**

## 42.7 Reinforcement 7

Type: **Pile**  
Outside Point: **(-79, 164.5) m**  
Inside Point: **(-79, 133) m**  
Slip Surface Intersection: **(-79, 149.89) m**  
Total Length: **31.5 m**  
Reinforcement Direction: **90 °**  
Applied Load Option: **Variable**



F of S Dependent: No  
Pile Spacing: 2.5 m  
Shear Capacity: 500 kN  
Shear Safety Factor: 1  
Shear Load Used: 200 kN  
Shear Option: Perp. to Reinf.  
Resisting Force Used: 0 kN/m

## 43 Regions

	Material	Points	Area (m <sup>2</sup> )
Region 1	dt1	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	104.38986
Region 2	USMC	17,18,19,20,21,22,23,1,16,15,24,25	3387.3302
Region 3	UA	42,43,44,45,46,47,48,28,27,26,18,17	788.14976
Region 4	cfr	2,41,40,39,38,37,36,35,34,33,32,31,30,29,28,27,26,18,19,20,21,22,23,1	936.08454
Region 5	muro	51,31,30,29,50,49,53,52	19.063976
Region 6	cuscinoghiaia	49,50,29,28,48	40.837285

## 44 Points

	X (m)	Y (m)
Point 1	-129.85017	137.23696
Point 2	-118.87924	147.09768
Point 3	-121.7583	146.21577
Point 4	-121.99236	146.03738
Point 5	-122.56036	145.99772
Point 6	-124.61185	144.24241
Point 7	-125.85903	143.31684
Point 8	-127.05586	142.39193
Point 9	-129.45612	140.86356
Point 10	-132.34559	140.81594
Point 11	-132.50931	140.80511
Point 12	-133.09425	140.61674
Point 13	-135.31503	140.48405
Point 14	-142.52094	140.05379
Point 15	-142.52094	133.54013



Point 16	-133.30025	133.54013
Point 17	-40	150.5
Point 18	-74.44762	150.41625
Point 19	-82.06496	144.90097
Point 20	-89.30255	140.04252
Point 21	-97.08536	135.8203
Point 22	-110.87638	133.69697
Point 23	-124.7034	135.02855
Point 24	-142.52094	108.82885
Point 25	-40	108.5
Point 26	-72.50319	157.43402
Point 27	-71.27913	166.88443
Point 28	-70.70601	170.60772
Point 29	-77.49807	164.67918
Point 30	-77.49807	163.17918
Point 31	-84.29807	163.17918
Point 32	-85.05487	163.08441
Point 33	-92.52094	159.61202
Point 34	-104.1277	154.21384
Point 35	-105.70589	153.48061
Point 36	-106.8808	153.05112
Point 37	-110.88547	150.68051
Point 38	-112.59347	149.53671
Point 39	-114.43719	148.88182
Point 40	-115.81246	148.14091
Point 41	-118.11058	147.44368
Point 42	-40.5	176
Point 43	-59.20631	175.83728
Point 44	-60.35886	175.63395
Point 45	-61.57157	175.41322
Point 46	-64.91642	175.34715
Point 47	-65.22455	175.33308
Point 48	-67.31953	173.519
Point 49	-76.61602	173.49917
Point 50	-76.68607	172.79917
Point 51	-84.29807	164.67918
Point 52	-78.50305	164.67918
Point 53	-77.62106	173.49917



## 45 Critical Slip Surfaces

	Slip Surface	FOS	Center (m)	Radius (m)	Entry (m)	Exit (m)
1	5	1.307	(-100.064, 175.035)	32.82	(-67.2768, 173.556)	(-117.925, 147.5)

### 45.1 Slices of Slip Surface: 5

	Slip Surface	X (m)	Y (m)	PWP (kPa)	Base Normal Stress (kPa)	Frictional Strength (kPa)	Cohesive Strength (kPa)
1	5	-116.8687	146.8698	-82.761946	27.591245	11.711789	5
2	5	-115.12485	145.8843	-66.363649	68.663412	29.145889	5
3	5	-113.51535	145.11455	-52.595076	102.70188	43.594361	5
4	5	-111.7395	144.3749	-38.480436	139.0579	59.026575	5
5	5	-109.8843	143.73555	-25.043065	177.58156	75.3789	5
6	5	-107.88195	143.1757	-11.817174	212.83427	90.342789	5
7	5	-106.40275	142.8359	-2.769929	233.89235	99.281411	5
8	5	-105.8153	142.7223	0.61362696	239.57415	101.43272	5
9	5	-104.9168	142.5848	5.4331465	248.90615	103.34816	5
10	5	-104.06385	142.45895	9.9627621	257.82863	105.21282	5
11	5	-103.18005	142.3729	15.576275	266.0393	106.31525	5
12	5	-101.5402	142.25775	25.75221	280.24482	108.0257	5
13	5	-99.90035	142.2249	35.120734	292.6179	109.30106	5
14	5	-98.26047	142.2741	43.683799	303.18787	110.15294	5
15	5	-96.620605	142.40575	51.439352	311.95818	110.58368	5
16	5	-94.98074	142.6209	58.37556	318.92148	110.59518	5
17	5	-93.340875	142.92115	64.479547	324.05702	110.1841	5
18	5	-91.76745	143.2897	69.543154	327.26115	109.3948	5
19	5	-90.26047	143.7225	73.610991	328.63407	108.25087	5
20	5	-88.75349	144.2351	76.897777	328.32766	106.72565	5
21	5	-87.263715	144.82375	79.035269	326.2706	104.94517	5
22	5	-85.79115	145.4914	79.998435	322.3907	102.88941	5





23	5	-84.67647	146.048	80.223262	316.07524	100.11323	5
24	5	-83.332235	146.82165	79.490003	331.99499	107.18201	5
25	5	-81.40056	148.06275	77.172345	303.35526	96.008951	5
26	5	-79.468885	149.5104	72.82631	271.32998	84.259808	5
27	5	-78.062055	150.68825	68.448325	335.60457	113.4011	5
28	5	-77.559565	151.1447	66.53445	413.80735	147.4086	5
29	5	-77.09207	151.6006	64.447106	380.5124	134.16176	5
30	5	-76.651045	152.03425	62.443382	352.75904	123.23169	5
31	5	-76.05801	152.6688	59.24398	336.67669	117.7632	5
32	5	-74.777385	154.1423	49.48874	302.51639	107.40387	5
33	5	-73.33216	156.03355	34.637815	259.04299	95.254347	5
34	5	-72.55637	157.1319	25.851374	194.32125	97.26613	30
35	5	-72.345825	157.4618	23.154741	186.78611	94.472616	30
36	5	-71.733795	158.4885	14.651872	163.56211	85.973363	30
37	5	-71.024675	159.75045	4.0902318	135.29468	75.750922	30
38	5	-69.891495	162.31895	-18.200316	50.124178	28.939208	30
39	5	-68.16615	168.6026	-75.410474	-125.13156	-72.244742	30
40	5	-67.29815	173.1786	-118.067	-45.197027	-26.094516	30