ALLEGATO 11
VERIFICHE DI STABILITÀ INTERFERENZA 19
SEZIONE A-A' - RELAZIONI DI CALCOLO

VERIFICA DI STABILITÀ PRE-OPERAM IN ASSENZA DI FALDA ACQUIFERA

Analisi di stabilità dei pendii con BISHOP

Numero di strati	4.0
Numero dei conci	50.0
Coefficiente di sicurezza [R2]	1.1

Superficie di forma circolare

Maglia dei Centri

Ascissa vertice sinistro inferiore xi	66.03 m
Ordinata vertice sinistro inferiore yi	189.5 m
Ascissa vertice destro superiore xs	133.9 m
Ordinata vertice destro superiore ys	237.5 m
Passo di ricerca	10.0
Numero di celle lungo x	10.0
Numero di celle lungo y	10.0

Coefficienti sismici [N.T.C.] 2018

Dati generali

Descrizione:	
Latitudine:	41.81
Longitudine:	14.97
Tipo di costruzione:	2 - Opere ordinarie
Classe d'uso:	Classe IV
Vita nominale:	50.0 [anni]
Vita di riferimento:	100.0 [anni]

Parametri sismici su sito di riferimento

Categoria sottosuolo:	C
Categoria topografica:	T1

S.L. Stato limite	TR Tempo ritorno [anni]	ag [m/s²]	F0 [-]	TC* [sec]
S.L.O.	60.0	0.76	2.47	0.31
S.L.D.	101.0	0.98	2.5	0.32
S.L.V.	949.0	2.51	2.45	0.35
S.L.C.	1950.0	3.27	2.44	0.36

Coefficienti sismici orizzontali e verticali

Opera: Stabilità dei pendii

S.L. Stato limite	amax [m/s²]	beta [-]	kh [-]	kv [sec]
S.L.O.	1.14	0.2	0.0233	0.0116
S.L.D.	1.47	0.2	0.03	0.015
S.L.V.	3.3226	0.28	0.0949	0.0474
S.L.C.	3.9626	0.28	0.1131	0.0566

Coefficiente azione sismica orizzontale	0.0949
Coefficiente azione sismica verticale	0.0474

Vertici profilo

N	X m	y m
1	0.0	146.3
2	66.66	150.0
3	85.6	155.0
4	106.14	160.0
5	122.43	165.0
6	143.07	170.0
7	147.06	170.7
8	238.28	175.0

Vertici strato 1

N	X m	y m
1	0.0	146.3
2	66.66	150.0
3	74.28	151.12
4	98.45	155.43
5	106.58	157.28
6	113.57	159.26
7	122.54	162.06
8	132.22	164.63
9	140.35	167.5
10	147.06	170.7
11	238.28	175.0

Vertici strato 2

N	X m	y m
1	0.0	146.3
2	66.66	150.0
3	66.66	150.0
4	74.28	151.12
5	98.45	155.43
6	106.58	157.28
7	113.57	159.26
8	122.82	160.49
9	132.53	161.51
10	140.28	162.04
11	149.84	162.96
12	238.28	167.0

Vertici strato 3

N	X m	y m
1	0.0	143.0
2	18.94	143.29
3	43.57	144.94
4	60.48	147.5
5	68.24	148.83
6	74.28	151.12
7	98.45	155.43
8	106.58	157.28
9	113.57	159.26

10	122.82	160.49
11	132.53	161.51
12	140.28	162.04
13	149.84	162.96
14	238.28	167.0

Stratigrafia

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

Strato	c (kg/cm²)	Fi (°)	G (Kg/m³)	Gs (Kg/m³)	Litologia
1	0.1	23.4	1927	2080	
2	0.15	26.4	2070	2080	
3	0	32	1870	1920	
4	0.15	23.2	2100	2180	

Risultati analisi pendio [A2+M2+R2]

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Fs minimo individuato	1.49
Ascissa centro superficie	99.97 m
Ordinata centro superficie	208.7 m
Raggio superficie	51.23 m

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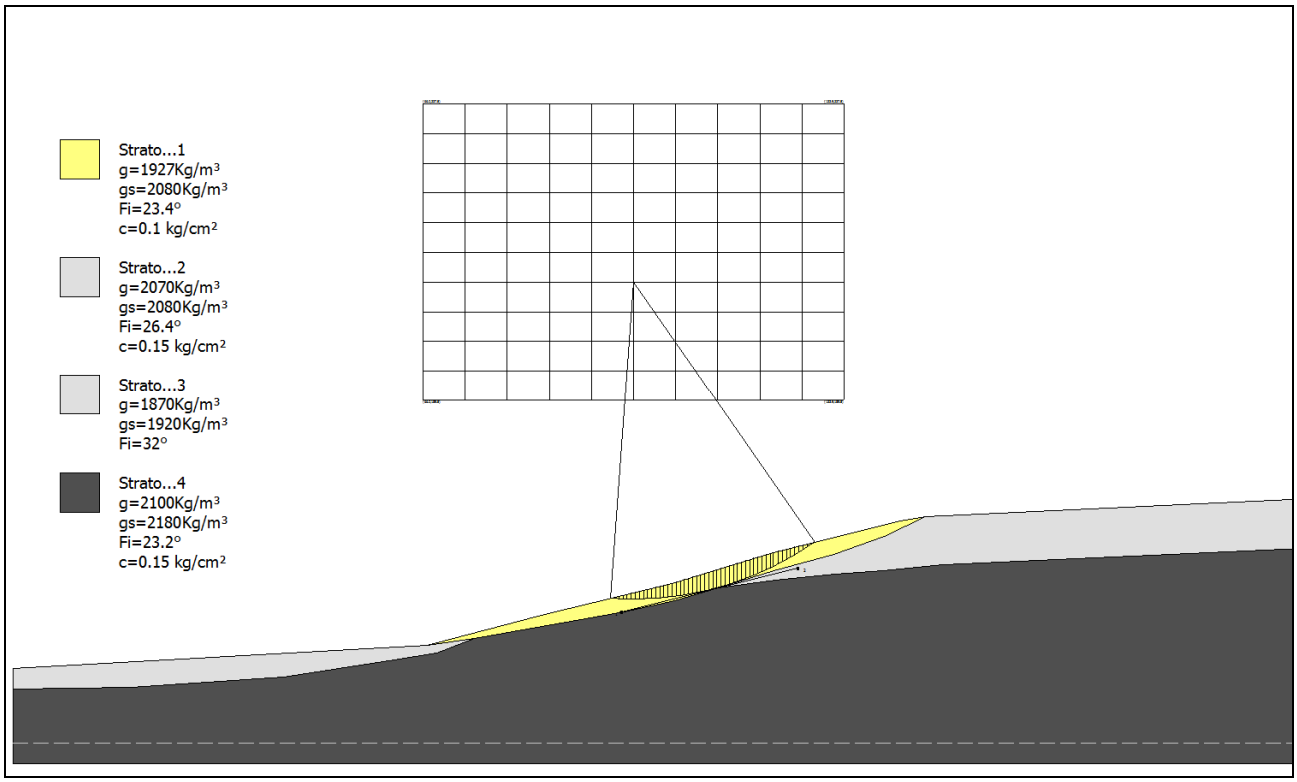
Analisi dei conci. Superficie...xc = 99.966 yc = 208.698 Rc = 51.225 Fs=1.4863

Nr.	B m	Alfa (°)	Li m	Wi (Kg)	Kh•Wi (Kg)	Kv•Wi (Kg)	c (kg/cm²)	Fi (°)	Ui (Kg)	N'i (Kg)	Ti (Kg)
1	0.66	-3.7	0.66	130.32	12.37	6.18	0.08	19.1	0.0	156.2	391.5
2	0.66	-3.0	0.66	382.79	36.33	18.14	0.08	19.1	0.0	406.9	449.6
3	0.66	-2.3	0.66	624.49	59.26	29.6	0.08	19.1	0.0	644.9	504.9
4	0.66	-1.5	0.66	855.44	81.18	40.55	0.08	19.1	0.0	870.6	557.3
5	0.66	-0.8	0.66	1075.64	102.08	50.99	0.08	19.1	0.0	1084.1	606.9
6	0.66	-0.1	0.66	1285.08	121.95	60.91	0.08	19.1	0.0	1285.7	653.8
7	0.66	0.7	0.66	1483.81	140.81	70.33	0.08	19.1	0.0	1475.6	698.1
8	0.66	1.4	0.66	1671.76	158.65	79.24	0.08	19.1	0.0	1653.9	739.7
9	0.66	2.2	0.66	1849.03	175.47	87.64	0.08	19.1	0.0	1821.1	778.8
10	0.66	2.9	0.66	2015.47	191.27	95.53	0.08	19.1	0.0	1976.9	815.2
11	0.66	3.6	0.66	2171.21	206.05	102.92	0.08	19.1	0.0	2121.7	849.2
12	0.66	4.4	0.66	2316.09	219.8	109.78	0.08	19.1	0.0	2255.6	880.7
13	0.66	5.1	0.66	2450.19	232.52	116.14	0.08	19.1	0.0	2378.6	909.8
14	0.66	5.8	0.66	2573.36	244.21	121.98	0.08	19.1	0.0	2490.9	936.4
15	0.62	6.6	0.63	2544.74	241.5	120.62	0.08	19.1	0.0	2456.7	910.5
16	0.69	7.3	0.7	2957.34	280.65	140.18	0.08	19.1	0.0	2848.3	1039.1
17	0.66	8.1	0.66	2959.78	280.88	140.29	0.08	19.1	0.0	2844.7	1020.5
18	0.66	8.8	0.67	3092.16	293.45	146.57	0.08	19.1	0.0	2966.4	1049.5
19	0.66	9.6	0.67	3213.46	304.96	152.32	0.08	19.1	0.0	3077.4	1076.1
20	0.66	10.3	0.67	3323.49	315.4	157.53	0.08	19.1	0.0	3177.9	1100.3
21	0.66	11.1	0.67	3422.32	324.78	162.22	0.08	19.1	0.0	3267.7	1122.2
22	0.66	11.8	0.67	3509.76	333.08	166.36	0.08	19.1	0.0	3347.0	1141.6
23	0.66	12.6	0.67	3585.74	340.29	169.96	0.08	19.1	0.0	3415.5	1158.6
24	0.66	13.3	0.68	3650.21	346.4	173.02	0.08	19.1	0.0	3473.4	1173.2
25	0.66	14.1	0.68	3702.95	351.41	175.52	0.08	19.1	0.0	3520.4	1185.3
26	0.66	14.8	0.68	3744.06	355.31	177.47	0.08	19.1	0.0	3556.6	1195.0
27	0.66	15.6	0.68	3773.15	358.07	178.85	0.08	19.1	0.0	3581.8	1202.2
28	0.66	16.4	0.69	3790.34	359.7	179.66	0.08	19.1	0.0	3596.0	1206.9
29	0.66	17.1	0.69	3795.27	360.17	179.9	0.08	19.1	0.0	3598.8	1209.0
30	0.66	17.9	0.69	3788.0	359.48	179.55	0.08	19.1	0.0	3590.3	1208.6
31	0.66	18.7	0.69	3768.17	357.6	178.61	0.08	19.1	0.0	3570.1	1205.6

32	0.66	19.5	0.7	3735.81	354.53	177.08	0.08	19.1	0.0	3538.2	1199.9
33	0.66	20.2	0.7	3690.55	350.23	174.93	0.08	19.1	0.0	3494.1	1191.5
34	0.66	21.0	0.71	3632.36	344.71	172.17	0.08	19.1	0.0	3437.8	1180.4
35	0.66	21.8	0.71	3560.92	337.93	168.79	0.08	19.1	0.0	3368.8	1166.3
36	0.66	22.6	0.71	3476.1	329.88	164.77	0.08	19.1	0.0	3286.8	1149.4
37	0.66	23.4	0.72	3377.56	320.53	160.1	0.08	19.1	0.0	3191.5	1129.5
38	0.66	24.2	0.72	3265.22	309.87	154.77	0.08	19.1	0.0	3082.6	1106.6
39	0.66	25.0	0.73	3138.62	297.86	148.77	0.08	19.1	0.0	2959.5	1080.4
40	0.45	25.7	0.5	2079.63	197.36	98.57	0.08	19.1	0.0	1958.2	726.9
41	0.86	26.5	0.97	3713.82	352.44	176.04	0.08	19.1	0.0	3486.3	1331.5
42	0.66	27.5	0.74	2573.21	244.2	121.97	0.08	19.1	0.0	2401.8	958.9
43	0.66	28.3	0.75	2332.97	221.4	110.58	0.08	19.1	0.0	2161.9	906.1
44	0.66	29.2	0.75	2076.93	197.1	98.45	0.08	19.1	0.0	1904.5	849.4
45	0.66	30.0	0.76	1804.87	171.28	85.55	0.08	19.1	0.0	1628.8	788.6
46	0.66	30.9	0.77	1516.18	143.89	71.87	0.08	19.1	0.0	1333.9	723.6
47	0.66	31.7	0.77	1210.55	114.88	57.38	0.08	19.1	0.0	1018.9	654.0
48	0.66	32.6	0.78	887.46	84.22	42.07	0.08	19.1	0.0	682.7	579.7
49	0.66	33.5	0.79	546.41	51.85	25.9	0.08	19.1	0.0	324.1	500.4
50	0.66	34.4	0.8	186.87	17.73	8.86	0.08	19.1	0.0	-58.0	415.8



VERIFICA DI STABILITÀ PRE-OPERAM IN PRESENZA DI FALDA ACQUIFERA

Analisi di stabilità dei pendii con BISHOP

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Numero di strati	4.0
Numero dei conci	50.0
Coefficiente di sicurezza [R2]	1.1

Superficie di forma circolare

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Maglia dei Centri

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Ascissa vertice sinistro inferiore xi	66.03 m
Ordinata vertice sinistro inferiore yi	189.5 m
Ascissa vertice destro superiore xs	133.9 m
Ordinata vertice destro superiore ys	237.5 m
Passo di ricerca	10.0
Numero di celle lungo x	10.0
Numero di celle lungo y	10.0

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Coefficienti sismici [N.T.C.] 2018

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Dati generali

Descrizione:	
Latitudine:	41.81
Longitudine:	14.97
Tipo di costruzione:	2 - Opere ordinarie
Classe d'uso:	Classe IV
Vita nominale:	50.0 [anni]
Vita di riferimento:	100.0 [anni]

Parametri sismici su sito di riferimento

Categoria sottosuolo:	C
Categoria topografica:	T1

S.L. Stato limite	TR Tempo ritorno [anni]	ag [m/s²]	F0 [-]	TC* [sec]
S.L.O.	60.0	0.76	2.47	0.31
S.L.D.	101.0	0.98	2.5	0.32
S.L.V.	949.0	2.51	2.45	0.35
S.L.C.	1950.0	3.27	2.44	0.36

Coefficienti sismici orizzontali e verticali

Opera: Stabilità dei pendii

S.L. Stato limite	amax [m/s²]	beta [-]	kh [-]	kv [sec]
S.L.O.	1.14	0.2	0.0233	0.0116
S.L.D.	1.47	0.2	0.03	0.015
S.L.V.	3.3226	0.28	0.0949	0.0474
S.L.C.	3.9626	0.28	0.1131	0.0566

Coefficiente azione sismica orizzontale	0.0949
Coefficiente azione sismica verticale	0.0474

Vertici profilo

N	X m	y m
1	0.0	146.3
2	66.66	150.0
3	85.6	155.0
4	106.14	160.0
5	122.43	165.0
6	143.07	170.0
7	147.06	170.7
8	238.28	175.0

Falda

Nr.	X m	y m
1	0.0	146.3
2	66.66	150.0
3	85.6	155.0
4	106.14	160.0
5	122.43	165.0
6	143.07	170.0
7	147.06	170.7
8	238.28	175.0

Vertici strato 1

N	X m	y m
1	0.0	146.3
2	66.66	150.0
3	74.28	151.12
4	98.45	155.43
5	106.58	157.28
6	113.57	159.26
7	122.54	162.06
8	132.22	164.63
9	140.35	167.5
10	147.06	170.7
11	238.28	175.0

Vertici strato 2

N	X m	y m
1	0.0	146.3
2	66.66	150.0
3	66.66	150.0
4	74.28	151.12
5	98.45	155.43
6	106.58	157.28
7	113.57	159.26
8	122.82	160.49
9	132.53	161.51
10	140.28	162.04
11	149.84	162.96
12	238.28	167.0

Vertici strato 3

N	X m	y m
1	0.0	143.0

2	18.94	143.29
3	43.57	144.94
4	60.48	147.5
5	68.24	148.83
6	74.28	151.12
7	98.45	155.43
8	106.58	157.28
9	113.57	159.26
10	122.82	160.49
11	132.53	161.51
12	140.28	162.04
13	149.84	162.96
14	238.28	167.0

Stratigrafia

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

Strato	c (kg/cm²)	Fi (°)	G (Kg/m³)	Gs (Kg/m³)	Litologia
1	0.1	23.4	1927	2080	
2	0.15	26.4	2070	2080	
3	0	32	1870	1920	
4	0.15	23.2	2100	2180	

Risultati analisi pendio [A2+M2+R2]

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Fs minimo individuato	0.97
Ascissa centro superficie	99.97 m
Ordinata centro superficie	208.7 m
Raggio superficie	51.23 m

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B: Larghezza del concio; Alfa: Angolo di inclinazione della base del concio; Li: Lunghezza della base del concio; Wi: Peso del concio ; Ui: Forze derivanti dalle pressioni neutre; Ni: forze agenti normalmente alla direzione di scivolamento; Ti: forze agenti parallelamente alla superficie di scivolamento; Fi: Angolo di attrito; c: coesione.

Analisi dei conci. Superficie...xc = 99.966 yc = 208.698 Rc = 51.225 Fs=0.9702

Nr.	B m	Alfa (°)	Li m	Wi (Kg)	Kh•Wi (Kg)	Kv•Wi (Kg)	c (kg/cm²)	Fi (°)	Ui (Kg)	N'i (Kg)	Ti (Kg)
1	0.66	-3.7	0.66	140.67	13.35	6.67	0.08	19.1	102.7	111.4	583.8
2	0.66	-3.0	0.66	413.18	39.21	19.58	0.08	19.1	301.7	248.0	632.1
3	0.66	-2.3	0.66	674.07	63.97	31.95	0.08	19.1	492.2	377.1	677.9
4	0.66	-1.5	0.66	923.36	87.63	43.77	0.08	19.1	674.3	498.8	721.1
5	0.66	-0.8	0.66	1161.04	110.18	55.03	0.08	19.1	847.8	613.5	761.8
6	0.66	-0.1	0.66	1387.12	131.64	65.75	0.08	19.1	1012.9	721.0	800.2
7	0.66	0.7	0.66	1601.62	151.99	75.92	0.08	19.1	1169.6	821.7	836.2
8	0.66	1.4	0.66	1804.5	171.25	85.53	0.08	19.1	1317.7	915.7	869.8
9	0.66	2.2	0.66	1995.84	189.41	94.6	0.08	19.1	1457.4	1003.2	901.2
10	0.66	2.9	0.66	2175.5	206.45	103.12	0.08	19.1	1588.7	1084.0	930.4
11	0.66	3.6	0.66	2343.61	222.41	111.09	0.08	19.1	1711.4	1158.5	957.4
12	0.66	4.4	0.66	2499.98	237.25	118.5	0.08	19.1	1825.6	1226.8	982.2
13	0.66	5.1	0.66	2644.73	250.98	125.36	0.08	19.1	1931.3	1288.9	1005.0
14	0.66	5.8	0.66	2777.68	263.6	131.66	0.08	19.1	2028.4	1344.8	1025.6
15	0.62	6.6	0.63	2746.79	260.67	130.2	0.08	19.1	2114.7	1321.7	989.9
16	0.69	7.3	0.7	3192.15	302.94	151.31	0.08	19.1	2216.9	1527.3	1120.5
17	0.66	8.1	0.66	3194.79	303.19	151.43	0.08	19.1	2333.0	1520.7	1091.0
18	0.66	8.8	0.67	3337.67	316.75	158.21	0.08	19.1	2437.3	1581.1	1113.6

19	0.66	9.6	0.67	3468.6	329.17	164.41	0.08	19.1	2532.9	1635.3	1134.1
20	0.66	10.3	0.67	3587.37	340.44	170.04	0.08	19.1	2619.7	1683.6	1152.6
21	0.66	11.1	0.67	3694.04	350.56	175.1	0.08	19.1	2697.5	1725.8	1169.0
22	0.66	11.8	0.67	3788.43	359.52	179.57	0.08	19.1	2766.5	1762.2	1183.4
23	0.66	12.6	0.67	3870.44	367.3	183.46	0.08	19.1	2826.4	1792.4	1195.8
24	0.66	13.3	0.68	3940.03	373.91	186.76	0.08	19.1	2877.2	1816.7	1206.2
25	0.66	14.1	0.68	3996.96	379.31	189.46	0.08	19.1	2918.8	1835.0	1214.5
26	0.66	14.8	0.68	4041.33	383.52	191.56	0.08	19.1	2951.1	1847.3	1220.8
27	0.66	15.6	0.68	4072.73	386.5	193.05	0.08	19.1	2974.1	1853.5	1225.1
28	0.66	16.4	0.69	4091.29	388.26	193.93	0.08	19.1	2987.6	1853.6	1227.3
29	0.66	17.1	0.69	4096.61	388.77	194.18	0.08	19.1	2991.5	1847.4	1227.3
30	0.66	17.9	0.69	4088.76	388.02	193.81	0.08	19.1	2985.8	1835.1	1225.4
31	0.66	18.7	0.69	4067.36	385.99	192.79	0.08	19.1	2970.2	1816.4	1221.2
32	0.66	19.5	0.7	4032.43	382.68	191.14	0.08	19.1	2944.6	1791.3	1215.0
33	0.66	20.2	0.7	3983.57	378.04	188.82	0.08	19.1	2909.0	1759.6	1206.5
34	0.66	21.0	0.71	3920.76	372.08	185.84	0.08	19.1	2863.1	1721.2	1195.9
35	0.66	21.8	0.71	3843.65	364.76	182.19	0.08	19.1	2806.8	1676.1	1182.9
36	0.66	22.6	0.71	3752.09	356.07	177.85	0.08	19.1	2739.9	1624.0	1167.6
37	0.66	23.4	0.72	3645.73	345.98	172.81	0.08	19.1	2662.3	1564.8	1150.0
38	0.66	24.2	0.72	3524.48	334.47	167.06	0.08	19.1	2573.7	1498.3	1130.0
39	0.66	25.0	0.73	3387.82	321.5	160.58	0.08	19.1	2473.9	1424.2	1107.4
40	0.45	25.7	0.5	2244.74	213.03	106.4	0.08	19.1	2380.9	933.4	748.0
41	0.86	26.5	0.97	4008.7	380.43	190.01	0.08	19.1	2232.0	1637.2	1380.1
42	0.66	27.5	0.74	2777.52	263.59	131.65	0.08	19.1	2028.3	1102.5	1005.4
43	0.66	28.3	0.75	2518.21	238.98	119.36	0.08	19.1	1838.9	966.9	961.8
44	0.66	29.2	0.75	2241.84	212.75	106.26	0.08	19.1	1637.1	822.2	915.2
45	0.66	30.0	0.76	1948.18	184.88	92.34	0.08	19.1	1422.6	668.2	865.5
46	0.66	30.9	0.77	1636.56	155.31	77.57	0.08	19.1	1195.1	504.3	812.5
47	0.66	31.7	0.77	1306.66	124.0	61.94	0.08	19.1	954.2	330.1	756.1
48	0.66	32.6	0.78	957.93	90.91	45.41	0.08	19.1	699.5	145.1	696.2
49	0.66	33.5	0.79	589.79	55.97	27.96	0.08	19.1	430.7	-51.3	632.6
50	0.66	34.4	0.8	201.7	19.14	9.56	0.08	19.1	147.3	-259.6	565.1