ALLEGATO 10
VERIFICHE DI STABILITÀ INTERFERENZA 18
SEZIONE A-A' - RELAZIONI DI CALCOLO

VERIFICA DI STABILITÀ PRE-OPERAM IN ASSENZA 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	72.02 m
Ordinata vertice sinistro inferiore yi	217.24 m
Ascissa vertice destro superiore xs	178.4 m
Ordinata vertice destro superiore ys	291.57 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:	41.82
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	0.97	2.5	0.32
S.L.V.	949.0	2.5	2.45	0.35
S.L.C.	1950.0	3.26	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.	1.455	0.2	0.0297	0.0148
S.L.V.	3.3131	0.28	0.0946	0.0473
S.L.C.	3.9553	0.28	0.1129	0.0565

Coefficiente azione sismica orizzontale	0.0946
Coefficiente azione sismica verticale	0.0473

Vertici profilo

N	X m	y m
1	0.0	148.0
2	20.08	148.9
3	22.77	149.0
4	33.57	150.0
5	52.18	155.0
6	80.22	160.0
7	100.65	165.0
8	128.37	170.0
9	161.51	175.0
10	177.85	180.0
11	197.63	185.0
12	199.6	185.5
13	207.95	188.0
14	212.33	189.8
15	229.22	193.0
16	284.28	193.0

Vertici strato 1

N	X m	y m
1	0.0	148.0
2	20.08	148.9
3	26.1	147.82
4	35.53	146.94
5	54.84	148.26
6	78.75	152.21
7	100.65	156.2
8	128.37	161.2
9	156.62	168.22
10	175.92	174.36
11	190.83	180.06
12	202.24	184.89
13	207.95	188.0
14	212.33	189.8
15	229.22	193.0
16	284.28	193.0

Vertici strato 2

N	X m	y m
1	0.0	148.0
2	20.08	148.9
3	20.08	148.9
4	20.08	148.9
5	26.1	147.82
6	35.53	146.94
7	54.84	148.26
8	78.75	152.21
9	100.65	156.2
10	128.37	161.2
11	156.62	168.22
12	175.92	174.36

13	190.83	180.06
14	202.24	184.89
15	207.95	188.0
16	212.33	189.8
17	231.2	188.75
18	284.28	188.0

Vertici strato 3

N	X m	y m
1	0.0	143.0
2	10.41	143.74
3	19.15	144.57
4	23.12	145.06
5	28.0	145.67
6	35.53	146.94
7	54.84	148.26
8	78.75	152.21
9	100.65	156.2
10	128.37	161.2
11	156.62	168.22
12	175.92	174.36
13	190.83	180.06
14	202.24	184.89
15	207.95	188.0
16	212.33	189.8
17	231.2	188.75
18	284.28	188.0

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	0.04	23.4	1927	2080	
2	0	32	1900	1950	
3	0	32	1900	1950	
4	0.15	23.2	2100	2180	

Risultati analisi pendio [A2+M2+R2]

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Fs minimo individuato	1.17
Ascissa centro superficie	157.12 m
Ordinata centro superficie	232.1 m
Raggio superficie	60.66 m

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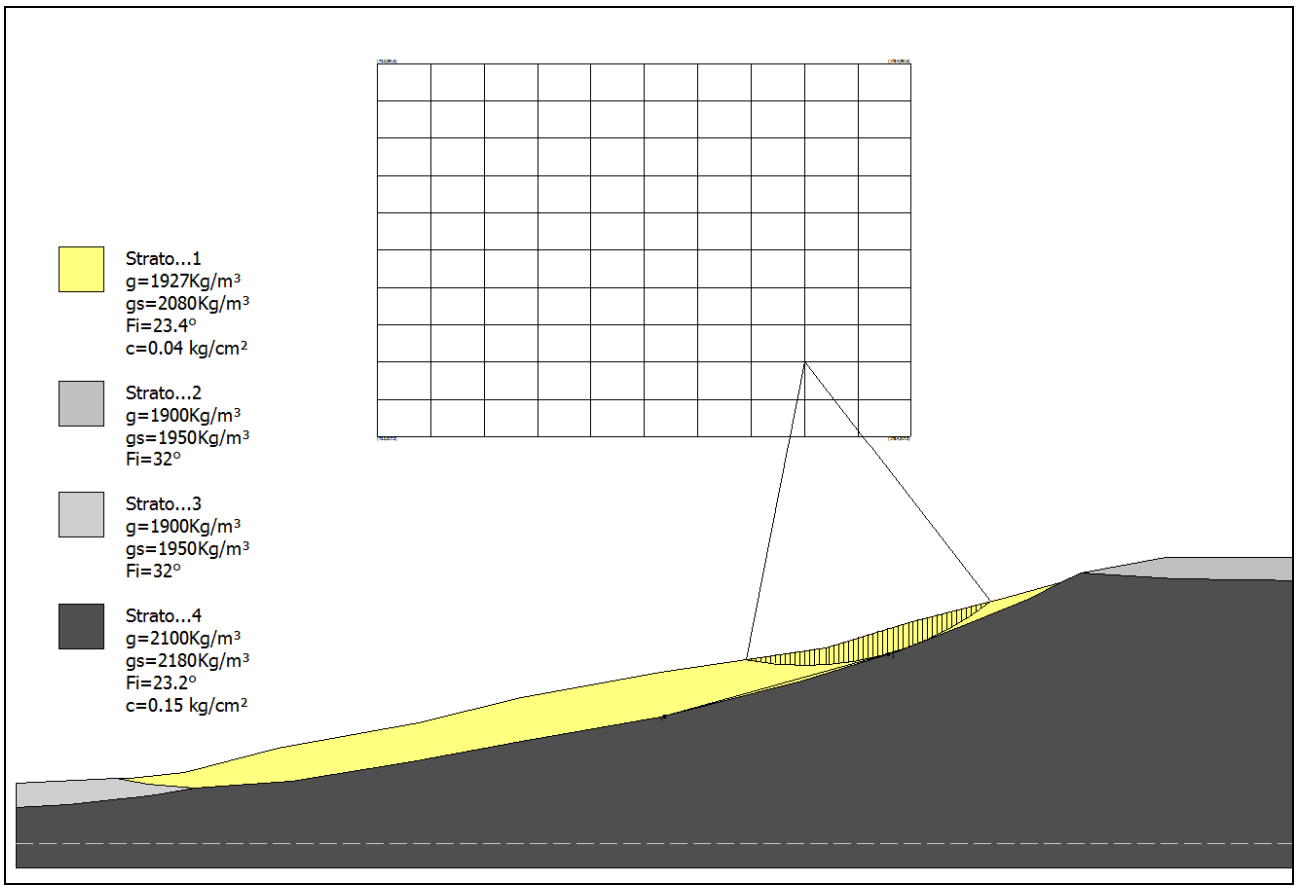
B: Larghezza del concio; Alfa: Angolo di inclinazione della base del concio; Li: Lunghezza della base del concio; Wi: Peso del concio ; Ui: Forze derivanti dalle pressioni neutre; Ni: forze agenti normalmente alla direzione di scivolamento; Ti: forze agenti parallelamente alla superficie di scivolamento;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

Analisi dei conci. Superficie...xc = 157.121 yc = 232.105 Rc = 60.664 Fs=1.171

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	0.98	-10.6	0.99	315.08	29.81	14.9	0.03	19.1	0.0	393.4	387.9
2	0.98	-9.7	0.99	921.88	87.21	43.6	0.03	19.1	0.0	1033.7	576.4
3	0.98	-8.8	0.99	1497.75	141.69	70.84	0.03	19.1	0.0	1631.4	752.4
4	0.98	-7.8	0.99	2043.05	193.27	96.64	0.03	19.1	0.0	2188.3	916.4
5	0.98	-6.9	0.98	2557.87	241.97	120.99	0.03	19.1	0.0	2705.8	1068.8
6	0.98	-6.0	0.98	3042.47	287.82	143.91	0.03	19.1	0.0	3185.5	1210.2
7	0.98	-5.0	0.98	3496.91	330.81	165.4	0.03	19.1	0.0	3628.8	1340.8
8	0.98	-4.1	0.98	3921.44	370.97	185.48	0.03	19.1	0.0	4036.7	1461.1
9	0.98	-3.2	0.98	4316.17	408.31	204.16	0.03	19.1	0.0	4410.5	1571.3
10	0.98	-2.3	0.98	4681.1	442.83	221.42	0.03	19.1	0.0	4750.9	1671.7
11	0.98	-1.3	0.98	5016.4	474.55	237.28	0.03	19.1	0.0	5059.2	1762.7
12	0.98	-0.4	0.98	5322.09	503.47	251.73	0.03	19.1	0.0	5335.8	1844.4
13	0.98	0.5	0.98	5598.23	529.59	264.8	0.03	19.1	0.0	5581.7	1917.2
14	0.98	1.4	0.98	5844.59	552.9	276.45	0.03	19.1	0.0	5797.2	1980.9
15	0.98	2.3	0.98	6061.45	573.41	286.71	0.03	19.1	0.0	5983.2	2036.0
16	1.42	3.5	1.42	9152.45	865.82	432.91	0.03	19.1	0.0	8984.1	3045.4
17	0.53	4.4	0.53	3545.95	335.45	167.72	0.03	19.1	0.0	3466.3	1170.5
18	0.98	5.1	0.98	6831.47	646.26	323.13	0.03	19.1	0.0	6658.5	2236.5
19	0.98	6.0	0.98	7214.33	682.48	341.24	0.03	19.1	0.0	7006.8	2339.9
20	0.98	7.0	0.98	7567.33	715.87	357.93	0.03	19.1	0.0	7325.9	2434.8
21	0.98	7.9	0.99	7889.73	746.37	373.18	0.03	19.1	0.0	7615.4	2520.9
22	0.98	8.8	0.99	8181.78	774.0	387.0	0.03	19.1	0.0	7876.1	2598.7
23	0.98	9.8	0.99	8443.15	798.72	399.36	0.03	19.1	0.0	8107.9	2667.9
24	0.98	10.7	0.99	8673.76	820.54	410.27	0.03	19.1	0.0	8311.4	2728.9
25	0.98	11.7	1.0	8872.88	839.37	419.69	0.03	19.1	0.0	8486.0	2781.4
26	0.98	12.6	1.0	9040.63	855.24	427.62	0.03	19.1	0.0	8632.2	2825.6
27	0.98	13.5	1.0	9176.73	868.12	434.06	0.03	19.1	0.0	8750.0	2861.5
28	0.98	14.5	1.01	9280.27	877.91	438.96	0.03	19.1	0.0	8838.6	2888.8
29	0.98	15.4	1.01	9351.32	884.63	442.32	0.03	19.1	0.0	8898.3	2907.7
30	0.98	16.4	1.02	9389.4	888.24	444.12	0.03	19.1	0.0	8928.8	2918.0
31	0.98	17.4	1.02	9394.03	888.68	444.34	0.03	19.1	0.0	8929.6	2919.7
32	0.98	18.3	1.03	9364.3	885.86	442.93	0.03	19.1	0.0	8899.9	2912.4
33	1.16	19.4	1.22	10992.33	1039.88	519.94	0.03	19.1	0.0	10448.3	3423.8
34	0.8	20.4	0.85	7478.06	707.42	353.71	0.12	18.9	0.0	6902.4	2893.7
35	0.98	21.3	1.05	8938.84	845.61	422.81	0.12	18.9	0.0	8235.3	3485.7
36	0.98	22.3	1.06	8666.65	819.86	409.93	0.03	19.1	0.0	8248.5	2727.1
37	0.98	23.3	1.06	8359.52	790.81	395.41	0.03	19.1	0.0	7962.5	2644.7
38	0.98	24.3	1.07	8014.27	758.15	379.07	0.03	19.1	0.0	7640.9	2551.8
39	0.98	25.3	1.08	7629.73	721.77	360.89	0.03	19.1	0.0	7282.0	2448.1
40	0.98	26.3	1.09	7205.17	681.61	340.8	0.03	19.1	0.0	6884.5	2333.2
41	0.98	27.4	1.1	6739.65	637.57	318.79	0.03	19.1	0.0	6446.7	2206.5
42	0.98	28.4	1.11	6231.64	589.51	294.76	0.03	19.1	0.0	5966.5	2067.4
43	0.98	29.5	1.12	5680.28	537.35	268.68	0.03	19.1	0.0	5441.8	1915.4
44	0.98	30.5	1.13	5084.04	480.95	240.47	0.03	19.1	0.0	4870.3	1749.7
45	0.98	31.6	1.15	4441.56	420.17	210.09	0.03	19.1	0.0	4249.1	1569.6
46	0.98	32.7	1.16	3751.05	354.85	177.42	0.03	19.1	0.0	3575.2	1374.1
47	0.98	33.8	1.18	3011.01	284.84	142.42	0.03	19.1	0.0	2845.2	1162.3
48	0.98	34.9	1.19	2219.3	209.95	104.97	0.03	19.1	0.0	2055.1	933.1
49	0.98	36.0	1.21	1373.88	129.97	64.98	0.03	19.1	0.0	1200.6	685.1
50	0.98	37.2	1.23	472.52	44.7	22.35	0.03	19.1	0.0	276.8	416.9


Strato...1
g=1927Kg/m³
gs=2080Kg/m³
Fi=23.4°
c=0.04 kg/cm²
Strato...2
g=1900Kg/m³
gs=1950Kg/m³
Fi=32°
Strato...3
g=1900Kg/m³
gs=1950Kg/m³
Fi=32°
Strato...4
g=2100Kg/m³
gs=2180Kg/m³
Fi=23.2°
c=0.15 kg/cm²

VERIFICA DI STABILITÀ PRE-OPERAM IN PRESENZA 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	72.02 m
Ordinata vertice sinistro inferiore yi	217.24 m
Ascissa vertice destro superiore xs	178.4 m
Ordinata vertice destro superiore ys	291.57 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.]

Dati generali

Descrizione:	
Latitudine:	41.82
Longitudine:	14.97
Tipo opera:	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	0.97	2.5	0.32
S.L.V.	949.0	2.5	2.45	0.35
S.L.C.	1950.0	3.26	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.	1.455	0.2	0.0297	0.0148
S.L.V.	3.3131	0.28	0.0946	0.0473
S.L.C.	3.9553	0.28	0.1129	0.0565

Coefficiente azione sismica orizzontale	0.0946
Coefficiente azione sismica verticale	0.0473

Vertici profilo

N	X m	y m
1	0.0	148.0
2	20.08	148.9
3	22.77	149.0
4	33.57	150.0
5	52.18	155.0
6	80.22	160.0
7	100.65	165.0
8	128.37	170.0
9	161.51	175.0
10	177.85	180.0
11	197.63	185.0
12	199.6	185.5
13	207.95	188.0
14	212.33	189.8
15	229.22	193.0
16	284.28	193.0

Falda

Nr.	X m	y m
1	0.0	148.0
2	20.08	148.9
3	22.77	149.0
4	33.57	150.0
5	52.18	155.0
6	80.22	160.0
7	100.65	165.0
8	128.37	170.0
9	161.51	175.0
10	177.85	180.0
11	197.63	185.0
12	199.6	185.5
13	207.95	188.0
14	212.33	189.8
15	229.22	193.0
16	284.28	193.0

Vertici strato 1

N	X m	y m
1	0.0	148.0
2	20.08	148.9
3	26.1	147.82
4	35.53	146.94
5	54.84	148.26
6	78.75	152.21
7	100.65	156.2
8	128.37	161.2
9	156.62	168.22
10	175.92	174.36
11	190.83	180.06
12	202.24	184.89
13	207.95	188.0
14	212.33	189.8
15	229.22	193.0
16	284.28	193.0

Vertici strato 2

N	X m	y m
1	0.0	148.0
2	20.08	148.9
3	20.08	148.9
4	20.08	148.9
5	26.1	147.82
6	35.53	146.94
7	54.84	148.26
8	78.75	152.21
9	100.65	156.2
10	128.37	161.2
11	156.62	168.22
12	175.92	174.36
13	190.83	180.06
14	202.24	184.89
15	207.95	188.0
16	212.33	189.8
17	231.2	188.75
18	284.28	188.0

Vertici strato 3

N	X m	y m
1	0.0	143.0
2	10.41	143.74
3	19.15	144.57
4	23.12	145.06
5	28.0	145.67
6	35.53	146.94
7	54.84	148.26
8	78.75	152.21
9	100.65	156.2
10	128.37	161.2
11	156.62	168.22
12	175.92	174.36
13	190.83	180.06
14	202.24	184.89
15	207.95	188.0
16	212.33	189.8
17	231.2	188.75
18	284.28	188.0

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	0.04	23.4	1927	2080	
2	0	32	1900	1950	
3	0	32	1900	1950	
4	0.15	23.2	2100	2180	

Risultati analisi pendio [A2+M2+R2]

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Fs minimo individuato	0.65
Ascissa centro superficie	157.12 m
Ordinata centro superficie	224.67 m
Raggio superficie	53.51 m

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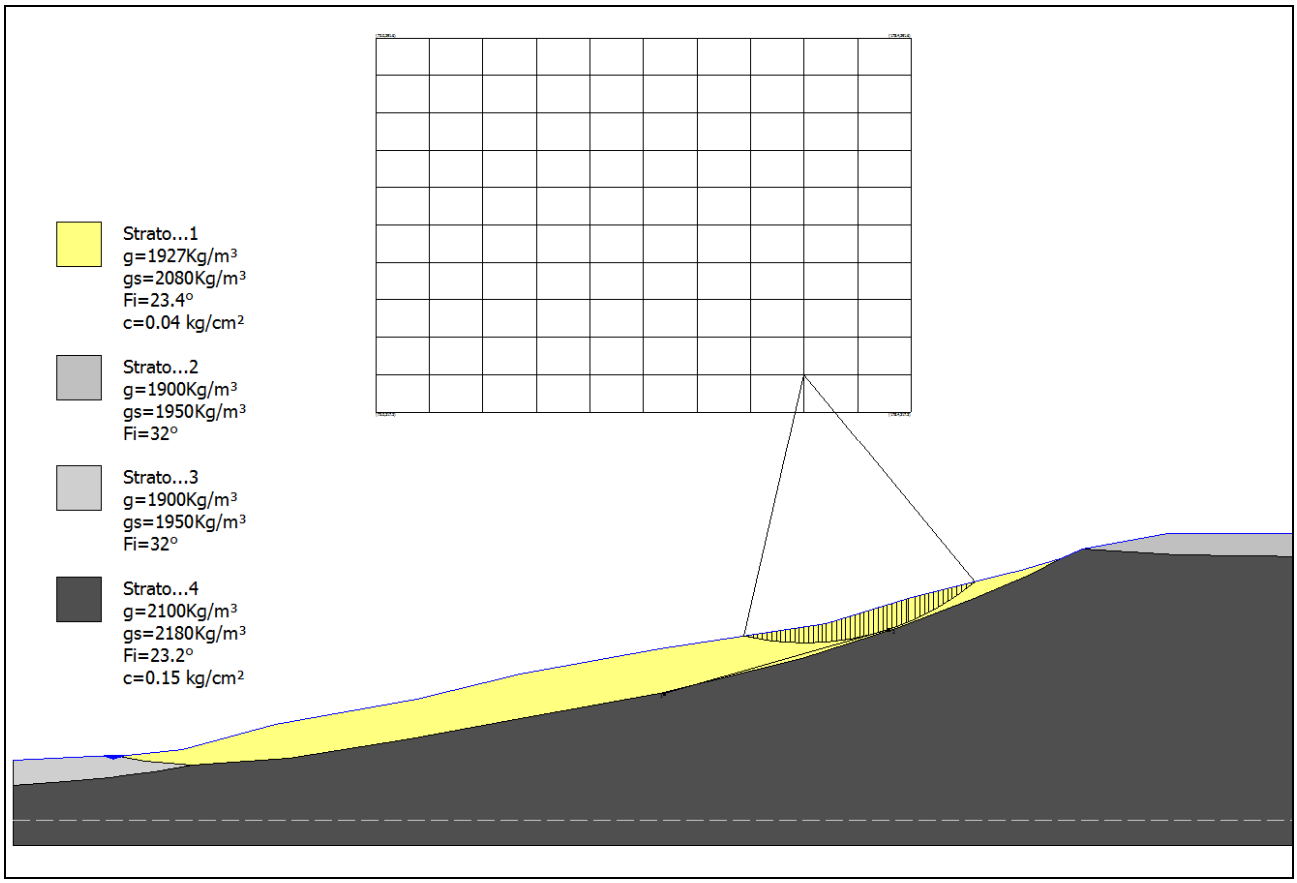
Analisi dei conci. Superficie...xc = 157.121 yc = 224.671 Rc = 53.508 Fs=0.6453

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	0.92	-12.5	0.94	331.42	31.35	15.68	0.03	19.1	173.2	317.0	637.3
2	0.92	-11.5	0.94	969.71	91.73	45.87	0.03	19.1	506.7	682.2	831.5
3	0.92	-10.4	0.94	1575.85	149.08	74.54	0.03	19.1	823.5	1018.3	1010.3
4	0.92	-9.4	0.93	2150.18	203.41	101.7	0.03	19.1	1123.6	1327.2	1174.6
5	0.92	-8.4	0.93	2692.97	254.75	127.38	0.03	19.1	1407.3	1610.5	1325.3
6	0.92	-7.5	0.93	3204.51	303.15	151.57	0.03	19.1	1674.5	1869.5	1463.2
7	0.92	-6.5	0.93	3684.88	348.59	174.29	0.03	19.1	1925.6	2105.5	1588.8
8	0.92	-5.5	0.92	2146.79	203.09	101.54	0.03	19.1	2160.6	2319.7	1702.9
9	0.92	-4.5	0.92	4553.33	430.75	215.37	0.03	19.1	2379.4	2513.1	1806.0
10	0.92	-3.5	0.92	4941.66	467.48	233.74	0.03	19.1	2582.4	2686.6	1898.5
11	0.92	-2.5	0.92	5299.62	501.34	250.67	0.03	19.1	2769.4	2841.1	1981.0
12	0.92	-1.5	0.92	5627.09	532.32	266.16	0.03	19.1	2940.5	2977.5	2053.9
13	0.92	-0.5	0.92	3076.12	291.0	145.5	0.03	19.1	3095.9	3096.1	2117.4
14	0.92	0.4	0.92	6191.29	585.7	292.85	0.03	19.1	3235.4	3197.8	2171.9
15	0.92	1.4	0.92	6428.03	608.09	304.05	0.03	19.1	3359.0	3283.2	2217.9
16	0.92	2.4	0.92	6634.28	627.6	313.8	0.03	19.1	3466.9	3352.5	2255.3
17	0.92	3.4	0.92	3536.19	334.52	167.26	0.03	19.1	3558.9	3406.4	2284.7
18	0.75	4.3	0.76	5698.03	539.03	269.52	0.03	19.1	3628.7	2824.7	1890.9
19	1.09	5.3	1.09	8519.14	805.91	402.96	0.03	19.1	3774.5	4184.4	2785.4
20	0.92	6.4	0.93	7614.31	720.31	360.16	0.03	19.1	3978.9	3704.9	2446.8
21	0.92	7.4	0.93	7940.93	751.21	375.61	0.03	19.1	4149.7	3832.4	2516.2
22	0.92	8.4	0.93	8236.77	779.2	389.6	0.03	19.1	4304.2	3943.9	2577.1
23	0.92	9.4	0.93	8501.07	804.2	402.1	0.03	19.1	4442.4	4040.2	2630.0
24	0.92	10.4	0.94	8734.14	826.25	413.12	0.03	19.1	4564.1	4121.4	2675.0
25	0.92	11.4	0.94	8935.18	845.27	422.63	0.03	19.1	4669.2	4187.3	2711.9
26	0.92	12.4	0.94	9104.16	861.25	430.63	0.03	19.1	4757.5	4238.5	2741.1
27	0.92	13.4	0.95	9240.79	874.18	437.09	0.03	19.1	4828.9	4275.0	2762.6
28	0.92	14.4	0.95	9344.32	883.97	441.99	0.03	19.1	4883.0	4296.7	2776.3
29	0.92	15.4	0.95	9414.76	890.64	445.32	0.03	19.1	4919.8	4303.8	2782.3
30	0.92	16.4	0.96	9451.17	894.08	447.04	0.03	19.1	4938.9	4296.2	2780.7
31	0.92	17.5	0.96	9453.57	894.31	447.15	0.03	19.1	4940.0	4273.8	2771.3
32	0.92	18.5	0.97	9420.71	891.2	445.6	0.03	19.1	4923.0	4236.6	2754.1
33	0.92	19.5	0.98	9352.71	884.77	442.38	0.03	19.1	4887.3	4184.3	2729.1
34	0.92	20.6	0.98	9248.29	874.89	437.44	0.03	19.1	4832.8	4116.7	2696.1
35	0.92	21.6	0.99	9107.05	861.53	430.76	0.03	19.1	4759.0	4033.8	2655.0
36	0.53	22.5	0.58	5191.95	491.16	245.58	0.03	19.1	4686.9	2290.6	1514.8
37	1.31	23.6	1.43	12353.89	1168.68	584.34	0.03	19.1	4542.7	5421.2	3615.9
38	0.92	24.9	1.01	8273.51	782.67	391.34	0.03	19.1	4323.4	3605.3	2437.2
39	0.92	26.0	1.02	7881.98	745.63	372.82	0.03	19.1	4118.9	3413.2	2338.7
40	0.92	27.1	1.03	7449.1	704.68	352.34	0.03	19.1	3892.6	3203.6	2231.1
41	0.92	28.2	1.04	6973.05	659.65	329.83	0.03	19.1	3643.9	2975.1	2113.8
42	0.92	29.3	1.05	6453.08	610.46	305.23	0.03	19.1	3372.1	2727.5	1986.5
43	0.92	30.4	1.07	5887.35	556.94	278.47	0.03	19.1	3076.5	2459.4	1848.6
44	0.92	31.6	1.08	5274.36	498.95	249.48	0.03	19.1	2756.2	2169.8	1699.7
45	0.92	32.7	1.09	4612.51	436.34	218.17	0.03	19.1	2410.3	1857.7	1539.1
46	0.92	33.9	1.11	3899.67	368.91	184.45	0.03	19.1	2037.8	1521.4	1366.1
47	0.92	35.1	1.12	3133.88	296.46	148.23	0.03	19.1	1637.6	1159.5	1179.9
48	0.92	36.3	1.14	2312.73	218.78	109.39	0.03	19.1	1208.6	770.2	979.6
49	0.92	37.6	1.16	1433.67	135.63	67.81	0.03	19.1	749.2	351.4	764.1
50	0.92	38.8	1.18	493.79	46.71	23.36	0.03	19.1	258.0	-99.2	532.4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Fi=32°
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