

## Typical field values of penetration resistance for density and consistency of soils (Literature & Empirical based)

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Sol Solution*

Relative Density of Sands and gravels				
Density	Friction angle (degrees)	NSPT (blows/feet)	qc (MPa)	qd(*) (MPa) P.A.N.D.A.
Very loose	< 30	0 - 4	0 - 2,0	0 - 1,5
Loose	30 - 35	4 - 10	2,0 - 5,0	1,5 - 4,0
Medium	35 - 40	10 - 30	5,0 - 10,0	4,0 - 9,0
Dense	40 - 45	30 - 50	10,0 - 20,0	9,0 - 18,0
Very dense	> 45	> 50	> 20	> 18,0

(\*) Obtained from Instrumented French Lightweight Dynamic Cone Penetrometer P.A.N.D.A. and by means of Dutch Formulae.

(\*\*) Empirical values

Consistency of Cohesive soils (silts and clays)				
Consistency	Strength (kPa)	NSPT (blows/feet)	qc (Mpa)	qd(*) (MPa) P.A.N.D.A.
Very soft	0 - 25	0 - 2	0 - 0,5	0 - 0,40
Soft	25 - 50	2 - 4	0,5 - 1,0	0,40 - 0,9
Firm	50 - 100	4 - 8	1,0 - 3,0	0,90 - 2,40
Stiff	100 - 200	8 - 16	3,0 - 6,0	2,40 - 4,80
Very stiff	200 - 400	16 - 30	6,0 - 12,0	4,80 - 10-0
Hard	> 400	> 32	> 12	>10

(\*) Obtained from Instrumented French Lightweight Dynamic Cone Penetrometer P.A.N.D.A. and by means of Dutch Formulae.

(\*\*) Empirical values

Intermediate soils					
Consistency	Cohesion (kPa)	Friction angle (degrees)	NSPT (blows/feet)	qc (Mpa)	qd(*) (MPa) P.A.N.D.A.
Loose	0 - 5	0 - 8	0 - 10	0 - 4,0	0 - 3,0
Medium	5 - 50	8 - 12	10 - 30	4,0 - 12,0	3,0 - 10,0
Dense	> 50	> 12	> 30	> 12,0	> 10,0

(\*) Obtained from Instrumented French Lightweight Dynamic Cone Penetrometer P.A.N.D.A. and by means of Dutch Formulae.

(\*\*) Empirical values