Angle of friction

in Parameters

- Geotechnical parameters,
- Shear strength parameters

<span ">Soil friction angle is a shear strength parameter of soils. Its definition is derived from the Mohr-Coulomb failure criterion and it is used to describe the friction shear resistance of soils together with the normal effective stress.Soil friction angle is a shear strength parameter of soils. Its definition is derived from the Mohr-Coulomb failure criterion and it is used to describe the friction shear resistance of soils together with the normal effective stress.

In the stress plane of Shear stress-effective normal stress, the soil friction angle is the angle of inclination with respect to the horizontal axis of the Mohr-Coulomb shear resistance line.

Typical values of soil friction angle

Some typical values of soil friction angle are given below for different USCS soil types at normally consolidated condition unless otherwise stated. These values should be used only as guidline for geotechnical problems; however, specific conition of each engineering problem often needs to be considered for an appropriate choice of geotechnical parameters.

Description	USCS	Soil friction angle [°]			Reference
		min	max	Specific value	
Well graded gravel, sandy gravel, with little or no fines	GW	33	40		[1],[2],
Poorly graded gravel, sandy gravel, with little or no fines	GP	32	44		[1],
Sandy gravels - Loose	(GW, GP)			35	[3 cited in 6]
Sandy gravels - Dense	(GW, GP)			50	[3 cited in 6]
Silty gravels, silty sandy gravels	GM	30	40		[1],
Clayey gravels, clayey sandy gravels	GC	28	35		[1],
Well graded sands, gravelly sands, with little or no fines	SW	33	43		[1],
Well-graded clean sand, gravelly sands - Compacted	SW	-	-	38	[3 cited in 6]
Well-graded sand, angular grains - Loose	(SW)			33	[3 cited in 6]
Well-graded sand, angular grains - Dense	(SW)			45	[3 cited in 6]
Poorly graded sands, gravelly sands, with little or no fines	SP	30	39		[1], [2],
Poorly-garded clean sand - Compacted	SP	-	-	37	[3 cited in 6]

Uniform sand, round grains - Loose	(SP)			27	[3 cited in 6]
Uniform sand, round grains - Dense	(SP)			34	[3 cited in 6]
Sand	SW, SP	37	38		[7],
Loose sand	(SW, SP)	29	30		[5 cited in 6]
Medium sand	(SW, SP)	30	36		[5 cited in 6]
Dense sand	(SW, SP)	36	41		[5 cited in 6]
Silty sands	SM	32	35		[1],
Silty clays, sand-silt mix - Compacted	SM	-	-	34	[3 cited in 6]
Silty sand - Loose	SM	27	33		[3 cited in 6]
Silty sand - Dense	SM	30	34		[3 cited in 6]
Clayey sands	SC	30	40		[1],
Calyey sands, sandy-clay mix - compacted	SC			31	[3 cited in 6]
Loamy sand, sandy clay Loam	SM, SC	31	34		[7],
Inorganic silts, silty or clayey fine sands, with slight plasticity	ML	27	41		[1],
Inorganic silt - Loose	ML	27	30		[3 cited in 6]
Inorganic silt - Dense	ML	30	35		[3 cited in 6]
Inorganic clays, silty clays, sandy clays of low plasticity	CL	27	35		[1],
Clays of low plasticity - compacted	CL			28	[3 cited in 6]
Organic silts and organic silty clays of low plasticity	OL	22	32		[1],
Inorganic silts of high plasticity	MH	23	33		[1],
Clayey silts - compacted	MH			25	[3 cited in 6]
Silts and clayey silts - compacted	ML			32	[3 cited in 6]
Inorganic clays of high plasticity	CH	17	31		[1],
Clays of high plasticity - compacted	CH			19	[3 cited in 6]
Organic clays of high plasticity	OH	17	35		[1],
Loam	ML, OL, MH, OH	28	32		[7],
Silt Loam	ML, OL, MH, OH	25	32		[7],
Clay Loam, Silty Clay Loam	ML, OL, CL, MH, OH, CH	18	32		[7],
Silty clay	OL, CL, OH, CH	18	32		[7],

Clay	CL, CH, OH, OL	18	28		[7],
Peat and other highly organic soils	Pt	0	10		[2],

Correlation between SPT-N value, friction angle, and relative density

Correlation between SPT-N value and friction angle and Relative density (Meyerhoff 1956)

SPT N3 [Blows/0.3 m - 1 ft]	Soi packing	Relative Density [%]	Friction angle [°]
< 4	Very loose	< 20	< 30
4 -10	Loose	20 - 40	30 - 35
10 - 30	Compact	40 - 60	35 - 40
30 - 50	Dense	60 - 80	40 - 45
> 50	Very Dense	> 80	> 45

Refrences

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Additional Info

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