

8.4 Soil parameters

For designing the foundations, following parameters are required:

- a. Limit bearing capacity of soil
- b. Density of soil and
- c. Angle of earth frustum.

These soil properties are normally obtained either by conducting in-situ or Laboratory tests on soil samples collected from the field during soil investigation or from available testing record of the area. The importance of above soil parameters in foundation design is discussed below in brief.

Limit bearing capacity

This parameter is vital from the point of view of establishing the stability of Foundation against shear failure of soil and excessive settlement of foundation when Foundation is subjected to total downward loads and moments due to horizontal shears and/or eccentricities as applicable.

Recommended limit bearing capacities of various types of soil are given in Table 9.1 of Annexure for guidance.

Density of soil

This parameter is required to calculate the uplift resistance of the foundation. Recommended values of angle of earth frustum for different types of soils/rocks are given in Table.1 of Annexure.

Angle of earth frustum

This parameter is required for finding out the uplift resistance of the foundation. Recommended values of angle of earth frustum for different types of soils/rocks are given in Table 8.1 of Annexure.

Table 8.1: Soil properties to be considered in foundation design for various types of soil

SI No	Types of soil	Angle of earth Frustum (Degrees)	Unit Wt.of soil (Kg/cum)	Limit bearing capacity (kg/sq.m)
1	Normal dry soil			
	(a) Without undercut	30	1440	25000
	(b) With undercut	30	1600	25000
2	Wet soil due to presence of sub soil Water/Surface Water	15	940	12500
3	Black cotton soil			
	(a) In Dry portion	0	1440	12500
	(b) In Wet portion	0	940	12500
4	Sandy soil			
	(a) With clay content 0-5%	10	1440	25000
	(b) With clay content 5-10%	20	1440	25000
5	Fissured Rock/Soft rock (with undercut)			
	(a) In Dry portion	20	1700	62500
	(b) In Wet portion	10	940	62500
6	Hard rock	-	-	125000
7	Normal hard dry soil (Morrum) with undercut	30	1600	40000

Note:

1. Limit bearing capacity of soil has been arrived at taking FOS 2.5 over the safe bearing capacity values. Soil research institute will be approached to furnish the limit bearing capacities of soil. If and when such data are available the above values can be reviewed.

2. Where clay content is more than 10% but less than 15% the soil will be classified as normal dry soil.

3. Angle of earth frustum shall be taken with respect to vertical.
(Source: Transmission line manual - Central board of irrigation and power)

Types of foundations

The foundations are designed for the uplift force, down thrust, lateral forces and over turning moments for varieties of soils.

Depending upon the ground water table and type of soil and rock, the foundations can be classified as follows.

Normal dry soil foundations

When water table is below foundation level and when soil is cohesive and homogeneous up to the full depth having clay content of 10-15%.

Wet soil foundations

When water table is below foundation level and up to 1.5m below ground level. the foundation in the soils which have standing surface water for a long

period with penetration not exceeding 1.0m below ground level (e.g. paddy fields) are also classified as wet foundations.

Partially submerged foundations

When water table is at a depth between 1.5m and 0.75 below ground level and when the soil is normal and cohesive.

Fully submerged foundations

When water table is within 0.75m below ground and the soil is normal and cohesive.

Black cotton soil foundations

When the soil is cohesive having inorganic clay exceeding 15% and characterized by high shrinkage and swelling property (need not be always black in colour)

Partial black cotton foundations

When the top layer of soil up to 1.5m is black cotton and thereafter it is normal dry cohesive soil.

Soft rock/Fissured rock foundations

When decomposed or fissured rock, hard gravel or any other similar nature is met this can be executed without blasting. Under cut foundation is to be used at these locations.

Hard rock foundations

Where chiseling, drilling and blasting are required for execution.

Sandy soil foundations

Soil with negligible cohesion because of its low clay content (0-10%)

The above categorization of foundations has been done for economizing the design of foundations; uplift resistance of foundations is a critical design factor which is greatly affected by the location of water table and the soil surrounding the foundation.

