Chapter 5
Experimental Analysis of Backfill Soils

ABSTRACT

In this chapter different types of backfill soils are investigated to select the most suitable type of soil that can be used to increase the underground ampacity by selecting the soils that limit the dry zones formation around the underground power cables. The tests carried out on the soils under study are:

1. *Grain size analysis*
2. *Specific gravity*
3. *Thermal tests.*

5.1 SOIL SAMPLES UNDER TESTING

Several experiments are carried out on different types of natural soils to study the dry out zone formation under different loading condition. In this chapter eight types of natural and artificial soils are investigated and tested for determination of their properties. Tables from 1 until 9 give classification for the investigated soil types.

5.2 GRAIN SIZE DISTRIBUTION

Grain size distribution means the determination of various sizes of particles within the soil. The grading curve of soils represents this grain size distribution, most systems of soil classification depend to some extent up on the distribution of various-sized particles in soil. For the soils under study this distribution may be determined by sieve analysis and for finer particles it can be determined by hydrometer analysis.

5.2.1 Sieve Analysis Test

A sieve analysis consists of shaking the soil through a stack wire screen of opening of known sizes. The experiment steps are carried out as follow:

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Table 1. Soil sample 1: sand 1

Sieve	Sieve Size (mm)	Mass of Soil Retained-Wn (g)	Percentage on Each Sieve Rn	Cumulative Percent Retained ΣRn	Percent Finer 100- ΣRn
4	4.75	115.2	11.52	11.52	88.48
8	2.36	268.6	26.86	38.38	61.62
16	1.18	242.5	24.25	62.63	37.37
30	0.6	190.6	19.06	81.69	18.31
50	0.30	110.4	11.04	92.73	7.27
100	0.15	36.3	3.63	96.37	3.64
Pan	-	36.4	3.64	100	0

Table 2. Soil sample 2: sand 2

Sieve	Sieve Size (mm)	Mass of Soil Retained-Wn (g)	Percentage on Each Sieve Rn	Cumulative Percent Retained ΣRn	Percent Finer 100- ΣRn
4	4.75	15.1	1.51	1.51	98.49
8	2.36	34.4	3.44	4.95	95.05
16	1.18	109.2	10.92	15.87	84.13
30	0.6	628	62.8	78.67	21.33
50	0.30	172.2	17.22	95.89	4.11
100	0.15	37.9	3.79	99.68	0.32
Pan	-	3.2	0.32	100	0

Table 3. Sample 3: Lime

Sieve #	Sieve Size (mm)	Mass of Soil Retained-Wn (g)	Percentage on Each Sieve Rn	Cumulative Percent Retained ΣRn	Percent Finer 100- ΣRn
4	4.75	11.2	1.12	1.12	98.88
8	2.36	11.6	1.16	2.28	97.72
16	1.18	383.8	38.38	40.66	59.34
30	0.6	296.6	29.66	70.32	29.68
50	0.30	219	21.96	92.28	7.72
100	0.15	58.2	5.82	97.64	2.36
Pan	-	19	1.9	98.1	0

1. The soil is dried at 110 °c, and sieves are cleaned and weighed. 0.5 kg of the dried soil is passed through a set of standard sieves by using a mechanical shaker.
2. Each sieve and the pan of soil retained on them are weight. The weight of soil retained on each sieve is determined. It should be noted that the sum of these retained weights equals the original soil weight.