Assessment of Compaction Character of Thar Sand with Clay

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Abstract-Compacted Thar sand or Dune Sand with small additions of clay ''Dune Sand - Clay'' mixture have been proposed in the present paper and utilized in a number of Geotechnical systems such as Engineered Barriers to Enhance Impermeable Landfill Liners and Zoned Earth Dam Cores and Radioactive Waste Repositories. In practice we are going to attempt to get a nominal mixture that meets the mechanical and Hydraulic needs.

Keywords*: Compaction, Dune Sand (Thar Sand), Clay.*

I. INTRODUCTION

In the deserts, dune sands have low water retentions and high evaporation which is the main stumbling problem. Many researchers have studied different impermeable materials. An attempt was made in this paper to learn about "Dune Sand-Clay" mixture. "Dune Sand-Clay" mixture consisted of two entirely different soils found in tropics. The chemical nature, permeability characteristics and particle size distribution makes them discrete soils. A strong impermeable barricade can be identified by an optimum proportion of Dune Sand-Clay.

II. CHARACTERISTICS OF MATERIALS USED IN THE PRESENT RESEARCH WORK

2.1 Dune Sand

Also called Thar Sand is a material found in large quantities in northwest region of India, It is well known to be Thar Desert. Dune Sand used as a raw material in the present research is from Rajasthan state of India. This dune sand sample is tested for grain size analysis, which is done as per IS: 2720 (Part IV)-1965 and also Specific Gravity is analysed as per IS: 2720 (Part II) – 1980. Dune Sand is abbreviated in the present paper, with 'R'. The permeability coefficient of dune sand is measured at 5.650×10^{-4} cm / sec. Unified soil classification system symbolized the present Dune Sand as SP.

2.2 Clay

Clay is well known soil for its sticky feel and water retention power. "Montmorillonite" is the key mineralogical part of Clay. Clay in this paper is obtained from a place in Rajasthan near Bikaner district known as 'Kolayat' .Two different clays are obtained, Light clay and Heavy clay. The two clays taken vary in their physical properties, fine particle's quantity and its plasticity index. These samples of clay were analyzed for all the consistency limits as per IS: 2720 (Part V) -1985, and also specific gravity analysis as per IS: 2720 (Part III)-1980.

The clay samples were abbreviated as J_1 for Light clay and J_2 for Heavy clay. Casagrande plasticity chart has symbolized the samples used here as CH which means the clay was having high plasticity inorganic clays and liquid cap more than 50% and clay was impermeable. The plasticity index was more than 150 for heavy clays and the plasticity index for Light clay was less than 150. As per USCS (Unified Soil Classification System), the clay samples are located under fine grained soil.

The coefficient of permeability for light clay (L) is measured at 4.977×10^{-7} cm / sec and for heavy clay (H) is measured 2.137×10^{-9} cm/sec.

III. "DUNE SAND – CLAY" MIXTURE

Dune Sand action in this paper is examined in the presence of clay (Light and Heavy). Clay is added to dune sand in different proportions by the dry weight of the Dune sand. With a rise of two units, the different proportions range from 0% to 12 %. Researchers like : Kenny et al (1992), Haug and Wong (1992), Gleason et al (1997), Santucci de Magistris et al (1998) and Abichou et al (2000), and have also worked in same domain.

Table 1. Category of "Dune Sand - clay" Mixture

S.No.	SAMPLES	DUNE SAND(%)	CLAY (%)	REMARKS
•	R $J_1$0	100	0	Dune Sand stands for - R and Light Clay stands for- J_1
•	R $J_1$1	98	2	
•	R $J_1$2	96	4	
•	R $J_1$3	94	6	
•	R $J_1$4	92	8	
•	R $J_1$5	90	10	
•	R $J_1$6	88	12	
•	R $J_2$0	100	0	Dune Sand stands for - R Heavy Clay stands for- J_2
•	R $J_2$1	98	2	
•	R $J_2$2	96	4	
•	R $J_2$3	94	6	
•	R $J_2$4	92	8	
•	R $J_2$5	90	10	
•	R $J_2$6	88	12	

3.1 Compaction character of ''Dune Sand-Clay" Mixture 'Standard Proctor Test' - SPT for the various mixtures were carried out as per IS: 2720 (Part VII) is as follows-

- Dune Sand with Light clay
- Dune Sand with heavy clay

Maximum Dry Density and thus the Optimum water content has been obtained from the above mentioned standard proctor test as shown in the table. (Abichou et al work is also in same area)

Table 2. Compaction character of "Dune Sand - Clay" Mixture

S.No.	Mix type	Standard compaction			S.No.	Mix type	Standard compaction	
		w (%)	Y_d max (g/cc)				w (%)	Y_d max (g/cc)
1	R $J_1$0	13.44	1.698		8	R $J_2$0	13.44	1.698
2	R $J_1$1	14.76	1.674		9	R $J_2$1	15.25	1.636
3	R $J_1$2	15.05	1.745		10	R $J_2$2	15.05	1.745
4	R $J_1$3	14.90	1.688		11	R $J_2$3	14.90	1.688
5	R $J_1$4	14.77	1.799		12	R $J_2$4	13.85	1.785
6	R $J_1$5	16.08	1.767		13	R $J_2$5	13.44	1.698
7	R $J_1$6	14.56	1.742		14	R $J_2$6	14.76	1.674
J_1= Light Clay				J_2= Heavy Clay				

IV. CONCLUSION

The essence of compaction found by test done on sand - clay mixtures hereby reveals that at a variation of light clay content of ranges 6% - 10%, the highest or maximum dry density is achieved and that in the case of variation of heavy clay contents is 8% - 10%.

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