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Effect of Grain Size Distribution on Geotechnical Properties of Alluvial Soils

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Abstract- **This research work concerns the analysis of the impact of changes in size of grain on the geotechnical characteristics of alluvial soils. So, collected soil samples from The University of Lahore, Lahore, Pakistan. In this research work, special experiments performed moisture, strainer analysis, hydrometer analysis, Atterberg limit (liquid limit and plastic limit), direct shear testing, and unspecified compression testing on our models. After these experiments, it is observed that as the density increases, the internal friction angle of the soil and the unknown force of the soil also increases. It has been observed that moisture content does not greatly affect silt and sand properties, as in the case of clay.**

Index Terms-- **Analysis, Alluvial Soil, Clayey, Compressive Strength, Geotechnical, Soil, Silt, Sand, Unconfined**

I. INTRODUCTION

The importance of soil in development cannot be ignored because no structure is formed in the air. Each construct has direct or indirect contact with the soil. The floor is an internal fabric with a variety of textures depending on the place and the source. Therefore, it is important to properly appreciate soil ecosystems for safe and sustainable growth. There is a great deal of research and a variety of research to understand soil engineering properties. As our turn, we interact with soil clay with the center needed to focus on the properties of these soils with changes in grain size. Alluvial soil fashion occurs when a soil drain slows its carrying capacity more slowly. Slowly, a river does not have enough power to prevent heavy mud; these cells are located along the river bank. To minimize the causes of the movement, remove small cells [1].

The river slows and slows down (its gradient becomes smaller in the lowlands), which contains only unusually beautiful particles of suspension. These cells accumulate at the mouth of the river, where they form a delta of stacked soil. Aluminum (as opposed to Latin, aluminum, sabs, wash) is loose, thick (not strong stone cement) soil and rain, and is re-distributed in some form by water and reproduced in the marine context. [2]. Alluvial sediments are large particles of clay and clay and large particles of sand and gravel. When this loose mixture is deposited in the lithological unit, cemented or stabilized, it is called an alluvial deposit.

The "aluminum" length is not normally used for moisture conditions for another geological method. These include (but are no longer prohibited): lake sediment, river basin (liquefaction) or glacier-derived debris (glaciers). Permanent circulation and / or accumulation in a river is called a specific 'nautical mile'. Since alluvial clay is part of our research work, the primary factor is the grain measurement variable [3].

The size of the grain is also called particle size, and the nature of the residue refers to the grain diameter of the particles in the classic rocks. The term can also be used for other granular materials. It differs from the crystalline form in that it is the same crystal shape in particles or grains. There may be very few crystals in a single grain. Clay materials range from very small impact cells to rocks through clay, sand, sand, and gravel. Most countries and groups categorize soils and measure specific types of soils to estimate their grain size [13].

II. LITERATURE REVIEW

Sand soil flow potential with specific grain compositions. In this research, SPT was performed to obtain results on in-situ parameters. Door inspection clothes have good sand. The end result of the research suggests that the sand structure strongly influences the granular structure and the presence of fine. This increase is attributable to the increase in the proportions of sandy soil volatiles that can be achieved by the drainage-free flow. Therefore, good sand has a wide range of densities and pressures, which are wetter than soft sand.[14].

The flow with two zero residual forces is limited to deposits with very low SPT shocks, which implies that such conditions do not enter the field regularly [4]. Difficulty - Granular country variables and silt sand are difficult. Silt sand samples were used in this search work. In this research, new inter-granular state parameters (and, f) and (e s, e f) are added as country variables to classify silt sand. Using these country variables, these researchers demonstrated the stress-strain electrical behavior of host sand assessments [5]. Reconstructed versus speed reconstructed sand and fine sand models. In this search, we consider the convergence and triangle validation used. Differences in Un-Drain Stresses - Research shows that stress behavior is also dramatic between specimens that are not specified and reproduced in the same space ratio. In all cases, constrained models confirmed weak and elastic behavior, whereas in all cases reconstructed models confirmed compressive behavior [6].

Therefore, variation and stability analysis based on the results of the reconstructed models is very misleading. Although the relative density is greater than 73% (E = 0.73), all the reconstructed models confirm very low altitude and fragile behavior. On the other hand, undefined samples were diluted even though their relative density was only 66% (E = 0.81). In order for the reconstructed moisture model to function similarly to the neutralized model, the reconstructed model undergoes an 80% relative density increase over the cutoff (e.g., 0.66). The next failure is geometry. This finding is demonstrated by incorporating failure in physics and predicting the geometry before failure. The kinetics of failure is assumed to be related to shear force collected during melting, known as flow failure [8]. The strength and hardness of sandy sand. Storage of a three-axis probe and the use of silt sand samples in the bender lookup process is an issue. Research contributions determine how non-plastic fines affect small-stress viscosity and shear strength. The inclusion of a small percentage of sand for cleaning significantly increases the elevation process at each initial density and critical-state friction angle [9].

Failure of the Merispruit Sewing Dam. His research was carried out in February 1994 to detect the failures of a 31-meter golden tail near the village of Merisprat in South Africa. They carried out a UN-verified tri-axial test on samples obtained from the surrounding area. Failure [10]. He concluded that in a meta-stable country, there were once large piercings and that Foxwell's exposure to erosion and erosion contributed to the constant erosion and consequent fracture. Static liquefaction is the purpose of a once pulsed glide slide [11][15]. Monotonic and cyclic decomposition of most sandstone sandstones with high silt content. The samples used in this test are Nevada sand, which has a high content of silt-free plastic. These models include drought and non-drought tri-axis testing, rainfall pre-cyclic triaxial testing and drought/drought instability testing. Researchers have found a significant amount of sand in different amounts than previously published checks [12]. They claim that increased silt content provides greater sensory feedback under pressure - the strain curve.

Monotonic un-drain tests show that `ancestor 'behavior, such as static lubrication, occurs at low turbulent pressures and simultaneously detects a tendency to change volume as the boundary pressure increases[16]. Reduced resistance to sand-silt alloys: An experimental. NS Impact Research. In this invention, the cyclic quarterly experiment was combined with a moderate saturation quality using a non-plastic treatment amount [17].

The international vacuum ratio SNS material, compared to the thread, can reduce and expand the liquefaction resistance of the sand - a non-plastic alloy NS alloy - to increase the lower vacuum content values. Management value. According to the results of the present study, the FC rate is approximately 44%. It should be noted that the threshold value is not FC specific, it depends on the properties of the hard and granular grains and adds E (14) to the global void ratio [18].

III. RESEARCH METHODOLOGY

This research is concerned with the study of alluvial soils with varying grain sizes. Collected three samples of soil from The University of Lahore, Lahore-Pakistan. After the collection of samples, all the research work has been done in UOL Lahore and the following test is performed.

- Moisture content Determination of samples
- Sieve analysis of samples
- Hydrometer analysis of samples
- Atterberg limits of samples
- Direct shear test of samples
- Unconfined compression test of samples

IV. RESULTS

Table 1: Summary of Moisture Content

Sample	**Moisture Content (%)**
Silt	0.577
Sand	0.499
Clay	1.335

Table 2: Summary of Sieve Analysis (Sand)

Sample Distribution	Percentage (%)
Fine Gravel	0
Coarse Sand	0.006
Medium Sand	0.149
Fine Sand	97.23
Silt And Clay	2.76

Table 3: Summary of Sieve Analysis (Silt)

Sample Distribution	Percentage (%)
Fine Gravel	0
Coarse Sand	0.179
Medium Sand	0.298
Fine Sand	70.25
Silt And Clay	28.82

Table 4: Summary of Sieve Analysis (Clay)

Sample Distribution	Percentage (%)
Fine Gravel	0.588
Coarse Sand	1.61
Medium Sand	1.69
Fine Sand	0.98
Silt And Clay	96.10

Table 5: Summary of Hydrometer Analysis (Silt)

Sample Distribution	Percentage (%)
Fine Gravel	0
Coarse Sand	0.178
Medium Sand	0.29
Fine Sand	70.20
Silt And Clay	28.83
Silt	27.52
Clay	1.53

Table 6: Summary of Hydrometer Analysis (Clay)

Sample Distribution	Percentage (%)
Fine Gravel	0.556
Coarse Sand	1.60
Medium Sand	1.55
Fine Sand	0.94
Silt And Clay	95.10
Silt	51.09
Clay	44.2

Table 7: Summary of Direct Shear Test (Sand)

Density(KN/m^3)	Angle Of Internal Friction (Φ)
15	31.413
16	33.01
17	34.02

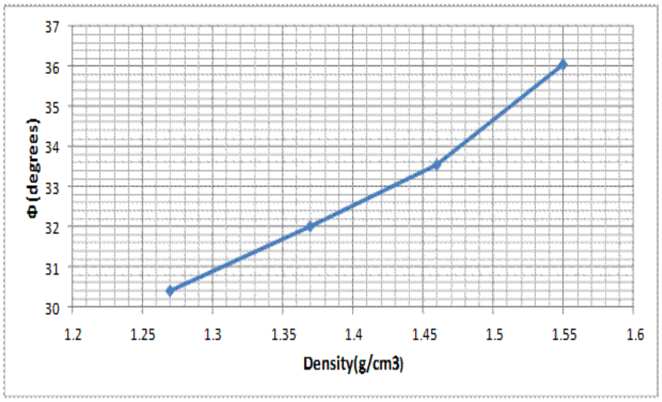

Figure 1: Relation between Density and Internal Angle of Friction

Table 8: Summary of Direct Shear Test (Silt)

Density(KN/m^3)	Angle Of Internal Friction (Φ)
15	27.02
16	29.04
17	30.47

Figure 2: Relation between Density and Internal Angle of Friction

Table 9: Summary of Unconfined compression test (Silt)

Density(KN/m^3)	Cohesion, C (lb/In^2)
17	6.98
18	25.33
19	32.11
20	41.51

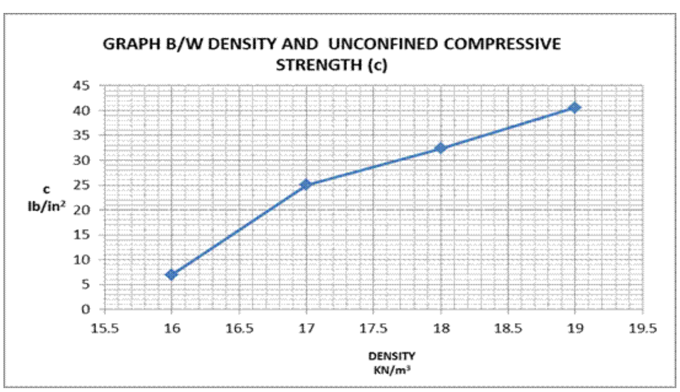

Figure 3: Relation between Density and unconfined Compressive strength

V. CONCLUSIONS

From the results of direct shear research for each sand and silt, it is concluded that the amount of friction inside increases with the density expansion . In the performance of direct shear tests, we found that concentrations of up to 17 kN / m3 can be easily obtained by applying them manually . Obtaining concentrations larger than 17 kN / m3 is very challenging. As the size of the silt increases, the silt is released from the sand, which increases the internal friction system. The difference between the policy values of friction within sand and silt is not so great now. The reason behind this is that our silt contains a large amount of sand (up to 72%). Soil classification results indicate that our silt sample is actually silt sand. The moisture content version does not significantly affect the internal friction attitude of the sand and silt. Immediate deposits of samples in the shear zone will not yield high-quality results. An excellent design is to first compact the pattern into the cutter and then transfer it to the cutting box. This is because we can get the desired density in the cutter. The stress version is not very large in our direct shear test; Therefore, the greater the difference between the pressures used, the greater the results. From the uncontrolled test, it can be concluded that the unspecified compressive stress increases with the expansion of the density. The variation of moisture has a great effect on undefined compressive strength. The results of unconfirmed compression tests show the excellent appearance of molding of the same specimen due to differences in extraction effort. Below are some suggestions to help in future related research work. UUDS (Un-Disturbed Model) is preferred for direct incision tests to get better and reliable results. The compression effort by compact compression applies more than manual compression so that both direct shear evaluation and infinite compression testing can achieve effective results. In addition to the above assumptions, to better understand the effects of grain dispersal on alluvial soils, we have strengthened the search function to perform the following tests. Permeability Test, Triaxial Compression Test, Modified Proctor Test, Resonance Column Test, and Soil Mineralogy.

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REFERENCES

[1] Cubrinovski, M. and Ishihara, K. (2000) "Flow potential of sandy soils with different grain compositions", Soils and Foundations 40(4): 103-119.

[2] Thevanayagam, S. and Mohan, S.(2000) "Inter-granular state variables and stress-strain behaviour of silty sands", Géotechnique 50(1): 1-23.

[3] Høeg, K., Dyvik, R. and Sandbækken, G. (2000) "Strength of undisturbed versus reconstituted silt and silty sand specimens", Journal of Geotechnical and Geo-environmental Engineering 126(7): 606-617.

[4] Olson SM, Stark TD, Walton WH, Castro G. Olson et al. (2000) "1907 static liquefaction flow failure of the north dike of Wachusett Dam", Journal of Geotechnical and Geo-environmental Engineering 126(12): 1184-1193.

[5] Salgado, R., Bandini, P. and Karim, A. (2000) "Shear strength and stiffness of silty sand" Journal of Geotechnical and Geo-environmental Engineering 126(5): 451-462.

[6] Fourie, A.B., Blight, G.E. and Papageorgiou, G. (2001) "Static liquefaction as a possible explanation for the Merriespruit tailings dam failure", Canadian Geotechnical Journal 38(4): 707-719.

[7] Yamamuro, J.A. and Covert, K.M. (2001) "Monotonic and cyclic liquefaction of very loose sands with high silt content" Journal of Geotechnical and Geo environmental Engineering 127(4): 314-324.

[8] Xenaki,V.C. and Athanasopoulo, G.A. (2002) "Liquefaction resistance of sand–silt mixtures: an experimental investigation of the effect of fines", Soil Dynamics and Earthquake Engineering 23 (2003) 183–194.

[9] Ng CWW, Fung WT, Cheuk CY, Zhang L. Zhang et al (2004) "Influence of stress ratio and stress path on behavior of loose decomposed granite", Journal of Geotechnical and Geo-environmental Engineering 130(1): 36-44.

[10] Georgiannou, V.N. (2006) "The un-drained response of sands with additions of particles of various shapes and sizes", Géotechnique 56(9): 639-649.

[11] Papadopoulou, A. and Tika, T. (2008) "The effect of fines on critical state and liquefaction resistance characteristics of non-plastic silty sands", Soils and Foundations 48(5): 713-725.

[12] Yamamuro, J.A., Wood, F.M. and Lade, P.V. (2008) "Effect of depositional method on the un-drained response of silty sand", Canadian Geotechnical Journal 45(11): 1525-1537.

[13] Yamamuro, J.A., Wood, F.M. and Lade, P.V. (2008) "Effect of depositional method on the micro-structure of silty sand", Canadian Geotechnical Journal 45(11): 1538-1555.

[14] Carraro, J.A.H., Prezzi, M. and Salgado, R. (2009) "Shear strength and stiffness of sands containing plastic or non-plastic fines", Journal of Geotechnical and Geo-environmental Engineering 135(9): 1167-1178.

[15] Hazirbaba, K. and Rathje, E.M.(2009) "Pore pressure generation of silty sands due to induced cyclic shear strains", Journal of Geotechnical and Geo-environmental Engineering 135(12): 1892-1905.

[16] Tsomokos, V. N. and Georgiannou (2010) "Effect of Grain Shape and Angularity On The Un-drained Response Of Fine Sands", Canadian Geotechnical Journal, 2010, 47:(5) 539-551, 10.1139/T09-121.

[17] Lupini, J.F., Skinner, A.E. and Vaughan, P.R. (2010) "The Drained Residual Strength Of Cohesive Soils", Géotechnique, Volume 31, Issue 2, pages 181 –213 , ISSN: 0016-8505, E-ISSN: 1751-7656.

[18] Monkul, M.M. and Yamamuro, J.A. (2011) "Influence of silt size and content on liquefaction behavior of sands", Canadian Geotechnical Journal, 2011, 48:(6) 931-942, 10.1139/t11-001.