Study on shear strength parameters of saturated clayey soils with GGBS

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Abstract Shear strength of a soil can be defined as the maximum shear stress that can resist by the internal forces of the soil. Shear strength must be determined to solve the soil stability problems. The shear strength parameters of the soil are cohesion and internal friction angle. These parameters can be determined in the laboratory by the direct shear test, tri axial test and unconfined compression test. In this study, tri axial compression tests are performed on saturated clayey soils under different confining pressures. Unconsolidated Undrained test is chosen to identify short term behavior. After the experimental procedure, the test is modeled and elationship between the results are presented.

Keywords: Shear Strength, Clayey Soil, Tri axial Compression Test,

1. INTRODUCTION

The shear strength of soil determines its resistance to deformation by tangential (or shear) stress. Soil that has greater shear strength will have more cohesion between particles and more friction or interlocking to prevent particles sliding over each other. Soil shear strength is used to calculate bearing capacity and design retaining walls, slopes and embankments.

Understanding the shear strength of soil is vital in geotechnical engineering. It enables us to work out the ground bearing capacity when designing building foundations, pavements or temporary access roads – equally, soil shear strength indicates how stable retaining walls, slopes and embankments will be.

Without first determining soil shear strength, it is impossible to know how geotechnical design projects will respond to different amounts of load and shear stress. As a result, engineers must understand the shear strength of soil (along with its other properties) to prevent structures from failing.

Soil shear strength can be increased by mechanical and chemical processes, as well as through the use of reinforcing materials. For example, engineers can adapt their designs based on the shear strength of soil by introducing suitable geo grids or wall and slope systems.

2. LITERATURE STUDIES

Hossne Garcia et al. studied the relationship between the shear strength and compaction of sandy loam soils under varying water content. Soil strength increased as compaction increased in the soil compaction-water characteristic curve, the optimal soil shear strength took place before the optimal compaction occurred. The effect of moistness, weakening the shear strength was greater than the effect of dry bulk density strengthening shear strength.

Rohit Ghosh studied the effect of moisture content of undrained shear strength of compacted clayey soil by vane shear test. Shear strength curve drawn for different compaction effort showed exponential decrease in the shear strength with gradual rise in water content.

Muawla A. Dafalla studied the effect of different proportions of clay content to sand with moisture content using direct shear test. The cohesion of the mixture was found to increase consistently with the increase of clay content. Increase in moisture content was found to cause a drop in both cohesion and angle of internal friction.

3. PROPERTIES OF MATERIAL USED

Soil types used in this study

Soil are classified in to 5 major types collected from various cities of karnool district which are discussed below

CASE A Soil (Adoni)

"Adoni is arranged upon three mountains which are joined together; it has a scope of unpredictable strongholds, heaped one over the other. To keep up with it requires a post of 30,000 men. The fortresses upon the mountains are in many cases weak...To the south of Adoni, a huge plain, toward the north there are mountains, upsetting from their proximity, toward the east there are different mountains. Toward the west there are additionally mountains and this part is the most vulnerable.

For this situation the dark cotton soil is examined from adoni city from the agribusiness fields the underneath figure shows the dark cotton soil test of adoni city.

Fig 1: Case A black cotton soil (Adoni)

CASE B Yemmiganur

Yemmiganur is one of the significant towns in the Kurnool region. It was essential for the Vijayanagar from the fourteenth 100 years to the sixteenth 100 years. From 1953 to 1956 it was an Andhra state, presently in piece of Andhra Pradesh.

For this situation the dark cotton soil is examined from Yemmiganur city from the agribusiness fields the beneath figure shows the dark cotton soil test of Yemmiganur city.

Fig 2: Yemmiganur city black cotton soil

CASE C Yerrakota

Yerrakota is a little Town/village in Yemmiganur Mandal in Kurnool Locale of Andhra Pradesh State, India. It is found 64 KM towards west from Area head quarters Kurnool. 7KM from Yemmiganur.

Yerrakota is encircled by Gonegandla Mandal towards East , Nandavaram Mandal towards North , C.Belagal Mandal towards East , Devanakonda Mandal towards South . Yemmiganur , Adoni , Kurnool , Raichur are the close by Urban communities to Yerrakota

For this situation the dark cotton soil is ordered from Yerrakota from the horticulture fields the beneath figure shows the dark cotton soil test of Yerrakota.

Fig 3: Yerrakota black cotton soil

CASE D Mantralayam

Mantralayam is a traveler town situated in Kurnool region in Andhra Pradesh, India. It lies on the banks of the Tungabhadra Stream on the boundary with adjoining Karnataka state. The town is known for the brundavana of Raghavendra Master, a holy person who lived in seventeenth Hundred years and who went into a samadhi alive before his followers. Large number of individuals visit the Raghavendra Matha and sanctuaries which are situated on the banks of Tungabhadra Waterway.

For this situation the dark cotton soil is gathered from Mantralayam from the farming fields the beneath figure shows the dark cotton soil test of Mantralayam.

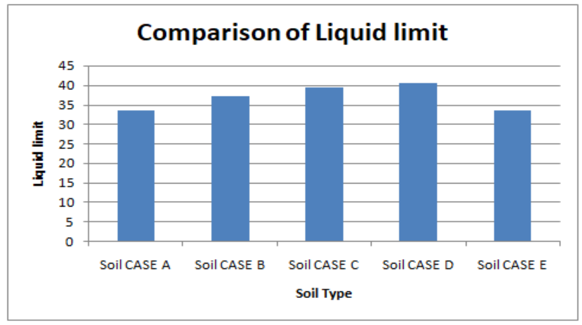
Fig 4: Black cotton field near Mantralayam

CASE E Kodumur

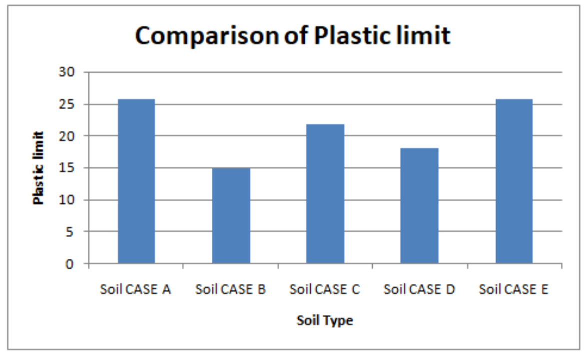
Horticulture is the principal type of revenue for individuals of Kodumur, with Cotton, Castor oil seeds, Red gram and vegetables as the primary harvests. Tungabhadra Undertaking Low Level Trench, the Handri-Neeva Sujala Sravanthi project (HNSS) Principal Channel, and the Gajuladinne Venture (Gross domestic product) Waterway (renamed the Sanjeevaiah Sagar), are the primary water system sources.

Fig 5: Kodumur black cotton soil

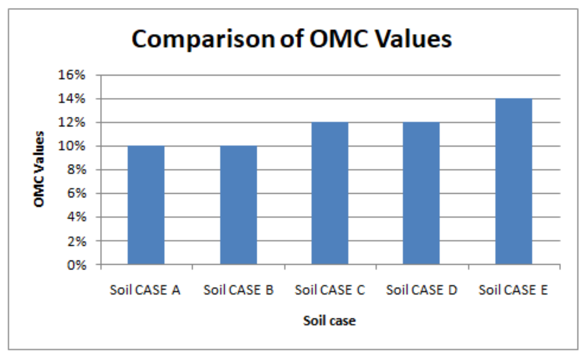
4. EXPERIMENTAL RESULTS



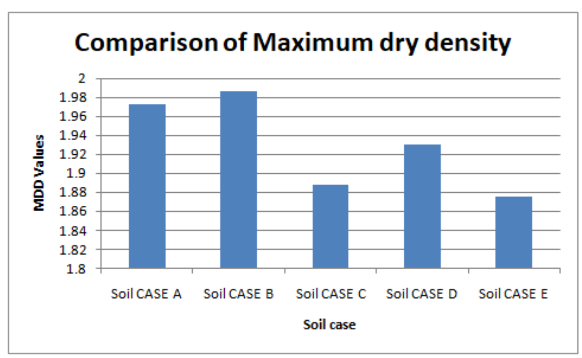
Graph 1: Comparison of liquid limit values



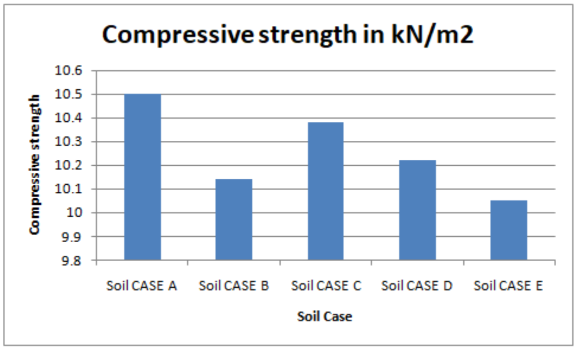
Graph 2: Comparison of plastic limit values



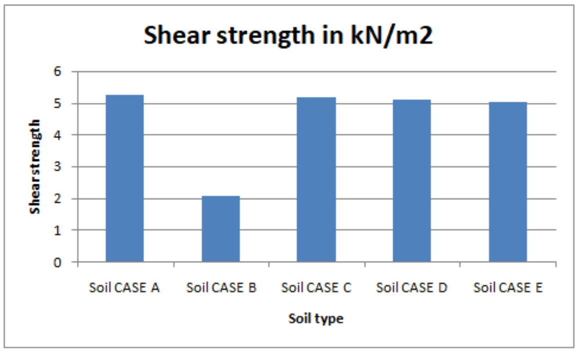
Graph 3: Comparison of OMC values



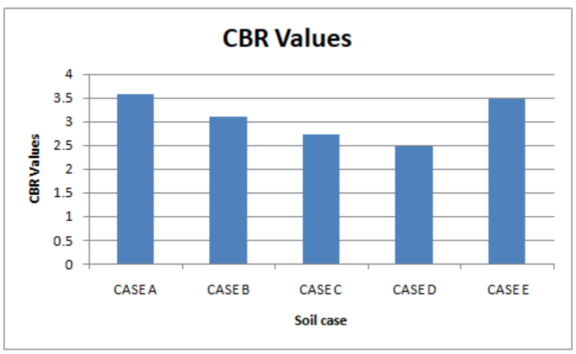
Graph 4: Comparison of maximum dry density values



Graph 5: Comparison of compressive strength values



Graph 6: Comparison of shear strength values



Graph 7: Comparison of CBR values

5. CONCLUSIONS

From this experimental study the following conclusions were made

1. The optimal value of liquid limit was observed at CASE D case soil than remaining trials and minimum value of liquid limit was observed at CASE A and CASE E soils.
2. For CASE A and CASE E soils has the plastic limit has similar and higher value is seen in the CASE C type soil.
3. The value of OMC increase with increase from soil A case to Soil E case
4. The value of maximum dry density increases initially to CASE B soil and then decreases CASE C soil.
5. The value of unconfined compressive strength and shear strength of soil is decreasing maximum value is seen in CASE A soil and minimum value is observed at CASE B soils.
6. The value of CBR decrease from Case A soil to Case C soil and then it will increases to Case E soil type.

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