Career Episode 1

Geotechnical Properties Study of Organic Soil in Khulna Region

A) Introduction

[CE 1.1] I executed the project in the civil engineering field.

Name of Project: Geotechnical Properties Study of Organic Soil in Khulna Region

Duration: [Date] – [Date]

Location: Khulna University, Bangladesh

Position: Civil Engineering Student

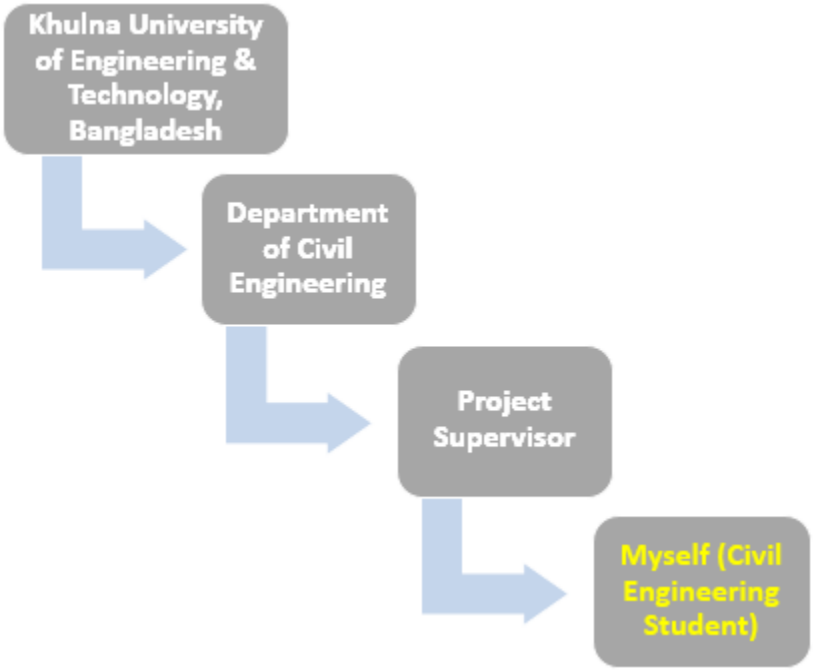
B) Background

[CE 1.2] In sub-soil, the organic matter present is undesirable while analyzing it from the Geotechnical Engineering viewpoint. The void ratio is high in the organic soils with the normal values typically ranges from 5 to 15. In some instances, it could be closer to 25 with the moisture content typically varies from 50% to 1000%. The soil containing higher organic matter has a higher value of compression index which typically set to 4 and above. Higher water absorption capacity is typically indicated in the soil containing higher organic matter with the higher volume alterations on the loading results in the lower shear strength, acidity, low dry density, and other construction material related characteristics. These sorts of characteristics are dependent on the composition, fabrics, deposition, soil structures type, and organic contents percentage.

[CE 1.3] The project was researching the organic soil geotechnical properties at varied locations and depths in the region of Khulna city. I collected the soil samples which had adequately varied organic contents and these were mainly collected from Khulna region two selected locations. In the work undertaken, I analyzed the sub-soil which consisted of the organic soil thick layer along with the silty clay. I obtained the sub-soil bearing capacity which was low. I performed liquid limit, unconfined compression strength, consolidation test and plastic limit test in the project. I obtained the test results which were analyzed well and noted that the plasticity index of the plastic limit enhanced with the enhancement of the soil organic content which ultimately reduced the specific gravity. It was noted that the unconfined compressive strength reduced with the variation made in the organic content and it enhanced from the value of 43 to 80. I obtained the results which indicated the unconfined compressive strength variation which did not obtain a decent relationship with the alteration of the organic content.

[CE 1.4] The project resulted in obtaining a well-defined relation on the soil geotechnical properties with the organic contents increment based on the conducted test. But I realized that the test results widely differed from each other. I recommended the laboratory experiments for getting a specific relationship among the studied soil geotechnical engineering properties.

[CE 1.5]



[CE 1.6] I had underneath duties:

- I did the soil material selection which behaved as the plastic material where there was significant water content present in it.
- I applied civil engineering knowledge for the liquid limit evaluation and it was in relation to the water content.
- I worked on determining the liquid limit which was dependent on the standard liquid device containing the brass cup.
- I conducted the strain and stress measurement at the failure point with the specimen preparation form the undisturbed soil.

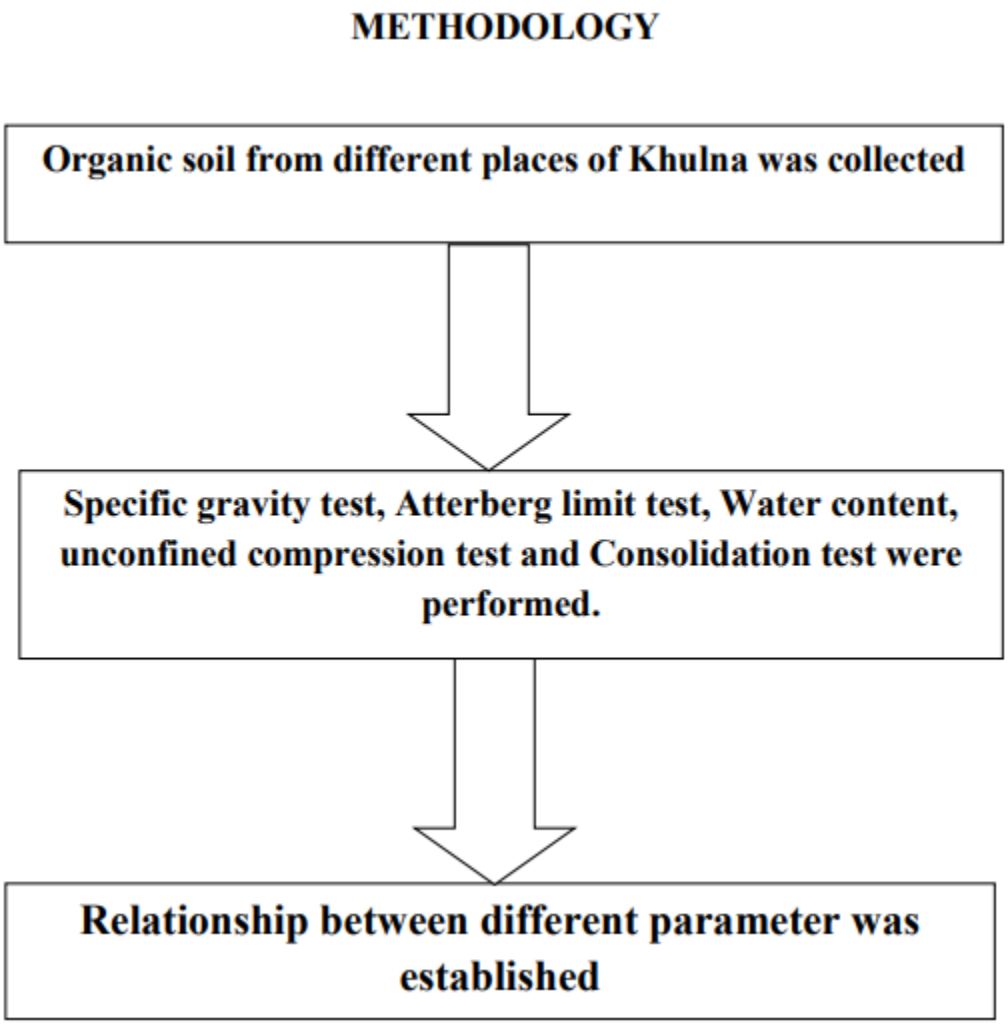
C) Personal Engineering Activity

[CE 1.7] I collected the organic soil which was at the 5ft depth below the surface ground area near the Shiromoni and I also worked on the excavated soils collection near Khulna which was excavated up to the 10ft depth under the surface of the ground. I took sufficient soil samples for the laboratory tests and determined the organic content loss using the ignition technique.

$$\text{Organic content} = (A-B)/(A-C)*100$$

I carried out the test which was with the implementation of the vertical load's sequence to the laterally confined specimen with the $1/4^{th}$ of the diameter height. I analyzed the vertical compression under each load over the defined period which was usually up to 24 hours. I

conducted the one-dimensional test as the lateral deformation was allowed from which the dimensional consolidation parameters were derived. The methodology flowchart is underneath:



[CE 1.8] I conducted the soil unit weight test in which the sample was collected based on the sample weight to volume ratio. It was expressed in the unit of gm/cm. I used Mercury for determining the sample volume and water was utilized for the sample volume determination. However, it did not provide accurate results with the consideration of the fact that the soil sample absorbed water. Thus, I utilized mercury for getting accurate results. I then analyzed the natural moisture content in which the soil sample was taken as the water weight ratio in the sample to the dry weight value. I expressed it in terms of percentage and the soil sample was weighted both in the oven-dry state and the natural state. I then calculated the percentage by splitting the sample weight to the dry weight.

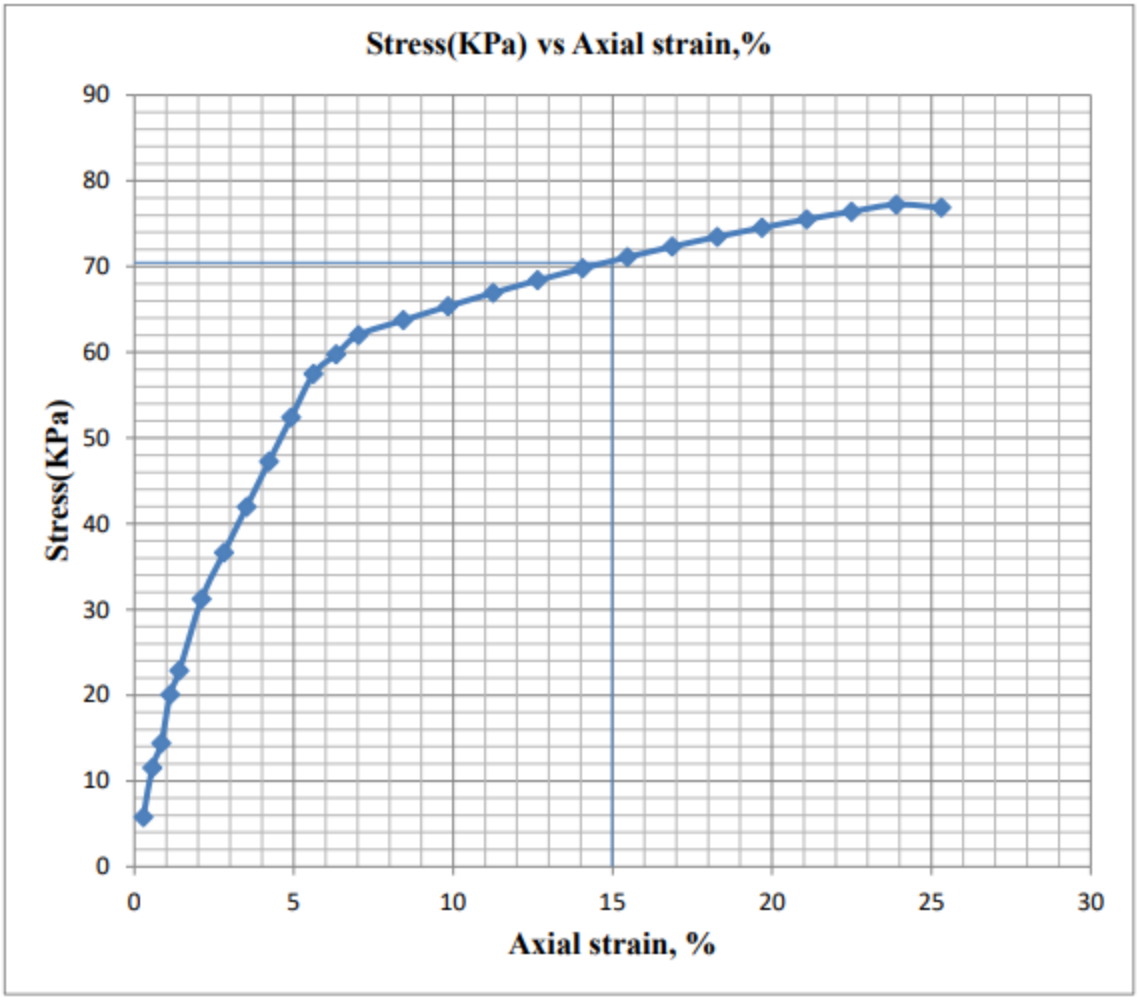
[CE 1.9] I implemented the Atterberg Limit test process for analyzing the clay physical properties which were highly influenced by water. I selected the soil material which worked as the plastic material depending on the content of the water it contained. I then evaluated the liquid limit which

was the water content minimum value at which the clay soil behaved like a fluid. I determined it with the standard liquid device which consisted of the brass cup and there was an agreement imparted for blowing the cup at the uniform rate. I cut the groove into 24 standard dimensions into the paste soil contained in the cup and the water content at which there was 25 blow executed adequately for the standard groove approach resulted in working as the soil sample liquid limit value. I obtained the plastic limit which was the minimum water content at which the soil was plastic and it was determined based on rolling out the soil sample with the slowly reduced content of water. It was done until the content of water reached the 1/8 inch diameter thread followed with the crumbling. I rolled the thread on the glass plate with hand.

[CE 1.10] I implemented the unconfined compression test which was the simple technique for determining the cohesive soil shearing strength. I kept the lateral confining pressure during the unconfined compression testing to zero and the load was applied directly on the laterally unsupported specimen top. I measured the strain and stress at failure point and the specimen was prepared from the undisturbed soil with the careful trimming to the cylindrical shape. It was set at the 2.8inch height and 1.4inch diameter. I obtained the plastic limit, liquid limit and plasticity limit final values as shown in the table.

Location of sample	Liquid limit (%)	Plastic limit (%)	Plasticity index (%)
Khulna	380	187.78	192.22
Shiromoni	272	174.921	97.08
Shonadanga	77.65	38.62	39.03
Fire service	76.93	50.99	25.94
Sheikpara	101.26	51.27	49.99

I obtained the graph between stress and axial strain as:



[CE 1.11] I obtained the relationship among the plasticity index and the unconfined compressive strength for both the organic soil types. I obtained the linear equation which was from the curve and it was then analyzed using civil engineering understanding. For organic soil, I applied the following equation.

$$qu = - 0.0712Ip + 51.147$$

For organic standard soil:

$$qu = - 0.1083\ Ip + 38.115$$

I compared the values with the standard curve results and the obtained curves were similar to the standard curve by nature and with the approximated values. I obtained a higher plasticity index of the organic soil for the same unconfined compressive strength values than that of the organic soil.

D) Summary

[CE 1.12] I analyzed the properties of the organic soil which had mainly higher compressibility, low dry density and higher volume alteration under loading. I did not obtain decent results with the unconfined compression strength variation which was altered with the soil organic content. I conducted different tests which resulted in indicating the fact that the Khulna region organic soil properties varied from place to place. I also noted that the plastic limit plasticity index, the liquid limit increased with the increment made in the soil organic content which resulted in the decrement in the soil specific gravity. I applied technical knowledge in getting the well-defined relationship among the soil geotechnical properties parameters which were done with the increment of the organic content.