ISSN 2277 – 5528
Impact Factor- 4.015

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & MANAGEMENT

DETERMINATION OF INDEX PROPERTIES OF SOIL AT VARIOUS LOCATIONS (NARAYANGAON, JUNNAR, KURAN, OTUR)

Aniket Pavale[*1], Akash Kute[2], Akash Chaugule[3] & Mohit Rengade[4].
[*1,2,3&4]Student, Department of Civil Engineering, Jaihind Polytechnic, Kuran, India

ABSTRACT

The study of geotechnical index properties of soils in Warri, Delta state was carried out to determine the index properties of soil. The laboratory test carried out included, moisture content, grain size analysis, Atterberg limits and compaction test. These results indicate that the soil is poorly graded, well drained, it is of intermediate plasticity, medium swelling potential. The results of particle grain size distribution test show that the soil sample is mainly sand. This means that they will tend to increase in compressibility and decrease in shear strength. Also, as a result of their poorly graded nature, they will have negative effects such as high effective porosity, large mean pore size, how density and high permeability. The compaction results show that the maximum dry density (MDD) and the optimum moisture content (OMC).

Keywords*: index properties, soil, plasticity*.

I. INTRODUCTION

Geotechnical investigations are performed by geotechnical engineers or engineering geologists to obtain information on the physical properties of soil and rock around a site to design earthworks and foundations for proposed structures and for repair of distress to earthworks and structures caused by subsurface conditions. This type of investigation is called a site investigation. Additionally, geotechnical investigations are also used to measure the thermal resistivity of soils or backfill materials required for underground transmission lines, oil and gas pipelines, radioactive waste disposal, and solar thermal storage facilities. A geotechnical investigation will include surface exploration and subsurface exploration of a site. Sometimes, geophysical methods are used to obtain data about sites. Subsurface exploration usually involves soil sampling and laboratory tests of the soil samples retrieved, some soil test measure direct properties of the soil, while other measure "index properties which provide useful information about the soil without directly measuring the property desired. Some of the more commonly performed laboratory test included: Moisture content determination, Atterberg limits, grain size analysis test and compaction test. There tests are very useful in determining the geotechnical behaviour of soil in Warri of Delta State.

II. LITERATURE REVIEW

OghonyonRorome[etal] The study of geotechnical index properties of soils in Warri, Delta state was carried out to determine the index properties of soil. The laboratory test carried out included, moisture content, grain size analysis, Atterberg limits and compaction test.

BipulSen[etal]Thelaboratory experiments have been conducted on six soil samples collected from different locations of Agartala, Tripura, INDIA in accordance with relevant ASTM standards to determine index properties.

Dr. S. K. Prasad Index properties are the properties of soil that help in identification and classification of soil. Water content, Specific gravity, Particle size distribution, In situ density (Bulk Unit weight of soil), Consistency Limits and relative density are the index properties of soil. These properties are generally determined in the laboratory. In situ density and relative density require undisturbed sample extraction while other quantities can be determined from disturbed soil sampling.

III. METHOD OF STUDY

(A) Field Techniques: The samples used for this work are disturbed samples obtained from seven boreholes in basic sites in Delta State, drilled to a depth of 6m (borehole 5), 2.5m (borehole 6) and 1.5m (borehole 7). During

sampling, visual examination of each sample was made as well as insitu description based on texture and colour. Samples were put into poythene bags to prevent loss of the natural water content and other alteration that may arise due to exposure to the air.

(B) Laboratory Techniques: The even disturbed samples were analyzed in the laboratory for water content, Atterberg limits, grain size distribution and compaction test.

(a) ***Moisture content determination:*** This is determination of moisture content of the soil samples

(b) ***Determination of Atterberg limits:*** This test enables us to know the moisture content at which a soil sample passes from one stage to the next and is known as consistency limit. The liquid and plastic limits are two of five limits proposed by A. Atterberg.

(c) ***Liquid limit determination:*** This is the minimum moisture content at which the soil will flow under its own weight. In order words, it is a soil – water mixture with no measureable shear strength..

(d) ***Plastic limit determination:*** Plastic limit is the maximum water content as which the soil can be rolled into a thread of 3mm an diameter without breaking.

(e) ***Compaction test:*** Compaction of densification is the process whereby soil particles are mechanically forced to pack more closely together by expelling air from the voids. The test involves the determination of mass of the dry soil per unit volume when the soil is compacted in a specific manner over a range of moisture content.

The strength of any earth material is related to its density, and the objectives of densification are simply to improve the engineering properties of the soil mass.

The laboratory compaction test also reveals optimum moisture content at which the compaction should be carried out to achieve the maximum dry density possible for the earth material (soil). In this work, the modified proctor test method was used. Some advantages of compaction include the reduction of subsidence, reduction in shrinkage (decrease in volume) and increase in soil strength (shear strength).

(f) G**rain size analysis:** The particles size distribution (texture) of a soil refers to the sizes and the relative proportions of various size groups of the solid particles that make up a given soil materials. The various particle size groups and their limits that are commonly used in Engineering Geology were adapted from MIT (Massachusetts's Institute of Technology) textural classification.

The laboratory determination of the particle size distribution of soils is usually accomplished by sieving and sedimentation analysis. The former method is used for the coarse fraction (i.e. sizes 0.075mm) while the latter is for fine fraction (<0.7mm). The full description of the laboratory procedure of these methods is given in the American Society for Testing of Material (ASTM 479) and the British Standard (BS 1377).

The following are the Index Properties of soil.
1. Water content
2. Specific Gravity
3. In-situ density
4. Particle size distribution
5. Consistency limits
6. Relative Density

1. Water Content

Oven drying method and Calcium carbide method are the two popular methods of determination of water content. Refer to IS 2720 – Part 2- 1973 for more detail.

ISSN 2277 – 5528
Impact Factor- 4.015

a) Oven Drying Method
It is an accurate method of determining water content of soil in the The procedure is as follows.

- Collect a representative sample of soil in a steel cup carrying a lid.
- Find the weight of cup and lid along with soil (W)
- Keep the cup with lid open in a thermostatically controlled oven for 24 hours at around 105oC.
- After cooling the cup, find the weight of cup and lid along with dry soil (W2)
- Find the empty weight of cup and lid (W3)

W= weight of water/ weight of soil solids

2. Specific Gravity of Soil Solids

Specific gravity of soil solids is commonly determined by Pycnometer method. Refer to IS 2720 – Part 3- Sections 1 & 2 - 1981 for more detail.

a) Pycnometer method

- Use pycnometer for the determination of specific gravity of coarse grained fraction and density bottle for that of fine grained fraction.
- Find the weight of clean, dry and empty pycnometer (W1).
- Put dry soil (about one third the height) in the pycnometer and find theweight (W2).

Fig. 1.Pycnometer Apparatus

- Add water till the top such that the air bubbles are completely removed and find the weight (W3).
- Empty the soil and fill water up to the top in the pycnometer and find the weight (W4).

S
pecific gravity= Weight of Soil/Weight of equal volume of water

3. Determination of In-situ unit weight of soil by Core Cutter method

The following are the steps involved in determination of bulk density and hence dry density of soil at a site.

ISSN 2277 – 5528
Impact Factor- 4.015

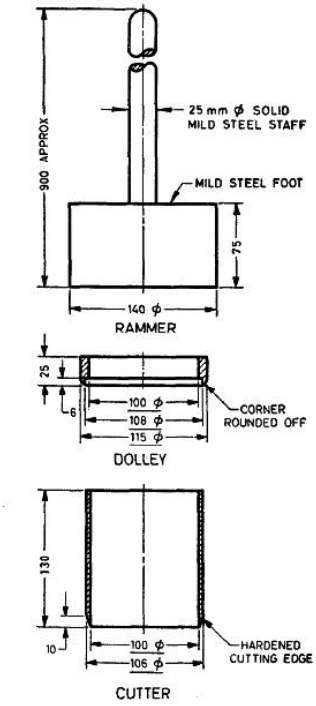

Fig. 2.Core Cutter Apparatus

- Refer IS 2720 – Part 29
- Main apparatus include Core cutter with a sharp edge, dolly or Collar and a rammer.
- This method is applicable for soil that sticks to the surface of cutter (Clayey soil) and that is not very stiff (where cutter can be penetrated in to ground by ramming).
- Sampling is done vertically by ramming downwards.
- The inner surfaces of core cutter and dolly are gr
- The ground surface is leveled after removing the top soil.
- Core cutter with collar on top and sharp edge at bottom is placed on the ground.
- It is then driven in to the ground using the rammer till the soil collects up to the collar.
- It is carefully taken out by loosening from outside such that the soil inside remains in tact.
- Dolly is carefully removed. The soil surface in the core cutter is trimmed from both the ends.

Let,

V = Volume of the core cutter
W1 = Empty weight of core cutter
W2 = Weight of core cutter with soil
Then, Bulk unit weight of soil at the site

$$\gamma = \frac{W2 - W1}{V}$$

IV. CONCLUSION

The sample analysis results from various locations in Warri Delta State show very high percentage of fine soil (i.e. silts clays and fine sand) without gravel sized particles. This is usually classified under the unified soil classification scheme (USC) as poorly graded since it does not contain particles of all sizes. This high percentage of fine and shows high porosity, low permeability with decreasing stability. The moisture content (MC) values range from 8.1 – 26%. This shows that some areas are well drained while others are not. The significance of the moisture content is that, the greater the amount of water a soil contains, the less interaction there will be between adjacent particles and the more the more the soil will behave like a liquid, i.e. decreasing shear strength. The liquid limit values range

between 19.5 – 22.4%. This shows that the soil is of intermediate plasticity, and is an indication of low strength. The plasticity index values range from 2.1 – 17.9%. This indicates that the soil is of low medium swelling potential. The larger the plasticity index, the greater is the engineering problem associated with using the soil as an engineering material.

REFERENCES

1. *Abuduls S & Richard E.B (1991) Relationship between petrographic characteristic, Engineering index properties, and Mechanical Properties of selected sandstone. Bulletin of Association of Engineering Geologist Vol xxvii No. 1. Pp 55-71*
2. *Akpokodje E.G (1989) Preliminary studies of the Niger Delta sub soils. Engineering Geology, No. 26; pp 247 – 257*
3. *Akpokodje E.G.(1989): The Engineering Geological classification of the superficial soils of the Niger Delta. Engineering Geology vol. 23; pp 193 – 211*
4. *Akpokodje E.G. (2001): Introduction to Engineering Geology properties of Earth Materials, Engineering Geology, Port Harcourt pp1. 147*
5. *Akpokodje E.G (1999): The Principles of Applied and Environmental Geology Paragraphics, Port Harcourt, pp 33 – 50*