The International Journal Of Engineering And Science (IJES)
||Volume||2 ||Issue|| 5 ||Pages|| 15-17||2013||
ISSN(e): 2319 – 1813 ISSN(p): 2319 – 1805

Engineering Geological and Foundation Characteristics of Granite Derived Subsoils at Ibuji Area, South Western Nigeria

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----------**ABSTRACT**----------
Engineering geological and foundation characteristics of granite derived subsoils at Ibuji area was investigated. The rock out-crops of the area were mapped. The dominant rock in the area is granite and the area generally falls within the precambrian basement rock terrain of Nigeria. Structural features in the rocks include micro joints, veins and minor fractures. Laboratory test results of the disturbed soil samples collected showed a natural moisture content ranging from 30.06% to 35.02%, liquid limit from 40% to 55%, linear shrinkage from 8.5% to 9.4% and specific gravity from 2.60 to 2.65. The dominant subsoils are clay and sands with good foundation properties.

KEYWORDS: *foundation characteristics, subsoil, properties, interrelationship*

Date Of Submission: 18 April 2013 Date Of Publication: 28,May.2013

I. INTRODUCTION

Ibuji town is small developing town in between Igbara-odo Ekiti in Ekiti state and Igbara-oke in Ondo state. New residential houses are emerging yearly in this environment. The wall of some of the buildings including the foundation of these buildings are threatened and damaged as a result of the ignorance of the engineering geology of the construction materials and terrain conditions in the locality. This paper evaluated the engineering geological and foundation properties of the soils in order to put an end to failures of buildings in the environment.

II. MATERIALS AND METHODS

The study involved both field and laboratory investigation. Field work involved geological mapping of the entire terrain encompassing reconnaissance survey and detail observation and study of rock outcrops. The soil mantles were studied in-situ with respect to matrix composition, colour, texture, soil particle shape and characteristics, nature of discontinuities and strength condition in which it occurs in-situ through touching of the soil surface in the field. Keen visual observation was made on the description of the soil as it occurred in-place.

Disturbed but representative samples of the soil were taken from established case study locations for laboratory analyses. The laboratory tests carried out on the disturbed soil samples include, grain size analysis, natural moisture content determination, Atterberg (consistency) limits, linear shrinkage, and compaction tests (BSI, 1975).

III. RESULTS AND DISCUSSION

3.1 Field Evidences

The area of investigation is shown in Fig 1. The major rock association belongs to precambrian basement complex which constitute the oldest rock in Nigeria. This rock group consists of migmatites, gneiss, schists, older granites and amphibolites (Fig 1). (GSN, 2000). At Ibuji, granite which varies from fine to coarse texture constitute the dominant lithology. The granites vary from greyish to light brownish colour but may also attain black colouration in area where decayed vegetation leaves cover the surface of the rock.

IV. RESULT AND DISCUSSION

The geotechnical properties of the subsoil materials at Ibuji town are shown in Table 1

Table 1: Geotechnical Properties of the Subsoil Materials at Ibuji Town

Sampling Index Number	Depth (m)	Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Specific Gravity (%)	Soil Description
IB1	1.00	34.82	44	34	10	8.5	2.60	Brownish Red Silty Sandy Clay
IB2	1.50	34.48	55	41	14	9.3	2.65	
IB3	2.00	35.02	47	29	18	8.9	2.61	
IB4	2.50	34.99	41	28	13	9.4	2.60	
IB5	3.00	30.06	40	30	10	8.6	2.62	

4.1 Texture and Consistency

Fig 2 shows some representative grain size envelopes for the studied soil. The chart showed that the soil is uniformly graded clayey silty sand. Fig 3 shows the casagrande plasticity chart of the studied soils (Casagrande, 1947). The soil plots within the region of inorganic clays and silts of intermediate to high plasticity.

4.2 Moisture - Density Relationship

Fig. 4 summarizes the compaction characteristics of the studied soil. The dry density of the soils range from 1450 kg/m^3 to 1600 kg/m^3. The optimum moisture content range from 11.5% to 12%.

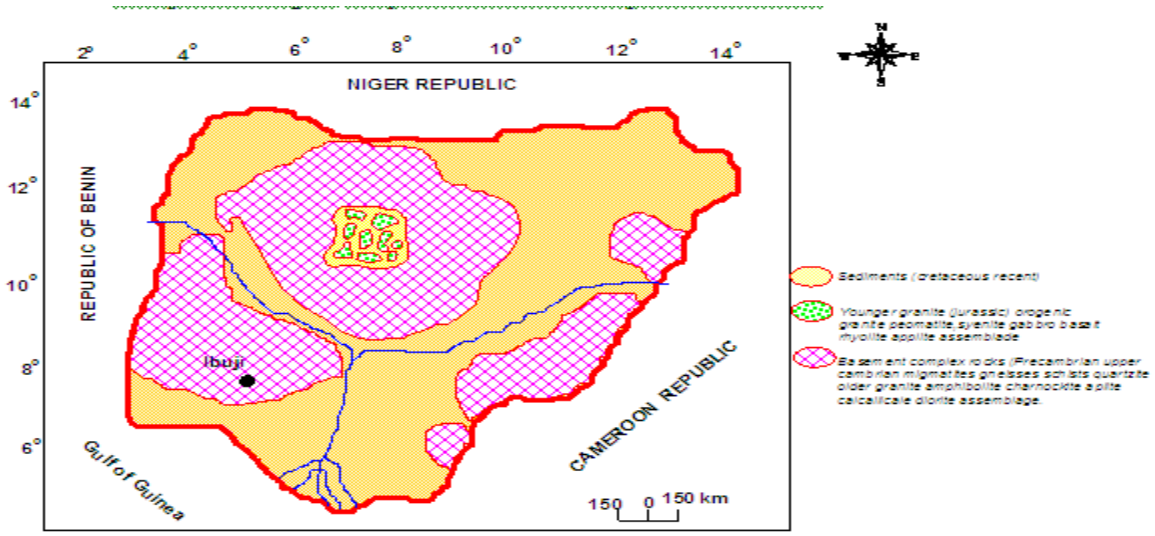

Fig.1 : Simplified Geological map of Nigeria showing Ibuji .

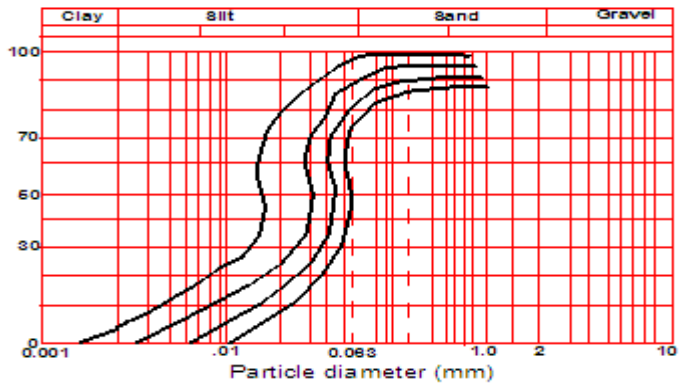

Fig 2: Particle size distribution envelopes for Ibuji subsoils.

4.3 Linear Shrinkage and Specific Gravity

The results of the linear shrinkage are presented in Table 1. From the table, one observes that the linear shrinkage is above 7, indicating an active soil that will be liable to have shrinkage and heaving problems when employed in construction (Brink et al 1982). The results of the specific gravity showed that the values range from 2.60 to 2.65. These values agree with the general specific gravity values obtained elsewhere within the basement complex terrains in Nigeria. (Jegede 1998).

4.4 Foundation Engineering Properties

4.4.1 Clays:

The bearing capacity of clays found at Ibuji is expected to be high. The compressibility will equally be low judging from finger touch test carried out in the field and its plasticity characteristics (Fig 3). However, in certain tropical conditions, leaching of the clays can occur at shallow depths, leaving a porous material with a fairly high compressibility.

4.4.2 Sands:

Sandy soils have bearing capacity and compressibility characteristics similar to gravels although very loosely deposited sands such as dune sands have a moderately high compressibility requiring correspondingly low bearing pressures in order to avoid excessive settlement of foundations. The sands at Ibuji are dense and cemented sands, therefore they are expected to have high resistance, low compressibility and high bearing capacity.Sands in their naturally deposited state above the water table are usually damp or cemented to a varying degree and thus will stand at a steep slope in excavations. However, support by timbering or sheet piling is necessary in deep and narrow excavations where a sudden collapse – caused by drying out of the sand or vibrations might endanger workmen. (Jegede 1995)

V. CONCLUSION

Although the linear shrinkage values appear moderately high, the finger touch test carried out in the field and the plasticity index values suggest a good founding soil. (Davey 1961). Other geotechnical deficiencies of the soil can be managed during employment of the soil in construction.

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