



NBRRI REPORT NO. 15

ENGINEERING PROPERTIES OF SUBGRADE SOILS IN THE FEDERAL CAPITAL TERRITORY OF NIGERIA

Foreword

This report covers another phase of the Institute's research programme in which the main sub-grade soils of Nigeria are systematically investigated to establish their engineering classification and properties with regard to the planning, design and construction of roads. The Institute believes that the information and data generated in the area of study will be invaluable to road planners, designers and contractors who can obtain, even before they engage in field work, a reasonable assessment of the engineering properties of the soils to be encountered in this area.

The results of the investigation on subgrade soils in the Federal Capital Territory are described in this report. As a result of the high potential for accelerated infrastructural growth of the area, it is hoped that highway engineers will benefit tremendously from this publication.

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1. BACKGROUND INFORMATION

1.1 Introduction

This project is the second phase of a comprehensive research programme at the institute to study the engineering properties of subgrade soils on a country-wide basis. The study of the first phase covering the problematic black cotton soils of north-eastern Nigeria has been concluded (11). The ultimate aim of the study is to develop a broad base comprehensive engineering subgrade soils map which will be an invaluable aid to highway engineers. The engineering data base generated will eliminate the drudgery and cost of a preliminary investigation in road design and provide suitable guides for further detailed work. In a virgin area like the Federal Capital Territory with a potential for rapid infrastructural development, such comprehensive road soils data and map will be expedient and cost-effective in road development in the area. However, no attempt has been made at pavement design since the basic principles involved can be found in standard textbooks.

1.2 Physiography and Setting

The Federal Capital Territory occupies a land area of 8,000 square kilometers south of Abuja in the central portion of the country. It is situated approximately between latitudes $8^{\circ} 26'N$ and $9^{\circ} 20'N$ (fig 1). The annual rainfall in the area ranges between 1000 to 1500mm and vegetation is woodland savannah type. The territory lies in a tilted plain on which there are numerous outcrops of residual hills such as inselbergs and rocky knobs with several ranges of low mountains and laterite capped masses. (photo 1).

1.3 Geology

The region is underlain by the basement complex consisting of crystalline rocks. The major rock types encountered in the area include:

(a) **Igneous Rocks:** In terms of extent and variety, fine to

coarse grained granites are the predominant rocks in the area.

(b) **Metamorphic Rocks:** These are mainly migmatites and migmatite gneiss, and schists rich in flaky minerals that are easily susceptible to weathering due to high foliation.

(c) **Sedimentary Rocks:** consisting mostly of sand with gravel beds and clay deposits.

Other rocks of minor extent include basalts, dolerites, syenites, pegmatites and quartzites. Most of these are rich in alumina and silicates such as feldspars and micas. Under tropical weathering, this leads to the formation of clayey soils such as lateritic clays with different amounts of silts and sands depending on the parent rock types.

1.4 Programme Implementation

The scope of the project is limited to the problems associated with pavement and drainage design. For this, the programme implementation is three-pronged consisting of

— Field investigation characterised by visual observations of the general terrain, soil types, groundwater conditions, road conditions etc; and sample collection.

— Comprehensive laboratory programme to determine the engineering characteristics of the samples collected.

— Analysis of the test data.

2. FIELD INVESTIGATION

The entire Federal Capital Territory is mostly underlain by igneous and metamorphic rocks with several rock outcrops. The rocky terrain is overlain by sandstone and claystone of the Nupe group. The hilly terrain and the general tilted plain make the territory an area of high erosion potential. The soils are mainly clay-soils mixed with sand in varying proportions.