



NBRRI REPORT NO. 18

**ENGINEERING PROPERTIES OF SUBGRADE SOILS IN BENDEL
(DELTA AND EDO) STATE OF NIGERIA**

NIGERIAN BUILDING AND ROAD RESEARCH INSTITUTE

FOREWORD

This report provides in copious details the work done by the Nigerian Building and Road Research Institute in determining the engineering properties of the subgrades in Bendel State for road design and construction. This is part of a comprehensive and long term programme in which the main subgrades covering the whole of Nigeria are systematically studied. Four previous reports covered the black cotton areas in North-Eastern Nigeria, the soils of Rivers States, Imo State and the Federal Capital Territory.

The data provided in this report are invaluable for the highway engineer and contractor for the planning, design and maintenance of highways in Bendel State (now Edo and Delta States). The report provides, within easy reach, data which otherwise will be most difficult to retrieve from many sources. It is my fervent hope that all cadres of professionals in the road sector will come to recognise the inestimable importance of this publication and use it widely for their road projects in Bendel (Edo and Delta) State.

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Director

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1. GENERAL INTRODUCTION

1.1 Background Information

In the planning, routing and construction of roads, it is the general experience that much input in terms of effort and costs usually go into the preliminary investigation of subgrade soils to determine their engineering properties. Over the years, information and data generated on the engineering properties of subgrade soils in different road projects all over Nigeria have not been systematically documented. They are usually tucked away in various numerous reports which are either inaccessible or lost. Consequently, effort sometimes become duplicated whenever a new road is proposed even in an area that has experienced road construction earlier.

To arrest this uneconomic trend, the Nigerian Building and Road Research Institute embarked on a comprehensive programme in which the main subgrade soils of Nigeria are systematically investigated and documented. The overall longterm objective of the programme is to establish the engineering properties of subgrade soils in Nigeria and therefrom develop an engineering geological map of Nigeria.

An engineering geological map is an invaluable tool to the engineer in the preliminary planning stage of civil engineering project. The map provides an overview of the site condition and gives an insight into the likely nature of the physical terrain and the soils to encounter on site. The engineering geological map produced from this study provides ready-to-use data on the classification and basic engineering properties of subgrade soils for pavement designs in different areas of Nigeria, which had hitherto been non-existent. Such information are of immediate concern to the highway engineer, planner and contractor in the performance of their professional duties. The investigation of subgrade soils in Bendel State is covered in this report.

1.2 Past Work

This programme was initiated with the study of black cotton soils of north-eastern states of Borno, Bauchi

and Gongola (1). So far, subgrade soils of Rivers (2) and Imo (3) States as well as of the Federal Capital Territory (4) have been investigated, concluded and the reports published for the use of the relevant professionals and the public. Also, as at the time of going to press, the reports on subgrade soils of Cross River, Akwa Ibom and Anambra States are being finalised for publication.

1.3 Scope of Present Work

The scope of the present work on Bendel State subgrade soils involves conducting

- i. detailed field investigation to evaluate the general road condition, the soils, the terrain etc. and to collect representative field samples.
- ii. comprehensive laboratory investigation on all field samples; and
- iii. analysis of the test results generated to characterise the subgrade soils.

2. GEOLOGY

Bendel State lies between longitudes 5°00'E and 6°40'E, and Latitudes 5°00'N and 7°30'N. About 90% of the State is underlain by sedimentary rocks while the remaining 10% located in the northernmost part around Igarra is underlain by crystalline rocks of the Basement Complex. The geology of Bendel State is presented in Fig.1.

2.1 Crystalline Rocks

The existing crystalline rocks are mainly metamorphic and consists of migmatite-gneiss complex; undifferentiated metasediments made up of schists, quartzites etc; porphyritic older granites; and other non-metamorphosed syenite dykes (5). These rocks can be quarried for use as aggregates in road construction. Typical towns in this area include Igarra, Auchu etc.

2.2 Sedimentary Rocks

The stratigraphic succession of the sedimentary basin in Bendel State is given in Table 1 and is described below