

**20 Years of
Innovative
Research**

**ENDOWMENT
FUND LAUNCH
BROCHURE**



**VENUE: NBRRI, LABORATORY
COMPLEX, OTA, OGUN STATE**
DATE: 30TH MAY 1998

**NIGERIAN BUILDING AND
ROAD RESEARCH INSTITUTE**



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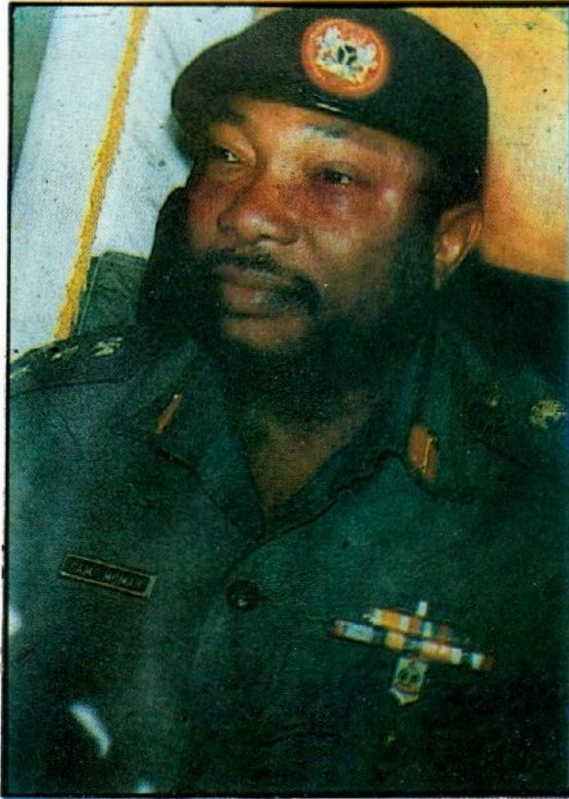




NBRRI RESEARCH COMPLEX BUILT WITH ALTERNATIVE BUILDING MATERIALS DEVELOPED BY THE INSTITUTE.



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Head of State & Commander-in-Chief of the
Armed Forces of Nigeria.



MAJ. GEN. SAM MOMAH *FNSE, MNI*
HON. MINISTER OF SCIENCE & TECHNOLOGY



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NBRI CHIEF EXECUTIVE

NIGERIAN BUILDING AND ROAD RESEARCH INSTITUTE
(Federal Ministry of Science and Technology)

BROCHURE FOR THE ENDOWMENT FUND LAUNCH

1 HISTORY BACKGROUND:

The Nigerian Building and Road Research Institute (NBRRRI) was established on 1 April, 1978 by the national Science and Technology Development Agency (NSTDA). In October 1979 NBRRRI came under the Federal Ministry of Science and Technology which replaced NSTDA.

2 MANDATE OF NBRRRI

NBRRRI was established to conduct applied research and development in the building and construction sectors of the economy. In particular is required to conduct research on:

- I local building and construction materials to determine the most effective and economic methods of their utilisation.
- ii architectural design of buildings to suit Nigerian climatic conditions with respect to lighting, ventilation, thermal comfort and humidity;
- iii the design and performance of functional units in buildings including electrical installations, plumbing, painting, drainage, ventilation and air-conditioning system;
- iv local construction techniques and foundations for buildings and bridges especially on problem soils;
- v the economic and social aspects of the building and construction industry;
- vi the design and construction of roads best suited to the Nigerian environment;
- vii road safety including the occurrence of accidents and methods of reducing the number of accidents;
- viii the economic and social aspects of the road and transportation schemes, accident and safety measures;
- ix structural designs of buildings and bridges and the development of design criteria;

- x all classes of engineering materials - metals, ceramics, and polymers including: materials production/synthesis, materials development, materials availability, materials processing, materials applications, materials failure analysis and prevention, corrosion protection and foundry technology.

In addition, the Institute provides:

- a) Consulting services relating to buildings, roads, and transport to the building and road construction industry and to Federal, State and Local Governments.
- b) specialist support services to medium and small scale cognate enterprises in the areas of training, testing and evaluation of products, materials property and characterisation, materials selection, feasibility study, materials information services, enhancement of product quality and market potential.

3 ORGANISATIONAL STRUCTURE

The Nigerian Building and Road Research Institute has its National Administrative Headquarters in Abuja, while the National Research Laboratory Complex and Production Support Services are located in Ota, Ogun State. The Institute maintains zonal display centres in Kano, Newi and Lagos. At present, the Institute has five Departments; Finance and Administration; Planning, Information and Production; Building Research; Road Research and Engineering Materials Research. The last three are purely Research oriented. Apart from the Departments, there is the Directorate under which are the Office of the Chief Executive Officer, the Foundry Training Centre, Consultancy Services Unit, the Maintenance/Transport Section, the Audit Unit, the Medical Services Section as well as a Public Relations/Protocols Unit, Legal Unit and the Socio-Economic Research Unit.

4 FACILITIES

The Institute has a number of functional Laboratories and Demonstration Centres. These include Soil Laboratory, Environmental Physics Laboratory, Analytical Laboratory and Building Material Laboratory etc. The Demonstration Centres include the Terrain Evaluation Centre and the Architectural Centre. These Laboratories and Demonstration Centres are fairly well established, though with equipment that are largely obsolete.

The Institute also has a Library and this has been serving both staff and members of the public. Journals and texts dealing with the mandates of the Institute are available. The Institute has just acquired a new fax machine and e-mail for communication purposes. A Computer Centre is also in place at the Institute. In addition, Research Officers access computers domiciled within the departments.

5 RESEARCH ACTIVITIES

The Institute is involved in intensive research activities. There are two research orientations. Primarily Research and Development activities and Programmes are carried out in line with national objectives as enshrined in the National Rolling Plan. These are complemented by Minor Research Grants. Recently, the Institute supported sixteen (16 No.) minor research projects with grants totally N480,000.00.

6 DEPARTMENTAL ACTIVITIES AND ACHIEVEMENTS

1.6 Building Research Department

The Building Research Department is engaged in formulating and implementing research into the various problems of the building construction industry. To this effect, the Department comprises the following Sections:

- a. Building Materials Development
- b. Building Physics
- c. Architecture
- d. Building Construction
- e. Structures
- f. Fire Safety

ACHIEVEMENTS

- i. The first phase of a survey of soils in Northern Nigeria for brick making was completed. Samples are undergoing tests and analysis. The aim of these tests and analysis is to have a comprehensive data on soils in Nigeria so that rational choice can be made on the use of soils for brick making.
- ii. Design and Fabrication of brick making machines. NBRRI bricks so produced compare favourably with those from other existing machines which are much more expensive than the NBRRI machine.
- iii. Design and Fabrication of Fibre Concrete Roofing Tile (Mador-Tile) production plant.

- iv. Completion of construction aggregates survey in Kaduna and Enugu States.
- v. Design and construction of a 2.5 tonne capacity vertical shaft prototype kiln for the production of building lime, to provide an alternative to cement.
- vi. Mechanisation of NBRRI manual brick making machine.

Future and Ongoing Activities

There are plans to widen the scope of research activities in Building Research Department. The projects planned in the various Sections are:

1. The thermal comfort survey of the Sokoto area
2. The Sky Luminance measurements of Sokoto
3. Collaboration with the Federal Ministry of Works and Housing and the Energy Commission in formulating standards for comfort in conditioned and unconditioned buildings.
4. Development of Architecture for the remaining cultural zones in Nigeria.
5. Mass Housing Delivery strategy and design standards for housing schemes.
6. Use of wood and bamboo in building construction
7. Analysis of different soils of Nigeria for compressed earth brick making.
8. Roofing failure studies
9. Building collapse and failure in Nigeria
10. Development of alternative binders for construction - lime production.
11. Environmental requirements and their optimisation for health and energy conservation.
12. Mobile houses (design, construction and maintenance).

6.2 ROAD RESEARCH DEPARTMENT

The Road Research Department is mandated to formulate and implement research and development programmes into the problems of the road and construction industry in Nigeria.

The Department consists of the following sections:

1. Road Materials Section
2. Terrain Evaluation
3. Road Safety
4. Geotechnics/Hydrology Section
5. Road Design Section
6. Transport
7. Road Construction

ACHIEVEMENTS

Significant achievements have been recorded in the Department over the years. These include the following:

- i. Systematic analysis of the subgrade soils of Nigeria to assist road planners and engineers in detailed field work. So far, investigation on subgrade soils of all States in Eastern Nigeria, Edo, Delta, Benue, Kogi and Kwara State, the Federal Capital Territory and the black cotton soils of north-eastern Nigeria have been completed. Some of the valuable aspects of the report have been published.

These data and subgrade maps are particularly useful to local governments who may not be able to afford the appointment of consultants for the design and construction of rural roads.

- ii. Remote sensing techniques have been successfully applied in road route planning, land resource and terrain evaluation. This technique has been used to map out calcretes (locally termed jiggling) in Kano State. Studies have also been carried out in Sokoto, Edo, Cross River, Anambra States, Mambilla Plateau in Taraba State and the Federal Capital Territory. The engineering soil maps are being mass produced for use in the construction industry.
- iii. The recent national problem of road deterioration and failures in Nigeria has engaged the attention of the department. The failure investigation of the Shagamu-Benin Road has been carried out. A very important observation is that the Ogun State Section of the Road which has stone base has remained stable while the Edo/Ondo State Sections which had laterite base in the high water table terrain experience frequent deterioration and failures.
- iv. Road Traffic Accident (RTA) studies have been carried out in Lagos and Oyo States. A computer coded national RTA format was developed and has been successfully used. This format has now been adopted by FRSC for road traffic accident information system in Nigeria.
- v. The geotechnical properties of peats and peaty soils in coastal areas of Lagos and Ogun States have been investigated. The information and data generated will be useful in formulating for simple structures in problem soils.

FUTURE AND ONGOING PLANS

Future thrust for research and development activities in the Road Research Department will focus on:

- i. Development of an effective maintenance strategy for low, medium and high volume roads in Nigeria

- ii. Development of appropriate technology for rural road design, construction and maintenance in Nigeria
- iii. Use of motor cycles and tri-cycles as a mode of transportation in Nigeria.
- iv. Utilisation of poor quality materials for road construction in problem areas
- v. Inter transport studies - integration of road and railway transport schemes in urban centres in Nigeria.
- vi. Investigation of failure and performance of roads in Nigeria.
- vii. Effectiveness of footbridges in urban cities.
- viii. Traffic flow characteristics in urban cities.
- ix. Dam Design and failure
- x. Design, Utilisation and Performance Evaluation of bridges in Nigeria.
- xi. Soft clay engineering, including soil improvement
- xii. Cost effective techniques, erosion control and reclamation.

6.3 ENGINEERING MATERIALS DEPARTMENT

This is a newly established department in the Institute. The Department was established in 1993 to conduct applied research and development into the systems and processes for the conversion of raw and or semi-finished materials into engineering materials of various shapes, gauges, forms, etc which are needed in the production of capital goods (machinery, equipment, spare parts).

The central objective of the Department is to catalyse rapid development of facilities and national capability to design and mass produce machinery,, equipment and spare parts needed to support activities in the engineering materials sector of the economy.

The Department has three major research programmes (Metal Technology, Ceramic and Structural Polymers and Special Materials) under which are distributed the following section:

1. Ferrous Metals Section
2. Non-Ferrous Metals Section
3. Ceramic Section
4. Structural Polymer Section
5. Glass/Glass Ceramic Section
6. Electronic Materials Section
7. New Materials/Material Testing Section

ACHIEVEMENTS

The Engineering Materials Division has made considerable progress though it was started only a few years ago.

- i. Feasibility Studies have been completed on the proposed Foundry Training and Development Centre.
- ii. The Ceramic Research Division has also taken off.

FUTURE & ONGOING PROJECTS

The activities of the Department covers a wide field but the Department intends to focus on:

- i. Establishing and running a Foundry Development and Training Centre with the specific objectives to:
 - a) Finding local substitute for imported technology
 - b) Solving technical problems of the small and medium scale industry
 - c) Providing technical services for the subsection.
- ii. Developing a Virile ceramic research group to provide cheap and easily to fabricate materials for only the Engineering Material Division also. For the Building and Roads Division.
- iii. Initiating research projects in the area of:
 - a) glass and glass ceramics and composites
 - b) electronic materials
 - c) engineering polymers - involving thermoplastic, thermoses and electrometers
- iv. Providing materials information referral services with the aim of saving time for industries with materials problems.
- v. Improvement of the NBRRI brick-making machine for batter compaction and ergonomics

6.4 SOCIO-ECONOMIC RESEARCH PROJECT UNIT

This unit was set up in the Institute in September, 1996 to conduct socio-economic and environmental research as they relate to Buildings, Roads and Engineering Materials activities of NBRRI.

Current research trust of the unit is in the area of economic, social and cultural aspects of Housing particularly Housing decay, Housing supply and demand situations, Housing mobility and post occupancy study etc.

Within a short period of its establishment, the unit has successfully complete and produced a technical report of a study on "Urban Housing Problems in the Federal Capital Territory, Abuja", as a part of a comparative study of "Public

Residential Buildings in selected Nigerian Cities." This report is currently being reviewed for publication by the Institute's Journal of Construction and Materials Technology. Similarly, the Port Harcourt phase of the study is in the analysis stage.

Other areas of the Unit's activities include:

1. Building materials price index survey in Nigeria
2. Post occupancy evaluation of residential estates in Nigeria
3. Inter and intra urban housing mobility study.

6.5 PLANNING, INFORMATION AND PRODUCTION DEPARTMENT

Planning, Information and Production Department comprises three Divisions under which are the following Sections:

1. Library Services,
2. Computer Centre,
3. Extension Services,
4. Production Unit.
5. Planning and Budget.

Its main function is to co-ordinate the planning and budget activities, monitoring of projects through monthly, quarterly and annual reports, dissemination of information within and outside the Institute.

Much was achieved in the area of technology transfer especially in the promotion of Madortile developed by the Institute. Many technological packages were bought by private investors and the transfer of technology carried out. Also of importance is the introduction of the technologies and products developed by the Institute to NYSC Corp members during orientation programmes in collaboration with National Directorate of Employment as part of its extensions services programme.

The Institute has participated in various exhibitions and trade fairs. Of much importance was the habitat II Conference and Exhibition that was held in Istanbul, Turkey and Food and Culture Fair held at Tafawa Balewa Square, Lagos. At the conference and exhibition that was held in Istanbul, Turkey, the Institute put up a pictorial display of her research findings and this was adjudged one of the best from developing countries. At the Food and Culture Fair, a prototype housing unit using NBRRRI bricks and tiles was put up.

7 NBRRI SEMINARS AND TRAINING WORKSHOPS

The Institute periodically organises seminars and workshops on topical issues that are relevant to the road, building and construction industry. In 1995, a 3-day national workshop on "Private Sector Participation in road Management" was held with focus on the "Build, Operate and Transfer" Scheme. The workshop was timely and generated a lot of interest because of limited funds to maintain the ever increasing volume of Nigerian highways. It further created strong awareness and nation-wide publicity for the Institute and the FMST. Recently, a national workshop on low cost maintenance of buildings and roads was organised between 9th - 11th December, 1997.

The Institute will from 1998 host an Annual NBRRI National Conference on Roads, Building and Materials Technology. This Annual Conference has been slated for the month of April 1998.

8 NBRRI PUBLICATION

The Institute has over the years produced a good number of reference materials and reports in the different areas of its mandate. The Institute recently commenced the publication of a high quality technical journal - **Journal of Construction and Materials Technology**. This is to be published twice a year and will bridge the existing gap in practical information exchange between researchers and industrial audience in the fields of building materials, design and construction, road materials, engineering materials geophysics, geological engineering, hydrology and related fields. Articles on policy, economics and environmental issues as they affect the above subject matters are also published in the journal. The journal is international in outlook in terms of authorship, distribution and membership of Editorial Advisory Board. The Editorial Advisory Board is drawn from leading scholars in the fields of the journal areas.

9 NATIONAL / ZONAL DISPLAY CENTRES

The Institute has a national display centre at Abuja with three other zonal centres located in Lagos to serve the Western States, Nnewi to serve the East and Kano for the North.

10 NBRRI CONSULT/BREMTECH

The Building, Road and Engineering Materials Technology (BREMTECH), is a registered company of the Institute to complement the activities of the Consultancy Unit. In conjunction with the consultancy unit, they popularise out technology and enhance the Institute financial base.

11 FUTURE PLANS OF THE INSTITUTE

The Institute relocated its National Research Laboratories and Offices to its Permanent site at Ota, Ogun State in early 1998. An appreciable development of the site has been effected with offices and laboratories already in place.

Already the Permanent Site for the National Laboratory complex at Ota is in a habitable form, some offices and laboratories are in place, water and electricity are available. The plan is to make NBRRI a model for other Research Institutes by hiring highly qualified, highly motivated, and result-oriented technocrats, who translate research findings into tangible products thus making NBRRI an acknowledged centre of technological development.

Part of the plan is also to make NBRRI a whole community where creative, educational, social, religious and economic activities will be made to play interactive roles and thereby establishing and nurturing a unique citadel of knowledge worthy of emulation. Significant strides have been made in this direction. In recognition of this the Institute was declared a centre of excellence by the Federal Ministry of Science and Technology in 1997.

- i) Development of infrastructure within the laboratory complex like the Staff Clinic, Nursery and Primary School, Staff quarters, Club House, Central Analytical Laboratory, etc.
- ii) Equipping the Laboratories with modern state-of-the-art equipment to facilitate research work.
- iii) Development of a Foundry Training Centre as a training centre for middle-level manpower in metal/metal fabrication.
- iv) Collaborative research with national and international bodies in the area of NBRRI's mandates. Examples of such collaborative efforts include:
 - a. Construction of small scale lime kiln pilot plant in collaboration with Raw Materials Research and Development Council.
 - b. Construction of Made-In-Nigeria model houses in collaboration with the Federal Ministry of Works and Housing.
 - c. Training and transfer to NBRRI technologies to NYSC members in collaboration with the National Directorate of Employment (NDE).
 - d. Construction of medium scale burnt brick production plants in collaboration with IDRC of Canada.

Others in the pipeline include collaboration with:

- a. UNCHS (Habitat) in the area of Human Settlement
- b. United Nations Development Programme.
- c. Construction of luxurious Made-In-Nigeria Model Houses in collaboration with Urban Development Bank.

- v) Development and production of Ceiling Boards from local fibres.
- vi) Small scale paint production using alternative raw materials
- vii) Road failure investigation and design of failure resistant roads
- viii) Establishment of a National Metallurgical Laboratory analysis and testing of all materials
- ix) Establishment of a National Asphalt/Bitumen Laboratory to serve as a national reference laboratory for the construction industry.

12 PRESENT DIFFICULTIES

The Nigerian Building and Road Research Institute faces among others the following difficulties:

- a) Inadequate funding.
- b) Inadequacy of equipment and physical infrastructure. The Institute's National Laboratory Complex at its Permanent Site at Ota, Ogun State is still littered with uncompleted structures and abandoned pilot schemes. These structures need to be completed and occupied to enable the Institute better meet its mandates.
- c) Inadequacy in high level research staff strength.
- d) Poor patronage on the part of Federal, State and Local Governments of NBRRI developed alternative building and construction materials in preference to conventional materials.

All summary of cost estimates covering various activities and infrastructure required for the full development of NBRRI is presented below.

CONCLUSION

The current status and future projections of activities at NBRRI enumerated in this presentation is designed to launch NBRRI into the next millennium as an enviable, result oriented scientific centre capable of satisfying the needs of the construction industry in Nigeria and the West African sub-region. As a semi-autonomous organisation, NBRRI is funded wholly by the Federal Government. However the funding is inadequate to meet the Institutes current need. Consequently, the contributions and assistance of well meaning Nigerians, corporate organisations in the private and organised sectors, Federal Government establishments, and multi-national organisations are welcomed.