

NATIONAL ENGINEERING CONFERENCE SERIES ISSN 1118-8383

KADUNA POLYTECHNIC, KADUNA
VOLUME 4, NUMBER 2 - 1997



**PROCEEDINGS OF THE FOURTH
NATIONAL ENGINEERING CONFERENCE**

CONFERENCE THEME

**The Relevance of
Indigenous Technology
in the Realisation of
Vision 2010**

Held on the 11th and 12th of December,
1997 at the College of Engineering,
Kaduna Polytechnic, Kaduna, Nigeria

VOLUME 4, NUMBER 2: 11th & 12th December, 1997

Conference Theme:

**THE RELEVANCE OF INDIGENOUS TECHNOLOGY IN THE
REALISATION OF VISION 2010**

EDITOR-IN-CHIEF

J. Mumah; *Ph.D, MNSE, MNSChE, MSES*
College of Engineering
Kaduna Polytechnic
Kaduna

TECHNICAL SECRETARY

E. A. Adebayo; *BSc, MSc, MNSChE*
College of Engineering
Kaduna Polytechnic
Kaduna

Conference Chairman

Engr. Dr A. T. ABDULLAHI,
EXECUTIVE SECRETARY,
NATIONAL BOARD FOR TECHNICAL EDUCATION

Guest Speaker

Dr. A.A. Aliyu,
DIRECTOR GENERAL, FAMILY ECONOMIC
ADVANCEMENT PROGRAMME, (FEAP),
ABUJA

Chief Host

Engr. Dr. N.A. Yakubu,
Director,
Kaduna Polytechnic

Host

Engr. D. Isah,
Ag. Director, College of Engineering,
Kaduna Polytechnic

Table of Contents (Vol. 4 No. 2)

Authors / List of Papers		PAGE
22.	J. KATENDE AND D. ISAH Design Of A Sliding Mode Servo-system For Industrial Robots	156
23.	L. M. ADESINA Load Forecasting Using Statistical Trend Analysis	164
24.	M. G. YISA Dynamic Analysis Of A Scale-Model Tractor-Implement System On Slopes	171
25.	M.I. OGUNBAJO The Construction Industry And The Provision Of Quality Infrastructure For Nigeria - A Geological Perspective	179
26.	O.I. NWANKWO Power Transmission And Distribution: Problems, Prospects And Solutions	187
27.	A.N. O. AGHOTOR Management Of Engineering Infrastructures: Focus On The Metal Industry	195
28.	P.I. IGBAX and ABDUL AUDU Effective Pollution And Environmental Management Through Recycling Of Industrial Waste Products	202
29.	A.B. IBITOYE Labour Based Road Maintenance	209
30.	O. CHIJIJOKE and G.U. OJIAKO Interbasin Water Transfer: Nigerian Experiments	216
31.	O.I. NDUBUBA and E.E. NDUBUBA Sewages Disposal Systems In Student's Hostels - A Case Study	223
32.	YUSUF ABOKI The Construction Industry And The Provision Of Quality Infrastructures For Nigeria: The Legal Perspectives	227
33.	R.A. ATAGUBA The Manufacturers Liability For Defective Goods Produced For Sale In Nigeria	236
34.	S.N. MUMAH Technological Advancement Prospects For Nigeria	242
35.	I.K. OBIOHA Alternative Building Materials For Affordable Houses For Nigerians In The Twenty First Century Submitted	247
36.	A.M. JINADU and M.A. KOLEOLA Termites Problem And The Sustenance Of Rural Housing Infrastructure In Niger State	253
37.	Y. YERIMA, and B. G. DIGIMA Functional Electrical And Magnetic Stimulation	259
38.	A.M. MIYIM , A. S. DALI , and I. S. ALI Digital Audio Broadcasting (DAB)	265
39.	E. A. ADEBAYO Hazard Minimisation In Process Industries	272
40.	N. A. YAKUBU Indigenous Technology and the Industrial Development Process in Nigeria	283
41.	AKIN AJISEGIRI Kinetics Of Sorption And Stability Of Biomaterials	288
42.	P. C. OKONKWO Development Of Process Simulation Model For Lime Kiln Design	298
43.	YAHAYA GILIMA KARQFI Components And Ingredients, Of Solid Waste Service Delivery System For Effective Environmental Management	305
44.	J. N. TSUZOM AND I. S. AMOKA Reclamation Of Mined Lands For Agricultural Purposes: A Case Study Of Jos Minefield	310

TERMITES PROBLEM AND THE SUSTENANCE OF RURAL HOUSING INFRASTRUCTURE IN NIGER STATE

A.M. JINADU and M.A. KOLEOLA

Department of Town and Regional Planning, The Federal Polytechnic, Bida.

ABSTRACT

Housing is an important rural infrastructure which forms the basis for the demand, provision and management of other services. However, rural housing is the least considered in most rural development programmes. This paper considers the ecological problem of rural housing in four selected village in Niger State, Nigeria. It examines the effect of termites on the existing housing stock, the different control measures available and their effectiveness. The study found out amongst others that, the incessant attack of termites on buildings results in quick depletion of the existing stock and has significant cost implication too. The local and orthodox methods of control also have temporal effects. The paper therefore conclude with recommendation of future indigenous research to sustain the rural housing fabrics in the area.

INTRODUCTION

The rural economy in Nigeria is an important sector for national development. Amongst others, it provides habitat for about 80% of the population, employs about 70% of the working force and account for about 70% of the non-oil exports. Its improvement therefore holds better prospects for a balanced economy and sustainable development. In Nigeria, the rural areas generally face the problem of inadequate provision and management of basic infrastructure roads, water, electricity, health, education and housing facilities. Among these, housing which forms the basis for the demand, provision and management of other rural infrastructure is not often seen as a problem and it is the least considered. This forms the basis need to intensity efforts and researches on rural housing stock to sustain the rural economy. This is the issue addressed in this paper.

Poor quality and rapid depletion of the existing stock are the most visible aspect of rural housing problem. This assertion is confirmed by 1981 survey conducted by the Ahmadu Bello University has found out that, 75.4% of the existing rural stock in the Northern States needed improvement while 8.4% needed replacement. In qualitative term therefore, rural housing in Nigeria falls below minimum standard in all respect (NEST, 1991).

The rural housing quality problem is engendered by certain ecological problem prominent among which is the incessant attack of termites on houses. The effect of this on human shelter has been drastic thereby reducing the number of habitable housing stock (Malaya, 1985). Not only this, the problem of termites has made the use of certain building materials not sustainable. This has threatened the survival of the indigenous building technology in Nigeria. Sustaining the rural fabrics requires an intensive research into the nature of the problem as well as the necessary control measures. This paper examines the nature of termites problem in the rural areas of Niger State and the existing local control measure. It considers the effectiveness of the control measures used and recommended area for future indigenous research so as to preserve the rural housing infrastructure in Nigeria.

SURVEY OF SOME KNOWN ACTIVITIES OF TERMITES

Termites are of great economic importance to man. Significant contributions to research on the biology, economic significance, ecology and the control of termites have been made by Sanda (1962) and Harris (1985). In many of these studies, it has been empirically established that termites have a great damaging effect on ornamental shade-providing trees, farms and human buildings. With regards to the destruction of ornamental trees, research results from the university of Ife (now Obafemi Awolowo University) and the University of Lagos in Nigeria as well as the University of Ghana, Lagon have shown that termites were involved in the damage of

ornamental shade providing trees in the three campuses. Specifically, such termite family as the *Amitermes*, *Evuncifer*, *Macrotermes subhyalinus*, *Termes* sp., *Termervitermes Geminatus*, *M. Bellicosus*, *Ancistrotermes Odontotermes* Sp., etc have effected 70%, 90% and 98% attack on ornamental shade trees in Obafemi Awolowo University, the University of Lagos and the University of Ghana respectively. The nature of the damage done, as given by Sands (1962), ranged from scavenging on the bark and tree branches, eating out galls in the roots and stems, as well as nesting within the roots and thus weakening the anchorage of the trees by loosening their surrounding soil (Malaka, 1985).

Apart from the destructions made to ornamental trees, the negative effects of termites cover many other aspects of human endeavour. Usher and Barnacle (1974) have, for instance, noticed the attack of termites on telegraph poles in the northern region of Ghana while Howse (1970) and Clagg (1965) reported that termites have caused serious damage to man-made fabrics such as polyesters, and PVC, Metal foils, electric cable insulators as well as transmission lines and cables. However, more than any other areas of human endeavour, the negative effects of termites on human houses is quite frustrating. Although the attack varies in intensity and is easily noticed in areas of occurrence, more insight into dimension of attack has been given by Malaka (1985). In his study of students temporary hostels of the Obafemi Awolowo University, the author found out that, of the 100 rooms partitioned with timber boards, all were subjected to termites attack while 4 others were invested by termites eating ants. The effect of the insects was also noticed in a number of senior staff quarters of the same university, the main foci of attack being the door frames and furniture.

At the University of Lagos, similar attack was noticed at student's hostel in the college of education. While the wooden door frames of the college auditorium was badly damaged, household and personal effects such as bookcase, shoes and clothing were also destroyed by termites. In the same vein, termites were reported to have built galleries up to the rooftops in staff houses at the University of Ghana, Lagon and have attacked wooden fences, wooden floors, ceiling boards, clothes and plastic records. In his estimates, Malaka (1985) observed that over 20% of all building on the campus had ceiling boards, furniture and other wooden structure affected by termites of the *Ancistrotermes* sp. family.

The forgoing review establishes that the damaging effects of termites on man-made fabrics, most especially building and household materials, is quite considerable. According to Harris (1971) such termites family as *Amitermes*, *Evuncifer*, *Odontotermes*, *Pamperanus* and the *Coptotermes Intermedium* have a devastating effects on building in Nigeria. The destructive and threatening activities of these termites requires effective control for the sustenance of the rural housing infrastructure. This among others is the issue addressed in this paper.

RESEARCH SETTING

This research focuses on Lavun Local Government Area (LGA) of Niger State which is a major area of widespread and intensive termites activities in the Nigerian middle region. The LGA is a rural local government with headquarters at Kutigi. It has numerous agrarian village and hamlets which are locationally dispersed in space. Prominent among these villages are Kuchi, Woro, Doko, Pati Bologi, Fitiki, Gunchi, Jima, Zhigichi, Sankwa, Tumaka, Saachi, etc among which Kuchi Woro, Saachi, and Zhigichi were selected for this study.

Kuchi Woro village is located at about 8 Km away from Bida town along the A25 road an undeveloped access road. The settlement is connected to the national electric grid with few other social services which include a primary school, a dispensary and one Directorate of Food, Roads and Rural Infrastructure (DFRRI) hand pump well. Unlike Kuchi Woro, Saachi (24 km from Bida), Zhigichi and Tumaka villages are generally unplanned and have fewer services. These villages mainly have restricted access, no electricity and they use water mainly from wells, nearby rivers and ponds. The buildings in the four village are predominantly the plastered mud type with corrugated iron sheets roofs. However, few other ones are build with cement blocks while some are unplastered mud houses with thatched roofs. The buildings are locationally unplanned and are mainly accessed through numerous footpaths found in the villages. Generally, the buildings are in their various stages of dilapidation with few others abandoned due to termites attack.

METHODOLOGY

Data for this study came from direct field survey and the existing literature. The choice of villages for study was preceded by a reconnaissance survey during which the evidence of termites problem was established in a number of villages in the Local Government Area. After a random selection of the four villages, a detailed survey was carried out with the aid of a structured questionnaire, oral interview and personal observation.

In the process of data collection, the questionnaires were administered on selected home owners through a random systematic method. In each village, a 10% sample of the existing residential building were selected. Hence in Kuchi Woro (with 292 buildings) a total 29, 50, 55 questionnaire were administered respectively. Altogether, a total of 184 questionnaire were administered in the four villages.

RESEARCH FINDINGS

This section examines the nature and the destructive effects of termites on buildings, termites control measures, building maintenance costs and problems in the study areas. It concludes with recommendations based on the findings of the study.

THE NATURE AND EFFECTS OF TERMITES ATTACK ON BUILDINGS

Having noticed the presence of termites problem in the study areas, investigation on the nature and effects of termites on building proceeded from a test for awareness of the problem in the villages. Responses to our questions were affirmative as all the residents interviewed agreed that the problem exists. The attack is said to occur all the year round. However, 156 (84.5%) of the respondents reported that, the attack on buildings becomes more intensive during the raining season (April - August). The intensive of attack is found to be a function of the population of termites in a particular village and the type of building materials used. The effect is therefore more intensive at Tumaka and Zhigichi and is more noticeable on the less resistant components of the buildings.

Various reasons were adduced to the intensive attack noticeable during the rains. First, the residents accounted that the termites are normally disturbed by rain on the open farmlands, where they reside mostly during the pre and immediate post harvest period. Hence they migrate into building where they build their termitarium. The farm to building migration is also aided by the wetness of the soil which allows for easy passage through the soils and within the building wells. Since the termites normally search for food during the rains, the wet part of the building and the roof members are easily attacked. The traditional earth food storage (rhombus) also attracts the food ravaging insects into the residential area.

In the four villages, the damaging effects of termites is most noticeable on wooden window and door frames, ceiling boards and roof members, building walls and foundation as well as household equipment such as furniture, wooden boxes and clothing. The termites are said to be more active at night in their foraging activities. However, the intensity and area of concentration of attack vary. For instance, the rate of destruction is higher, for Tumaka and Higichi while in Saachi village, the attack is more on the buildings substructure. The effects of the frequent attack on the identified building components is such that they are severally damage or eating up by insects. In Tumaka, Zhigichi and Kuchi, cases of falling frames, doors and windows as well as half hanging ceiling board were noticed. In some cases, roofs (most especially the thatched ones) were completely eating up leading to repeated roofing of some buildings in the area, thus exacerbating repairs. With respect to structural damage, movement of the termites within the buildings walls are found to have created cracks and holes in the falling of the cement materials used in plastering the mud wells in Kuchi Woro, and Tumaka. In Saachi, a termite family associated with water logged are do more damage to building substructure. This has, in some cases resulted in cracks of different magnitudes and has in other cases led to complete structural failure. It was therefore observed that over 85% of the buildings, in Saachi have cracked wells. The damages done by termites in the are is relatively costly. In monetary terms, the annual damages done in Saachi and Kuchi Woro, villages have been estimated at between N1,000 - N2,000 depending on the rate of attack on individual building. In Zhigichi and Tumaka, house owners estimated the annual building damage as ranging between N6,0000 and N7,000.00. Where buildings are not maintained for two to three years, the damage

used could cumulate to over N20,000.00.

the aggregate, building destruction done by termites in the four villages is considerable. In Tumaka for instance, 17 houses have been rendered useless while in Zhigichi and Kuchi Woro, 10 and 5 buildings have been rendered uninhabitable respectively. Also in Saachi, the primary school has collapsed due to termites attack while the town hall and the house in Kuchi Woro have been invaded by termites and are abandoned completely. In all the villages, the problem is continuous or recurrent. Sustaining the buildings therefore requires a concerted effort in termite control and building maintenance. Considered in the next paper.

METHODS OF TERMITES CONTROL

In response to the problem of termites and the damage done to buildings, residents in the four villages have devised methods of termites control. The methods used are both local and orthodox in nature. These are considered under different headings below.

Local Control Measures

The local control measures includes the use of hot water, ashes, naked fire and smoke, digging of trenches around buildings and the use of termites resisting buildings materials. The treatment method of each is considered in details.

i) Use of hot water.

Here the inhabitant heat water to boiling points and pour it on areas of termites concentration. The hot water sink deep into the ground to kill the termites.

ii) Use of ashes:

In this case the people pour hot ashes either in powder form or in solution to areas of concentration of spray around the buildings either to kill or prevent the insects from moving close to the buildings.

iii) Use of naked fire and smoke:

This measure involves a direct attack on the termites using naked fire to kill the insects or the smoke to prevent attack on buildings.

iv) Digging of Trenches:

Trenches are normally dug around the buildings during the rains so as to allow the rain water to sink deep into the ground. The sinking water is capable of disturbing the termite's queen and it is caused to migrate out of the buildings surroundings together with the entire termites community.

v) Use of Termites Resisting Materials:

This measure is preventive rather than curative. It involves the use of Palm tree planks for windows and door frames as well as the for roofs Pauline. The palm tree planks are said to be capable of resisting termites attack for between 20 - 30 years.

ORTHODOX CONTROL MEASURES

This involves the use of chemicals and petroleum products got outside the immediate environment. The materials used include Gamalin 20, Karrate, Nogus, Solignum and Phenics D, while the petroleum products used include petrol, kerosine and used engine oil. These chemicals and other related products are applied directly on the affected parts of the wood members are used in varying degree and their degree of effectiveness varies as considered below.

EFFECTIVENESS OF THE CONTROL MEASURES

In all the villages studied, both the local and orthodox method of treatment are found to have short time effect. The local measure are generally said to be effective for between 10 - 20 days after which the termites resurface again. The termites in the are therefore said to have developed resistance to the use of some local treatment materials, most especially ashes. The chemicals used are said to be relatively more effective. However, they could only preserve the buildings for between four and six months.

The different control measure have limitations. In a test for the general effectiveness of termites control

measure, 99 (87.6%) of the 113 people who responded to the question opined that the different measure only produce temporal solution. (Table 1). This is because the termites community are well organized and could not be traced to a specific location. Hence the problem becomes a complex and recurrent one which has imposed heavy maintenance cost on the people.

TABLE 1. GENERAL EFFECTIVENESS OF TERMITES CONTROL MEASURES

Responses	Numbers	Percentage
Effective	14	12.4
Temporarily Effective	99	87.6
Not effective	-	-
Total	113	100

Sources: Field Survey, July, 1997

BUILDING MAINTENANCE COST AND PROBLEM

Termite control activities and the maintenance work have certain cost implications in the villages studied. Against the background of the not too buoyant rural economy and people's low economic status, the cost implicating of the routine control and maintenance work was examined. Here, it was found out that, the amount spent on building renovation is a function of the rate of damage done and the economic capacity of the house owner. Also, the annual expenses on buildings maintenance is generally inadequate finance to carry out commensurable repairs. Thus, majority of the respondents (77.2%) spend well above N1,000 (Table 2). Most of the respondents who spend more than N1,200 come from Tumaka and Zhigichi villages. This amount is considered high by most of the respondents who are mostly small scale farmers.

TABLE 2 BUILDING MAINTENANCE COST

Amount	No	Percentage
₦100 - ₦500	28	15.2
₦501 - ₦1,000	142	77.2
Above ₦1,000	14	7.6

Sources: Field Survey, July, 1997

Financial constraints is a major problem of termite control and building maintenance in the area. This has resulted in the neglect of some parts of buildings while others have been completely abandoned. The financial constrains is often worsened by high and rising cost of required chemicals. This brings about the needs to look for a more cost effective and sustainable control measures as argued in the discussion below.

DISCUSSION

The co-habitation of human beings and termites in an ecological setting is always a marriage of inconvenience. As we found out in this research, the presence of termites in Kuchi Woro, Saachi, Zhigichi and Tumaka villages has inflicted and is currently inflicting severe damages on human buildings and other fabrics. The recurrent and incessant attack on building has therefore warranted continuous exercises of termites control and building maintenance which impose heavy financial burden on the poor inhabitants.

Faced with a natural problem, the villagers become more handicapped due to their inability to secure the necessary materials to combat the problem. Not only are the necessary chemicals not readily available in the immediate locality of the people, the prices has gone dup over the years. For example, Nogus chemical which

cost ₦60.00 per liter in the 1980s now cost ₦200.00 while the price of Karrate is not as high as ₦100.00. The dual problems of temporal effectiveness of the current treatment methods and the rising cost of chemicals have therefore combined with the poverty situation of the villagers to limit their ability to cope with this perennial problem.

Along with others, sustaining the housing infrastructure and the rural economy of the people require the development of a more effective local treatment methods and materials. Although the development of a sustainable approach to termites control in the area is outside the focus of this paper, such an exercise is currently being embarked on by the authors in a separate research. It is observed that the juice of Neem tree and the solution from cassava are capable of preserving building materials against termite attack. Effort is currently being made to develop these natural resources and to test their long term effectiveness using three experimental stations in the study areas. These materials, if found more effective, will provide the people with a cheap, indigenous and sustainable approach to termite control in the area.

REFERENCES AND BIBLIOGRAPHY

- Abiodun J. (1985): "Housing problems in Nigeria cities" in Poju Onibokun (ed) *Housing in Nigeria*. NISER, Ibadan, 1985.
- Adeeniye E.O. (1985): "Housing and Construction Industry" In Poju Onibokun (ed) *Housing in Nigeria*. NISER Ibadan, 1985.
- Johnson R.A. et al (1980), *A check list of Nigerian Termites (ISOPTERA) with Brief Notes on their Biology and Distribution Niger, Fld. 1980.*
- Koleola M.A. (1993): *The influence of Termites on Building maintenance in Nigeria; A case study of Bida, Niger State. A paper presented at the symposium organised by the association of Quantity Surveying Students. The Federal Polytechnic, Bida 14th June, 1993.*
- Malaka S.I.O. (1985): *Economic Importance of termites. Six case studies in Nigeria and Ghana. The Nigerian Field. 1985 pp. 222-229.*
- Malaka S.I.O. (1980): *Foraging Behavior of mitermes Evuncifer silvestri (Isoptera, Termitidea Omitermitineis). Journal of National History, 1980, pp. 351-360.*
- Sands W.A. (1962): *Observation on Termites Destructive to Trees and Crops Nigeria, Reg. Min. Agric. Samaru Reg, Bull. 26 pp. 1-14.*
- Sands W.A. (1971): *Termites as pests of Tropical Food Crops. Paper presented at a seminar on Agricultural Research in West Africa, sponsored by IITA at the conference Centre, University of Ibadan Ibadan 1971.*