CONFERENCE PROCEEDINGS

FOR THE

3RD

ANNUAL CONFERENCE OF CIVIL ENGINEERING

CIVIL 2011 @UNILORIN

DEPARTMENT OF CIVIL ENGINEERING,
FACULTY OF ENGINEERING AND TECHNOLOGY,
UNIVERSITY OF ILORIN, ILORIN, NIGERIA.

THEME :

FAILURE MENACE IN ENGINEERING INFRASTRUCTURE

DATE:

6th - 8th July 2011

VENUE:

Main Auditorium, University of Ilorin, Ilorin, Nigeria.

Editors: B. F. Sule, A. Y. jimoh and A. A. Adedeji

CONFERENCE PROCEEDINGS

FOR THE

3RD

ANNUAL CONFERENCE OF CIVIL ENGINEERING

CIVIL 2011 @UNILORIN

DEPARTMENT OF CIVIL ENGINEERING,
FACULTY OF ENGINEERING AND TECHNOLOGY,
UNIVERSITY OF ILORIN, ILORIN, NIGERIA.

THEME :

FAILURE MENACE IN ENGINEERING INFRASTRUCTURE

DATE:

6th - 8th July 2011

VENUE:

Main Auditorium, University of Ilorin, Ilorin, Nigeria.

Editors: B F Sule, A. Y. jimoh and A A Adedeji

Published in 2011

Published by:
Department of Civil Engineering, Faculty of Engineering and Technology, University of Ilorin, Ilorin, Nigeria

Editors

Prof. B. F. Sule
Dr. Y. A. Jimoh
Dr. A. A. Adedeji

Contents

Structural Appraisal of Collapsed Mud Buildings in Ibadan South-East Local Government

[1] W. O. Ajagbe, [2]B. A.Olaoye , [2]S. I. Adedokun and [3]A. A. Ganiyu
Department of Civil Engineering, University of Ibadan, Nigeria
alpha_est1@yahoo.com; wo.ajagbe@mail.ui.edu.ng
[2]Department of Civil Engineering, Ladoke Akintola University of Technology, Ogbomoso, Nigeria
[3]Department of Civil Engineering, King Fahd University of Petroleum & Minerals, Saudi- Arabia

Abstract

The collapse of building structures in recent time has become a source of worry for the professionals in the building industries with particular attention being on cement concrete structures. This paper however examined the causes and remedy to the ever increasing failure of mud buildings in cores of our major cities in Nigeria with particular focus on Ibadan South East Local Government Area of Ibadan, Oyo state.
The major causes and nature of the failures of mud buildings, evaluation of the strength of failed buildings and the ones in service, and environmental impact of the collapsed buildings on the inhabitants were examined. Data used for this study were collected by the use of structured questionnaires, oral interviews, field trips made to selected areas to ascertain common failure of buildings and the use of Schmidt hammer to test the compressive strength of some selected mud buildings in the study areas. Secondary data were also obtained from local government officials and few published journals. It was observed that failure occur due to lack of adequate maintenance, improper alteration, poor planning of the area, vibrations from vehicles, poor drainage system, and poor solid waste management due to bad road network, material incompatibilities and primitive method of construction. Appropriate preventive measures were provided in the study as means of preventing future occurrence of the failures.

Keywords: Mud, buildings, collapse, Schmidt hammer test, Compressive strength.

1. Introduction

The agony of building collapses among all other things has become an endemic plague constantly striking in recent years in this country without it being properly addressed and prevented (Bala, 2006; John and Eric, 2006). Though this occurrence is not limited to Nigeria alone, whenever it occurred both lives and properties were lost. However, it is important to note that building failure is not only limited to concrete block buildings as

much attention and interest of the government, people and industry practitioners are only paid in this direction. Based on recent research survey carried out in the study area, it was observed that quite a number of mud buildings had collapsed or at the verge of collapse. The failure rate of mud building in the heart of Ibadan city; causes of the collapse and pragmatic approach to halting the problems were examined in this study.

1.1 Adobe Brick as a Construction Material

Adobe brick has been defined as the oldest and most common building materials known to man which were traditionally never kiln fired (Barnes and Mark, 1975; Omange, 1985). Traditionally, adobe bricks are unbaked and consisted of clay - a readily and abundantly available material in Nigeria, sand, water, sometimes gravel and often straw or grass mixed together by hand (Kawka, 1975). They are often more appropriate to the environment than alternative modern materials such as cement or plastic based materials. Today some commercially available adobe-like bricks are fired which are stronger and more durable than the sun dried adobe. NBRRI (1988) opined that the sun dried produced from clays has advantages of high fire resistance, good thermal comfort and the production by unskilled labour. Alade (1997) also observed that economically, clay was said to be highly competitive compared with other alternative technologies and requires no heavy capital mobilization. However, Eyre (1935) pointed out that Adobe will not permanently bond with metal, wood or stone because it exhibits much greater movement than these other materials, it either separates, crack, or twist where they interface.

1.2 Area of study

Ibadan South-East Local Government is one of the eleven local government areas of the Ibadan metropolitan areas and has a total land area of 81.37 km^2. Residential land use has the largest share of land in the local government; it occupies an area of 60.21 km^2 representing about 74% of the total land area. This was classified into core unplanned residential areas and newly developed areas. The unplanned residential area among which are the majority of the mud buildings include Bere, Oke Mapo, Aremo, Agugu, Ode-Aje, Oke Dada, Eleta and Oranyan etc.

2.0 Methodology

Visual inspection of few selected collapsed buildings in the study area was carried out. Careful observation was made on the following: failure types and their likely causes; nature of subsoil; groundwater level and flooding; topography of the area, ground erosion and drains, nearby streams or rivers, foundation condition of the buildings.

To enhance easy collection of data, nine locations were selected within the study area based on the number of failed buildings. They include Bere, Oke Mapo, Oja Oba, Kobomoje, Oranyan, Ita Bale, Eleta, Kudeti, and Oke Oluokun. Five buildings were sampled each from Bere, Oke Mapo, Oja Oba, Kobomoje and Oranyan based on large number of collapse buildings and three buildings were considered in each of Ita Bale, Eleta, Kudeti, and Oke Oluokun.

Primary data regarding the mud buildings were collected with a questionnaire. The questionnaire was divided into three sections: respondent information, the building environment and questions on the failure of buildings. 30 questionnaires were administered to the inhabitants of the selected buildings. Oral interviews were also conducted, as an alternative means, in most of the selected areas where the respondents are illiterate. Another questionnaire was drawn to extract information from the local government officials. The N type Schmidt hammer was used to test for compressive strength of some selected mud buildings in the study areas. Serviceable buildings plastered with cement mortar and the unplastered ones were considered separately. Some abandoned or failed buildings were also considered. To measure the strength, the test surface was first prepared, and then the surface was striked in five places. Readings were then taken within 25 mm of an edge. Readings that differ significantly from others were discarded and repeated in more than five places to get accurate readings. The final compressive strength was obtained by finding the average of individual readings.

3.0. Results and Discussion

The questionnaires revealed that minimum of two buildings collapsed per year during the research period (1999-2006), with the highest number of cases recorded in the year 2003 (Table 1). Investigations revealed that most of these buildings had suffered structural defects in the past before they reached their present conditions. Two third (40%) of the buildings have been altered with cement mortar and 60% with mud mortar.

It was deduced that the design capacity of most of the buildings had been exceeded, 66.7% of the bungalow buildings which suppose to have less than 10 occupants was found to have more than 20 people while 33.3% have occupants ranging between 10-20 residents.

Some of the buildings at Bere, Oranmiyan, Ita-Baale are very close to main road. The condition of the roads determines the ease at which the residents dispose their domestic waste. The entire area is characterized with bad road network, which poses serious problem to solid waste management. The private waste collector cannot easily assess these areas thus making waste collection practically impossible. The people have to employ alternative means to get rid of their domestic waste. About 13.3% dispose their waste at nearby unapproved dumpsites, 20% beside the road and 66.7% into watercourse. This ultimately result into flood and affects the structural capability of the clay material.

Table - 1: Building Collapse in the Study Area (1999 – 2006)

Year of collapse	No. of Buildings	Percentage Collapsed (%)
1999	2	6.7
2000	3	10
2001	5	16.7
2002	4	13.3
2003	6	20
2004	5	16.7
2005	3	10
2006	2	6.7

Source: Questionnaires

Majority of the residents are farmers (40%) and traders (30%) while teachers and others are 10% and 16.7% respectively depicting the category of people living in the area. Also, majority of the residents in these types of buildings are old people, 66.7% of the residents range between the ages 60-100 years, 20% range between 40-60 years while 13.3% are between 20-40 years. Therefore, these old and poor people did not want to leave the area since they have been there for long periods of years and have adapted to the environment. They prefer rehabilitation of the buildings to relocation. On the part of the Local Government Officials, however, relocating the inhabitants and upgrading the area to house modern buildings with proper planning are the best solutions.

The damages or disasters which often resulted from mud buildings collapse are the lost of lives and properties. The study revealed 60% of the respondents claimed to have lost some lives and properties while 40% of the respondents have neither lost property nor life. The compressive strength test revealed that most of these buildings have varying compressive strengths (Table 2), which resulted from varying material contents of different clay soil.

Table 2- Compressive Strength range of selected buildings

Strength (Mpa)	Bungalow (No)	Storey (No)	Total (%)
10-12.5	11	6	56.6
12.5-15	1	1	6.6
15-17.5	2	2	13.4
17.5-20	1	-	3.3
20-22.5	3	3	20

Source: Questionnaire

4. Conclusion

It was observed that adobe bricks are not permanently hardened, on exposure to moisture they shrink and swell. This property of adobe brick call for special maintenance but most of these buildings are poorly maintained.

Other causes of failure of mud buildings have been identified, these include long abandonment, alteration, overloading, and primitive method of construction. Other secondary causes include poor road network and drainage system which assist flooding of the area.

Also noted is that the completely collapsed buildings constituted an environmental nuisance serving as open dump and as hideout to hoodlums from where the populace are terrorised. Despite the bad condition of some of these buildings, many people who could not afford to rent new apartment still manage them without fear of imminent danger. Finally, mud buildings failure like block buildings often resulted in lost of lives and properties.

4.1. Recommendations

Based on the outcome of the research, the following recommendations are made:

- State/Local government should assist the people of the area by constructing good road with proper drainage system to prevent flood.
- The entire area should be re-planned by Town Planning Authority to improve both the image of the area and entire city of Ibadan. This will involve demolition of some buildings with appropriate consideration for the affected people or possibly relocate the people to enhance rehabilitation of the area.
- The collapsed buildings should be cleared off to prevent further degradation of the environmental.
- Government and professionals should also focus their attention on mud buildings to prevent lost of lives and properties.

References

Alade, G.A. (1997) "Compressed Earth Brick Technology for Low Cost Housing-Environmental Advantages of Compressed Earth Brick Technology" University Of Ibadan, Ibadan.

Bala, O. (2006) "Building Collapse" The Tribune, Tuesday, January 24, p.20

Barnes, J. and Mark, R. (1975) "Adobe Bibliography", The Association for Preservation Technology Bulletin, Vol. 7, No. 3, August. pp 1-3

Emmitt, A.O.; Stephen, E.B. and Christopher, G.A. (2005) Barry's Introduction to Construction of Buildings, Vol. 2, 3rd Edition, Lagos, Blackwell.

John A. and Eric, I. (2006) "Collapse Hospital Building" The Tribune Saturday, January 21, p.3

Kawka, S. (1975) Natural Resources, Building Materials, Zaria, Ahmadu Bello University.

NBRRI, (1988)" Ten Years of Building and Road Research" Lagos, NBRRI.

Omange, G.N (1985) "Cheaper and Durable Housing" Paper Presented at the Federal Ministry of Housing and Environment, Seminar on the Use of Clay Bricks, Zaria, Nigeria.