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STUDY OF FACTORS RESPONSIBLE FOR INCESSANT COLLAPSE OF BUILDING IN LAGOS STATE

A.T Adesanya and D.O Olanrewaju
Department of Building Technology,
Lagos State Polytechnic, Lagos, Nigeria.

Abstract
The rate of building failure in Nigeria especially Lagos State is very alarming and has resulted in the loss of lives, properties and even much financial investment is wasted. Every built structure is expected to satisfy the functional objectives that is safety, serviceability and economy. It is against this backdrop that the study sets out to identify the prevalent factors responsible for building collapse and also examines the degree of influence exerted by the factors, in order to formulate necessary steps of minimizing if not totally eradicate incidences of building collapse in the state. The study makes use of both primary and secondary data. The primary data was generated through the use of structured questionnaires administered to the stake holders in the construction industry within the state. Inferential statistics such as agreement index and chi square test of associations were used for the analysis. The result revealed five critical factors that need serious and urgent attention in developing strategies for overcoming collapse or failure of built structures in the state. The factors are non enforcement of building codes, conversion and disregard for approved drawings, use of substandard materials, poor workmanship and quackery. This study is an eye opener for the policy makers to ensure that building code is passed into law in Lagos state.

Keywords: building, building collapse, stakeholders, remedial measures

INTRODUCTION

Buildings are structures which serve as shelter for man, his properties and activities. They are expected to be properly planned, designed and erected to obtain desired satisfaction from the environment. However, in recent times, especially in the last seven years, one hundred and thirty five (135) cases of structural collapse of building has been recorded in Lagos State alone (NAN, 2013). Collapse in building could be total or partial failure of one or more of its components leading to inability of the building to perform its principal functions of safety and stability. Ikpo (1998) defined building failure as a defect or imperfection, deficiency or fault in a building elements or components. It may also be as a result of omission of performance. The degree of building failure can therefore be related to the extent or degree of deviation of a building from the "as-built" state which in most cases represent the acceptable standard within the neighbourhood, locality, state or country. Every structural system is designed to meet some needs and be safe to avoid lost of live, property and damage to the environment. In a normal setup, building collapse are not expected within the projected lifespan of structures, but due to the imperfection in the actions of human beings and the existence of so many other external factors that influence the safety of structures, failures do occur (Ede 2010).

The menace of building collapse in Lagos state is growing at an alarming rate, seemingly uncontrollable or beyond easy control and this has been a source of serious concern to all state holders - the professionals in building industry, government, private developers, clients and users, as well as neighbourhood residents. Building collapse is very dangerous and should be avoided using all necessary precautions and machineries possible. Ultimately, the effect of collapse of building structures, particularly at its completion stage and when it is occupied by users is devastating on human lives. It is also important to safeguard the lives of people which may be jeopardized in an occurrence of a building collapse during construction. Several productive lives and properties have been lost in the various incidences of building collapse in Lagos and these losses which would truly be felt by future generations, have negatively impacted the social-economic status of its citizens (Olajumoke et al, 2009). Improving the qualities of live in a city is fundamental to cities sustainability and a sustainable city is one that maintains lasting security from environmental hazards that may threaten developmental achievements. The present situation is disturbing and an holistic approach is urgently needed to arrest development.

This paper therefore aims at assessing the factors responsible for building collapse in Lagos from the stakeholders' point of view with particular emphasis on factors that could ameliorate the menace of building collapse. The study is of significance to the policy makers and the other stake holders in taking proactive measures at curbing the ugly trend of building collapse in the state.

The objectives are:

i. To identify factors responsible for building collapse
ii. To examine the degree of influence exerted by the various factors on this menace of incessant building collapse in Lagos State.
iii. To make recommendations on way forward.

SIGNIFICANCE OF THE STUDY

Research into factors responsible for incessant collapse of buildings in order to find solution to the menace can reduce unnecessary waste of energy and natural

resources. It can also reduce both the need for land area for extracting resources and land fill. This brings about sustainability in our development and promotes human capacity building. Sustainable development has emerged as a paradigm for balancing environmental, social and economic goals (Tah, 2006), which includes the provision of safe and affordable homes(Howard,2000). Most of the building failures often result in loss of productive lives and time which does not augur well for sustainable development goals. According to Shepherd and Woskie (2013), Workers who cut, grind or polish concrete are at risk of inhaling air-borne silica, which can lead to silicosis. Concrete dust released during the process of building demolition and disasters like collapse can be a major source of dangerous air pollution.

STUDY AREA

The coastal city of Lagos, currently the 5th Largest City in the world is situated within Nigeria along latitude 6^0 23"N and 6^0 41"N and longitude 2^0 42"E and 3^0 42"E. It is the smallest of the administrative states in the country in terms of land area occupying only 3,577 sq km of mostly coastal plains. It is expected that the population of Lagos will be 24.4million by 2015. The pressures of increasing urbanization and climate change combined with projections of significant increases in coastal population on the state necessitate an holistic approach to curbing the problem of building failure or collapse.

LITERATURE REVIEW

Incidence of Recent Building Collapse in Lagos State and Its Implications on Sustainable Development

Buildings and the provision of safe and affordable homes are major contributors to sustainable development through the centuries and this has been an important aspect of social economic development of humans. Buildings that meet desired performance requirements add value to the national asset stock and enhance its Gross Domestic Product (GDP). Such buildings are sustainable because they meet the need of the present while contributing to future needs. However, the contribution of buildings to Nigeria's development especially in Lagos State has not yielded the desired potentials because of constant failed projects

Below are examples of three of the major incidences of collapse buildings that occurred in Lagos State recently

*Picture of a two storey building that collapsed at the end of Church Street Jakande Estate Extension, Oke-Afa, Isolo, Lagos State, on Wednesday 6th November, 2013.

Picture of The Don de Dieu Plaza, a 6-storey building, which was located at 11, Aderibigbe Street, in Maryland, Lagos which collapsed on Wednesday, 26th October, 2011

The building was occupied by over 10 companies as at the time it collapsed. Over 350 people escaped death as they had been evacuated before the building collapsed

Picture of a 3 storey building belonging to Foursquare Gospel Church that collapsed in Ojodu-Berger Area of Lagos on May 8th, 2013. Several construction workers were trapped in the building

From the foregoing, it can be inferred that current building construction practices in Lagos do not conform to basic principles of sustainable development advocated by Sev(2009), Vanagers(2003) and Redcliff(2005). Sustainable building principles advocate the use of durable and sustainable materials. There are also evidences to suggest that planning and management of construction activities has been unsustainable, hence the high incidences of building collapse in Lagos.

Factors Responsible for Building Collapse

Quite a number of factors are responsible for this incessant collapse of buildinsg in Lagos, ranging from non enforcement of building codes, use of substandard materials, greedy clients, poor workmanship, cost of building materials and many other factors. Akinpelu (2002) categorized the following as major causes of structural failures: environmental changes, natural and

man-made hazards, improper presentation and interpretation in the design.

According to the tribunal of enquiry on building collapse constituted by the state government on May 20th, 2013 (NAN 2013), the problem of building collapse endured because most building projects were handled by quacks. Poor enforcement of the state building control law, gross indiscipline and corruption by all stake holders have added to the problem as they have rendered the relevant laws in-effective and passive stance of law enforcement agencies and the ministry of justice in the arrest and prosecution of violators of building control laws, Sunday (2006) classifies the causes as physical factors, ecological status of the site, composition of technical components, social factors, economic factors, engineering factors, human factors, government policies and political factors. Richard (2002) opines that deterioration of reinforced concrete could occur as a result of corrosion of the reinforcement caused by carbonation and chloride ingress, cracking caused by overloading, subsidence of basic design, fault and construction defect are causes of building collapse. The use of local building materials and methods of construction without any design code is another reason for building failures according to Ayininuola and Olalusi (2004). Various researchers have worked on causes of building collapse with a lot of recommendations and yet the situation is getting worse in the study area. This suggests holistic approach of researching into the factors responsible for the failure from stakeholders point of view

RESEARCH METHODS

The study used both primary and secondary data sources. The primary data was generated through the use of structured questionnaires administered to the professionals in the construction industry within Lagos state. The respondents were asked to assess the factors on five point Likert Scale of 1 for strongly disagree, 2 for disagree, 3 for agree little, 4 for agree and 5 for strongly agree based on their day to day involvement in construction activities within the state. The analysis ranked the factors based on the agreement index. The agreement indices were measured using the formula referenced by (Idrus and Newman, 2002).

$$A.I = \sum_{i=1}^{i=n} \frac{w_i f_i}{n}$$

Where A.I is the agreement index, fi is the frequency of response, wi is the weight of each rating (number of points in a scale) and n is the total number of response.

Chi Square statistical technique with the formula

$$X^2 = \frac{(O - E)^2}{E}$$

Where X^2 = chi-square

O = Observed frequency

E = Expected frequency

was used to measure the degree of relationship between the prevalent factors and the building collapse.

Decision Rule

The null hypothesis of independence which says building collapse in Lagos state does not depend on any factor will be rejected at 0.05 level of significance if the computed value of X^2 exceeds the critical value of X^2 for (c – 1) degrees of freedom. Secondary data used include data from the government agencies, parastatals, ministries, libraries and internet among others

DATA ANALYSIS, RESULTS AND DISCUSSION

Table 1: Causes of Building Collapse in Lagos State

Factors	A.I (N=62)	Rank
Non enforcement of building code	4.08	1
Profit maximization	4.02	2
Greedy Clients	3.61	3
Use of substandard materials	3.60	4
Poor workmanship	3.21	5
Quackery	3.18	6
Insufficient planning	3.16	7
Dearth of skilled labour	3.16	7
Inadequate supervision	3.09	9
Hasty construction	3.09	9
Conversion and disregard for approved drawings	3.08	11
Non adherence to government policy	3.01	12
Encroachment by allied professionals	3.01	12
Cost of building materials	3.01	12
Professional negligence	2.86	15
Client ignorance	2.09	16
Non availability of quality materials	2.01	17
Building developer syndrome	1.89	18
Incompetent professionals	1.75	19
Force majeure	1.62	20

Source: Field survey (2013)

From Table 1, it is observed that the prevalent cause of building collapse in Lagos state from stake holders point of view is non enforcement of building code followed by profit maximization, greedy client, the use of substandard materials, poor workmanship, quackery, insufficient planning, dearth of skilled labour, inadequate supervision, hasty construction, conversion and disregard for approved drawings, non adherence to government policy, encroachment by allied professionals and high cost of building materials. This data suggests that the majority of building collapses are traceable to human activity (or inactivity).

Table 2: Chi- Square Test of Association

Prevalent factors	X^2 Value
Non enforcement of building code	74.86
Conversion and disregard for approved drawings	62.14
Use of substandard materials	46.05
Poor workmanship	44.51
Quackery	43.93
Profit maximization	43.05
Greedy Client	42.89
Insufficient planning	39.72
Dearth of Skilled Labour	36.11
Inadequate Supervision	25.04
Hasty Construction	25.01
Non adherence to government policy	24.89
Cost of building materials	24.62
Encroachment by allied professionals	24.51

Source: Field Survey (2013)

Expected Frequency =12.4
Degree of freedom =(c-1)(r-1) =76
Significant level =0.05
Table value =43.773

Table value of X^2 for all variables is 43.773 at the $P < 0.05$ level of significance this means that any computed X^2 value above 43.773 shows a significant relationship between the two variables and the higher the difference between the value of computed X^2 and table value of $X^{2,}$ the greater the level of significance of that factor on the occurrence of building collapse.

Table 2 shows Chi Square test of association $X^2 = 74.86$, at $P < 0.05$ for non enforcement of building code, $X^2 = 62.1$ 4, for conversion and disregard for approved drawings, $X^2 = 46.05$ for use of substandard materials, $X^2 = 44.51$ for poor workmanship and $X^2 = 43.93$ for quackery. All these computed value of X^2 exceeded the critical value of X^2 for (C-1) degrees of freedom, therefore the null hypothesis will be rejected for these factors while accept we accept the alternate hypothesis. Further interrogation of the causes of building collapse from other documented sources corroborates these findings. For example, this result is in line with the findings of Tribunal of Enquiry on building collapse that most building collapse as a result of poor enforcement of the building control laws.

National Building Code

Implementation of National Building Codes is one of the major tools that need to be used by the government for managing the risk of collapse building in the interest of public safety. National Building code spells out among others the role of each stakeholder in the construction industry. For convenience, safety and quality of project delivery, the National Building code has conveniently divided the development process into four stages:

- Pre design stage
- Design stage
- Construction and
- Post construction.

Design and Construction Team

In this team are those who apply, adopt, use standards, produces specification that have to do with expected final quality of work, specifies materials type and other proprietary systems. In the built environment, the consultants include: builders, architects, engineers, quantity surveyors, estate surveyors, land surveyors and town planners. Each has varying roles to play in the development process. Non involvement of professional builders in the production of building in Nigeria is one of the major factors that contribute to building failures. This is consistent with the submission of Ogunwusi (1999) which opined that in all the buildings that have collapsed so far in Nigeria, no professional builders were involved in the planning and management of the construction works. Currently also, no professional builders were confirmed to be involved in the production and management of any of the buildings that collapsed recently.

The construction team must include a professional for the building production management of the work. The builder takes the centre stage to integrate the parts from design, standards, components to form the whole and manage all resources to achieve the goal with professional focus on quality, standards, timelines, economy and safety during construction and in perpetuity. At the design stage, he has input in the design process by conducting buildability, maintainability analysis on building designs. These analyses are not meant to deride or ridicule other's designs but rather to enhance them, to promote construction friendliness thereby reducing many negatives for the client and others. The design can be adjudged structurally safe in design, but the construction friendliness – buildability analysis, construction methodology has to be analyzed by experts and not just be left to chance.

Standard Organization of Nigeria (SON) which was established to regulate standards for materials, workmanships for goods and products has to wake up because their own quality monitoring is for input. They are therefore indirectly critical for the output. In the event of any building failure, the forensic examination should go as far as testing material inputs.

CONCLUSION AND RECOMMENDATIONS

Some conclusions and recommendations flow from this discourse. The research work has been able to point out the prevalent indicators contributing to the incessant Building Collapse in Lagos State. In view of these findings and conclusions reached in the study, the following recommendations are hereby offered:

- Adequate measures needed to be taken to upgrade the safety awareness of all the operators in the sector.
- The presence of certified professionals at every stage should become mandatory in every building site.
- Government to intensify efforts towards fishing out professionals operating in projects they is not skilled to handle.
- The law enforcement agencies like Standard Organization of Nigeria (SON) should take their responsibility of regulating standards for materials, workmanship for goods and products serious. They should evolve acceptable standards for all building materials.

If these measures are in place, the incidence of frequent building collapse will be reduced.

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