

AVERTING THE INCREASING INCIDENTS OF COLLAPSED BUILDINGS: - CASE FOR ARCHITECTS AND ALLIED PROFESSIONALS IN THE BUILDING INDUSTRY

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ABSTRACT

Incidents of collapse of buildings have been on the increase and unprecedented in recent times. It could no longer be seen as accidents as the sporadic reoccurrence cut across the geopolitical zones of the country. The causes are multifarious and in some cases complex but the signals normally persist for quite sometimes before resulting in collapse of the affected building. Sufficient literature exists as to the factors that led to the collapse of building yet little success have been recorded in preventing reoccurrence of this sad situation. This paper reviews these factors in order to identify silent factors causing collapse of building structure. The need to have building maintenance manual as part of documents for assessing level of routine maintenance of the building and its installations as well as the role of stakeholders in averting the menace form the conclusion of the paper.

Keywords: Accident; Collapse; Signal; Maintenance; Stakeholders

INTRODUCTION

Over the years there have been increasing cases of collapse of building structures and this cut across the high rise as well as simple bungalow residential buildings. When this occurs many lives are lost and many properties worth of billions of Naira destroyed. The safety of lives and properties in the event of such disaster especially in high rise/public buildings hardly reflect presence of any safety measure inbuilt in the design and construction of such building. The collapses recorded in recent times hardly reflect any safety measures inbuilt in the designs and construction of the affected building. Thorough investigation is therefore inevitable to identify the silent factors whose overlook could result in eventual collapse of building structure and to synthesise stakeholders on the role required of individuals in preventing the disaster. In the past the incidence of collapse of buildings was common with occurrence of natural disasters such as earthquake, flooding, etc however many buildings collapse as a result of structural failure due to overloading, severe fire outbreak, use of substandard building materials, poor workmanship and supervision, non compliance with specifications, and in recent times through terrorist. Nigeria witnessed increase cases of collapse of buildings between 2004 -06 more than ever. The nation recorded more than hundred cases that spread across the geographical zones. These figures exclude those washed away by flood and those razed down by fire as a result of pipeline vandals. In the light of this the paper examines the technicalities that its undermine could result in similar disaster in the future and the challenge posed to architects, allied professionals and the users with view to allow all stakeholders to actively play complimentary roles in preventing collapse of buildings and save valued lives and properties.

Collapse of Building Structures

Building is a permanent fixed structure forming an enclosure and providing protection, comfort and delight to the users. Ransom (1987) defines it as structure utilized primarily for working and storage. Collapse of Building is the falling apart of a fixed structure when the loads can no longer be supported by the various components of the building. Factors leading to collapse of building are numerous and interconnected and the failure symptoms usually persist for sometimes before the final disintegration of the structure. These causes can be discussed under the following major headings;

i). Inadequate Design Data

Site problems differ from one geographical location to other. Prior to design of a building there are preliminary investigations to be conducted. Its extent depends on the nature of the site and the complexity of the building. The technicality may be complex and even involve interdisciplinary experts like geologists, meteorologists, soil engineers, etc. Design team a times make wider consultations with statutory agents like aviation, telecommunication, water, etc to meet their safety requirements. Information regarding the historical development of the site to identify the underlying existing infrastructure such as petroleum or

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sewer lines, earthquake, and volcanic eruption zone can no longer be ignored in design decisions. Feasibility/Viability requirements such as access road, water presence of electricity and communication must go together with the technical details of the site in order to avoid false assumptions that could lead to collapse of building due to poor investigation. The bomb explosion at Ikeja military barracks in 2004 is a typical example where people did not know that explosives are stored several meters under the foundations of their structures.

ii). Ignoring Climate Change Data

The current global weather pattern is said to be causing anxiety even among scientists. The depletion of ozone layers, pollutions, destruction of ecosystem, high impermeability of the ground soils are many areas that are of great concerns in this direction. The climate change and its effects on building fabrics affect the life span of the fabrics. Years 2006 was described as 'El - Nino' year by the United Nations.

"El - Nino is a warming of the water in the tropical Pacific Ocean that is associated with changes in air pressure and the movement of high - level winds that can affect weather world wide"

According to the report this occurs every 4 - 7 year and this continuous global warming is a signal towards unusual events. Nigeria experienced similar warming between 1997 - 88. In 1998 it was so hot that meteorologists predicted drought and warned farmers against early planting. Hurricane, tornado, flood, etc are several disasters causing collapse of buildings. Directional drainage must accomplish access roads and houses must be accessible by motor roads for control of flood disasters. Ogunpa (Ibadan) flood disaster in 1980 and in recent times Umuhahia, Port Harcourt, Anambra and etc in 2006 are typical flood disaster that washed away several buildings and even causing depressions as deep as 20 - 30 meters in the ground.

iii). Deficient Structural Drawings

Building may collapse when structural details are based on false assumptions of loads distribution. In some cases storey buildings are approved with structural details that have no correlation to the architectural drawings. Such drawings are merely attached to the architectural drawings for purpose of meeting the planning authority requirements. The interpretation of this is that such building was not designed structurally and its loads distribution is based on assumptions and guessing. Types of reinforcement bars, stirrups, spacing, etc have no technical justifications for their selection and arrangement. The information on these drawings could be misleading and inadequate for the loads being indicated. Many buildings that collapsed in the process of construction are traced to this sharp practice. The physical planning authority bears the onus of the blame for collaborating with some applicants for these unethical professional abuses. Such drawings bear neither names nor address of the authors. Many developers prefer quack to professional simply for the exploitation of the latter. Consequently when there is mishap the blames go to the professionals.

iv). Building without Approval

The primary objective of building regulation is to guarantee safety of lives and property as well as protecting the interest of individuals such that right of an individual to his property does not constitute inconvenience, nuisance, danger and etc to owner of adjoining property. Buildings are constructed without recourse to road setbacks, building along property lines, inadequate ventilation and lightning of the spaces are absence. Even the electrical wiring system employs cables not meant for socket outlets for appliances such as air conditioners, electric stove and etc. This makes the building susceptible to fire outbreak in event of overloading. Absence of political will is not making the authority to enforce the laws to the later. In some cases the authority seldom visit site to ascertain the correct interpretations of the approved plan. Situation where developers become master builder and nothing serious is happening is making nonsense of the industry and it is in the opinion of this paper to have a more collaborative approach to this attitude which is the common attitude among the elites in the urban areas.

v). Overloading of Existing Foundation

Another factor causing collapse of building occurs when a building initially designed and constructed as a bungalow is now converted to storey building without strengthen the existing foundation to sustain the additional loads. Besides some contractors/developers in a bid to cut corners for maximum profit alter approved building plans without corresponding amendment to other drawings (Uji, 2005). The consequence of this is poor redistribution of loads and overloading of the foundation. The end result is collapse of the structure. Overloading takes many forms; change in use, additional floors, alteration of initial structure, etc.

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vi). Alteration without Approval

Due to population upsurge which brings about change in social and economic activities of the people in urban centres many residential buildings are now changed to commercial building - sitting room, bedroom, garage and etc are now converted to shops and warehouses with alterations causing serious devastation to the load bearing elements and the foundation. Worst still many of these activities are carried out without any technical certification from the appropriate authority. Even when they are aware the periodic revenue charged on the users overwhelm their decisions as stipulated by the planning regulation. Many bungalows residential buildings are now storey buildings in most of the commercial cities. The goods and services used the spaces to accommodate are additional loads to the foundation. Since the law did not restrain alteration or conversion then the necessary supports needed to strengthen the additional loads must be provided and certified by the physical planning authority. This should not be compromised.

vii). Absence of Proper Supervision

Supervision is the process by which experience personnel in a trade oversees the activity of works so that technicality that could inhibit performance to the required standards are identified and corrected. Proper supervision ensures good quality control over the works, materials, and the labour in order to achieve value for money expended. Uji, (2005) states that even where a structural design is not deficient absence of proper supervision on the site by qualified personnel can lead to building failure. Sharp practices usually exhibit by some key actors which could lead to substandard output are eliminated. Reinforcement concrete slab, column and beam have given way in many cases due to use of inadequate mix ratio of aggregate, use of substandard reinforcement bars, and absence of stirrup links before casting of the concrete. When these occur uncoordinated bending moment occur in the concrete thereby causing structural sagging, cracks etc of the components until the building finally collapse as a result of severe structural defects. Most of the conflicts among the subcontractors causing delay in execution of quality works could be adequately managed through proper supervision of the project. Uses of substandard materials, poorly apply finishes, and use of inefficient labour are many sharp practices causing building failure that could be eliminated through adequate supervision. The informal sub - sector of the building industry is dominated by clients who are generally medium size property owners and often execute their project in phases according to availability of funds. Many artisans may be engaged during its construction life span. The client becomes his project manager even without professional experience and construction technicality. The consequence of this is not only substandard job but dilapidated and ready to collapse building. Enough public awareness is required to make this sector understand that engaging professionals would even deliver the project faster and at minimum cost.

viii). Use of Acidic and Salty Water

Aggregates are mixed with clean waters devoid of acid, salt or detergent. Acidic and salty types of water are commonly found in coastal areas. This compound solution degrades the concrete and cause corrosion of the reinforcement bars. The building fabrics produced using contaminated water like this is already weakened to support any loads. This could lead to building failure.

ix). Collapse Due To Poor Maintenance of Building

BS 3811 defines maintenance as the combination of all technical and associated administrative actions intended to retain an item in or restore it to a state in which it can perform its required functions. Building Maintenance is said to be work undertaken to restore/keep every part of a building, site, and contents in a state of disrepair to an acceptable standard (Seelay 1987). Collapse of building could be as a result of poor maintenance of the mechanical and electrical installations under the roof of the building. Fire outbreaks from electrical installations are common occurrence in the urban centres. The average dwelling is loaded with appliances such as room air conditioners, electric stoves, kettles, Etc without recourse to the capacity of the wiring installations. Ogunade (1983) observes that overloading of wiring results from wanton connections of additional electric loads beyond the capacity of the wiring system. Many monumental high rise buildings have collapsed as a result of systematic fire outbreak. The high-tech smoke detectors and fire alarm installations within the building could have been faulty long before the incidence. Technology of the equipment may be obsolete and even developed technical faults long before the time of emergency. This explains reason for non performance of these installations in case of fire outbreak. Maintenance/Facility manager of complex buildings may have no understanding of the wiring, installation, and loading layouts of

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the building simply for absence of building maintenance manual. Some conduit electrical circuits have to be surfaced when the installation layout could not be understood by the officer – in – charge when there is need to rectify technical fault. Maintenance manual is a document that contains the list of materials, types of fabrics fittings, and equipment used or installed in the building. It contains the details of their locations, working conditions, fire rating property, and precise conditions to handle the equipment for efficiency and economic use. It is the opinion of this paper that this document be made mandatory for all storey and commercial buildings to assess the level of routine maintenance and installations of the building

Role of Architects and Allied Professionals in averting the Building Collapse

The stakeholders in the building industry embrace the following;

- **Client (Employer):** the employer is the building owner and every other directly or indirectly work for him. David (1992) et al observes that employer appear in many guises. They are clients of the professionals; they are employers under the building contract and are the ultimate owners of the building until such time as they disposed it. They could be individuals, corporate body, or government. The client must be adequately informed and transparently carry along right from the inception to the completion of the project by the architect. The scope of the project determines the nature and extent of other professionals that would be involved in the project delivery and the architect must advise his client appropriately.
- **Architects:** They design and supervise building project. They have the task of translating client's ideas into acceptable functional design and coordinate inputs from allied professionals. Good human relationship must exist between the architect and his client in order to establish confidence and credibility in each other. It is the responsibility of the architect to advise the client on the technical expertise required to deliver the project at minimum delay. Client should be well informed why experts such as geologists, meteorologists, etc and agents like aviation, communication, fire service, etc must be consulted at the inception of the project. The role of architect in averting collapse of building is becoming more challenging with technological advancement and peasants, herdsmen, etc demand for modern structures in which to house their growing families that will commensurate with their new rise in living standards. Similarly architects must penetrate the informal sub – sector who acts as master builder in their own project for quality job.
- **Structural Engineers:** The structural engineers determine the structural stability of the building through technical distribution of the loads and specifications. The load bearing levels of the site must be determined and not by interpolations. Structural drawings must be read with architectural drawings. Where structural drawings do not represent and define the contents of architectural drawings such work must be stopped and appropriate disciplinary action taken against the erring client and his agent.
- **Mechanical & Electrical (Services) Engineers:** The mechanical and electrical services form the nervous system of a building project. Technical fault develop by their installations usually form the basis for failure of the building. The design of wiring and installation systems must be flexible enough to accommodate overloading, sparking and ease of replacement problems that cause fire outbreak in public and commercial buildings.
- **Land Surveyors:** The Land Surveyor defines the property lines, establishes the slope of the site. They could be engaged even in setting out of the building in complex project as well as establishing levels at different points of the site. All these assist architect in identifying and solving most of the site problem at the design stages. Many assumptions which later constitute complicated problems are addressed.
- **Statutory Regulatory Body (Physical Planning Authority):** the law empower it to scrutinize the development plans, ascertain their ingenuity or other wise and approve/disapprove the proposal. The appropriate stamp of a license authors of the plans must be appendage before the authority could even process it. The set of drawings usually demanded vary from authority to authority. Some may insist on sighting the survey plan in addition to other set of drawings while others may even request for services drawings for all development proposals. The planning authority is therefore the gateway to due process if collapse of building is to be averted. Many collapsed buildings in the past had no approval of their local authority while many had structures different from what was approved for the site. The law does not vest the right to demolish, or stop physical development works on anybody beside the planning authority. Then if every member of the stakeholder is playing is role accordingly then the erring factor would be identified and appropriate measures taken but one thing is obvious the planning authorities have not been given the necessary political will to accomplish their responsibilities in most of our urban

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centres and this is facture and need to be corrected if collapse of building through flooding, use of substandard materials, and etc are to be eliminated.

- **Quantity Surveyors:** are construction accountants who advise the client on cost implications of the scope and materials chosen for the project.
- **Contractors (Builders):** A builder is a specialist in building contractor. He handles the project according to specifications. The traditional way of chosen a contractor is true competitive tender having priced a bill of quantities.

RECOMMENDATIONS

It is a well known fact that towns and cities in Nigeria over 140 millions are experiencing rapid urban growth as a result of natural increase and migration. Cases of collapsed building occur in other parts of the world but not through professional negligence, sharp practice and indiscipline. The impact of professional inputs have been overwhelming where regulations have been strictly adhere to but the activity of the informal sub sector is still inimical in most cases due to cultural and social values attached to land in our environment which affects the procurement process of personal projects. The physical planning authority must be adequately equipped with relevant qualified personnel and the necessary political will to enforce the law to the later. The enforcement should be given a collaborative approach among all stakeholders including traditional informal sub sector in averting the menace of collapse of buildings. To achieve this; All drawings must bear the professional seal of the authors and construction must be carried out according to approved plan. Law must take it course on Illegal alteration/conversion. Government should undertake random soil test of various locations in their domain and the data should be available at the local planning authorities. Building maintenance manual should accomplish all completed storey and commercial buildings to ascertain age of the building and its installations. Collapse of buildings traceable to professional misconducts appropriate disciplinary actions should be taken on the erring parties whose action/inaction have contributed to the menace. The local planning responsibility is becoming more challenging in the present day elitists and community participations is required in carrying every member of the stakeholders along through structured line of communication to the grass root In the event of any building collapse the local planning authority should be held responsible for any professional misconduct this is because of their regulatory role in ensuring due processes in the building industry. An area that is presently encouraging the patronage of the quacks is the professional fee charged by the consultants as developers argue why they must be made to pay many statutory bodies before realizing their project. In this regard collaboration of the professional bodies should be to encourage awareness on the various available services for property safety and not for statutory obligations. In view of the observation by Omotosho (1983) that even with the best fire safe building design in the world fires, still do occur, high rise buildings should have provision for water reservoir and trained fire fighting personnel in addition to fire protection arrangements made for the building. Many incidences of building collapse in the past are due to systematic fire outbreaks by carelessness in case of residential or arsonist in case of public buildings, the law should take it course accordingly as the case may be. Government should develop natural channels and water ways to forestall flooding and enough research should be encouraged towards climate change data.

CONCLUSION

In terms of collapsed building, building design and construction practices have improved over the years especially cities with reasonable degree of enforcement of the law. The magnitude of the problem can be devastating when a multi-storey is involved or is as a result of flooding. Due to the capacity of multi-storey buildings to accommodate large numbers of occupants and the impracticability of evacuation, building collapse have resulted in staggering death and injury tolls for both occupants and construction workers. Losses in building collapse are rarely covered by insurance or compensation by the governments who charge tournament rate and other levies on the occupants. It is the opinion of this paper that building collapse could be averted through due processes and if it occurs should be investigated, and erring parties prosecuted and victims compensated accordingly.

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