

The Social Isms, Effect and Trends of Building Collapse in Urban Africa

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Abstract:

Building collapse in any form is a subject of discuss amongst researchers, scholars and stakeholders all around the world. For many years, urban Africa has had her sad moments in the loss of valuables, human lives and deficits on local economy. The stability of any building depends primarily amongst others on the foundation and structure. Therefore research studies the social isms of building collapse as trending in some cities in Africa. What causes a building to collapse? What effect does a foundation and structure portends as evident in the planning, design and construction of a building as to ensure stability and healthy state? Before any building collapse, there are signs within a time frame, it gives as a warning for an impending danger prior to its failure. Paper thus posit factors leading to building collapse and measures to curb menace. Paper agrees to the fact that a healthy building aside from dependent on foundation and structure, also depends on variables like a good design, quality of material, components, construction technology, adherence to building laws, and proper building supervision at early and every stage of construction. Nonetheless the political will of city governance to stem the tide and menace of building collapse, author concur cannot be overemphasized.

Key words: Building, Building Code, Building Collapse, Foundation, Structure, Urban Africa.

1 INTRODUCTION

Africa's remarkable urban development rate in a promising environment has spurred the development of new buildings, apartments, shopping malls and infrastructural facilities to provide for the needs of an expanding population and the influx of businesses, industries and hospitality facilities setup in order to tap into the growing market. But even as demand for buildings and services has risen, the quality of the workmanship has begun to leave a lot to be desired resulting in several reports of buildings collapsing in some cities. A fractional or total collapse of any building is an evidence of a failure in the structure or foundation. Fortunately such incidents are rare but have currently increased in frequency in some cities in Africa. However, no part of Africa is free of an occasional structural disaster. In every case, it reminds us of the latent danger inherent in every building when standards have been ignored or lowered during construction. Building collapses are not uncommon, neither in the Americas, Europe or Asia. According to Adiukwu, Adedeji & Adiukwu (2017) many of Africa's cities are where the vast majority of modern productive activities are concentrated, thus contributing the greatest opportunities in social, economic and cultural resource for her citizens. Therefore a need for concern whenever a building collapse in any city. The increasing number of buildings collapsing while under construction or soon after has reached alarming proportions and something urgently needs to be done. A Building collapse for a variation of reasons, which can be natural or manmade. Natural phenomena such as earthquakes, hurricanes, floods, mudslides, avalanches, and storms are the usual cause for multi-building collapses in many cities in the world. Single-building events are generally more unexpected, such as the collapse of the department store in Seoul, South Korea in June 1995, due to design and construction defects, and the World Trade Centre Towers at

New York City in September, 2001, due to a terrorist attack. For most developing economies like Ethiopia, the often reason, is that of human errors since evidence suggest not many cases of natural disaster. After a building collapsed in Kenya, killing at least 33 people, experts look at some reasons why such incidents occur. The findings strongly indicate human errors. A six-storey residence building in Kenya's capital Nairobi came down during a heavy rain, report indicates more than 80 people missing under the rubbles (BBC, 2016). While investigations are constantly ongoing for causes of building collapse, many buildings in Africa nevertheless suffer many depreciations accounting for many collapse which in many cases are ignored. Every building need care to ensure durability and a healthy life span. A healthy building can be easily noticed physically by observing its physical features and performance. Many factors leads to building collapse as evidence based observations suggests. For purpose of emphasis, the words building *collapse* and building *failure* are used interchangeably. The next subsection discusses building, building code and building collapse.

1.1 BUILDING

A Building is a physical structure, designed and built for human shelter and other social, religious and economic activities. A building when appropriately planned, designed and built, gives desired satisfaction to the owner or user. Some of the factors to be considered in measuring the standard of a building include durability, adequate stability to prevent its failure or discomfort to the users, resistance to weather, fire outbreak and other forms of accidents (Ikpo, 2006). According to Adiukwu (2015) a building in the context of 'housing' for human needs is an important means of man's survival, and contributes in no small measure to the attainment of physical, health and psychosocial need of a nation which also stimulates the social stability, work efficiency, and the development of individuals in

the community. The methods of building in construction are constantly changing with the advent of new building materials and construction methods. Consequently, the work involved in the design and construction stages of buildings are largely dependent on the choice of materials for construction, building components and structures that will meet the expected building standards and aesthetic value as specified. Building is a structural enclave that provides shelter to human livings and valuables e.g., a school, church, shop, or factory are all building. Quite a number of buildings in Africa's cities – Addis Ababa, Nairobi, Accra, Cairo, Monrovia, Kampala and Lagos have collapsed; thereby causing a significant loss in local economy running into millions of dollars and some instance the untimely deaths of citizens as a results of building collapse.

1.2 BUILDING CODE

Encyclopedia Britannica (2015) defines Building Code as a systematic statement of a body of rules that govern and constrain the design, construction, alteration, and repair of buildings. Such codes are based on requirements for the safety, health, and quality of life of building users and neighbors, and vary from city to city. Model codes developed by states, professional societies, and trade associations—including the BOCA (Building Officials and Code Administrators) code, National Building Code, Uniform Building Code, and Standard Building Code—are typically adopted by local communities, with amendments. New York City's code is the oldest (1916) and, because of the city's population density and such concerns as fire prevention, adequate light, and ventilation, the most stringent. Building Code is a set of legal requirement of which the purpose is to promote good practice in the design, construction and maintenance of buildings, in the interest of the health, safety and welfare of people who use buildings. The Code sets out the basic requirements for the design and construction of buildings which represents a code of good

building practice (Obiegbu, 2006). Despite the availability of building codes and professionals in the Nigerian construction industry, the reported cases of building collapse had become very alarming and worrisome (Dimuna, 2010).

1.3 BUILDING COLLAPSE

Building collapse can be defined as the failure of part or all part of a building resulting from the compromising of structure or foundation or both, while building collapse gives evidence of a weak structural member or members in structure or foundation or both; being unsafe before the actual collapse. Buildings do not just collapse there are leading factors that cause its collapse. Building failure in a construction is an indispensable factor that must be considered with great care and skills in other to avoid future collapse. The incidence of building failures and collapses has become major issues of concern in the development of the Nigeria nation as the frequencies of their occurrence and the magnitude of the losses in terms of lives and properties are now becoming very alarming, to the extent that it has become familiar occurrence (Fagbenle and Oluwunmi 2010).

2 LITERATURE REVIEW AND THEORETICAL CONTEXT

2.1 URBAN AFRICA AND BUILDING COLLAPSE TRENDS

The urban Africa's cityscape has in recent time witnessed a high volume of building construction work occasioned by the effect of increasing urbanization and dynamic migration of people from rural habitation to the cities for greener pasture. Thus, putting pressure on many city developers, builders and land speculators to construct more buildings to accommodate the ever increasing human demography. Many of the urban residents in Africa, face disparate exposure to increasing risks

and dangers prevalent in their living conditions occasioned by poor and defective buildings and unhealthy habitation. A city is experienced by its inhabitants in its urban built environment-buildings, roads, infrastructure and other structures, public spaces (Adiukwu, Adedeji & Adiukwu, 2017). Therefore a healthy and safe building in city is a strong indication of vibrancy and thus a need for every city to have a satisfactory human habitation. In June, 2017, at least 15 people were missing after a seven-story residential building gave way in Nairobi, Kenya, highlighting once again the problem of shoddy construction in one of Africa's fastest-growing cities (BBC, 2017). According to media reports, the building began to show signs of imminent collapse a day before collapse, and most of its inhabitants had left after warnings from officials, according to an official briefing by the Kenyan Red Cross. But several residents refused to leave, and thus were unaccounted for after the building gave way later that night. Residents of the building said they had noticed cracks a week earlier, and that the owners had covered them over with cement. But a day to collapse, serious cracking emerged again, prompting the evacuation order. In 2013 alone, news reports of buildings collapsing claimed lives of more than 60 people across Africa. January 2013 saw 5 people lose their lives and scores of others injured in Kisumu, Kenya's third largest town. At the end of March, same year a building under construction collapsed in Tanzania's largest city, Dar es Salaam, claiming more than 35 lives. In May, 4 people lost their lives when a building under construction in Nyagatare, some 100 km northeast of the Rwandan capital Kigali collapsed. In July, 8, 2013, people died after a two-storey commercial building collapsed in Uganda's capital Kampala. In November, same year at least 6 people died when a four-storey building they were building collapsed in Nigeria's most populous city Lagos. Another incident reported took place in November 2013 in South Africa, a nation with a reasonably safe record of building collapse. A roof of a three-

storey shopping mall under construction collapsed killing 2 people and injuring several others in Tongaat near the eastern coastal city of Durban. These tragic incidences tell of an industry in dire need of reform. Author evidence based observations and reviews of further studies by other researchers observed that many root cause of building collapse in some African city, results from failures in substructure and superstructure. Though at some instance, the bearing capacity failure, which is due to high moisture content in the soil and differential and excessive settlement of building is amongst other factor leading to building collapse or failure. However, investigation of structural failure in a building is an extensive research work, needing a lot of laboratory test, dedicated observation and scientific analysis, is required but for the purpose of research, effort have been made to reduce the investigation on those aspect considered very relevant to subject matter. Physical observed evidence suggests that a building intending to collapse more often leaves many warning signs to the user, to take precautions and effect repairs. However it is a very common practice in many cities in Africa to find many users ignorant or acting ignorant of danger indicator(s) or unwilling to do much due to financial implication of cost of repair (a strong index of poverty) in some obvious dilapidation in building components and structure. Windapo and Rotimi, (2012) posits in their study, that in 20.3% of the incidents, of building collapsed (Nigeria) there was no loss of life, between one and five lives were lost in 44.4% of the incidents, and the worst case scenario was the loss of over 21 lives in 9.3% of incidents. The number of life lost in building collapse incidents in Africa's cities give an indication of the severity of the problem, and where live was not lost, physical injuries are very severe. However any case of building failure would ultimately result in loss of productive time which does not portend well for sustainable development goals (Windapo and Rotimi; 2012).The incident of structural failures and

building collapse in the past decades has resulted in the loss of many lives and properties worth several millions of dollars leaving many citizens grossly devastated.

2.2 MAJOR CAUSES OF BUILDING COLLAPSE IN AFRICAN CITIES

In Nigeria, as with many other African cities the common causes of building collapse have been traced to bad design, faulty construction, the use of low quality materials, hasty construction work, foundation failure, lack of proper supervision, ineffective enforcement of building codes by the relevant Town Planning Authorities, lack of proper maintenance etc. (Folagbade, 2001 and Badejo, 2009; Ogunsemi, 2002). Hall (1984) attributed faulty design, faulty execution of work and use of faulty materials as major causes of structural failures. While Federick and James (1989) suggested that the overturning of structures due to heavy wind loads, sliding of structures due to high wind, roof uplift or sliding, and building sway due to lateral loads are major types of building failures. On the other hand, Akinpelu (2002) categorized the following as major causes of structural failure: environmental changes; natural and man-made hazards; improper presentation and interpretation in the design. Richard (2002) opined 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 or basic. (Olusola et al, 2011) examined technological and non-technological factors that were responsible for the occurrence of collapse buildings in the South-Western Nigeria. They identified technological factors to include building design, design error, site production, and use of poor materials, faulty design of foundation among others. While non – technological factors were lack of site –trade training and corruption etc. Ayininuola and Olalusi, (2004) observed that the reasons for structural failures were due to

limited knowledge of building structural behavior and unanticipated environmental phenomena. Fagbenle and Oluwunmi, (2010) blamed the high rate of building collapse on the very low level of compliance with approval of building plans before construction commencement, ineffective monitoring mechanism put in place by the relevant government agencies and the low level of awareness of the existing Building/Planning Regulations by clients/contractors. Several productive lives and properties have been lost in the various incidents of building collapses in Nigeria, and these losses, which would only truly be felt by future generations, have negatively impacted the socio-economic status of its citizenry (Olajumoke et al, 2009). According to Author's field survey and interviews of some experts and stakeholders in the building construction industry as to seek their opinion on the state of building collapse, the next subsections relates findings as were highlighted as the reasons for collapse.

2.2.1 Building by-laws

A negligence in enforcing building by-laws has been identified as a major contributor to building collapsing phenomena and even when those responsible for flouting the laws are prosecuted it is apparent that they do not face hard sentences that would act as a deterrent. In Nigeria, experts urge the government to live up to its responsibility by penalizing any person or group that acts contrary to the law in the construction industry. In 2016 a church building collapsed in Uyo, a capital city in southern Nigeria, in which the official death toll was about 50 people (BBC, 2016). The recent resonate of building collapse in Africa's cities is perturbing. In 2014, there was the collapse of the guest house of a church at Ikotun Lagos, and subsequently, a residential complex, Lekki Gardens in Lagos where about 30 people died. Nairobi, which has a population approaching four million, half of whom live in substandard dwellings, lack adequate infrastructure, and here

contractors routinely flout building codes. Nairobi's authorities posit that as at 2017, the Kenyan capital had at least 30,000 to 40,000 buildings constructed without approval and at risk of failure. Tragedies involving building collapses have become regular occurrences in many cities in Africa.

2.2.2 Building designs

Though there are cases where engineers have made mistakes in the design of a structure, many believe that most of the problems arising from building collapse spring from developers who take short-cuts in order to avoid paying the fee for a competent engineer, and officials who turn a blind eye when approving the plans for a building. There are cases where a building is designed and approved for a certain number of floors but the developer later illegally adds additional floors prompting excessive loading for which the structure was not designed. For example in the case of a Tanzanian building collapse, the developers for instance violated a permit to build an apartment building with 10 floors and at the time of collapse, it had 16 completed floors, with 3 more planned for a total of 19 floors. Another factor many believe is bad design by professionals which can be a contributor. A structural design is the responsibility of the structural engineer who designs a building structure to withstand dead load or its own weight and live loads which are the weight of persons and objects within the building as well as the force of natural elements as wind, rain and hail. A structural failure may occur when the design is wrong and a component or the structure as a whole loses its ability to carry these loads. In a well-designed structural system even localized failure should not result in immediate or even progressive collapse of an entire structure. Every design should conform to building codes.

2.2.3 Building materials

Material chosen for any construction activity should be able to perform their required function without any failure, yet material failure is a major causes of building collapses in many cities in Africa. Aside from the architects' specifications, material choice is the responsibility of the structural engineer who should have the knowledge, experience and understanding of materials chosen at the design phase, and whether they are able to perform their required function. Incompatible materials chosen for a structure can lead to material failure and collapse. Though faulty construction and sub-standard materials used during construction, in order to save money, and due to limited knowledge in understanding, a contractor may want to take shortcuts in the construction and use sub-standard and cheaper building materials. The engineer who does not inspect and insist on materials and construction as specified in the construction documents is also at fault. Many scholars and researchers are of the opinion that contractors should know the negative consequences of taking shortcuts and using sub-standard building materials which can be far more costly in case of catastrophic building collapse.

2.2.4 Professional Ability

The building and construction industry professionals play a major role in ensuring that all projects they are involved in are completed successfully and without any room for failure leading to collapses. This calls for sufficient number of professionals to meet the growing demand from developers. However, Africa's cities is facing a dire deficit of construction industry professionals, for example most development control offices in Nigeria, Ethiopia and some others do not have adequate technical capacity to handle checks and approvals of many building design projects which often are hurriedly done without thorough checks in order to avoid delay. Many scholars are of the view that qualified and competent professionals from the

development control office be deployed to the various construction stages of any project and indeed up to commissioning. Many believe that the professional regulatory bodies also have to take part of the blame for building collapses. In the case of Uganda, many view that the construction industry largely lacks professional engineers and this leads to substandard works in the industry. Experts agree that skill shortages is a major challenge facing the industry. The construction industry must continue to maintain the highest standards for sustainability, integrity and quality because of the critical role it plays in providing shelter, facilities and infrastructure.

2.2.5 Public awareness

The public has also been blamed for going for the cheap option. This leads to hiring of unqualified persons who end up delivering shoddy and unfit buildings. Many experts are of the view that clients and the public should be educated that money spent on using the services of experienced professionals is to their benefit and they can avoid unnecessary and costly expenditure that can occur in the event of building failure. Many are of the view that the important role of the professionals engaged in construction work is still poorly understood by the public resulting in a selection processes dominated by price rather than quality. The public often times do not demand for professional services quite often as they should which renders professionals out of work. Here government has a role to play in promoting the use of professionals according to the public needs and also education in use of professional services by citizenry so as to boost the construction industry.

2.2.6 Site supervision

Some scholars faults the professionals of laxity. Viewing that most architects and engineers these days merely design the

project and once the controlling authority has approved the plans, they are not keen on monitoring the projects especially when clients are unwilling to pay adequately for service. Many experts agrees that apart from officials who turn a blind eye when approving the plans for a building, lack of proper supervision during construction compounds the problem. Thus, recommends that qualified engineers should be paid during construction by the employer to perform site functions and to ensure contractors follow construction specifications. Shoddy construction is a big problem in many cities in Africa.

3 MEASURES TO PREVENT BUILDING COLLAPSE IN AFRICA'S CITIES

There are many factors contributing to a building failure as posited from research. According to Adiukwu, Ala & Olarenwaju (2016) social structures of the environment shape rules and resources to organize, guide, and order human actions. Therefore an effective way of ensuring safety and health of a building is from the initial stage of design, construction and post occupancy to prevent building collapse. Author views the measures in the next subsections as a strong indices for considerations.

3.1 FOUNDATION

Good foundations can be costly. Often times, resulting to half the price of a total building construction cost. Thus, two factors should be considered when building the foundations - the solidity of the soil and the weight of the building and its contents. Building sites in coastal hubs of Africa's cities as in the case of Lagos Island, Accra, Mombasa, Monrovia, and many others; in swampy grounds requires strong foundations. Far stronger than solid ground. But here, the observed practice in some instance is developers 'save money' that should be spent on foundations when building on these swampy ground. Thus exposing many of these buildings to collapse as a result of

corruption. Even on solid ground, foundations need to be strong enough for the load bearing. Inadequate foundations for a four-storey building was one of three reasons given by investigators for a building collapse in northern Rwanda in 2013, which killed six people.

3.2 BUILDING MATERIAL

A good building material is a strong factor to considerer for any formidable building, at the very early stage of construction. Poor Materials that are not strong enough to withhold the expected dead and live loads are often used, in many of Africa's cities according to African Organization for Standardization. Oftentimes, there is a market for counterfeit materials in some cities – for example the use of scrap metal instead of steel during construction. When a six-storey building in Uganda's capital Kampala collapsed, the director of the city authority suggested it had been constructed with counterfeit materials, with authority blaming cases of counterfeiters faking authentication certificates and some instance contractors also knowingly using the incorrect materials to cut costs. So they may use concrete intended to bear the load of a one-storey building in a four-storey building. Author advocate for adequate policing by regulators to curb menace.

3.3 WORKERS MISTAKE OF JUDGEMENT

In some construction site when workers are given material specifications for the correct quantity of materials of material to be used; as in the case to make concrete, they mix material amounts incorrectly, this results to weak concrete cure with inadequate strength to hold the load. Many developers are 'cutting costs' by employing unskilled workers who are cheaper to employ than trained builders and artisans. This one reason why a building in Uganda collapsed in 2004. Research shows that the workers misunderstood the mixing ratios of the concrete. It suggested that they used wheelbarrows instead of

measuring gauges to measure cement. Therefore gross mistakes can be restrained by an 'informed' work force.

3.4 STRUCTURE

The structure of a building comprises of the physical building envelope as observed in the vertical and horizontal structural members, components such as doors, windows, roof etc. expected to carry some form of load either dead or live loads and most instance both loads, withstanding such environmental impact factors such wind, sonic boom, and any other impact that may be occasioned by humans or the environment. A good structure is expected to stand the test of time in withstanding forces that may tend to impact or act negatively on the health and stability of building. The next subsections reveal instances of failures in structure.

3.4.1 The Load Is Heavier Than Expected

A building collapse when the live and dead load is beyond the strength of the building to carry. For example in Lagos, a building with more than 100 people - mostly visitors from South Africa - died when a church guesthouse collapsed in Nigeria in 2014. In Rwanda, over 30 people were rescued alive after a building collapsed in Nyagatare, north-eastern Rwanda in 2013.

3.4.2 Conversion in Use

Sometimes when the foundations and the materials are strong enough for what they were originally built for, that purpose may change in the use of building, resulting in the straining of capacity to carry loads. If a building was designed to be a residency and is then turned into a library where boxes and boxes of books are piled up, the building may strain under the additional weight. Another reason why the load is often heavier than the original design is because extra storeys are added in

some cases. In 2014 an upmarket apartment which had more storeys than planned collapsed in Lagos, killing 34 people.

3.4.3 The Strength of Material Is Not Tested

At all points of construction the strength of the building material is an indispensable factor for safety and stability thus should be tested. The building law states that materials must be tested for strength prior usage. The enforcement of the law is often the problem. Many believe that at every stage of construction there is someone with a strong motivation to save money or take money- corruption. There are many physical reasons why a building can collapse but only one driving motivation for that to happen- money. And for this single factor, forms a major upheaval reason buildings collapse – corruption.

4 BUILDING CONSTRUCTION AND MAINTENANCE PROACTIVE MEASURES

Every city authority and developer, construction professional and clients should be interested in measures to minimize the possibility of building collapse. Thus, it should be pleasant to know that there are protective actions which can be observed in order to avert building collapse as posit in the next subsections.

4.1 SOIL BEARING CAPACITY FOR FOUNDATION

The physical stability of any building lies on its vertical connection to the soil (land), it's resistant to wind, strong impacts and sonic explosion. The soils bearing capacity for any given construction site, for any reason, requires an understanding of the type of soil expected to carry the proposed building. The costs of many important buildings in many cities have been greatly increased by lack of proper exploration of the soil, material, characteristics, and condition of the foundation beds beneath the site. Ground water is often present below the surface of the ground at distances varying from a few inches, in

some locations, to many hundreds feet in others. Not only is its elevation variable inside a given site, but it rises and falls throughout the year, depending on conditions of rainfall and drought. It must be remembered that the presence of water not only complicates the difficulties of excavations and foundation laying but may also alter a good bed into a very poor one. Water attack on building must always be carefully considered in the design and construction of foundations and all the other elements in the building, such that are continually exposed and at risk of water attack.

4.2 CONSTRUCTION SUPERVISION

An initial and very effective action is to be certain that the project architect and his structural engineer counterpart are professionally competent to handle the particular project job in designing and supervision. Furthermore, the design may be adequate but the workmanship faulty, therefore, the construction should be monitored. In such situations, the potential for failure in the examples cited above can be detected and the mishap prevented. Ensure the presence on the job site of a competent structural engineer to certify detailed review of the materials provided and of the installation process by contractors. Production of formworks, assembling the reinforcement bars and concrete, etc. needs to be supervised so as to ensure safety, material specification complaint and workmanship competent. The experience of recent building collapse in some cities in Africa indicates that construction was not professionally monitored, hence faulty workmanship at some instance. In a similar state of a six storey building collapsed in Kano, a considerable segment of the structure came down, killing many people. Forensic investigation points to the foundation as a major cause of collapse.

4.3 TECHNOLOGY

A typical problem in structural design is the failure to compensate for the expansion and contraction of building members caused by temperature changes. Evidences of temperature changes in building materials show more frequently on the exterior surface of a building than on the interior because the outdoor temperature variation is greater and because door openings in interior walls tend to act as expansion joints. Common problems resulting from defects in structures are the gradual development of cracks in floors, walls, or ceilings, falling plaster, peeling paint, sticking doors and windows, bulging floors and the like. Repairs to eliminate such problems on the individual basis are relatively minor, but they add materially to the cost of maintaining a building. Indeed, if caused by a serious structural deficiency, they eventually could require major expenditure to correct. Exterior masonry repair is one of the largest single items in terms of cost to eliminate structural deficiencies and potential hazards. In some buildings, the complete rebuilding of the brick surfacing was found to be necessary because inadequate wall ties were provided during construction.

RECOMMENDATION

The design of structural systems and foundation is highly technical and necessarily must vary with each building and each site. Thus, no developer or member of his staffs, no matter their experience, can be expected to have the overall competency to check either the accuracy of a structural design or the extent of compliance with the design by the contractor. This inability does not mean that positive action cannot be taken to minimize structural deficiencies that may result in hazardous conditions, or high maintenance costs, or both. Thus, author recommends the followings-

- a. As has been mentioned, when an architectural firm is to be selected, an important criterion should be its demonstrated ability to design structurally sound buildings. Having commissioned an architectural firm, the developer/client must see to it that the construction specifications include such items as provisions for adequate testing of the bearing characteristics of the soil site prior to construction and, during construction, adequate testing of such items as soil compaction, steel welding, and cub tests; these requirements are intended to ensure the contractor's compliance with the structural design.
- b. Closely allied to the adequacy of structural design and completeness of specifications is, of course, the quality of the work done by the contractor. As in the selection of the architect, the developer should take positive action to eliminate a low bidder when the likelihood of obtaining a sound structure is in doubt. Such a decision presumably would be based upon the bidder's demonstrated incompetence or his lack of experience in the type of construction proposed. Developers should always try to select the lowest and best bid; with this in mind, they might well consider pre-qualifying bidders by requiring them to meet certain standards.
- c. Typical standard architectural contracts specify general architectural supervision by the firm as needed. On all major projects, however, a "clerk of the works" should be engaged. Such a construction supervisor is selected cooperatively by the architect and the owner on the basis of his overall knowledge of construction and consequent ability to see that plans and specifications are followed.
- d. The contract with the architect should insure personal involvement by structural engineers at specific points during construction. For example, inspection of the reinforcement rods installed in a concrete slab, beam, or

column is a most critical item, and the structural engineer should be required to be present and give his approval before concrete is poured.

- e. The architect and the structural engineer can be expected to base their designs upon such considerations as investigations of soil characteristics, climatic conditions, and applicable codes and ordinances.

CONCLUSION

The research study concludes that the major causes of building collapse are multiples and dependent on many factors which compromises the healthy state of a building. It includes bad design, faulty construction, over loading, non-possession of approved construction drawings, Possession of approved drawings but non-compliance with specifications, the use of quacks, error in design, poor workmanship, and poor communication in supervision. Also, the level of compliance with the approval of building plans before construction commencement was found to be very low. This could be hinged on the ineffective monitoring mechanism put in place by the relevant government agencies across many of Africa's cities and the low level of awareness of the existing Building Control Agency by clients/contractors and the public. Author welcome and applauds positive measure to curb building collapse by the authorities of Africa's cities governance. And, thus recommends strict adherence to code of practice, determination of bearing capacity of soil before design, getting approval before commencing construction on site, Building Control Officials should ensure compliance with approved building plans and specifications, adequate supervision. Professionals should carrying out proper site investigation, strict conformance to working drawings, prohibiting the use of quacks and adherence to building plan specification.

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