Case Report

Monumental effects of building collapse in Nigerian cities: The case of Lagos Island, Nigeria

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Structural collapse occurs all over the world, but the rate of occurrence in Nigeria is beyond bound. Every built structure is expected to satisfy the functional objectives of safety, serviceability and economy. The cost of building collapse in terms of human lives, economic waste, loss of investment, jobs, income, etc., are of unmeasured account. It is against this backdrop that the study examines the monumental effect of building collapse in Nigeria using Lagos Island as case study. The primary data used for the study were generated through questionnaire survey of 235 households with the aid of stratified and random sampling techniques. It was found out from chi-square statistics that building collapse have significant effect on various aspect of human life such as physical and human development, landscape structure, infrastructure, security, among many others. The need for State and Federal Government, and other stakeholders to intensify efforts toward curbing the ugly trend is highlighted.

Keywords: Monumental effect, Building, Collapse.

INTRODUCTION

Building collapse, though a common phenomenon all over the world is more unbridled and devastating in the developing countries particularly in Nigeria. The incidence of building failures and collapses has become major issues of concern in the development of this nation as the frequencies of their occurrence and the magnitude of the losses in terms of lives and properties are now becoming very alarming. In fact, building collapse has now become a familiar occurrence, even to layman on the street in Nigeria.

For the past 50 years, Nigeria has been striving to develop itself as a nation in every field of human endeavor including the built environment. These structures serve as place of residence, work, worship, etc. or as means of transportation and other public infrastructure. They are so essential to man just as air, water and food (Salau, 1996). The exponential population growth and the consequent productive activities needed to sustain mankind forces the demand to be more pressing. The quest to meet up with this demand has led to different approaches of realizing the housing and infrastructural development, some genuine and some fake approaches, which lead to structures of different qualities. When the quality of these structures fall below certain standards, structural failures are inevitable. However, the frequency of collapse of buildings in Nigeria in the past few years had become very alarming and worrisome. Many lives and properties have been lost in the collapse of buildings, mostly in Port Harcourt, Abuja and Lagos. Many property owners have developed high blood pressure and some have even died as a result of the economic loses they suffer either as owners of the collapsed building or victims of the collapse.

In the recent years, a lot of building collapse is being experienced in Nigeria among the existing structures and those under construction. The building collapse rate has become so uncontrolled that one has virtually lost count of the number of these disasters. On the 28th of April 2010, a two-storey market plaza in Oshodi - Lagos, collapsed, killing at least four persons and leaving many others wounded. In the same way another one occurred at Ikole Street, Abuja on 11th of August 2010, killing more than 13 occupants.

Every structural system is designed to meet some
needs and be safe to avoid loss of life, property and damage to the environment. In a normal set up, 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 cost of this building collapse in terms of human lives, economic waste, loss of investments, jobs, income, etc. cannot be over emphasized. Both the environmental impact and the disgrace it brings to the professionals involved in the building industry must not be overlooked also.

Collapse according to the Dictionary of Architecture and Construction refers to mechanical failure. Collapse is a state of complete failure, when the structure has literally given way and most members have caved-in, crumbled or buckled; the building can no longer stand as originally built. It can be seen therefore, that collapse is very extreme state of failure.

Monumental effect of building collapse is a multi-dimensional effect that cut across various aspects of human life. Apart from environmental implication of building collapse, one also notices the effects as affecting socio-economic, cultural and political aspect of people, and this is the main focus of this paper.

Aim and Objectives of Study

This paper aim to assess the colossal effects of building collapse in Lagos Island. Previous studies have been focuses on the causes and effects of building collapse in Nigeria. However, most of them not only hypothetical but also cursory in nature. It is on this note that the present study empirically assesses the monumental effects of building collapse. This study is of significance to policy makers in making proactive measures at curbing the ugly trend of building collapse in Nigeria. The objective of study is to examine effects of building collapse on the following: losses on physical development, human development, soil texture and landscape structure, infrastructure and facilities, security, ethnic relations, peace and unity, community spirit among others.

Literature viewpoint

Incidence of Building Collapse

Building collapse is an unacceptable difference between expected and observed performance. A failure can be considered as occurring in a component when that component can no longer be relied upon to fulfill its principal functions. Limited deflection in a floor, which causes a certain amount of cracking/distortion in partitions, could reasonably be considered as defect but not a failure, whereas excessive deflection resulting in serious damage to partitions, ceilings and floor finishes could be classed as a failure (Roddis, 1993).

Incidences of distressed or collapsed buildings are global phenomenon and are not limited to Nigeria. At the international level, a number of building collapses were reported–Ronan Point apartments collapse in the U. K., when kitchen gas exploded on the 18th floor, sending a 25-storey building to the ground in 1968; the 2000 Commonwealth Avenue Tower collapse in Boston, 1971; The Civic Center of Pavia in 1989; and collapse of Murrah Federal Building in Oklahoma City in 1995, where air blast pressure caused the collapse of few lower floors while the upper floors failed by progressive collapse. In the year 2000, a four-storey commercial building at 14th and 2nd Avenue in Brooklyn, USA, collapsed and vacant building at 124th Street in the north of Manhattan in New York that partially collapsed in 2007. Similarly, a five-storey vacant building in Manhattan that earlier appeared to be falling apart for months finally collapsed on March 4th, 2008.

Other notable collapses include an uncompleted building that showed sign of breaking up in central Nairobi, Kenya collapsed in 2006; an apartment building in downtown Baku, Azerbaijan on August 28, 2007; and a twelve-storey apartment building in northern Egyptian Port City of Alexandria, Egypt on December 19, 2007; while on 29 March, 2008 in Luanda, Angola, a six-storey police building collapsed with detainees and other people trapped and injured. In May 2008, a wall collapsed at a building site in Farooq Nagar, the suburbs of New Delhi, India; and hotel building which consisted of a basement plus three upper floors located opposite Ahmedabad Main Railway Station, Kalupur, India on February 3, 2008 (Heinle and Leonhardt, 1996; Binda et al., 1992; Levy et al, 2002; Bazant et al, 2002; Pearson et al, 2005; Bazant et al, 2006; Adeniji, 1998; Yussuf, 2006; Ismayilov, 2007; Islam, 2008).

Factors Responsible for building collapse

In general terms, earlier studies have identified a number of factors that are responsible for building collapse in Nigeria. Yussuf (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 factor. Those who investigate and report on failures of engineering facilities are in a good position to identify trends leading to structural safety problems and to suggest topics for critical research to mitigate against this trend (Chapman, 2000).

Failure in buildings could be of two types namely: Cosmetic failure that occurs when something has been added to or subtracted from the building, thus affecting the structures’ outlooks. On the other hand, structural
failure affects both the outlook and structural stability of the building (Philip, 2002).

In Nigeria, building collapse have been attributed to the following causes: design faults (50%), faults on construction site (40%) and product failure (10%) (Oyewande, 1992).

Hall (1984) ascribes faulty design, faulty execution of work and use of faulty materials as major causes of building collapse; while Merritt and Ambrose (1989) are of the opinion that 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 were major factors of failures in buildings. Frederick and James (1989) suggest 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 failures of buildings. On the other hand, Akinpelu (2002) categorizes the following as major causes of building collapse. They are; environmental changes, natural and manmade hazards, improper presentation and interpretation in the design. 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 over loading, subsidence or basic design faults, and construction defects are causes of building collapses.

Ayinuola and Olalusi (2004) opined that as a result of high cost of modern building materials, use of local methods of construction were employed without design codes. The composition of the construction methods included structural slabs and all-round lintels of hollow sandcrete blocks of low compressive strength that sometimes resulted in sagging of slabs and crushing of blocks underneath the slabs. In addition, Ahmad (2004) found additional causes different from earlier studies. These are; fungus stain and harmful growth, erosion of mortar joints, defective plastered rendering, cracking and leaning of walls, defective rainwater goods, decayed floor boards, insect or termite attack, dampness and penetration through walls, and unstable foundations.

According to Oyeredem (1999) and Global Corruption Report (2005), corruption has been identified as one factor that has caused high cost of building materials and reduction in standard of construction works in the developing economy. They stated that corruption may be at different stages, namely, at contract award, planning and design stage, construction stage, and when the building is completed. It may take different forms like bribery, deception and collusion, the end products of which are lowering of construction standard, increasing cost of repair and maintenance, defects in building that may not be discovered until its eventual collapse.

RESEARCH METHODOLOGY

The study used both primary and secondary data sources. The primary data were generated through the use of structured questionnaires administered in the study area. The study is interested in making the assessment of the monumental loss/effect brought about as a result of incessant cases of building collapse. The variables used to detect such effect include losses on physical development, human development, soil texture and landscape structure, infrastructure and facilities, security, etc.

The sample frame for the study is Lagos Island local government area. However, the sample size was determined based on the population distribution of the study area. In this case, the 1991 population census recognized eleven enumeration areas. They are (Olowogbowo, Offin, Agarawu, Idumota, Isale-Eko, Isale-Gangan, Oke Popo, Epotedo, Popo-Aguda, Lafiaji, Araromi-Odo). The total population data for the area according to 1991 census is 165,996. The 1991 population provision was projected to 2011 using 3% growth rate and it is given as 363,711. The questionnaire administered among the residents of each area was proportionally and it was worked out taking the 0.075% of the population. As a result, a total of two hundred and thirty-five (235) questionnaires were proportionally administered. The study employs stratified sampling method, and random sampling technique. This was used within the context of already stratified or demarcated areas in Lagos Island. The technique involves the subdivision of the population of “N” (Lagos Island) into subpopulation of N₁, N₂,…N₁₁, units respectively. These subpopulation are referred to as “strata”; they are non – overlapping and they together constitute the whole of the population so that: N₁ + N₂ + … N₁₁ = N

The use of stratified sampling method in combination with other provides the opportunity to obtaining a proportional of the different categories within N population of Lagos Island. Individual residents are selected from each stratum in a random systematic fashion. This involves selecting “n” units out of “N” such that every one of the “n” which is subset of the N (n ≤ N) distinct samples has an equal chance of being drawn. In a nut shell, questionnaires were evenly distributed among the residents in the stratified areas and each possible sample of residents in the population has equal chance of being selected.

Secondary data used include data from the government agencies, parastatals, ministries, libraries, internet among others. Among these are the Lagos State Physical Planning Development Authority (LASPPDA), Local
Planning Authority of Lagos Island. The data were analyzed with the SPSS software using both descriptive and inferential statistics such as chi-square etc.

**Study area**

Lagos state is located on the South Western part of Nigeria on the narrow coastal plain of the Bight of Benin. It lies approximately on longitude 2° 42'E and 3° 22'E respectively and between Latitude 6°22'N and 6°42N. It is bounded in the North and East by Ogun State of Nigeria, in the West by the Republic of Benin, and stretches over 180 kilometers along the Guinea coast of the Bight of Benin on the Atlantic Ocean. Its jurisdiction comprises the city of Lagos and four administrative divisions of Ikeja, Ikorodu, Epe and Badagry. Politically, Lagos State encompasses an area of 358,862 hectares or 3,577sq.km (Figure 1). However, the study covers Lagos Island Local Government Area. The eleven enumeration areas identified by National Population Commission (NPC) in 1991 are: (Olowogbowo, Offin, Agarawu, Idumota, Isale-Eko, Isale-Gangan, Oke Popo, Epotedo, Popo-Aguda, Lafiaji, Araromi-Odo).

**FINDINGS AND DISCUSSION**

It is observed in table 1 that majority of respondents are tenants in the study area. They are also stakeholder in shaping or mar building utility. Besides, it is of high interest to report here that Storey Building is the most common types of building in the study area according to the majority of the respondents. This might be due to lack
Table 1. Dynamics of Buildings in Lagos Island

<table>
<thead>
<tr>
<th>Building Index</th>
<th>Percentage (%)</th>
<th>Building Index</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Ownership</td>
<td>Building Use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owner occupier</td>
<td>13</td>
<td>Fully Residential</td>
<td>10</td>
</tr>
<tr>
<td>Inherited</td>
<td>9</td>
<td>Commercial</td>
<td>34</td>
</tr>
<tr>
<td>Government</td>
<td>24</td>
<td>Mixed uses</td>
<td>55</td>
</tr>
<tr>
<td>Tenant</td>
<td>54</td>
<td>Others</td>
<td>1</td>
</tr>
<tr>
<td>Building Type</td>
<td>Building Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storey building</td>
<td>55</td>
<td>1 – 10 years</td>
<td>1</td>
</tr>
<tr>
<td>Bungalow</td>
<td>5</td>
<td>11 – 120 years</td>
<td>3</td>
</tr>
<tr>
<td>Duplex</td>
<td>3</td>
<td>21 – 30 years</td>
<td>13</td>
</tr>
<tr>
<td>Brazilian</td>
<td>34</td>
<td>31 – 40 years</td>
<td>27</td>
</tr>
<tr>
<td>Traditional</td>
<td>2</td>
<td>41 – 50 years</td>
<td>38</td>
</tr>
<tr>
<td>Shops</td>
<td>1</td>
<td>No Response</td>
<td>18</td>
</tr>
</tbody>
</table>

Source: Author's Field Survey, 2012

Table 2. Chi square of the effects of Building Collapse in Lagos Island

<table>
<thead>
<tr>
<th>S/N</th>
<th>Effects</th>
<th>$X^2$</th>
<th>df</th>
<th>P-value</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Physical Development</td>
<td>237.085</td>
<td>3</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>2</td>
<td>Human Development Index</td>
<td>221.460</td>
<td>3</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>3</td>
<td>Soil Texture</td>
<td>80.081</td>
<td>3</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>4</td>
<td>Infrastructure and Facilities</td>
<td>206.345</td>
<td>2</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>5</td>
<td>Landscape Structure</td>
<td>208.796</td>
<td>3</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>6</td>
<td>Job Opportunity</td>
<td>139.043</td>
<td>3</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>7</td>
<td>Security</td>
<td>193.987</td>
<td>3</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>8</td>
<td>Ethnic Relations</td>
<td>52.502</td>
<td>3</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>9</td>
<td>Peace and Unity</td>
<td>88.694</td>
<td>3</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>10</td>
<td>Community Spirit</td>
<td>116.711</td>
<td>3</td>
<td>0.000</td>
<td>Significant</td>
</tr>
</tbody>
</table>

Source: Author’s Computation, 2012.

of land availability in Lagos Island and as such metamorphosis of bungalows into storey building is seriously embraced. It could be observed in the table that most of the building uses in the study area are mixed uses according to the information given by the majority of respondents in the study area. Further, majority of respondents mentioned 41-50 years as the ages of most building in the study area. This tells us the fact that in the study area hardly can you see vacant land for development now since vast of the land in the study area has been seriously developed at the time Lagos State served as the capital of Nigeria. The implication of this is that as observed in the study area age of the building are also contributory factor to the occurrence of building collapse. This rightly supports Ahmad (2004) view that fungus stain and harmful growth, erosion of mortal joints, defective plastered rendering, cracking and leaning of walls, defective rainwater goods, decayed floor, insect or termite attack, dampness and penetration through walls and unstable foundations do causes building collapse, which is as a result of ageing of building.

Table 2 shows the analysis of monumental effect of building collapse in the study area. To identify the degree of importance placed on each of the variables in the determination of monumental effects that building collapse has on people; chi-square ($X^2$) statistics was computed. Accordingly, the highest $X^2$ was 237.085 while the least was 52.502. Some of the monumental effect variables with high $X^2$ include: effect on physical development, human development index, landscape structure, infrastructure and facilities, and security effect. Variables with low $X^2$ include Job opportunity, community spirit, peace and unity, soil texture and ethnic relations.

It is absolutely clear that building collapse do have significant effect on various aspect of human life. Concerning physical development, the manifestation of this could take the form whereby adjoining land use and nearby infrastructure facilities becomes damage in the process of building collapse. As it becomes very clear here that building collapse have effects on the human development, this might not be unconnected with the high rate of death of professionals (skilled and unskilled) being recorded for every building collapse in the study area. It is also established that infrastructure is also share some of the havoc wrecked by building collapse in the study area. Findings on the security might not be unconnected with the fact that building collapse in the study area have been reported to have bring about killing of people and as well the rubbles of the building also identified to be the hidden place for the men of the underworld and
miscreant in the study area. As it becomes very clear here that building collapse have effects on the ethnic relations, this might not be unconnected with the question of integrity and honesty as to when people of different ethnic relations are involved in building construction and the building eventually collapse, it will bring about betrayal of trust among the ethnic relations involved.

Policy issues and conclusion

It must be stated that every incidence is unique and must so be treated by adopting unique approach and thorough investigation to discover hidden causative factors for each occurrence. That structural defects have accounted for greatest number of collapses requires further investigation to ascertain the remote causes of such defects. High occurrences of collapsed buildings in Lagos Island Local Government Council areas of the metropolis should not be treated as mere coincidence; they were swampy, sand-filled, and reclaimed terrains close to the Lagoon. Detailed study of the geophysical characteristics of the soils in all locations of the study area must be carried out urgently to establish their compositions and appropriate measures taken if the seemingly stunning prediction in this study is to be averted.

The academic and researchers must take interests in building survey to create complete data set of buildings, including their standard, structural stability, and state of repairs which must be updated regularly. The Nigeria Building and road research Institute should be empowered through provision of materials and fund to carry out research, especially in developing locally-made building materials to meet local requirements and specifications thereby preventing use of substandard materials. This will also go a long way at assisting Nigerian and non-Nigerian researchers in having access to such material and reduce incidences of building collapse to the minimum.

The Town Planning Authority should maintain competent professionals in the relevant areas for design approval and from a long term perspective, provide the necessary training. Moreover, there should be regular monitoring visits to all the construction sites with a view to ensuring compliance with the approved building plans.

The high rate of casualties verified for high rising buildings is directly related to the difficulties involved in realizing such edifice which can only be adequately handled by highly skilled professionals. Adequate measures need to be taken to upgrade the safety awareness of all the operators in the sector. The presence of certified safety professionals should become mandatory in every building site. This also calls for the government and the professional bodies to intensify efforts towards fishing out professionals operating in projects they are not skilled to handle. The State governments with the assistance of the Federal Government should intensify efforts towards arresting the trend. This can be done through free intensive basic skill acquisition training for the artisans and more accurate monitoring of the professionals operating in the building industry as to enforce the code of practice.

That law enforcement agencies be mandated to enforce eviction in houses marked for demolition, as that could have save the lives that were lost in the most recent case. Stiffer penalties (such as jail or death sentences) should be placed on owners of collapse buildings and the project handlers in the country, especially where loss of lives is involved. This will serve as a deterrent to the carefree developers in the country.

This research has succeeded in bringing to the fore the dynamics of monumental waste in the Nigerian building industry. This means that effective measures for the reduction of the high casualty rate must include the intensification of control and monitoring of structures of more than a storey building constructions. It opens up the door for more interesting researches that will help to bring under control this embarrassing situation in the country and save the lives of our citizens.

REFERENCES

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