



An Analysis of the Impact of Occupancy Ratio in the Occurrence of Collapsed Residential Buildings in Ikeja Area of Lagos

Ajayi M.T.A and Fabunmi F.O

Department of Estate Management, Federal University of Technology, Minna, Nigeria.

ARTICLE INFO

Article history:

Received: 24 November 2014;

Received in revised form:

19 April 2015;

Accepted: 30 April 2015;

Keywords

Occupancy ratio,
Load bearing capacity,
Building collapse/failure,
Building codes,
Occupancy standard,
Building occupants.

ABSTRACT

The occurrence of building collapsed has become a national embarrassment with its human and societal casualties. The issue of load bearing capacity in terms of the number of occupants observed in the building in comparison with the standard expected occupancy ratio has not been well identified. The study therefore uses purposeful method to select six buildings from the collapsed buildings in different areas of Ikeja Lagos. Questions were administered orally to the immediate residents of the collapsed buildings. With a chi square of 65.34% in the conducted analysis it reveals that there is a strong statistical relationship between the observed load bearing capacity in terms of occupancy rate and the standard expected. This tends to suggest that the occurrence of buildings collapsed in Lagos may be due to an abnormal occupancy ratio or a higher load bearing capacity. The study thus recommends a strict adherence to the use of building codes and zoning to enforce building design and type for residential areas and the adoption of fees payment in lieu of default for those buildings with a higher ratio than normal.

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Introduction

The issue of building collapse is an important societal problem that leaves both lives and the properties in disarray after its occurrence. Daily Times (2011) attested to this that the collapse of building has become a regular occurrence in which between Dec 2006 and July 2011, more lives have been lost to collapse of residential building and properties worth millions of Naira lost. Naturally, the issue of building collapse is not strange in the construction industry all over the world. As noted by Taiwo and Afolami (2010) Building collapse usually originates from structure failure though not design to happen, it is not uncommon in the construction industry and most especially in the developing economy of the world. In fact, Roddis (1993) opined further that Building collapse is as a result of failure of any of the building component.

The failure becomes an issue to be addressed when the component can no longer be relied upon to fulfil its principal functions. 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 structure's outlook. On the other hand, structural failure affects both the outlook and structural stability of the building. Major structural failures of buildings are currently well known in Nigeria because many are described in the print media. Nigeria Institute of Buildings (2011) has revealed that more buildings may have collapsed during construction in Lagos state than in the rest of the country put together over the past 45 years (1955–2000). There are similar cases of collapsed buildings across the country the most prominent being Lagos and Abuja. The focus therefore is on the intention of the developer to effect completion in order for such development to be occupied as soon as possible since there is no known occupational standard to be adhered to after completion. This study therefore focused on the need to reduce the death toll that usually arises from building collapse by identifying occupational standard as a factor to be considered as one of the causes in residential building collapse in an urban area.

Building Failure and Collapse

Building Collapse results from the failure of building components. Structural failure in buildings, in broad terms comes in various forms and degrees of severity; the worst of which is a collapse. Deterioration or decay especially of vigour or usefulness of a building can be categorized as a failure of some sort but a total loss of bearing strength resulting in a sudden breakdown, physical depletion and/or falling apart is termed a collapse. Among these factors are greed, incompetence, corruption, poor planning, poor enforcement of building codes, inadequate public awareness and education, and limited financial and technical resources (Falobi, 2009). The collapsed buildings were found to be constructed with low quality building materials, incompetent craftsmen rather than professionals were found to be engaged while the existing building codes, meant to guide builders were rendered ineffective because of lack of political will to enforce same by the Town Planning Authorities. According to Adebayo (2000), the skill, experience and personal ability of the workmen involved in the building construction is of utmost importance in creating value. The so-called ready-made hollow sandcrete blocks sold by some block-making industries do not measure up to standard as a result of anticipated abnormal profits. Once these lapses are tolerated intentionally or otherwise, the quality of the sub-structure or super-structure cannot be guaranteed. The quality of the workmen is a measure of their effectiveness and efficiency at all times during construction while the level of building maintenance after its occupation depends on the performance of workmen. The conclusion of Adebayo (2000) can only be relied upon where the building developer or the contractor are capable and willing to appreciate quality and ready to pay for same. In addition, he must be willing to deliver high quality building materials to site in required quantities coupled with strict supervision of workmen by the Site Supervisor. Thus according to the Council for Registered Engineers of Nigeria (2010) when a building collapsed it is due to technical defect in the major

components of the building. Thus technical defects leads to building failure and thereafter to the collapse of the Building. However, Oloyede et al (2010) opines that technical defects in a building can be attributed as follows First, building experts blamed building collapses on the use of low quality building materials coupled with employment of incompetent artisans and weak supervision of workmen on site. Second, public opinion revealed that the blames of building collapse were due to non-compliance with specifications/standards, use of substandard building materials and equipments and the employment of incompetent contractors. Third, opinion of the academia on remote causes of building collapse showed that the route causes are mainly the non-enforcement of existing laws and endemic poor work ethics of Nigerians at large. Furthermore, Building Contractor.Com (2010) attest the followings as reason for the technical defects in a building The first problem is boycotting the professionals -This issue has been overflogged both in print media and electronic media but the same problem still persists. There is also a problem of eggheads professionals, that believes they know all and are not ready to take advice from a colleague. There are known cases like that, that has turned awry, the big buildings that are collapsing in Lagos business district were handled by professionals. Secondly Contractors cutting corners - Contractors trying to make gains at the expense and lives of the users of the building is another problem that have to be tackled. There should be a check from policy makers to make sure specification is thoroughly followed by contractors. Thirdly Human activities on building - As insignificant human weight may seem to be, the moving up and down of the live loads and dead load contributes overtime in no small measure in wearing down the building. It will take long time though, but houses also expires, and in the case of the types of buildings we have in Nigeria, there lifespan is shorter than others in civilised world. Fourthly Inadequate foundation - This is the most important part of a building, unfortunately a lot of people are not giving adequate monitoring to this and is causing more problem. Lastly Aging Building – Many do not know that buildings also have their life span most of the building in Lagos Mainland have spent 25 years and above, despite that they are of shallow foundation and very low quality materials are used for them. As you lay your bed, so you'll lie on it. If you had used low quality material thereby thinking you'll cut cost, then also be expecting to park out of that building very soon. Idoro (2010) identified faulty design in which the components and materials specified were inadequate or inappropriate to guarantee the structural stability of buildings as a major cause of collapse. Another cause of collapse, according to him, is faulty construction in the form of wrong application or combination of materials for their production, wrong production methods, rushed construction and the use of fake materials. Building collapse, he said, might also be caused by overloading, wrong use or occupation, poor maintenance and defective components in existing buildings.

Occupancy Standards and Ratio In Buildings

According to Lamco (2010) The term "Occupancy Standards" refers to the number of persons living in the unit as tenant, cotenant or household member as per the most current Tenant Certification. Guests are allowed but must be reported in accordance with the terms of the lease for the unit. Any subsequent person(s) that wish to be added to the Tenant Certification must be determined eligible and not violate the Occupancy Standards for the apartment. The minimum number of persons living in a unit is one (1) person per bedroom. For the purpose of minimum number of persons the following are considered as part of the household but will not be added on the

Tenant Certification unless/until becoming a permanent member of the household: The maximum number of persons living in a unit is two (2) persons per bedroom. For the purpose of maximum number of persons, one child 48 months of age and below per bedroom are not counted. Any time the situation changes to the extent that the tenant household is no longer qualified to live in the apartment under the Occupancy Standards in effect at that time, the household will be required to move to an apartment of correct size in accordance with those Occupancy Standards. Countries usually determines the occupancy ration and standard expected of different type of building within the Building codes. Thus the importance of building codes in specifying the minimum standard for building performance is important. In the opinion of Ellingwood (2002) No building system can be engineered and constructed to be absolutely risk-free because of uncertainties in demands on the system, in engineering properties of construction materials and in predictions of building system performance from the current generation of design software. Building codes are among the tools used by structural engineers for managing risk in the interest of public safety. The provisions for structural design in codes and standards for load combinations and design strength address the risks in building performance as the code and standard-writers have historically understood them. Beitel (2008) further attested that occupancy use and standard is a very important objective in any building code specifications as it is an important point for investigation in any building failure or collapse.

Building Failure/Collapse and Occupancy Ratio In Building

Every Building is design to carry a certain minimum load for a within a period of time. However this can be subjected to a lot of other risk that is associated with building mangement. Thus there is the need to give consideration to such various factors that may constitute risk in the management of the building as an investment resurces. Therefore, Consideration of competing hazards in risk management is an essential tool for maximizing return on investment of resources on technology and regulatory provisions that will enhance and improve building practices. It is not feasible technically or economically to consider in detail in design all hazards that might impact building performance. Moreover, some hazards would have little impact on building risk. A competing hazard model allows the technical community and decision-makers to screen out trivial hazards, to focus on those hazards that lead to unacceptable increases in building failure rates, and to devise appropriate risk mitigation strategies for those hazards (Stewart and Melchers 1997). The occurence of occupancy ratio/standard as a factor in building management was highlighted by Ellingwood(2002) that Building failures can result from a number of hazards – occupancy loads and other demands, misuse, extreme environmental effects, fires, and other abnormal loads. Abnormal loads are, by definition, low-probability events and few buildings are ever exposed to them. In the developed countries. Accordingly, such events are either not normally considered in structural design for economic reasons or addressed indirectly through passive protective measures rather than by explicit structural calculations. Abnormal loads may be grouped as pressure loads (e.g., explosions, tornado wind pressures), impact (e.g., overuse- characterise by high occupancy load, vehicular collision, missile impact, debris, swinging objects during construction or demolition), or as deformation-related (fire, foundation subsidence).

Table 1. The location, the Use and Onwersip Structure of the collpased Buildings in the Study area

Streets	No. of Bldgs	Ownership	Use of Buildings	Neigh. Density
Ali	2	Individual	Residential	High
Obadina	1	Private	Res/Com.	High
Thomas	1	Individual	Residential	High
Omididun	1	Individual	Residential	High
Total	5			

Table 2. Occupancy Rate in the Collapsed Buildings

Number of rooms			Numbers of person per room		
Buildings (Street)	Total Number Rooms	Percentage	Mean Persons / Room	Percentage	Total Observed Occupancy rate /Building
Omididun	15	15.0	5	10.0	75
Thomas	15	15.0	5	20.0	75
Obadina	15	20.0	7	30.00	105
Ali	20	50.0	7	40.0	140
Total	45	100.0		100.0	

Table 3. Perception of Residents on the Occupancy Rate Effects on the Collapsed Building.

S/N	Result	Strongly agree	Agree	Undecided	Disagree	Strongly disagree	Total
1.	Deterioration	5	30	4	6	0	45
2.	Inadequate maintenance	15	10	15	5	0	45
3.	Cracks	2	19	0	0	0	45
4.	Over Use of facilities	20	25	0	0	0	45

Table 4. Perception of Residents on the causes of building collapse

S/N	Causes	Strongly agree	Agree	Undecided	Disagree	Strongly disagree	Total
1.	Flood	5	30	4	6	0	45
2.	Lack of maintenance	15	10	15	5	0	45
3.	Use of poor or sub-standard building materials	21	24	0	0	0	45
4.	Overpopulation	24	21	0	0	0	45

Source :field survey 2011

Table 5. The Observed Occupancy Ratio and the Expected In the Collapsed Building

Buildings	Observed Frequency of Occupancy/Room	Expected frequency Occupancy / Room
Thomas street	75	30
Obadina street	105	35
Ali street	140	40
Total	395	135

Characteristically, the loads usually act over a short period of time in comparison with ordinary design loads. They may be static or dynamic in their structural action, depending on the frequency content of the load and the dynamic response characteristics of the structural system affected (Ellingwood and Leyendecker 1978). It generally is believed that strategies to manage the risk of progressive collapse focus on methods that enable a damaged structural system to maintain its overall integrity following an abnormal load event (Breen and Siess 1979). Nevertheless, it seems desirable to understand the characteristics of some of these load events, for such knowledge is necessary in order to predict the extent of damage that might have to be tolerated by the building structural system.

Research Methodology

The research adopted a purposeful research method to identify the residential properties that have collapse in Lagos. The target population for the study are the immediate residents in the vicinity of the collapsed buildings. The primary data required are the opinions of the residents on the causes of the collapsed building and the number of people occupying a room in the collapsed building. The secondary data supplied by the Establishment concern with the management of disaster and building approval were relied upon as basis for data analysis

through comparative tabular presentaion and chi sqaure analysis to asses the degree of the occupancy ratio in the collapsed buildings.

Results

The result from Table 1 indicate that Five Buildings that have collapse are all own by Individuals using them for rentage as Residnetial property while one is of mixed used. The mixed use comprises of residential occupation and lock up shops . All the Buildings are situated within a High density residential neighbourhood.

The result from Table 2 indicate that while the buildings in Omidun, Thomas and Obadina streets both have a total of 15 rooms each and a total population of 75 people in a building that should normally accomodate 30 based on a approved occupancy ratio of 2 person per room for high density residential area. The figure also indicate that the building in Ali street with 20 rooms is being occupied by 140 based on an average occupancy ration of 7 person in a room.The table thus revealed an excess of 45 people for buildings in Omidun and Thomas street. An Excess of 60 people for the building in Obadina Street while the building in Ali street have an excess occupancy number 100. The Table 2 thus present collapse buildings in a high density residential neighbourhood that is having an occupancy rate of people twice

of thrice more than the required standard occupancy rate of 30 or maximum of 40 expected for such buildings.

The resident of the Buildings within the vicinity of the collapse building are aware that the high number of people do constitute a major factor towards the collapse of the buildings. Table 3 present the perception of the residents within the area on the effect of the high population within the building on the collapse building, The majority of resident stongly agree that the high popluation leads to the over use of the facilities. On the basis of effects on maintenance 15 people of the 45 respomdent strongly agree that the high population constitte a major source of inadequate maintenace. The result as presented above therefore revealed that resident of building within the vicinty do believe that the high occupancy in the collapse building led to inadequate maintenance and over use of the building. The combination of both factors the respondent believe led to the collapse of the buildings in the neighbourhood. The perception is further presented in Table 4. Having identified other factors like flood, lack of maintenence, use of substandard materials and over population that could constitute to the collapsed buildings, 24 resposnts which is the highest perceived that overpopulation is a major fcator in the collapsed rate.

The Chi Square analysis thereafter revealed that occupancy ratio is responsible for about 65.34% variation in the collapsed building in the study area. The revealed figure indicate that all factors like high number of people residing within a property, the usage of the property by the occupant and the load bearing capacity of the occupant have all combined to cause the correlation between the occupanacy ratio and the collapsed building. In essence, having observed that the occupancy ratio is higher than the normal, there is the factor of the high usage of the property by the occupant which has led to high human casualties. It can therefore be stated that a building with a higher occupancy ratio will have a higher human casualties in the case of its collapse.

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