
BUILDING PROFESSIONALS PERCEPTION OF DETERIORATION OF BUILDINGS DUE TO DESIGN AND CONSTRUCTION ERRORS IN MAKURDI METROPOLIS OF BENUE STATE

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ABSTRACT

This study investigated deterioration of buildings due to design and construction errors in Makurdi metropolis of Benue State. Two research questions guided the study. The study adopted a descriptive survey research design. The population for the study was 172 building professionals. A proportionate stratified random sampling technique was used to select 111 building professionals. The instrument used for data collection was a 28-item self structured questionnaire titled Building Deterioration (BD) which was validated by three experts. Cronbach Alpha was used to ascertain the internal consistency of the instrument which yielded an overall reliability coefficient of 0.82. The data was collected through direct contact. The descriptive statistics of mean and standard deviation were used to answer the research questions and One-way Analysis of Variance (ANOVA) was used to test the null hypotheses at 0.05 level of significance. The study found that design errors like absence of damp proof courses specifications in building designs, poor specification of damp proof construction materials, defective design of water systems among others leads to deterioration of buildings. It was also found that construction errors like use of sub-standard plumbing fitting leads to deterioration of buildings, low placement of floor gradient, lean mixture of concrete among others causes deterioration of buildings. It was therefore recommended that architects should always include appropriate moisture control elements in their building designs, building construction professionals should ensure to include appropriate water channels during construction of buildings, construction engineers and builders should always adhere to design specifications when carrying out building projects.

Keywords: *Buildings, Deterioration, Design, Construction*

INTRODUCTION

The phrase “building deterioration” is the gradual adverse loss of physical or chemical properties of building components. The sudden rise in the level of building deterioration has being a menace to building owners, tenants, building professionals and the society at large. Building deterioration reduces the value of buildings and consequently in most cases leads to its collapse and in turn results to waste of resources. Often time, when a building deteriorates to the point of collapsing, severe destruction of lives and properties occur (Adesanya, 2016). Building deterioration is one of the major building problems that significantly need attention. Though building deterioration is not peculiar to Nigeria, the trend in Nigeria is becoming quite worrisome and a source of concern to stakeholders in building construction industry. The frequency of occurrence has equally become a major source of concern not only to the government but to all Nigerians and most especially the professionals in construction industry as the magnitude of the incidents is becoming very unprecedented. According to Kolawale (2012), it is quite unfortunate that building

deterioration incidence is still regularly occurring despite the fact that there has being an increasing diffusion of engineering knowledge over the years.

Building design refers to the making of drawings or plans for the construction and maintenance of buildings to meet their intended purposes. The quality of planning and design of building is one of the primary factors of success in any building project. The design of buildings includes every aspect of the building construction including usage and maintenance. The design of buildings incorporates a set of specifications to guide the contractor in developing the means and methods of construction (Chohan, Che-Ani, Memon, Tahir, Abdullah & Ishak, 2010). According to Onweluzo (2008), poor design details causes concentration of high stresses on structural members. These high stresses may lead to cracking of concrete which in effect, allows water or harmful chemicals to pass through the concrete. Thus, poor design details may lead to defect in the structural members (Ashila, 2013). In a similar way, poor design details leads to structural failure and subsequently causes deterioration

of buildings. These problems can be prevented by a thorough and careful review of plan specifications for the construction work (Ashila, 2013). For instance, poor design of building section may cause stress concentrations that may result in cracking of the building. Typical examples include the specification of relatively thin columns, beams and walls in places where thicker ones are needed. Onweluzo (2008) observed that insufficient reinforcement at corners and openings also tend to cause stress concentrations that may cause cracking of walls. Other factors of building deterioration due to design errors are inadequate provision for deflections, provision for drainages, insufficient travel allowances in expansion joints, incompatibility of materials and neglect of creep effect among others (Atkinson, 2013).

Similarly, construction errors lead to building deterioration. In the words of Olagunju (2012), construction errors refer to those occasions in which a planned sequence of construction activities fails to achieve its intended outcome. According to Sauoma (2011), construction errors directly cause building deterioration.

During construction of buildings, there are many construction procedures to consider which include the method of digging the trenches, laying the foundation, pouring the concrete, making frame works, laying of bricks or blocks, roofing among others. These works should be done according to particular specifications in the drawings created by the architect. These specifications clearly show the protective and efficient methods for the construction of buildings (Olagunju, 2012). If the construction engineers and builders do not carefully follow these specifications correctly, the whole construction goes wrong. This leads to the deterioration of the building. For instance, the specification says the trenches must be 2000mm depth; but workers decide to dig only 1600mm. Such error can lead to deterioration of that building.

STATEMENT OF THE PROBLEM

The primary function of any residential building is to provide comfort for its occupants while keeping its appearance intact throughout the life span of the building. However, a number of factors such as deterioration could render a building facility

unsuitable for habiting. Buildings are often subjected to deterioration due to several factors such as errors emanating from the planning and design, poor construction techniques among others. Building deterioration is one of the major problems that need urgent attention by all relevant stakeholders in the building construction industry. In Makurdi metropolis, there have being several cases of building deterioration which often reduces the value of a buildings and also leads to collapse of such buildings with the attendant consequences of waste of resources and wanton destruction of lives and properties of the inhabitants.

Purpose of the Study

The purpose of this study was to investigate deterioration of buildings due to design and construction errors in Makurdi, Benue State. Specifically, the study sought to determine:

1. Building professionals' perception of buildings deterioration due to design errors;
2. Building professionals' perception of buildings deterioration due to construction errors;

Research Questions

The following research questions guided the study:

1. What is the perception of building professionals on buildings deterioration due to design errors?
2. What is perception of building professionals on building deterioration due to construction errors?

Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance:

Ho₁: There is no significant difference between the mean perceptions of building professionals on building deterioration due to design errors;

Ho₂: There is no significant difference between the mean perceptions of building professionals on building deterioration due to construction errors..

METHODOLOGY

The study adopted a descriptive survey research design. The population of the study is 172 building professionals which comprises of 66 builders, 76 Architects and 30 Estate Surveyors and Valuers (NIOB, NIA & NIEV). The sample size for the study was 111 building

professionals. The proportionate stratified random sampling technique was used to select 43 builders, 49 architects and 19 Estate Surveyors and Valuers. Proportionate stratified random sampling procedure as described by Emaikwu (2011) is the sampling technique where the researcher select the sample size of each stratum in such a manner that it is proportional to the population size of the stratum when viewed against the entire population. The instrument used for data collection was a 10-item self structured questionnaire titled Impact of Building Applicationon Building Deterioration (IBABD) which was validated by three experts. According to Nworgu (2006), questionnaires are the most valid instrument for data collection when the study is primarily concerned with eliciting the opinion or thoughts of the population group on a phenomenon. In order to establish the reliability of the instrument, a pilot study was carried out where 30building professionals (10 Architects, 10 builders & 10 Estate surveyors and valuers) in Lafia, Nassarawa State which were not part of the study area but exhibit similar characteristics were issued questionnaires. The instrument used for data collection was a 28-

item self structured questionnaire titled Building Deterioration (BD) which was validated by three experts. Cronbach Alpha was used to ascertain the internal consistency of the instrument which yielded an overall reliability coefficient of 0.82. The instrument was administered to the respondents via direct contact with the aid of 2 research assistants. For effective administration of the instrument, the researcher contacted the State chairpersons of the population group (Architects, Builders & Estate surveyors and valuers) to find out the days of their professional bodies meeting. Thereafter, the researcher visited each group on the days of their meetings at Ministry of works and housing, Makurdi, Benue State to administer the instrument. The descriptive statistics of mean and standard deviation were used to answer the research questions and One-way Analysis of Variance (ANOVA) was used to test the null hypotheses at 0.05 level of significance. To answer the research questions, items with mean response scores of 2.50 were considered as agreed while items with mean rating scores below 2.5 were considered disagreed. Furthermore, One-way Analysis of Variance (ANOVA) was employed to test the null hypotheses at 0.05 level of

significance. The decision to either reject or retain a null hypothesis was based on the comparison of the probability value (p -value) and level of significance (α – value). When p -value $\leq \alpha$, the null hypothesis

was rejected and other wise, the null hypothesis was retained.

RESULTS

Research Question One: What is the perception of building professionals on building deterioration due to design errors?

Table 1
Mean and Standard Deviation of Architects, Builders and Estate Surveyors and Valuers on Building Deterioration due to Design Errors.

S/N	Building Deterioration due to Design Errors	\bar{X}_i	SD _i	Remarks
1	Absence of damp proof courses specifications in building designs.	2.89	0.47	Agree
2	Poor specification of damp proof construction materials.	3.73	0.53	Agree
3	Defective design of water systems.	3.08	0.47	Agree
4	Placement of gutter near the building.	2.70	0.56	Agree
5	Improper design of slopes on roofs.	3.05	0.44	Agree
6	Inadequate provision for drainages.	2.96	0.57	Agree
7	Wrong location of air conditioners in buildings.	3.02	0.67	Agree
8	Wrong location of buildings on site.	3.14	0.58	Agree
9	Neglect of creep effects.	2.93	0.40	Agree
10	Lack of access for maintenance measures.	2.02	0.59	Disagree
11	Unanticipated shear stress in structural.	3.03	0.48	Agree
12	Inadequate specification of joint spacing in slabs.	2.89	0.46	Agree
13	Water penetration due to wrong gutter sizes on roofs.	3.08	0.49	Agree
14	Defective orientation of building.	1.93	0.57	Agree
Cluster Mean		2.94		Agree

Result of data presented in Table 1 shows that respondents are of the perception that design

errors leads to deterioration of buildings as shown in their cluster mean response scores of

2.94 which is above the cut off point of 2.5. It was shown from Table 1 that respondents were of the opinion that absence of damp proof courses specifications in building designs causes deterioration of buildings (M = 2.89, SD = 0.47); poor specification of damp proof construction materials is responsible for deterioration of buildings (M = 3.73, SD = 0.53); = 2.02, SD = 0.59).

defective design of water systems leads to deterioration of buildings (M = 3.08, SD = 0.47); improper design of slopes on roofs can lead to deterioration of buildings (M = 3.05, SD = 0.44) among others. Respondents, however disagreed that lack of access for maintenance measures is not responsible for building deterioration (M

Research Question Two: What is the perception of building professionals on building deterioration due to construction errors?

Table 2

Mean and Standard Deviation of Architects, Builders and Estate Surveyors and Valuers on Building Deterioration due to Construction Errors

S/N	Building deterioration due to construction errors	\bar{X}_i	SD _i	Remarks
15	Use of sub-standard plumbing fitting.	3.10	0.69	Agree
16	Inadequate thickness of plaster.	1.89	0.72	Disagree
17	Low placement of floor gradient.	3.05	0.48	Agree
18	Lean mixture of concrete.	3.09	0.58	Agree
19	Moisture entrapped during construction.	3.09	0.69	Agree
20	Construction of thin damp proof course.	3.77	0.49	Agree
21	Use of permeable concrete.	3.10	0.49	Agree
22	Construction of depressed floors.	3.13	0.39	Agree
23	Poor bonding of bricks and blocks.	2.88	0.56	Agree
24	Construction of bad quality roof.	3.08	0.71	Agree
25	Faulty construction of water channels.	3.03	0.76	Agree
26	Excavating foundations below the specified dept.	3.03	0.70	Agree

27	Inadequate skirting.	3.03	0.70	Agree
28	Use of porous building materials like bricks and blocks	2.47	0.77	Disagree
Cluster Mean		2.98		Agree

Result of data presented in Table 2 shows that respondents are of the perception that construction errors leads to deterioration of buildings as shown in their cluster mean response scores of 2.98 which is above the cut off point of 2.5. Respondents agreed that use of sub-standard plumbing fitting leads to deterioration of buildings (M = 3.10, SD = 0.69); low placement of floor gradient can cause deterioration of buildings (M = 3.05, SD = 0.48); lean mixture of concrete can cause deterioration of buildings (M = 3.09, SD = 0.58); moisture entrapped during construction can facilitate deterioration of buildings (M = 3.09 SD = 0.69) among others. Respondents on

the other hand disagreed that inadequate thickness of plaster is not responsible for deterioration of buildings (M = 1.89, SD = 0.72) and use of porous building materials like bricks and blocks do not cause deterioration of buildings (M = 2.47, SD = 0.77).

Test of Hypotheses

The Null hypotheses formulated for the study were tested at 0.05 level of significance and were presented as shown below:

Null Hypothesis One (Ho₁):

There is no significant difference in the perception of building professionals on building deterioration due to design errors

Table 5

One-way ANOVA of Architects, Builders and Estate Surveyors and Valuers on building deterioration due to design errors

	Sum of Squares	Df	Mean Square	F	P-Value
Between Groups	25.57	2	10.47	0.52	0.50
Within Groups	2435.22	108	17.76		
Total	2340.23	110			

Result of data presented in Table 6 shows that there is no significant difference in the perception of building

professionals on the extent of building deterioration due to design errors, $F(2, 108) = 0.52$, $P=0.50$. This shows that the Null

hypothesis is retained. The result therefore, indicates that Architects, Builders and Estate Surveyors have similar perceptions on the causes of building deterioration due to design errors.

Null Hypothesis Two (Ho₂):
 There is no significant difference in the perception of building professionals on building deterioration due to construction errors.

Table 6
One-way ANOVA of Architects, Builders and Estate Surveyors and Valuers on building deterioration due to construction errors

	Sum of Squares	Df	Mean Square	F	<i>P-Value</i>
Between Groups	3.08	2	1.54	0.07	0.94
Within Groups	2543.483	108	23.55		
Total	2546.559	110			

Result of data presented in Table 6 shows that there is no significant difference in the perception of building professionals on the extent of building deterioration due to construction errors, $F(2, 108) = 0.07, P=0.94$. This therefore shows that the Null hypothesis is retained. The result indicates that the perceptions of Architects, Builders and Estate Surveyors on the causes of building deterioration due to construction errors are similar.

DISCUSSION OF FINDINGS

Result of data presented in table 1 shows that respondents are of the perception that design errors leads to deterioration of

buildings. Supporting this view Okuntade (2014) posited that inadequacies in the performance of buildings emanate from deficiencies in design and perhaps, in Nigeria, building failure have been attributed to the causes such as design faults (50%), faults on construction site (40%), and product failure (10%). According to Okantune (2014), if a building is constructed without any appropriate design, the building is hovering towards failure. Norhaniza (as cited in Okuntade, 2014, p. 56) further stated that if the designer fails to plan well the entire plan will also fail. Every decision made during

the building design and construction has its own impact, too often the professionals that design and constructs do not border whether the building they design and build will work properly.

Their major concern is just to complete the project and move to the next job while the consequence is left for the client to handle. The effect of faulty building design and construction has become one of the major issues in maintaining building in Nigeria. Dosumu and Iyagba (2013), however, describe bad design in relation to this view, thus bad design does not only mean poor architectural design, but it involved some other professional's design inputs. The architect may contribute by starting design without adequate visibility study. This may include the authenticity of the land and nature of soil adequacy, site inventory and analysis. Others may include, inadequate or poor design details, poor supervision, sub-standard material specification and faulty or lack of maintenance schedule.

Result of data presented in table 2 shows that respondents are of the perception that construction errors cause deterioration of buildings. This view is supported

by Ukessay (2015) who revealed that faulty construction directly causes buildings to deteriorate. This is because, during construction, many activities are carried out such as digging of trenches, making foundations, concreting, frame work, masonry work among others. The works should be done according to particular specification and drawings are done by architects and engineers. These specifications and drawings show the clear, protective and efficient path for the building (Assaf, 2015). Olagunju¹ and Aremu (2013) further asserted that faulty construction contributes up to 40% to deterioration in building. In many occasions, failure of contractors to build according to the plans and specifications or poor mixing and placement of concrete contribute largely to deterioration. Others may include formworks vertical or lateral overloading, unstable bearing support and premature removal, all these often lead to deterioration of buildings.

CONCLUSION

Following the finding of the study, it was pertinent to conclude that building professionals and occupant of buildings have much to do in other to reduce the rate of

deterioration in buildings. This is because most of the factors responsible for building deterioration were traced to design, construction and application of buildings which are based on either incompetence, negligence on the side of building construction professionals, and poor maintenance culture. It was also found that environmental factors also contribute to deterioration of buildings. Though environmental factors are mostly natural phenomenon, both building professionals and occupants of buildings are responsible for the application of control measures that will reduce these to a minimum level.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations were made:

1. Architects should always include appropriate moisture control elements in their building designs. This will reduce the accumulation of moisture within the building environment and hence reduce the rate of deterioration in buildings.
2. Construction engineers and builders should always adhere to design specification when carrying out building

projects so as to avoid errors during construction.

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