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# A review on error-induced-building collapse at the construction stage in Lagos, Nigeria.

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**Abstract.** The ever-increasing occurrence of building collapse with attendant loss of lives in recent years has called for serious concern in Nigeria. Hence, it has become necessary to strategically look into the issue with a spirited effort to provide measures to stem the tide of the occurrence. Moreover, errors in building construction sites during construction activities often bring about defects in the building, which usually result in failure and eventual collapse of the building if not discovered and addressed. Evidence has shown that most building collapses in Nigeria as well as around the globe resulted from occurrences of error during the construction stage; past researchers have primarily focused their searchlight on the occurrences of error at the pre-construction stage of building projects, neglecting the occurrence of errors at the construction stage and the danger it portrayed. Hence, the primary purpose of this paper is to review relevant literature and evaluate the occurrences of building errors at the construction stage of building projects as one of the major causes of repeated building collapse in Lagos, Nigeria. The data for the review were gathered through the records of past building collapses in Nigeria from 2009 to 2019. Tables and bar graphs were used for data presentations and analysis. The paper review shows that Lagos has the highest percentage of building collapse cases in Nigeria; it also reveals that the collapse was due to common errors occurring at the construction stage of building activities onsite. And it finally identifies those common errors inducing building collapses. Stakeholders in the building industry are to focus more attention on the construction stage of the building process. The review will serve as a conceptual development guideline to minimize construction errors during construction activities, thereby reducing incessant building collapse.

## 1. Introduction

Buildings serve as one of the essentials of life, and they provide accommodation for people to live in and carry out other social, economic, educational, religious, and sporting activities. In this modern-day development, life without buildings is unimaginable. Furthermore, different countries have clear policies and procedures for building construction to meet different intended needs and safeguard the users [1]. Building construction involves various processes to serve the purposes above; the construction process is divided into various stages: preparation and brief concept design, developed design, technical design, construction on site, handing over, and use [2]. Every aspect of the building planning and processes, from the architectural designs to the construction and maintenance, requires proper and adequate supervision and quality input by professionals and stakeholders in the building industry [3]. The effective participation and good input of professionals in the building industry, from the design to the construction of the buildings, including the supervision at every stage, is paramount if standards and procedures are to be followed [4]. Research has shown that the absence of adherence to the proper standard, adequate supervision, and monitoring by various professionals during the construction of a building structure has not only hindered the building from fulfilling its purpose but also resulted in failed projects and eventually leads to the collapse of such a building [5].

Moreover, any building construction project with no adequate deployment of good supervision, use of standard materials, proper inspection, and good artistry will be characterised by occurrences of errors



which will likely result in defects, rework, and eventually collapse of such building. [6] reveals that most errors occurring in building construction activities were traceable to 40% of the construction stage activities. About 28% of building collapse cases in Nigeria were recorded during construction activities and were attributed to errors [7]. Around the globe, it is a fact that natural disasters cause building collapse as a result of earthquakes, hurricanes, floods, landslides, volcanic eruptions, rising sea levels, or storm surges, or it could also be a result of errors emanated from poor design and construction [8].

Furthermore, there are various stages of construction in the building project, such as the pre-contract or design stage, construction stage, and post-construction stage. Table 1 shows much research done in Nigeria, focusing more on errors at the pre-contract or design stage and nothing or less on errors at the construction stage. Furthermore, the appendix table reveals the empirical data on collapsed buildings in Nigeria. The table reveals that a more significant percentage of collapsed buildings occurred during construction on site [9]; this resulted from various errors emanating from the construction activities, not necessarily design errors from the pre-contract stage. Meanwhile, [10] explained that most structural failures and associated damage costs are due to mistakes in the construction stage of building projects. Notably, most errors occurring at the planning and design stages can easily be corrected at the construction stage. In contrast, errors occurring at the construction stage might only be noticed or corrected after such errors result in the collapse of the building [6]. Moreover, from the review of the available literature, there appear to be limited studies on errors occurring at the construction stage of the building process, which is capable of causing building collapse during the construction stage. However, this paper focuses on the construction stage of the building process and errors occurring when construction works are ongoing, which are capable of causing the collapse of the building if adequate precautions are not taken to prevent it.

**Table 1.** Construction errors researched in the past 10 years

List of Authors	Title	PCS	C S	Post-C S
[11]	Minimising contract document error	✓		
[40]	An assessment of the causes, cost effects, and solutions to design error-induced variations on selected building projects in Nigeria	✓		
[12]	Causes of errors in construction contract documents in South-western Nigeria	✓		
[13]	Errors in bills of quantities	✓		
[15]	Assessment of construction errors in reinforced concrete beams		✓	
[6]	Perceived effects of prevalent errors in contract documents on construction projects	✓		
[14]	Strategies for reduction of design-related rework	✓		
[16]	An appraisal of factors responsible for errors in Nigerian construction documents	✓		

Source: Author's literature review 2023.

Key: PSC = Pre-Construction Stage, CS= Construction Stage, PSC= Post Construction Stage

## 2. Literature review

Causes of building collapse have significantly been attributed to human errors or man's negligence, mainly at the construction stage of the building process [17]. Enhancement of efficiency in skill and experience in the workmanship aspect of the building process on site is of great importance; lack of this will result in errors that will bring about building collapse [18]. Furthermore, errors occurring at the design and construction stages are significant causes of building failures in Nigeria [19].

Errors in construction processes will generate defective buildings; this mainly occurs when work is not carried out according to a specified standard by professionals [20]. Most of those errors include poor concrete mixes, premature removal of formworks, and generally poor workmanship. Meanwhile, Lagos contributes slightly more than 50% of all incidences of building collapse in Nigeria [21]. This suggests that more building errors are occurring in construction sites in Lagos than in any other state in Nigeria [22]. Subsequently, [23] identifies faulty materials and poorly executed work on construction sites, including lack of construction supervision and non-compliance with building codes and regulations, as the significant indicators that generate construction errors during building project activities. [10] explained that most structural failures and associated damage costs are due to errors in the construction stage of building projects. Errors occurring during construction activities, such as poor materials and others, have also been revealed to contribute to reworks [24] significantly.

### 2.1 Definition of error

Furthermore, [6] noted that error entails different meanings depending on how it is conceptualised. Webster (2017) defined error as "a deviation from accuracy or correctness; a mistake, as in action or procedure; an inaccuracy as in speaking or writing". This implied that error could occur if there are deviations due to failure to follow specified procedures, lack of adherence to working drawings, ignoring laid down rules, specifications, and instructions, and outright carelessness. Building construction consists of various processes from inception to completion. There are some building standards and procedures to follow in the construction activities to deliver a quality project on time at a considerable cost; deviation from the norm makes it unachievable [11], and therefore, [11] defined an error as "something that causes deviation from correctness or standard". It could be intentional or non-intentional. Error is an unsafe act and procedural violation [25]. The error can also be carrying out work unnecessarily or incorrectly. [26]. Deviation from a code of behaviour is an act involving an unintentional deviation from truth or accuracy; a show that, through ignorance, deficiency, or accident, fails to achieve what should be done (The Webster's New Encyclopaedic Dictionary (1996) cited in [16], while [27] viewed human error is an event or process that departs from commonly accepted competent professional practice. From the various established definitions, an error can be considered as anything or activities that stray from the accepted standard, making it difficult to achieve the desired result.

### 2.2 Construction error

Construction error may occur due to failure to follow specified procedures, standards, regulations, good practices and outright carelessness. The result could hurt the building structure with time. [28] Viewed construction error as the cause of approximately 80% of accidents occurring on building construction sites. It can invariably be inferred that any deviation from the standard of doing work on-site could result in construction error, eventually leading to accidents. Hence, construction errors could be viewed as one of the causes of accidents on site. Construction errors are also identified as one of the primary reasons for excessive time and cost in building construction projects. The number of occurrences is a good indicator of project performance [29]. Meanwhile, construction error is a significant source of building rework and an unintentional deviation from goals, rules, and standards [30]. To improve safety and quality in construction as well as project performance, the concept of construction error management needs to be introduced, which involves openly acknowledging errors and finding ways of minimising them; this concept has yet to be previously looked into in the construction literature [31]

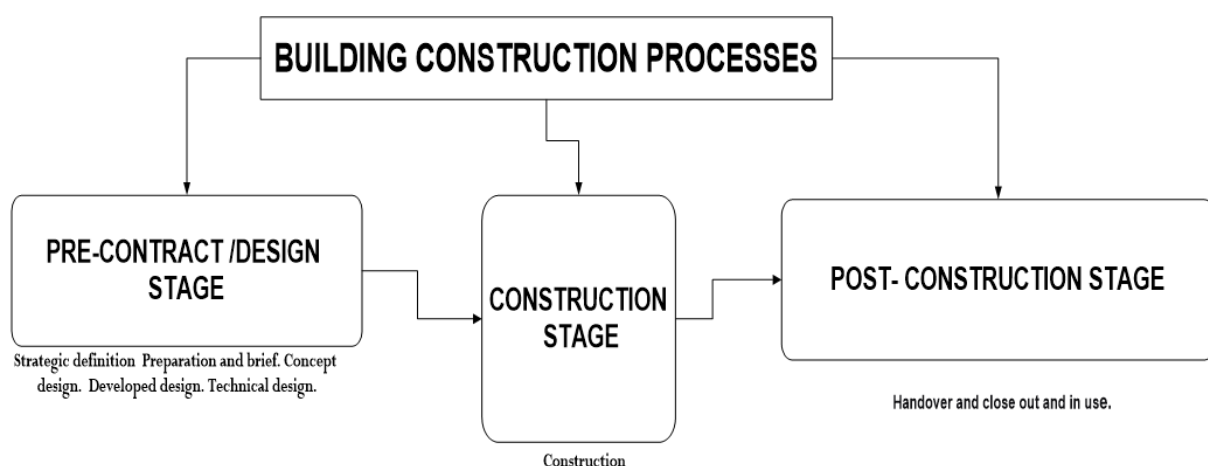
### 2.3 Construction error-induced building collapse

Research has shown that design errors, construction errors, and lack of maintenance often cause local damage to building structures, which usually leads to the destruction of the entire building [32]. In the past ten years (2010- 2020), as observed in [7], a significant number of buildings (forty-eight) have collapsed in Nigerian urban cities, with about a 77% increase from the previous decade. The study also revealed that almost 28% of collapse cases were recorded during construction [7]. From 1978 to 2012, 139 buildings collapsed in Lagos, Nigeria ([23], [33]). Meanwhile, from 2012 to 2022, 10 buildings collapsed in Lagos state, ranging from 1 to 21-story buildings ([1], [34]). These collapses were due to structural failure due to construction errors that occurred during construction activities [35]. Also, [36] investigated the effects of construction errors during the execution of concrete T-beams; the study revealed the severe impacts of mistakes on the construction of concrete T-beams. According to a study in Ethiopia, 90% of building failures result from building construction errors [37]. Occurrences of construction errors are adversely having a severe impact and affecting building performance [28]. Therefore, construction errors are inimical to the progress of the building construction industry because of the damaging effects it could have on the image of the construction practitioners and the country as a whole.

### 2.4 Building construction processes

The primary purpose of a building constructed is to provide shelter to carry out normal day-to-day activities for human beings. The human race has grown up to develop and advance in technology by making provisions for safe and more conducive and protective shelter for continuous human existence [35]. It is a known fact that all over the world, building is one of the most valuable assets of the human race. It offers accommodation in diverse ways to humanity. E.g., residential, churches, mosques, offices, schools, hospitals, etc., and also affords the skilled and unskilled, otherwise known as craftsmen, to get engaged or employed [38]. To ensure that a building achieves its desired satisfaction, it must be appropriately designed, well-planned, and constructed according to the specifications and its maintenance. Buildings are erected on plain land, otherwise known as a site, which is where buildings are manufactured. This can also be termed where building construction activities are taking place.

Building construction is the physical process of building, landscaping, or refurbishing. According to [39], the process of constructing a building is divided into various stages and also highlighted by the work stages of [2] that the construction process can be said to start at stage 5 and finish at the end of stage 6, as shown : (0) Strategic definition. (1) Preparation and brief. (2) Concept design. (3) Developed design. (4) Technical design. (5) Construction. (6) Handover and closeout, (7) In use. Construction processes can also be grouped into three stages, as mentioned in [11]: the pre-contract stage/design stage, the construction stage, and the post-construction stage, as shown in Figure 1.



**Figure 1.** Building construction processes. Source. [2]

### 3. Research methodology

#### 3.1 Description of the study area

The authors conducted this study in Lagos State because it is one of the 36 states of Nigeria, exclusive of the Federal Capital Territory (FCT). It is situated in the southwestern part of the country. Lagos state is the country's most economically notable state in Nigeria. The population of Lagos is based on the census of 2006 (which is 9,013,534). The density of the state is about 2,500/km<sup>2</sup>. Lagos State is between latitude 6° 35' and 6° 58' degrees north of the equator and 3° 45' and 3° 07' east of the Greenwich meridian. On the North and East, it has a boundary with Ogun State. In the West, it shares boundaries with the Republic of Benin. Lagos has a border boundary with the Atlantic Ocean in the south. Twenty-two per cent (22%) of its 3,577 km<sup>2</sup> are lagoons and creeks ([23], [40]).

The fast-growing status of Lagos as an emerging megacity (Figure 2) has made it become the economic hub of Nigeria, the major contributor of more than thirty per cent (30%) to Nigeria's GDP, a central African financial centre, and a commercial nerve centre in sub-Saharan Africa. This development must attract a different number of challenges. These include a fast-growing population, a decaying city centre, housing problems with the rush to own a house, deterioration of the environment, and persistent occurrence of both artificial and natural disasters such as floods, fire outbreaks, and incessant building collapse. Between 2009 and 2019, there were records of 56 cases of building collapse in Nigeria, of which 34 out of 56 cases occurred in Lagos state only [41]. Between 2020 and 2022, ten (10) buildings collapsed in Lagos state, ranging from 1 to 21 story heights [1]. Hence, Lagos state is selected for this research due to the highest recorded cases of building collapse in the past ten (10) years in Nigeria ([1], [38], [23]). Furthermore, Lagos is suitable for this study because it has witnessed a spate of building collapses in recent times and the past years, with more than half of the cases happening during the construction phase [42].



**Figure 2.** Administrative Map of Lagos Metropolitan Area. Source. [63].

### 3.2 Methodology adopted

Relevant literature was reviewed, and necessary data information was gathered from secondary sources and tabulated to achieve the aim of the research, which is to establish that errors causing building collapse mainly occurred at the construction stage rather than at the design stage, as earlier revealed in the past research ([11], [6]) and to identify the common errors causing the collapse and recommend ways of minimising the error. The data on building collapse in Nigeria from 2009 to 2019 were gathered. The data were obtained from [43-44] and confirmed by [41]. The data were analysed through descriptive analysis and percentiles, and the results were presented in tabular forms. The following data were considered as the basis of the findings:

- *Data shows Lagos with the highest percentage of building collapses in Nigeria.*

This is to establish that Lagos state in Nigeria needs more attention in minimising the occurrences of building collapse in Nigeria.

- *Data showing the stages at which building collapses and the causes*

This is to determine the actual stage at which building collapse occurs and the actual error causing it; this will enable effort to be channelled to the appropriate area on time to minimise the errors and reduce the rate at which building collapses in Lagos.

- *Data showing the identified errors that induce the collapse.*

This is to reveal and identify the salient and common errors that silently occur during the construction activities of the professionals, contractors, and artisans in various construction sites in Lagos, which will later cumulate in the building collapse.

### 3.3 Data analysis and discussion of findings

Table 2 shows the percentage of occurrences of building collapse in Nigeria for a period of Ten years. It also reveals that Lagos has a higher percentage of 50% of occurrences of building collapse; the major causes of this were analysed in [22] as a series of errors committed through workmanship and materials deployed on site. Between the years 2009 to 2013, almost 18 cases of building collapses were recorded in Lagos alone [23]. The error emanated from causes of building collapse, like faulty materials, poorly executed work, poor supervision, and non-compliance to building codes and regulations. Furthermore, the use of inexperienced/unskilled labour and quacks has contributed significantly to placing Lagos at the top of the table among the states known for occurrences of building collapse, with 50% within the period of ten (10) years [22]. It is essential that Lagos has to be focused on the issue of building collapse in Nigeria.

**Table 2.** Percentage of building collapse among states in Nigeria from 2009 to 2019

State and location of occurrence of building collapse in Nigeria.	Frequency of occurrences	Percentage of occurrences
Oyo State	4	7%
Lagos State	29	50%
Abuja	10	18%

Enugu State	1	2%
Ogun State	1	2%
Rivers State	1	2%
Ondo State	2	4%
Kwara State	2	4%
Edo State	1	2%
Abia State	1	2%
Bayelsa State	2	4%
Anambra State	1	2%
Osun State	2	4%
Plateau State	1	2%
Oyo State	4	7%
<b>Total</b>	<b>58</b>	<b>100%</b>

Table 3 reveals the common stages at which some of the buildings in Lagos are collapsing and the common errors causing the collapse. Numerous studies have been conducted in the past to look into the issue of error at the pre-contact stage of the building process. ([6], [11-14], [45]). Moreover, contrary to many of these studies, which focus on design and contract document error at the pre-contract stage as a major cause of building collapse, the results of the analysis in Table 3 show that most errors that cause building collapse occur at the construction stage and not at the pre-contract stage of the building process. Furthermore, the analysis also established that errors emanating from using poor materials and workmanship are the major causes of building collapse in Lagos, Nigeria.

**Table 3.** Building collapse at different stages of the building process with causes

Dates of collapse	Incidents of building collapse	Stages of the building process		Error causing building collapse.				
		DS	CS	PSC	NC	PWM	EL	ND
June 2009	The collapse of a building		✓					
26th April 2010	The collapse of an ongoing residential building		✓			✓		
2 <sup>nd</sup> June 2010	The collapse of an uncompleted story building		✓			✓		
28 <sup>th</sup> Sept. 2010	The collapse of a 4-story building	✓	✓		✓			



13 <sup>th</sup> March 2010	5- story hotel under construction		✓				✓	
July 2011	3-story building		✓					
October 2011	5-story block of structure with a penthouse		✓					
4 <sup>th</sup> , Nov., 2012	collapsed building	✓	✓				✓	
20 <sup>th</sup> Nov 2012	The collapse of a building	✓		✓			✓	
8 <sup>th</sup> May 2013.	The collapsed building	✓	✓				✓	
May 2013	2-Story building under construction	✓	✓				✓	
11 <sup>th</sup> , June, 2013	3-story building collapse					✓		
21 <sup>st</sup> July 2013	3- story building		✓			✓		✓
11 <sup>th</sup> July 2013	2-story uncompleted building under			✓			✓	
30 <sup>th</sup> , June, 2014	residential building			✓		✓		✓
30 <sup>th</sup> , July, 2014	2-story barrack building		✓			✓		✓
15 <sup>th</sup> , July 2015.	The collapse of a three-story building			✓		✓	✓	
21 <sup>st</sup> , Oct. 2015	3-story residential building			✓		✓		
9 <sup>th</sup> March 2016	2- story building		✓					✓
27 <sup>th</sup> August 2017	Residential building			✓				✓
February 3 <sup>rd</sup> 2019	3-story building							
13 <sup>th</sup> March 2019	3-story building		✓					
Total		5	14	6	7	9	3	2

Source: This analysis is from data on building collapse in Nigeria from 2009 to 2019, as attached in the appendix.

KEY: DS – Design Stage, CS – Construction Stage, PCS – Post Construction Stage, PM/W- Poor Materials & Workmanship, NC - Non-Compliance, EL – Excessive Loading, ND – Natural Disaster.

[11] defined error as a deviation from acceptable standards, Table 4 reveals some of the errors emanated from the causes of the building collapse. Several studies have identified many causes of building collapse. Moreover, this has not ended the menace of building collapse in Lagos, Nigeria. Hence, identifying those errors that constituted the causes of building collapse and minimising or eliminating them will bring sanity to the building industry. Poor workmanship is one of the causes of building collapse. Still, errors like the wrong interpretation of drawing by craftsmen, the wrong arrangement of a steel bar on the slab, and non-proper shuttering in formwork are errors that constitute Poor workmanship (cause of building collapse) [46-48]. These identified errors from the construction stage have confirmed that poor quality of materials and workmanship accounted for about 50% of the total building collapse in Nigeria, which occurs at the construction stage of the building process [22].

**Table 4.** List of identified errors related to the causes of building collapse

Causes of building collapse	Identified errors	Authors
Poor materials	Weak blocks	
	Whitewood for formwork	[49]
	The error of inefficient materials	[50]
	Low-quality cement for concrete mix	[51] [52]
	Usage of the wrong size of coarse aggregate	[53] [54]
Poor Workmanship	Wrong interpretation of the drawing.	[55] [28]
	No proper shuttering in formwork	[56]
	Inadequate concrete strength	[57]
	Steel exposed after casting concrete.	[50]
	Wrong arrangement of steel in the slab	[58] [59]
	Inadequate reinforcement cover	
	Mixing of concrete not to design specification.	
Non-compliance with building standards	Non-testing of concrete.	[63]
	Wrong arrangement of steel in the slab	[28]
	Early remover of formwork from the soffit of the freshly casts concrete slab.	[50]
	Non-availability of statutory bodies for continuous inspection of works.	[60]

### 3.4 Summary of discussion of findings

The findings revealed that Lagos has a higher percentage of 50% of building collapse occurrences in ten years of consideration; the major causes of this were analysed in [22]. This was a result of a series of errors emanated from the causes of building collapse, like workmanship and materials. The results of this review conform with the findings of ([23], [33], [41]). Furthermore, this finding justifies the necessity of focusing attention on the areas of errors that bring about the causes of building collapse in Nigeria and Lagos in Particular. [60] established that the primary reason for the collapse of the building was artificially induced errors.

Furtherance to the finding, the results also reveal that most errors that emanated from the causes of building collapse occur at the construction stage of the building process. Contrary to the findings of ([6], [11-14], [16], [65]), errors mainly occurred during pre-contract activities, such as errors in the contract document, design errors, and errors in the planning stage. Though those findings were substantial to some extent, those findings rely on the assumption that pre-contract or design errors in the building process are capable of causing building collapse and some other vices as a long-term effect; moreover, those researchers did not into consideration that any error committed at the design, preparation of contract document, and planning stage can easily be corrected by a suitable supervisor or by the collaboration of the professionals at the construction stage; hence, those pre-contract or design error are not as potent as the error made at the construction stage of the building process. This conformed with the study carried out by [62], which established that errors in construction methods at the construction stage contributed to about 33.7% of the causes of building collapse in Lagos state.

Furthermore, findings also revealed that errors emanating from poor materials and workmanship are Lagos's most common causes of building collapse. This confirmed the assertion of [22] that rated poor materials and workmanship as the highest causes of building collapse in Nigeria. Finally, the findings identified a number of errors from the established causes of building collapse. Identified errors such as wrong interpretation of drawing [55], wrong arrangement of bar [28], and inadequate concrete strength [50] emanated from the causes of collapse like poor workmanship.

### 3.5 Recommendations on how to minimise construction errors

The Federal Government of Nigeria needs to focus more on Lagos since it has been established that they have the highest percentage of building collapse cases. As a result, most errors occur on-site [46 – 48], this can be done by creating an agency that will monitor and approve all building construction activities on-site. This will go a long way in minimising the occurrence of errors that cause building collapse.

Secondly, the Lagos State Government should introduce an accredited checker comprising a structural engineer and a builder to focus on the material and workmanship aspect of work at the construction stage of any building project to enhance compliance and ensure materials and workmanship are of standard [22].

Thirdly, the attention of all the stakeholders in the construction industry should be shifted to the construction stage of building processes so as to ensure proper supervision and monitoring of the stage. This will enable the construction stage of the building process to be error-free or minimise construction errors.

The fourth essential step is that all stakeholders in the construction industry, especially in Lagos, must ensure that craftsmen are well-trained before they are employed to work in building construction to avoid errors [60]. A qualified site supervisor must be employed to supervise every building project effectively and to forestall errors that can be generated from poor workmanship and materials.

## 4. Conclusion

The study revealed that Lagos has the highest percentage of building collapse in Nigeria, and this was a result of the need to focus attention on the construction stage of the building process, which has poor workmanship and materials as one of the highest activities of the construction process. Hence, the review concluded that through the identified errors like wrong interpretation of drawing, wrong arrangement of steel in the slab, lack of monitoring of the labour when casting, and inadequate concrete strength,

building collapse can easily be induced or triggered during or after the construction processes on site in Lagos State.

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### Appendices.

#### 2009 to 2019 record of building collapse in Nigeria

S/N	Location	Date of collapse.	Type of building	Causes of collapse
1	Ogbomoso, state	Oyo February 2009	Six-storey Lautech Teaching Hospital under construction	Substandard material Poor supervision
2	Ogbomoso state	Oyo March 2009	Four-story building under construction	Not reported
3	Lagos	June 2009	Two storey building	Not reported
4	Aghaji Crescent GRA Enugu	August 2009	A fence wall	No proper drainage
5	Oke padre street Itamorin Abeokuta	18th October 2009	Uncompleted residential building	Use of substandard materials Hasty construction
6	Garki Abuja	November 2009	2-storey commercial building	Structural failure Substandard material
7	Isopakodowo street, cairo oshodi Lagos	26th April 2010	Residential building under construction	Use of substandard material
8	Adenike Street off new market estate VI Lagos	2nd June 2010	Uncompleted storey building	Use of substandard materials
9	Plot 702 Port-Harcourt crescent Garki 11 Abuja	July 2010	6 Suspended floors for commercial purpose with a basement	Substandard materials Unqualified professionals
10	2 Okolie street off Gimbiya street, Abuja	11th August 2010	Uncompleted four storey building	Substandard materials Disregard for building regulations
11	Tinubu street VI Lagos	28th September 2010	4-Storey Building	Structural defect and Overloading
12	No 9B Adenubi close ikeja Lagos state.	13th March 2011.	5- storey hotel under construction	Poor quality concrete

13	Oba ile Housing Estate Akure	2011		Collapse of a hotel Building under construction	Structural failure
14	Mararaba (near Abuja)	29th June 2011		Collapse of a 2-storey Zenith Bank Plc	Expansion building No geotechnical investigation, Undersized reinforcement, Large span slab, No specific floor thickness on drawing.
15	Oloto Street, off Cemetery Road, Ebute Metta, Lagos	July 2011		3-storey building	Non-adherence to building standards & regulations
	Orosanye Street Lagos.	August 2011		3-storey building	Wrong supervision
16	Aderibigbe street, Maryland Lagos	October 2011		5-storey block of structure with a pent house	Structural failure
17	No 3 AdemolaAwosike Road Kubwa Extension III, Abuja	3 8 th August 2012		Collapse of 2-storey building under construction	Poor quality material poor workmanship Weak foundation Failure of structural element
18	Gwarinpa Estate Abuja	28th January 2012		Collapse of two storey building	Structural defect
19	Apo Mechanic Village Abuja	13th June 2012		1-storey commercial building under construction	No qualified professional on site Poor supervision Use of poor-quality material
20	MuriOkunola street Eti-Osa LGA of Victoria Island	4th November 2012		Collapsed building under construction	Structural failure Poor construction
21	Jakande estate in Oke-AkeAfa, Isolo Lagos state.	20th November 2012		Collapsed of a building (in use)	Structural failure, Occupants ignored governments safety warning
22	74 Corporation drive Dolphin Estate, Ikoyi Lagos	20th November 2012		Collapsed of a building	Structural failure
23	Ojodu, Lagos	8th May 2013		2-storey Building under construction	Illegal approval Structural failure
24	Agbama area, Umuahia	15th May 2013		Building under Construction	Structural failure
25	Ojodu, Lagos	May 2013		Three  storey building	Not reported

26	Agege motor road, Mushin Lagos	11 <sup>th</sup> 2013	June	Three storey building	Unauthorized conversion Use of quacks
27	Ishago road, surulere Lagos	21 <sup>st</sup> 2013	July	2-storey uncompleted building under construction	Noncompliance to regulatory authority warnings Inferior building materials
28	Ebeute-meta, Lagos	11thjuly 2013		Residential Building	Structural defect
29	Maitama, Abuja	6th September 2013		Building Collapse	Not reported
30	Nyanya, Abuja	27th September 2013		Government secondary school	Not reported
31	Lagos Island	25th September 2013		Three storey building fell on a bungalow	Not reported
32	Amassoma in southern ijaw LGA of Bayelsa State	5th October 2013		Lecture theatre building at the permanent site of the Niger Delta University	Use of substandard material No compliance with the standard procedures in the use of materials
33	Ologuneru in Ido LGA of Ibadan city.	May 2014	3rd	An uncompleted 2 Storey building. -	Not reported
34	Akure, Ondo state	9th May 2014	May	A hostel building under construction	No geotechnical report Use of quacks
35	Agudama-Epie, near Yenagoa	19th May 2014	May	Uncompleted Church building	Heavy downpour
36	Onitsha, Anambra state	2nd June 2014	June	An uncompleted four-storey building	Structural failure
38	Pedro police station, somolu Lagos	30th June 2014	June	2-storey barrack building	Not reported
39	Ejigbo, Osun state	10th July 2014	July	School building complex few hours before commissioning	Not reported
40	Bucknor estate, jakande-isher. Ejigbo/isolo Lagos state	30th July 2014	July	Collapse of three three-storey building	Structural failure
41	Osogbo, Osun state	19 <sup>th</sup> August 2014		One storey building	Heavy downpour
42	Lagos	12th September 2014		Collapse of a warehouse at synagogue church	Demolition process

	Ikotun-Egbe area of Lagos state, Nigeria.	14 <sup>th</sup> September, 2014	Synagogue Church of All Nations (SCOAN)	Structural failure
43	Bukuru Jos	September 2014	Abu naimi school building collapse	Structural defect
44	Benin	30th September 2014	Collapse of liberty power bible church	Illegal conversion Structural defect Use of substandard material
45	Ebute meta Lagos	15th July 2015	3-storey Residential Building	Structural defects
46	Swamp street Odunfa island Lagos	21st October 2015	3-storey Residential Building	Structural defects
47	Lekki, Lagos	9th March 2016	Five storey Building Under Construction	Heavy rainfall and foundation failure
48	Mile 12, Lagos	19th March 2016	Two storey building	Structural defects
49	Malete, Kwara state	2016	Three storey building	Not reported
50	Lagos Island	27th August 2017	Residential Building	Heavy downpour Vibration
51	Zulu Gambari Road, Ilorin	18th August 2017	Four Storey Building	Not reported
52	Abuja	18th August 2018	An abandoned Building	Old age
53	Port-Harcourt	November 19th 2018	7- Storey Building under construction	Illegal conversion Not Reported
54	Lagos	February 3rd 2019	3-storey Building	Not reported
55	Ita-faji, Lagos Island	13th March 2019	3-storey building	Noncompliance to regulatory authority warnings. Old age
56	Sogoye, Bode Area of Ibadan	15th March 2019	3- Storey building under construction	Concrete was not allowed to cure before continuing the construction.

**Figure A1. Building collapse in Nigeria from 2009 to 2019. Source. [41]**

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