

Research Article

Framework for Building Collapse Investigation and Proffered Mitigation Measures for Nigeria; the NBRRI Approach

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Abstract

The persistent incidence of building collapse in Nigeria has emerged as a critical concern for researchers and stakeholders in the built environment. Despite the frequency of these events, many have not been systematically analyzed to determine their underlying causes. This study investigates a selection of collapsed buildings across various locations in Nigeria, examining parameters such as building type, structural condition at the time of collapse, number of casualties, prevailing weather conditions, and both causative and contributory factors expressed in percentages. Findings reveal that the predominant cause of building collapse is the use of substandard construction materials, accounting for 35.38% of cases. Geotechnical investigation failures follow as the second leading cause at 21.54%, while poor or non-professional design contributes 13.85%. Other significant factors include ageing infrastructure, dilapidation, induced stress, and inadequate supervision (10.76%), poor workmanship (10.78%), and non-compliance with building regulations (7.69%). The study concludes that mitigating building collapse in Nigeria requires a multifaceted approach involving proactive planning, stringent enforcement of building codes, and heightened public awareness. These measures are essential to safeguard lives and property and to ensure the integrity of the built environment.

Keywords

Building Industry, Building Collapse, Substandard Materials, Geotechnical Investigations

1. Introduction

Building collapse remains a persistent and alarming issue in Nigeria, with far-reaching consequences for public safety, economic stability, and urban development. Over the past two decades, the country has witnessed a disturbing frequency of

structural failures, particularly in urban centers such as Lagos, Abuja, and Port Harcourt. These incidents have resulted in significant loss of life, displacement of residents, and erosion of public trust in the construction industry [1].

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The causes of building collapse in Nigeria are multifaceted, encompassing technical, regulatory, and socio-economic dimensions. Studies have consistently identified poor construction practices, use of substandard materials, inadequate supervision, and non-compliance with building codes as primary contributors [2, 3]. Additionally, systemic issues such as corruption, lack of enforcement, and engagement of unqualified personnel exacerbate the problem [4].

Rapid urbanization and the increasing demand for housing have further strained the regulatory capacity of government agencies, leading to lapses in monitoring and enforcement [5]. Environmental factors, including soil erosion, flooding, and climate variability, also pose significant risks to structural integrity when not properly accounted for during design and construction [1].

To address this crisis, there is an urgent need for a comprehensive framework that guides the investigation of building collapses and outlines effective mitigation strategies. Such a framework must integrate forensic engineering principles, regulatory reforms, professional accountability, and technological innovation. It should also promote collaboration among stakeholders—architects, engineers, builders, regulators, and policymakers—to ensure that buildings are designed, constructed, and maintained to meet safety standards [2, 6, 7].

Recent research emphasizes the pivotal role of architects and engineers in implementing rigorous safety protocols and adopting innovative technologies such as Building Information Modeling (BIM) to enhance project coordination and structural resilience [1]. Furthermore, continuous professional development and capacity building are essential to equip practitioners with the knowledge and skills required to uphold best practices in construction [3].

Ultimately, the development and implementation of a robust investigative and mitigation framework will not only reduce the incidence of building collapse but also restore confidence in Nigeria's built environment. It is a critical step toward safeguarding lives, preserving property, and fostering sustainable urban growth.

1.1. Building Collapse Incidents in Nigeria: A Persistent Challenge

Between the year 2020 - 2025, Nigeria recorded over 200 building collapses, resulting in more than 126 fatalities, according to the Nigeria Building and Road Research Institute (NBRRI). The latest incident occurred in Kubwa, Bwari Area Council, Federal Capital Territory, Abuja.

Key contributing factors include the use of substandard materials, poor design and workmanship, geological instability, and weak foundations. Widespread professional incompetence, unqualified practitioners, and inadequate enforcement of building codes have also been identified as major causes.

NBRRI and other professional bodies in the Architectural, Engineering, and Construction (AEC) sector have consistently called for stricter enforcement of standards, thorough investigations, and sanctions against responsible parties. Measures such as demolition of unsafe structures, integrity testing, and promotion of safe building practices have been implemented. However, these efforts remain largely reactive, especially in urban areas where higher professional standards are expected. Development Control agencies and regulatory bodies continue to work toward mitigating these incidents. NBRRI has documented several cases of building collapses as from the year 2020 - 2025, as presented in Tables 1-6.

Table 1. Some selected building collapse recorded in 2020.

S/N	Building Location	Building Type/Nature of collapse	Date	Result of Preliminary Investigation	No. of Casualties
1.	Yar'Adua Drive, Oweri, Imo	Eight storey building under construction	April, 30 2020	Not adhering to design provided	15 dead
2.	No. 6, Olonode Street, Ebute Meta, Lagos	Three storey building – Partial collapse	May, 25 2020	Preliminary report by LASEMA- Severely distressed	No casualty
3.	Shanuaje Street, Iju, Lagos	Two storey building – Partial collapse	June 14 2020	Lack of maintenance	No casualty
4.	46, Gafari Balogun Street, Ogudu, Lagos	One storey building	June 17, 2020	Mud slide	2 children trapped and died
5.	86, Nkwere Street, Umuahia, Abia	Three storey building	June 24, 2020	Sub-standard building materials.	No casualty
6.	16 and 17 Freeman Street, Lagos Island, Lagos	Three storey building collapsed on nearby bungalow	July 11, 2020	Defective structure	3 confirmed dead – A policewoman and two children.
7.	Nkaliki Road, opposite Aba-	Three storey building under	July 22,	Sub-standard materials	No casualty

S/N	Building Location	Building Type/Nature of collapse	Date	Result of Preliminary Investigation	No. of Casualties
	kaliki L. G. A. Ebonyi State	construction	2020		
8.	95, Abeokuta Street, Ebute-Meta, Lagos	Three storey building	July 24 2020	Lack of geotechnical investigation	One woman wounded and hospitalized
9.	Behind Dawaki Market, Galadima Area, FCT, Abuja	Two storey building under construction	July 25 2020	Faulty design	Ten people trapped.

Table 2. Some selected building collapse recorded in 2021.

S/N	Building Location	Type/Nature of Building	Date	Result of Preliminary Investigation	No. of Casualties
1.	Federal Medical Centre (FMC), Umuahia, Abia State	Two storey building under construction	20 th May 2021	Lack of geotechnical investigation before construction	No casualty.
2.	Amikwo village, Akwa, Anambra State	Two storey building under construction.	July 6th 2021	Substandard Materials	20 persons escaped death
3.	Okofe, Orumba North Local Govt., Anambra, State	Two storey building	July 6th 2021	Poor supervision	Four persons trapped and rescued
4.	No. 19, Church Street, Lagos Island, Lagos State	Partial collapse of a three-storey building	8th July, 2021	Already earmarked for integrity tests by LASEMA due to visible cracks found on walls and columns.	One five years old boy found dead
5.	77, Tapa Road, Oke-Ojo, Isawo, Ikorodu, Lagos State	Two storey building (Attachment to the main building) under construction	20th July, 2021	-	One dead
6.	Nweke Awkuzu Street, Ugbene Area of Abakpa Nike, Enugu State	Three storey building	20th August 2021-	Lack of geotechnical investigation before construction	No casualty
7.	Holy Ghost Church Building, Abeda Pave Community, Chachangi Ward, Takum Local Council, Taraba State	Church Building	11th September 2021	Substandard Materials	Two worshipers dead.
8.	Nazareth High School, Imeko – Afon, Ogun State	School building	26th September 2021	Substandard Materials	One student died while two sustained injuries.
9.	97, Lagos Road, Haruna Axis of Ikorodu, Lagos State	Two storey building	18 th October, 2021	Failed integrity test earlier conducted by LASBCA*	One dead, two rescued from debris.

Table 3. Some selected building collapse recorded in 2022.

S/N	Building Location	Type/Nature of Building	Date	Result of Preliminary Investigation	No. of Casualties
1.	Salvation Ministry, Okpanam, Oshimili North Local, Delta State	One storey building	11th Jan. 2022	Lack of geotechnical investigation before construction	4 dead and several injured.
2.	16, Akanbi Crescent, Off	Three storey building under con-	12th Febru-	Substandard Materials	5 dead, 2 rescued.

S/N	Building Location	Type/Nature of Building	Date	Result of Preliminary Investigation	No. of Casualties
	Adeshina Street, Harvey, Yaba, Lagos State	struction	ary 2022		
3.	Along Audu Bako Way, Kano, Kano State	One storey building under renovation	16th March 2022	Poor supervision	No casualty
4.	The heart of Oba, Idemili North LGA, Anambra State.	Five storey building	31st March 2022	Already earmarked for integrity tests.	Many trapped as at time of reporting
5.	Hotoro Unguwar Gabas, behind Chula Filling Station, Kano State	Uncompleted one storey building	9th April 2022	Earmarked for integrity tests.	2 dead, 3 critically injured
6.	Bende Street, Old Port Harcourt Township., River State	Old three storey building. Already evacuated	29th June 2022	Earmarked for integrity tests.	No casualty
7.	Kubwa Area, FCT Abuja	Three storey mall building under construction.	26th August 2022	Substandard Materials	2 dead and many injured
8.	Oba Idowu Oniru Street close to Sand Field Bus Stop, Lekki, Lagos State	Seven storey building under construction	4th September 2022	Substandard Materials	6 dead
9.	Ibobo, Oraifite, Ekwusigo Local Government Area	Two storey building under construction	23rd September 2022	Substandard Materials	2 persons died

Table 4. Some selected building collapse recorded in 2023.

S/N	Building Location	Type/Nature of Building	Date	Result of Preliminary Investigation	No. of Casualties
1.	7th Avenue, Gwarimpa, FCT Abuja	Two storey building under construction	2nd February 2023	Lack of geotechnical investigation before construction	3 dead, over 40 trapped
2.	Aluu Community, Ikwerre LGA, River State	Two storey building under construction	4th February 2023	Substandard Materials	3 persons died
3.	1st Avenue, Banana Island, Ikoyi, Lagos State	Seven storey building under construction	12th April 2023	Poor supervision	1 dead, several injured.
4.	Muri Nta Eke Street, off Ikot Eyo, Cross River State	Two storey building under construction.	29th April 2023	Substandard Materials	13 escaped death.
5.	Ifo Layout Abakpa Nike Area, Enugu State	Two storey building	18th June 2023	-	1 woman trapped
6.	Ada George Area, Obio/Akpor Local Government Area of Port- Harcourt, River State	Two storey building under construction	29th June 2023	Lack of geotechnical investigation	No casualty
7.	Dape, Life Camp Abuja	Four storey hotel building under construction	3rd July 2023	Substandard Materials	Undisclosed numbers of labourers trapped
8.	High Court of Justice, Ado-Ekiti, Ekiti State	A section of High Court Complex	12th July 2023	Substandard Materials	Chief Justice of the State injured.
9.	Inalende Area, Mokola, Ibadan, Oyo State,	Three storey building	24th July 2023	Collapsed due to settlement after heavy rainfall.	8 people rescued.
10.	Itedo Eledumare Street, Obale, Akure North LGA, Ondo State	Section of the building wall collapsed.	1st August 2023	Following over 24 hrs rainfall	1 dead and another sustained injury

Table 5. Some selected building collapse recorded in 2024.

S/N	Building Location	Type/Nature of Building	Date	Result of Preliminary Investigation	No. of Casualties
1.	Ochanja Market, Onisha, Anambra State	Two storey building under construction	26th February, 2024	Substandard Materials	Many trapped and number of dead yet to be ascertained then.
2.	Umumbi Autonomous Community, Ukwu West LGA, Abia State	Three storey building under construction	7th June 2024	Substandard Materials	Five people trapped.
3.	Dennis Memorial Grammar School Onisha., Anambra State	Five storey building under construction	12th June 2024	Poor supervision	One dead, three people feared trapped
4.	Nicholas Ukachukwu's Praco Limited Estate, Plot 458 Guzape, FCT Abuja	Unnamed multi-storey building under construction	28th June 2024	Poor supervision	Unidentified number of workers trapped
5.	Close 10, Drive 5, Second Gate of Prince and Princess Estate Gudu, FCT, Abuja	Duplex under construction	28th June 2024	-	Two trapped persons rescued
6.	12, Cameroun Street, off Ewenla, Mushin, Lagos State	Two storey building	3rd July 2024	Lack of geotechnical investigation before construction	Seven persons rescued
7.	Ifite-Akwa, Near Nnamdi Azikiwe University, Anambra State	Three storey building under construction	12th July 2024	Substandard Materials	No casualty
8.	Cupid Road (Sultan Dasuki Way) Kubwa, FCT, Abuja	A section of two storey residential building	13th July 2024	Substandard Materials	Unspecified numbers of residents trapped
9.	Okpanam Community, Oshimili North Local Govt Area, Delta State	Two storey building under construction	14th September 2024	Failed integrity test	Unspecified number of workers trapped.
10.	Egbelu Mgbaraja Area of Ogbogoro Community, Obio Akpo LGA, River State.	Two storey building under construction	4th November 2024	Not adhering to design provided	One person died

Table 6. Some selected building collapse recorded in 2025.

S/N	Building Location	Type/Nature of Building	Date	Result of Preliminary Investigation	No. of Casualties
1.	Aboaga Along Igwuruta-Etche Road, Ikwerre Local Govt Area, Rivers State.	Three storey building under construction.	4th January 2025	Lack of geotechnical investigation before construction	Seven workers injured and rescued
2.	Norther Vulture Estate, Chevron Dirive, Ikota Lekki, Lagos State.	Two storey building under construction.	29 th January 2025	Substandard Materials	Three people died, six injured
3.	Mayigi Community Comprehensive High School, Ilase, Ipokia Local Government, Ogun State	Mud school building due to rainstorm	19th March 2025	Aged building	One student died while five others and two teachers were seriously injured
4.	10, Oremeta Street, Ojodu-Berger, Lagos State.	Three storey building housed a restaurant	19th April 2025	Substandard Materials	Five people died 12 rescued as at the time of compiling this report
5.	Opposite Mobil Filling Station (formerly Bugon Filling Station), Ota – Ona, Ikorodu, Lagos	Two storey building undergoing construction.	26th May 2025	-	Three persons dead, others rescued.

S/N	Building Location	Type/Nature of Building	Date	Result of Preliminary Investigation	No. of Casualties
6.	No. 5, Craig Street, Off Apata Road, Shomolu	Two storey building under construction collapsed on RCCG, Liberty Parish	15th June 2025	Lack of geotechnical investigation before construction	No casualty
7.	Abedi Area of Sabon Gari, Fagge Local Govt. Area, Kano State	Three storey building under construction.	13th July 2025	Substandard Materials	Four dead, Seven injured.
8.	Pentagon Lodge, Ekwueme Federal University, Ndufu-Alike, Ikwo, Ebonyi State	Three Storey hostel building	25th July 2025	Lack of geotechnical investigation	No casualty.
9.	Olokoru Road, Federal Low-Cost Housing Estate, Umuahia	Three storey building under construction	26th July 2025	Substandard Materials	Seven people sustained injuries

1.2. Understanding Building Collapse and Structural Failure in Nigeria

Building collapse is defined as a complete structural failure, where the building can no longer withstand external forces and its components have given way [8]. According to Ayinuola & Olalusi [9], structural failure occurs when a component can no longer perform its intended function. Adebowale et al. [10] further classify building failure into three categories:

Ultimate Limit State; leading to total collapse; Serviceability Limit State; involving deflections and cracks and Durability Issues; deterioration of structural elements.

Collapses may result from natural phenomena such as earthquakes and hurricanes, though these are rare in Nigeria or from Man-made causes resulting from human negligence. Man-made causes include poor construction practices, lack of supervision, and use of substandard materials.

Extensive research has identified key contributors to building collapse in Nigeria. Oloyede et al. [11] highlighted human factors such as inadequate soil investigation, poor monitoring, and failure to account for additional loads and environmental stresses as the causes of building collapse. Some research conducted by [12-14] emphasized poor design, non-compliance with approved plans, and lack of qualified professionals as the main causes of building collapse in Nigeria.

Chinwokwu [15] also noted that natural disasters and systemic issues such as corruption and unauthorized alterations to approved drawings are the contributory factors of building collapse in Nigeria. Similarly, research conducted by [8, 16-18] also pointed to poor maintenance culture as a contributing factor. A notable case reported by Chendo & Obi [19] involved a collapse in Port Harcourt due to premature continuation of work before the concrete had adequately set. Figure 1 summarizes the major causes of building collapse in Nigeria.



Figure 1. Causes of building collapse.

1.3. Socioeconomic and Environmental Impacts of Building Collapse in Nigeria

Building collapses in Nigeria have profound implications across social, economic, psychological, and environmental domains. Beyond the tragic loss of lives, often involving innocent civilians, many survivors suffer permanent disabilities, while others are displaced and deprived of shelter and their property [1, 4].

The economic consequences are extensive, encompassing the destruction of assets, increased costs for emergency response, site clearance, and post-collapse investigations. These incidents also elevate insurance premiums and maintenance costs across the construction sector [2]. Moreover, the psy-

chological toll on survivors, bereaved families, and nearby residents is significant, manifesting in anxiety, depression, and post-traumatic stress disorder [3].

The reputation of Nigerian construction professionals is adversely affected, as frequent collapses erode public trust and diminish international credibility [6]. Job losses among construction workers and related professionals are common, and abandoned collapse sites often become hazardous zones, attracting dangerous wildlife and posing further risks to communities [5]. Windapo and Rotimi [20] emphasize that building collapse events result in substantial loss of productive time, undermining progress toward sustainable development goals. Figure 2 summarizes the multifaceted impacts of building collapse in Nigeria.

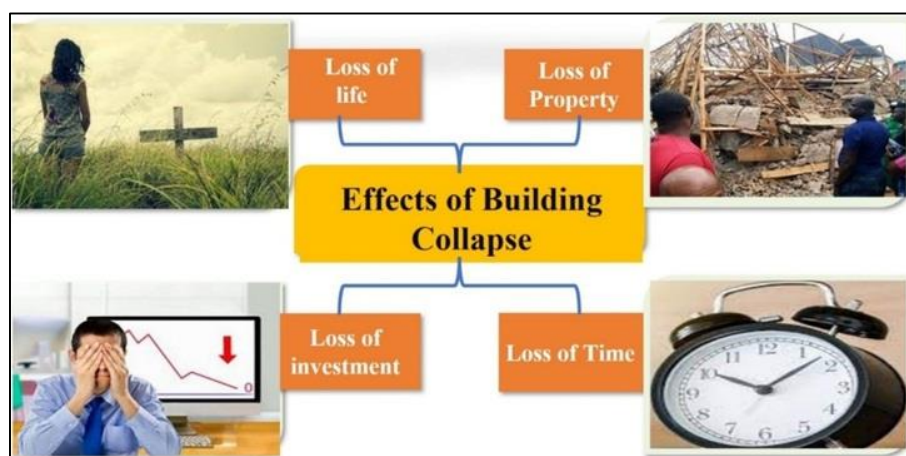


Figure 2. The effects of building collapse.

2. Methodology: The NBRRI's Approach to Building Collapse Investigation

Nigerian Building and Road Research Institute (NBRRI) adopts a multi-phase, evidence-based methodology for investigating building collapse incidents across Nigeria. This approach integrates fieldwork, laboratory analysis, stakeholder engagement, and data synthesis to identify root causes and recommend mitigation strategies. The phases of investigations are explained below.

Phase 1: Preliminary Assessment and Literature Review

The investigation begins with a comprehensive review of existing literature and historical data on building collapses within the target region. This phase helps establish baseline knowledge and informs the design of field instruments and data collection strategies.

Phase 2: Preliminary Assessment and Literature Review

NBRRI conducts on-site assessments at collapse locations, focusing on:

Material Testing: Random sampling and laboratory testing

of construction materials (e.g., concrete, steel, blocks) to assess compliance with standards.

Geotechnical Analysis: Excavation of trial pits and soil testing to evaluate foundation conditions and subsoil integrity.

Structural Evaluation: Examination of design documents, load paths, and construction practices to identify design flaws or execution errors.

Phase 3: Stakeholder Engagement

Structured questionnaires and oral interviews are administered to residents and eyewitnesses near collapse sites, Construction professionals involved in the project and regulatory officials and site supervisors. This qualitative data provides insights into supervision practices, professional competence, and regulatory compliance.

Phase 4: Data Analysis and Reporting

Quantitative and qualitative data are synthesized to identify failure modes and contributing factors, evaluate the skill level and qualifications of involved personnel and assess adherence to building codes and standards. Findings are compiled into technical reports, which include recommendations for preventive measures, policy reforms, and enforcement strategies.

Phase 5: Dissemination and Policy Advocacy

NBRRI shares its findings with relevant government agencies, professional bodies, and the public. The institute also advocates for stricter enforcement of building codes, improved professional training, and the adoption of stand-

ardized construction practices.

Figure 3 shows how these 5 phases is detailed into a seven step NBRRI process of carrying out investigation on building collapse.

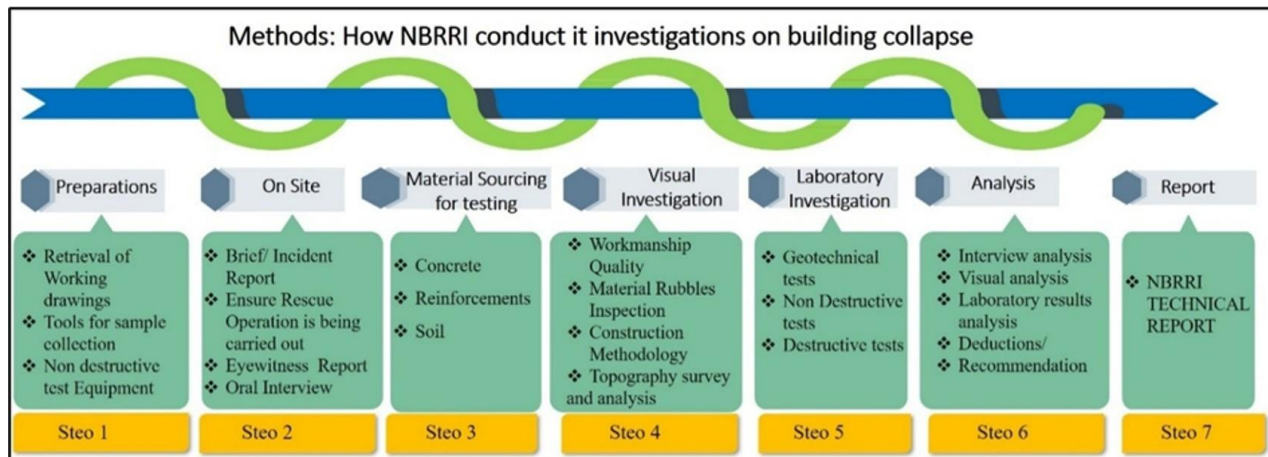


Figure 3. How NBRRI conduct it investigation on building collapse.

3. Results and Discussion

Results from 18 building collapse cases investigated by NBRRI in Nigeria were analyzed and presented. The locations, building type, State as at collapse, Number of Injured/

Number of deaths, Weather as at time of Collapse, Causative Factor, Contributory factor in Percentage were obtained and represented in Table 7. It gives an overall analysis of causative factors and the extent of their impact on building collapse.

Table 7. Cases of building collapse investigated by NBRRI.

S/N	Location	Building Type	State as at Collapse	No. of Injured/ No. of deaths	Weather Condition at time of Collapse	Causative Factor	Contributory factor in Percentage	Remark /Source of Evidence
1	Lagos	5 storey building Residential	Under construction	35/10	Rainy season	Materials Design Workmanship Geotechnical failure Compliance	7% 1% 2% 5% 85%	Primary Cause of Failure Is Violation of Approved Design
2	Ogun	Residential	Dilapidated mud house	5/2	Rainy season	Materials Design Workmanship Geotechnical failure Compliance	100% NIL NIL NIL NIL	Primary Cause of Failure Is Material
3	Anambra	3 storey building Residential	Under construction	13/7	Rainy season	Materials Design Workmanship Geotechnical failure Compliance	94% 2% 3% 2% NIL	Primary Cause of Failure Is the Use of Sub-Standard Material
4	Abuja	4 storey building Residential	Under construction	6/2	Rainy season	Materials Design Workmanship Geotechnical failure Compliance	90% 1% 4% 5% NIL	Primary Cause of Failure Is the Use of Sub-Standard Material
5	Abuja	1 storey building Residential	Under construction	7/0	Rainy season	Materials Design Workmanship Geotechnical failure Compliance	92% NIL 8% NIL NIL	Primary Cause of Failure Is the Use of Sub-Standard Material

S/N	Location	Building Type	State as at Collapse	No. of Injured/ No. of deaths	Weather Condition at time of Collapse	Causative Factor	Contributory factor in Percentage	Remark /Source of Evidence
6	Akwa Ibom	Religious Building	In Use	29/3	Dry season	Materials Design Workmanship Geotechnical failure Compliance	3% 95% 2% NIL NIL	Primary Cause of Failure Is Poor and Non-Professional Design
7	Lagos	2 storey building Residential	In Use	13/2	Dry season	Materials Design Workmanship Geotechnical failure Compliance	34% 1% 2% NIL NIL	Material And Other Factors Are Responsible; Prolong Exposed to Adverse Weather Conditions
8	Owerri	4 storey building Residential	Under construction	15/4	Rainy season	Materials Design Workmanship Geotechnical failure Compliance	90% 1% 4% 5% NIL	Primary Cause of Failure Is the Use of Sub-Standard Material
9	Owerri	4 storey building Residential	Under construction	15/4	Rainy season	Materials Design Workmanship Geotechnical failure Compliance	4% 94% 2% NIL NIL	Primary Cause of Failure Is Poor and Non-Professional Design
10	Lagos	Bungalow Building Residential	Under construction	4/2	Rainy season	Materials Design Workmanship Geotechnical failure Compliance	NIL NIL 2% 98% NIL	Primary Cause of Failure Is Soil Settlement Due to Heavy Downpour
11	Lagos	4 storey building plus Penthouse Residential	In Use	16/8	Rainy season	Materials Design Workmanship Geotechnical failure Compliance	95% 3% 1% 1% NIL	Other Factors Are Responsible; Prolong Exposed to Adverse Weather Conditions
12	Owerri	3 storey building Residential	Under construction	7/0	Rainy season	Materials Design Workmanship Geotechnical failure Compliance	90% 1% 4% 5% NIL	Primary Cause of Failure Is Poor and Non-Professional Design
13	Lagos	3 storey building Residential	In Use	8/0	Rainy season	Materials Design Workmanship Geotechnical failure Compliance	24% 9% 2% NIL NIL	The Factor Responsible Is Ageing and Dilapidated Nature of The Structure
14	Anambra	2 storey building Residential	Under construction	6/0	Dry season	Materials Design Workmanship Geotechnical failure Compliance	92% 5% 2% 1% NIL	Primary Cause of Failure Is the Use of Sub-Standard Material
15	Abuja	4 storey building Residential	Under construction	12/3	Rainy season	Materials Design Workmanship Geotechnical failure Compliance	2% 2% 87% 4% NIL	Lack Of Supervision and Poor Workmanship Are the Factors Responsible
16	Anambra	3 storey building Residential	In Use	7/1	Rainy season	Materials Design Workmanship Geotechnical failure Compliance	8% 88% 4% NIL NIL	Primary Cause of Failure Is Poor and Non-Professional Design
17	Abia	3 storey building Residential	In Use	13/2	Rainy season	Materials Design Workmanship Geotechnical failure Compliance	94% 3% 2% 1% NIL	Primary Cause of Failure Is the Use of Sub-Standard Material
18	Ebonyi	3 storey building Residential	In Use	7/1	Rainy season	Materials Design Workmanship Geotechnical failure Compliance	91% 4% 2% 3% NIL	Primary Cause of Failure Is the Use of Sub-Standard Material

From the analysis on the investigated cases of building collapse, it can be deduced that most of the building collapsed during the raining season which can be attributed to low values of soil bearing capacity (over saturation of the soil). The causative factors include;

- 1) The use of substandard building materials which accounts for 35.38% and it's the highest cause of building collapse.
- 2) Failures from Geotechnical investigations ranks as the second highest cause of building collapse with 21.54%

- 3) The third causes of building collapse is poor and non-professional design accounting for 13.85%.
- 4) Other causes, which includes ageing, dilapidation, induced stress and poor supervision accounts for 10.76% of building collapse and ranked as the fourth cause of building collapse.

- 5) Poor workmanship accounts for about 10.78% while non-compliance accounts for about 7.69% causes of building collapse.

Figure 4 depicts the graphical representation of contributory factors of building collapse.

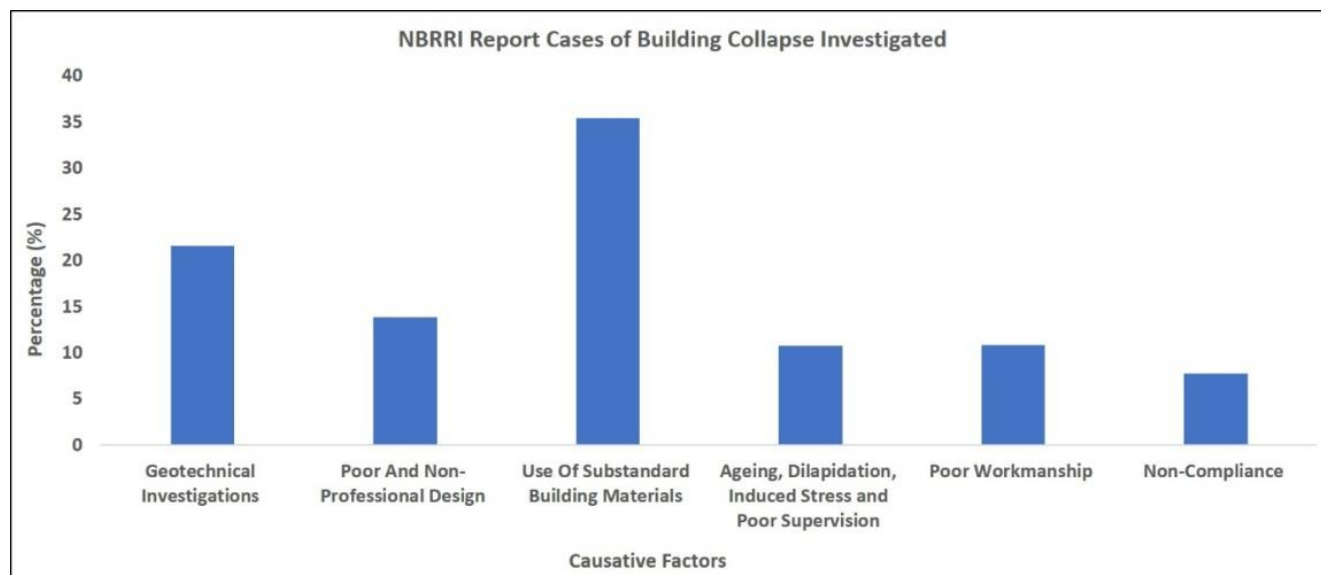


Figure 4. Causes of building collapse.

3.1. NBRRI Challenges in Investigating Building Collapse

A number of challenges are usually faced during building collapse investigation. Among them are:

- 1) No access to design calculations: It is always difficult to get access to designed calculation to ascertain whether the structure was initially design properly or not.
- 2) No access to site or rubbles (failed construction materials).
- 3) Nobody takes responsibility (blame games): Neither the government nor the professional body takes responsibility to punished whosoever is involved.
- 4) No access to material test results, used during construction due to inadequate good laboratory to carried out the test.
- 5) No access to working drawings.
- 6) No access to site supervisors hand book to verify the level of instruction/supervision.
- 7) At times NBRRI staff received “threat to life” when indicating recommendations are made.

3.2. Structural Integrity Assessment and Building Collapse Mitigation: A Perspective from NBRRI

NBRRI has emphasized the critical importance of con-

ducting Structural Integrity Assessments (SIA) on all existing structures and ongoing construction projects where necessary. Structural Integrity Assessment is defined as the systematic process of evaluating the reliability of a structure to sustain current and anticipated loads over a specified period, while effectively fulfilling its intended functions. NBRRI further underscores that a thorough evaluation of both the structural integrity and the remaining service life of buildings is essential. This is not only to safeguard public safety and environmental sustainability but also to inform economically sound decisions regarding the construction of new structures, as well as the maintenance and rehabilitation of existing ones. To ensure that structures maintain adequate integrity, NBRRI advocates for consistent and periodic inspections. These inspections serve as a proactive measure to detect potential failures and ensure continued serviceability.

A key component of SIA is the application of Non-Destructive Testing (NDT) techniques. NDT offers a relatively swift and cost-effective method for assessing the condition of a structure without causing damage to any part of it. These techniques utilize various technologies to detect inherent flaws or deterioration resulting from usage, thereby enabling informed decisions about structural health without compromising the structure itself. In support of these recommendations, NBRRI has proposed a framework for building collapse mitigation, which is illustrated in Figure 5.

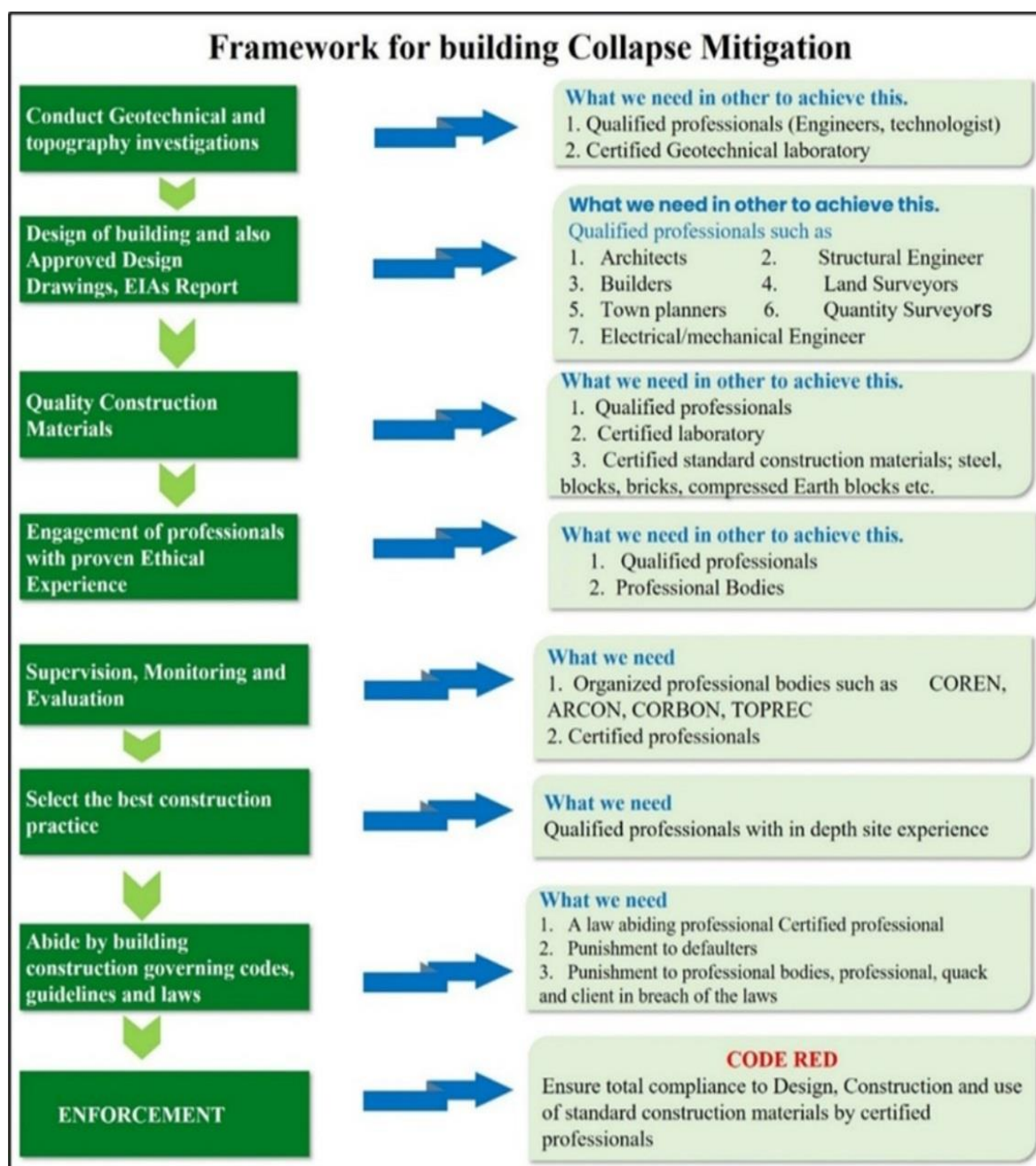


Figure 5. NBRRI Framework for building collapse mitigation.

3.3. Strategies for Minimizing Building Collapse in Nigeria: A Multi-Stakeholder Approach

Minimizing the incidence and impact of building collapse in Nigeria necessitates a comprehensive strategy that integrates proactive planning, strict regulatory enforcement, and widespread public engagement. The government, as a central stakeholder, can play a pivotal role in mitigating building failures through the following key interventions:

- 1) **Enforcement of Building Codes and Regulations:** Ensuring strict compliance with the National Building Code and relevant local regulations is essential. This

includes periodic updates to building codes to reflect evolving safety standards and the adoption of innovative construction technologies.

- 2) **Capacity Building and Professional Training:** Continuous education and training programs should be provided for construction professionals—architects, engineers, builders, and artisans. A robust certification and licensing framework must be implemented to ensure that only qualified individuals are engaged in construction activities.
- 3) **Monitoring and Supervision:** Regular site inspections are necessary to verify adherence to approved building standards. Additionally, stringent supervision and audit

mechanisms should be established to detect and correct deviations from approved construction plans.

- 4) Public Awareness and Education: Public awareness campaigns are vital to educate citizens on the importance of building safety and the risks associated with sub-standard construction. Community engagement initiatives should promote compliance with safety standards, especially in self-built housing projects.
- 5) Penalties and Legal Enforcement: Developers and contractors who violate building codes should face substantial fines and penalties. Legal action must be taken against individuals responsible for negligent construction practices and incidents of building collapse.
- 6) Funding and Incentives: Financial support should be provided to encourage the use of high-quality materials and modern construction techniques. Subsidies for essential pre-construction assessments, such as soil testing, can further promote safe building practices.
- 7) Research and Development: Investment in research focused on improving building materials, construction methodologies, and safety protocols is crucial. Collaboration with academic institutions, research bodies, and industry experts can foster innovative solutions to enhance structural safety.

By implementing these measures, stakeholders across the construction industry can significantly reduce the risk of building collapse and contribute to the development of safer, more resilient infrastructure in Nigeria.

4. Conclusion

The early detection and identification of potential causes of building collapse through mandatory, periodic, or conditional Structural Integrity Assessments (SIA) is a critical strategy in preventing recurrent structural failures and mitigating the associated loss of life and property. The absence of routine structural assessments has historically undermined effective property management, rendering it incapable of curbing catastrophic building failures. Importantly, the requirement that any structure failing a mandatory integrity test be subject to demolition serves as a powerful deterrent. This legal consequence would compel stakeholders including clients, builders, and contractors to adhere strictly to construction standards and execute their responsibilities with diligence. To ensure effective implementation and compliance, it is imperative that the Structural Integrity Assessment Report be enshrined in law, making it a statutory requirement both prior to occupancy and throughout the lifespan of a building. Such legal backing would institutionalize accountability and reinforce the culture of safety within the construction industry. Above all, strict adherence to the provisions of the National Building Code by all relevant stakeholders remains fundamental. Compliance with these standards is essential to fostering a safe, resilient, and sustainable built environment in Nigeria.

Abbreviations

AEC	Architectural, Engineering, and Construction
BIM	Building Information Modeling
NBRRI	Nigeria Building and Road Research Institute
NDT	Non-Destructive Testing
SIA	Structural Integrity Assessments

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Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Ajayi, T. O., Adhuzo, O. O., & Nwako, B. A. (2023), "Examining causes and solutions for building collapse in Nigeria: A review". International Research and Engineering Journal. Retrieved from <https://www.irejournals.com/formatedpaper/1706301.pdf>
- [2] Ayedun, C. A., Oloyede, S. A., Durodola, D. O., Adedoyin, A. A., & Ogunde, A. O. (2018), "Building failure and collapse: A framework for tackling its scourge in Nigeria". International Journal of Mechanical Engineering and Technology, 9(9), pp 395–404.
- [3] Orikpete, O. F., & Ewim, D. R. E. (2023), "Investigating the root causes of recurring building collapse in Nigeria: A systematic review and meta-analysis". Journal of Earth & Environment Science, pp 61–70.
- [4] Ekundayo, O. O. (2023), "Building failure crisis in Nigeria: Addressing causes, prevalence and solutions". World Journal of Engineering Research and Technology, 9(12), pp 82–93. Retrieved from <https://www.wjert.org/download/article/72112023/1701852067.pdf>
- [5] Ekponyoh, U. D., George, W. K., Etuk, E. R., Elijah, E. S., & Kabari, A. D. (2025), "Building collapse in Abuja and Lagos between 1984 and 2023: Assessing structural vulnerabilities to prevent reoccurrence". World Journal of Innovative Management and Technology, 9(2), pp 1–27. <https://doi.org/10.56201/wjimt>
- [6] Qurix, W. B., & Doshu, R. G. (2020), "Mitigating building collapse in Nigeria". ARTEKS Journal, 5(3). <https://doi.org/10.30822/arteks.v5i3.596>
- [7] Olagunju R. E., Aremu S. C. and Ogundele J. (2013), "Incessant Collapse of Buildings in Nigeria: An Architect's View". Civil and Environmental Research 3(4), pp 49 –54.

- [8] Ede, A. N. (2010), "Building Collapse in Nigeria: The trend of casualties in the last decades (2000-2010)". *International Journal of Civil and Environmental Engineering IJCEE-IJENS*, 10(6), pp 32–42.
- [9] Ayinuola, A. J., & Olalusi, O. O. (2004), "Assessment of Building failures in Nigeria: Lagos and Ibadan case study". *African Journal of Science and Technology*, 5, pp 73–78.
- [10] Adebawale, P. A., Gambo, M. D., Ankeli, I. A., & Daniel, I. D. (2016), "Building Collapse in Nigeria: Issues and Challenges". In *Proceeding of the International Journals of Art and Sciences* (pp 99–108).
- [11] Oloyode, S. A Omogun, C. B and Akinjare, O. A (2010), "Tracking Causes of Building Collapse in Nigeria". *Journal of sustainable Development* 3 (3), PP 127-132.
- [12] Oseghale, G. E., Ikpo, I. J., & Ajayi, O. D. (2015), "Causes and Effects of Building Collapse in Lagos State, Nigeria". *Civil and Environmental Research*, 7(4), pp 34–43.
- [13] Folagbade, S. O. (2002), "Case Study of Building collapse in Nigeria". In *Proceedings on building collapse: Causes, Prevention and Remedies*, Ondo State, Nigeria: The Nigerian Institute of Building (pp 110–121).
- [14] Youdeowei, P. O. and Rowland-Lato, E. O (2019), "Geotechnical Investigation of a collapsed building site in Port Harcourt, Rivers State". *International Journal of Engineering Research Technology*, 8 (4), pp 125-136.
- [15] Chinwokwu, G. (2000), "The role of professionals in averting building collapse". *Proceedings of a workshop on Building collapse: Causes, prevention and remedies* (pp 12-28). The Nigerian Institute of Building, Lagos State.
- [16] Olagunju, R. E. (2011), "Development of Mathematical Models for the Maintenance of Residential Buildings in Niger State, Nigeria", Ph.D (Architecture) Thesis, Department of Architecture, Federal University of Technology, Minna, Nigeria.
- [17] Fagbenle O. I. and Oluwunmi A. O. (2010), "Building Failure and Collapse in Nigeria: The Influence of the Informal Sector". *Journal of Sustainable Development* 3(4), pp. 268–276.
- [18] Babalola H. I. (2015), "Building Collapse: Causes and Policy Direction in Nigeria". *International Journal of Scientific Research and Innovative Technology* 2(8), pp 1-8
<https://core.ac.uk/download/pdf/234683168.pdf>
- [19] Chendo, I. G. and Obi, N. I. (2015) "Building Collapse in Nigeria: The Causes, Effects, Consequences and Remedies" *International Journal of Civil Engineering, Construction and Estate Management*, Vol. 3, No. 4, pp 41-49.
- [20] Windapo, A. O., & Rotimi, J. O. (2012), "Contemporary Issues in Building Collapse and Its Implications for Sustainable Development". pp 283–299.
<https://doi.org/10.3390/buildings2030283>