Assessment Of Building Collapse Causes and Structural Safety Compliance in Nigeria

Akwenuke, O.M
Department of Civil and Water Resources Engineering Southern Delta University, Ozoro, Nigeria

***Abstract*—Building collapse has become a major challenge affecting the construction industry in Nigeria, resulting in loss of lives, destruction of property, economic losses, and reduced public confidence in structural safety practices. Rapid urbanization, poor construction practices, use of substandard materials, inadequate supervision, noncompliance with building regulations, and weak enforcement of structural safety standards have contributed significantly to increasing incidents of building failure across Nigerian cities. This study assessed the causes of building collapse and the level of structural safety compliance in selected Nigerian urban centers using field surveys, structural assessments, and analysis of regulatory practices. Data were collected through site inspections, questionnaires administered to construction professionals, and review of documented building collapse cases. Structural Safety Compliance Index (SSCI), Material Quality Index (MQI), and Construction Supervision Index (CSI) were computed to evaluate compliance levels and construction quality. Results revealed that poor structural design, inadequate supervision, use of low-quality construction materials, and violation of building approval regulations were major contributors to building collapse. Strong positive relationships were observed between structural safety compliance and building performance (r = +0.87), while poor material quality exhibited a strong negative relationship with structural stability (r = −0.82). Buildings constructed without proper professional supervision recorded significantly higher structural defects compared with professionally supervised structures. The findings demonstrate that weak enforcement of building regulations and poor compliance with structural safety standards significantly contribute to building collapse in Nigeria. Effective regulatory enforcement, professional supervision, quality control of construction materials, and public awareness are essential for improving structural safety and reducing building collapse incidents.**

***Index Terms*—Building collapse, Structural safety, Construction failure, Building regulations, Nigeria, Structural compliance**

I. INTRODUCTION

Building collapse has become one of the most serious challenges facing the construction industry in many developing countries, particularly Nigeria. Over the past decade, Nigeria has experienced a significant increase in cases of structural failure and building collapse, resulting in loss of lives, destruction of property, displacement of residents, financial losses, and public distrust in the construction sector (Windapo & Rotimi, 2016; Ede, 2017). The increasing frequency of building collapse incidents has raised concerns among engineers, architects, urban planners, policymakers, and the general public regarding the effectiveness of structural safety practices and regulatory enforcement in the Nigerian construction industry.

A building collapse refers to the partial or total structural failure of a building resulting from the inability of structural elements to withstand imposed loads, environmental conditions, and operational stresses. Structural failure may occur during construction, immediately after completion, or after years of occupancy depending on the nature and severity of structural deficiencies (Omenihu et al., 2016). Building collapse is often associated with multiple interacting factors including poor structural design, inadequate supervision, use of substandard construction materials, weak foundations, noncompliance with building regulations, overloading, environmental influences, and poor maintenance practices (Alabi & Fadamiro, 2020; Oyedele et al., 2018).

Nigeria's rapidly increasing urban population has intensified demand for housing, commercial buildings, and urban infrastructure. Major cities such as Lagos, Abuja, Port Harcourt, Kano, and Ibadan have experienced rapid urban expansion and extensive construction activities over the past few decades (Afolabi et al., 2019). However, urban growth has often occurred faster than the development of regulatory frameworks, quality control systems, and professional supervision mechanisms required for ensuring structural safety. Consequently, many buildings are constructed without adequate compliance with approved engineering standards and building regulations (Windapo & Rotimi, 2016).

Poor construction practices remain one of the leading causes of building collapse in Nigeria. In many cases, contractors and developers fail to adhere to approved structural designs and engineering specifications during construction. Structural components such as beams, columns, slabs, and foundations are frequently poorly reinforced or improperly constructed, thereby reducing the load-bearing capacity and overall stability of buildings (Ede, 2017; Oloyede et al., 2019). Inadequate concrete mixing ratios, insufficient curing, poor workmanship, and improper reinforcement detailing significantly weaken structural integrity and increase vulnerability to failure.

The use of substandard construction materials is another major factor contributing to structural failure in Nigeria. Inferior cement, weak reinforcement bars, poor-quality aggregates, and defective building components reduce the strength and durability of structures (Akinpelu et al., 2020). Material quality testing is often neglected due to cost-saving practices, corruption, and weak enforcement of construction standards. In some instances, locally fabricated reinforcement bars fail to meet required engineering specifications, thereby compromising the structural performance of buildings (Fagbenle & Oluwunmi, 2017).

Inadequate professional supervision during construction activities also contributes significantly to building collapse. Many construction projects are executed without proper supervision by qualified engineers, architects, builders, and quantity surveyors. The involvement of unqualified personnel, commonly referred to as quacks, often results in poor workmanship, deviation from approved structural drawings, and violation of safety standards (Omenihu et al., 2016; Alabi & Fadamiro, 2020). Buildings constructed without professional supervision are more likely to develop structural defects that may eventually lead to collapse.

Noncompliance with building codes and development control regulations remains a critical challenge in Nigeria's construction sector. Building regulations provide standards for structural design, material selection, construction procedures, and safety requirements necessary for ensuring public safety and structural stability (Afolabi et al., 2019). However, enforcement of these regulations remains weak in many Nigerian cities due to institutional inefficiency, corruption, political interference, and inadequate monitoring capacity (Oseghale et al., 2015). Unauthorized building modifications, illegal conversion of residential buildings into commercial facilities, and construction without approval are common practices that compromise structural safety.

Geotechnical and environmental conditions also influence structural performance and building stability. Poor soil conditions, inadequate geotechnical investigations, foundation settlement, erosion, flooding, and groundwater fluctuations contribute significantly to structural instability in many parts of Nigeria (Oyedele et al., 2018; Ede et al., 2020). Coastal and flood-prone regions such as Lagos and the Niger Delta are particularly vulnerable because of weak subsoil conditions, high groundwater tables, and environmental degradation associated with urbanization and climate change.

Overloading of buildings is another major cause of structural failure in Nigeria. Buildings designed for specific load capacities are often subjected to excessive loading due to unauthorized addition of extra floors, installation of heavy machinery, storage of excessive materials, or conversion of residential buildings into commercial structures (Ede, 2017). Such practices increase stress on structural components and may eventually lead to collapse when the structural load-bearing capacity is exceeded.

Corruption and weak institutional enforcement further aggravate building safety challenges in Nigeria. In many cases, building approvals are granted without proper review of structural drawings and engineering calculations. Inadequate inspection

of construction activities allows developers to violate approved standards without sanctions (Akinpelu et al., 2020). Weak regulatory systems and poor coordination among development control agencies significantly reduce the effectiveness of structural safety enforcement.

Several catastrophic building collapse incidents have occurred across Nigeria in recent years. Lagos State records the highest number of building collapse cases because of its rapid urbanization, intense construction activities, and high population density (Afolabi et al., 2019). Incidents such as the collapse of multi-storey buildings in Ikoyi, Lagos, Abuja, and Port Harcourt have resulted in substantial fatalities and economic losses. Similar patterns have been reported in other developing countries where weak regulatory systems and poor construction practices contribute to structural disasters (Fagbenle & Oluwunmi, 2017).

The socioeconomic implications of building collapse are severe. Structural failure results in loss of investments, increased construction and rehabilitation costs, homelessness, injuries, and fatalities (Oseghale et al., 2015). Building collapse also creates psychological trauma for victims and affected communities. Frequent structural failures reduce public confidence in the construction industry and discourage investment in real estate and infrastructure development.

Building collapse additionally affects national economic growth and sustainable urban development. Resources that could have been utilized for infrastructure expansion and social services are often diverted toward rescue operations, compensation, demolition, and reconstruction of failed structures (Akinpelu et al., 2020). Insurance costs associated with structural failure also increase significantly in environments characterized by poor safety compliance.

Structural safety compliance is therefore essential for ensuring building durability, public safety, and infrastructure sustainability. Compliance involves adherence to approved structural designs, quality control of materials, proper supervision, geotechnical assessment, and conformity with building regulations and professional standards (Windapo & Rotimi, 2016). Effective structural safety compliance requires collaboration among engineers, architects, builders, urban planners, regulatory agencies, contractors, and property developers.

Recent studies have highlighted the growing importance of strengthening structural safety practices in Nigeria. Oloyede et al. (2019) observed that poor quality control and inadequate supervision significantly contribute to structural defects in Nigerian buildings. Similarly, Ede et al. (2020) emphasized that improper foundation design and weak geotechnical assessment are major contributors to structural instability in flood-prone urban areas. Akinpelu et al. (2020) also reported that corruption and noncompliance with development control regulations significantly undermine structural safety enforcement in Nigeria.

Despite increasing awareness of building safety challenges, building collapse incidents continue to occur due to weak institutional capacity, inadequate professional ethics, poor regulatory enforcement, and increasing pressure for rapid urban development (Alabi & Fadamiro, 2020). Comprehensive assessments linking structural safety compliance, material quality, construction supervision, and building performance remain limited.

Therefore, this study aims to assess the causes of building collapse and evaluate the level of structural safety compliance in Nigeria by examining construction practices, material quality, professional supervision, regulatory compliance, and structural performance. The study further seeks to identify the major factors responsible for structural failure and provide recommendations for improving building safety and reducing building collapse incidents in Nigeria.

II. MATERIALS AND METHODS

Study Area

The study was conducted in selected major urban centers in Nigeria including Lagos, Abuja, Port Harcourt, Ibadan, Kano, and Enugu. These cities were selected because of their rapid urbanization, high rate of building development, increasing population density, and documented cases of building collapse over the years.

Lagos, located in southwestern Nigeria between latitude 6.45°N and longitude 3.39°E, is Nigeria's largest commercial city and records the highest number of building collapse incidents in the country due to intense construction activities and rapid urban growth. Abuja, the Federal Capital Territory,

experiences extensive infrastructure expansion and high-rise building development associated with administrative and commercial growth.

Port Harcourt, located within the Niger Delta region, is characterized by intensive industrial and residential construction activities. The city experiences high rainfall, flooding, and weak soil conditions that may influence structural stability. Ibadan, Kano, and Enugu were selected because of increasing urbanization, expanding housing development, and varying geotechnical conditions influencing building performance.

The selected cities collectively represent different climatic conditions, construction practices, urbanization patterns, and geotechnical characteristics within Nigeria.

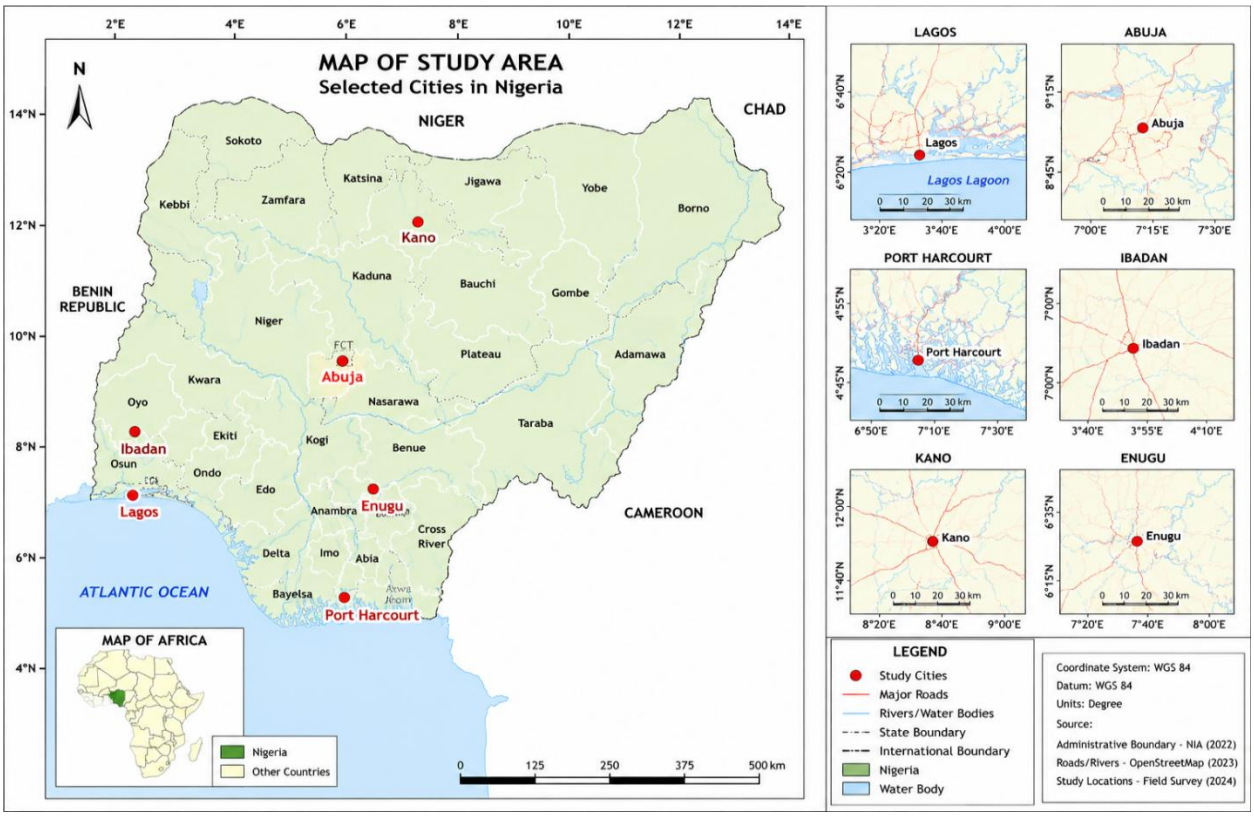

Figure 1: Map of Study Area

III. RESEARCH DESIGN

The study adopted a quantitative observational and comparative research design to assess the causes of building collapse and evaluate structural safety compliance in Nigeria. The study involved field inspections, questionnaire surveys, structural assessments, and statistical analysis of compliance indicators.

The comparative approach enabled evaluation of differences in structural safety compliance across buildings with varying construction characteristics, supervision levels, and regulatory approval status. Both primary and secondary data were utilized to ensure reliability and comprehensiveness of the study.

IV. POPULATION OF THE STUDY

The study population consisted of:

- Civil engineers
- Structural engineers
- Architects
- Builders
- Quantity surveyors
- Town planners
- Construction contractors
- Regulatory agency officials

- Property developers

The study also included selected completed and ongoing building projects within the study locations.

V. SAMPLE SIZE AND SAMPLING TECHNIQUE

A purposive and stratified sampling technique was adopted for the study. Buildings and professionals were selected based on:

- Presence of structural defects
- Construction stage
- Accessibility of building sites
- History of structural failure
- Availability of professional personnel
- Type of building construction

A total of:

- 120 construction professionals were surveyed through questionnaires
- 60 building sites were inspected
- 20 documented building collapse cases were reviewed

The sampled buildings included:

- Residential buildings
- Commercial buildings
- Institutional buildings
- Multi-storey buildings

The selection ensured adequate representation of different building categories and construction practices within the study areas.

VI. SOURCES OF DATA COLLECTION

Both primary and secondary data were utilized for the study.

Primary Data

Primary data were obtained through:

- Field inspections
- Questionnaire administration
- Structural assessment
- Site observations
- Interviews with construction professionals

Secondary Data

Secondary data were obtained from:

- Government reports
- Building regulatory agencies
- Published journals
- Conference proceedings
- Construction records
- Structural assessment reports
- Previous building collapse investigations

Field Inspection and Structural Assessment

Field inspections were conducted on selected construction sites and completed buildings to evaluate structural conditions and compliance with safety standards.

The following parameters were assessed during field inspections:

- Foundation condition
- Beam and column integrity
- Reinforcement detailing
- Concrete quality
- Structural cracks
- Building settlement
- Material storage practices
- Construction supervision
- Compliance with approved drawings
- Presence of structural modifications

Visual inspection techniques were used to identify structural defects such as:

- Cracks
- Deflections
- Settlement
- Reinforcement exposure
- Honeycombing
- Structural deformation

Photographic documentation of structural defects and construction practices was also carried out during site inspections.

Questionnaire Administration

Structured questionnaires were administered to construction professionals and regulatory officials to obtain information regarding:

- Causes of building collapse
- Structural safety practices
- Compliance with building regulations
- Material quality assessment
- Supervision practices
- Professional involvement
- Regulatory enforcement challenges

- Construction defects

The questionnaire consisted of both closed-ended and open-ended questions. Responses were measured using a five-point Likert scale ranging from:
1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly agree

Assessment of Structural Safety Compliance

Structural safety compliance was evaluated using a Structural Safety Compliance Index (SSCI). The index was developed to assess the degree of compliance with structural safety requirements and building regulations.

The SSCI was computed using:

SSCI = (BD + MQ + PS + RC) / 4

Where:

- SSCI = Structural Safety Compliance Index
- BD = Building design compliance score
- MQ = Material quality score
- PS = Professional supervision score
- RC = Regulatory compliance score

The SSCI values ranged from 0 to 1, where:

SSCI Range	Compliance Level
0.00–0.30	Very poor compliance
0.31–0.50	Poor compliance
0.51–0.70	Moderate compliance
0.71–1.00	High compliance

Buildings with higher SSCI values were considered structurally safer and more compliant with approved standards.

Material Quality Assessment

Construction material quality was assessed through visual inspection, laboratory testing records, and professional evaluation.

The following materials were evaluated:

- Cement
- Reinforcement bars
- Concrete aggregates
- Sandcrete blocks
- Structural steel
- Timber components

The Material Quality Index (MQI) was computed using:

MQI = (CS + RS + BS + AG) / 4

Where:

- CS = Cement quality score
- RS = Reinforcement quality score
- BS = Block strength score
- AG = Aggregate quality score

Material quality assessment considered:

- Compliance with engineering standards
- Physical appearance
- Compressive strength
- Durability
- Storage condition

Construction Supervision Assessment

Construction supervision practices were evaluated using the Construction Supervision Index (CSI).

The CSI was computed using:

CSI = (PI + SI + QC) / 3

Where:

- PI = Professional involvement score
- SI = Site inspection score
- QC = Quality control score

The assessment focused on:

- Frequency of site inspections
- Presence of qualified professionals
- Quality control procedures
- Adherence to approved structural drawings
- Documentation practices

Review of Building Collapse Cases

Documented building collapse cases within the selected cities were reviewed to identify common causes and structural deficiencies associated with collapse incidents.

The review considered:

- Building type
- Number of floors
- Structural defects
- Construction stage
- Cause of collapse
- Fatalities and injuries
- Regulatory approval status
- Supervision records

This analysis helped identify recurring patterns and major contributors to structural failure in Nigeria.

Geotechnical Assessment

Soil and foundation conditions were evaluated through review of geotechnical reports and field observations.

The following geotechnical factors were considered:

- Soil type
- Bearing capacity
- Groundwater level
- Settlement characteristics
- Flood susceptibility
- Erosion conditions

Particular attention was given to coastal and flood-prone areas such as Lagos and Port Harcourt where weak subsoil conditions significantly affect structural stability.

Statistical Analysis

Descriptive statistical methods including mean values, percentages, standard deviation, and frequency distribution were used to summarize data obtained from questionnaires and structural assessments.

Pearson correlation analysis was conducted to evaluate relationships among:

- Structural safety compliance and building performance
- Material quality and structural defects
- Supervision level and structural stability
- Regulatory compliance and building failure risk

The following relationships were specifically analyzed:

- SSCI versus structural defect occurrence
- MQI versus building performance
- CSI versus structural stability
- Regulatory compliance versus collapse frequency

Correlation coefficients (r) were interpreted as follows:

Correlation Range	Interpretation
0.00–0.30	Weak relationship
0.31–0.50	Moderate relationship
0.51–0.70	Strong relationship
0.71–1.00	Very strong relationship

Tables, charts, and comparative analyses were used to present results and evaluate structural safety conditions across the selected study locations.

Ethical Considerations

Permission was obtained from relevant construction firms, regulatory agencies, and property owners before conducting site inspections and questionnaire administration.

Information obtained from respondents and construction sites was treated confidentially and used strictly for academic and research purposes.

VII. LIMITATIONS OF THE STUDY

The study was limited by restricted access to some construction sites and incomplete documentation of certain building collapse cases. Some respondents were also reluctant to disclose detailed information regarding regulatory violations and construction practices.

Despite these limitations, the combination of field inspections, questionnaire surveys, structural assessments, and case study analysis provided sufficient information for evaluating building collapse causes and structural safety compliance in Nigeria.

VIII. RESULTS AND DISCUSSION

Structural Safety Compliance and Building Performance

The assessment revealed considerable variation in structural safety compliance among the selected Nigerian cities. Buildings constructed under proper professional supervision and in compliance with approved building regulations exhibited significantly better structural stability and lower defect occurrence compared with buildings developed without adequate supervision or regulatory approval.

Lagos recorded the highest number of observed structural defects and documented collapse cases due to rapid urbanization, intense construction activities, and high population pressure. Field inspections showed that several buildings exhibited cracks, beam deflections, foundation settlement, reinforcement exposure, and poor concrete finishing. Similar findings were reported by Windapo and Rotimi (2016), who observed that rapid urban expansion and

weak regulatory enforcement contribute significantly to structural failure in Lagos State.

Abuja recorded relatively higher structural compliance levels because of stricter development control practices within planned districts. However, rapidly developing peri-urban settlements around Abuja showed increasing cases of noncompliance with building regulations and inadequate professional supervision. This finding agrees with Akinpelu et al. (2020), who reported that urban expansion beyond planned city centers often reduces the effectiveness of regulatory monitoring and compliance enforcement.

Port Harcourt and Ibadan also exhibited moderate to high levels of structural defects associated with poor drainage conditions, weak soil characteristics, flooding, and inadequate quality control practices. In Port Harcourt, high groundwater levels and poor soil conditions contributed to foundation instability and structural settlement. Similar observations were made by Oyedele et al. (2018), who identified geotechnical and environmental factors as major contributors to structural instability in flood-prone Nigerian cities.

Table 1. Structural Safety Compliance Indicators

City	SSCI	MQI	CSI	Major Structural Defects Observed
Lagos	0.38	0.42	0.35	Cracks, settlement, beam deflection
Port Harcourt	0.46	0.49	0.43	Foundation instability, wall cracks
Ibadan	0.51	0.55	0.50	Structural cracks, reinforcement exposure
Kano	0.58	0.61	0.56	Minor settlement, material defects
Enugu	0.62	0.64	0.60	Moderate wall cracking
Abuja	0.71	0.73	0.70	Minor structural defects

The Structural Safety Compliance Index (SSCI) results indicate that Lagos recorded the lowest compliance level among the studied cities. The low SSCI value reflects poor adherence to approved building designs, inadequate supervision, and weak enforcement of development control regulations. Similar findings were reported by Alabi and Fadamiro (2020), who observed that noncompliance with structural safety standards significantly contributes to building collapse in Nigeria.

The relatively higher SSCI value recorded in Abuja indicates better regulatory enforcement and construction supervision practices within the Federal Capital Territory. However, the presence of minor structural defects suggests that structural safety challenges still exist despite improved compliance levels.

The Material Quality Index (MQI) results further demonstrate that poor material quality contributes significantly to structural instability. Buildings constructed with low-quality cement, reinforcement bars, and sandcrete blocks exhibited greater structural deterioration and defect occurrence. Fagbenle and Oluwunmi (2017) similarly reported that substandard construction materials significantly weaken building durability and structural integrity in Nigeria.

Causes of Building Collapse

Questionnaire responses and structural assessments identified poor construction practices, use of substandard materials, inadequate supervision, and noncompliance with building regulations as the major causes of building collapse in Nigeria.

Table 2. Major Causes of Building Collapse

Cause of Collapse	Mean Score	Rank
Poor construction practices	4.78	1st
Use of substandard materials	4.65	2nd
Inadequate professional supervision	4.52	3rd
Noncompliance with building regulations	4.48	4th
Poor foundation design	4.31	5th
Structural overloading	4.18	6th
Corruption and weak enforcement	4.12	7th
Environmental factors	3.95	8th

Poor construction practices recorded the highest mean score, indicating that improper execution of structural works significantly contributes to building failure. Structural components such as beams, columns, and slabs were often poorly reinforced or improperly constructed. Similar findings were reported by Ede (2017), who emphasized that poor

workmanship and inadequate construction procedures are major contributors to structural collapse in Nigeria.

The use of substandard materials ranked second among the identified causes of collapse. Construction professionals reported that low-quality reinforcement bars, weak concrete mixtures, and poor sandcrete blocks significantly reduce structural strength. Oloyede et al. (2019) similarly observed that poor material quality is a major factor responsible for structural defects and collapse in Nigerian buildings.

Inadequate professional supervision ranked third among the major causes of building collapse. Many construction sites lacked qualified engineers and builders responsible for ensuring adherence to approved structural designs. Omenihu et al. (2016) similarly reported that involvement of unqualified personnel in construction activities contributes significantly to structural failure in Nigeria.

Noncompliance with building regulations also recorded a high mean score. Unauthorized modifications, illegal construction practices, and failure to obtain development approval were common among collapsed buildings reviewed during the study.

Structural Defects Observed During Field Inspection

Field inspections revealed several structural defects in both ongoing and completed buildings.

Table 3. Structural Defects Identified in Buildings

Structural Defect	Frequency (%)
Wall cracks	82
Foundation settlement	68
Reinforcement exposure	61
Beam deflection	54
Concrete honeycombing	49
Roof deformation	38
Column cracking	35
Structural tilting	21

Wall cracks were the most frequently observed structural defect. These cracks may result from poor concrete quality, foundation settlement, thermal stress, or structural overloading. Similar findings were reported by Ede et al. (2020), who identified cracking as one of the earliest indicators of structural instability in Nigerian buildings.

Foundation settlement was also common, particularly in flood-prone and coastal areas such as Lagos and Port Harcourt. Weak soil conditions and inadequate geotechnical investigations contributed significantly to foundation instability. Oyedele et al. (2018) similarly reported that poor soil conditions and groundwater fluctuations increase the likelihood of foundation failure.

Reinforcement exposure and concrete honeycombing were frequently observed in poorly supervised construction sites. These defects indicate inadequate concrete cover, poor compaction, and poor workmanship during construction.

Influence of Material Quality on Structural Stability

Material quality assessment revealed strong relationships between material performance and structural safety.

Table 4. Relationship Between Material Quality and Structural Defects

Material Parameter	Correlation with Structural Defects (r)
Cement quality	−0.81
Reinforcement quality	−0.84
Concrete strength	−0.87
Block quality	−0.76

The strong negative correlation between concrete strength and structural defects indicates that buildings constructed with stronger concrete mixtures exhibited fewer structural problems. Similar findings were reported by Fagbenle and Oluwunmi (2017), who observed that poor concrete quality significantly increases structural vulnerability in Nigerian buildings.

The strong relationship between reinforcement quality and structural performance demonstrates the importance of using standard reinforcement bars that meet engineering specifications.

Buildings constructed with low-quality blocks exhibited extensive cracking and wall instability. Poor curing methods, inadequate cement content, and improper block manufacturing practices likely contributed to reduced block strength.

Construction Supervision and Structural Stability

The Construction Supervision Index (CSI) revealed that buildings constructed under professional supervision exhibited significantly better structural performance than buildings lacking adequate supervision.

Table 5. Construction Supervision and Structural Stability

Supervision Level	Average Structural Defect Score
High supervision	1.8
Moderate supervision	3.2
Low supervision	4.7

Buildings with high supervision levels exhibited fewer structural defects because qualified professionals ensured adherence to approved designs and quality control procedures. Similar findings were reported by Omenihu et al. (2016), who emphasized that professional supervision significantly reduces structural failure risks.

Poorly supervised buildings often deviated from approved structural specifications and exhibited poor workmanship, inadequate reinforcement detailing, and weak structural connections.

Regulatory Compliance and Building Safety

The study revealed that buildings approved and regularly inspected by regulatory agencies generally performed better structurally than unapproved buildings.

Table 6. Regulatory Compliance and Collapse Risk

Approval Status	Collapse Risk Score
Approved and inspected	1.5
Approved but poorly inspected	3.4
Unapproved buildings	4.9

Unapproved buildings recorded the highest collapse risk because construction activities were often executed without adherence to engineering standards and building regulations. Similar observations were reported by Alabi and Fadamiro (2020), who noted that weak enforcement of development control regulations significantly contributes to building collapse in Nigeria.

Corruption, inadequate staffing, political interference, and weak institutional capacity were identified as major factors limiting effective enforcement of building regulations.

Correlation Analysis

Pearson correlation analysis revealed strong relationships among structural safety compliance, material quality, supervision practices, and building performance.

Table 7. Correlation Matrix of Key Variables

Variable Pair	Correlation Coefficient (r)
SSCI vs Building Performance	+0.87
MQI vs Structural Stability	+0.82
CSI vs Structural Performance	+0.85
Poor supervision vs Structural Defects	−0.79
Regulatory compliance vs Collapse Risk	−0.83

The strong positive relationship between structural safety compliance and building performance indicates that compliance with engineering standards significantly improves structural stability and durability.

The strong negative relationship between regulatory compliance and collapse risk demonstrates that effective enforcement of building regulations reduces structural failure occurrence.

IX. IMPLICATIONS FOR CONSTRUCTION SAFETY AND URBAN DEVELOPMENT

The findings demonstrate that building collapse in Nigeria is primarily driven by human, technical, and institutional factors rather than unavoidable natural causes. Weak regulatory enforcement, poor material quality, inadequate supervision, and noncompliance with building standards significantly compromise structural safety.

The study highlights the urgent need for improved structural safety compliance, stronger regulatory monitoring, professional ethics, quality control of

materials, and public awareness regarding safe construction practices.

Without significant reforms in construction regulation and enforcement, building collapse incidents may continue to increase alongside rapid urbanization and infrastructure expansion in Nigeria.

X. CONCLUSION

This study assessed the causes of building collapse and evaluated the level of structural safety compliance in selected Nigerian cities including Lagos, Abuja, Port Harcourt, Ibadan, Kano, and Enugu. The findings revealed that building collapse in Nigeria is strongly associated with poor construction practices, use of substandard construction materials, inadequate professional supervision, weak regulatory enforcement, and noncompliance with approved building standards.

The study demonstrated that buildings constructed without adequate structural safety compliance exhibited significantly higher levels of structural defects such as wall cracking, beam deflection, foundation settlement, reinforcement exposure, and concrete honeycombing. Lagos recorded the highest level of structural defects and collapse vulnerability due to rapid urbanization, intense construction activities, weak development control practices, and poor supervision. Abuja recorded relatively higher compliance levels because of better urban planning and regulatory monitoring, although some structural deficiencies were still observed in rapidly expanding peri-urban areas.

Material quality assessment showed that the use of inferior cement, weak reinforcement bars, low-quality blocks, and poor concrete mixtures significantly reduces structural integrity and increases the likelihood of structural failure. Buildings constructed with poor-quality materials exhibited greater structural deterioration and instability compared with buildings developed using standard engineering materials.

The study further revealed that inadequate professional supervision contributes significantly to structural defects and building collapse. Construction sites lacking qualified engineers, architects, and builders frequently deviated from approved structural designs and exhibited poor workmanship. Buildings constructed under proper professional supervision showed significantly better structural performance and lower defect occurrence.

Noncompliance with building regulations and weak enforcement of development control standards were identified as major institutional factors contributing to building collapse in Nigeria. Unauthorized building modifications, construction without approval, inadequate site inspections, and corruption within regulatory systems significantly increase structural failure risks.

Geotechnical and environmental conditions also influenced structural performance, particularly in flood-prone and coastal areas characterized by weak soil conditions and high groundwater levels. Poor foundation design and inadequate geotechnical investigation contributed to foundation settlement and structural instability in several buildings assessed during the study.

Correlation analysis demonstrated strong positive relationships between structural safety compliance, material quality, supervision practices, and building performance. The results indicate that improved regulatory compliance, quality control, and professional supervision significantly reduce the risk of structural failure and building collapse.

Overall, the study concludes that building collapse in Nigeria is largely preventable when proper engineering standards, professional ethics, quality control measures, and regulatory frameworks are effectively implemented and enforced. Sustainable urban development and public safety therefore depend on strengthening structural safety compliance, improving construction practices, and enhancing institutional capacity within the Nigerian construction industry.

XI. RECOMMENDATIONS

1. Government agencies should strengthen enforcement of building codes and development control regulations.
2. Only qualified and licensed professionals should supervise construction projects.
3. Construction materials should undergo regular quality testing before use on sites.
4. Developers should conduct proper geotechnical investigations before foundation design and construction.

5. Unauthorized building modifications and construction without approval should be strictly prohibited.
6. Regulatory agencies should increase routine inspection and monitoring of construction sites.
7. Public awareness programs on building safety and structural compliance should be intensified.
8. Sanctions and penalties should be imposed on contractors and developers violating construction regulations.
9. Continuous training and certification programs should be organized for construction professionals and artisans.
10. Sustainable and climate-resilient construction practices should be encouraged to improve structural durability and safety.

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