AMERICAN SOCIETY OF
SAFETY PROFESSIONALS

Managing Incidence of Building Collapse in Nigeria: Role of the Safety Professional

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Quest for shelter

Man naturally needs a place of abode to shelter him from the elements and dangers of his co-tenants on this earth. From time he has taken shelter in naturally occurring facilities such as caves.

As civilisation grows and population increase, man learnt to **build** his own shelter. Starting from fragile tents to huts to more robust houses that could withstand the elements and stand the test of time while providing shelter for him, his people, and his business.

Rapid population growth spurred greater demand for shelter per time and space. This stimulated housing developments in high risk types and areas of the towns and cities.

Housing development/ Real Estate became big business and then the buildings began to suffer the vagaries of business. Many buildings stand and exist while some others fail and collapse. Partial collapse or completely

This Paper

Purpose of the Paper is to examine the occurrence of incessant collapse of buildings in Nigeria from Risk Management point of view in order to identify the challenges and prescribe actionable solutions especially for the Safety Professional and to Nigeria ns at large

Value addition: Contribution to development of the safety profession and enhancement of the safety and prosperity of society

Content and Presentation Format

- Review of occurrence of building collapse in Nigeria - frequency, associated causes and consequences, and reactions.
- Overview of the commonplace building development practice in Nigeria and a brief comparison of same with best practice
- Identification of the risks factors to buildings and how to manage them.
- Recommendations to HSE professionals and by extension to Nigeria

This Paper_2

Learning outcomes

- The key takeaways include:.

1. appreciation of the impact of recurrent building collapse on the health, safety, and prosperity of the society
2. application of risk management in building lifecycle to achieve sustained longevity, safety of the building and sustained prosperity
3. actionable solutions for HSE professionals for effective and efficient participation in building development projects for the purpose of ensuring safety of persons, properties and environment.

This Paper _3

Research Methodology

In this research, incidence of collapse of buildings in Nigeria in recent past was reviewed.

Primary data

- Interviews with developers, site workers and site “engineers”
- direct observation of building development process

Secondary Data

Published journal articles, conference proceedings, academic and newspapers reports were reviewed.

Occurrence of Building Collapse

Buildings collapse occur not only in Nigeria but all over the world.

- Miami, USA – 2021 - a beachfront Condo suddenly collapsed.98 Died
- Genoa, Italy - 2018- Morandi Bridge, collapsed, killing 43 people.
- Istanbul, Turkey – 2021 - building collapsed, claiming over 20 lives. .
- Port Harcourt, Nigeria - 2018, a seven-story building.
- Lagos, Nigeria - Synagogue Church of all Nations-2014 - over 115 died
- Ikoyi, Nigeria – 2021, 21-storeybuilding collapse. Casualties yet to be ascertained
- Abidjan, Cote d'ivore – March 2022, 4-storey building 5 died,15 injured
- Etc.

Occurrence of Building Collapse

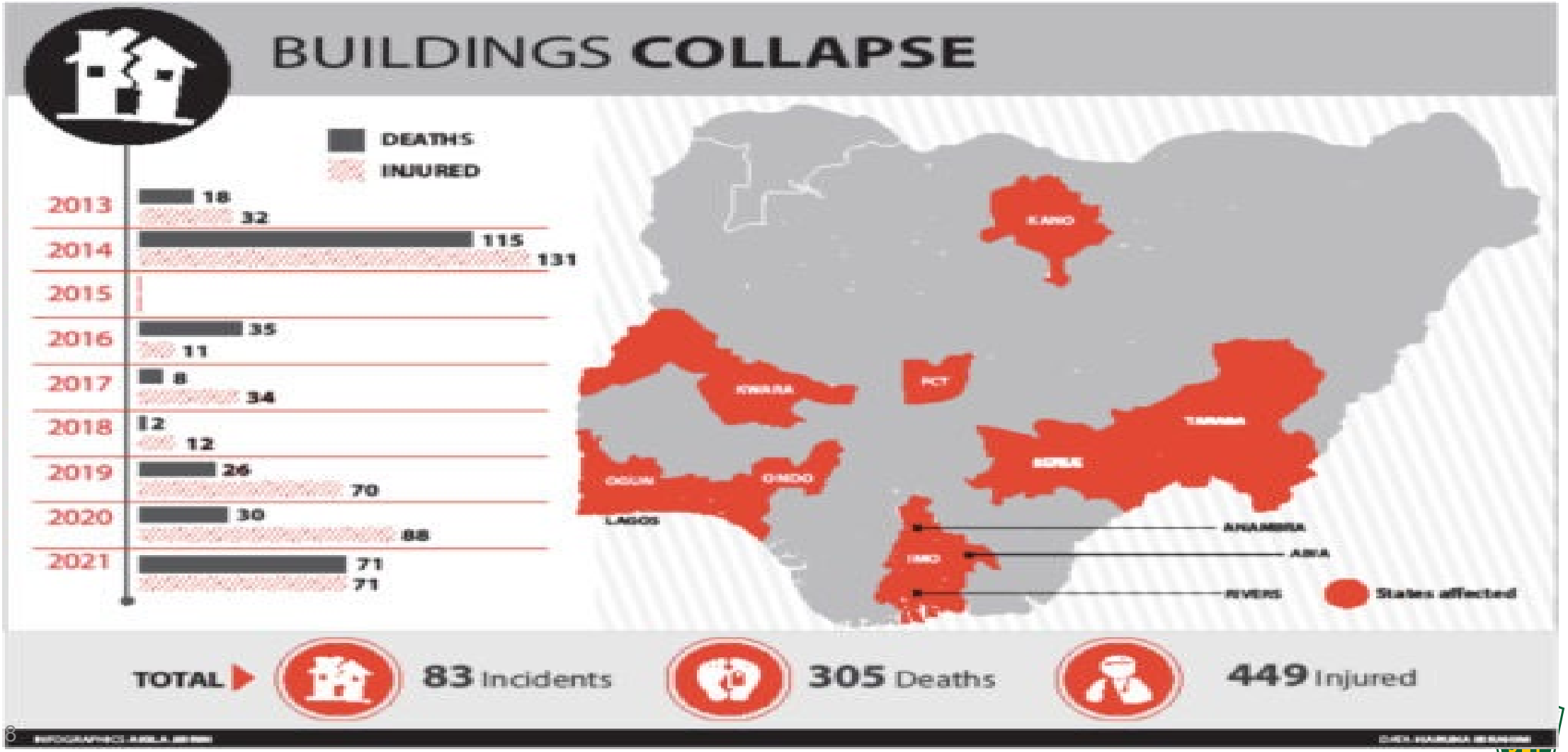
The incidence of building collapse in Nigeria in the major cities, the frequency and severity of collapse, have become cause for concern.

Several incidents - reported and unreported, total and partial collapse in Lagos, Abuja, Onitsha, Kano and Port Harcourt, etc. have become commonplace

From 1974 to July 2021, statistics show that:

- over 461 buildings have collapsed in Nigeria
- over 1,090 deaths recorded and many injured.
- Psychological trauma
- and economic losses cannot be quantified

Despite Nigeria's capacity in terms of trained relevant manpower and material resources, her construction industry does not meet necessary standards; resulting in defective buildings and consequent building collapse.


BUILDINGS COLLAPSE
DEATHS
INJURED
2013
18
32
2014
115
131
2015
2016
35
11
2017
8
34
2018
12
12
2019
24
70
2020
30
88
2021
71
71
KANO
KWARA
FCT
OGUN
OSUN
LAGOS
ANAMBRA
ABIA
RIVERS
States affected
TOTAL
83 Incidents
305 Deaths
449 Injured

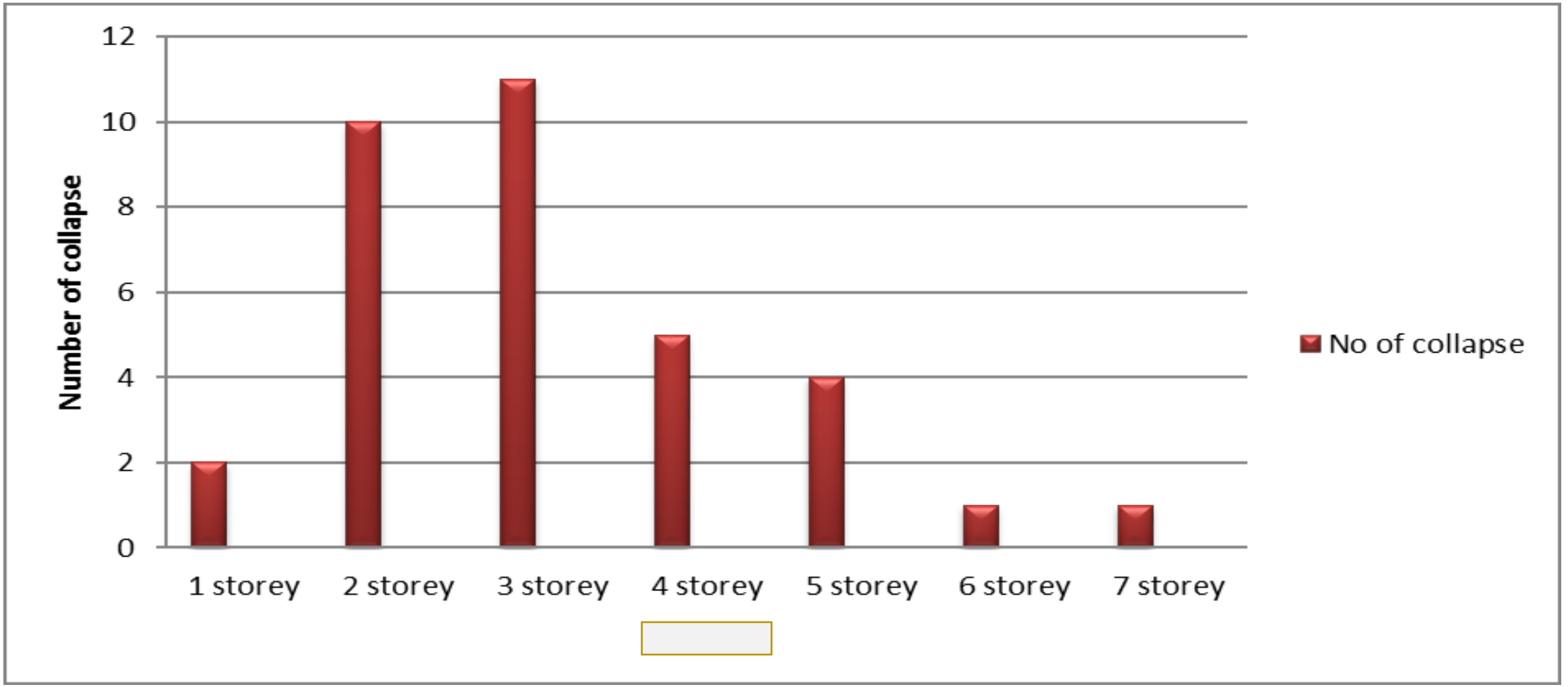
This aerial view taken on November 2, 2021, shows rubble of the 21-story building that collapsed in Ikoyi, Lagos, on November 1, 2021. A day after the disaster killed at least seven and left many more trapped. The 21-storey building was still under construction when it fell abruptly into a pile of concrete slabs. (Photo by Benson Ibeabuchi / AFP

rubble of the 21-story building that collapsed on in Ikoyi

School Building Collapse

The collapsed SCOAN Guest House 2016

A 2-storey building. Old and ill maintained



Number Collapse according to Height

Building collapse

Building - Exists to meet the shelter needs of man, his goods, and his business.

Building Collapse –

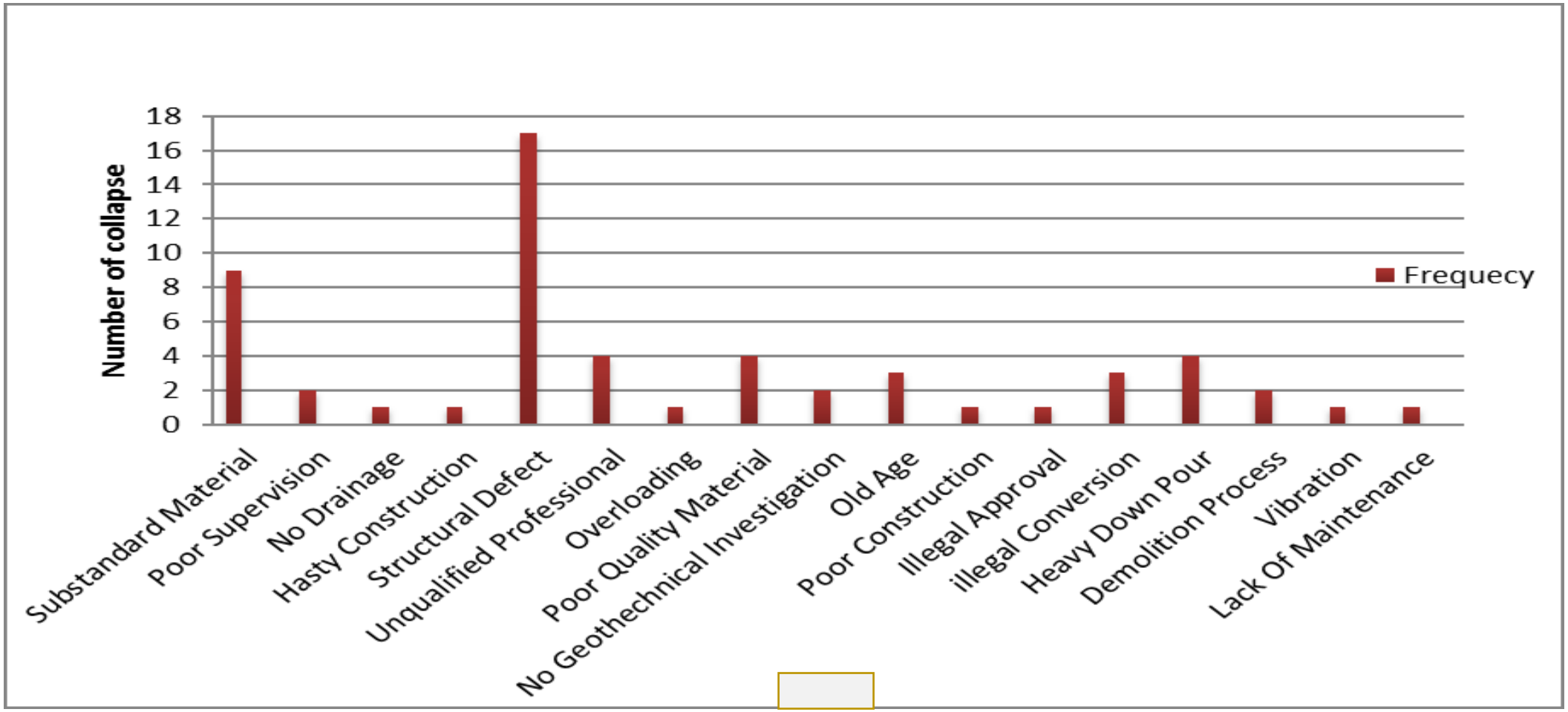
- when the structure has physically given way.
- Most of the members have failed.
- The entire Structure has partially or completely crumbled.

Collapse is a state of complete failure, the building can no longer stand as originally built (Ede, 2010).

Building Collapse : Causes

- Causes of Collapse
  - natural disasters - earthquakes, hurricanes, floods, erosion.
  - Man-made factors also known as human errors - defective design and defective construction methods.
  - unskilled workmen, use of poor quality material and lack of quality management
  - the root causes are mainly the non-enforcement of existing laws and endemic poor work ethics of Nigerians (QED)

A building, once properly constructed is expected to be in use for a very long time.



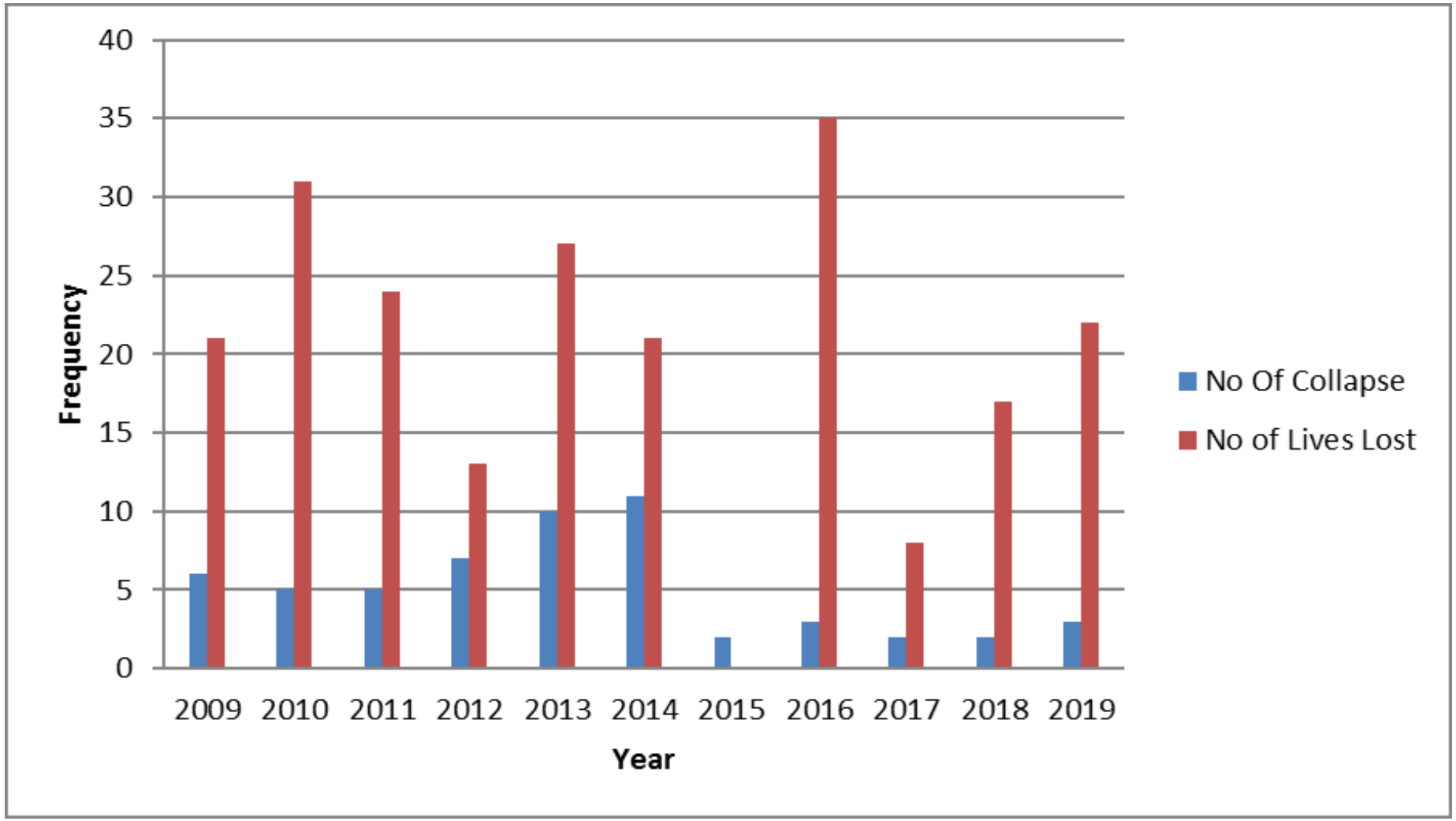
Collapse according to hazard type/causes

Impact of Building Collapse in Nigeria

The consequences are negative social and economic impacts

- Irreparable: Fatalities and injuries
- Economic waste in terms of: loss of properties, investments, jobs, incomes,
- Social/Psychologic: exasperation among the stakeholders and mental stress and trauma
- Environmental damage.

Leaving aside the grossly quantifiable economic sums, the stress, trauma and shocks may have some far-reaching effects upon the building owner and/or employees, occupants, and others stakeholders.



Frequency by Year (S. O. Odeyemi et.al. 2019)

Impact of Building Collapse in Nigeria

The consequences are negative social and economic impacts

The negative impact of such failures on the social-economic development of Nigeria's fragile economy is obvious.

The nation loses the contribution that could have come from these victims towards the socio-economic growth of the nation.

Overview of the commonplace building development practice in Nigeria

- Conception – never refined or perfected
- Design – downright amateurish, at best done by a draughtsman quacking as architect
- Approval – never sought
- Construction – just a mason who is supervised by amore experience done –claiming expertise –"we have always done it like this for years"
- Commissioning and use – use trends along with possible returns: originally a residential block, converted to school, then shops, then ..
- Retrofitting arising from change of intent/ use and/or economic considerations. Or the owner becomes richer and makes the building taller and bigger

Building development _Best Practice

Building Development – This is an engineering process and like any one of such, it is expected thatevery aspect of building development process, from the architectural designs through to the electrical, structural, mechanical engineering, construction and maintenance;

- is properly considered, planned and implemented with quality inputs by competent professionals,
- following applicable tried and tested standards and codes. by professionals in the building industry.
- It happens in stages:
  - **Pre design**
  - **Design**
  - **Construction**

Building development_2

- Conception:

1. definition of need and use including aesthetics and space allocation – the principal use of the building, appearance (façade/elevation), number of rooms to be used for what, lobbies, verandas etc.

This gives rise to Conceptual Design

- Carry out necessary studies by relevant competent Professionals with the conceptual design as major input

1. Risk Assessment - including impact from and to Other existing structures and facilities in the vicinity (Fuel Station, Markets, Power station, Airports, Rail line etc

Building development_3

Studies:

2. Environmental Assessment: Wind, River, Weather, Relief/Terrain (Erosion prone), Existing structures and Facilities
3. Soil Studies: Can the soil in the area sustain the building? What need to be done to enhance sustainability

This gives rise to the main Architectural Design and Structural Design

Building development_5

- Design reviews with inputs from the following :

Safety/Risks Assessment including Environmental risks assessment and Soil Studies.

This yield:

1. foundation type and design,
2. the building skeleton, reinforcements and
3. specification of types and strength of material for the building

Having finalised the architectural and structural Designs, the Mechanical and Electrical Designs start. The final Architectural and Structural designs being the main input

Building development_5

- Mechanical and Electrical Design with due cognisance of
  - Life safety codes – NFPA101
  - Local building Codes and Regulations
  - Prevention Through Design (PTD)

This yields the Utilities system-

- the Plumbing and sewerage system,
- ventilation,
- electrical piping and wiring ,etc.

Building development_6

Bill of Quantities (BoQ) –

This gives a fact based, intelligent estimate of materials and labour – quantities and costs.

- The essence is to help with planning and cash flow on the part of the developer, and on the part of the regulator, to determine the capacity of developer to carry through the development as a basis for decision to approve or not approve the design.
- **Plan Approval** with due application of necessary criteria as provided in the local Building Code and other engineering standards.. The approving authority approves the design and it is ready for Construction.

This yields Approved Design

Construction_1

1. Site clearing

Removal of items that might obstruct construction. On a large plot, mechanised equipment e.g. bulldozers, excavators, or land mowers to do the job.

2. Foundation

The foundation is the lowermost part of the building. It connects the building with the soil. It constitutes part of the building's subsurface structure..

The Foundation is the most crucial part of building structure because the other parts of the building rely on the foundation's strength to hold. Therefore it requires the best effort - material and human resources to ensure that the foundation is of utmost strength.

Construction_2

3. Plinth beam and slab

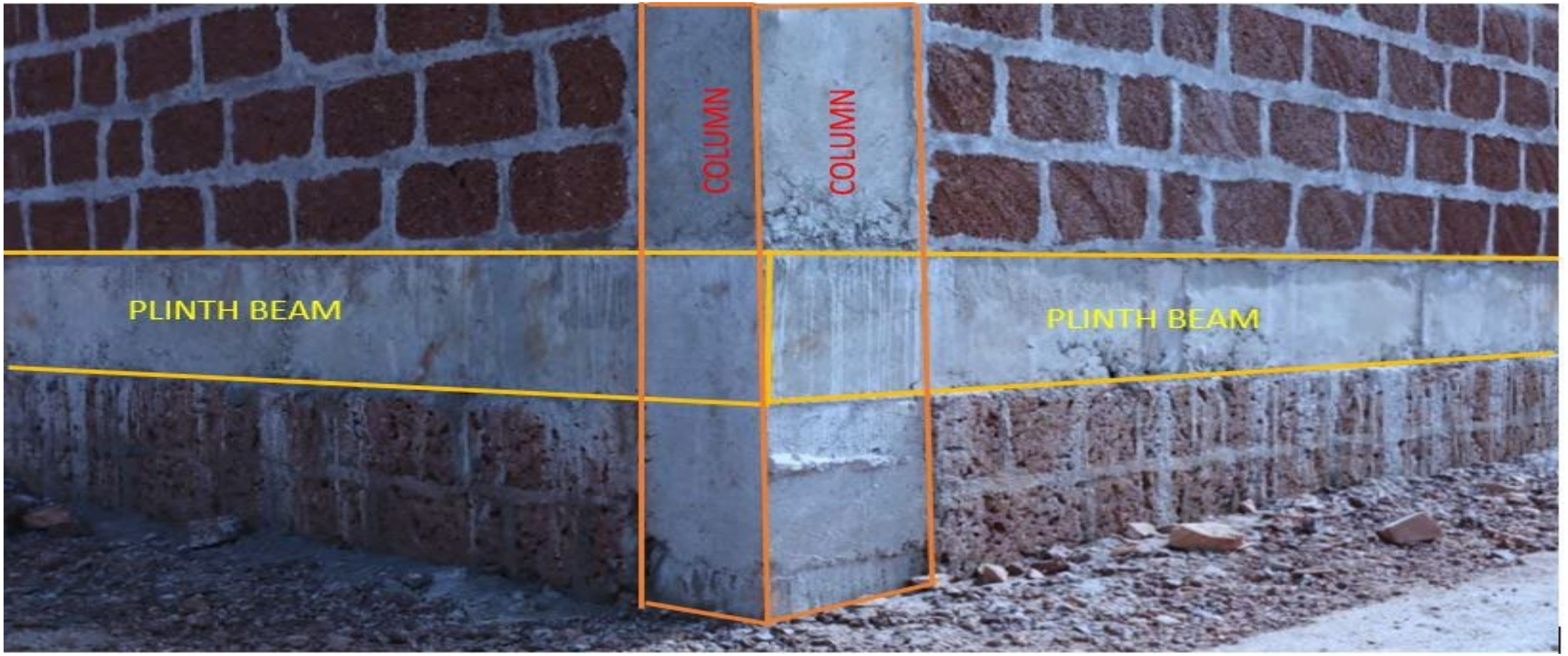
Plinth beam is **a reinforced concrete beam constructed between the wall and its foundation**.

Plinth beam is provided to prevent the extension or propagation of cracks from the foundation into the wall above when the foundation suffers from settlement. And to protect the foundation from dampness

A waterproof coating is added to stop water from entering the slab and casting.

4. Superstructure

Members of the superstructure include the column designed to strengthen the load mounted upon the building's foundation. The columns are constructed up to the slab level and frame for further construction.


COLUMN
COLUMN
PLINTH BEAM
PLINTH BEAM

Construction_3

5. Bricklaying

This is where the visible portion of the building is constructed using concrete blocks, sandcrete blocks , burnt bricks etc

according to the owner's preference and /or structure laid down by the architect in the building plan. Cement mortar is used to bind the bricks together.

6. The Lintel

the lintel is built on top of the wall. Like the plinth beam and slab, a lintel is a beam placed across door and window openings to support load of the structure that will be placed above it.

Construction_4

7. Roof –

The load that the lintel supports is the roofing structure. It is the building covering. Carpentery in most cases for residential building

8. Electrical and plumbing

Cables and pipes in most modern homes are hidden from sight between the walls and slabs; only the endpoint of the pipes and sockets are visible.

9. Exterior and interior finishing

Plastering work. A mixture of cement and sand is used to plaster the exterior part of the building to specified thickness

Plastering provides added structural strength to the building, protect it from the effect of weather, and make it look attractive.

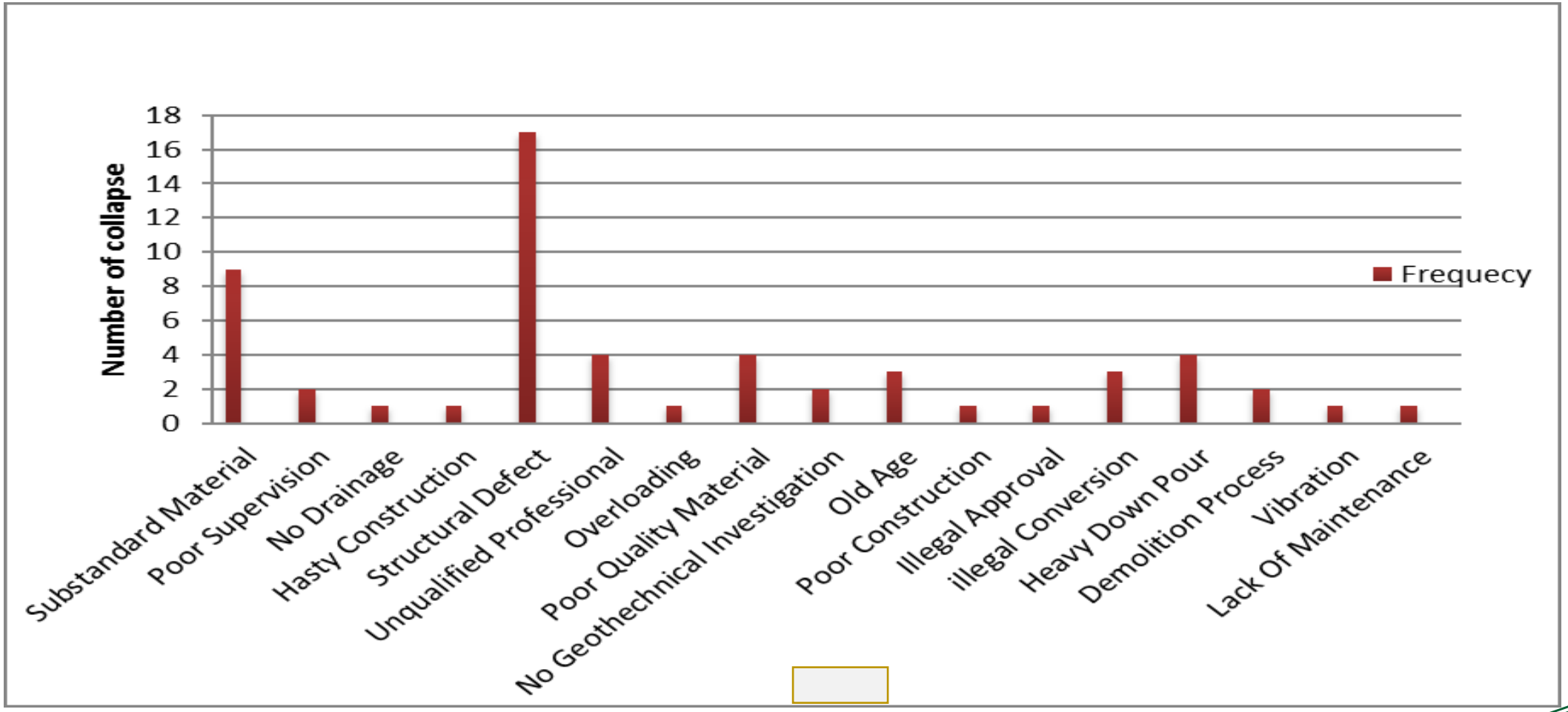
Construction_5

10. Flooring

There are various types of flooring according to their uses, economy, and owner’s preference.. Ceramic tiles, vitrified tiles, clay tiles, granite, marble, wood, are options.

11. Painting

Painting is used to beautify the building and protect is from the effects of weather



Collapse according to hazard type/causes

Risk Factors_1

Many researchers have shown that the following factors affect construction and can put the product of Construction i.e. the Building at risk;

- Building Materials – Quality, Quantity, timeous availability
- Equipment – right type, functional, and expertise to use (scaffolds, Form-works, concrete mixers, etc.)
- Manpower – right quality and mix, expertise and availability, Quackery
- Stages Management-
  - Substructure (Excavation, Foundation);
  - Superstructure,
  - Roofing etc.

Has enough time been given for transition from one stage to the other?

Risk Factors_2

- Methods –
  - Manual Concrete Mixing and pouring
  - Speed: Due to high stakes in real estate investment, the interest in completing construction tasks and projects quickly is high.
- Supervision – competence, effectiveness, efficient (only one so-called ”Engineer”)
- Costs – consequence of financial incapacity of the developer
- Environmental Risk –
  - Collateral effect of accidents such as fires, excessive vibration due to heavy construction works nearby, explosions, in the neighbourhood
  - Weather – Excessive Rain, Flooding, Wind,
  - Erosion

Risk Factors_3

Existing Buildings

- Retrofitting - without adequate risks assessment - expansion too large for Foundation to carry

"**Nigerian Factor**" – The root cause?

- failure of regulatory agencies in monitoring and enforcement,
- alleged sharp practices by representatives of regulators, and developers
- the inability of professional bodies to fulfil oversight functions,
- failure of government at different levels to prosecute offenders conclusively which is believed to help perpetuate impunity
- endemic poor work ethics of Nigerians

Risk Factors_4

Research has shown that if the factors are not properly managed, the building is at the risk of collapse whether during construction or when already in use.

Therefore, there is a critical need to mitigate these risks in order to stem the tide of Buildings collapse.

This need indicates a clear gap in the Building industry which needs to be filled in order to manage these risk factors. And the safety professional is most suited to do so

Role of the Safety Professional_1

- Role of Construction safety professionals need to expanded to cover construction quality management
- Construction safety professionals does not need become experts on quality management, but they can develop sufficient competencies to participate in and possibly lead Construction quality control aspects.
- The process of managing safety and managing quality control are very similar. Safety professionals can deliver greater value when they combine the two function in Building Construction.
- Only a little training is required and the learning curve can be very short.

Role of the Safety Professional_2

The major goal of the Role is to manage the risks factors to prevent construction defects by:

- Facilitating selection of qualified, quality-oriented Contractors/subcontractors
- Ensuring that work conforms to the contract documents and functional performance requirements;
- Ensuring that workmanship required by the contract documents is performed by knowledgeable craftspeople;
- Ensuring performance of timely inspections and tests (e.g. by contractor personnel, third-party personnel);
- Gain control over processes by working with employees and managers to identify and eliminate process problems

Role of the Safety Professional_3

What quality management tasks would a construction safety professionals perform in Construction?

- **Pre- design and design**

Participate fully in the pre-design, design and design review phases of Building project (including selection of Contractors) to ensure compliance with all standards, local codes and regulations geared towards ensuring stability and longevity of the final product – the Building.

Participation here is very crucial because this is the point where success or failure of the building is determined.

Role of the Safety Professional_4

- **And in the field,**
  - Verify that every piece of material delivered meets project requirements
  - Perform daily/weekly audits to identify products not in conformance and ensure they are taken out
  - Carefully inspect initial work activities to make sure crews are following instructions properly from the outset to ensure that the work performed conforms to project requirements.
  - Conduct a pre-closure inspection (e.g., walls, pipe chase, utility vaults) to ensure that work performed meets project requirements before the work is enclosed by insulation or finish materials

Role of the Safety Professional_5

- **Both at Pre-design and on the field**,
- conducting required safety compliance audits/inspections and ensuring that mandated scheduled (daily, weekly, monthly, project milestone) safety checks are performed and issues identified are resolved.
- document reports and notify responsible personnel of code/rule/standard violations. And must notify regulatory authorities of such violation/noncompliance
- immediately notify the regulatory authority of conditions that could be hazardous to the building and/or the public.
- Investigate all site incidents including accidents and noncompliances and implement measures to ensure prevent reoccurrence

Project Safety Manager_1

- Safety standards, building codes, safety plans and all other safeguards put in the design and project documentation are effective only to the extent that they are followed and enforced.
- Experience has shown that it is almost always the Safety Team that is able to forestall disasters on the Site..(if safety approval is not obtained, the work or even play cannot proceed)
- Moreover, studies have indicated that workers are more comfortable when they have a supervisory figure who cares and promotes safety; as a result they are more likely to perform operations in a safe manner (Langford, Rowlinson & Sawacha, 2000).

Project Safety Manager_2

Therefore, establishing a dedicated Project Safety Manager who will be:

- responsible for all safety requirements and
- adequately empowered to enforce his decisions
- will help to address most of the risks to Buildings that may lead to collapse

The Safety Professional on Projects therefore needs to be empowered in line with his expanded role.

- The responsibility must be matched with commensurate authority and resources for him to deliver on the role

Project Safety Manager – The Person

- The individual must be a competent person who will be capable of identifying existing and predictable hazards in the surroundings and/or society, or working conditions which are hazardous or risky to buildings.
- He/she must be capable of managing risks posed by such hazards successfully.
- And he must have sufficient authority to take prompt corrective measures to eliminate the hazards

Project Safety Manager – The Person

- He/she must be;
- of the STEM – Science, Technology, Engineering, Mathematics background
- licensed by his/her relevant professional body and/or (the Nigerian authority on Buildings development - Nigeria Institute of Building?)
- must have a requisite number of years experience working on major buildings;
- And as a competitive advantage, she/he must have complete an approved course and passed a written examination administered by (the Nigerian authority on Buildings -NIoB).

Conclusion _1

- Collapse of Buildings is not peculiar to Nigeria. It happens everywhere in the World. The peculiarity with Nigeria is the frequency and severity of the incidents.
- The consequential impacts on the individual owners and stakeholders and the Nation at large is horrendous. This can be avoided.
- It is our role as safety professionals to support the Nation by deploying our expertise and efforts to identify and manage those risks factors which lead to collapse of buildings to ALARP so that the Incidence is reduced to bearable minimum.

Conclusion

- Government is urged to work harder on enforcement of the Building safety related regulations.
- Professional bodies should ensure that Quackery is eliminated from their Practice.
- The Organised Private Building Sector is advised to educate their workers and insist on doing the right thing always. it is the surest way to bigger profits
- ASSP should collaborate with ISPoN and other Safety advocate organisations to keep up the advocacy – educate the building public and keep the Regulators on their toes.

Appreciation

Many thanks
for your
attention

Questions & Contributions

This Paper

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Project Safety Manager

- Safety standards, building codes, safety plans and all other safeguards put in the design and project documentation are if only they are followed and enforced.
- Experience has shown that it is almost always the Safety Team that is able to forestall disasters on the site. (Example: My NLNG Experience: if HSEQ/2 has any objection, the work/design/activity is reconsidered and necessary measures put in place to address the concern I raised. Failing to do this, if there is any consequent issue, the noncompliant team in entirety takes the blame and are heavily sanctioned for disregarding Safety opinion)
- Moreover, studies have indicated that workers are more comfortable when they have a supervisory figure who cares and promotes safety; as a result they are more likely to perform operations in a safe manner (Langford, Rowlinson & Sawacha, 2000).

Overview of the commonplace building development practice in Nigeria (*develop slide further, Expatiate on the bullet points*)

- Conception
- Design
- Approval
- Construction
- Commissioning and use
- Retrofitting arising from change of intent/ use and/or economic considerations

FROM 1974 to July 2021, statistics show that:
over 461 buildings have collapsed in Nigeria
over 1,090 deaths recorded and many injured. Over the years:

- Lagos recorded over 295 cases,
- Abuja 16,
- Oyo, 16,
- Anambra 15,
- Kano 9,
- Ondo 10,
- Abia 9,
- Kwara 8,
- Rivers 8,
- Delta 8,
- Enugu 7,
- Ogun 7,
- Plateau 6
- Kaduna 6,
- Imo 5,
- Osun 5
- Benue 3,
- Adamawa 3, and
- Ebonyi 3
- Niger 2
- Kebbi 2,
- Ekiti 2,
- Cross River 2,
- Sokoto 1,
- Bauchi 1,
- Akwa-Ibom,
- Kogi 1