GUIDELINES ON HANDLING INFRASTRUCTURE DISASTERS IN GHANA

Abstract

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GUIDELINES ON HANDLING INFRASTRUCTURE DISASTERS IN GHANA

1. Introduction

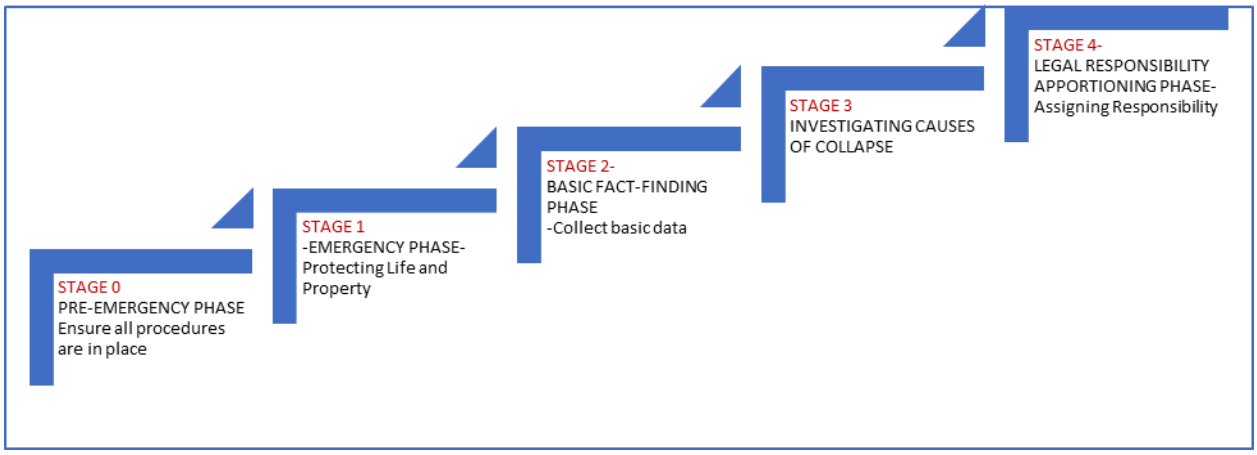
This document, by the Ghana Engineering Infrastructure Advisory Group (GEIAG), provides guidelines on how to handle infrastructure disasters in Ghana. Structural collapses have become a recurring concern in Ghana, with devastating consequences for human lives and the economy. It is, therefore, important to develop a methodology to help to first prevent such occurrences and when they do, to investigate and understand the causes, including any responsibilities or culpabilities, and finally to make recommendation on how to minimize, if not prevent any future occurrences. The GEIAG is recommending a 5-stage (Stages 0 to 4) process to address the issue of engineering infrastructure disasters. This aims to shed light on the key issues contributing to structural failures in Ghana and propose potential solutions to prevent future collapses.

The five stages are:

- **Stage 0**: The Pre-Emergency Phase where are procedures aimed at ensuring the prevention of disasters are in place.
- **Stage 1:** The Emergency Phase where in the heat of the disaster the focus is on saving and protecting lives and property.
- **Stage 2:** The Basic Fact-finding Phase where the situation allows for the collection of data concerning the disaster.
- **Stage 3:** The Investigation Phase for the cause(s) of the disaster.
- **Stage 4:** The Legal Responsibility Phase where the responsibility for the cause of the accident is determined.

The stages are outlined in Figure 1 below.

Figure 1. The 5-Stage Process for Engineering Infrastructure Disasters



2. Stage 0: The Pre-Emergency Phase

2.1 Indicators to consider for Pre-Emergency Phase

By implementing these strategies, the Engineering Council can significantly reduce the risk of failures and substandard infrastructure in the construction industry. Regular evaluation and adaptation of regulations based on lessons learned from past projects will be essential for maintaining safety and quality standards over time.

Causes of building collapse in Ghana

- Poor structural design from the use of unqualified personnel.
- Poor workmanship from use of low-skilled personnel in construction, negligence, carelessness, indiscipline, corruption, lack of supervision, lack of equipment.
- Inappropriate construction practices with limited adherence to set construction standards and regulations.
- Poor application of materials that are standard compliant.
- Use of substandard materials – due to ignorance, corruption, poverty.
- Non-adherence to approved building designs – Use of unqualified personnel with poor or no supervision, corruption.

Underlying causes of building disasters

- Ignorance of safety imperatives
- Long costly, complicated, permitting processes,
- Human and other resource problems undermine the enforcement and compliance with set construction standards and regulations. Insufficient funding, insufficient appropriately trained personnel, insufficient inspectors.
- Poverty and a belief that building construction is simple
- Poor building maintenance culture
- Phenomenon in which partially completed buildings are left to the mercy of the weather
- Change in use of buildings especially leading to heavier than expected loads
- Renovation of existing structure resulting in less stable structure
- Huge pressure created by building needs, particularly housing

2.2 Measures Required To Mitigate the Incidence of Building Collapse in Ghana

To reduce the incidence of building collapse, there is a need to ensure that all the elements and personnel involved in the construction industry are effectively regulated. This will require

collaboration with Metropolitan, Municipal and District Assemblies, Regulators and Professionals of the Built Environment, Energy Commission, Factories Inspectorate Division, and the Ghana Standards Authority.

A. **Personnel**
B. **Materials**
C. **Design**
D. **Construction Techniques**
E. **Safety Measures**

A) Personnel

Professional Licensing and Training: Require construction professionals, including architects, engineers, surveyors and contractors, to be licensed and demonstrate competence through appropriate education, training, and experience. Regularly review and update licensing requirements to reflect industry advancements.

B) Materials

The use of substandard materials has been identified as a problem in the Construction Industry.

- Engage the Ghana Standards Authority to ensure appropriate standards.
- Regulate the sale of important construction materials. Those selling construction materials must be required to register and display their certifications in their stores.
- Develop a process to approve new construction materials, methods, and technologies

C) Design

- Ghana needs comprehensive building codes and standards that cover all known types and aspects of construction. These codes also need to be regularly updated to incorporate advancements in technology and best practices.
- The Engineering Council must clearly define who can design what. Registered engineering personnel with broad knowledge of a field are not necessarily capable of all design work in the field (Civil – Structural).
- Engineering Council must establish a system of peer review in which developers are required to appoint peer reviewers. The reporting format for reviews must be predetermined by the Engineering Council and reports certified by the Reviewer. The Engineering Council must determine the qualifications required to become a reviewer.
- Develop deemed to satisfy rules for smaller buildings.
- Develop standard designs with assistance of Architects and Quantity Surveyors that will be cheaper to construct.

D) Construction Techniques

I. Regular Inspections and Certification of Building Processors

1) Regular inspections at various stages of construction to ensure compliance with building codes and standards.
2) These inspections should be carried out by qualified engineering practitioners that are knowledgeable about the construction practices and safety requirements for the type of construction being undertaken.
3) It is not feasible for District and Metropolitan Assemblies to employ personnel in sufficient numbers and of the right calibre to undertake these inspections.
4) Developers should be required to engage their own inspectors. These may be organizations or independent inspectors to provide oversight and verification of construction projects. This is especially important for major infrastructure projects.
5) The Engineering Council will need to determine the qualifications of inspectors that will be required for each type of building. Inspectors will be required to certify that the works have been completed as required.
6) The Engineering Council must determine the reporting requirements. These will necessarily be more involved for larger construction (Materials Testing, Safety Measures on Site, Environmental Considerations). These reports must be certified by the appropriate registered Engineering Personnel and submitted to the Assemblies.

II. Environmental Considerations

Encourage sustainable and environmentally friendly construction practices to minimize the negative impact on ecosystems and communities.

III. Transparency

Ensure transparency in the construction industry by making information about building codes, safety records, and regulatory compliance easily accessible to the public. Make it a requirement for Developers of major infrastructure projects to display prominently on-site names of organisations involved in a construction project.

IV. Culture of Continuous Improvement

Promote a culture of continuous improvement within the construction industry. There must be knowledge-sharing, learning from failures, and incorporating these lessons into future projects.

E) Safety Measures

I. Audit Existing Buildings

Conduct Regular audits of existing large occupancy and public buildings to ensure there are no changes in use that will adversely affect building performance, acceptable state of repair etc.

II. Public Education

Educate the public about construction standards and safety, including how to recognize and report substandard construction practices or failures. Set up anonymous reporting mechanisms to encourage whistle-blowers to come forward with concerns.

3. Stage 1: The Emergency Phase

3.1 RESPONDING TO ENGINEERING EMERGENCIES
Role of Stakeholders

Introduction

NADMO is alarmed at the spate of collapsing structures at a time the country is not experiencing natural events that trigger such occurrences. These occurrences have led to fatalities, casualties, livelihood losses and displacements across the country. To inform members of the procedures involved in search and rescue operations and the role of various stakeholders in a structural collapse incident, NADMO and Stakeholders have responded to 49 structural collapses since 2010. During this period, Search and Rescue operations have:

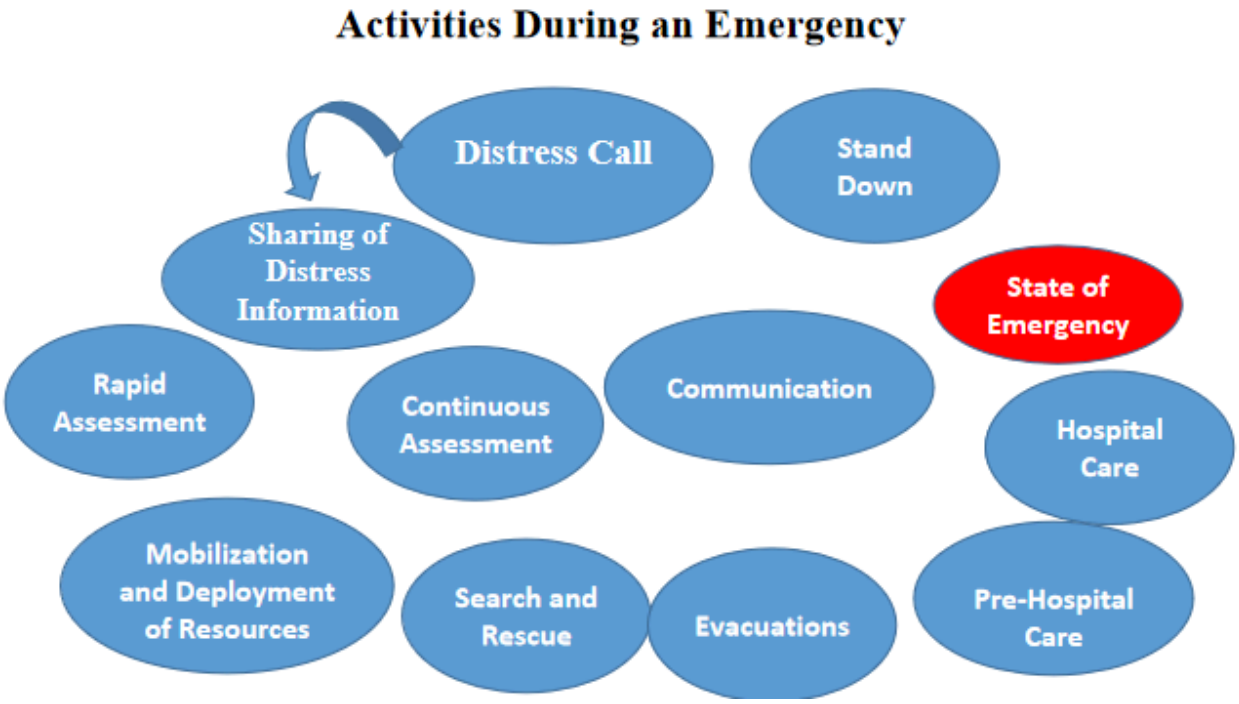
- Rescued 325 casualties.
- Recovered 92 bodies including women and children.

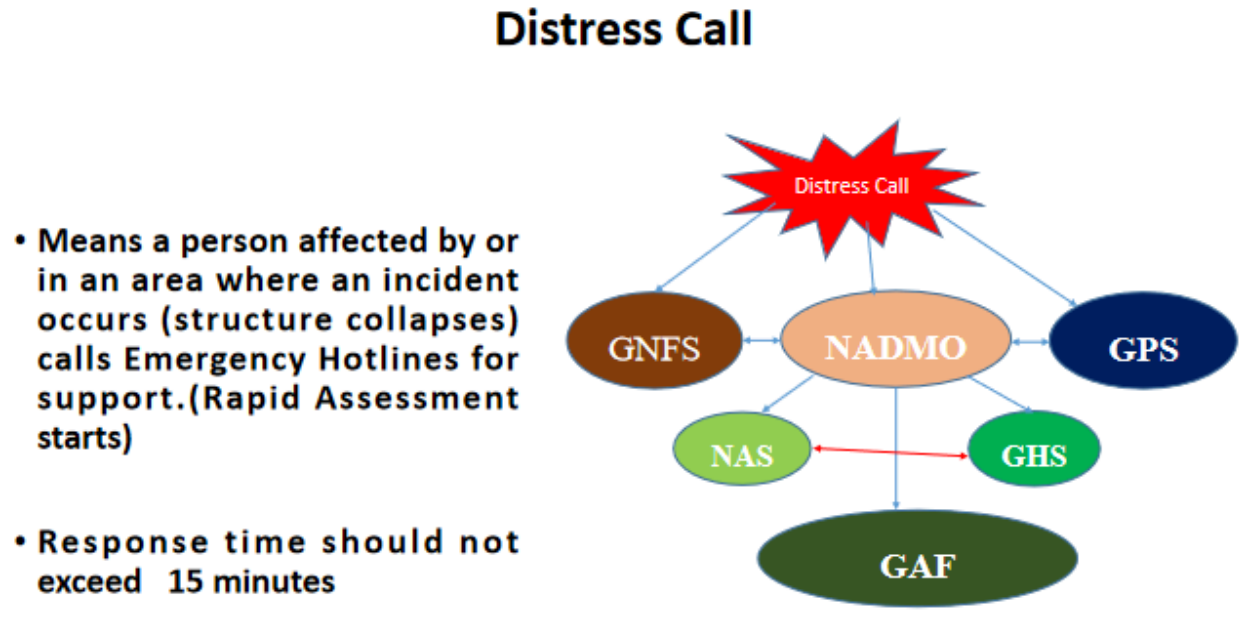
The regional breakdown is as follows: GAR – 28,

- AR – 6,
- ER – 3,
- WR – 3,
- CR – 2,
- VR – 2,
- BR – 2,
- BE – 1,
- NR – 1,
- UE – 1.

Stakeholders in search and rescue are GAF, GNFS, GPS, and Volunteers, NAS, GHS

3.2 Operational Structure of Activities during an Emergency





Rapid Assessment

- Observe
- Communicate
- Determine Impact
- Determine Required Resources
- Recommend Priority Actions

➢NAS

➢GHS



Search and Rescue

- Locate and Map Position of Victims
- Extricate and Evacuate
- Extricate and Recover
- Triaging
- Pre-hospital Care
- Hospital care/Morgue



State of Emergency

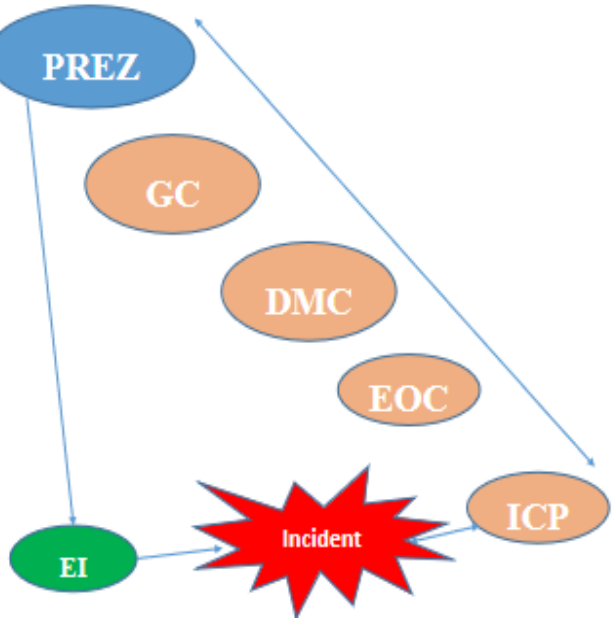
- The president may declare in accordance with Article 31 of the 1992 Constitution where the imminence or prevalence of a disaster is established to the council.
- The President may by Executive Instrument make regulations

➢State Resources

➢Private Resources

➢Personnel of State and private Institutions

➢Implementation of part or whole of applicable DMP and SOP



Stand Down and Closure

STAND DOWN

The Incident Commander will recommend the stand down of the emergency response to the Director-General of NADMO.

- **CLOSURE**

Upon recommendation of the IC, the Director-General of NADMO, in consultation with the Minister of the Interior, will order the deactivation of the EOC and the cessation of response activities.

1. . Search and Rescue is Over
2. All Responders and affected Persons have been accounted for.
3. All other Resources directly involved in the response have been accounted for

Role of Stakeholders

NADMO

- Rapid/Continuous Assessment
- Logistics
- Coordinate the Response
- Search and Rescue
- Evacuation
- Victim/Family Identification
- Victim Support
- Media Engagements
- Mobilise Additional Resources
- Stand Down and Closure



- Lead Technical Agency
- Logistics
- Continuous Assessment
- Direct the Search and Rescue
- Search and Rescue
- Evacuation

GAF
(48 Engineers Regiment)

GNFS

- Continuous Assessment
- Logistics
- Search and Rescue
- Evacuation
- Mobilise Additional Resources



NAS

- Continuous Assessment
- Pre-hospital Care
  - ➢Triaging
  - ➢First-aid
  - ➢Evacuation
- Logistics
- Victim/Family Identification
- Mobilise Additional Resources



- Continuous Assessment
- Hospital Care
  - Triaging
  - First-aid
  - Evacuation
- Logistics
- Victim/Family Identification
- Mobilise Additional Resources



- First Line Response
  - ➢Distress Call
  - ➢Search and Rescue
- Evacuation
- Victim/Family Identification



Conclusion

Question

At what point does the Engineering Council come in to commence investigations?

Should it be during or after search and rescue operations have damaged evidence?

- **Proposal**

48 Engineers Regiment.

Investigations from the EC will:

1. **identify the human induced causes of structural collapses**
2. **Determine measures to curtail the collapses.**
3. **This will go a long way to preserve lives and livelihoods**

4. Stage 2: The Basic Fact-finding Phase

4.1 Issues to Consider in Carrying out investigations of Engineering Disasters

- Visit site immediately
    - Contact NADMO, Police, Fire Service
    - Conduct initial assessment
        - Take good pictures
        - Speak to agents of project, if possible
            - Inquire professionals involved
            - Inquire about any distress during construction or use
            - Inquire about functionality of project or project intention
            - Inquire about any construction documentation – test results on construction materials, drawings, etc.
        - Observe and note any key structural pointers – defects on columns, beams, slabs, etc.

- Contact relevant jurisdiction of project
    - Inquire about project status
        - Relevant documentation
            - Approvals protocols (personnel involved)
            - Request for project design and drawings

- Contact relevant licensed professional bodies
    - Inquire about status of professionals involved in project – design, supervision stages
    - Meet professionals involved for discussion

- Data appraisal
    - Collate data from subject site, relevant jurisdiction, and views sought
    - Examine data from various sources for consistency
    - Analyse data to finalize recommendations

5. Stage 3: The Investigation Phase

5.1. Overview

Stage 3 of the process focuses on investigating the causes of the collapse. Stage 2, the Basic Fact-finding phase, would have concluded that a more detailed investigation is likely to yield useful information. Stage 3, therefore, covers why and how the structure collapsed. It is aimed at examining and understanding the causes behind the incidents of structural failures.

To achieve this, a three-step approach is proposed: conducting a detailed assessment of collapsed structures, surveying eyewitnesses, and modeling the failure.

5.2. The 3-Step Proposal

5.2.1. Conduct a Detailed Assessment

The first step in understanding the causes of structural collapses is to conduct a thorough assessment of the affected structures. This involves on-site investigations, examining the structural elements, materials used, and construction techniques employed. Additionally, it is crucial to analyze the maintenance records and inspection reports to identify any potential negligence or lack of adherence to safety standards. By scrutinizing these aspects, it becomes possible to identify common patterns or deficiencies that contribute to structural failures.

5.2.2. Survey Eyewitnesses

Eyewitness accounts play a crucial role in reconstructing the events leading up to a structural collapse. By interviewing individuals who were present during the incident, valuable information can be gathered regarding the initial signs of distress, any reported structural anomalies, or unusual activities that preceded the collapse. These firsthand accounts can provide valuable insights into the sequence of events and potential contributing factors that may have led to the failure. The survey should be conducted by trained professionals to ensure accurate and reliable information is obtained.

5.2.3. Model the Failure

Utilizing advanced modeling techniques, such as finite element analysis or computer simulations, can help recreate the collapse scenario. By inputting data gathered from the detailed assessment and eyewitness accounts, it is possible to simulate the behavior of the structure under different loading conditions and identify potential weaknesses or design flaws. This step allows for a deeper understanding of the structural vulnerabilities, construction errors and can provide insights into the failure mechanisms that contributed to the collapse.

5.3. Recommendations

The past three months have witnessed unfortunate incidents of structural collapses in Ghana, leading to loss of lives and property. By carrying out the above steps, a comprehensive understanding of the reasons behind these collapses can be achieved. Against this backdrop, it is essential to observe the following, to prevent further structural failures and safeguard lives and infrastructure in Ghana.

1. Implement stricter building codes,
2. Improve construction practices,
3. Enhance material quality,
4. and ensure proper maintenance culture on all structural units.

Understanding the causes of structural collapses is essential, but it is equally important to implement preventive measures to avoid future incidents. Based on the findings of the assessment, eyewitness accounts, and failure modeling, guidelines and regulations should be developed to enhance construction practices, improve structural design, and enforce regular inspections and maintenance.

Additionally, public awareness campaigns can educate citizens about the importance of reporting structural concerns and promoting a culture of safety. By prioritizing preventive measures, Ghana can significantly reduce the occurrence of structural collapses and ensure the safety and well-being of its population.

6. Stage 4: The Legal Responsibility Phase.

1. Who bears legal responsibility for collapse of a Building?
2. And what are the Legal liabilities and Sanctions awaiting a person found to be responsible for a collapse of a building?

- **Key Actors in Building Construction Projects**
- **Legal Liabilities and Sanctions**

6.2 Persons Who May Bear Legal Responsibility When A Building Collapses

- Property Owner
- Project Manager
- Project Design Team
- Project Supervisor
- Builder
- The Occupier
- Local Authority (District Assemblies)

❖ **Legal Liabilities**

A person who is found to have contributed to or responsible for collapse of a Building may be liable for ***Civil Liabilities*** and ***Criminal Liabilities.*** The liability may be out of:

- **Misrepresentation**: That is making false statement of fact to another person which induces that person to act on it and the person suffers loss or injury or damage. It may be made negligent or fraudulent.

- **Negligence**: This simply means the failure to exercise the care towards another which a reasonable or prudent person would do in the same or similar circumstances. Is a breach of a duty of care to another person which has resulted in damage or injury.

- **Offences: 1. Criminal Negligence**
  Section 12 of Criminal Offences Act 1960 (Act 29) states "A person causes an event negligently if, without intending to cause the event, he causes it by voluntary act, done without such skill and care as are reasonably necessary under the circumstances."

  2. Defrauding by False Pretense.
  Section 131 of Act 29 states whoever defrauds any person by any false pretense shall be guilty of a second-degree felony.

  3. Causing Loss, Damage, or Injury to Property
  Section 179A (3) any person through whose willful, malicious, or fraudulent action or omission—

  (a) the State incurs a financial loss; or

  (b) the security of the State is endangered, commits an offence.

4. Manslaughter

Section 51 of Act 29 states whoever causes the death of another person by any unlawful harm shall be guilty of manslaughter. Provided that if the harm causing death is caused by negligence, he shall not be guilty of manslaughter unless the negligence amounts to a reckless disregard for human life.

6.2.1 PROFESSIONAL BODIES REGISTRATION ACT 1973, NRCD 143

A. Offences

Section 20 of Professional Bodies Registration Act 1973 provides that A person who.
(a) not being registered under section 17 as a member of a registered professional body poses as so registered, or
(b) not having the qualification for admission to or enrolment in or for being accepted as a member of a registered professional body poses as having that qualification, or
(c) otherwise contravenes a provision of this Act.

B. Offences by Bodies of Persons

Section 20 of Act 1973 (NRCD 143) states where an offence under this Act is committed by a body of persons then every president, vice-president, chairman, vice-chairman, director or partner and every officer of that body commits that offence where that person is proved to have directly or indirectly by an act or omission, permitted to be done the act or omission which constitutes the offence commits an offence and is liable on summary conviction to a term of imprisonment not exceeding five years or to a fine not exceeding one thousand penalty units (1000 p.u.) or to both the fine and the imprisonment; and where the offence is of a continuing nature the offender is liable to a further fine not exceeding twenty-five penalty units in respect of each day during which the offence continues.

6.2.2 FOR ARCHITECTS

Striking Off and Cancellation of Registration

The section 13 states, subject to section 14 of Architects Act 1969, NLCD 357 the Governing Board (Council) may strike off the register the name of an architect if satisfied that the architect is unfit to practice the profession of architecture by reason of having been found guilty of professional misconduct.

6.2.3 FOR ENGINEERS

Suspension Or Cancellation of Registration

Section 17(1) of Engineering Council Act 2011 (Act 819) states The Board may suspend or

cancel the certificate of registration of an engineering practitioner where an enquiry conducted by the Board confirms that the registered engineering practitioner.

6.2.4 Laws which may be breached

You may be charged of the following offences:

1. Criminal negligence (s. 12 of Act 29)
2. Defrauding by false pretense (s. 131 of Act 29)
3. Causing damage to property (s. 179A of Act 29)
4. Manslaughter (s. 51 of Act 29)
5. Section 17(1) of Engineering Council Act 2011 (Act 819).
6. The section 13 states subject to section 14 of Architects Act 1969, NLCD 357.
7. Section 20 of Professional Bodies Registration Act 1973 (NRCD 143).
8. Occupiers liability.