

# Hazards in Building Construction Sites and Safety Precautions in Enugu Metropolis, Enugu State, Nigeria

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## Abstract

*Construction is project-based where different parties work together to achieve a common goal. The means of achieving this goal is fraught with hazards, which pose danger to human life. Hazard is therefore a phenomenon or a process that can endanger construction workers and their work environment. Hazard associated with building construction can be from work materials, equipment, work method, and practices among others. This paper explores the different types of hazard that exist in building construction sites and their rate of occurrence in order to create the needed awareness that will induce careful actions as well as advance some safety precautions for their mitigation. The literature reviewed the different types of hazard that can be found in building construction sites and the corresponding safety precautions for abating them, while the field survey used questionnaire to elicit the frequency of hazards on site; this was administered through convenience sampling techniques within Enugu metropolis in Enugu state. The descriptive analysis tools were used for analysis. The findings revealed that hazard due to the use of equipment are often encountered on site while electrical hazard is rarely encountered. Conclusion was reached and recommendations based on the findings were made in the paper.*

**Keywords:** Building Construction hazards, Safety Precaution, Enugu metropolis

## Introduction.

According to Bala et al. (2012) the construction industry is faced with numerous health and safety challenges, this is as a result of hazards inherent in construction activities.

The construction industry has been identified with the highest occurrence rate of accidents compared to any other industry. In the recent past, death tolls, permanent disability, partial disability and some other severe environmental threat had increasingly been on the rise through collapse of buildings and major operational accidents. This unfortunate scenario has been a monumental threat to productivity and the overall performance of the construction projects in Nigeria (Orji 2014 cited in Olatunji et al. 2007).

The high rate of accidents in Nigerian construction industry according to ILO (1992) as cited in Bala et al. (2012) has been traced to the following factors:

- The high proportion of small firms and of self-employed workers
- The variety and comparatively short life of construction sites.
- High turnover of workers
- The large number of seasonal and migrant workers, many of whom are unfamiliar with construction processes.
- Exposure to the weather and many trades and occupation

Hunter (2011) narrowed his opinion to the construction sites, in his opinion, the construction sites are considered the most potentially hazardous and accident-prone parts of any working environment. Excessive exposure to these

construction sites hazards, exposes the construction workers to injury and possible death. Construction workers are constantly exposed to adverse technical, economical, material, social, psychological and environmental conditions while working on site. As a matter of fact, everything a safety practitioner may consider taboo can be found in the construction site.

On the other hand, the construction industry is a key indicator and driver of economic activities and wealth creation and it has a profound effect on our daily lives, ranging from the building we live and work in, to the roads and bridges we drive on; the services distribution systems we use and the spaces and facilities through which we travel and trade. These are all products of the construction industry (Realestate Insight, 2010).

Considering the importance of the sector to every economy and as the quest to achieve sustainable development continues in Nigeria, the construction industry requires adequate attention from all stakeholders to address the situation of hazards and safety precautions in construction sites with the aim of improving the health and safety conditions of the workers. The specific objective of this work is to identify the types of hazards that is being encountered particularly in building construction sites and the frequency of their occurrence in Enugu metropolis.

**Statement of the problem**

The level of civilization and technological changes has advanced the application of complex techniques to construction works. Technological changes require a corollary of manpower that is trained to effectively respond to them. Unfortunately, anecdotal evidence shows that this is not the case in the Nigerian construction industry, as unsafe practices characterize construction processes, leading to accidents that leave severe consequences on the project and the nation’s economy in general

**Literature.**

Hazard is a phenomenon or a process that can endanger human being and their work environment. Hazard associated with construction can be from work material, equipment, work method and practice among others. Hazard pose health and safety challenges on construction sites and adjoining properties, workers and the general public (Bala et al. 2012).

According to MacCollum and Hughes (2005), hazards are more than an unsafe physical condition and many lie latent and unsuspected until they cause irrevocable harm; that is why Hunter (2011),

strongly opined that every employee be acquainted with the provisions of the Occupational Safety and Health Administration (OSHA) in order to understand how their actions may constitute harm or injury to them in their workplace. Hazards may be present in any of the three modes illustrated in table 1 below:

Table 1: Different Modes of Construction Hazards.

Mode	Description	Source
Dormant	The hazard has latent ability to cause harm but has not been activated	Omission or inclusion on the drawing board found in proposed materials or construction method.
Armed	The hazard has the necessary ingredients that could cause harm but awaits its interaction with people	Interaction between people and machines in the form of operating them or working close to the position of a faulty equipment
Active	The hazard arises from a combination of factors that activate it and cause harm.	Operating a machine without observing the safety measures for its operation, working in confined spaces without adequate safety measures.

Source: (Adapted from McCollum, 1995)

In whatever form that hazards present themselves, they always come with consequences ranging from serious injuries to death, thus the Council of Registered Builders of Nigeria cited in Bala et al. (2012) identified the following as consequences of construction hazards:

- Risk to the health and safety of workers
- Risk to the health and safety of third parties and third party property
- Risk to the environment
- Risk to the adjoining properties
- Risk of delay to the completion
- Risk of financial losses and additional cost
- Prosecution
- Loss of reputation
- Increased insurance premium and
- Loss of production among others.

**Types of hazards**

Building construction hazards may be summarized under the following headings:

- Design hazards
- Hazards due to the use of unqualified persons.
- Hazards due to use of construction materials
- Hazards due to Falls
- Hazards due to Equipment
- Hazards due to construction methods
- Electrical hazards

### **Design hazards**

In practice, it is difficult to anticipate the fatal hazards which construction workers encounter on a daily basis, some of these, if known can be minimized by design measure. If one is aware of any environmental problem in an area where developmental action is to be taken place, one will have to consider these problems in the design to avert possible hazard (Orji 2014).

The purpose of any building structure is to satisfy some human needs. The design of any such structure must satisfy the functional objectives of safety, serviceability, and economy. The structure must be safe under the worst system of loads. Under extreme loadings, damage to the structure can be localized and possible loss of lives reduced, but progressive and catastrophic collapses must not occur. Under the working load, the deformation of the structure must not impair the appearance durability and performance of the structure (Ede 2011).

According to Davison and Owens (2003) as cited in Ede (2011), the design stage is the planning and feasibility studies stage in which professionals may assist the owners to evaluate the technical and economical options available and then realize the design. The design consist of the creation of the architectural form, identification of the loads for structural design, mechanical and electrical designs, selection of materials and proportioning of the section. They further stated that during this stage, the basic requirement of safety, aesthetic, economy, and constructability must be considered irrespective of the clients brief.

### **Hazards due to the use of unqualified Persons**

Jambol (2012), lamented that the frequency of collapse of buildings in Nigeria in the recent past has become vexatious, menacing and embarrassing. The incidences have become an issue of concern to all stakeholders in the construction industry and indeed, the built environment as the sustainability of the built environment is increasingly and greatly threatened. The impact of building collapse has affected the entire fabric of human endeavor, ranging from psychological trauma on those

affected to the economy of the nation. Lives and properties are lost, revenue to government in tenement rates and taxes are lost, investments and subsequently jobs are lost, victims suffer permanent disabilities, homelessness, among others, including fatalities.

Salau (1996) cited in Ede (2011), highlighted the earlier cases of building collapse verified in Nigeria and their possible causes and suggested among other things the involvement of qualified professionals in the different phases of building construction process and the review of academic program to enhance the capacity of craftsmen and technologist in the building industry.

The engagement of unqualified persons in building construction process has been one of the principal causes of building collapse in Nigeria and the possible causes can be traced to the activities that take place in the conception – design stage, construction-supervision stage and post construction-service stage. For a realization of quality jobs in any of these stages of building process, a high level of skill and professionalism is needed.

Ede (2011) further stated that the construction stage is the implementation stage where every effort is made to ensure compliance with the design and specifications. The activities that takes place within this stage are so enormous and often conflicting that only a trained professional can handle them. Certified Architects, Builders, Engineers and skilled artisans have their respective roles in this stage so as to enforce the quality assurance specification. Therefore the professional bodies should step up their surveillance of the building sector so as to eject the imposters.

### **Hazards due to construction materials**

Construction work involves the use of different materials to realize a structure; these materials are made from the combination of chemical compounds which pose danger to health. Most of the primary construction materials like cement, glass, metals, paints, asbestos, asphalt etc pose very severe health hazard during site application than during manufacturing. For instance silica, cement, timber, quarry and asbestos dust are known to cause lung infection, impairment, chronic obstructive lung diseases, restrictive lung diseases, pneumoconiosis, serious bacterial infection, skin cancer and carcinoma of the lungs, stomach and colon (Olatunji et al. 2007).

To further worsen the situation, the Nigerian construction market is flooded with materials of unknown integrity that are weak to support the intended load and subsequently causes accident due

to failure of constructed parts (Construction Storm 2002).

Hazards due construction materials can come from the storage plan designed for the materials in the site. Ideally, materials should be stored according to the prescribed method; hazardous materials should equally be stored in watertight containers or protected by a temporal cover. Access to those storage spaces should be restricted to specific people.

Construction Storm (2002) further submitted that a good site layout plan is important for an accident free site and efforts should be placed on proper construction materials waste disposal. Hazardous wastes must be stored in sealed containers constructed of suitable material with a label that clearly shows the contents and accumulation dates.

### **Hazards due to falls**

Falls from height is the leading cause of injury in the construction industry. In the Safe Work Australia (2013), eight year period survey from 2003 to 2011, revealed 232 deaths which accounted for 11% deaths resulting from falls from height. In another submission by Oladiran and Sotunbo (n.d), accidents resulting from height received the highest ranking.

Accidental falls are common in construction projects because workers are exposed to risky situations like working from a height with the aid of scaffolds and ladders. Falls from scaffold or ladders often result from the use of unsuitable ladder and faulty or poorly constructed scaffolds. Moreover, construction workers hardly receive any training to prepare them for such work, and scaffolds construction is not properly supervised. Hunter (2011), therefore advises that employers must provide a full protection program that will advance the overall safety of the workplace. Such program should include providing fall protection systems such as guard rails, safety nets, personal fall arrest system, positioning device system and warning line system

Other forms of fall considered in this literature are fall of hard objects from a height and indiscriminate disposal of hard objects by workers from a height. In this case, hard hat should be worn plus providing safety nettings around the perimeters of the building. Scaffold should be checked to be sound, rigid and sufficient enough to carry its own weight plus four times the maximum intended load without settling or swaying. It must be erected by a trained personnel. Ladder should be properly constructed to be able to carry any intended load.

### **Hazards due to Equipment**

In high rise structures, construction makes more use of equipment ranging from the hand powered tools to sophisticated types like crane and hoist. The use of these equipment can pose risk to workers. Fischer (1998) identified the main causes of mechanical hazards as human error and internal mechanical breakdown involving the steering mechanism and brake system. Citing an example with the collision of a loader with the wall of building, which resulted to the death of a worker, he established that mechanical failure of machine parts can happen anytime in spite of being in good condition at the onset. For this reasons, it is imperative that parts of machines be checked before operating them; ideally, routine service checks should be carried out at intervals according to the prescriptions of the machines' manufacturers.

In a similar situation, Hunter (2011) submitted that equipment hazards can present themselves in ground workers being struck by a vehicle changing direction, rolling over of equipment, running over of vehicles when brakes are not properly set, falling of equipment from back hoes, buckets and moving construction vehicles.

Equipment hazards can be eliminated and controlled by strict adherence to all construction safety guidelines such as:

- Using and operating vehicles under a planned preventive maintenance scheme.
- Providing all vehicles with driving and devices capable of giving warning of forward and backward approaches.
- Keeping reversing to the absolute minimum
- Designating parking areas for vehicles on level ground that has good surface and adequate access.
- Providing an incentive for drivers to take pride in their vehicle.
- Providing good and well defined access ways for vehicle bringing in construction materials, equipment and removing surplus soil or damaged materials from site.

### **Hazards due to construction methods**

Construction method in this literature embraces actions taken in manipulating and converting raw materials to realize a building structure. Realizing a stable structure requires the engagement of construction professional to carry out the construction work with the aid of skilled artisans.

Poor construction methods and workmanship arising from the use of quacks are responsible for the failure of most buildings, however such disaster do not relate only to finished buildings, in fact



buildings that are still under construction collapse causing the death of workers. Poor construction methods are caused by negligence and inadequate quality control on site leading to:

- Incorrect placement of steel, which could lead to collapse
- Poor construction of formworks for wet concrete
- Incorrectly made construction joints and
- Inadequate cover to reinforcement.

### **Electrical hazards**

Electrical hazard is considered one of the major hazards in construction contributing to approximately 350 deaths each year (OSHA n.d).

Similarly the Bureau of Statistics cited in OSHA (2002) recorded that 278 workers died from electrocution at work in 1999, accounting for almost 5% of all on-the-job fatalities that year. Another submission by McCann and Paine (2002) revealed that electrical and electrocution accidents on site between 1992 and 1998 accounted for 1002 deaths due to electrocution and 17 due to electrical flashes on site. Unfortunately, statistics are not available in Nigeria to show the number of deaths or injuries arising from electrical hazards, but McCann and Paine's submission showed that the main victims of electrical injuries are electrical workers as such their findings may be applied to Nigeria since construction, irrespective of the geographical location has the same features.

The causes of electrical death or injury on site according to Brenner and Cawley (2009) in their decreasing order of importance are: contact with overhead power lines, contact with wiring or other electrical components, contact with electrical current from machines, tools and appliances and contact with underground power lines.

Electrical hazards can be avoided by observing the relevant safety measures such as provision of personal protective equipment (PPE). Lockout and tagging of faulty and idle electrical device, ensuring that all cables are in proper condition before any electrical device is switched on, ensure that nobody shall connect, maintain or modify electrical equipment or installations unless the person is an electrician certified under the trades qualification and apprenticeship.

### **Management of Construction Hazards**

Management of construction hazard is not getting the required attention that it deserves in Nigerian construction industry; this may be due to the fact that it does not produce a direct dividend that is easily perceived, unlike the actual production process. Unfortunately for the industry,

resources are wasted every year, the industry is seriously facing the dearth of its workforce, which is evident in the scarcity of skilled artisans and a heavy reliance on migrant workers.

A number of safety precautions to be taken on construction site have been prescribed by Michele et al. (2011) as follows:

- Perform a thorough walk through of the site to identify and assess any workplace hazard and write down anything that may be considered unsafe.
- Train all personnel in work-site safety and operating procedure either on-site or at training facility: training should include proper lifting techniques to help reduce common back injuries.
- Identify and mark any hazardous material and determine any risk involved to personnel: label and store any material deemed hazardous in proper container and secure them in a safe location. Make sure there is an MSDS (material safety data sheet) for all potentially hazardous chemicals/materials.
- Inspect equipment to be sure it is working properly: be on the lookout for unusual noise and jerky movement. Report any problem immediately and do not operate the machinery until repairs have been made.
- Use harnesses and other safety equipment when performing roof work or working on the scaffold.
- Provide personal protective equipment to all employees, including hard hats, safety goggles and boots, hand gloves, ear plugs (or another form of protective) and face masks.
- Be sure OSHA (occupational safety and health administration) standards are met. Engage a health and safety inspector.
- Prepare for emergencies, operators and site workers should know what to do in case of electrical, mechanical and power failure or injuries.
- Protect the public by barricading the construction site during work hours. After working hours lock all point of entry.

### **Methodology**

A research methodology consisting of a literature and a field survey was used to achieve the objective of this research. The literature survey was used to summarize the different types of hazard that can be found in building construction site and their safety precautions, while the field survey involving 30 building construction sites within Enugu metropolis were used to investigate the hazards been encountered on site and their rate of occurrence.

A well-structured questionnaire was designed and administered to building construction professionals on selected projects within Enugu metropolis.

#### **Data analysis procedure**

The questions were placed on a 3 point Likert scale. The data analysis therefore employed the following steps.

- a. Computation of the Mean using the average formula

- The hazards been encountered in building construction site in Enugu metropolis and their rate of occurrence
- That hazard due to the use of equipment is often encountered while electrical hazard is rarely encountered
- That most of the building construction professionals in Enugu metropolis know the importance of safety and advocates for precautionary measures to mitigate hazards

The study therefore recommends as follows:

- Building constructions should be carried out based on a design made by professional in the relevant areas with the input of the client
- The construction of any building should be carried out by a registered builder with the aid of skilled artisans
- Good and quality materials should be used for building construction work
- Personal protective equipment (PPE) such as safety boot, hard hat, protective clothing, hand glove etc should be provided for the construction workers
- Scaffolds, ladders and equipments should be properly inspected before use.

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