

# **Monitoring and Analysis of Site Accidents on Construction Site in Nigeria**

**Theophilus EGUH and Olumide ADENAIYA, Nigeria**

## **ABSTRACT**

Accidents on construction site are unplanned event and so many workers have lost their life on site, both skilled and unskilled workers, thousands of workers have become permanently disabled on construction site accidents. This study was conducted to analyzed causes and results on occupational accidents on site in Lagos State Nigeria. Data were collected from different construction sites and was analyzed using SPSS. This study shows that causes and results of occupational accidents that occurs on construction site were investigated.

The majority of occupational accidents occurs between Mondays through Wednesday in the weeks of every month. The most important reason of occupational accidents is unsafe behavior with a rate of 75% which is defined are not to obey the rules although the necessary occupational accidents statistics in not kept enough in Nigeria.

The aim of this paper is to monitor and analyzed the accidents on construction site in Nigeria and suggest a clear procedure to develop safety performance by reducing risk and hazard on construction site. To ensure safety and to reduce the occurrence of construction site accidents to the minimum, management of construction firms must undertake and implement some of the context of this study such as implementation of safety policy, use of safety items and gears, training on safety measures and accident prevention methods, ensuring safe working environment and enforcing safety rules.

**Keywords:** Accident, Construction, Occupational, and Site

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## 1. INTRODUCTION

One of the most hazardous work in the industrial activities in the world is construction works.

The level at which injuries occurs in the construction industry is higher any others industry. Every year many people fall victim to injury, harm and even death caused by accidents on construction sites. Control of accident is vital in the construction industry employers are required to assess risk and take practical measures to protect, ensure safety and health of their workers, minimizing risk by means of continuous surveillance and monitoring of where accidents are likely to occur (Odetoyinbo 1986 Kadir et al 2014). Seyyed and Zahra (2012) mentioned that Accidents in construction sites are unplanned occurrences involving movement of persons, objects or materials which may result in injuries, damages and losses to properties or people. The majority of accidents happen as result of unsafe acts and unsafe condition. According to report by NSC (National Safety Council) in 1996, 1000 construction workers died at work and 350,000 suffered disabilities. In every year, 60.000 fatal accidents occur worldwide in construction sector and one worker dies because of an occupational accident in every 10 minutes. Construction sector involves high risks due to its production processes and labor intensive characteristic and the sector is faced with financial loss in large scale because of occupational accidents (Yilmaz 2015). On the construction site accident occurs during the daily activities and operations results in no win situation. Then, when accident occurs, it should always be promptly reported to the office of Safety and Health to ensure that immediate action could be taken by the organization. Further inspection could be conducted to identify the factors causing the accident and the way on how to prevent it from occurring in the future. An employee also urged to report any near miss injuries or accidents either to their supervisors or Safety and Health Office (Noorul et al 2012). This paper will help on how to monitor and analysis of site accidents on construction site.

Makinde (2014) mentioned that construction industry in Nigeria needs more attention on safety and health conditions. This is because the industry harbors a lot of quacks and questionable tradesmen, most building contracts in the rural areas both private and government contracts fall into the hands of illiterate “money bags” who has taken over constructing jobs in Nigeria. Statistics published out by the Federal Tenders Board, 1985 in Lagos State stipulates that “this category of contractors handles a substantial percentage of contracts; yearly as they constitute about 70% of our contractors who handle job below five million naira (#5,000,000.00). The construction professionals in built environment are to be fully aware of hazards and prepared to deal with accidents when they occur. They should apply proper investigations and reporting procedures afterwards because the probability and severity of accidents in construction are more compare with other industries. From another way, accidents not only cause horrible human disasters but also create substantial economic losses. These financial losses are due to the impact of accidents and damages on plants and

equipment and workers. Moreover, there is also a loss of productive work time until the normal site working environment and morale return to the initial state

(Charehzehi and Ahankoob 2012)

## 2. CAUSES OF ACCIDENT IN CONSTRUCTION SITE

Unsafe act or unsafe condition: In order to improve safety performance in construction industry we require to identify the root causes of construction accident,

Equipment and machineries, site condition, nature of the industry, management attitude and method, and human elements can directly influence the safety performance in construction industry. Working at height, in adequate safety devices, poor management, lack of obedient on site, negligence of worker, and employing unskilled worker is so common in construction industry that causes the major accident and making damage and injuries (Pipitsupaphol and Watanabe 2000; Charehzehi and Ahankoob 2012). Cause of accident can be divided into two factors namely human and physical factor. Abdelhamid and Everett (2000); Charehzehi and Ahankoob (2012) stated that Human factors are related to personal duty and responsibility, neglect to use protective equipment, utilizing machines and equipment without permission, rushing in operating and doing work, personal factors, service moving and energized equipment, remove safety device, select unsafe position in working, utilizing improper equipment and other unsafe act. Physical factors were addressed to wrong act of another person, unconsidered to accident source, disregard to special procedure, clothes hazard, environment hazard, fire hazard, wrong method or arrangement, assignment of personnel in wrong position, no safety guard in site and other unsafe condition.

Cause of accident according to statement mentioned above can identify by fishbone model (Fig.1):

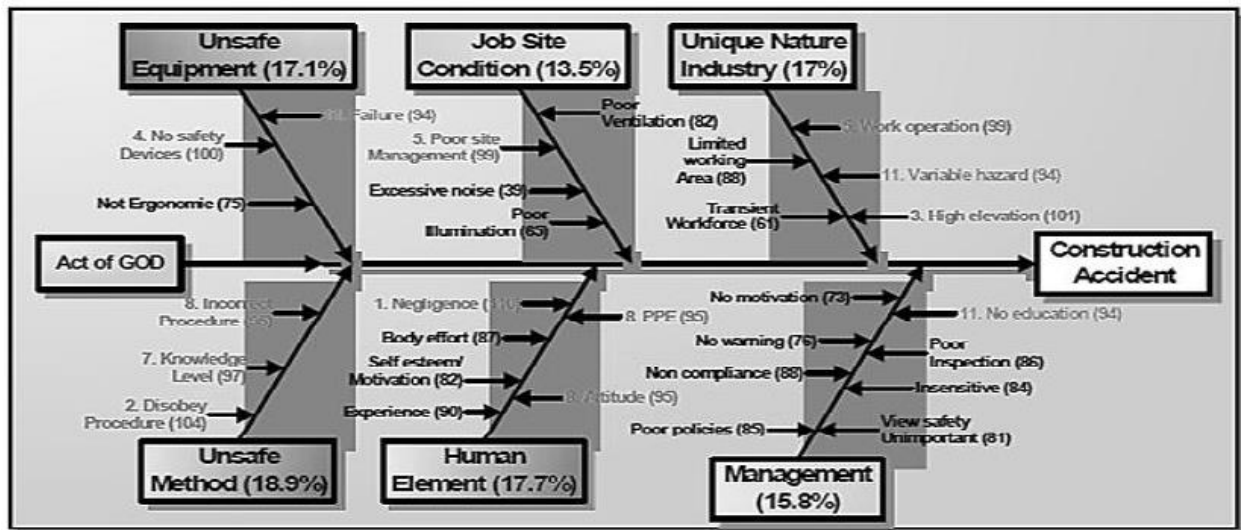


Figure 1. Root Causes of Accident Charehzehi and Ahankoob (2012)

## **2.1 PREVENTION OF ACCIDENT**

All the activities can cause different accident happened and these often result in deaths or injuries. Therefore, accident prevention should be done to decrease the rate of the accidents (Ali et al 2010). Holt (2001); Ali et al (2010) stated that accident prevention in construction site is not just a matter of setting up a list of rules and making safety inspection, but is required to have a system for managing health and safety which meets and complies with the law. The safety measure that discussed in this paper are safety and health rules, regulation and policy, personal protective equipment, housekeeping, fire prevention and fire extinguishers, tool inspection, emergency procedures, safety bulletin board, construction safety meeting, first aid training and incident investigation.

### **2.1.1 SAFETY AND HEALTH RULES, REGULATIONS, POLICIES**

According to CSAO (1993), a health and safety policy is a written statement of principles and goals embodying the company's commitment to workplace health and safety. Safety policy demonstrates top management's commitment to ensure safe working environment and methods at every single construction sites. In Nigeria, The Department of Occupational Safety and Health (DOSH) and other government agencies have regulations that set down the legal requirements to ensure the safety and health of all the workers at the place of work.

### **2.1.2 FIRE PREVENTION OR FIRE EXTINGUISHERS**

According to Holt (2001), Ali et al (2010) there are two methods of dealing with fire in construction work; preventing it happening and controlling the consequences if it should happen. Both require equal attention during the planning process. The three ingredients of fire are fuel, oxygen and a source of ignition. By removing any one of them and there will be no fire. Much of fire prevention takes place at the planning stage, where simple rules apply:

Use less flammable materials, Minimum the quantity of flammables on site, store flammable solids, liquids and gases safely, separated from each other and from oxygen cylinders or oxidizing materials., Make sure that rubbish is removed regularly, Ban smoking in appropriate areas

### **2.1.3 EMERGENCY PROCEDURES**

Gibb (2000); Ali et al (2010) revealed that the most obvious emergency is fire. The safety plan should contain an appropriate emergency plan, written to cover the detailed arrangements on a project. Other potential emergency situations which may require the emergency plan include flooding and multiple injuries from any cause. A more common form of emergency is the need to evacuate an injured person especially from the most inaccessible area of the project. Emergency plan can shorten the duration taken between an injury occurring and arrival at a treatment centre. This should always be evaluated and reassessed as construction work proceeds.

Planning for emergencies begins with the purpose of minimizing their likelihood. The aim of publishing an emergency plan is to ensure that everyone on site can be alerted in an emergency, and knows the emergency signal and also the action should be taken. All the

emergency routes must be identified, signed, adequately lit and kept clear. When planning emergency procedures, routes and exits, the following should be taken into account:

Size and characteristics of the site and the work being done, Way to raise the alarm under those conditions, Plant and equipment being used in site, Quantity of people are likely to be present (size of the exits) Properties of substances likely to be present, Location of the nearest emergency services and their capabilities, Access to the site for emergency services

#### 2.1.4 TOOL INSPECTION

Cheung (2005); Ali et al (2010) states that safety inspection was conducted on weekly and also daily to ensure the all the devices and equipment's are well functioning and are in the good condition. According to the guidelines that been established by the OHS regulation (2001) inspection and testing should be done by qualified person. All the equipment's and machinery have to be completely inspected before come into operation such as personal protective equipment (PPE), hand tools and portable tools and equipment.

#### 2.1.5 FIRST AID TRAINING, EQUIPMENT AND PROCEDURES

According to OHS regulation (2001), first aid is important and required in every workplace. First aid provides the initial and immediate help to a person who suffering an injury and also prevent the injury from become worse. Employers are required to provide a first aid station where it is accessible at all the time in the workplace. Training generally includes the mandatory topic such as emergency scene management, severe bleeding and rescuer CPR.

### 3 MATERIAL AND METHOD

Research data were obtained with "Retrospective Cohort" method in a construction site at Eti Osa Local Government Lagos, Nigeria. 200 occupational accidents, which occurred in the site between January 2017- May 2018, were investigated. Data were collected from the occupational health and safety experts' accident reports for registered occupational accidents. The process of obtaining and analyzing data with cohort method was monitored by occupational safety consultant of the construction site. 200 major and minor accidents in construction site were determined and classified by types, the causes and demographic characteristics of exposed workers by analyzing all of the factors that cause occupational accidents. The victim's age, gender, education level, department, cause of accident, accident date, type of the injury and accident, workday losses and other related information were collected. The findings of 'accident investigation reports' must be considered in order to determine the causes of the occupational accidents. The total of workdays was 290; monthly average number of workers was 302; the total working hours was 700,640 for the construction project in 2013.

There are two serious occupational accidents, the occurs on construction site, a "falling from height" and a "falling object", occurred during the project and both of them resulted with disability more than 30 days.

#### 4. DISCUSSIONS AND FINDINGS

Table 1 shows that 29 %, 21 % and 13 % of workers were exposed to occupational accident in construction site are unqualified workers, moulders and plumber, respectively. Because the

			<b>Age Group of the Workers</b>		
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monitoring period is rough construction stage, occupational accidents occurred for these occupational groups more. The great number of unskilled workers in the construction site causes more occupational accidents for these occupational groups. Young workers are highly employed due to the heavy duty conditions in construction sites, age groups of 18-24 and 25-39 are exposed to 44 % and 52 % of occupational accidents, respectively. In consideration of the age group of 18-39 is exposed to 96 % occupational accidents, it can be understood that young workers sustain injuries more.

**Table 1: Accident rates with respect to trades and age groups (%)**

<i>Trades</i>	<i>Age Group of Workers</i>				<b>Total</b>
	18 - 24	25 - 39	40 -50	51 – 55	
Gateman				1	1
Painter	1	4			5
Smith	5				3
Manson	3	1			3
Unskilled workers	12	17			29
Gangers	1	1			2
Electrician		6			6
Foreman		1	1		2
Administrative Personnel		1			1
Moulder	11	10			21
Welder		1	1		2
Fitter	3	1			4
Operator			1		1
Plasterer	1	3			4
<i>Plumber</i>	7	6			13
<b>Total</b>	<b>44</b>	<b>52</b>	<b>3</b>	<b>1</b>	<b>100</b>

<b>Types of Accidents</b>	18 -24	25-39	40 -54	51 -55	<b>Total</b>
Falling from the same level	3	3			6
Hit to an object	2	6	1	1	10
Being stung by an object	6	4	1		11
Being hit by an object	6	12			28
Dashing or flitting object	12	11			23
Being squeezed between or under two people	5	1			6
Fight		1			1
Exposure to welding beam	1				1
Exposure to chemicals	1				1
Falling object	4	10	1		15
Drifting or rubbing	1	1			2
Falling from height	1	2			3
Being forced	2	1			3
<b>Total</b>	<b>44</b>	<b>52</b>	<b>3</b>	<b>1</b>	<b>100</b>

**Table 2. Accident rates with respect to types of accidents and age groups**

Table 2 show that Being hit by dashing and flitting object is the most common reason for occupational accidents in the construction site with a ratio of 23 %. All of these types of accidents are exposed by young workers, who are between the 18-39 age group. While Being hit by objects (18 %) is the second highest common type of accident. After these falling

objects (15 %), “being stung by something” (11 %) are the most common reasons, respectively. Besides, workers who are in the age group of 25-39 and 18-24 are mostly

				<b>Accident occur in Days</b>				
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exposed to “being hit by object” (12 %) and “being hit by dashing and flitting object” (12 %), respectively. “Falling objects” accidents are also affected note worthily to the workers in the age group of 25-39. Due to power and strength requirements, manual handling or handling with the aid of some equipment, are performed by young workers more, it can be deduced that young workers expose to “falling objects” accidents more. Worker, who are above 40 years of age generally don’t work on active tasks. Skilled workers, foremen, chiefs, technicians and administrative personnel expose to occupational accidents less.

It was observed that unskilled worker exposure to “being stung by an object” with the rate of 7 %; plumbers and unskilled worker’s exposure to “being hit by dashing or flitting objects” with the rate of 6 %. Also, moulders expose to “falling objects” by 5 % and electricians, moulder and plumbers expose to “being hit by an object” by 4 %. 63 % of all occupational accidents are exposed by unskilled workers, moulder or plumbers. These workers, who are uneducated and even illiterate, are faced with difficulties in adapting to the rules of occupational safety, they pay no attention to the rules, disuse the equipment and it result in fatal accidents. Some of these workers are employed for a brief and temporary period and thus, they have difficulties in adapting to physical and working conditions. Besides, because the workers are employed for a temporary period; they are forced to work rapidly since they are undeclared workers. It was obviously seen that these conditions invite the accidents. According to the research; the most common result of injuries from occupational accidents is “incision” (29 %). Incision is followed by exposure to metal burr (14 %), contusion, transient loss of vision and trauma (11 %), perforation (10 %) and bruise (7 %). Eye, finger, foot, hand and leg are the most common injured body parts with ratios of 25 %, 19 %, 12 %, 11 % and 9 %, respectively. Eyes are effected most (14 %) by the metal burrs that are produced as a result of hot working such as metal cutting and welding processes; fingers (11 %), hands (8 %) and face (5 %) are effected most by frequent use of drilling and cutting tools; feet are effected most by falling objects with a result of perforation. Due to exposure to chemical vapor, hot weather and intense beam; transient loss of vision may occur (11 %). Several processes are performed with an intense usage of labor force. Thus, these processes include accident risks that may cause not only partial injuries for different organs but also major injuries to the whole body and can result in even death. Because the necessary measures are taken, personnel protective equipment (PPE) and educations are provided completely in the construction site in which this study was applied, most of the accidents are got off lightly. On the other hand, because these measures aren’t taken in many construction sites in Eti Osa local Government Lagos Nigeria, a great number of deadly occupational accidents occur.

**Table 3. Accident rates with respect to months and days**



Monthly Accident	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total (%)
January		2	2	2	2			8
February		1	2	1	2			6
March	1	2	1	1	1	1		7
April		2	2	1	1	3	1	10
May		1	2	1	2	1		7
June		4	1	2		2	1	10
July		3	1	2	2	1	1	10
August		3	1	2	2	1	1	10
September	2	3	2	1	1			9
October		2	1	2		1	2	8
November		3	1	1	1	1	1	8
December	1		2	1	1	2		7
<b>Total (%)</b>	4	26	18	17	15	13	7	100

Table 3 shows that Most of the occupational accidents in the construction site occurs on Monday (26 %) and Tuesday (18 %), Wednesday (17%) and Thursday (15 %) were the other days on which accidents occur commonly. Number of occupational accidents is found to reduce on Sundays since there is less work on Sundays frequently. Due to the lack of motivation after weekend holiday, it is meaningful that Mondays and Tuesdays were the days on which accidents occur most. While occupational accidents occur more frequently in raining season months, they occur less in dry season months. Besides, it is determined that 40 %, 50 % and 10 % of the occupational accidents occur from the 5<sup>th</sup> month to the 9<sup>th</sup> month and during 7th-8th working hours, respectively.

**Table 4. Work-day losses with respect to types of accidents**

<b>Type Accident</b>	Without day loss	1 day	2 days	3 days	10 days	16 days	30 days	<b>Total Occupational Accident</b>
Falling from same level	6	2	4					12
Hit to an object	14	4	2					20
Being stung by an object	12	4	6					22
Being hit by an object	26	2		2	6			36
Dashing or flitting objects	38	6					2	46
Being squeezed between or under two people	8		2	2				12
Fight	2							2
Exposure to welding beam		2						2
Exposure to chemicals	16	2						18
Falling objects			6		8			14
Drifting or rubbing		4						4
Falling from height	4					2		6
Being forced	4	2						6
<b>Frequency</b>	130	28	20	4	14	2	2	200

Table 4 shows bad behaviours that causes an accident and the places at which an accident occur are investigated within the scope of the research. According to the results, the main reason of the accidents is “unsafe behaviours” (67 %) which was determined be not obey the rules despite the safety measures are put in place. The second most common cause of accident is not to use the personal protective equipments (12 %). Using the equipment and tools in a dangerous way is the third most common reason (8 %). “Working dangerously fast” and “unsuitable stowing and loading” are also important reasons of accidents. While the majority of the accidents (62 %) occur in the building which was constructed, 28 % of the accidents

occur at open fields in the construction site. The remarkable fact in the data is determining that a significant amount of accidents occur not only in the buildings that are constructed but also at outdoor environments as open construction fields. Especially the number of accidents, which occur as a result of falling objects that carried by heavy duty vehicles, must be less. These results show that the measures taken in the outdoor environment are inadequate and neglected. 130 of the 200 (65 %) occupational accidents occurred during the monitoring period are escaped lightly without workday loss. 28, 20 and 14 of 200 accidents, which correspond 14 %, 10 % and 7 %, respectively, caused 1, 2 and 10 workday losses, respectively. “Dashing and flitting objects”, “being hit by an object” and “falling objects” are the most common reasons of accidents that cause workday loss. Especially accidents related with falling objects, dashing objects and falling from height cause longtime treatment and recovery duration. 312 days of workday loss, which is related with occupational accidents, occurred during monitoring period.

## **5. DISCUSSION**

The result of this study shows the facts about the ages, occupation and education level of the victims, injured parts of the body, severity of injury, unsafe behavior that cause accidents and types of accidents. There have been no fatal accidents in the site during the period of research. Only 2 severe injuries occurred. Nevertheless, it is known that minor occupational accidents, which are not considered sufficiently and even not registered, cause great financial loss in workplaces. While 9 major accidents, which cause disability for more than 10 days, occur in the construction site during the monitoring period, the others are minor accidents that cause disability for less than 3 days. According to the results of the study, 29 % and 21 % of workers, who are exposed to occupational accident, are unskilled workers and moulders, respectively. 44 % and 52 % of the accidents affected workers in 18-24 and 25-39 age groups, respectively. Majority of the accidents caused by “dashing and flitting objects”, “being hit by an object”, “falling objects” and “being stung by an object”. The injuries as a result of accidents are “incision”, “exposure to metal burr”, “transient loss of vision”, “trauma” and “perforation”, respectively. Eye, finger, foot and hand injuries are the most common areas that affected from the injury. Most of the accidents occur on Mondays, in summer months and during 4th-6th working hours. According to the results of this research, ‘unsafe behaviours’, which is defined as not to obey the rules despite the necessary measures are taken, is the most important reason for accidents with a rate of 67 %. Not using the ‘personal protective equipment’ and ‘using the tools and equipment in a dangerous way’ are the other important causes of accidents. In spite of all warnings, measures and trainings, personal protective equipment aren’t used effectively and regularly. Especially hand tools and lifting machines such as crane and forklift are used in dangerous way and for the wrong purposes. 312 workday losses occurred as a result of occupational accidents during the monitoring period.

## **6 CONCLUSION AND RECOMMENDATIONS**

This research was Carried out to determine the causes, results and dangerous behaviours of accidents in construction sites in Nigeria. The study aims to develop an accident analyze and management system. In this way, the study aims to present the contribution of preventive measures to the sustainability of enterprises by reducing the losses occurred as a result of accidents. Hundreds of serious accidents occur in Nigeria due to lack of attention, dangerous

behaviours, disregarding the occupational safety rules, disapplying the rules of working at height, disusing of the lifting vehicles and hand tools, which have a high potential for accidents, lack of maintenance and control of the equipment, lack of experts, technical staffs, inspections and trainings.

The main reason of the accidents is determined as dangerous behaviours of the workers, it is also well known that managerial faults have an important effect on the accidents. In brief, ignorance, disregarding and lack of equipment, which are the main reasons of dangerous behaviours, must be investigated and thus, the necessary measures must be taken in order to minimize these reasons. At this point, systematic trainings of occupational safety play a key role. Besides, the workers must report the improper practices, obey the occupational safety rules and demand from administration to take measures. All employees have to pay attention to use PPE. Educational, instructional and informative occupational safety seminars, which cover all topics and risks, should be conducted. Necessary interventions should be done to avoid mistakes after examining the occupational safety reports that are prepared by both company and whole sector. Trainings should be given regularly until the workers interiorize the usage of personal protective equipment as an obligation.

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