Contractors Perception towards Excavation Hazard

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Abstract

Construction employees all over the world, are faced with series of dangers within a depth greater than 1.5 metres in an excavation work, due to the extent of collapse. The study assessed contractors' perception associated with hazards with excavation work. Forty-seven contractors within Central Region were involved in the face-to-face administration questionnaire. Findings from the study reveal that excavation depth, nature of the strata, presence of water, exposure to wet weather, any load close to the edge of the zoned of influence and the presence of chemical gases within the excavation area have major impact on excavation works. Excavation depth and nature of the strata were ranked as the highest among the thirteen hazardous variables within construction work area and the least was the time under which the excavation works will be carried out. Planning for hazard prevention should be in accordance with the OSHA guidelines. The identified hazards should be carefully analyzed for prompt measures to be taken.

Keywords: Construction, depth of excavation, influence of water, risk, weather condition.

1. Introduction

The construction industry`s safety record is unenviable, since the incidence rate of fatal accidents is higher than any other industry in most countries. Moreover, with the recognition of the significance to prevent accidents at an early stage, some major efforts have been made on the prediction of accidents in construction. However, existing precision of prediction on safety risks is inadequate and far from satisfactory (Wu, 2010). Employees on construction sites are faced with different types of fatalities when they are working at depth more than1.5m, due to the risky nature of the activities (Phoya, 2012). A lot of construction activities will require excavations to be undertaken before works, such as preparations for the foundations for erection of a new building. A report from Safe Work Australia (2014) indicated that an excavation site can be hazardous to all employees in the vicinity of the construction work. Report from International Labour Organisation (ILO, 2009) shows that hazard from workplace could impair the health and well-being of workers. Any particular hazard identified in relation to excavation work as indicated in a Safe Work Australia (2014) report shows that there should be a proper handling of any hazard identified to minimize or prevent accidents on site. Opaleye, O., Smallwood, J. and Shakantu, W. (2015 in their study of Accident on Small Scale Construction Sites in Pretoria, concluded that conclusion that hazards on construction sites include: poor supervision of the workers and unsafe behavior of workers on site, misappropriate use personal protective equipment (PPE), and employees not heeding to instructions during erection of scaffolds and inappropriate use of ladder. The paper assessed contractors' perception towards hazards in excavation works.

2. Literature

Ground excavating is very hazardous, since it involves a number of potential risks to health and safety. The most obvious danger is the risk of the sides collapsing in, on the employees who are working down in the trench. Even if it looks safe, the sides of a trench or excavation may not be stable at all. The deeper the excavation, the harder it will be for the workers to escape, especially if the collapse is extensive or is a trench and lead to the eventual crushed or suffocation from the material that has fallen on them (Ministry of Labor, 2014). Adbelhamid, Narang and Schafer (2011) asserted that accidents are common on construction site due to the dangerous nature activities. Even though, there have safety programmes all over the world to cater for such dangerous activities on construction sites. Hale et al., (2012) was of the view that the dynamic nature of construction work and the transient nature of the workforce makes it difficult to prevent accident on sites. Hale et al., (2012) further indicated that improvement on present measures to prevent accidents on sites are not curtailing this menace, but that does not safety personnel to institute measures on how to prevent or reduce this accident.

Excavation in construction is any operation in which earth, rock, or other material in or on the ground is moved or otherwise displaced by means of tools, equipment, or explosives, and includes earthwork, trenching, wall shafts, tunneling and underground work (Safe Work Australia, 2014; OSHA. 2015). High-risk obligations apply to excavations with a depth greater than 1.5 metres (Safe Work Australia, 2014). A trench is defined as a narrow excavation (in relation to its length) made below the surface of the ground, with a depth greater than its width, but the width of a trench (measured at the bottom) is not greater than 4.6 m (OSHA. 2015). Excavation failures occur quickly and this limits the ability of the worker to escape especially if the collapse is extensive or is a trench. The speed of an excavation collapse increases the risk associated with this type of work and the consequences are significant as the falling earth can bury or crush any person in its path. This can result in death by suffocation or internal crush injuries. Factors such as rain, extreme dryness or the pressure from nearby movement can all cause the ground to give way at any moment without warning. These conditions will determine how the trench needs to be dug, including the steepness of the sides and whether any support is needed to prevent the possibility of collapse. The magnitude of the consequences particularly in relation to trench collapse highlights the need to protect the employees and other person working at or near excavation sites (Ministry of Labor, 2014).

2.1 Excavation work Hazards

Most of the employees working within construction work area are faced with several hazards, such as the following: the extent of excavation depth, nature of the strata (soil variations creating the potential for the sides to collapse), fractures or faults as a result of previous exercise, the presence of water (from other sources), exposure to wet weather, presence of load close to the edge of the zoned of influence, the time under which the excavation works will be carried out, any previous disturbance as a result of previous exercise, presence of adjoining buildings, proximity of adjacent excavations to the current one, the result of vibration from other activity which may increase the potential to collapse, the presence of existing underground services within the area of the excavation and the presence of chemical gases within the excavation area (Safe Work Australia, 2014).

Some potential hazards associated with trenching work include falling loads, hazardous atmospheres, and hazards from mobile equipment. Since, an unprotected trench can be an early grave to employees. Therefore, employees must enter trenches only when adequate protective measures have been put in place (OSHA. 2015). Effective planning and management of all identified hazards associated with excavation works will contribute to hazards prevention on construction sites (Safe Work Australia, 2014). A report from OSHA (2015) shows that trenching and excavation work presents serious hazards to all workers involved. The greatest risk is associated to cave-ins (OSHA. 2015). Employers should protect their employees from such hazards by either of the following: sloping and benching the sides of the excavation, supporting the sides of the excavation or placing a shield between the side of the excavation and the working environment (OSHA. 2015).

2.2 Duties of employers in hazards prevention

It is the duty of employers to manage risks to health and safety which arise from excavation work, systematically. Employers can employ four steps to manage excavation risk. Employers can systematically manage the risks by undertaking four-step risk management process, such as hazards identification, conducting risk assessment associated with the hazards, ensuring that the risk identified is put under control and review the process on regular basis (Safe Work Australia, 2014). An employee capable of identifying existing, predicting hazards and authorized should be in

charge of excavations in order to give prompt corrective measures to eliminate them. The personnel should be able to classify soil and inspect protective systems available. In addition to designing structural ramps, monitoring water removal equipment, and conduct site inspections (OSHA. 2015).

3. Methodology

The section describes the methodology employed during the questionnaire administration. All the registered contractors in the Central Region were contacted, using information from **The Architecture and Engineering Services Limited (AESL).** There were forty- seven contractors within Central Region and all of them were approached to answer the questionnaires. At each of the construction firms, one professional was delegated by the management to answer the questionnaire, depending on who was in charge of the project. The respondents were made up of professional in the field of architect, quantity surveying, a structural engineering, health and safety and site or construction management. The selected respondents were considered to be the key personnel in the construction industry in Ghana. The fieldwork was conducted in March 2018 and a follow-up in April 2018 to ensure that each firm had an equal opportunity to participate in the survey. Descriptive statistics was employed in the analysis of the questionnaires received from the respondents.

4. Discussion of results

This section discusses the findings from the respondents based on demographic information and contractors' perception on excavation hazard.

4.1 Demographic Information

4.1.1 Gender of respondents

Table 1 shows that majority of the respondents were males, with few females. This shows that the construction industry in the Cape Coast Metropolis was dominated by males.

Table 1: Gender

	Frequency	Percentage
Male	42	89.4
Female	5	10.6
Total	47	100.0

4.1.2 Qualification of Respondents

Table 2 shows that the educational background of majority of the respondents were between Bachelors' degree and Higher National Diploma. Only few of the respondents had Postgraduate and Senior School Certificates. This shows that employees had acquired high knowledge and skills in the required field.

Table 2: Highest Qualification

	Frequency	Percentage
Senior school certificate	6	12.8
National diploma or certificate	18	38.3
Bachelor's Degree	18	38.3
Post-graduate	5	10.6
Total	47	100.0

Table 3 shows that most of the respondents were site managers and followed by site engineers and foremen; architects and surveyors respectively. This shows that adequate data were collected based on the calibre of the respondents who were directly involved with activities of construction.

4.1.3 Respondents Status in Firm

Table 3: Position in Firm

		Frequency	Percentage
	Foreman	7	14.9
	Site Engineer	7	14.9
	Architect	5	10.6
	Site Manager	17	36.2
	Surveyor	5	10.6
	Store Manager	2	4.3
	Total	43	91.5
Missing	System	4	8.5
	Total	47	100.0

4.1.4 Number of Years Firm has been in Existence

Table 4 shows that most of the respondents had a knowledge of the existence of the firm they been working with based on the number of years they have been with firm. It also shows that the firms have gained enough experience with the challenges associated with executing project.

Table 4: Years of Firm

	Frequency	Percentage
5-9yrs	8	17.0
10-14yrs	10	21.3
15-20yrs	15	31.9
21-30yrs	6	12.8
31yrs and above	6	12.8
Total	45	95.7
MissingSystem	2	4.3
Total	47	100.0

4.1.5 Classification of Firms

With respects to classification from Table 5 shows that the activities of the construction sites in Cape Coast Metropolis were duly under the care of competent and qualifies professionals, since D1/K1 and D2/K2 handling most of the projects. Few of the projects were handled by D3/K3 and D4/K4 respectively. It also shows that the respective firms had the necessary organizational capacity to enable them tender and execute the projects.

Table 5: Firm's Classification

	Frequency	Percentage
D1/K1	15	31.9
D2/K2	17	36.2
D3/K3	8	17.0
D4/K4	5	10.6
Total	45	95.7

MissingSystem	2	4.3
Total	47	100.0

Table 6: Influence of Contractors' Perception on Excavation Hazard

Variables	Mean	Std. Deviation	Ranking
The extent of excavation depth	4.04	1.053	1st
Nature of the strata (soil variations creating the potential for the sides to collapse)	4.31	0.900	2nd
Presence of water, exposure to wet weather	4.53	0.894	3rd
Any load close to the edge of the zoned of influence	4.22	0.850	4th
The presence of chemical gases within the excavation area	4.30	0.840	5th
Presence of load close to the edge of the zoned of influence	4.27	0.837	6th
The result of vibration from other activity which may increase the potential to collapse	4.45	0.829	7th
Exposure to wet weather	4.40	0.798	8th
The presence of existing underground services within the area of the excavation	4.27	0.780	9th
Proximity of adjacent excavations to the current one	4.43	0.773	10th
Fractures or faults close to the excavation area	4.47	0.757	11th
Presence of adjoining buildings	4.30	0.756	12th
The time under which the excavation works will be carried out	4.44	0.755	13th

5. Conclusion and Recommendation

The study assessed how contractors' perception will influence hazards occurrence in excavation. The extent of excavation depth in predicting the occurrence of accidents has the highest standard deviation of 1.053. Indicating the need to put appropriate measures during the exercise to minimise any unforeseen. All the thirteen variables of excavation hazards have a mean ranging from 4.04 – 4.47 which shows that all the variables are considered to be very necessary during excavation works. The standard deviation of all the variables ranging from 0.755 – 1.053 also show how strong the variables when it comes to excavation works. Contractors should take all the listed variables serious and considered them during any excavation works, in order to minimise major injuries and any unforeseen deaths on sites.

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