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Views of Construction Accident Analysis in Bloemfontein

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ABSTRACT

Purpose: The reported study examined how infographic analysis of construction accidents can uncover unsafe acts and conditions.

Design: The phenomenology study obtained data through 26 semi structured interviews conducted among contractors and health and safety consultants. The study attempts to respond to “what are the causes of accidents and how important is accident analysis in construction”.

Findings of Empirical Research: Unsafe acts appears to contribute more to accident causation than unsafe conditions. Notable accidents reported include hand cuts, hit and fall, electrocution, struck-by objects and caught between objects. However, the use of (infographic) accident analysis is limited even though most of the interviewees occur with its benefits.

Practical Implications: The leading causes of accidents through unsafe acts and conditions that require the attention of stakeholders were highlighted in the study. The use of infographic analysis, which would visually assist all workers should be encouraged in the industry.

Research limitations/Implications: The study is limited to Bloemfontein in terms of primary data.

Conference Theme: Health and Safety

Keywords: Accident, Construction, Contractor, Infographic analysis

1. INTRODUCTION

The construction industry is designated as one of the industries with high accidents rate in many part of the world, when compared to other industries (Nielson, 2013). Construction accident can be defined as an unplanned,

unexpected, undesirable, and uncontrolled event that occurs by chance to a person involved in work on a construction site (Hamid, Majid, and Singh, 2008). An accident could result in fatalities, injuries and damages to the material or equipment, especially those used during the work, and a loss in a production flow (Hamid, et al, 2008). However, these consequences of accidents show that there are numerous factors that contribute to the manifestation of construction accidents. Workers' poor attitude to safety, working at high elevations, failure of workers to obey safe work procedures (SWPs), negligence, operating equipment without safety device, lack of knowledge and skill, failure to use Personal Protective Equipment (PPE), and harsh work operations are some of the factors (Hamid, et al., 2008). However, there are also various acts of God that cause calamity on site. Some so-called acts of God include rainfall, high wind, flooding, earthquake, and landslides (Kediri et al., 2014).

No matter the origin of an accident, it is important to analyse the event for future mitigation purposes. A range of qualitative and quantitative methods are used for such analysis. One of such qualitative tool is infographics. Infographics, also known as information graphics that is defined as a graphic visual representation of information, data or knowledge is intended to clarify and integrate difficult information quickly and clearly (Siricharoen, 2013). Infographic is not a new technology, but was used mostly in the early 1980s to support the field of journalism to accommodate newsletters, magazines, newspapers, and media reports (Siricharoen, 2013). Media journalism has changed a lot and currently is developed to improve the quality of peoples live, they enable people to react quickly to what they visualize rather than the concept they do not visualize or understand. The infographics is often used to present the survey data, simplify complicated data, explain how something works, and to compare two different theories (Siricharoen, 2013).

For example, the Occupational Safety and Health Administration (OSHA) in the United States of America (USA) through its agency of the Bureau of Labour Statistics (BLS) used infographic tools to present the top four injuries that contributed 57% of the fatality rate in the American construction. The four major's injuries described were, falls, electrocutions, caught between objects, and struck by an object. However, 36% of the injuries were resulted from fall. While 10% of injuries resulted from being struck by objects and 9% was from electrocutions and 2% was from being caught between objects. (OSHA, 2012)The representation conveys excellent information with illustrations.

In global terms, an approximated 60000 fatal constructions accidents occur worldwide annually and one worker dies in every 10 minutes (Yilmaz, 2015). Such information when presented in graphics could arrest the attention of the project team and maybe would speed up the process of a positive attitude towards safety management on site. However, this paper explored

the use of information graphics when analysing the causes of accidents on construction sites, specifically under fall protection, electrocution, caught between objects, and struck by an object.

2. CAUSES OF CONSTRUCTION ACCIDENTS

Accidents experienced on construction sites are unexpected, unplanned and uncontrolled events involving the movement of construction workers, objects, and materials, which may result in injuries, damages, and losses to properties or people (Hosseinian and Torghabeh, 2012). The construction industry is therefore a high-risk industry because there is a high risk of accident occurrence (Nielson, 2014). However, majority of the contractors prioritise the subject of period, cost, and quality over the safety of people working in construction. Furthermore, Hamid et al. (2008) explained that many contractors aim to maximum their profit instead of preventing accidents.

Hamid et al. (2008) stated that 99% of accidents on construction sites are caused by unsafe acts and conditions. Unsafe acts can be defined as a performance of works in a construction site in a manner that may threaten the safety of workers (Nielson, 2014). For example, failure to use PPE, or a failure to warn people about hazards inherent in working activities. Unsafe acts are a violation of an accepted safe procedure, which would allow the occurrence of an accident (Hamid et al., 2008). Similarly, an unsafe condition is a condition in construction sites that is likely to cause an accident, for example, fire and explosion hazards with inadequate warning systems.

Accidents on a construction site can be prevented by establishing the root causes of accidents (Hosseinian and Torghabeh, 2012). However, there are big accidents causation theories that were developed to explain the causes of accidents so that proper actions could be taken to make an improvement. Modern theories are the domino theory, which was created by Heinrich in 1930 and multiple causation theory by Petersen in 1971 (Hamid et al., 2008). These theories are concisely explained in this section.

The domino theory was developed by Heinrich in 1930. It suggests that one event leads to another, then to another and so on, ultimately results in an accident. According to Hamid et al. (2008), this theory points two main concepts. Firstly, people are the basic sources of the caused accidents. Accident occurs merely because people do not comply with regulations of safety. Secondly, the management should be accountable for the prevention of the accidents. Management should provide safety measures to prevent workers from hazardous environments. This theory of causation consists of five dominoes which are ancestry and social environment, a fault of a person, unsafe acts and conditions, accidents, and injuries (Hamid et al., 2008).

The multiple causation theory was invented by Petersen in 1971. Petersen believed that unsafe act and unsafe condition are the two primary features of the event which lead to an accident. However, there are more than one ground which contributes to both unsafe act and unsafe condition that produce the occurrence of an accident (Hosseinian and Torghabeh, 2012).

2.1. INFOGRAPHICS IN THE ANALYSIS OF ACCIDENTS

Siricharoen (2013) defined infographics as the use of a computer-supported interactive representation of data to amplify cognition. However, there are so many ways in which infographics can be utilized, for instance; a recruiting tool, presenting survey data, simplifying a complicated concept, explaining how something works, comparison, interesting facts, raise awareness, and so on (Futterman, 2016). The study by Siricharoen (2013) explained that infographic can be used in the construction industry to highlight the survey data, and to bring closure to unforeseen event. For example, the study by OSHA (2012) showed that every day, on average, two construction workers die of related injuries in the USA and the fact is, one in five workplace fatalities are construction related. The results gathered from a survey data of accidents in construction are usually presented statistically. The graphic representation is useful as statistics and numbers can overwhelm the public to the extent that such data may lose much of its importance. For example, according to statistical data on accident's reports Heinrich deduced that 88% of accidents are caused by unsafe acts of workers; 10% occur due to unsafe conditions and 2% occur due to acts of God such as natural disasters (Hosseinian and Torghabeh, 2012). The data can be better presented in graphics that will be easy to explain to everyone on a project. If statistics is organized in an infographic format, it becomes easier to draw meaning from data. Figure 1 shows how data is presented in an infographic format.



Figure 1: Four leading causes of worker deaths on construction sites in USA (Source: OSHA, 2012)

3. METHODOLOGY

An in-depth qualitative approach was adopted for this study to discover the causes of accidents in the construction industry of South Africa. A semi-structured interview was conducted among contractors as well as health and safety consultants. The qualitative approach was seeking to answer, 'what are the causes of accidents and how important is accident analysis in construction', as recommended by Tracy (2013). The interviews were conducted to help in understanding the range of construction accidents problems experienced on the construction site. The researcher adopted non- purposive sample to help in selecting the participants interviewed as recommended by (Mezler, 2014). The reason for using purposive sampling was to help in selecting participants who understand the phenomenon under investigation. The interviews between the researcher and the participants took place face-to-face and were recorded using a cell phone. Thereafter, the cell phone recordings were transcribed and the information, which had less impact on the study, was deleted. The sample of the study resulted to 26 out of 35 participants that initially agreed to be interviewed. The demographic information of the study shows that 62% (16 out of 26) were contractors, while 38% (10 out of 26) were H&S consultants.

4. FINDINGS AND DISCUSSION

The data of this study were analysed by eliminating answers which did not answer the research questions. This section presents the results and discussion based on the analysis of the interview transcripts. Twenty-six (26) interviews were conducted to examine the causes of accidents at construction sites so as to determine the significance of infographics in the analysis of construction accidents, and to comprehend how infographics are applied in the analysis of construction accidents. After the transcription of resultant data from the interviews, explanations in the form of themes were developed.

Factors leading to construction accidents

Most of the participants explained that the construction industry is exposed to numerous factors that cause accidents on sites. The results obtained from the participants revealed the crucial factors influencing accidents on site. Such mentioned factors include poor recognition of hazards, lack of communication, lack of management involvement, lack of proper training, improper use of PPE, damaged machinery, not following instructions, working under the influence of substances (intoxication), and working during adverse weather conditions.

When requested to identify the leading causes of accidents in Bloemfontein, the analysis of the interview transcripts suggest that 14 participants agreed that unsafe acts are the major causes of accidents on construction sites, whereas 12 of them were convinced that accidents at construction sites are caused by unsafe conditions. The participants defined dangerous acts as incorrect procedures and work styles performed by the workers in a manner that may threaten the safety of employees. This may be due to the lack of information from the management. Moreover, the extent of knowledge and skills of employees regarding safe working procedures (SWPs) is also crucial to the proper execution of works. The participants defined an unsafe condition as a condition on construction sites that is likely to cause an accident.

A follow-up question asked the interviewees to rate the top four accidents reported by OSHA in the USA regarding their occurrence in Bloemfontein. In general, the rating from the interviewees indicates that the top four accidents experienced in the USA are not prevalent in Bloemfontein. However, 14 of the participants failed to recall if anyone of the four injuries has occurred on their projects while 11 of them were of the view that such accidents are often experienced on their job sites. However, a contractor explained should they experience accidents on their site; they follow steps shown in Figure 2 to investigate the causes of accidents. The first step to be taken is for the safety officer to inform or instruct the workers on site to stop production, determine if there are injuries or fatalities and apply first aid where necessary. Secondly, the safety officer in cooperation with the site manager should inform the health department in case of serious injury or fatality. The area where the serious injury or death took place would be barricaded for investigation of the cause of the incident or injury and or for determination of the contributing factors. Finally, once an investigation has been finished, the incident should be reported to the closest relevant Department of Labour in the province.

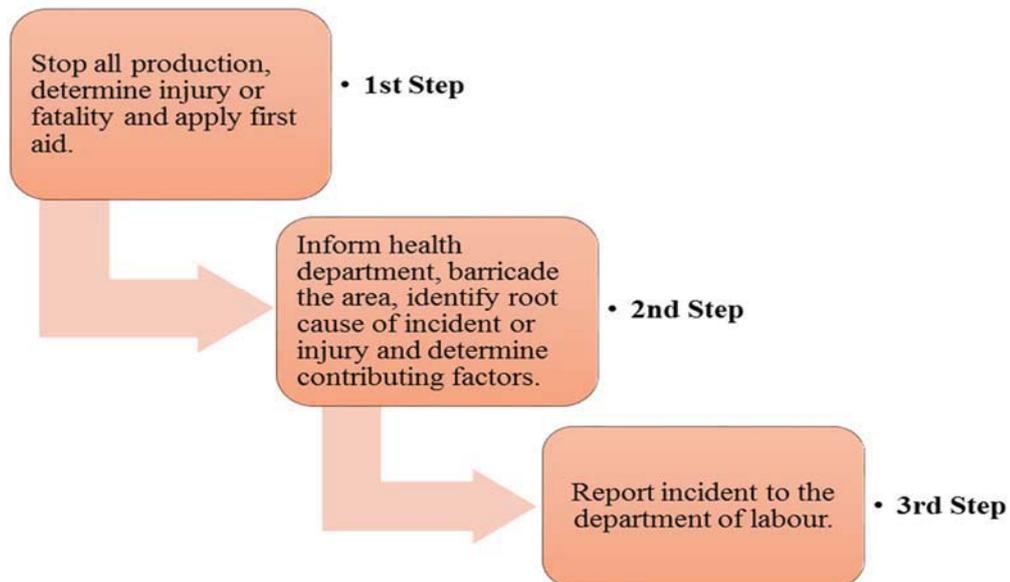


Figure 2: Steps for accident investigation

The follow-up question asked the participants to illustrate the action they are taking should they be exposed to accident. Figure 3 shows a guideline or map which should be followed by the contractors should they be exposed to accidents on construction site. It should be noted that the construction managers are responsible to share information with the safety officer and managers or any person delegated to the management of the project. As stated out in the General Administrative Regulations section 8(3), if an employee is injured on duty, the safety officer or the authorised person must report the incident to the Department of Labour using the WCL2 through fax or email. However, according to the views shared in the interviews, not all injuries or accidents are reported to the Labour Department. Reporting of accidents appears to be influenced by 'compensation'. Most of the participants stated that they only report major accidents and injuries, because such accidents require special treatment and the victims must be compensated, which will involve the Department of Labour.

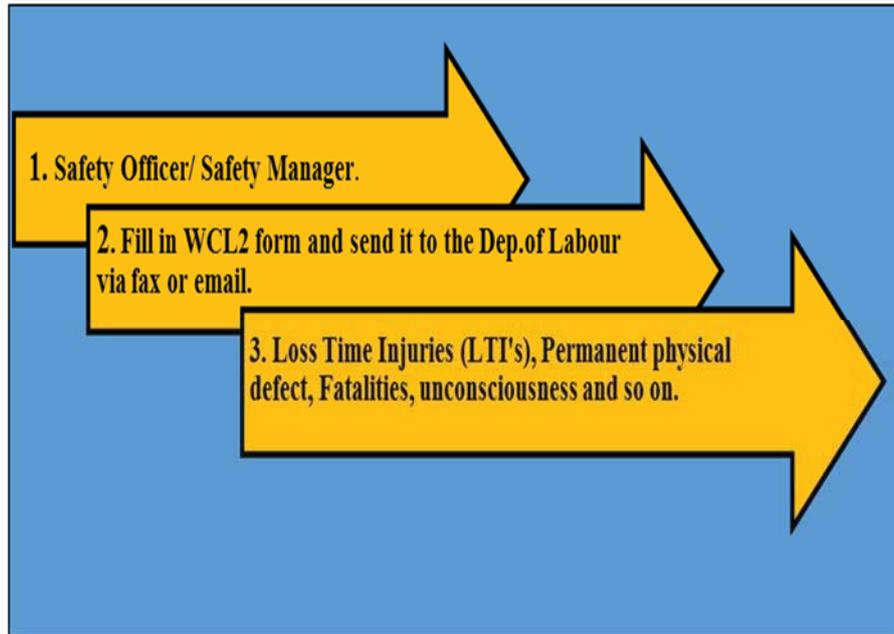


Figure 3: Reporting of accidents to the department of labour

Perceptions of information graphics

It was assumed in this study that a persons' ability to interpret visual images depends on the brain's natural ability to detect objects through processing of shapes, contours, and space. In broad terms, the interviewed participants agreed that infographics on construction sites are very convenient to simplify a complicated concept and explain how 'things' work. The H&S consultants explained that infographics are helpful for carrying out induction training programmes because some of the employees are unable to read or write and relate to work situations; for instance flash reports, induction pieces of training, and toolbox talks. The participants further added that infographics use a combination of images, words, and numbers, and operate in a hybrid system to offer a great opportunity for enhanced effectiveness of a communication. For instance, in construction project event probabilities are simplified to make it easy for workers to interpret up to a point, beyond which further abstraction starts to obscure its meaning.

Furthermore, the participants considered infographics as an essential tool for presenting complicated or complex concepts to workers and public visitors to the construction site. There is numerous type of information that could be presented in a visual format. The information could be spatial, chronological, qualitative, and quantitative. The space information includes

information that describes relative positions and spatial relationships in a physical or conceptual location. Chronological information consists of information that describes following positions and casual relationships in physical or conceptual positions. It should be noted that qualitative information target qualities and information that cannot be measured.

There are also many infographic devices that are utilized in the presentation of various kind of information such as the types. In spatial information, data could be presented using diagrams through icons, sequence, process, timelines and exposition. In chronological information, maps could be used to present data, locator and schematic more likely qualitative information where qualities are presented. Quantitative information could be presented through the application of charts such as flows, bars, and pies.

The participants were asked if they have employed the use of infographics for accident investigations and analysis. It is however notable that most of the participants from the contractors reported that they do not employ the use of infographics for accident investigation and analysis, only a few do it in conjunction with H&S consultants. This was evident in the following response:

“Since that, there had been no fatalities occurred in the past few years therefore, there had been no much accidents investigations and analysis. Moreover, infographics are expensive because they require the organisation to have special infographic designers, of which their costs are not normally comprised in the project budgets”.

However, the H&S consultants explained the procedures for the application of infographics in accident investigations and analysis. They clarified that the construction sector is one of the sectors with significant number of illiterate workers, so once a fatality occurs, the workers should be reinstructed based on the recorded accident. Reinstructions could be done through induction trainings and toolbox talks where infographics are presented. The processes, awareness, and warnings with regards to that fatality should be illustrated in a visual format and pasted to demarcated areas on sites. To sum up, the participants contend that communicating induction training information through proficient infographics is the best procedure to eliminate fatalities in construction sites.

5. CONCLUSIONS

This explorative study explored the causes of accidents on construction projects. The paper also went beyond the causes of accidents by highlighting the potentials of infographics in the analysis of construction

accidents. Given that accidents could manifest on a site through a combination of factors that are not limited to poor identification of hazards, lack of communication, lack of management involvement, lack of proper training, improper use of PPE, damaged machinery, not following instructions, and substance abuse, it is essential to communicate with workers and the public with more than one medium. Information graphics has been confirmed to be useful in tool box talks, but its potentials in accident analysis and behaviour modification after an accident should be further explored in the industry.

The construction sector is recognized as one of the sectors where non-educated workers are in a majority, apart from being a multilingual workplace. The use of visual imagery and aids is highly relevant in this context. The use of information graphics would make training sessions convenient and simplified for illiterate workers. The H&S trainings should thus comprise of the combination of text and graphic presentations to optimize communication and to accommodate those who cannot read textual contents. In addition, such combinations of text and graphics are very useful for site trainings. The graphics present the physical context in a specific and precise manner, whereas the textual content complements it with procedural information that would have been less effectively communicated through visual presentation.

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