

Assessment of Occupational Safety and Health in Construction Sites in Nairobi County, Kenya

R. K. Kemei¹, J. W. Kaluli² and C.K. Kabubo³

Kenya Army Corps of Engineers, Kenya Defence Forces, Thika
^{2,3} Sustainable Materials Research and Technology Centre, JKUAT

wambuak@gmail.com

ABSTRACT

Construction industry in Kenya plays a vital role in achieving social economic development goals, providing shelter, infrastructure and employment. Safety at construction sites is often compromised in a market driven society where concern is for completion of projects at the required quality, at minimum cost and time. A study was carried out to identify the common accidents in construction sites and to evaluate factors that cause these construction sites in Nairobi County, Kenya.

The research adopted a questionnaire survey where a study was carried out in 41 construction sites sampled from all the 9 regions in Nairobi and identified the common accidents in construction sites and factors contributing to the accidents in construction sites. The results show that out of a population of about 6,295 construction workers there were 571 cases of reported injuries of varying severity each year; 391 cases were minor not requiring time off duty, 119 required up to 3 days off, 51 required more than 4 days off duty and 4 were fatal cases. Therefore, the results show that Kenya experiences about 64 fatalities per 100,000 employees each year which is high compared to UK which experienced 0.44 fatalities per 100,000 employees in 2013, China experienced 3.8 fatalities per 100,000 employees in 2013 while South Africa experienced 25.5 fatalities per 100,000 employees in construction sites. In the study conducted on Nairobi, most injuries in construction sites was as a result of being hit by falling objects (17%), injuries as a result workers falling from heights (15%) injuries as result of operating motor vehicles or light machines (13%) and lifting heavy objects (11%). The main factors that cause these accidents are reluctance to provide resources for safety (12%), lack of training (12%), lack of enforcement of rules and regulations (12%), poor safety consciousness among workers (11%) and lack of strict operational procedures (11%) in construction sites. To reduce accidents in construction sites in Kenya, Construction companies need to provide workers with the necessary Personal Protective Equipment (PPE), which include safety belts, retaining belts, safety ropes, safety harness and catch nets to prevent being hit by falling materials and falling from heights. In order to improve safety in the construction industry, health and safety should be included right from preparation of contract documents and there is need to provide funding for the regulatory body that oversees safety in construction industry.

Keywords: Safety, Occupational Safety and Health (OSH), Construction sites, Nairobi, Kenya.

¹ Kenya Army Corps of Engineers, Kenya Defence Forces, P.O Box 1830-01000, Thika

² Corresponding author - Email: wambuak@gmail.com; Sustainable Materials Research and Technology Centre, JKUAT, P.O. Box 62000-00200, Nairobi

³ Sustainable Materials Research and Technology Centre, JKUAT, P.O. Box 62000-00200, Nairobi- Email: kabcha2001@gmail.com

Introduction

Construction is a basic pillar for global competitiveness and foundational enabler to Kenya's Vision 2030. Kenya has experienced a construction boom during the last decade. According to Kenya National Bureau of Statistics (KNBS) construction sector in Kenya contributes 4.9 per cent of the Gross Domestic Product (GDP) (KNBS, Economic Survey Report, 2013). Infrastructure development accounted for 8.7 per cent of the total budget for Financial Year 13/14 of the total budget of KES 1.6 Trillion (KNBS, Economic Survey Report, 2013). According to the Economic Survey report, 2013, the construction sector has generated new jobs and has grown by 62 % between 2007 and 2013 ahead of other economic sectors. The number of people who worked in construction industry in 2013 stood at 130,300 (KNBS, Facts and Figures report 2014).

Construction activities are among those consuming the bank credit at the fastest rate in the past few years. In December 2012, construction sector held KES 246 Billion of the total of KES 1.3 Trillion in loans from commercial banks which accounts to 20% (KNBS, Economic Survey Report, 2013).

Despite the steady growth in the construction sector in Kenya, the industry is a very accident prone. Data available from Directorate of Occupational Health and Safety Services (DOHSS) indicates that in between 2005 and 2009, there were 7769 fatalities across all industry sectors. In 2011, construction industry accounted for 16% of fatal accidents (40 cases reported for 100,000 workers) and 7% of non-fatal cases (DOHSS Annual Report, 2011).

In Kenya, there are no reliable data on accident cases in construction because most contractors do not report all the accidents (DOHSS Annual Report, 2011). Many workers have met their deaths in construction sites while others have become permanently crippled from construction related injuries. Further, laws on occupational safety and health are not strictly enforced. Safety rules in most construction sites do not exist and if they exist, the regulatory authority is weak in implementing each rule effectively. When accidents occur, they result on both direct and indirect cost. Direct cost includes, medical bills, premium for compensation benefits, liability and property loss. Indirect cost include, time lost while attending burial ceremonies, time lost in investigation, down time on damaged equipment and losses arising from site closure

An accident can be defined as an unplanned, undesirable, unexpected and uncontrolled event (Hinze J W, 1981). An accident does not necessarily result into an injury. It can be in terms of damage to equipment or materials; however those that result to injuries receive greatest attention (Hinze J W, 1981). Accidents that do not cause damage to materials or equipment or injury to personnel may foretell future accidents with less desirable results.

According to United Kingdom Health and Safety Executive (HSE) Report 2013/2014, there were 0.44 deaths per 100,000 workers in Financial Year (FY) 2013/2014 and 0.56 deaths per 100,000 workers in FY 2012/2013. In china, there are 3.8 deaths per 100,000 workers in construction industry in 2013 (China Statistical Yearbook, 2013). In South Africa, Smallwood *et al*, 2013 established there were 25.5 deaths per 100,000 workers in construction industry in South Africa. This shows accidents in construction industry in Kenya are still high going by the annual

DOHSS Reports. It has been acknowledged that 25-40% of fatalities in the world's occupational setting are contributed to construction (ILO, 2005).

It has been further noted that throughout the world, construction is one of the most hazardous industries (Suazo G A. and Jaselskis E.J., 1993). The major causes of these accidents are related to the unique nature of construction industry, human behavior, difficult work site conditions and poor safety management which result in unsafe work methods and procedures (Koehn *et al* 1995). When construction industry is compared with other labour intensive industries, construction industry has experienced a disproportionately high rate of disability injuries and fatalities (Hinze, J W, 1997).

Hughes and Ferret, 2005 identified the common accidents on site to be falling from heights, cutting of limbs due to mishandling heavy equipment, objects falling from height, electric shock from cables, caving in of excavations and lifting of heavy tools and equipment. They further stated that, workers are also deemed to cause site accidents due to fatigue, lack of discipline, carelessness and distractions. Other causes are attributed to the senior management ignorance, lack of training and poor communication.

Research done by Dedobbeleer and Beland, 1991; Ringen et al., 1995; Gillen et al, 1997; Laitinen et al., 1999; Loosemore and Lee, 2001; Tam et al., 2004; Cheng et al., 2010; Sertyesilisik et al., 2010; Tam and Fung, 2011 identified a number of relevant causes influencing safety performance in the construction industry namely: Poor safety awareness from top leaders, Lack of training, Poor safety awareness of project managers, Reluctance to input resource on safety, Reckless operation of machines, Lack of certified skilled labor, Poor maintenance of equipment, Lack of first aid measures, Lack of rigorous enforcement of safety regulation, Lack of organizational commitment, Low level of education of workers, Poor safety consciousness of workers, Lack of personal protective equipment, Ineffective operation of safety regulation, Lack of technical guidance, Lack of strict operational procedures, Lack of experienced project managers, Shortfall of safety personnel on site, Lack of protection of material during transportation, Lack of protection of material during storage, Lack of teamwork spirit, Fatigue by workers, Shortage of safety management manuals, Lack of innovative technology on safety and Poor information flow.

Lubega et al (2000) found that the causes of construction accidents in Uganda include lack of knowledge about safety rules, engaging in an inexperienced workforce and poor respect for safety. Pipitsupaphol and Watanabe (2006) did a study in Thailand construction sites and classified causes of accidents as unique nature of the industry, job site conditions, unsafe equipment, unsafe methods, human elements and management elements. Other factors identified are, failure to use personal protective equipment, improper loading or placement of equipment or supplies, failure to warn co-workers or to secure equipment and improper use of equipment.

Whereas many research efforts have been made in identification of causes of accidents in construction industry, research has also been done in construction safety. In 1931, Heinrich suggested that unsafe acts are the cause of a high percentage of accidents. His study found out that 88% of accidents in construction were caused by people while 10 % of accidents were attributed to unsafe conditions. Heinrich was the first researcher to suggest that incidents are symptoms of lack of management commitment to safety. He summarized that 98% of accidents are preventable by management. Komaki, 1986, reemphasized Heinrich's theory and suggested that monitoring and providing feedback as attributes of effective management.

Although regulations in occupational safety and health in Kenya are quite comprehensive, Directorate of Health and Safety (DOHS) do not have the capacity to strictly undertake safety inspection and audit at regular times thus making accidents at construction sites to be alarming. There is a need to determine why the number of accidents and fatalities in Kenya are still at very high level. It is very important to find any loop holes in enforcing the requirements of Safety Acts or any weaknesses in inspecting and auditing construction sites. In order to address these shortfalls, this research seeks to find out why accidents levels in construction industry are still high despite the legislation passed. This will help establish the strategies by policy makers in seeking to reduce the number of the accidents in construction industry.

To develop a safe construction sites in Kenya, owners, contractors and regulatory agencies are obliged by law to help to provide safe work environment to minimize injuries. The owner cannot have hands-off approach towards safety because construction activity will take place in the owner's property. Architects, Engineers, Project managers and employees also need a tool to integrate safety and health measures in project planning. It's against this background that it's pertinent to examine the safety of construction sites in Nairobi County in Kenya. This study was undertaken to identify the common accidents in construction sites in Nairobi County, Kenya and to evaluate factors affecting health and safety performance in construction sites in the study area.

Research Methodology

Various methods were employed in this study. This research commenced by reviewing the relevant literature on previous research through study of academic journals in order to develop in-depth understanding about accidents in construction sites. Based on the literature review, the researcher designed a questionnaire for collecting data. The initial questionnaire was revised based on interviewees' feedback. The literature review was followed by data collection, data analysis, discussion and conclusion.

The questionnaire developed had two main sections; the first section has general information on the company. This part gives details of the construction company under study, the number of years of existence, their specialization in construction work the company undertakes and the number of employees. The study also establishes the professional body the company is registered with, classification and the approximate value of the contract currently being undertaken.

The second section of the questionnaire evaluates in details health and safety procedures. The study seeks to establish the number of accidents in each construction site for the last three years, common construction site accidents, the budget the companies allocate to health and safety and causes of construction site accidents.

Data collection

The questionnaires were distributed to a sample of construction sites of ongoing projects. While selecting the sample, the researcher considered the main administrative divisions of Nairobi which are Central, Dagoreti, Embakasi, Kasarani, Kibera, Karen, Makadara, Pumwani and Westlands. The nine major administrative regions in Nairobi were used as a sampling frame out of which five regions were selected using cluster sampling. The regions of Nairobi County covered were North, South, East, West and Central Business District. Data was collected between 4th February 2014 and 6th June 2014.

The study area targeted Nairobi County construction sites which comprised of general building contractors and sub-contractors. The sampling frame consisted of large and medium sized

contractors which have registered with Building and Civil Engineering contractors in Kenya and Kenya Property Developers Association. The research focused on middle and large contractors in Nairobi County. The target respondents were persons who are well versed in construction work and in particular accidents at site such as project engineer, site manager, site engineer, safety and health officer, site supervisor, clerk of works and site agents. Respondents were from Class A, B, C and Class D contractors operating in Nairobi County. The respondents selected were expected to have extensive working experience in construction industry and were involved in construction at the time of data collection. The validity of the results was dependant on the responses from the sample. The selection of experts on construction sites was deemed to be of utmost importance.

The study established the common construction sites accidents using Likert Scale between 0 and 5 where 0 indicate “ accidents did not happen” and 5 “ frequency of the accidents is high” so as to create level of importance of each factor. Common construction accidents which were identified in the introduction of the research were; Hit by falling objects, Falling from heights, Use of light machines with motor, lifting of heavy weights, Operating heavy machines, Toxic or suffocation, collapse of earthwork, electrocution and Fire Explosion. Statistical analysis was conducted using the Statistical Package for Social Science (SPSS) so as to get the mean values of each factor and the ranking of the importance.

The study further seeks to establish the relative importance of the twenty five (25) factors identified by researchers highlighted in the introduction that contribute to the construction site accidents. Using Likert scale between 1 and 5 where 1 “ the least contributing factor in construction accidents” and 5 “the most contributing factor in construction accidents” to create a level of importance of each factor. Further, Statistical analysis was conducted using the Statistical Package for Social Science (SPSS). To determine relative ranking of the factors above, the scores were transformed to important indices based on Formula by Tam et al (2000).

$$\text{Relative Importance, RI} = \frac{W}{A \times N}$$

Where

W = Weightage given to each factor by respondents.

A = Highest Weight.

N = Total number of respondents concerning that factor.

The Relative Importance is normalized to fall within 0 to 1 range.

The number of questionnaires that were duly filled and returned was 41 representing 68% response. From the 41 questionnaires received, all were filled and usable. Data were checked, edited, coded and analysed.

Results and Analysis

Causes of construction site accidents in Nairobi County

The total number of employees in 41 construction sites studied in Nairobi was 6295. The annual number of reported accidents were classifies as Minor 1 (injuries not requiring time off duty); Minor 2 (Injuries requiring up to 3 days off duty); Severe (injuries requiring at least 4 days off

duty) (Figure 1). This shows that Kenya experiences about 64 fatalities per 100,000 employees each year (Figure 2). In the UK, the number of fatal accidents changed from 0.56 per 100,000 employees per year in 2012, to 0.44 fatalities per 100,000 per year in 2014 (UK Health and Safety Executive, 2014). In china, there are 3.8 deaths per 100,000 workers in construction industry in 2013 (China Statistical Yearbook, 2013). South Africa experiences 25.5 construction site fatalities per 100,000 workers per year (Smallwood et al., 2013). Therefore, Compared to developed countries Kenya experiences a very large number of fatalities (about 64 deaths per 100,000 construction workers per year).

According to Table 1, the five most significant causes of injuries in Kenya’s construction sites include being hit by falling objects (17%); falling from heights (15%); motor operated machines (13%); lifting of heavy weights (11%); and the use of heavy machines (10%). Various researchers have also found falling from heights, being struck by falling items and electric shock to be responsible for construction site fatalities (Reese and Edison, 2006; Hinze and Russel, 1995). Florence et al. (2008) found that in Singapore falling from heights was responsible for 55% of fatalities while being hit by falling objects caused 37.5% of the fatalities.

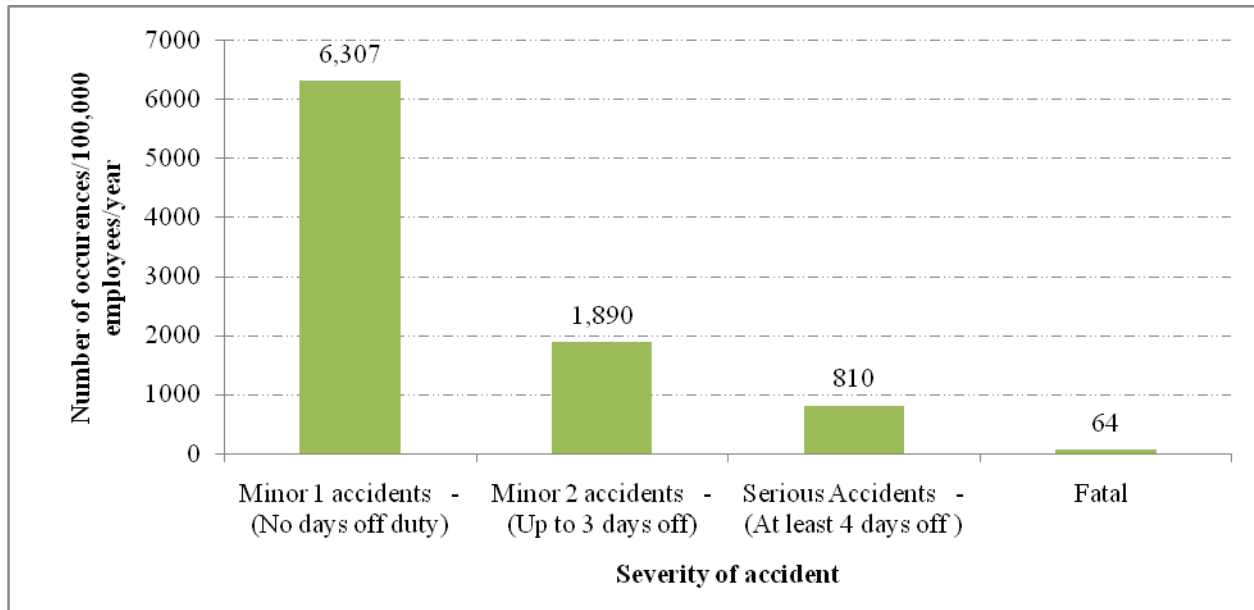


Figure 1: Occurrence of accidents in Kenya

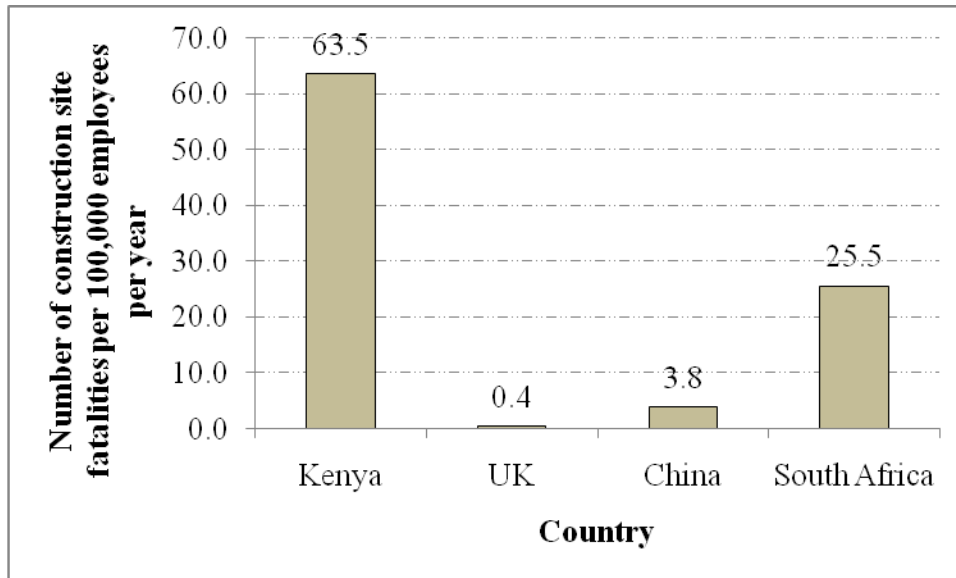


Figure 2: Number of Fatalities Resulting from Construction Site Accidents

Table 1: Common construction site accidents in Nairobi

Type of accident	Relative importance (%)
Being hit by falling materials	17
Falling from heights	15
Injury from motor operated machines	13
Injury from lifting of heavy weights	11
Injury from use of heavy machine	10
Suffocation	9
Collapse of earthwork	9
Electrocution	8
Fire and explosion	8

Tam et al (2004) working in China, and Florence et al. (2008) working in the United States found the most significant cause of accidents in construction sites to include falling from heights (37-50%), electrocution (5-13%), hit by falling objects (12-21%), collapse of earthwork in China (9%) and injuries due to use of heavy machine in China (9%). This shows a slightly different scenario where falling from heights is the most significant cause of accidents. This be because of the higher level of development and hence more construction of high rise buildings.

Ayman Ahmed (2010) established that most construction site accidents in South Africa were occurred as a result of falling from heights (28.18%), hit by falling objects (22.85%), electrocution (19.57%) injuries from motor operated machines like motor vehicles and concrete mixers (18.51%).

It may be concluded that being hit by falling objects and falling from heights contributes towards about 32% of all construction site accidents. Therefore construction companies need to provide

workers with the necessary Personal Protective Equipment (PPE), which include safety belts, retaining belts, safety ropes, and safety harness and catch nets to prevent being hit by falling materials and falling from heights. Furthermore, workers need to be continuously trained on the importance of using PPE.

Factors contributing to construction site accidents in Nairobi County

As is evident in Table 2, the ten most significant factors affecting safety in construction sites include Reluctance to invest in safety (12%); Lack of training (12%); Lack of enforcement of safety regulation (12%); Poor safety consciousness of workers (11%); Lack of strict operational procedures (11%); Poor safety awareness from top leaders (11%); Lack of personal protective equipment (11%); Lack of organizational commitment (10%); Lack of competence in Machine operation (10%) and Poor safety awareness from top leaders (10%).

Effective safety training reduces the number of construction site accidents (O'Toole, 2002). This study showed that lack of training in health and safety contributes about 12 % towards construction site accidents. Kenya has very few certified safety trainers (DOSHS, 2011). Health and safety training should be offered as a separate subject within Construction Management, Civil Engineering, Project Management and Architectural programs.

Table 2: Causes of construction site accidents in Nairobi

Type of accident	Significance (%)	Type of accident	Significance (%)
Reluctance to invest in safety	12.0	Lack of technical guidance	9.6
Lack of training	11.9	Lack of experienced project managers	9.6
Lack of enforcement of safety regulation	11.7	Lack of certified skilled labor	9.4
Poor safety consciousness of workers	11.2	Low level of education of workers	8.8
Lack of strict operational procedures	11.1	Poor maintenance of equipment	8.7
Poor safety awareness from top leaders	10.9	Lack of first aid measures	8.6
Lack of personal protective equipment	10.7	Lack of teamwork spirit	8.5
Lack of organizational commitment	10.3	Lack of innovative technology on safety measures	8.2
Reckless operation of machines	10.2	Poor information flow	7.8
Poor safety awareness from top leaders	10.2	Fatigue by workers	6.9
Shortfall of safety personnel on site	9.8	Shortage of Safety management manuals	6.3
Ineffective operation of safety regulation	9.6	Lack of protection of material during transportation	6.1
Lack of protection of material during storage	5.4		

Lack of enforcement of safety regulation by DOSH contributed 12 % of the accidents. DOSH has inadequate staffing compared with increased workload has continued to affect the smooth running while discharge their duties (DOSHS, 2011). Work Injury Benefits processing take a lot of officers and support staff time leaving them with little time to perform other official duties as specified in their performance contracts. This has been largely attributed to the inability of the Directorate to attract and retain qualified personnel. Another challenge faced by field officers was lack of transport to cover all workplaces within their jurisdiction. This resulted in officers not reaching all areas that fall under them and in most cases inspections carried out concentrated within a small area within Nairobi’s Industrial Area.

In the US, Irrizary and Abraham (2006) identified that lack of awareness of dangers in the construction industry, lack of safe behavior and lack of safety training as the factors influencing accident occurrence in construction. This could also be the case in Kenya where 61% of surveyed companies had projects valued at over KES 500 Million (Figure 3); and yet 63% of the construction companies budgeted less than KES 0.5 Million per year (Figure 4) to cater for health and safety.

Most of the construction sites visited lacked safety policy and written documents that enforces safety in the construction site. According to MacCollum 1995, project managers have a safety responsibility to prepare project safety plan, identify potential hazards at the site, prepare a written safety plan and insist on reporting of injuries, death and property damage as a result of accidents.

The construction industry in Kenya does not seem to have a clear policy and a regulatory body that deals with accidents in construction sites.

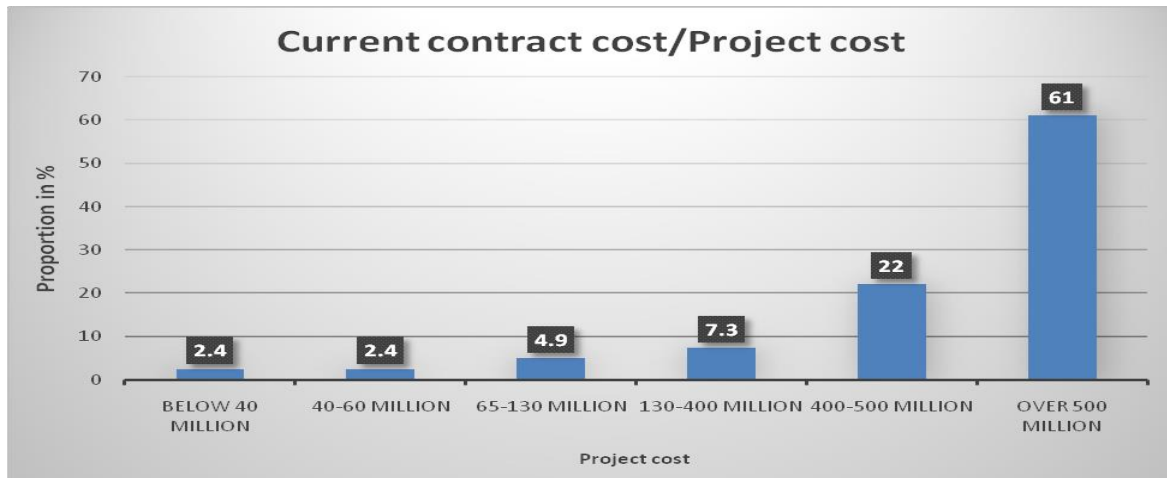


Figure 3: Cost of current project (KES)

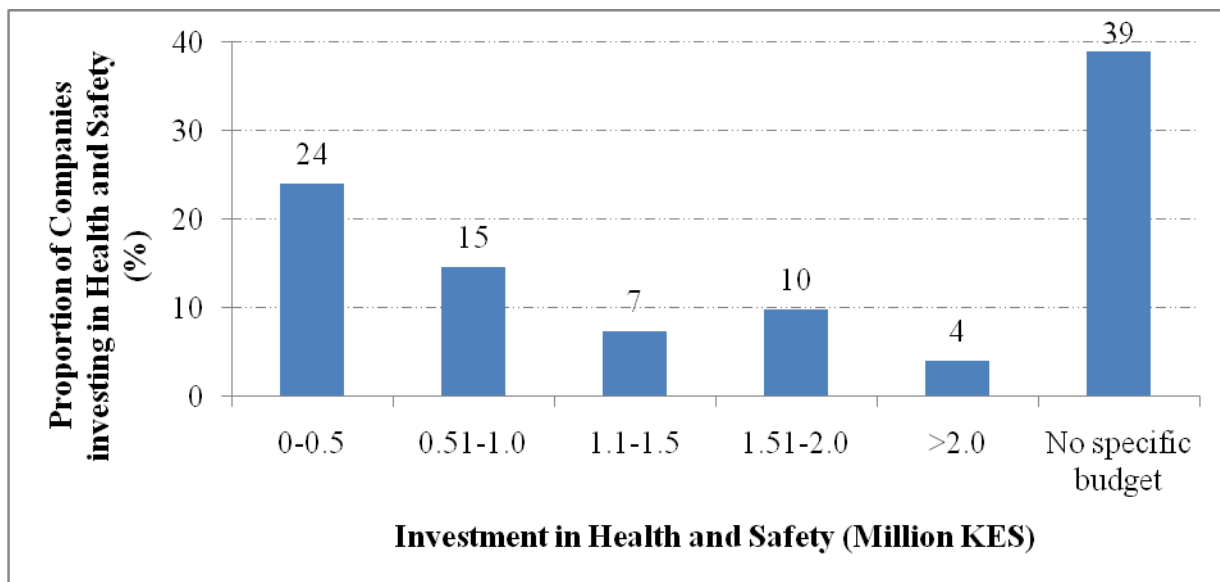


Figure 4: Invested in Health and Safety (Millions KES)

Conclusion

This study concludes that compared to developed countries Kenya still experiences a large number of fatalities (about 64 deaths per 100,000 construction workers per year). Being hit by falling objects and falling from heights contributes towards about 32% of all construction site accidents. Majority of the construction companies do not have specific budget for health and safety and allocate less than 1% of the project budget to health and safety. This could be because the construction industry does not seem to have a clear policy.

Recommendations

Construction companies need to provide workers with the necessary Personal Protective Equipment (PPE), which include safety belts, retaining belts, safety ropes, and safety harness and catch nets to prevent being hit by falling materials and falling from heights. Furthermore, workers need to be continuously trained on the importance of using PPE.

Funding for the regulatory body needs to be improved. In order to improve safety in the construction industry, health and safety should be included right from preparation of contract documents.

All employees from top management should undergo proper job related health and safety training. This can be done through customized or tailored courses, workshops, seminars, conferences or field demonstrations. Universities and technical colleges that teach Civil Engineering should also introduce safety training from undergraduate level.

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