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INSTITUTE OF TECHNOLOGY SCHOOL OF CIVIL AND ENVIROMENTAL ENGINEERING

STUDY OF OCCUPATIONAL SAFETY AND HEALTH IN ETHIOPIAN CONSTRUCTION INDUSTRY: A CASE STUDY ON ADDIS ABABA AND WELKITE

BY SEIFEDIN SERMOLO

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Abbreviations

BBS = Behaviour Based Safety

CREATE = Construction Research Education Training Enterprises

CWD= Compensating Wage Differentials

ESAW= European Statistics on Accidents at Work

FDRE = Federal Democratic Republic of Ethiopia.

GDP= Gross Domestic Product

HSE= Health and Safety Executives

HS = Health and Safety

ILO= International Labour organization

MoFED= Ministry of Finance and Economic Development

OSH = Occupational Safety and Health

PPE= Personal Protective Equipment

TSC = Total Safety Culture

UNIDO = United Nations Industry Development Organization

WHO = World Health Organization

Abstract

The objective of this study was to assess the occupational health and safety practices of construction companies in Ethiopia specifically Addis Ababa and Welkite. Consequently, survey research design was used to accomplish the objective of the study. Mainly a five point Likert scale questionnaire was distributed to engineers and foremen in construction companies and consultants to collect the data on the level of health and safety conditions of construction activities. Descriptive analysis is used to summarize and interpret the data.

Accordingly, the findings indicate that the overall safety and health condition in the Ethiopian construction industry is very poor. In addition there is very low level of implementation of OSH standards, rule and policies in the construction companies. Little training and orientation on OSH is given to employees, most of the construction companies do not have OSH components like written safety policy, safety officer, health and safety committee, hazard identification and reporting program, and properly placed safety signs. Based on the responses obtained from engineers/foremen, poor working conditions and environment, and lack of personal protective equipment are the main causes of accidents in the construction sector. On the other hand, foot and hand injuries, and falling from heights are the more frequently occurring types of accidents in the industry.

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Safety can be defined as the state of being "safe", the condition of being protected against physical, social, spiritual, financial, political, emotional, occupational, psychological, educational or other types or consequences of failure, damage, error, accidents, harm or any other event which could be considered non-desirable. Safety can also be defined to be the control of recognized hazards to achieve an acceptable level of risk. This can take the form of being protected from the event or from exposure to something that causes health or economic losses. It can include protection of people or of possessions. Similarly construction site safety can be defined as the efficient and effective implementation of the policies and tasks necessary to satisfy the safety of a construction firm's employees and management. Construction safety focuses on the careful management of the processes involved in the production and distribution of products and services within construction sites (Bernold et al. 1993). The subject of health and safety is very wide and can be approached from different perspectives such as management, medicine, psychology, sociology and economics to investigate the determinants and implications of health and safety for individual workers, economies and societies (Pouliakas and Theodossiou, 2010).

Construction industry makes significant contributions to the socio-economic development of most countries. The industry makes its direct contributions to economic growth by providing the basis upon which other sectors can grow by constructing the physical facilities required for production and distribution of other goods and services (United Nations Center for Human settlement, 1984).

The construction industry being a significant factor for the development of the whole economy of a nation and encompasses significant portion of the labor force, its safe operation will be of paramount importance. Safety in the construction industry has always been a major issue. Construction historically has been the most hazardous industry as measured by number of fatalities. For example in U.S. 1,178 out of 4,956 on-the-job fatalities in the private sector in 2007 occurred in the construction industry, no other industry ranks higher than construction industry. The majority of construction deaths resulted from falls and transportation accidents; i.e. 38% and 24%, respectively, in 2007;(Linda, 2008).

Health and Safety Executives (2007) estimates that 2,000,000 people within the UK currently suffer from an illness caused by, or made worse by the working environment. Ill-health can have a significant impact on the productivity of a business – sickness absence costs the UK economy an estimated £12 billion per annum. In 2005/2006 the construction industry in UK had the second highest rate of self-reported illness attributed to work at 3,800 cases per 100,000 employed persons (HSE, 2006).The ILO report estimated that 2 million occupational fatalities occur across the world every year (ILO, 2003b). According to the European Statistics on Accidents at Work (ESAW), every year in the 15 Member States of the European Union (EU) before the enlargements of 2004 and 2007 about 5,000 workers were killed in accidents at work and about 5 million workers were victims of accidents at work leading to more than three days‘ absence from work (EU, 2004).In sub-Saharan Africa, the fatality rate per 100,000 workers is 21 and the accident rate 16,000. This means that each year 54,000 workers die and 42 million work-related accidents take place that cause at least three days‘ absence from work (Benjamin, 2008). In general injuries and illnesses increase workers‘ compensation and retraining costs, absenteeism, and faulty product. They also decrease productivity, morale, and profits. Businesses

operate more efficiently when they implement effective safety and health management systems. Construction industry is both economically and socially important. However, the construction industry, at the same time, is also recognized to be the most hazardous (Suazo and Jaselskis, 1993).

Safety of workers on construction site must be of paramount importance to any construction company that wants to continue to operate. Though much improvement in construction safety has been achieved in the developed countries, the industry still continues to lag behind in most other industries with regard to safety. In developing countries, safety rules usually do not exist; if any exist, the regulatory authority is usually very weak in implementing such rules effectively. Furthermore, work hazards at the construction workplace are either not perceived at all, or perceived to be less dangerous than what they actually are (Ali and Hussain, 2006).

Ethiopia‘s economy has expanded on an average of 11 percent over the past seven years. International Monetary Fund data shows that the government is targeting growth of as much as 14.9 percent over the next five years. According to The Ministry of Finance and Economic Development (MoFED) the government will intensify efforts to address hurdles of investment flow by expanding infrastructure facilities. MoFED also stated that government has attached due attention for the development of railways, roads, telecommunications, irrigation and potable water and sanitation sectors. Moreover; more than 2,000 km of railway networks would be constructed in different parts of the country. The nation has also planned to generate 8,000 to 10,000 MW from water and wind resources during the next five years (ERTA News, 6 August, 2010).The Industry sector contributes 13 percent of Ethiopia‘s GDP of which 6 percent comes from the construction sub sector (ERTA News, 29 August, 2012); which creates a construction boom, led by state investment in low-cost housing, roads, dams and universities and private

investment. Therefore, Ethiopia is currently enjoying a relatively strong growth in construction activities. The country's booming construction sector is attracting thousands of labourers (PlusNews, 2010). Unfortunately, Ethiopia‘s construction industry suffers from poor safety and health conditions,eventhough; the constitution (1995) article 42/2 declared rights of labours to work in a healthy and safe work enviroment. The framework of the existing occupational safety and health conditions is fragmented and inadequately enforced, making construction sites more hazardous.

The high technology character of the construction industry results in two major impacts on the occupation safety and health of construction workers on site. In the first instance the high levels of technology applied in the machines and process used requires that special precautions must be taken to protect the workers on site. The second major problem, however, is seen in the worker‘s exposure to a number of materials either associated with the final product or as a part of the manufacturing process for which little may be known about the long-term health effects on the workers of exposure to these materials (Adenuga, Soyingbe and Ajayi, 2007).

1.2. Problem Statement

Tadese and Kumie (1991) noted that work-related injuries present a major public health problem resulting in serious social and economic consequences that could be prevented if appropriate measures are taken. Annually, throughout the world, an estimated number of 271 million people suffer work-related injuries, and 2 million die as a consequence of these injuries. The estimated economic loss caused by work-related injuries and disease was equivalent to 4 % of the world‘s gross national product (Occupational health program of WHO, 2003). The impact is 10 to 20 times higher in developing counties, where the greatest concentration of the world‘s workforce is located (WHO/ILO Occupational health and safety in Africa, 2001). Moreover, the majority of the world‘s workforce does not have access to occupational health services. Only 5 to 10 percent of workforce in developing countries and 20 to 50 percent of workforce in developed countries have access to some kind of occupational health services (Tetsuya, 1999).

Small and medium-scale industries employed about 80% of the workforce and contribute over 90% of all industries in developing countries. Workers in these industries are at greater risk of work-related injuries, chronic illness, stress, and disability or death because of low educational and literacy rates, unfamiliarity with work process and exposures, and inadequate training (Faris, 1998; and Park, 2001). According to a study conducted among 268 smaller industrial workers in Norway, injury rate of 317 per 1000 exposed workers was observed in the one-year period (Bull , Riise and Moen, 2002).Results from United States (US) study showed a rate of 75 per 1000 exposed workers per year (Dembe, Erickson and Delbos, 2004). Studies that are available on industrial injuries in Africa indicated that work-related injuries appeared with greater frequency and severity. For instance, the injury rate among small scale industrial workers in Zimbabwe was 131 per 1000 exposed workers per year (Loewenson, 2004). In Ethiopia, very limited attempts

have been made to identify work-related injuries and their determinants even among large industrial workers. In a study among 3,100 textile factory workers in Addis Ababa reported an incidence rate of 200 injuries per 1000 exposed workers per year (Senbeto, 1991). The injury rate among 4,462 industrial workers in Addis Ababa was 80 per 1000 exposed workers per year (Fulle, 1988). Reports from Department of Environmental Health of Ministry of Health in the country indicated that among 16,610 large-scale industrial workers in Addis Ababa, a prevalence rate of 723 injuries per 1000 exposed workers was observed (Ministry of Health Department of Environmental Health. 1996).

In addition to the above statistical figures there are also other major non-quantifiable costs, such as the insurance and health care costs, that affected individuals face, the indirect costs that companies incur (e.g. the cost of training inexperienced replacement workers, administrative expenses, production bottlenecks, low employee morale), the impact on families and communities and the inefficiency of having a large proportion of a potentially active workforce being disabled, idle or prematurely retired (Pouliakas and Theodossiou, 2010). According to estimated report by ILO (2008), the global number of work-related fatal and non-fatal accidents and diseases does not seem to have changed significantly during the past 10 years. This is mainly driven by the globalization process and by rapid industrialization in relatively poor countries that are not capable of maintaining effective health and safety systems. It has, therefore, been argued that the need to focus on health and safety is as paramount as ever, given that the traditional hazard and risk prevention and control tools are still effective but need to be completed by strategies designed to address the consequences of a continuous adaptation to a rapidly changing world of work (ILO, 2008,).

According to Ethiopiahot (2012), in all over Ethiopia, millions of daily laborers work in big constructions in unsafe working environment and without supportive and protective equipment. They do not have protective caps, hand gloves, eye glasses, working clothes, shoes and so on. They work on high rise buildings standing on old and inclined wooden scaffolds and ladders, they even transport heavy construction materials on them. Moreover, the constructions do not have safety nets, restraint and fall arrest systems. As a result, a dozen of daily laborers get different serious injuries. Many, in fact, lose their life. As it has been stated in Ethiopiahot (2012) in a recent scaffold collapse accident in Bahir Dar city, the capital of Amhara Region, it is witnessed that, 18 young women daily laborers have died, while many others were seriously injured. Sohail(1999), described that Construction and operation in developing countries is particularly dangerous, and a cursory inspection of any job site will reveal many health and safety hazards. From International Labour Office, Ethiopia Labour Inspection Audit described that, with the growth of construction industry in Ethiopia, many fatal accidents are taking place but most are not reported.

The right of labor is declared with detail obligations of employers in the _Ethiopian Labor Proclamation No 377- 2003‘. The proclamation explains that an employer must take appropriate steps ranging from instructing or notifying employees concerning the hazards of their respective occupations to provide workers with protective tools, clothing and other safety equipment. But, unfortunately, this legal document, according to the existing working environment and situation of daily laborers, seems to have been just shelved at the Ministry of Social and Labor Affair, justice bodies, and construction companies.

Pouliakas and Theodossiou, (2010) state that the need for up-to-date information on health and safety is of critical importance for the purposes of identifying areas of required action and for setting priorities for policy initiatives on improving health and safety at work. Despite the greater availability of data sources on health and safety at work, the available research remains incomplete, obscure or uncertain for many relevant topics. The harmonization and international comparability of appropriately-designed occupational health and safety indicators in terms of comparable definitions, data collection methodologies and quality remains one of the major challenges of future research (Pouliakas and Theodossiou, 2010). There is very little literature relating directly to the safety on construction sites in developing countries (Sohail and Kolsky, 1999). Similarly, prior studies conducted in the area of safety in construction industry in Ethiopia are very few. The existing few health and safety studies were focused on the manufacturing industries rather than the construction sector. Since health and safety features in different industries are likely to be different, it is worth studying the health and safety status of the construction industry in Ethiopia. Furthermore the findings of studies conducted in developed countries may not apply to a developing country like Ethiopia due to various factors associated with the level of economic development of the countries. In addition almost all the existing limited studies in Ethiopia focus on identifying factors causing accident in industries. Hence; they did not evaluate health and safety in Ethiopian construction industry. Therefore, unlike prior researches, this study is aimed at studying occupational health and safety practices in the construction industry in Ethiopia by comparing with various health and safety standards, rules, directives and proclamations.

1.3. General Objective of the Study

The main objective of this study is to assess occupational health and safety practices in the construction industry in Ethiopia particularly in Addis Ababa and Welkite.

1.4. Specific Objective of the Study

The specific objectives of this study are:

i. To assess the existing occupational health and safety standards, and their implementation in the Construction industry.
ii. To measure the level of awareness of employees of the construction industry regarding construction safety program.
iii. To identify major factors causing accidents in construction sites

1.5. Scope and Limitation of the Study

This research assesses occupational health and safety mechanisms in the construction industry in Ethiopia. The study measures the standard of the safety and health practices in general. This is done from the perspective of employees of construction companies and consultants. It is based on opinion of engineers and foremen working in the selected companies. Due to shortage of time and other constraints it was not possible to study this topic from different perspectives (e.g. company owners, top management, clients, and government). In addition this study does not include the health and safety practices of other industries like factories in Ethiopia.

1.6. Significance of the Study

There is very little literature relating directly to the safety on construction sites in developing countries like Ethiopia. Existing publications tend to suggest how accidents may be prevented but assume that a strong regulatory body exists to enforce legislation (Sohail and Kolsky, 1999). Therefore, this study contributes to the literature of safety and health in developing countries. In Ethiopia it serves as a spring board for future researchers in the area. The findings of this study may be utilized by the government to formulate policies on safety and health issues. In addition the construction companies, consultants, worker in construction companies and the general public are among the beneficiaries of the research outcome.

1.7. Structure of the paper

This paper is organized in five chapters. Chapter one presents introductions of the study. Chapter two presents the literature review. Chapter three presents the research methodology. Chapter four presents the results and discussion. Finally, chapter five presents the conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

In this chapter the researcher reviews prior literature on health and safety in the construction industry. First, to provide sufficient understanding of the subject, the nature and importance of health and safety in the construction industry and characteristics of the construction industry are briefly discussed. Second issues related to health hazards and accidents in construction with their ways to prevent and control are presented. Third, construction safety in Ethiopian context are presented from prior literature and other secondary data. Fourth, findings of previous empirical studies are presented

2.1. Nature and Importance of Health and Safety

Safety can be defined to be the control of recognized hazards to achieve an acceptable level of risk. This can take the form of being protected from the event or from exposure to something that causes health or economical losses. It can include protection of people or of possessions of construction companies (wikipedia.org). On the other hand, Construction Site Safety Management is defined as the efficient and effective implementation of the policies and tasks necessary to satisfy the safety of a construction firm's employees and management. Construction safety management focuses on the careful management of the processes involved in the production and distribution of products and services within construction sites (Bernold et al. 1993). According to Bernold et al (1993) activities such as the management of purchases, the control of inventories, logistics and evaluations are often related with construction site safety

management. Therefore, construction site safety management includes the analysis and management of internal processes.

Paulson (1992) argues that safety is a subject to which most people are quite willing to pay lip service, but which too few are willing really to do something about. Health and safety is of profound importance particularly in the construction industry. Because, as stated in International Labour Office (ILO) (1995) in many countries known fatal accidents, and those involving loss of working time in this industry, frequently exceed those in any other manufacturing industry. Contributing to the high rate of accidents are those characteristics of the industry which distinguish it from the rest of the manufacturing sector. These are: (1) the high proportion of small firms and of self-employed workers; (2) the variety and comparatively short life of construction sites; (3) the high turnover of workers; (4) the large numbers of seasonal and migrant workers, many of whom are unfamiliar with construction processes; (5) exposure to the weather; (6) the many different trades and occupations (ILO, 1995).

On the other hand, Helander (1991) states that, construction work is much more hazardous than most other occupations. Most accidents involve falls of persons and occur during work on roofs, scaffolds and ladders. Collapse of structures and falling materials also account for many fatalities. Many of these accidents can be avoided by the establishment of procedures and regulations to enhance safety. And often construction workers underestimate the hazards in their own work. This affects the motivation for adopting safe work procedures. Helander (1991) further states that the cost of construction accidents amounts to about 6% of total building costs. There are hence forceful monetary incentives in construction safety. Consequently, these may encourage the industry as well as agencies to invest in this area. Accordingly, managing safety and health is not only good for purpose of safety; it also gives good financial benefits. Ignoring

safety can result in accident and ill-health which not only reduces the profits but can also go to the extent of crippling the whole company. Similarly, Rozario (1996) maintains that in order to increase efficiency and reduce accidents, which not only benefits the individual construction company but also the whole nation, there should be a consistent high standard of performance throughout the construction industry.

Pouliakas and Theodossiou (2010) also stressed the significance of health and safety by stating that the increasing competition related to the globalization era, the predominance of service-oriented industries, the rising job insecurity associated with labour market flexibility (e.g. part-time/temporary contracts) and the shifting demographic composition of the workforce (towards more female, racially diverse and elderly employees), poses important challenges for the health and safety of workers in modern economies. Given the rapidly changing economic environment of recent decades health and safety has therefore gained new impetus, spurred primarily by the non-trivial costs it entails to both individual and national welfare.

As stated by Construction Industry Training Board (CITB) (1990), the employees‘ health, safety and welfare at work are protected by law. The employer has a duty to protect the employees and to keep them informed about health and safety. However, employees also have a responsibility to look after themselves and others.

2.2. Characterization of the construction industry

The construction industry is one of the biggest industrial employers in many countries of the world. The ILO (2009) estimates the number of construction workers in the world are more than 110 million (usually, between 5 to 10% of the world‘s workforce). The construction industry plays an important role in the economy, and the activities of the industry are also vital to the

achievement of national socio-economic development goals of providing shelter, infrastructure and employment. It is clear that construction activities affect nearly every aspect of the economy and that the industry is vital to the continued growth of the economy. The Confederation of International Contractors‘ Associations (CICA) estimates the world production by the construction industry at 3 to 4 billion Euros. The American construction industry, responsible for nearly 4% of the nation's Gross Domestic Product, directly employs over five million people and provides millions of additional support jobs in related fields (Gerald, 1997).

The ILO estimates the number of fatal occupational accidents in the construction industry at about 60,000 every year with about 64% in the Asia and Pacific region, 17% in the Americas, 10% in Africa and 9% in Europe (ITC-ILO, 2009).

The role the construction industry plays in socio-economic development is significant. The industry is a distinct sector of the economy, which makes its direct contributions to economic growth. Infrastructure is indispensable to achieve the main development targets such as urbanization, industrialization, equitable income distribution, and sustainable economic development.

Many of the decisions are sequentially developed throughout the construction process by different decision makers. In a typical public construction project, the employer (public body), the engineer (consultant) in charge of contract administration, and the general contractor are the major stakeholders. Public employers invest capital and provide economic power. The engineer acting as the employer‘s representative maintains efficient progress on a project. The contractor provides service, skills, and knowledge towards achieving a successful project, that is, a project completed on time, on budget, and of the best or specified quality.

2.3. Health Hazards in Construction

A hazard is the potential for harm. In practical terms, a hazard often is associated with a condition or activity that, if left uncontrolled, can result in an injury or illness (Elaine, 2002). As in other jobs, hazards in construction are typically of four classes: chemical, physical, biological and social (Weeks and James L, 2011).

Chemical hazards

Chemical hazards are often airborne and can appear as dusts, fumes, mists, vapours or gases; thus, exposure usually occurs by inhalation, although some airborne hazards may settle on and be absorbed through the intact skin (e.g., pesticides and some organic solvents). Chemical hazards also occur in liquid or semi-liquid state (e.g., glues or adhesives, tar) or as powders (e.g., dry cement). Skin contact with chemicals in this state can occur in addition to possible inhalation of the vapour resulting in systemic poisoning or contact dermatitis. Chemicals might also be ingested with food or water, or might be inhaled by smoking.

Several illnesses have been linked to the construction industry, among them:

- Silicosis among sand blasters, tunnel builders and rock drill operators
- Asbestosis (and other diseases caused by asbestos) among asbestos insulation workers, steam pipe fitters, building demolition workers and others
- Bronchitis among welders
- Skin allergies among masons and others who work with cement
- Neurologic disorders among painters and others exposed to organic solvents and lead.

Elevated death rates from cancer of the lung and respiratory tree have been found among asbestos insulation workers, roofers, welders and some woodworkers. Lead poisoning occurs

among bridge rehabilitation workers and painters, and heat stress (from wearing full-body protective suits) among hazardous-waste clean-up workers and roofers. White finger (Raynaud‘s syndrome) appears among some jackhammer operators and other workers who use vibrating drills (e.g., stoper drills among tunnellers).

Alcoholism and other alcohol-related disease is more frequent than expected among construction workers. Specific occupational causes have not been identified, but it is possible that it is related to stress resulting from lack of control over employment prospects, heavy work demands or social isolation due to unstable working relationships.

Physical hazards

Physical hazards are present in every construction project. These hazards include noise, heat and cold, radiation, vibration and barometric pressure. Construction work often must be done in extreme heat or cold, in windy, rainy, snowy, or foggy weather or at night. Ionizing and non-ionizing radiation is encountered, as are extremes of barometric pressure.

The machines that have transformed construction into an increasingly mechanized activity have also made it increasingly noisy. Noise is present on demolition projects by the very activity of demolition. It affects not only the person operating a noise-making machine, but all those close-by and not only causes noise-induced hearing loss, but also masks other sounds that are important for communication and for safety.

Pneumatic hammers, many hand tools and earth-moving and other large mobile machines also subject workers to segmental and whole-body vibration.

Heat and cold hazards arise primarily because a large portion of construction work is conducted while exposed to the weather, the principal source of heat and cold hazards. Roofers are exposed to the sun, often with no protection, and often must heat pots of tar, thus receiving both heavy radiant and convective heat loads in addition to metabolic heat from physical labour. Heavy equipment operators may sit beside a hot engine and work in an enclosed cab with windows and without ventilation. Those that work in an open cab with no roof have no protection from the sun. Workers in protective gear, such as that needed for removal of hazardous waste, may generate metabolic heat from hard physical labour and get little relief since they may be in an air-tight suit. A shortage of potable water or shade contributes to heat stress as well. Construction workers also work in especially cold conditions during the winter, with danger of frostbite and hypothermia and risk of slipping on ice.

The principal sources of non-ionizing ultraviolet (UV) radiation are the sun and electric arc welding. Exposure to ionizing radiation is less common, but can occur with x-ray inspection of welds, for example, or it may occur with instruments such as flow meters that use radioactive isotopes. Lasers are becoming more common and may cause injury, especially to the eyes, if the beam is intercepted.

Those who work under water or in pressurized tunnels, in caissons or as divers are exposed to high barometric pressure. Such workers are at risk of developing a variety of conditions associated with high pressure: decompression sickness, inert gas narcosis, aseptic bone necrosis and other disorders.

Strains and sprains are among the most common injuries among construction workers. These, and many chronically disabling musculoskeletal disorders (such as tendinitis, carpal tunnel

syndrome and low-back pain) occur as a result of either traumatic injury, repetitive forceful movements, awkward postures or overexertion. Falls due to unstable footing, unguarded holes and slips off scaffolding and ladders are very common.

Biological hazards

Biological hazards are presented by exposure to infectious micro-organisms, to toxic substances of biological origin or animal attacks. Excavation workers, for example, can develop histoplasmosis, an infection of the lung caused by a common soil fungus. Since there is constant change in the composition of the labour force on any one project, individual workers come in contact with other workers and, as a consequence, may become infected with contagious diseases—influenza or tuberculosis, for example. Workers may also be at risk of malaria, yellow fever or Lyme disease if work is conducted in areas where these organisms and their insect vectors are prevalent.

Toxic substances of plant origin come from poison ivy, poison oak, poison sumac and nettles, all of which can cause skin eruptions. Some wood dusts are carcinogenic, and some (e.g., western red cedar) are allergenic.

Attacks by animals are rare but may occur whenever a construction project disturbs them or encroaches on their habitat. This could include wasps, hornets, fire ants, snakes and many others. Underwater workers may be at risk from attack by sharks or other fish.

Social hazards

Social hazards stem from the social organization of the industry. Employment is intermittent and constantly changing, and control over many aspects of employment is limited because construction activity is dependent on many factors over which construction workers have no

control, such as the state of an economy or the weather. Because of the same factors, there can be intense pressure to become more productive. Since the workforce is constantly changing, and with it the hours and location of work, and many projects require living in work camps away from home and family, construction workers may lack stable and dependable networks of social support. Features of construction work such as heavy workload, limited control and limited social support are the very factors associated with increased stress in other industries. These hazards are not unique to any trade, but are common to all construction workers in one way or another (Weeks and James L, 2011).

2.4. Accidents in the Construction Industry

Accidents can be defined as ―any avoidable action by personnel or any failure of equipment, tools or other devices that interrupts production and has the potential of injuring people or damaging property" (Oglesby et al. 1989). Accidents in construction projects in many countries are of important issue to handle. The phenomena makes the construction industry has a big image of risky place of accidents (Sawachaetal., 1999; Shi, 2009). The nature of construction project itself has potential hazards of accidents since its uniqueness, open space, exposure to weather, involving many unskilled labours, tight schedule of short targeted project duration, workers turn over and working at height, confined space and psychologically and physically vulnerably working environment (Imriyas et al., 2007)

Some of the most common types of construction accidents include construction site falls, crane accidents, scaffolding accidents, workers being run-over by operating equipment, electrical accidents, trench collapses, fires and explosions, and welding accidents.

Construction Site Falls

Common construction site falls include roof related falls, crane falls, scaffolding falls, elevator shaft falls, falls resulting from holes in flooring, and falling objects. Proper protection equipment and safety precautions are necessary to protect the lives of workers.

Crane Accidents

Crane accident deaths can arise from a number of factors, including lightning, high winds, defective cranes, falls, electrocution, and other hazards associated with construction at heights. Many crane accidents can be avoided with proper training and safety procedures.

Scaffolding Accidents

Scaffolding is a temporary structure used to support people and material in the construction or repair of buildings and other large structures. It is estimated that 65 percent of the construction industry works on scaffolds frequently. The use of scaffolding is necessary in the construction industry. Some of the most dramatic structures that have been built by humans relied on scaffolds to get the job done. Many of construction workers injured in scaffold accidents connected the event with planking or supports giving way or the employee slipping or being struck by a falling object. Most scaffolding accidents can be avoided through proper training and preventative measures.

Run Over by Operating Equipment

The construction site is an extremely busy work environment with movement of workers and vehicles. There are circumstances when construction workers are run-over or injured by operating equipment. Accidents such as this can occur at any worksite, but risks are increased

when working on highways or near busy roads with heavy equipment. In these environments workers must be vigilant and meticulous when practicing safety standards.

Electrical Accidents on Construction Sites

It is estimated by OSHA that nearly 350 construction workers die every year from electrical accidents. A few causes of these fatalities include electric shock, electrocutions, steam accidents, and power line contact. The risks of these hazards are heightened for workers who perform their jobs on scaffolding or in cranes near overhead power lines.

Trench Collapses

The building of trenches is necessary for many construction tasks. They are present wherever buried utilities are constructed or repaired. A trench is narrow in length with its depth greater than its width. When trenches are constructed they must have safeguards in place to protect workers inside the trench from a collapse. When a trench collapses workers may easily become crushed under the weight of heavy soil from above. It is absolutely imperative that appropriate safety measures are taken during the building process to ensure the safety of all workers involved.

Fires and Explosions in Construction Site

The Occupational Safety and Health Administration has determined that workplace fires and explosions kill 200 and injure more than 5,000 workers each year. For these reasons, special safety guidelines have been established to prevent construction accidents arising from fires and explosions.

A fire plan should exist at construction sites so that workers can be safely evacuated in the event of fires and explosions. These accidents can result in a great number of injuries, including burns

that can result in extensive pain and even death. Fires and explosions are perhaps the most dynamic and tragic construction accidents that can occur.

Unsafe/Dangerous Construction Equipment Accidents

The size and power of the machines and equipment used in the construction industry can be responsible for some of the most grievous injuries if not used carefully and professionally. Construction equipment, like every other type of machinery, can experience mishap and failure - particularly if it is overused or improperly maintained. Everything from cranes to forklifts to scaffolding and ladders can cause potentially fatal accidents with the failure of a manufacturer to provide safe equipment or with the negligence of those responsible for repair and maintenance.

Structure Failure on construction site

By definition, a structure failure takes place when a building or other structure breaks in such a way that it cannot carry as great a load as it could before failure. Structure failures can be catastrophic and result in major injury and loss of life. Safety of the public is compromised for financial gain or time constraints, the designer and the contractor should be responsible for the works they produce.

2.5. Accident Causation Model

A job hazard analysis is a technique that focuses on job tasks as a way to identify hazards before they occur. It focuses on the relationship between the worker, the task, the tools, and the work environment. Ideally, after you identify uncontrolled hazards, you will take steps to eliminate or reduce them to an acceptable risk level (OSHA, 2002).

In order to have a meaningful analysis of the accident data, there is a need for a fundamental accident causation model that highlights the main accident events and main types of causal factors. Accident causation models are originally developed in order to assist people who had to investigate accidents, so that such accidents could be investigated effectively. Knowing how accidents are caused is also useful in a proactive sense in order to identify what types of failures or errors generally cause accidents, and so action can be taken to address these failures before they have the chance to occur (http://www.hrdp-idrm.in/e5783/e17327/ e24075/e27340 /index_eng.html).

There are several major theories concerning accident causation, each of which has some explanatory and predictive value.

Accident Proneness Model: Originally, people believed that accidents were a result of pure chance, and could happen to anyone at any time, and some people were more likely to suffer an accident than others. This was referred to as the Accident Proneness Model (Cooper, 1998). In the past, the prevailing influence of this approach meant that most accidents were blamed solely on employees rather than on the work processes, poor management practices or a combination of these. However, this model has been criticized for: (1) It encouraged a retrospective view of human involvement in accidents. The existence of accident proneness could only be investigated

or 'proved' once people had had accidents. (2) It focused upon only one factor, the characteristics of the victim, and paid little attention to how the accident happened. (3) With the focus on individual differences, accidents and causal factors which were common to many individuals were largely ignored. (4) The preventive actions which could logically be derived from the model were all related to influencing the individual differences studied. This could be done by avoiding those with the undesirable traits or by trying to modify through training, and counseling (Hale and Glendon, 1987).

Domino Theory: This theory was developed by H. W. Heinrich, one of the earliest developed. The theory points that injuries result from a series of factors, one of which is an accident. According to Heinrich, an "accident" is one factor in a sequence that may lead to an injury. The factors can be visualized as a series of dominoes standing on edge; when one falls, the linkage required for a chain reaction is completed. Each of the factors is dependent on the preceding factor. According to this theory, there are five factors in the sequence of events leading to an accident: ancestry/social environment, fault of person, unsafe act/mechanical or physical hazard, accident, and injury. These events, if permitted to occur in continuity, result in an accident, which may result in injuries and damages. Any accident is prevented by breaking the chain (or removing a domino) of the series of events at any location.

The human factors theory: The Ferrell‘s Human Factor Model is also another accident causation model. Ferrell defines accidents in terms of being the result of an error by an individual. As such, he explains his theory using the assumption that accidents are caused by one person (Heinrich, Petersen, and Roos, 1980). Ferrell identifies three general causes of accidents: overload, incompatibility and improper activities. Each of these is actually broad categories that contain several more specific causes. Improper activities encompasses two sources of accidents.

First, it is possible that the responsible person simply didn‘t know any better. Alternatively, he or she may have known that an accident may result from an action, but deliberately chose to take that risk. The incompatibility cause encompasses both an incorrect response to a situation by an individual, as well as subtle environmental characteristics, such as a work station that is incorrectly sized. The remaining cause, overload, can further be broken down into three subcategories: First, the emotional state of the individual. Second, the capacity refers to the individual‘s physical and educational background. Finally, the load of the individual can also contribute to an overload.

Accident/Incident Theory: This theory is extension of human factors theory. Here the following new elements are introduced:

- Ergonomic traps: These are incompatible work stations, tools or expectations (management failure)
- Decision to err: Unconscious or conscious (personal failure)
- Systems failure: Management failure (policy, training, etc.)

The epidemiological theory: This theory of accident causation holds that the models used for studying and determining the relationships between environmental factors and disease can be used to study causal relationships between environmental factors and accidents.

The systems theory: System model of accident causation views any situation in which an accident might occur as a system with three components: person (host), machine (agency), and environment. The Systems Approach to safety presents humans as one element in a mutually interdependent system which also consists of the hardware used, the situation in which it is used (both to a large extent designed and built by other humans), the rules and procedures which are laid down by others to try to govern that use, and the organizations which manage the system.

From this point of view human behaviour is a response to those other system elements (Hale and Glendon, 1987).

2.6. Accident Investigation

These are basic rules for accident investigation as described by (http://www.google.com.et/url?sa=t&rct=j&q=prevention%20of%20accident%20construction) are:

- The purpose of an investigation is to find the cause of an incident and prevent future occurrences, not to fix blame. An unbiased approach is necessary to obtain objective findings.
- Visit the incident scene as soon as possible – while facts are fresh and before witnesses forget important details.
- If possible, interview the injured worker at the scene of the incident and ―walk" him or her through a re-enactment. Be careful not to actually repeat the act that caused the injury.
- All interviews should be conducted as privately as possible. Interview witnesses one at a time. Talk with anyone who has knowledge of the incident, even if they did not actually witness the mishap.
- Consider taking the signed statements in cases where facts are unclear or there is an element of controversy.
- Graphically document details of the incident: area, tools, and equipment. Use sketches, diagrams, and photos as needed, and take measurements when appropriate.

- Focus on causes and hazards. Develop an analysis of what happened, how it happened, and how it could have been prevented. Determine what caused the incident itself (unsafe equipment/condition, unsafe act, etc), not just the injury.
- How will you prevent such incidents in the future? Every investigation should include an action plan.
- If a third party or defective product contributed to the incident, save any evidence. It could be critical to the recovery of the claim costs.

2.7. Hazard Prevention and Control

Continually review the work environment and work practices to control or prevent workplace hazards.

Systems used to prevent and control hazards include (OSHA, 2002):

- Engineering Controls
- Safe Work Practices
- Administrative Controls
- Personal Protective Equipment (PPE)
- Systems to Track Hazard Correction
- Preventive Maintenance Systems
- Emergency Preparation
- Medical Programs

Engineering Controls

The first and best strategy is to control the hazard at its source. Engineering controls do this, unlike other controls that generally focus on the employee exposed to the hazard. The basic concept behind engineering controls is that, to the extent feasible, the work environment and the job itself should be designed to eliminate hazards or reduce exposure to hazards. Engineering controls can be simple in some cases. They are based on the following principles:

- If feasible, design the facility, equipment, or process to remove the hazard or substitute something that is not hazardous.
- If removal is not feasible, enclose the hazard to prevent exposure in normal operations.
- Where complete enclosure is not feasible, establish barriers or local ventilation to reduce exposure to the hazard in normal operations.

Safe Work Practices

Safe work practices include the company‘s general workplace rules and other operation-specific rules. For example, even when a hazard is enclosed, exposure can occur when maintenance is necessary. Through established safe work practices, employee exposure to hazards can be further reduced.

Administrative Controls

Administrative controls to mean other measures aimed at reducing employee exposure to hazards. These measures include additional relief workers, exercise breaks and rotation of

workers. These types of controls are normally used in conjunction with other controls that more directly prevent or control exposure to the hazard.

Personal Protective Equipment (PPE)

When exposure to hazards cannot be engineered completely out of normal operations or maintenance work, and when safe work practices and other forms of administrative controls cannot provide sufficient additional protection, a supplementary method of control is the use of protective clothing or equipment. This is collectively called personal protective equipment, or PPE. PPE may also be appropriate for controlling hazards while engineering and work practice controls are being installed.

PPE Hazard Assessment and Training

The basic element of any management program for PPE should be an in depth evaluation of the equipment needed to protect against the hazards at the workplace. The evaluation should be used to set a standard operating procedure for personnel, then train employees on the protective limitations of the PPE, and on its proper use and maintenance. Using PPE requires hazard awareness and training on the part of the user. Employees must be aware that the equipment does not eliminate the hazard. If the equipment fails, exposure will occur. To reduce the possibility of failure, equipment must be properly fitted and maintained in a clean and serviceable condition.

Systems to Track Hazard Correction

An essential part of any safety and health system is the correction of hazards that occur despite the overall prevention and control program. For larger sites, documentation is important so that

management and employees have a record of the correction. Hazard correction information can be noted on an inspection report next to the hazard description. Employee reports of hazards and reports of accident investigation should provide space for notations about hazard correction.

Preventive Maintenance Systems

Good preventive maintenance plays a major role in ensuring that hazard controls continue to function effectively. It also keeps new hazards from arising due to equipment malfunction. Reliable scheduling and documentation of maintenance activity is necessary. The scheduling depends on knowledge of what needs maintenance and how often. The point of preventive maintenance is to get the work done before repairs or replacement is needed. Documentation is not only a good idea, but is a necessity.

Emergency Preparation

During emergencies, hazards appear that normally are not found in the workplace. These may be the result of natural causes (floods, tornadoes, etc.), events caused by humans but beyond control (train or plane accidents, terrorist activities, etc.), or within a firm‘s own systems due to unforeseen circumstances or events.

You must become aware of possible emergencies and plan the best way to control or prevent the hazards they present. Some of the steps in emergency planning include:

- Survey of possible emergencies;
- Planning actions to reduce impact on the workplace;
- Employee information and training;
- Emergency drills as needed.

Medical Programs

A company‘s medical program is an important part of the safety and health system. It can deliver services that prevent hazards that can cause illness and injury, recognize and treat illness and injury, and limit the severity of work-related injury and illness. The size and complexity of a medical program will depend on many factors, including the:

- Type of processes and materials and the related hazards,
- Type of facilities,
- Number of workers,
- Characteristics of the workforce, and
- Location of each operation and its proximity to a health care facility.

2.8. Total Safety Culture and Behaviour-Based Safety

When participating in construction safety management, proactive owners generally implement initiatives that promote safety. The concept of total safety culture and behaviour-based safety management are among the latest safety management initiatives that are introduced. Today, as the zero injuries objective is accepted and sought by many owners and contractors, total safety culture (TSC) and behaviour-based safety (BBS) have become the popular approaches being implemented by many proactive firms. The basic logic of these approaches is to prevent construction accidents by continually addressing the very front-end of the accident chain – the culture and habits. Safety management is based on the scientific approach that is focused on the psychology and the behavior of workers.

Geller (2001) summarized the essence of TSC as the following:

- Promotes a work environment based on employee involvement, ownership, teamwork, education, training, and leadership.
- Builds self-esteem, empowerment, pride, enthusiasm, optimism, and encourages innovation.
- Reinforces the need for employees to actively care about their fellow co-workers.
- Promotes the philosophy that safety is not a priority that can be reordered, but is a value associated with every priority.
- Recognizes group and individual achievement.

He further pointed out that total safety culture requires continual attention to three domains environmental factors (including equipment, tools, physical layout, procedures, standards, and temperature), personal factors (including people's attitudes, beliefs, and personalities), and behavior factors (including safe and at-risk work practices, as well as going beyond the call of duty to intervene on behalf of another person's safety). In a total safety culture:

- Everyone feels responsible for safety and does something about it on a daily basis;
- People go beyond the call of duty to identify unsafe conditions and at-risk behaviours, and they intervene to correct them;
- Safe work practices are supported intermittently with rewarding feedback from both peers and managers;
- People "actively care" continuously for the safety of themselves and others;
- Safety is not considered to be a priority, but it is a value. This change in philosophy is based on the premise that priorities can change but values cannot.

2.9. Compensating Wage Differentials for Job Disamenities

The theory of compensating wage differentials (CWDs), originates in the economics discipline which has been argued to constitute ―the fundamental long-run market equilibrium construct" of labour economics. This theory questions the necessity of health and safety policies. According to this theory, the existence of market forces ensures the payment of wage premiums by firms which are characterized by inferior working conditions, as a means of recruiting and retaining valuable labour. It is further postulated that in a perfectly competitive labour market an equilibrium wage distribution should arise whereby ―matching" of the preferences of workers and firms occurs. Thus, risk-averse workers will take up jobs in firms which provide a safer working environment, whereas less risk-averse workers will be more willing to be employed in jobs in which the marginal cost of safety provision is dearer (Pouliakas and Theodossiou, 2010). Therefore, it raises the question about whether government intervention in the form of occupational safety and health (OSH) policies and regulations is likely to distort the efficiency of the incentives provided by competitive markets. Nevertheless, the CWD to work properly requires the existence of competitive markets forces at work and there are also convincing arguments that exist on both equity and efficiency grounds regarding the necessity for OSH policies (Pouliakas and Theodossiou, 2010).

2.10. Principles of Occupational Health and Safety

Occupational health and safety is an extensive multidisciplinary field, invariably touching on issues related to among others things, medicine and other scientific fields, law, technology, economics and concerns specific to various industries. Despite this variety of concerns and interests, certain basic principles can be identified including the following (ILO, 2001):

1) All workers have rights. Workers as well as employers and governments, must ensure that this rights are protected and foster decent conditions of labour.
2) Occupational health and safety policies must be established. Such policies must be implemented at both governmental and enterprise level. They must be effectively communicated to all concerned parties.
3) There is need for consultation with the social partners i.e. employers, workers and other stakeholders. This should be done during formulation, implementation and review of policies.
4) Prevention and protection must be the aim of occupational health and safety programs. Efforts must be focused on primary prevention at work place level. Work places and working environments should be planned and designed to be safe and healthy.
5) Information is vital for the development and implementation of effective programs and policies. The collection and dissemination of accurate information on hazards and hazardous materials, surveillance of workplace, monitoring compliance with policies and good practices are crucial.
6) Health promotion is central element of occupational health and safety practice. Efforts must be made to enhance workers‘ physical, mental and social well-being.
7) Compensation, rehabilitation and curative services must be made available to workers who suffer occupational injuries, accidents and work-related disease. The consequences of Occupational hazards should be minimized.
8) Education and training are vital components of safe and healthy working environment. Workers and employers must be aware of the importance and means of establishing safe working procedures.

9) Workers, employers and competent authorities have certain responsibilities, duties and obligations. For example workers must follow established procedures; employers must provide safe work place; and authorities must advise, communicate and review health and safety policies.
10) Policies must be enforced. A system of inspection must be in place to secure compliance with occupational health and safety policies.

In addition to the above general statements there are also different principles and good practices that are relevant to enhance occupational health and safety of companies including:

1. Establishment of safety and health committee, appointing a designated safety officer in the companies.
2. Holding regular craft –toolbox" safety meetings to exchange information on health and safety issues in construction areas.
3. Companies should provide adequate and proper safety equipment and enforces the use of the safety equipments.
4. Workers should be encouraged to intervene when unsafe conditions are observed. Unsafe jobs should be stopped when they are found, giving priority to safety.
5. Workers should not be forced to work too many hours per week, because fatigue can be a cause for accidents.
6. The companies should have injury management programs like: medical insurance for workers, compensation for workers suffering occupational accident, first aid kit should be available and easily accessible with sufficient materials in it.

2.11. Health and Safety in the Construction Industry

The overall construction industry is still looking at positive way to change to a safer working environment with the influence of everyone‘s concern not just the workers or individuals (Hinzer, 1996). Kunju (2000), states that safety should look beyond accidents and more towards human behaviours and culture. And he also said that measurement would enable comparison and benchmarking of performance and track progress from time to time. Once the principle and the practice of measurement become the norm, this will facilitate the transformation of motivations attitudes and choices in every construction company.

On the other hand, Anderson (1992) states that proactive safety performance is assured by providing the following: Having plant and equipment which is fit for the purpose of reducing risks from identified hazards as far as is reasonably practicable; system and procedure to operate and maintain equipment in a satisfactory manner and to manage all associated activities; and people who are competent, through knowledge, skills and attitude, operate the plant and equipment and to implement the system and procedure.

Liska (1993) has introduced the concept of zero accident techniques as follows; safety planning including goals, personnel, policies and procedures; fire protection programmes and safety budget; safety training and orientations; safety incentives; alcohol abuse programmes; proper record keeping and follow-up; regular safety meetings; personal protective equipment. Other safety measures include; a comprehensive safety policy statement; a review of construct ability; reliable contractor screening; pre-construction meetings (safety review); inspection; good housekeeping.

2.12. General Safety Rules for Construction

These are general safety rules recommended by different safety manuals

1. Always store materials in a safe manner. Tie down or support piles if necessary to prevent falling, rolling, or shifting.
2. Shavings, dust scraps, oil or grease should not be allowed to accumulate. Good housekeeping is a part of the job.
3. Trash piles must be removed as soon as possible. Trash is a safety and fire hazard.
4. Remove or bend over the nails in lumber that has been used or removed from a structure.
5. Immediately remove all loose materials from stairs, walkways, ramps, platforms, etc.
6. Do not block aisles, traffic lanes, fire exits, gangways, or stairs.
7. Avoid shortcuts – use ramps, stairs, walkways, ladders, etc.
8. Standard guardrails must be erected around all floor openings and excavations must be barricaded. Contact your supervisor for the correct specifications.
9. Do not remove, deface or destroy any warning, danger sign, or barricade, or interfere with any form of protective device or practice provided for your use or that is being used by other workers.
10. Get help with heavy or bulky materials to avoid injury to yourself or damage to material.
11. Keep all tools away from the edges of scaffolding, platforms, shaft openings, etc.

12. Do not use tools with split, broken, or loose handles, or burred or mushroomed heads. Keep cutting tools sharp and carry all tools in a container.

13. Know the correct use of hand and power tools. Use the right tool for the job.

14. Know the location and use of fire extinguishing equipment and the procedure for sounding a fire alarm.

15. Flammable liquids shall be used only in small amounts at the job location and in approved safety cans.

16. Proper guards or shields must be installed on all power tools before use. Do not use any tools without the guards in their proper working condition. No ~~h~~omemade" handles or extensions (cheaters) will be used!

17. All electrical power tools (unless double insulated), extension cords, and equipment must be properly grounded.

18. All electrical power tools and extension cords must be properly insulated. Damaged cords must be replaced.

19. Do not operate any power tool or equipment unless you are trained in its operation and authorized by your firm to do so.

20. All electrical power equipment and tools must be grounded or double insulated.

21. Use tools only for their designed purpose.(http://www.google.com.et/url?sa=t&rct=j&q=prevention)

2.13. The Safety Precautions in a Construction Industry

Safety measures must be strictly followed especially in the site. There are many incidents which they cannot predict ahead of time; and prevention is a must to avoid serious conditions among the workers.

Head is one of the vital parts of the body since it contains the brain. A helmet should be wear always to protect the head. In the construction site, there are many falling debris. If the workers are on the ground, there is a great possibility that any of these falling objects might hit them. But if they constantly use their helmet and it happens that they are being hit by the falling objects, they might not have serious injury.

They should wear their safety harness. Most especially if the building which they have built is very tall; it is a part of their job to work with heights. If they use safety harness, safety lanyards, and roof fall protection, they will be prevented by sudden fall accident. These workers work under pressure with their deadlines and under the heat of the sun. Because of these, they can‘t avoid to sometimes lose their grip.

They must also protect their eyes with the use of eye goggles. Specifically, those who are electricians and welders are prone to eye irritation. Hand gloves are also one of those safety gears being used. These will protect them from slipping their hands off while they are holding the rails or metals.

Safety first aid kit and medicines should be all over the site. If an accident will occur, with the application of first aid, it will prevent the situation of the workers to aggravate. If the incident is less serious, first aid can solve the problem without the need of taking the affected worker in to the hospital.

There should also be safety and danger signs to warn each of the workers, specifically, if the area involves with electricity. If danger signs are present, the workers will be able to prepare on how to approach the area without harming themselves.

If company owners will have the proper compliance about the importance and the application of safety measures for their workers, they will also have successful and productive projects.

Safety expert John Meola expresses his list of top ten reasons for construction accidents, as well as precautions one can take to ensure safe equipment operation on the construction site (http://www.forconstructionpros.com/article/10302747/top-ten-construction-safety-tips).

1. **Getting on and off equipment**

Getting on and off the machine is one of the causes of injury to equipment operators, therefore; checking your gloves and boots. Clean the mud off before climbing, and use "high grip" gloves for a secure hand hold. Next, use a three-point stance going and coming. Use large size hand and foot holds. Securely engage the entire hand and foot, avoiding a toe-hold or finger-hold grip. Use a step ladder for access when no hand or foot holds are provided. Avoid carrying objects while climbing.

If the machine needs additional hand holds or steps installed, do it. Operators come in different sizes. Make it as easy and safe as possible to ascend/descend. Avoid the need to stretch by putting the grab rails where they're easy to securely reach.

2. **Loading/unloading equipment**

Even on level ground, there is a risk of machine roll-over during loading or unloading. Make sure you are centered on the ramps and stay straight. Allow enough room to maneuver the trailer and machine, which is sometimes difficult on tightly compressed jobsites.

Use a spotter for guidance. Make sure the machine clears the ramps before turning. Keep people away from the sides of the machine during loading/unloading. Check the trailer deck, clearances and stability. Review your lock-out/tag-out plan to be sure the machine is at "Zero Energy State" when stowed.

Use proper tie-down procedures. If using compression chain binders, use caution when opening the handle. The load may shift just enough to add tension to the chain and the handle may spring open. Use safety tie wires or switch to ratchet binders.

3. **People crowding the work area**

People on the ground must stay well away from the machine operating area. Review this important point at safety meetings. Foremen need to enforce this, not the operator.

When ready to start work, use the horn to warn people to stay back; stop the machine if needed; and always check your back before backing up the machine.

4. **Machine swing radius**

It's important to rope off the swing radius around the machine or otherwise secure it. Allow no spectators; use a spotter to keep all people clear.

5. **Operation on slopes**

Caution is always required when operating on slopes. You might make it up the slope with a load, but coming down is another story! Know the limits of the machine, allow for surface conditions and don't push it.

6. **Overhead/buried obstructions**

Be aware of overhead obstructions and underground utilities, including electrical lines, water, sewer, gas, telecom, etc.

Definitively mark or warn of overhead lines or low clearances. Continue to use caution even after underground lines are marked, since errors in marking are common. Be prepared to hand dig when it's getting close.

7. **Backing**

Always check the machine perimeter before moving. When vision is impaired, have a spotter (in high-visibility apparel) guide you. Use wide angle mirrors. The new generation of machines is fitted with best viewable surface mirrors. Keep them clean and adjusted.

Use rear-mounted cameras and/or rear-mounted presence-sensing alarms. Presence-sensing alarms are becoming more reliable as technology improves. The equipment industry recognizes the urgency of the problem and will find technical solutions to address chronic people behaviour problems.

8. **Machine upset**

Always use a seat belt. A professional operator will not have to be reminded of this rule. Wear the belt even with the cab door closed. It decreases how much you will bounce around in the cab during normal operations, and may help you control the machine in a borderline upset situation.

In addition, operators need to understand the machine's stability characteristics on all surface types and conditions. Check to see if the equipment manufacturer or dealer offers an instructional video.

9. **Instability or loss of load**

All rigging attachments for lifting must be engineered for safety.

10. Lock-out/Tag-out

All pinch points on a machine must be identified and protected (guarded) when possible. The minimum warning is a pictorial decal advising of the hazard.

Refueling, service personnel and mechanics need to use positive means to assure their safety while servicing or working on the machine.

Review manufacturer directions for safety in all cases, even if this is the fifth generation of machine you bought from the same manufacturer. There are illustrations and directions in all manuals to point out safety features, do's and don'ts, good practices/bad practices, efficiency measures, etc.

2.14. The Role of Design in OHS in the Construction Industry

The key role design plays in OHS has been identified in numerous studies. The study carried out by Rechnitzer (2000) identified the priority injury risks related to falls from height, manual handling and contact with power tools and other equipment. A conclusion reached in regard to reducing injury risk, related to the key role of designers and architects: –Lack of Designer & Architect OHS consideration (and accountability) for erection and maintenance, and downstream risks. Many risks to which construction workers are exposed to are in part dictated to by the design of the particular project. These risks can be overcome or reduced by rethinking designs to take into account OHS considerations. In other words, there is a lack of accountability for injury risk by system designers. That is, architects and engineers are not required (typically) to consider constructability or operation and maintenance in terms of OHS risk. A holistic view needs to be developed whereby due consideration is given to downstream consequence of any design:

- exposure to injury risk during construction

- exposure to injury risk during operation
- exposure to injury risk during maintenance
- exposure to injury risk during refurbishment/ demolition

The tendering process can also lead to separation of the design from the construction process, thereby further removing the scope for construction personnel to reduce injury risk during construction, by design changes."

2.15. Construction Safety and Health in Ethiopian Context

Construction in developing countries, like Ethiopia, is more labor intensive than that in the developed world, many of them are unskilled. Without a significant difference between large and small contractors found in Ethiopia, almost all of them do not have a safety policy. For the majority of contractors, however, maximizing profit is the prime concern. Unsafe conditions exist on many sites, both large and small, and laborers are subjected to numerous hazards. On many sites, no training programs for the staff and workers exist; therefore, no orientation for new staff or workers is conducted, hazards are not pointed out, and no safety meetings are held. Employees are required to learn from their own mistakes or experience. In addition, lack of medical facilities, shanty housing, and substandard sanitation. Workers undertake a risk while at work and the following problem areas are common:

1. While excavating in deep trenches (with no proper shoring or bracing)
2. Concreting is done mainly by laborers, and cements burns due to the unavailability of protective gloves and boots are common.
3. Workers fall from heights due to weak scaffolding and the unavailability of safety belts.

4. Workers sustain injuries on the head, fingers, eyes, feet, and face due to absence of personal protection equipment.

Condition of work of construction workers in Ethiopia is found to be poor. This is mainly due to the poor employment relationships and lack of safety measures. Safety measures are nonexistent in the construction sites; therefore, workers are exposed to different kinds of work related hazards. Most of the injured workers did not receive compensation because of triangular employment arrangements between the building contractors, sub-contractors and sub-contractors which obscure lines of liability (Limenih, 2010).

Injuries generally are unreported; however, if necessary, a laborer might receive first aid or preliminary medical care. In most cases, specialized medical treatment or compensation is unavailable. Workers themselves consider accidents as due to their own negligence, and accept that construction is a dangerous occupation. Nevertheless, major accidents involving the death of a worker may be reported due to the financial expenses and litigation that could be involved.

Some informal assessments identified a few major reasons for safety non-performance which included: lack of development of construction sector in the shape of mechanization and industrialization; lack of professional construction management practices, inadequate safety provisions laid by the existing regulatory environment which has failed to establish safety as a major industry objective, insufficient and incentive-less insurance mechanisms which have failed to establish safety as a business survival issue, and unfavorable business environment which has led to adversarial business relationships among stakeholders resulting in controversies, conflicts, claims and litigation and hence diverting the focus away from issues like safety (Farooqui et al., 2007). The researcher was tried to get data from Addis Ababa University, Ministry of labour and Social Affairs and Ministry of Works and Urban Development concerning health and safety in

Ethiopian construction industry, but the researcher found nothing except health and safety manual prepared by Ministry of Labour and Social Affairs.

2.16. Review of Empirical Studies

There is very little literature relating directly to the safety on construction sites in developing countries like Ethiopia. Existing publications tend to suggest how accidents may be prevented but assume that a strong regulatory body exists to enforce legislation (Sohail and Kolsky, 1999). This result is consistent with the findings of this research as stated in section 2.15 of this paper. Though most of the existing studies were conducted in developed countries, their findings will be applicable in most situations in the developing nations as well.

Helander (1991) analyzed the causes of 739 construction fatality accidents that occurred in the UK. He found that fifty two percent of them occurred due to falls from roofs, scaffolds and ladders. Falling objects and material were involved in 19.4 per cent of the deaths, and transportation equipment, (e.g. excavators and dumpers) were involved in 18.5 percent. Helander also found that 5 percent of construction accidents occur during excavation work. The categories used for classifying fatal accidents were: falls, falling material and objects, electrical hazards, transport and mobile plants, and other. The majority of accidents that involved falls occur during work on roofs, scaffolds and ladders. Collapses of structures and falling materials also account for a large proportion of fatalities. Many of the safety hazards are specific to the different trades, and typically construction workers underestimate the hazards in their own work which affects the motivation for adopting safe work procedures. The establishment and use of procedures and regulations to enhance safety can avoid a large proportion of these accidents (Helander, 1991).

Helander (1991) finally suggested that top managers can contribute to reducing the number of accidents if they:

- Note the safety records of all their field managers and give these figures the same importance as productivity and overall cost.
- Communicate safety issues to staff along with cost and timing issues.
- Develop mechanisms for allocation of safety costs.
- Ensure through improved planning that equipment and materials required for safe working are available on site.
- Train newly hired people in safety issues.
- Make safety awards.
- Ensure the effective use of safety departments.

Dedobbeleer and German (1987) studied the relationships between an attitudinal factors related to safety and a worker‘s safety performance index. The authors analyzed three factors these are: reinforcing factors, enabling factors, and predisposing factors. Reinforcing factors measure the attitudes of other towards safety; enabling factors measure the availability of safety factors (e.g. safety equipment) at the work place; predisposing factors measure the knowledge and attitudes towards safety of the individual worker. Some other factors like demographic were also used for interaction. Most of the variation in safety performance was explained by predisposing factor alone. Most workers under 26 years of age had relatively low safety performance scores, relatively little knowledge about safety and an unfavorable attitude towards safety performance. The study concluded that: (1) falls are the most serious hazard; (2) research on safety motivation shows that hazard recognition is an essential element; (3) many accidents involve hand tools. Ergonomics can improve safety through better design; (4) protective equipment needs to be comfortable (Dedobbeleer and German, 1987). The paper also discussed the psychological aspects of safety, such as motivation and attitudes. It suggested a shift from the current practice

of training which stresses the desirability of safety to a subtler approach which asks what methods are available to motivate and change attitudes of construction related personnel to improve safety.

The research conducted in UK by Loughborough University (2003) on the causal factors in construction accidents by collecting data from 100 construction companies found that:

- Problems arising from workers or the work team, especially worker actions or behavior and worker capabilities, were judged to have contributed to over two thirds (70%) of the accidents. These points to inadequate supervision, education and training.
- Poor communication within work teams contributed to some accidents, due to the physical distance between work colleagues or high levels of background noise.
- Workplace factors, most notably poor housekeeping and problems with the site layout and space availability, were considered to have contributed in half (49%) of the accident studies. Standards of housekeeping and workplace layout with respect to safety are low in construction when compared with other industrial sectors.
- Shortcomings with equipment, including PPE, were identified in over half (56%) of the incidents. Poor equipment design and inappropriate use of equipment for the task were prominent aspects of this. Designers, suppliers and purchasers of equipment appear to give insufficient attention to the safety of users.
- Deficiencies with the suitability and condition of materials, including packaging, featured in more than a quarter (27%) of incidents. The operation of the supply/purchase chain at present appears to act as a barrier to innovation as far as safety is concerned.
- Originating influences, especially inadequacies with risk management, were considered to have been present in almost all (94%) of the accidents.

- Frequently, no risk assessment had been undertaken covering the circumstances involved in the accident. Where a risk assessment had been carried out, it was often found to be superficial and unlikely to have prevented the accident.
- It appears that PPE is relied upon habitually as a substitute for risk elimination or reduction at source.
- It was judged that up to half of the 100 accidents could have been mitigated through a design change. However, many designers are still failing to address the safety implications of their designs and specifications.
- Accident investigation by employers or supervising contractors is frequently superficial and of little value as far as improving safety is concerned. It appears that HSE investigations generally focus on safety failures in the activity being undertaken, without capturing the upstream influences upon these.
- Many of the incidents were caused by commonplace hazards and activities that will continue to occur on site whatever design changes might be made. The wide spread presence of the many generic safety risks accompanying construction needs to be tackled before the benefits of design improvements will be realised.

A study conducted in a developing country, in Pakistan, by Farooqui, Arif and Rafeeqi (2008) who investigated the safety performance measurement of various construction firms as well as the overall construction industry of Pakistan based on an investigative site survey. The findings of the study were as follows. The top three safety non-performance practices at building construction work sites are (1) ear defenders not worn (while using noisy equipment); (2) protective footwear not worn; and (3) face masks not worn (in dusty conditions). Most of the safety non-performance issues belong to self-protection category. This showed that the site

workers themselves were either unaware of the importance of personnel safety practices or they do not want to wear protective gears and kits as they consider it as a hindrance in their work productivity.

Furthermore, the study of Farooqui, Arif and Rafeeqi (2008) showed that the site management seemed to be non-interested in emphasizing the need of personnel safety practices among their workers. Overall, most of the companies lie in the range of extremely unsafe to moderately unsafe range. This shows that the overall level of the industry as regard to site safety needs drastic improvement. Safety seems to be on the less priority on the agenda. A mean value of Safety Performance Index of 0.52 was assessed for the building construction sites, which indicated that even the basic practices required for safety are not present at most construction sites. Also, the scattered safety performance levels of firms indicated lack of standard safety management systems. The authors also recommended that at the industry level, safety rules and regulations need to be defined, documented and enforced. An administrative body for occupational safety and health implementation is needed; the industry needed to develop the attitude of project owners towards an active safety management implementation; awareness programs need to be developed and implemented; formal and informal education and training in safety in the form of graduate education and career development programs are appropriate Farooqui, Arif and Rafeeqi (2008).

Another unpublished study conducted by Adedapo (2008) explored the status of health and safety in the construction industry in Nigeria. A total of 15 questionnaires were distributed equally among 3 construction sites and randomly distributed among the operatives on each site. The study revealed that the average Nigerian man is not proactive in the case of occupational health and safety; rather he will wait till the danger occurs before seeking solution. The

following recommendations were made: (1) All the parties involved in the production of buildings should understand that they all are to provide occupational health and safety. (2) Construction companies should have a good health and safety policy. (3) Construction companies should hold regular health and safety training.(4) All site operatives should know and be aware of their safety rights.(5) It must be mandatory for all site operatives to put on protective clothing.(6) All construction sites must have a well-equipped first aid box. (7) Accident should be prevented instead of treated.

Similarly, a research conducted by Construction Research Education and Training Enterprises (CREATE) of South Africa evaluated the status of construction health and safety in South Africa in 2009. Findings, of the research showed that:

- South Africa is not lacking in terms of health and safety legislation.
- The construction regulations need to be amended to promote optimum health and safety throughout all phases of a project.
- The study also noted that enforcement of the construction regulations is inadequate and that the OHS Inspectorate is understaffed and lacks the requisite construction expertise.
- Furthermore, there was lack of comprehensive construction health and safety statistics.
- At the organizational and site level, poor construction health and safety performance was attributable to a lack of management commitment, inadequate supervision and inadequate or a lack of health and safety training.
- A lack of worker involvement, personal risk appreciation and work pressures also contribute to poor performance.
- Lack of leading professional association for health and safety contributed to the lack of professionalism in terms of construction health and safety.

- The education sector does not adequately address construction health and safety.

The recommendations of CREATE (2009) were grouped into the following areas:

- Enhancing the impact of the Construction Regulations;
- Using public sector procurement to achieve improvements in construction HS;
- Enhancing the understanding of the status of construction health and safety in South Africa through the timeous provision of health and safety information and statistics;
- Establishing minimum competence standards and accreditation to client appointed health and safety agents in terms of the Construction Regulations;
- Establishing of a ' Health and Safety Agency' as a focus point for the promotion, awareness, information, advice and promotion of research on construction HS;
- Building health and safety capacity within relevant unions and facilitating closer working relationships between employers and union members to enhance construction HS;
- Ensuring that tertiary education addresses construction health and safety and related issues; and
- Facilitating a developmental approach to support the small and emerging contractors.

A senior essay conducted by Hayat, Hlina, Medina and Meron(2012) assessed the status of health and safety at construction site in Addis Ababa. They concluded that the local health and safety practice was not well exercised, because of the following reasons

i. Lack of strict follow up by regulatory bodies
ii. Lack of training and investigation
iii. Lack of awareness of the concept
iv. Lack of investigation during contact
v. Lack of responsibility among stakeholders.

CHAPTER THREE

RESEARCH METHODOLOGY

Research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically (Kothari, 2004, p.8). As data and methodology are highly interdependent, the methodology to be used for a particular research problem must always take into consideration the nature of the data that will be collected to resolve the research problem (Leedy and Ormrod, 2005). The main objective of this research is to explore occupational health and safety of Ethiopian construction industry. This chapter discusses the research methodologies and creates link among the objectives of this research; and the strategies and philosophies adopted for the study. The chapter is organized in two sections. Section 3.1 discusses the research approaches. Section 3.2 presents the method adopted in the study including the methods of data collection and analysis.

3.1. Research Approaches

There are three, frequently used approaches of inquiry. These are quantitative approach, qualitative approach, and mixed methods approach (Creswell, 2009). Each of these approaches has their own strengths and weaknesses. The basic features of the three approaches are summarized below to select the methodology that best suits the research objective.

The quantitative research approach is one in which the researcher primarily uses postpositive claims for developing knowledge. Post positivism assumes that causes determine outcomes (Creswell 2009). The approach involves the generation of data in quantitative or numerical form which can be subjected to rigorous quantitative analysis in a formal and rigid fashion (Kothari 2004, p.5). Similarly, Creswell (2009) states that, in the quantitative approach the researcher use

survey or experiment to collect data needed to see cause and effect relationship among variables of interest. The quantitative approach follows deduction in that it tests existing theories to verify them. The major benefit of the quantitative approach is that it enables the researcher to utilize statistical techniques to make generalization about the population. As the data in quantitative approach are numerical, the numbers are readily collected, coded, summarized and analyzed. The major weakness of a quantitative research is that the researcher knows only about the collective or average experience of study participants but not their individual experiences (Dunn 1999, p.37).

The qualitative approach is defined by Creswell (2009) as one in which the researcher often makes knowledge claims based primarily on constructivist perspective. In other words, in this approach the researcher tries to develop theories from the individual experiences of study participants. Qualitative data are not numerical nor are they usually subjected to statistical methods of analysis. Rather they are examined in their raw form (Dunn 1999). Hence, in qualitative methodology the researcher follows induction, as the researcher collects open-ended data with the primary intent of developing theory from the data. The main benefit of using qualitative approach as stated by Dunn (1999) is that the information gathered is of no fixed variety; hence, it represents *open systems view*. The openness of the approach becomes very useful when it comes to developing hypothesis in the early stages of investigating a topic. However, the disadvantages of qualitative researches are the fact that the data cannot be quickly, easily, or efficiently summarized nor is it often possible to generalize from given qualitative observation to another situation (Dunn 1999).

The mixed methods approach tries to combine the benefits of both quantitative and qualitative approaches. It integrates the two approaches for the purpose of gaining better insight into a social

phenomenon (Baker 2010). Baker (2010) further argues that the mixed methods approach is better than either method alone because it provides not only more information but also better quality of information. Therefore, in the mixed methods approach the researcher uses both the qualitative and quantitative approaches together at the same time or sequentially. As cited in Baker (2010), Creswell and Plano Clark (2007) summarized the advantages of mixed methods approach as: (1) the ability to choose from among all the quantitative and qualitative tools in order to perform a comprehensive study of the research problem, (2) the ability to answer more in-depth research questions, (3) the ability to combine both inductive and deductive reasoning. They also stated the disadvantages of using a mixed methods approach include: (1) more resources are needed to implement the study and collect the necessary data, (2) mixed methods research can be complicated to perform and difficult to sort out the results, and (3) researchers must be skilled in both quantitative and qualitative techniques in order to use this method.

3.2. Methods Adopted

The purpose of this study is to assess occupational health and safety of Ethiopian construction industry. Based on the features, strengths and weaknesses of different research approaches discussed above, the researcher found the mixed methods approach to be suitable for this study. The use of mixed methods approach for this research was intended to drive the benefits of both quantitative and qualitative approaches. The quantitative features in this case enabled the researcher to generate data from larger sample size about different variables then to generalize the results to the population, whereas, the qualitative features will allow the researcher to explore the current status of health and safety of Ethiopian construction industry. Mainly primary data was used in this study. More specifically, the researcher used questionnaire survey. In addition

interview and observation were also be used in order to substantiate results obtained from different data sources and types.

3.2.1. Survey Design

Survey design is the main strategy of enquiry used in this paper. The use of survey design provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population in order to generalize from the sample to the population (Creswell 2009). Besides, surveys provide a systematic and structured method for obtaining research information on the same topic from a large group of people in a relatively short time (Gerhardt 2004). The survey design was selected because the researcher wanted to include relatively large number of participants in the sample for the data to be collected within the limited time and budget. The survey was conducted by using semi-structured form of Self-administered questionnaire. The questionnaire is shown in the appendix.

Workers on the construction sites are mainly from the construction company and consulting firm, therefore; the target population of the study is all medium and large size construction companies and consultants, legally registered and operating in Ethiopia at the end of the year 2012. Generally, respondents were selected from ten construction companies and consultants that are taken as a sample frame from whom the sample respondents were selected for the questionnaire. From a single company only a single construction site is included in the sample. Most of the sites, however, were located in Addis Ababa. The ten companies were selected through convenient sampling, where by companies willing to cooperate for the research were involved. The companies were stratified in to two groups. Because, stratified sampling is useful when the researcher is aware of the existence of sub groups in the population (Devies, 2007). Half of the ten companies were among the large companies and the other half were among medium size

companies. This is to account for the effect of size on health and safety practice of the companies, and also to select a more representative sample. Furthermore, 6 respondents were selected from each of the ten companies, resulting in a total sample size of 60 respondents for the questionnaire. All of the questionnaires were filled by employees in construction sites and having some managerial position (i.e. Foremen and engineers). Because, most accidents occur in construction sites and the managers at this level are believed to have good experience and knowledge about health and safety practices of their companies. The questionnaires were distributed to them personally by the researcher.

Thus, the sample size for the survey part was 60 respondents. The researcher believes that this sample size is relatively small to make generalization. However, this sample size is decided based on the time and budget constraints, and the characteristics of the respondents. Therefore, taking sufficiently large sample becomes practically impossible in this context. Finally, to increase accuracy, the data is triangulated using different methods of data collection and analysis. Furthermore, according to Fowler (1986) the appropriateness of any sample design feature can be evaluated only in the context of the overall survey objectives. The important point for the researcher is to be aware of the potential costs and benefits of the options and weigh them in terms of the main purpose of the study.

The questionnaire contains both open - ended and close - ended questions. These questions were extracted from occupational health and safety standards, good practices and related literature. Of the total questions, 95 percent were close – ended and the remainders were open – ended questions. The close – ended questions were aimed at exploring the existence of certain health and safety features in the company and measure extent of the features. Therefore, the questions were partly five- point Likert scale, to rate the level of agreement and disagreement with a given

statement and partly choice among given other types of alternatives. Respondents answered these questions by ticking on a box or circling the letter of choice.

3.2.2 Data Analysis Method

This research used two types of data analysis methods, to analyze the sample data. The descriptive statistical analysis was used to analyze the means of the data collected through the close-ended questions of the questionnaire. The data collected using observation and open-ended questions of the questionnaire were analyzed using qualitative data analysis techniques together with the results of the descriptive statistics in order to supplement one by the other. Finally, descriptive statistical analysis methods and SPSS software were used to analyze and present the data obtained from the questionnaires in a tabular form.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

The main objective of this study is to assess occupational health and safety practices in the construction industry in Ethiopia. Accordingly, in this chapter, the results obtained from the respondents of the questionnaire will be presented and discussed.

4.1. Results

The data is collected from employees of construction contractors and consultants. As presented in table 4.1 totally 10 companies were included in the sample; of which 7 are contractors and the remaining 3 are consultants. Out of the 60 questionnaires distributed to foremen, and engineers, 50 properly completed questionnaires were returned back by respondents.

Company Type	No. of Companies included	Class (Level)	No. of Respondents
Contractor	7	1 up to 5	35
Consultant	3	1 up to 4	15
Total	10		50

Table 4.1 Category of companies included in the sample

4.1.1. Respondents' Personal Information

Table 4.2 presents the summary of personal information of respondents. The table contains the frequency and percentage of each category. The age classification shows that **25 (50%)** of the employees are within the age group of **(18-30)** and **19 (38%)** are within age group of **(31-40).** Only **6 (12%)** are **above 40**. This means **44 (88%)**of the employees are between **18 and 40** years old. This indicates that the relatively young population is engaged in the construction activity. Since most of the employees are in the productive age group more attention should be given for the OSH in the construction sector. The table also shows **33 (64%)** of the respondents have got

first degree and above, and almost all of the employees have some level of education related construction. In addition, **43 (86%)** the employees have worked in the construction sector for more than 1 year. Therefore, the respondents are likely to have reasonable knowledge of the situation of OHS in the construction sector, which increases the reliability of responses.

Age	**(18 - 30)**	**(31 – 40)**	**(41 – 50)**	**Total**
Frequency	25	19	6	50
Percent	50	38	12	100
Gender	**M**	**F**		
Frequency	41	9		50
Percent	82	18		100
Educational Background	**College Diploma**	**College Degree**	**Above**	
Frequency	17	27	5	50
Percent	34	54	10	100
Years of Experience in the construction sector	**<1 year**	**1 - 5 years**	**>5 years**	
Frequency	7	31	12	50
Percent	14	62	24	100

Table 4.2 Respondents' Personal Information

4.1.2. Descriptive Statistics

Numerical values were assigned to each of the survey responses, so that strongly disagree = 1, disagree = 2, Neutral = 3, agree = 4, and strongly agree = 5. Lower mean scores indicate stronger disagreement whereas higher mean scores indicate stronger agreement for each of the questions. The descriptive statistics are presented in Table 4.3 and Table 4.4

Table 4.3 presents the descriptive statistics of the responses of the questionnaires collected from engineers and foremen with regard to OHS. The table shows the frequency and percentage of the results. It is clear from Table 4.3 that 52% of the respondents disagree that their companies have written safety policy and only 6% agree that their companies have written safety policy. Almost none of the respondents agree to the statement that the policy is communicated to all concerned parties in the company while 50% strongly disagree and 44% disagree. Regarding the existence of health and safety committee in the company; 48% of the employees strongly disagree that there is health and safety committee in the company.50% of the foremen/engineers strongly disagree and 40% disagree that the company has a designated health and safety officer whereas 4% agree to the statement. Regarding the statement that the company holds craft –toolbox" safety meetings frequently; 50% strongly disagree and 38% disagree, while 2% agree. 50% and 32% of the engineers/foremen strongly disagree and disagree respectively, that the company provides and enforces the use of safety equipment. On the other hand, 44% of the engineers/foremen strongly disagree that their company has a program in place for the reporting and correction of workplace hazards. Whereas, 66% of the respondents disagree with the idea that workers are encouraged to intervene when unsafe conditions are observed. Similarly, 46% and 42% of the engineers/foremen strongly disagree and disagree respectively that the company will take disciplinary measures on workers who do not follow safety procedure.

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
		Frequen	*Percent*	Frequen	*Percent*	Frequen	*Percent*	Frequen	*Percent*	Frequen	*Percent*
1	The company has written health and safety policy	19	*38*	26	*52*	2	*4*	3	*6*	-	
2	The policy is communicated to all concerned parties in the company	25	*50*	22	*44*	3	*6*	-	-	-	-
3	The company has a health and safety committee	24	*48*	22	*44*	3	*6*	-	-	1	*2*
4	The company has a designated health and safety officer	25	*50*	20	*40*	3	*6*	2	*4*	-	-
5	The company holds craft ~~-t~~oolbox" safety meetings frequently	25	*50*	19	*38*	5	*10*	1	*2*	-	-
6	The company provides and enforces the use of safety equipment	25	*50*	16	*32*	9	*18*	-	-	-	-
7	A program is in place for the reporting and correction of workplace hazards	22	*44*	21	*42*	3	*6*	4	*8*	-	-
8	Workers are encouraged to intervene when unsafe conditions are observed	14	*28*	33	*66*	3	*6*	-	-	-	-
9	The company will take disciplinary measures on workers who do not follow safety procedure	21	*42*	23	*46*	6	*12*	-	-	-	-
10	The company has a nurse or a doctor on staff	21	*42*	6	*12*	-	-	19	*38*	4	*8*
11	First aid kit is available and easily accessible with sufficient materials in it.	14	*28*	13	*26*	-	-	19	*38*	4	*8*
12	The company provides health and safety training to employees regularly	21	*42*	24	*48*	3	*6*	2	*4*	-	-
13	The company provides safety orientation for new employees	21	*42*	29	*58*	-	-	-	-	-	-
14	The company conducts regular site safety inspections	19	*38*	21	*42*	5	*10*	4	*8*	1	*2*
15	The safety inspection results are documented and communicated	21	*42*	29	*58*	-	-	-	-	-	-
16	Hazardous jobs are clearly identified and special attention is given by the company	21	*42*	15	*30*	10	*20*	4	*8*	-	-
17	Unsafe jobs will be stopped by safety officers when they are found	21	*42*	28	*56*	1	*2*	-	-	-	-
18	The company gives priority for safety as they give priority for profitability	23	*46*	20	*40*	4	*8*	3	*6*	-	-

Table 4.3 Descriptive Statistics

With regard to the presence of a designated nurse or a doctor on staff and first aid materials, 42% strongly disagree and 38% agree that the company has a nurse or a doctor on staff; whereas 28% strongly disagree 38% disagree that first aid kit is available and easily accessible with sufficient materials in it. Concerning the provision of safety training and orientation, 42% strongly disagree and 4% agree with the statement the company provides health and safety training to employees regularly; similarly, 42% strongly disagree and 58% disagree that the company provides safety orientation for new employees. When it comes to safety inspection 42% disagree and 8% agree that regular site safety inspection is conducted in the company. 42% and 8% of the engineers/foremen strongly disagree and agree respectively, with the claim that hazardous jobs are clearly identified and special attention is given by the management. 56% of the respondents disagree that unsafe jobs will be stopped by safety officers when they are found.While46% of them strongly disagree and 6% agree with the statement that the company gives priority for safety as they give priority for profitability.

It can be observed from Table 4.4 below that 74% of the respondents (engineers/foremen) strongly agree that there should be a strong policy or regulation for the implementation of safety and health by the government. 80% of the respondents disagree and 8% agree that sometimes they have to ignore a safety rule or policy in order to complete an assignment to meet the schedule. Concerning, safety signs 42% and 14% of the engineers/foremen disagree and agree respectively, that safety signs are properly put in place at the working site.

It can also be observed from the responses that the responses of the respondents from the consultant and the contractor side are almost similar in many of the questionnaires. Major differences are observed in some of the questionnaires mainly in survey question 1, 10, 11 and 18. The responses of the consultant for survey question 1 is that 75% of the respondents strongly

disagree and disagree that their companies have written safety policy and 25% agree that their companies have written safety policy while 100% of the respondents from the contractor side strongly disagree and disagree that their companies have written safety policy. With regard to the presence of a designated nurse or a doctor on staff and first aid materials (survey question 10 and 11), 100% of the respondents from the consultant strongly disagree and disagree that first aid kit is available and easily accessible with sufficient materials in it; whereas only 34% of the respondents from the contractor strongly disagree and disagree that first aid kit is available and easily accessible with sufficient materials in it. Concerning the presence of designated nurse or a doctor, 100% the respondents from the consultant strongly disagree and disagree that the company has a nurse or a doctor on staff; whereas only 34% of the respondents from the contractor strongly disagree and disagree that the company has a nurse or a doctor on staff. The other major difference on the responses of the consultant from the contractor is on the company gives priority for safety as they give priority for profitability (survey question 18), 53% of the respondents from the consultant strongly disagree and disagree that their company gives priority for safety as they give priority for profitability; whereas 100% of the respondents from the contractor strongly disagree and disagree that their company gives priority for safety as they give priority for profitability;

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
		Frequency	*Percent*	Frequency	*Percent*	Frequency	*Percent*	Frequency	*Percent*	Frequency	*Percent*
19	There should be a strong policy or regulation for the implementation of safety and health by the government	-	-	-	-	2	*4*	11	*22*	37	*74*
20	The accidents occurred before are mainly due to employee's mistake	2	*4*	7	*14*	41	*82*	-	-	2	*4*
21	The accidents occurred before are mainly due to faulty procedure of work	-	-	9	*18*	35	*70*	-	-	-	-
22	Sometimes I have to ignore a safety rule or policy in order to complete an assignment to meet the schedule	-	-	46	*92*	-	-	4	*8*	-	-
23	Safety signs are properly put in place at the working site	-	-	21	*42*	22	*44*	7	*14*	-	-
24	The company has a medical insurance for all workers	21	*42*	7	*14*	7	*14*	15	*30*	-	-
25	When workers lose their working ability due to occupational accident they are given Compensation	-	-	21	*42*	-	-	29	*58*	-	-
26	I have the safety knowledge needed for the hazards we face on this job	-	-	14	*28*	17	*34*	19	*38*	-	-
27	The site supervisors always follow site safety rules and procedures very closely	5	*10*	4	*80*	2	*4*	3	*6*	-	-
28	The company do not force workers to work too many hours per week on their job	6	*12*	37	*74*	7	*14*	-	-	-	-
29	The laws, directives and regulations of the country regarding health and safety are known and implemented by management of the company	7	*14*	39	*78*	3	*6*	1	*2*	-	-

Table 4.4 Descriptive Statistics

Table 4.4 also shows that 42% disagree but 30 agree that the company has a medical insurance for all workers; whereas, 42% disagree and 58% agree with the statement that when workers lose their working ability due to occupational accident they are given Compensation. The table reveals that 28% of the engineers/foremen disagree but 38% agree that the respondent has the safety knowledge needed for the hazards they face on their job. On the other hand, 80% of the engineers/foremen disagree and 6% agree that the site supervisors always follow site safety rules and procedures very closely. Similarly, 74 % of the respondents disagree that their company do not force workers to work too many hours per week on their job. Finally, 78% of the engineers/foremen disagree and 2% agree that the laws, directives and regulations of the country regarding health and safety are known and implemented by management of the company.

		A		B		C		D		E	
		Frequency	*Percent*	Frequency	*Percent*	Frequency	*Percent*	Frequency	*Percent*	Frequency	*Percent*
30	What are the most common accidents that occur frequently at construction sites?	15	30	10	20	25	50	0	0	0	0
31	What is the main problem of companies on the implementation of the OHS at the work place?	4	8	6	12	0	0	40	80	0	0
32	What are the main causes of accidents at construction sites?	2	4	30	60	5	10	13	26	0	0

Table 4.5 Descriptive Statistics (A, B, C, D, and E are the choices shown in the questionnaire)

Based on Table 4.5 the most common accidents that occur frequently at construction sites are foot and hand injuries caused by accidents rather than falling and collision of vehicles (50%), falling (30%), and collision of vehicles (20%). In addition the main problems of companies on implementation of the OHS at the work place are incurring unnecessary cost (80%), and

negligence (12%). According to the engineers/foremen the main causes of accidents at construction sites are poor working conditions/environment (60%) followed by lack of personal protective equipment (PPE)(26%).

Figure 4.1: Main Cause of Accidents

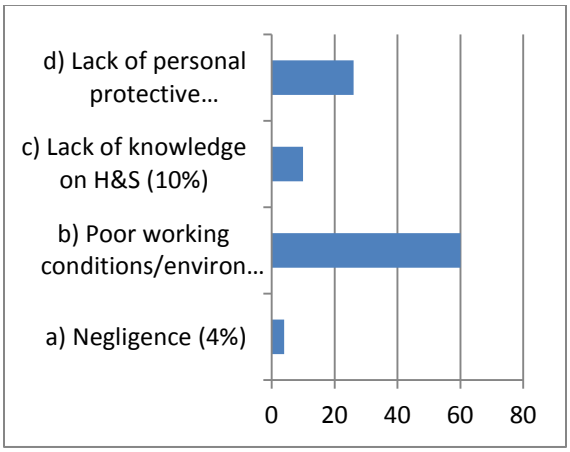
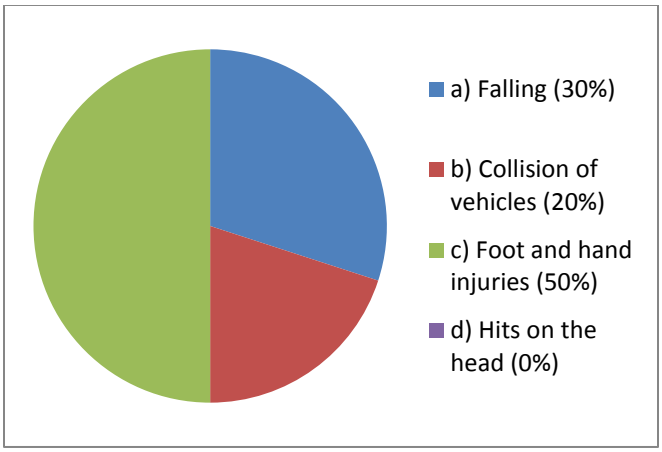


Figure 4.2: Most Common Accidents



4.1.3. Sites Observation Results

During the questionnaire survey in construction sites the researcher also performed personal observation of site, and interviewed some of the respondents to substantiate the results obtained using questionnaire, from different data types and sources. The results of site observations and interview showed the following:

- Contractors apply OSH depending to the interest of the client but the client has to pay additional money for the contractor to apply OSH requirements, otherwise OSH is not applied.
- Workers are sometimes reluctant to use PPE (e.g. Gloves, Harness etc...) believing that it will reduce their productivity.
- The scaffoldings observed on most of the construction sites selected for the study are timber scaffolding that has been used for too long time and they were constructed without a design.

- Even though, the work contract strictly requires the application of OSH in the construction sites where OSH was supposed to be applied, the represented safety supervisor tend to be reluctant to properly supervise the implementation of the contract on safety issues.
- After receiving payment for applying OSH from the client, the contractor do not want to incur cost to fulfill the OSH requirements.
- In most of the construction sites observed by the researcher, it was difficult to see a worker with the proper PPE.

Table 4.5 shows a summary of accidents occurred in the construction industry, that were disclosed to three insurance companies for compensation purpose for the years 2002 and 2003 E.C. The table shows the type of accident, the amount of money paid in terms of Birr by the insurance companies.

Table 4.5 Summary of accidents

No	Severity of accidents	Year 2002 E.C.		Year 2003 E.C.		Total	
		Amount	Insurance payment	Amount	Insurance payment	Amount	Insurance payment
1	Temporary disablement	2051	817,973.92	2530	846,308.40	4581	1,664,282.32
2	Permanent disablement	108	296,949.09	129	725,627.66	237	1,022,576.75
3	Death	12	740,200.00	10	441333.00	22	1,181,133.00
Total		2172	1,855,123.01	2669	2,013,269.06	4840	3,868,392.07

Source: Addis Ababa city Administration Labour and Social Affairs Bureau

The table shows that the average amount money paid for the death of a person is 53,700 which is not sufficient it should adjusted.

The pictures below were taken in construction sites located in Addis Ababa during the questionnaire survey.

Figure 5.1 Road construction in Addis Ababa

Figure 5.2 Road construction in Addis Ababa

Figure 5.3 Road construction in Addis Ababa

The above three pictures (pic.5.1, pic. 5.2 and pic. 5.3) were taken from road construction sites located in Addis Ababa. According to international occupational safety and health standards Construction work should be fenced off to protect people from site dangers. However, these contractors were executed their works without any barrier.

Figure 5.4 Railway construction in Addis Ababa

The above picture (pic.5.4) was taken from a construction site located in Addis Ababa. This picture showed us the worker is fixing the reinforcement bars (dia. 8) using the fixed ones as a scaffold. However, this should be done with a proper platform and harness.

Figure 5.5 Car accident around Akaki

Figure 5.6 Car accident around Akaki

The above two pictures (pic.5.5, and pic. 5.6) were taken from road construction site located in Addis Ababa. These two accidents occurred in the same place in one day difference at night time. Excavating the roadway without putting any reflecting signs was the cause of the accident.

4.2. Discussion of Results

The tables presented above indicate that the standard of safety and health in the construction sector is very poor. The frequency of responses in the likert scale for the OSH questions by the engineers/foremen show that most of the construction companies do not have written safety policy; contrary to this, Article 37 of the labor proclamation no. 377/2003 of the FDRE requires that employers should have written safety and health policy and this should be communicated to employees. Similarly, the tables show that attention is not given by the construction companies regarding safety officer and safety committee; unlike, the Article (60-61) of the labor proclamation no. 377/2003 of the FDRE that states the employer has an obligation to assign safety officer as well as establish an occupational safety and health committee. This implies that the proclamation is not implemented by the construction companies. The analysis also reveals that –toolbox" safety meetings are not conducted frequently and there is also poor provision and use of safety equipment's. Even though proper reporting and correction of safety hazards is necessary for better safety, majority of the companies have not established a program for such activity. On the other hand, workers are not urged to follow safety procedures while working, based on the analysis of responses.

Fortunately, based on the figures in Table 4.3 significant number of the companies have a nurse or a doctor on staff as well as there is first aid kit with sufficient materials in it (38% agree). Nevertheless, little training and orientation is given to employees regarding health and safety by the companies. This contradicts with the provisions of ILO (1995) and the labor proclamation no. 377/2003 of the FDRE, which seriously requires the provision of regular health and safety training to employees of the construction company. Again with regard to site safety inspections, few of the companies conduct safety inspections regularly. Majority of the engineers/foremen do

not believe that their companies give priority for safety as they give priority for profitability. This is not in agreement with the principle –safety comes first".

Because of the fact that there is weak safety and health condition in the construction industry, the engineers/foremen suggest strong government regulation for the implementation of safety and health standards (74% strongly agree).This result is consistent with the finding of CREATE (2009) in South Africa, noted that enforcement of the construction regulations is inadequate and that the OHS Inspectorate is understaffed and lacks the requisite construction expertise. Therefore, more attention should be given for the implementation of safety and health standards by the Ministry Of Labor and Social Affairs and other concerned government bodies in Ethiopia. According the survey in Table 4.4 time pressure is not a major factor for not following safety procedures by employees. On the other hand, significantly large numbers of the companies provide medical insurance and Compensation for occupational accident to workers (30% and 58% respectively). Concerning health and safety awareness, however, the employees, the site supervisors as well as management of the companies have relatively lower knowledge and implementation compared to what supposed to be (based on the responses for survey questions 26, 28, 29).Similarly, CREATE (2009) attributes poor construction H&S performance to a lack of management commitment, inadequate supervision and inadequate or a lack of H&S training.

The most frequent type of accident that occurs at construction areas according to this survey is foot and hand injuries, followed by falling from heights. But this result is not in agreement with the finding of Helander (1991) who found that 52% of fatal accidents occurred in the UK are due to falls from roofs, scaffolds and ladders. When it comes to the main cause of accidents in construction sites, poor working conditions/environment is the first one followed by lack of personal protective equipment (PPE).According to Article 41 of the labor proclamation no.

377/2003 of the FDRE that states the employer is obliged to provide workers with the appropriate personal protective equipment besides the employer is responsible for the maintenance of the PPE.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Most of the findings are consistent with the previous literature in other developing countries. It is found that the level of occupational health and safety practices in the Ethiopian construction industry is very poor. Similarly, the level implementation of occupational health and safety standards and policies by the construction companies is very weak. Very little training and orientation on OHS is given to employees, though training is a crucial aspect of OHS. Most of the construction companies do not have OHS components like written safety policy, safety officer, health and safety committee, hazard identification and reporting program, and properly placed safety signs.

However, among the good features, according to the engineers/foremen many of the companies provide medical insurance and Compensation for occupational accident to workers. In addition significant portion of the companies maintain proper first aid kit and a health trained person on staff. Poor working conditions/environment and lack of personal protective equipment (PPE) are the main cause of accidents in construction industry. On the other hand, foot and hand injuries, as well as falling from heights are the more frequently occurring types of accidents in the industry.

5.2. Recommendation

- To improve the level of occupational health and safety practices in the construction industry, the concerted effort of stakeholders of the construction industry including owners, management and employees of construction companies, consultants as well as government is necessary.

- The Ministry of Labor and Social Affairs and other concerned government bodies should monitor the implementation of the labor proclamations on health and safety in the construction sector through frequent site inspection by increasing its capacity like sufficient and competent staff.

- Regular health and safety training and orientation should be given to employees by construction companies. The Ministry of Labor should also give training to representatives (e.g. Safety officers) of construction companies and certify them. The Safety Officers intern will train workers in their respective companies and inspect the site regularly.

- The concerned government body should give certificate for construction companies, which have better occupational safety and health practice.

- Occupational safety and health education should be given by colleges/universities to students who will be working in the construction sector when they graduate.

- Clients of construction companies should consider the health and safety practices of companies during the selection of contractors.

- Construction workers should be encouraged to participate on issues related to occupational safety and health of their company, which includes during hazard identification, risk assessment and control procedures.

- Demolition of works should be done by a contractor which has good health and safety policy.

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APPENDIX

Questionnaire

My name is Seifedin Sermolo and I am currently working on a masters thesis for the partial fulfillment of the MSc degree in Construction Technology and Management at Addis Ababa University Institute of Technology.

The purpose of the study is to Study Occupational Health and Safety in Ethiopian Construction Industry. To achieve this objective the study requires the gathering of data related to health and safety of medium and large construction and consulting companies in Ethiopia. The data collected will be used for academic purpose and it will be confidential. I am grateful in advance for your cooperation in completing the questionnaire.

Section 1: General information

A) Code----------

B) Work status ❑site engineer ❑ Forman

C) Age ---------- Gender ----------

D) Employment status ❑ definite period ❑Indefinite period

E) Educational background ❑ High school diploma ❑University diploma ❑University degree and above

F) How many years have you worked in the construction sector? ----------

G) How many years have you worked in this construction work? ----------

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	The company has written health and safety policy					
2	The policy is communicated to all concerned parties in the company					
3	The company has a health and safety committee					
4	The company has a designated health and safety officer					
5	The company holds craft ―toolbox" safety meetings frequently					
6	The company provides and enforces the use of safety equipment					
7	A program is in place for the reporting and correction of workplace hazards					
8	Workers are encouraged to intervene when unsafe conditions are observed					
9	The company will take disciplinary measures on workers who do not follow safety procedure					
10	The company has a nurse or a doctor on staff					
11	First aid materials are available and easily accessible in the company					
12	The company provides health and safety training to employees regularly					
13	The company provides safety orientation for new employees					
14	The company conducts regular site safety inspections					
15	The safety inspection results are documented and communicated					
16	Hazardous jobs are clearly identified and special attention is given by the company					
17	Unsafe jobs will be stopped by safety officers when they are found					
18	The company gives priority for safety as they give priority for profitability					
19	There should be a strong policy or regulation for the implementation of safety and health by the government					
20	The accidents occurred before are mainly due to employee's mistake					
21	The accidents occurred before are mainly due to faulty procedure of work					
22	Sometimes I have to ignore a safety rule or policy in order to complete an assignment to meet the schedule					
23	Safety signs are properly put in place at the working site					
24	The company has a medical insurance for all workers					
25	When workers lose their working ability due to occupational accident they are					

	given Compensation					
26	I have the safety knowledge needed for the hazards we face on this job					
27	The site supervisors always follow site safety rules and procedures very closely					
28	The company do not force workers to work too many hours per week on their job					
29	The laws, directives and regulations of the country regarding health and safety are know and implemented by management of the company					

Section 2: Questions

30. What are the most common accidents that occur frequently at construction sites?
    A. Falling
    B. Collision of vehicles
    C. Foot and hand injuries
    D. Hits on the head
    E. All
    F. f) Others specify----------
31. What is the main problem of companies on the implementation of the H&S at the work place?
    A. Lack of awareness
    B. Negligence
    C. Inappropriateness
    D. Incurring unnecessary cost
    E. e) Others specify----------

32. What are the main causes of accidents at construction sites?
    A. Negligence
    B. Poor working conditions/environment
    C. Lack of knowledge on H&S
    D. Lack of personal protective equipment
    E. e) Others specify----------