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Assessment of Stakeholders' Awareness of the Construction Health and Safety Regulations on Construction Sites in South Africa

By

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A research report submitted to the Faculty of Engineering and the Built Environment, of the University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Science in Building, Project Management in Construction

Johannesburg, April 2018

DECLARATION

I declare that this research report is my own unaided work, executed fully by myself utilising information obtained from various sources and institutions. All sources utilised are acknowledged as references. I also declare that no portion of the work referred to in this research report has been submitted in support of an application for another degree qualification of this University or any other institution of learning. This research report is being submitted in partial fulfilment of the requirements for the degree of Master of Science in Building, Project Management in Construction.

Gcinithemba Masimula

Date: April 2018

ABSTRACT

In 2009, the Construction Industry Development Board commissioned the study of construction health and safety in South Africa, which revealed that despite the advancement in legislation in the form of the Construction Regulations promulgated in July 2003, health and safety performance in South Africa is still poor and the enforcement of the legislation by the Department of Labour Inspectorate was found to be lacking. The research established that there is a need for developing strategies that would cultivate the culture of health and safety necessary to improve compliance in health and safety amongst the people in the construction industry.

This research report presents an assessment of stakeholders' awareness of the construction health and safety regulations on construction sites in South Africa. The main objective of the study was to identify the reasons for the occurrence of accidents on the construction sites, despite the existence of health and safety legislation. In order to achieve the objectives of the study, the mixed methods approach was employed to collect data from the construction industry stakeholders, namely contractors, clients and designers / consultants. The questionnaire was used to collect data from the participants. The findings of the study indicated that health and safety is very important and should be prioritised just like any other issues in the construction industry. It was also found that human error, especially top management, is responsible for occupational accidents. This is because some organisations choose not to comply with the legislation on health and safety, while some workers choose not to utilise or fail to effectively utilise provided personal protective equipment prior to engaging in construction activities. Based on these findings, it was recommended that the Department of Labour Inspectorate should enforce health and safety legislation in the construction industry by regularly conducting site inspections and imposing penalties for non-compliance. It was also recommended that health and safety issues are every stakeholders' business and therefore, every participant in this regard should play his or her role in ensuring better working conditions for the people in the construction industry. It was also proposed that the Construction Industry Development Board should utilise health and safety records for companies as a grading criteria and non-complying contractors be downgraded in order to improve their performance.

Keywords: awareness, construction, health and safety, regulations, South Africa, stakeholders.

DEDICATION

I thank the Lord God Almighty, who made it possible for me to attain this achievement. All my soul and being do praise his holy name and proclaim his greatness.

This project is dedicated to both my parents who sacrificed all in life to ensure that I acquired the basic human right, education, when they had none and I shall remain indebted to them for their unselfishness. I also dedicate this work to my family, wife S'thembile with the most profound thanks and love for her unwavering support through all the years of our marriage and my two sons Thembumenzi and S'nethemba, who are the pillar of my strength and the reason for my living, siblings, Reverend F. Fakudze of the Church of the Nazarene with his indefatigable prayers for my success, relatives and friends for their encouragement, inspiration and their faith in me that I would eventually attain this qualification.

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I further extend my appreciation to all those who made an effort and sacrificed their time by answering the questionnaires and afforded me interviews which formed an integral part of the findings to my research question. The excellent response rate and considered answers shall assist the construction industry identify areas where improvements in health and safety can be made to mitigate injuries and fatalities on sites. I shall remain indebted to all of you, may you be truly blessed.

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LIST OF ACRONYMS

Acronyms are written in full at the beginning of each section in which they are found.

ACOP	:	Approved Code of Practice
AIA	:	Approved Inspection Authority
BEE	:	Black Economic Empowerment
CBE	:	Council for the Built Environment
CDM	:	Construction Design and Management
CIDB	:	Construction Industry Development Board
CoA	:	Cost of Accidents
COID Act	:	Compensation for Occupational Injuries and Diseases Act
DIIR	:	Disabling Injury Incidence Rate
DoL	:	Department of Labour
ECC	:	Engineering and Construction Contract
FEMA	:	Federated Employers' Mutual Assurance Company Limited
FIDIC	:	International Federation of Consulting Engineers
FIFA	:	Federation of International Football Association
GCC	:	General Conditions of Contract
GDP	:	Gross Domestic Product
HSC	:	Health and Safety Commission
HSE	:	Health and Safety Executive
H&S	:	Health and Safety
ILO	:	International Labour Organisation
ISO	:	International Organisation for Standardisation
JBCC	:	Joint Building Contracts Committee
MBA	:	Master Builders Association
NOHSP	:	National Occupational Health and Safety Policy
OH&S	:	Occupational Health and Safety
OHSA	:	Occupational Health and Safety Act
PPE	:	Personal Protective Equipment
SACPCMP	:	South African Council for the Project and Construction Management Professions
SAICE	:	South African Institution of Civil Engineering
SAPOA	:	South African Property Owners Association
SAPS	:	South African Police Service

SR	:	Severity Rate
UK	:	United Kingdom
USA	:	United States of America
WHA	:	World Health Assembly
WHO	:	World Health Organisation
WMD	:	Work-related Musculoskeletal Disorder
WSH	:	Workplace Safety and Health

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1 CHAPTER ONE: INTRODUCTION

1.1 Introduction

This chapter introduces the subject of this study: the health and safety (H&S) problems associated with the construction industry, with reference to the accidents happening on selected building sites. In view of that, the key legislations on health and safety in South Africa are briefly introduced. The problem statement, the motivation for the chosen topic and the justification for the research are also described in this chapter. Essentially, the chapter highlights the aims and objectives of the study, the significance of the study, as well as the limitations. A brief overview of the methodology employed in the study is also given. The role of the construction industry in the South African economy is also highlighted.

1.2 Background of the Study

The issue of poor H&S performance by construction workers, as well as the high rates of accidents, injuries and occupational health conditions, are of great concern (Eppenberger and Haupt, 2008). The construction industry provides various infrastructure such as homes, offices, transport infrastructure and other facilities we rely upon. The industry contributes to improving people's quality of life, both socially and economically. However, those involved in the construction are at high risk of pain, injuries and accidental deaths, which affects not only them, but their friends and families (ILO, 1991). A number of people in this industry have been killed and maimed, which makes the industry more dangerous than any other (Lingard and Rowlinson, 2005; Smallwood, 2007). As a result of this, H&S has become a major concern for the stakeholders in this industry, which include international bodies like the International Labour Organization (ILO) and the World Health Organization (WHO). Despite efforts towards encouraging positive health and safety in the industry, the improvement has not been significant. A study by the Construction Industry Development Board (CIDB, 2009a) revealed high numbers of injuries and fatalities resulting from non-compliance with the health and safety Construction Regulations of South Africa. In view of this, it is important that health and safety is emphasised in the construction industry.

In March 2003, South Africa approved the Occupational Health and Safety Convention (155 of 1981) by ILO. The purpose of the convention was to improve the practice and the working conditions of workers in the construction industry hence, countries' national policies on occupational health and safety were to be clearly formulated, implemented and reviewed on a regular basis. The reason for doing this was to reduce the number of injuries and accidents occurring on construction sites (OHSA, 2008). Thwala and Monese's (2008) study on motivation as a tool to improve productivity on the construction site revealed that the construction industry continues to suffer from poor productivity and increasing construction costs. Moreover, other studies also noted that poor performance in respect of health and safety in the industry significantly contributes to poor productivity, increased costs, unsatisfactory quality performance, time overruns and undesirable impact on the environment (Cole and Haupt, 1999; Agumba and Haupt, 2008; Ajayi and Smallwood, 2008; Pillay and Haupt, 2008).

Hinze (2006) asserts that among industries, construction is unique in that it affords great opportunities for workers to be involved in many projects of interest, which of course requires diverse skills. Additionally, construction work often takes place outdoors, in conditions that may not be completely favourable for H&S. In addition to the nature of the work and the mix of workers on construction projects, the location of the work frequently changes for the workers. Even though the special attributes of construction may be attractive to some workers, the issue of safety in the construction industry has remained a major concern. Those attributes need not result in injuries and fatalities.

Ajayi and Smallwood (2008) state that in view of the wide range of activities involved in the construction industry these expose the workers to work-related musculoskeletal disorders (WMDs), particularly of the neck, shoulder, hand and wrist which often occur when they twist their bodies, when they bend, when they work below the knee level, as well as above shoulder height. It is also common knowledge that the workers in the construction industry often manually lift or handle heavy loads which make them adopt dangerous postures, hence their exposure to all these activities make them vulnerable and put them at high risks of injuries and deaths. As a measure to mitigate this, it was suggested that health and safety policy standards should be emphasised. The International Labour Organization (2002) outlines that a safety policy should include among other things the following elements:

- ❒ Develop awareness of, and promote occupational health and safety (OH&S) as a way of showing that "safety pays" thereby improving productivity.

- ❒ All organisations should include OH&S in their business plans, for them to remain healthy and safe.
- ❒ All stakeholders should have access to information on safety norms, as well as dangerous materials, products and substances.
- ❒ Environmental assessment should be done in those areas being operated by the informal sector.

Hinze (2006) suggests that safety should not be viewed in a fatalistic manner, but rather in a positive manner. The objective of every employer should be to have no worker injuries. Coupled with that objective must be a deep-seated conviction that the goal is attainable. Firms must be prepared for the occurrence of injuries, but they should at the same time plan to have none. Hinze (2006) affirms that the construction industry has not had a favourable safety record over the years, despite having achieved some improvements in this regard.

1.3 Problem Statement

Despite the advancement in legislation in the form of the Construction Regulations promulgated in July 2003, accidents continue to be high on construction sites. It would seem that efforts made within the construction industry aimed at improving compliance with the Construction Regulations, have not yielded any satisfactory results. H&S issues remain a major concern in the construction industry, considering the many injuries and fatalities that occur on construction sites.

From a general observation, it seems health and safety rules are not existent, or if they are, then the regulatory authorities are not effective in the implementation of such rules. Thus, H&S in the construction industry remains an issue that deserves urgent attention by the relevant stakeholders. Findings from literature and descriptive surveys reveal that the rate of accidents in the construction industry is still high, regardless of the legislation being in place (Smallwood and Haupt, 2005; Smallwood, 2007; CIDB, 2009a; 2009b). Notwithstanding the occupational health and safety (OH&S) initiatives and campaigns, recent statistics from the Federated Employers' Mutual Assurance Company Limited (FEMA) indicate high numbers of injuries and deaths on the construction sites (FEMA, 2013).

This, therefore, raises the research question, *"What is the level of awareness of the Construction Health and Safety Regulations by the people involved in the construction industry in South Africa?".* In this regard, the study has the following aims and objectives:

1.4 Aim of the Research

The principal aim of this study is to investigate the construction industry stakeholders' awareness of the construction health and safety regulations. The aim of the research is, therefore, to measure the level of awareness or knowledge and attitude of the construction industry stakeholders, namely contractors, clients and designers / consultants towards the construction health and safety regulations. Thus, the study has the following objectives:

1.5 Objectives of the Study

The objectives of the research are:

- ❒ To assess the awareness and understanding of the Construction Regulations amongst the clients, consultants and contractors within the construction industry.
- ❒ To measure the level to which the clients, consultants and contractors are performing their health and safety responsibilities, as stipulated in the Construction Regulations.
- ❒ To evaluate the level of commitment to the Construction Regulations by the South African construction industry stakeholders.
- ❒ To investigate why the implementation of the Construction Regulations has not contributed to the decline in the occurrence of accidents on construction sites in South Africa.

1.6 Research Questions

To what extent are clients, consultants and contractors aware and familiar with the construction health and safety regulations, with regards to their roles and obligations in implementing construction projects in South Africa in relation to the construction regulations? The following sub-questions have been formulated to help address the specific objectives relating to the research question:

- ❒ What is the level of awareness and understanding of the obligations of the Construction Regulations within the South African construction industry?
- ❒ To what extent are clients, consultants and contractors performing their roles as stipulated in the Construction Regulations?
- ❒ What is the level of commitment, in terms of implementing the Construction Regulations in the South African construction industry?
- ❒ What are the effects of implementing the Construction Regulations on sites?

1.7 Significance of the Study

Although some studies have indicated the causes of construction accidents in South Africa (Smallwood and Haupt, 2005; Smallwood, 2007; Seevaparsaid-Mansingh and Haupt, 2008), the socio-economic impact of site accidents on the South African society (Mthalane, *et al.,* 2008), the cost of construction accidents (Pillay and Haupt, 2008), it should be noted that no study has been undertaken to assess stakeholders' awareness of the construction health and safety regulations on construction sites in South Africa, since they were first promulgated in July 2003. Naoum (2007) states that researchers conduct exploratory research to diagnose situations, to screen alternatives, as well as to discover new ideas. The emphasis of the research, therefore, would be to identify the contribution of the Construction Regulations in the prevention of accidents on construction sites and also devise a strategy to effectively implement these regulations.

This research is done with the anticipation of not only adding information to the body of knowledge already in existence, but it is envisaged that the results of the study would reveal the impact that the Construction Regulations have had in reducing occurrences of accidents on construction sites in South Africa, as well as the efforts that are being put in place by various stakeholders to prevent construction accidents from occurring. Seevaparsaid-Mansingh and Haupt (2008) argue that the ultimate goal for any construction stakeholder is to strive for zero accident occurrence. Any approach which does not prevent accidents is seriously flawed.

1.8 An Overview of the Research Methodology

A detailed description of the research methods is given in Chapter 3, hence, this section provides a snapshot of the methods employed to achieve the objectives of the study. The mixed methods approach was adopted to collect data for the study. This means that both quantitative and qualitative research methods were employed to gather sufficient information on the subject matter. To collect the data, the researcher used a questionnaire (see Appendix B) which comprised both closed-ended and open-ended questions and was randomly distributed to a sample of thirty (30) active contractors registered under general building category (grades 7-9), with the Construction Industry Development Board (CIDB) in the Gauteng Province in South Africa (www.cidb.org.za). The sample included ten (10) clients and ten (10) consultants under various disciplines, who were linked to completed construction projects or current construction projects that were being executed by the thirty (30) selected

contractors. The details regarding the sampling and data collections are described in the research design and methodology chapter.

1.9 Definition of Key Terms

1.9.1 Occupational Health and Safety

The ILO (1991) and WHO (2007) jointly refer to occupational health and safety as including the prevention of accidents and diseases, while at the same time ensuring the health of the workers by maintaining and promoting their health and working capacity, improving their work environment, developing work organisations and their cultures in ways that promote health and safety.

1.10 Structure of the Research

The research comprises the following chapters:

Chapter 1 **:** This first chapter entails the introduction of the health and safety problems associated with the construction industry. The problem statement and motivation for the chosen topic is explained and an indication of why the research was conducted.

Chapter 2 **:** A review of literature available on the state of construction health and safety is conducted. The history of health and safety, as well as the health and safety performance of the construction industry are presented, including accident statistics. The chapter further outlines the various accident causation theories and/or models that have been developed by researchers, in an effort to formulate accident prevention programs. The financial impact of accidents is also discussed.

Chapter 3 **:** The research design and methodology are described in detail in this chapter. The population for the study is described and the sampling techniques used in the survey are outlined. The methods used to analyse the data are also explained. A critical appraisal of the reliability and validity of the main research instrument is also performed in this chapter.

Chapter 4 **:** The data, analysis and findings are detailed in this chapter. Pie charts and histograms have been used to illustrate the findings from the respondents and to make the findings understandable. Tests of data reliability are undertaken. Inferential and descriptive statistical tests are executed on the four sub-questions. This chapter also discusses the limitations of the research methodology.

Chapter 5 **:** This chapter concludes the study and provides recommendations, based on the findings of the study. The conclusions are linked to the four research objectives, while the recommendations are intended to address the identified problem.

1.11 Conclusion

The main objective of chapter one was to give the introduction to the health and safety performance in the construction industry, as well as to highlight the role that the construction industry plays in the South African economy. The importance of the research and the description of the topic was outlined. The problem statement and objectives of the study were also given. The research methodology was outlined in brief and the structure of the research report was explained. The next chapter presents the literature review.

2 CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter reviews the literature on the state of health and safety (H&S) in the construction industry, H&S legislation, both internationally and locally and the implementation of the Construction Regulations, with reference to the roles and the obligations of the clients, consultants and contractors. The definition of health and safety is given alongside the history of the concept. An overview of construction H&S in South Africa is also outlined. The chapter also highlights the responsibilities of the various parties involved in a construction project. The H&S performance of the construction industry is also reviewed, based on the available statistics and in comparison with other industries. The causes of accidents in the construction industry are also explored. The health and safety problems encountered on construction sites and as observed by the researcher are also discussed. The chapter further outlines some of the accident causation models, as well as the human error theories that have been developed by some researchers, in an effort to formulate accident prevention programs. Finally, the financial impact of accidents in the construction industry is also discussed. The next section discusses definition of health and safety.

2.2 Defining Health and Safety

In order to appreciate the concept of health and safety, it is imperative to split the two words and define them separately. According to Mosby medical dictionary (2009), “health” refers to the general condition of a person, which comprises the body, spirit and mind. The World Health Organization (WHO, 2007) defines health as “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity”. In the context of this study, health refers to a state of being free from any form of illnesses, pain or injury resulting from construction activities. On the other hand, “safety” has to do with a state of being protected from external threats. It refers to being free from the threat of injury, harm, danger and any form of risks, which often occur accidentally or deliberately. By implication, safety thus refers to the ability to control the potential hazards which might endanger one’s life (Mosby, 2009). In the context of this study, safety of construction workers refers to the protection from harm, danger and any risks associated with the construction industry. As noted in Chapter 1, the International Labour Organization (ILO, 1991) and the World Health Organization (WHO, 2007) jointly refer to occupational health and safety as including the prevention of accidents and diseases, while at the same time ensuring the health of the workers by maintaining and

promoting their health and working capacity, improving their work environment, developing work organisations and their cultures in ways that promote health and safety.

Lingard and Rowlinson (2005) define occupational health and safety (OH&S) as a cross-disciplinary area and the legal system that is concerned with the protecting the health, safety and welfare of employees, with the aim of fostering a healthy and safe working environment. In the same way, Alli (2008) defines OH&S as generally the art of anticipating, recognising, evaluating and controlling hazards which might occur in the workplace and could affect the welfare of the workers.

Mosby's dictionary (2009) defines occupational health as: *the ability of a worker to function at an optimum level of well-being at a worksite, as reflected in terms of productivity, work attendance, disability compensation claims and employment longevity.* It is observed here that the word 'safety' is not mentioned in this definition.

Overall, the researcher adopts the definition of OH&S by ILO (1991) and WHO (2007) for use in this study, as it encompasses aspects of accidents prevention that could lead to injuries and at worst, the deaths of workers, as well as the prevention of diseases that might develop on workers as a result of the work environment. The following section introduces the history of health and safety in some developed countries as well as the developing country being studied.

2.3 History of Health and Safety

The history of health and safety is outlined below, using the case studies of two countries, namely the United Kingdom (UK) and the United States of America (USA), as well as South Africa, the case for this study. The UK and USA were chosen given that they are developed economies and are investing in research and development (R&D) on construction health and safety (Helander, 1991). It is, therefore, expected that developing nations like the one being studied have a lot to learn from them.

The UK formed a structured health and safety system in 1833, with the enactment of the Factories Act (1833). According to the Act, the inspectors were responsible for ensuring that workers do not get injured and are not exposed to harsh working conditions. The Factories Act had limited support, but it managed to enforce certain laws and regulations. During this period, the factory inspectors also managed to formulate new laws and regulations to ensure the effective enforcement of the Act. In the same way, they also influenced legislation on accident

reporting and machinery guarding. Between 1860 and 1871, the legislation was changed and this affected the Factories Act, as major technological advancement transformed the nature of employment. In 1840, a Royal Commission was instituted to assess the working conditions, particularly in the mining industry. The findings of the Commission revealed many accidents, long and harsh working conditions, brutality, as well as lung diseases. This led to the enactment of the Mines Act of 1842, which allowed for investigations into the working conditions of the mining community (HSE, 2012a).

Fast-forward to 1974, the Health and Safety at Work Act (1974) was instituted. This was described as “a bold and far-reaching piece of legislation” which introduced more goal-based regulations. According to this Act, both employees and employers were supposed to be consulted and engaged in decision-making processes which included designing a modern health and safety system. The Act also established the Health and Safety Commission (HSC), whose major role was to propose new regulations, to provide information, advice, as well as to conduct research. Essentially, its responsibility entailed “taking appropriate steps to secure the health, safety and welfare of people at work, to protect the public generally against risks to health and safety arising out of the work situation, to give general direction to the Health and Safety Executive (HSE) and guidance to Local Authorities on the enforcement provisions of the Act, to assist and encourage persons with duties under the Act and to make suitable arrangements for research and the provision of information”. The HSE is involved in effectively enforcing health and safety legislation in order to prevent accidents, as well as work-related deaths in the UK (HSE, 2012b).

In the USA, concern over workers' safety and health on the job arose in the late 1900’s as the country became an industrial power. The increasing use of heavy machinery in areas like mining, railroad freight and manufacturing resulted in accidents that crippled or even killed the workers. During the late 1800s, the workers and their families had little recourse except to sue the employers who could afford more talented lawyers. The United States took tentative steps towards regulating industries like coal mining and manufacturing, as early as 1869, but not until the early 1900’s did the actions of states force industries to reduce the possibility of work-related accidents or illnesses. Workplace safety and health slowly became issues as the USA rapidly industrialised. Unions and reformers first promoted the need for safer working conditions. The workers had few options if they became injured or ill on the job, until state Governments created regulations for industries like coal mining and manufacturing. Many viewed the system of state laws that protected workers as imperfect, and the Congress stepped in to regulate workplace safety at the beginning of the 1970’s. The Occupational Safety and

Health Act of 1970 ushered in a new era in terms of public efforts towards the protection of workers from being harmed whilst on the job (Alton, 2010).

In South Africa, the discovery of gold on the Witwatersrand in 1886 saw the growth of the gold mining industry, which also resulted in the proliferation of related manufacturing and service industries. The need to maximise gold production exposed the gold mining workers to dangerous situations, with many workers and medical specialists becoming concerned about the increasing cases of tuberculosis and silicosis, which led to the death of many people. The highly skilled miners from the UK were not spared in this trap and this led to many of them (mostly whites) dying of these diseases. Due to this, their unions complained about the situation, staging demonstrations and strikes in order to force the Government to solve their grievances. The African workers also died in their numbers, which forced the Government to improve the living conditions in the mining compounds. This led to the launch of the Factories Act introduced in 1918, which regulated and controlled the workers' working hours and working conditions in the factories. It also emphasised the strong supervision of machinery in order to prevent accidents. However, the Act was not so effective in terms of making organisations comply with the legislation as those who trespassed or contravened the Act paid very low penalties (Zwi*, et al.*, 1988).

The expansion of the mines in South Africa put the issue OH&S on the agenda and thus, it become the focus of attention by the employers, the workers and the state (Zwi*, et al.,* 1988; Hermanus, 1999). Zwi*, et al.* (1988) argue that these three interest groups, namely the state, the capital and the unions, had and still have different and conflicting perspectives. The role of the state in this regard includes ensuring that conflict is minimised, while productivity is not disrupted, as well as ensuring that working conditions are of an accepted standard. The main focus of the capital profit maximisation, as well as improving OH&S for the sake of good industrial relations. The union movement is the only interest group that is committed to the improvement of OH&S. However, in its efforts to achieve this objective, the union is faced with several challenges which include limited numbers of workers subscribed to the union, the nature of the employment which is often temporary and relies on the current projects being undertaken. The next section discusses H&S performance and intervention in developed countries which were randomly selected, namely United Kingdom, Australia and Singapore. Also, international bodies concerned with health and safety, namely the World Health Organization and International Labour Organization are presented.

2.4 Health and Safety Performance and Intervention in Developed Countries

The health and safety performance and intervention efforts employed in developed countries are presented hereunder.

2.4.1 Health and Safety Legislation

The primary drive to reduce poor health and safety performance on construction sites is largely achieved through legislation, which plays a pivotal role in motivating contractors and other industry stakeholders to implement practical measures to comply with H&S requirements. In this section, the researcher presents the occupational health and safety legislation, regulations, as well as conventions by the WHO and ILO, that have been ratified by various countries, South Africa included, in an effort to enhance health and safety conditions at the workplace. For the purposes of comparison, three international countries were randomly selected from different continents namely Europe, Asia and Oceania, these being the United Kingdom, Singapore and Australia respectively. The health and safety Acts and associated regulations enacted by the three countries mentioned above and those of South Africa, are discussed below.

2.4.2 World Health Organization

The main function of the World Health Organization (WHO) is to promote the improvement of working conditions and other aspects of environmental hygiene (WHO, 2007). WHO is mandated to achieve these functions as set out in article 2 of its Constitution. In 2007, the World Health Assembly endorsed the global plan of action on employees' health and this is implemented by WHO. The following objectives form part of the global plan of action to be achieved:

- *To devise and implement policy mechanisms on employees' health* – this objective [1] calls for, *inter alia*, the development of national approaches to mitigate occupational diseases and injuries, based on the different countries' priorities, and in line with WHO's global campaigns.
- *Protecting and promoting health at workplace* - this objective [2] advocates for, *inter alia*, the implementation of regulation, as well as the adoption of the basic standards to ensure that all organisations comply with the stipulated minimum requirements for health and safety at the workplace.

- *Improving access to occupational health services, as well as their performance* - this objective [3] is meant to ensure that human resources are developed to improve their health, for instance, through training and development in their relevant disciplines.
- *Providing and communicating evidence for action and practice* - this objective [4] supports the designing of surveillance systems to monitor employees' health, with the aim to identify and control occupational hazards.
- *Incorporating workers' health into other policies* - this objective [5] emphasises the need to consider workers' health in terms of trade policies, when taking precautions as indicated in resolution taken at the World Health Assembly (WHA59.26)[1] on the international trade and health. This also entails addressing the workers' health in the sectoral policies for different economic activities, especially those at high risk.

It has however been noted that, despite efforts towards the prevention of occupational hazards and the promotion of health in the workplace there still exists some irregularities, with regards to the health of the workers in some countries. In this view, the plan of action is grounded by certain principles advocating for better working conditions, mental and physical health of the workers (WHO, 2007). Thus, the mitigation of occupational health hazards should take centre stage.

2.4.3 International Labour Organization

Since its inception in 1919, the main objective of the International Labour Organization (ILO) has been to encourage a healthy and safe working environment. In order to achieve this, ILO developed some guiding documents to help organisations strengthen their capacities in preventing and managing workplace risks and hazards. The ILO has worked diligently in numerous countries to carry out its programme of promoting the implementation of ILO standards in health and safety in the construction industry (ILO, 1991).

The Constitution of ILO highlights the need to protect workers from diseases, injury and sickness which might result from the employment. Unfortunately, this is not the case with many employees around the world, as the majority of them continue to die from work related diseases and accidents. It has been estimated that about 160 million people have suffered

[1] At WHO's 59th World Health Assembly (WHA), member states urged their Governments to ensure that trade and health interests are appropriately balanced and coordinated, and that their relevant ministries work constructively to address aspects of international trade related to international health.

from work-related diseases, while around 270 million cases of work-related accidents are recorded per year as a result, about 4% of the world's gross domestic product (GDP) is lost. Again, employers have to deal with the loss of skilled employees, costly early retirements, as well as high insurance premiums caused by work-related diseases and accidents. These can however be prevented, if sound intervention strategies are put in place. In view of this, ILO adopted a global strategy in 2003, aimed at improving occupational health and safety, for instance, introducing a culture of health and safety, promoting and developing relevant mechanisms and technical assistance (ILO, 1999). In 1988, ILO adopted the Safety and Health in Construction Convention (No.167)[2] and Recommendation (No.175)[3], as measure to reduce the injuries, diseases and accidents in the construction industry. The organization also devised some codes of practice comprising practical guidelines for employers, employees, public authorities and specialised occupational health and safety protection entities. Nonetheless, the codes of practice are not legally binding and do not replace national laws but are simply guiding principles for health and safety in various economic sectors (ILO, 2003a).

2.4.4 United Kingdom – Health and Safety at Work Act (1974)

The UK's Health and Safety at Work etc. Act (1974) provides for the health, welfare and safety of people at work. The Act highlights the essence of protecting each other against health and safety risks, thus, it emphasises the need to control the acquisition and use of hazardous substances. It also emphasises the need to control some emissions into the air. Essentially, the Act further provides for the need to engage medical advisory services. The Act highlights the roles and responsibilities of employers and employees, as well as the purpose of the Health and Safety Commission (HSC) and the Health and Safety Executive (HSE) in monitoring compliance. In this view, the HSC was set up to promote health and safety laws, as it is mandated to propose safety regulations and the approval of codes of practice. The Act also focuses more on the premises, and not on individuals (HSE, 2009).

[2] The General Conference of the International Labour Organization, having been convened at Geneva by the Governing Body of the International Labour Office, and having met in its seventy-fifth session on 1 June 1988.

[3] Recommendation concerning Safety and Health in Construction, Adoption: Geneva, 75th International Labour Office, Session (20 June 1988) - status: up-to-date instrument (Technical Convention).

2.4.4.1 United Kingdom - Construction Regulations 2007 (CDM)

The Construction (Design and Management) Regulations (2007) (CDM) was launched in 2007, at the same time with the Approved Code of Practice (ACOP), whose main agenda is to provide guidance on compliance with the duties as indicated in the Regulations. The main purpose of the CDM2007 entails incorporating health and safety into project management, while at the same time encouraging all stakeholders to do the following:

- Improving the planning and project management from the very beginning;
- Early identification of risks;
- Targeting efforts where it can improve health and safety; and
- Discouraging unnecessary bureaucracy.

The (CDM)'s main focus entails planning and management of construction projects, from the designing stage up to the end. The intention is to ensure that health and safety are considered as important elements of project development. This implies that health and safety should be mandatory during the construction process, from planning to designing. In this view, health and safety is not just the responsibility of the contractor, but the entire participants who include the designers, the coordinators, principal and sub-contractors and all other relevant stakeholders.

2.4.5 Australia – Building and Construction Industry Improvement Act (2005)

The main objective of this Act entails the provision of enhanced work relations framework to ensure a fair, efficient and productive building work, for the benefit of everyone and the economy at large (Australia, 2005). In this view, the objectives would be achieved by the following:

- When the bargaining framework is improved at the workplace;
- Encouraging stakeholders to respect the rule of law;
- The rights of all stakeholders in the construction industry should be respected;
- Stakeholders in the construction industry should account for their illicit conduct;
- Relevant laws should be effectively investigated and enforced;
- Occupational health and safety in construction work should be improved;

- Employment levels in the construction industry should be encouraged; and
- Helping and advising stakeholders in the construction industry with regards to their rights and obligations, under the correct laws.

2.4.5.1 Australia - National Code of Practice (2009)

The National Code of Practice for the Construction Industry in Australia was instituted by the Commonwealth, State and Territory Governments. Written by the Australian Procurement and Construction Council Inc, the code highlights the principles which should inform the future development of the industry. The code also reinforces that highest ethical standards should be maintained in all the construction-related activities. On that note, the code highlights the standards and principles of behaviour which are anticipated to apply when dealing with partners in the construction industry, for instance, the clients and their representatives. The core principles of the code highlight that the industry should:

- Focus on the client and respect their rights;
- Build relationships founded on trust;
- Observe the ethical standards of tendering;
- Commit to best practices and on-going improvement;
- Support broadly-based workplace restructuring;
- Maintain occupational health and safety standards, as well as rehabilitation and environmental management; and
- Promote positive work relations, which would result in sustainable economic arrangements.

The principles highlighted above are a representation of the Government's position in terms of issues in the construction industry, thus, various government departments should strive to maintain the codes or develop some codes which would suit their situations and priorities.

2.4.6 Singapore - Workplace Safety and Health Act (2006)

Since Singapore embarked on her industrialisation programme in the early 1960s, the construction industry is a fast-growing sector of the economy. It is, therefore, not surprising that safety and health issues became serious concerns in the early 1970s. The safety

situation deteriorated so drastically that the Government had to bring in legislation with severe penalties, to deal with errant and recalcitrant contractors and employers (Ling, *et al.,* 2009). The Workplace Safety and Health Act (2006) replaced the Factories Act. The main tenet of the Workplace Safety and Health Act (2006) is that workplace safety is the responsibility of everyone. This means that the issue of safety should be a result of combined efforts by all the stakeholders in the industry (Singapore, 2012). The Act is therefore an important element of the new framework aimed at cultivating responsible safety practices and habits in everyone, from the management to the general workers. This means that every individual should ensure health and safety of the workplace and other individuals. The Act is founded on three principles which include:

- The need for all stakeholders to reduce the risk created at the workplace.
- The industry should own the OH&S standards. This entails shifting focus from simply complying with the requirements to ensuring that employers take responsibility in developing safe work practices which suit their particular conditions, so as to be able to achieve the required safety results.
- The prevention of accidents by highly penalising for poor health and safety management.

According to Ling, *et al.* (2009), the accident situation has improved significantly over the years in Singapore, as a result of all these measures which have been put in place.

2.4.6.1 Singapore - Workplace Safety and Health Regulations (2007)

The Workplace Safety and Health (WSH) Regulations (2007) was a replacement of the three Factories subsidiary legislations governing the WSH Officers in Singapore. Following the Workplace Safety and Health Act, these new Regulations adopted a performance-based kind of legislation, which was a move away from the traditional prescriptive approach. The reason was to grant the industry a sense of ownership in terms of health and safety at the workplace (Singapore, 2012). On that note, the Workplace Safety and Health Act introduced the following changes:

- It clearly states the liabilities for the different stakeholders, not just the occupier.
- Highlights the essence of effective management of health and safety in the workplace, to yield safe results and not just prescribing rules.
- Those who compromise health and safety receive harsh penalties.

The focus of the regulations is to ensure that there are qualified health and safety personnel in the workplace. These officers are important as they help to lift the general WSH standards and the industry performance in general. With the previous Factories (Qualifications and Training of Safety Officers) Notification, the law prescribed the qualifications for the WSH officers, while the new regulations adopted a more general approach whereby the candidate ought to demonstrate that "sufficiently competent and is, in all other respects, a fit and proper person, to be entrusted to carry out the work of a workplace safety and health officer" prior to being approved by the Commissioner.

The new framework highlights that organisations should assess the health and safety risks in their workplace and find the necessary mechanisms to deal with the risks. This, therefore, entails going further than appointing one officer for risk management, especially for large organisations. In addition, the review of the legislation was to keep pace with the developing industry hence, safety awareness amongst the different stakeholders was enhanced. The regulations particularly encourage the employers to self-regulate by implementing safety mechanisms to enhance the working environment. Safety management systems could also be set up, while safety audits can also be done on the other hand. The top management is also encouraged to register for safety courses at the Occupational Safety and Health (Training and Promotion) Centre, in order to enhance their knowledge of OH&S.

2.5 Health and Safety in the Construction Industry

The construction industry is one of the world's most performing industries. Among other things, the industry is responsible for rebuilding areas that have been damaged by disasters, both natural and man-made. It is also responsible for the provision of service and communication infrastructure, as well as power, thereby meeting the people's expectations of having access to housing, working buildings and transport infrastructure. It can therefore be argued that the industry plays a role in improving the quality of life of people. Besides that, the industry employs a greater percentage of people in a country, between 9 and 20 percent. However, the growth in this industry has got its own repercussions, mainly accidents which occur in the workplace (ILO, 1999). The deaths and injuries that result from the construction activities have left many families suffering and in pain. It is noted that the industry records the most deaths, as compared to other industries (ILO, 2003b; Lingard and Rowlinson, 2005; Smallwood, 2007).

Below is an example of what happens in the construction industry:

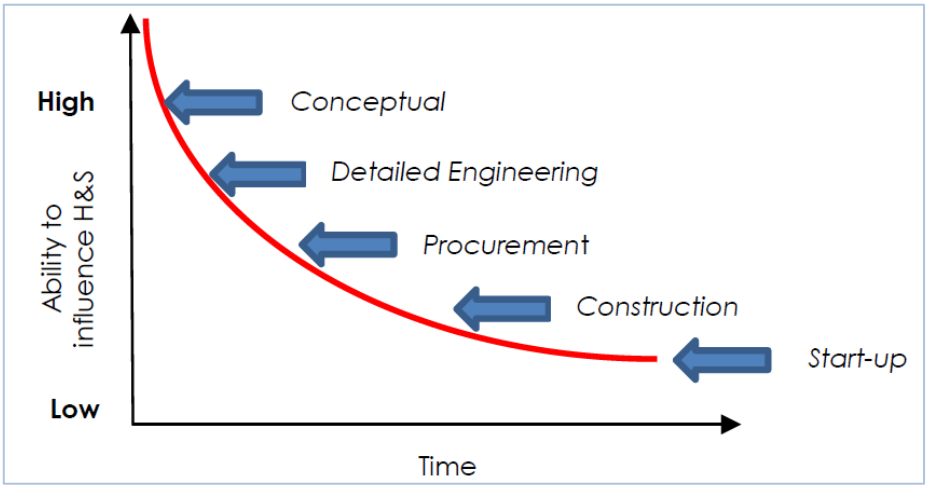
> *"A construction company based in South East London, United Kingdom, has been prosecuted for a serious safety breach after a roofing worker plunged four metres through a badly-protected skylight. The 45-year-old worker suffered multiple fracture injuries, including a broken right arm, when he fell through the roof opening which had been covered only with a thick plastic. The incident, on 29 February 2012, took place at a property in Tonbridge, Kent, where the building firm were the lead contractor overseeing the construction of an extension and swimming pool."*[4]

Hinze (2006) asserts that among industries, construction is unique in that it affords great opportunities for workers to be involved in many projects of interest. These various projects require diverse skills. Additionally, construction work must often take place outdoors, in conditions that may not be completely favourable for H&S. In addition to the changes in the nature of the work and in the mix of workers on construction projects, the location of the work frequently changes for the workers. Even though the special attributes of construction may be attractive to some workers, the safety record amassed in the industry is not to be envied. Hinze (2006) argues that these attributes need not result in injuries and fatalities.

Ajayi and Smallwood (2008) state that in view of the wide range of activities involved in the construction industry, which expose workers to hostile ergonomic challenges, there occurs many work-related musculoskeletal disorders (WMDs), especially in the shoulder, neck, wrist and hand, which often suffer when they bend or twist their bodies, working below the knee level or above the shoulder height, manually lifting heavy objects and materials, as well as taking risky postures. As a result, the industry records the highest numbers of injuries and fatalities (Ajayi and Smallwood, 2008). Hinze and Wiegand (1992); Mroszczyk (2006); Ajayi and Smallwood (2008) contend that designers strongly influence the health and safety of construction workers. Hence, there is a direct link between the decisions made by the designers and H&S construction. The designers influence projects at the designing phase. Figure 2.1 is a depiction of the ability to influence construction health and safety versus time. The curve indicates that the best time to influence H&S is at the concept and design phase, of which the ability to influence H&S fades as the schedule moves from concept towards the beginning of the project.

[4] http://www.hse.gov.uk/press/2013/rnn-se-10813.htm?eban=govdel-press-release&cr=23-May-2013

Figure 2.1: Time / Health and Safety Influence Curve



(Adapted: Ajayi and Smallwood, 2008)

Hinze (2006) suggests that safety should not be viewed in a fatalistic manner, but rather in a positive manner. The objective of every employer should be to have no worker injuries. In an effort to reduce worker injuries, some construction companies have introduced safety incentives. However, Hinze (2005b) criticises safety incentives, stating that they seem to encourage workers not to report injuries in order to benefit the rewards that come with the safety incentives. Thus, coupled with the objective of no injuries must be a deep-seated conviction that the goal is attainable. Firms must be prepared for the occurrence of injuries, but they should, at the same time plan to have none. Hinze (2006) affirms that the construction industry has not had a favourable safety record over the years, despite having achieved some improvements in this regard. The next section outlines the definition of an accident.

2.5.1 Definition of an Accident

An accident, according to the *Oxford Advanced Learner's Dictionary*, is defined as an unpleasant event that is not planned in advance, which happens unexpectedly and causes injury or damage to persons or property (Hornby, 2010).

Hinze (2006) defines an accident as an unintended, unwanted, unforeseen and uncontrolled occurrence. It does not always cause injuries, but might damage property, materials and equipment. Nonetheless, despite the kind of damages done, all accidents are a cause for concern.

Heinrich (1959 cited in Abdelhamid and Everett, 2000) defines an accident as an unintentional and uncontrolled occurrence which often cause injuries to people involved. Furthermore, Hughes and Ferrett (2008 cited in Manu, *et al.*, 2010) note that accidents often result in ill-health, injuries, loss or damage to property and the environment. In view of the above, the researcher adopted Hinze's (2006) definition of an accident, as it comprises the core elements of an accident. Causes of accidents are outlined in the following section.

2.5.2 Causes of Accidents

It is observed that health and safety in small and medium construction enterprises (SME's) has received minimal attention in South Africa, in terms of research or support for preventive initiatives (Agumba and Haupt, 2008). In the SMEs, the rates of occupational injuries are higher than in the larger corporations (Harper, 1998). Accidents during construction result in many tragedies, demotivates the workers, disturbs the construction processes and adversely influence productivity, costs, as well as the industry's reputation. Medical costs expenses and high employees' compensation insurance, as well as the damage to property, are often incurred. This shows the essence of safety in this industry (Kartam, 1997).

Ngamthampunpol (2008) notes that the main causes of accidents derived from the nature of the industry, the procedures, the difficult work-site conditions and the behaviours of the people involved. Thus, occupational injuries and illnesses should be prevented as far as possible. Research has indicated that the dangers associated with the construction industry are controllable, while the accidents are also preventable through using construction-safety programs. Thus, comprehensive safety programs should be a priority on the construction sites, in order to minimise accident rates.

In South Africa, the rate of construction has been increasing alarmingly, with many projects being implemented most of the times. This means that the number of construction-related accidents are also skyrocketing, thereby also increasing losses due to injuries and death. The effects of such need not be emphasised. The imperfect nature of the world in general and of the construction industry in particular, may lead to the acceptance of a limited number of accidents as inevitable. The hazardous nature of the industry results in fatal and non-fatal injuries (Davies and Tomasin, 1996). The International Labour Organization (2003b) reveals that one in six fatal accidents at work take place on construction sites. It has also been recorded that every year, around 60,000 fatal accidents take place on construction sites

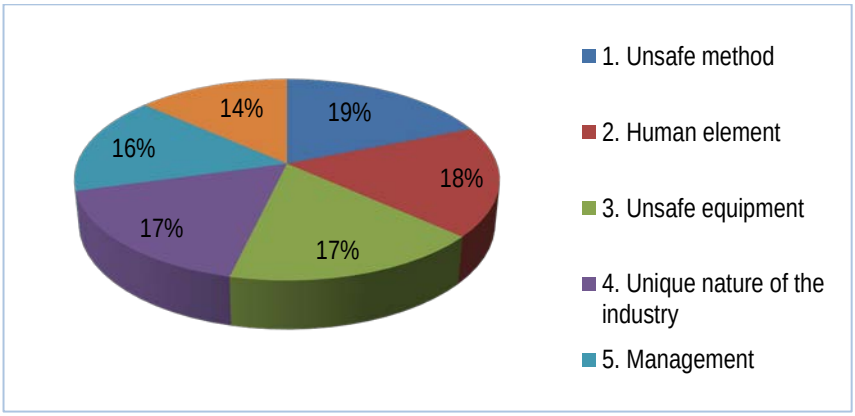
throughout the world. The reasons for the high rates of accidents in this industry include personnel factors, the hazardous nature of the projects, equipment factors, environmental, management, as well as project factors (Cheng, *et al*., 2010).

Ridley (1986, cited in Hamid, *et al.*, 2008) notes that accidents do not just happen, but something triggers them, arguing that ninety-nine (99%) percent of the accidents are a result of either unsafe conditions or act, or both. Unsafe condition refers to the hazardous physical appearance or situations which could directly cause accidents. However, many accidents are a result of both unsafe conditions or unsafe acts.

What causes accidents tend to differ, based on the type of the accident. This means that injuries from manual handling differ from those caused by being struck by a moving vehicle (Haslam, *et al.,* 2005). Haslam, *et al.* (2005) highlight the different accident types and these include those resulting from falling from height, slipping and falling on the same level, being injured while lifting, handling or carrying, being struct by moving objects or vehicles, getting in contact with electrical discharge or electricity, being trapped by a collapsing or overturning object, as well as striking oneself against something that is stationery. The fact that accidents are caused and are preventable makes it feasible to identify the factors contributing to accidents. Knowing the root causes of accidents would help to isolate the causes and it would be easier to identify the necessary steps to be taken in order to prevent the accidents. The causes of accidents have been identified as being management-related, the mental and physical condition of the workers or the environment (Cheng, 2012). Nonetheless, many accidents are a result of multiple factors, hence, no single factor could explain the occurrence of accidents.

Haslam, *et al.* (2005) identify five key factors which contribute to construction accidents and these include shortcomings in equipment, deficiencies in risk management, workplace issues, problems arising from workers, as well as those related to the condition and suitability of materials. Hamid, *et al.* (2008) reveal that in Malaysia, the common causes of construction accidents include unsafe equipment, human element, management and job site conditions, as well as the unique nature of the industry, as illustrated in Figure 2.2:

Figure 2.2: Causes of Construction Accidents



(Adapted: Hamid, *et al*., 2008)

Manu, *et al*. (2010) identify construction project features (CPF's) as the leading factors of accidents. These CPF's include site restriction, method of construction, project duration, design complexity, the nature of the project, procurement system, as well as the level of construction and sub-contracting. The CPF's could also be organisational, operational and the physical conditions surrounding the construction projects, which might result from the clients' brief project management and design decisions.

Pipitsupaphol and Watanabe (2000) present a statistical distribution of accident factors. They found that on average, accidents are mainly related to management (29.2%), for instance, poor inspection programs, the lack of safety education programs and the poor safety policies. The second major cause of accidents included unsafe method (26.4%), which is mainly related to poor work procedure. Human element was on the third position (12.5%), arguing that the lack of personal protective equipment usage (PPE) and workers' negligence highly contribute to accidents. Working in hazardous conditions and those that are highly elevated is part of the nature of the construction industry (11.1%), which makes the industry riskier than others. Finally, unsafe equipment (9.7%), job site conditions (11.1%) like the poor site management, also contribute to accidents on construction sites.

Lubega, *et al*. (2000 cited in Hamid, *et al.*, 2008) disclose that in Uganda, the main causes of accidents included the lack of awareness of safety regulations, incompetent personnel, poor regard for safety by the people involved, lack of enforcement of safety regulations, non-vibrant professionalism, physical and emotional stress, chemical impairment, as well as the mechanical failure of the machinery or equipment. Abdelhamid and Everett (2000) also classify the causes of accidents into human and physical factors, arguing that human factors

often result from the failure to secure and warn, horseplay, operating at unsafe speed, operating equipment without being authorised, personal factors, unsafe position and the use of defective tools, to mention a few. On the other hand, physical factors include unsafe acts of other persons, defects of accident source, environmental hazards, fire, improper assignment of personnel and the disregard of known prescribed procedures.

Pinto, *et al*. (2011) reveal several root causes of accidents, which include poor work and safety organisation, poor communication, lack of coordination, poor involvement of workers in safety issues, economic and time pressures, inadequate training and fatigue, poor safety awareness of top management, workers' specialisation, bad equipment selection, as well as company size, to mention a few. In the same way, Pipitsupaphol and Watanabe (2000) divulge that in Thailand, the most common causes of accidents include the unsafe equipment, the unique nature of the industry, human elements, unsafe methods, management factors and job site conditions. They also note that major causes of accidents were a result of failure to use personal protective equipment, failure to warn co-workers, improper use of equipment, as well as improper placement of equipment or supplies.

In the UK, the underlying causes of accidents in the construction industry were categorised as societal and industry-wide influences (macro); project and process factors (mezzo) and worker/supervisor/workplace causes (micro). At the macro level, the causes include immature corporate systems, lack of Government leadership, lack of influence from trade unions, inappropriate enforcement and the lack of proper accident data (Brace, *et al.*, 2009; Laryea and Mensah, 2010). Brace, *et al.* (2009) identify the mezzo factors as immature project systems and processes, lack of understanding and involvement by some of the design community, inappropriate procurement and supply chain arrangements, lack of proper accident investigation/data and subsequently, poor organisational learning. At the micro level, the causes of accidents include incompetent supervisors, lack of ownership, involvement, empowerment of the relevant people, as well as ineffective training. These factors are aggravated by poor behaviour, poor equipment or lack of it, poor employment practices, inadequate workforce management and cost pressures.

Toole (2002) notes some root causes of accidents: the lack of proper training, unsafe site conditions, deficient enforcement of safety, not using the provided safety equipment, as well as poor attitude towards safety. These causes are the same as those suggested by Abdelhamid and Everett (2000). Therefore, the underlying assumption is that the main cause of accidents is the behaviour of the workers. This however contrasts the assumption that

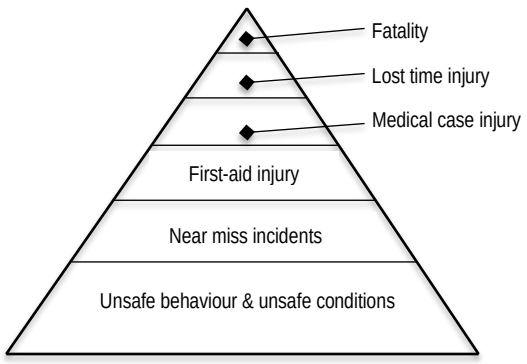
many accidents are a result of management failure and are preventable. Tam, *et al.* (2004) disclose that in China, the main causes of accidents ranged from poor safety awareness from top management, lack of training, reckless operations, lack of rigorous enforcement of safety regulations, as well as the reluctance to input resources for safety, among other things. According to Tam, *et al*. (2004) management is thus responsible for the main causes of accidents.

The literature indicated above highlights that accidents are caused by multiple factors. This, therefore, testifies the claim of multiple causation model, which indicates that accidents are caused by multiple factors. Thus, all the stakeholders ought to come together, combine efforts and resources to mitigate accidents in the construction industry. The important issue is to identify the root causes. The next section discusses the performance of the construction industry on health and safety.

2.6 Construction Health and Safety Performance

The emphasis on health and safety in the construction industry has been on the increase (Hinze, 2005a). Some sectors of the industry have even moved from simply monitoring health and safety performance to being proactively seeking to improve the performance. Dedicating themselves to continuous improvement implies that they are also improving on their performance. In this regard, an effective approach has to be adopted, one that does not necessarily monitor injuries after they have occurred, but one that is action-based and results in effective health and safety performance.

Figure 2.3: Incident Pyramid



(Adapted: Hinze, 2005a)

Figure 2.3 illustrates the incident pyramid which highlights the different types of accidents that are likely to occur during construction. The different types are regarded as lagging indicators

since their occurrence is supervised to highlight the level of safety performance, based on history. A more proactive focus is one that concentrates on first-aid injuries, unsafe conditions or behaviours, as well as near misses (Hinze, 2005b). Globally, the construction industry is relatively poor in terms of its health and safety record and South Africa is not spared. The South African construction industry enormously contributes a disproportionate number of deaths and injuries, as compared to other industrial sectors (CIDB, 2009a). Some construction health and safety performance comparisons with other industries locally, as well as internationally, are discussed below.

2.6.1 Comparison with other Industries

According to statistics and historical perspectives, Occupational Health and Safety (OH&S) has always been a challenging phenomenon. This is probably because of the nature of the conditions in which the construction work is done (Geminiani, *et al.*, 2005). The industry should therefore enhance its safety practices to be at par with other industries. The Compensation Commissioner indicates that it covers only a few categories of injuries which include temporary and permanent disablement, medical aid and fatalities, which are linked to the many agencies including transport, mining, construction, fishing, chemicals, agriculture and forestry, to mention a few. The statistics also highlight the disabling injury incidence rate (DIIR), together with the severity rate (SR). Accident frequency and severity rates are very important standards that are used in reviewing accident statistics. The rates indicate to what extent disabling injuries take place in different industries. They also indicate the gravity of the time that has been lost during an accident. It has been noted that the construction industry is the third highest in terms of fatalities, with the first being fishing, followed by transport (CIDB, 2009a).

2.6.2 International Comparison

Hamalainen, *et al.* (2006) argue that information on occupational accidents is however not standardised worldwide. The fact is that developing countries do not have up to date, or reliable information regarding occupational accidents, mainly due to improper notification and recording systems. Hence, many accidents go unreported, yet the available statistics still remain the point of departure for occupational safety work. Generally, the construction industry continues to poorly perform in this regard. The UK records indicate that the industry contributes a third of all work-related deaths, with the same performance in ill-health and injuries (Haslam, *et al.,* 2005).

A comparison between South Africa (developing country) and Singapore (developed country) highlights that South Africa lagged behind its Singaporean counterpart, in terms of how the management in these two different countries commit themselves to health and safety, the supervisory environment, employees' involvement, training and competence, personal risk assessment, as well as work pressures (CIDB, 2009a). With reference to the occurrence of construction accidents on sites, Smallwood (2004) contends that construction occupational fatalities, injuries and diseases result in human suffering and affect not only the workers directly involved, but also their families and communities at large. Smallwood and Haupt (2005); Smallwood (2007); Seevaparsaid-Mansingh and Haupt (2008) argue that despite the availability of accident causation models and theories as discussed above, accidents have continued unabated. The emphasis is that the root causes of accidents must be identified in order to have sustainable improvement in the construction industry (Abdelhamid and Everett, 2000). Typically, these theories focused on the construction worker as the major cause of accidents. Indeed, many occupational accident prevention programs still focus on attempts to modify the workers' behaviour to eliminate the immediate behavioural causes of accidents as confirmed by Abdelhamid and Everett (2000); Suraji*, et al.* (2001); Cheng*, et al.* (2004); Lingard and Rowlinson (2005); Hinze (2006). However, accidents can be prevented and are attributed to management failure. Smallwood (2002) argues that in essence, workers execute their duties in an environment created by management and thus, no worker wants to be injured, whilst Hinze (2006) contends that construction workers, like all workers, do not want to be injured as a consequence of their employment. In general, accident prevention is accepted as the responsibility of the management. It, therefore, appears that none of the accident causation theories comprehensively address these issues. In that view, organisations should therefore desist from blaming the workers and focus on the management, as well as the organisational errors that cause poor health and safety performance.

According to Hambleton (2005), it is apparent that people are prone to mistakes and systems fail, despite regular maintenance. Thus, risk management and patient safety professionals have made efforts in appreciating the system and human factors causing mistakes and failures, thereby affecting performance. Their understanding has made them shift from wanting to find out what happened and who caused it, but instead, understanding why it happened. It is thus only through this way that re-occurrences can be prevented (Hambleton, 2005). Having an understanding of why certain things happen is the basis to devising effective measures and recommendations.

According to Mroszczyk (2006), the practice has been to leave H&S of construction workers to contractors on site, which gave the contractors the liberty to make their own decisions that have unfortunately culminated in accidents. The design professionals can positively influence construction H&S by proposing better options during the designing and planning stages of projects. They can also improve H&S performance by analysing method statements submitted by contractors to establish if they address issues of H&S. As the bottom-level entity of construction supply chains, sub-contractors seem to be passive in construction management, the reason being that they tend to be poor in safety management. They also tend to overlook the whole essence of health and safety and in some instances, violate safety practices in the name of maintaining project schedules (Cheng*, et al.*, 2004). Instead, sub-contractors should be the ones responsible for health and safety on sites, followed by the main contractors, designers, as well as clients (Cheng*, et al.*, 2004). The closer these stakeholders are to the sites, the higher the chances of preventing unsafe operations. Cheng*, et al.* (2004), contend that workers are not the major causes of accidents, but rather those who are supposed to be properly managing the sites. In this view, there are five main factors influencing the workers' attitudes to safety management: organisational policy, industry norms, management behaviour, supervision and equipment management, as well as risk taking. Thus, those who ought to be closely working with the workers are liable for safety on construction sites (Cheng, *et al.*, 2004).

Duff*, et al.* (2001) point to the insufficient management control and poor management decisions as the main contributory factors to accidents on site, arguing that the accident causation model described earlier in this chapter often refer to the theoretical aspects rather than the practical investigation. The argument is that the models fail to identify the extent to which the causal elements or factors may be avoided, eradicated or minimised. Again, it seems attempts have not been made to position the operational and organisational factors which might increase accident risks. There are not yet detailed explanations by these models, as to which factors significantly contribute to construction accidents. This is essential because mitigating these factors calls for adequate understanding of the most influential factors, who are the best people to control those factors, as well as finding the most effective ways to control them. The section that follows briefly describes the health and safety status of developing countries in Africa randomly selected, namely Ghana, Namibia, Nigeria, Tanzania and the country being studied, South Africa.

2.7 Health and Safety Status in Developing Countries

An attempt has been made to focus on African countries whose construction industries are similar to South Africa. The rationale for adopting this approach arises from the fact that there is a general conclusion by various scholars that H&S in developing countries is not considered a priority (Mwanaumo, 2012).

The state of H&S in construction largely affects the workers in any given country. It has been noted that the construction industry is characterised by high rates of fatalities and work-related chronic ill-health. Thus, health and safety programs in this industry often focus on safety, i.e. how to prevent accidents. This is important because the effects of accidents are visible (Lopéz-Valcárzel, 2001, cited in Mwanaumo, 2012). Other problems associated with health and safety in developing countries include the poor reporting system, as well as the inadequate feedback. In this view, ILO promotes that statistics on occupational diseases and injuries should be compiled and updated regularly (Mwanaumo, 2012).

The general impression of those working throughout the developing world is that the level of legislations, regulations and enforcement is woefully inadequate, as compared to that of developed countries. Most of the H&S legislations and regulations in the African states draw from legislation from the industrialised countries of the late 19th and early 20th centuries (Mwanaumo, 2012). Despite many organisations assuming zero-accident policies as their goals, the infrastructure and the rate of industrialisation in developing countries are major hindrances. The fact is that it is difficult for organisations in developing countries to afford effective health and safety measures (Hamalainen, *et al.*, 2006).

The Ghanaian construction industry is characterised by poor coverage and reporting systems, as not all accidents occurring in the industry are being reported to the National Labour Department (Boakye, Akomah and Coles, 2010, cited in Mwanaumo, 2012). The available statistics for the country suggest that there is not any improvement that is recorded or observed in a six-year period. However, the trend indicates an increase in construction-related accidents, despite the existence of some health and safety laws and regulations (Mwanaumo, 2012).

The pieces of legislation surrounding occupational H&S in Namibia's construction industry include the Workmen's Compensation Act of 1941 (as amended); Factories, Machinery and Building Works (Ordinance, 1952); Regulations on the Health and Safety of Employees at Work of 1997 and the Labour Act of 1992 (Act 6 of 1992). According to Amweelo (2001, cited in

Mwanaumo, 2012), these H&S pieces of legislation are aimed at preventing accidents and diseases in the country's construction industry. Enforcement of their standards is usually carried out by factory inspectors who provide advice on compliance. Unfortunately, as is the case with most developing nations, Governments have very few inspectors to cope with the workload of providing day-to-day surveillance on construction sites (Mwanaumo, 2012).

The Nigerian construction industry lacks the statistical records on H&S performance (Idoro, 2011, cited in Mwanaumo, 2012). The absence of such reliable information on incidences of occupational accidents and diseases are a hindrance to reducing work related deaths and injuries (Okojie, 2010, cited in Mwanaumo, 2012). For any preventive measure at any level to be evidence-based and meaningful, the data required depends heavily on the reporting systems in place. The H&S regulations of Nigeria can be traced back to the UK and USA. Idoro (2011, cited in Mwanaumo, 2012) noted that the old Nigerian Factory Act of 1990 is a version of the UK Factory Act of 1961. The Act provides for the country to implement statutory practice and structures, in order to be able to inspect the H&S conditions and non-compliance of the construction industry (Mwanaumo, 2012).

Empirical findings emanating from Tanzania, suggest that H&S on construction sites is appalling and lacks the necessary commitment from key stakeholders (Mwombeki, 2006, cited in Mwanaumo, 2012). As with most developing nations, health and safety issues in the construction industry are not prioritised, while the implementation of health and safety measures on site are regarded as an unnecessary burden (Mbuya, 2002, cited in Mwanaumo, 2012). The legislation currently requiring reporting of injuries and diseases in Tanzania is the Workmen's Compensation Ordinance of 1949 and the Notification of Accidents and Occupational Diseases Ordinance of 1953 (Matiko, 2010, cited in Mwanaumo, 2012).

South Africa has also been focusing on health and safety in the construction industry. While efforts have been made by different role players in this industry to improve health and safety, there has not been any significant changes in terms of health and safety. Instead, the sector continuously records high numbers of fatalities and injuries, in as much as there continues to be high levels of non-compliance with the health and safety Construction Regulations in South Africa. Thus, H&S of the workforce is crucial to the success of the construction industry (Smallwood, 2007; CIDB, 2009a).

The importance and the role of the construction sector in the economy of any country has been confirmed in numerous studies (Cole and Haupt, 1999; Haupt and Smallwood, 2007; Agumba and Haupt, 2008; Thwala and Monese, 2008). These studies have confirmed that the industry reflected the country's level of economic development. Thwala and Monase (2008) argue that despite the fact that the construction industry's current contribution to South Africa's gross domestic product (GDP) has shrunk to approximately 3% compared to 7% recorded in the 1970's, it still remains, nonetheless, a vital economic sector.

Notwithstanding the industry's positive contribution to the economy of the country, South Africa continues to suffer from poor productivity and increasing construction costs (Thwala and Monese, 2008). Moreover, poor performance in respect of H&S in the industry significantly contributes to poor productivity, increased costs, unsatisfactory quality performance, time overruns and undesirable impact on the environment (Cole and Haupt, 1999; Agumba and Haupt, 2008; Ajayi and Smallwood, 2008; Pillay and Haupt, 2008). A pragmatic study undertaken by Pillay and Haupt (2008) to establish the cost of construction accidents revealed that construction accidents are liable for 4% of the global gross domestic product. This shows how accidents in construction affect the employers and the workers, both socially and economically (Mthalane, *et al.*, 2008).

The element of health and safety performance in the construction industry is a matter of concern. Eppenberger and Haupt (2008) indicate that the working conditions of this industry are not attractive when compared to other industries. Workers in construction are vulnerable to harsh weather conditions which are sometimes dusty, dirty, noisy, in addition to unhygienic work places. This is in addition to their inherently laborious, dangerous and physically demanding work activities. Despite the human cost of suffering accidents, the economic repercussions can also be devastating. Below is an instance of what can happen on a construction site in South Africa:

> *"A construction worker died after plunging from the ninth-floor level of a lift shaft whilst pouring concrete for the construction of a hotel and apartment block in East London, South Africa. The Department of Labour (DoL) inspectors immediately halted all construction work on site and ordered the contractor to erect barricades around open areas and later allowed works to proceed after being satisfied that the site as now safe. This illustrated a problem with either non- compliance with the Construction Regulations or adherence to general occupational health and safety procedures by the employer and/or the workers."*[5]

[5] https://www.labour.gov.za/media-desk/media-statements/2008/construction-worker-dies-after-9th-floor-plunge

The interaction of the three levels entailing the construction industry, construction firms and construction projects in addressing health and safety performance in South Africa shall be explored in the next section.

2.7.1 Construction Industry

The Government's role in the construction industry is to formulate the H&S legislation i.e. the Occupational Health and Safety Act No.85 of 1993 (OH&S Act) and the complementary Compensation for Occupational Injuries and Diseases Act No.130 of 1993 (COID Act). The Construction Regulations, which are critical to this study, were promulgated under the OH&S Act in July 2003. The primary objective of health and safety legislation is to minimise accidents occurrence, as well as their consequences which include fatality, disablement, injury and ill-health. This implies that effective legislations are required in order to achieve these objectives. In addition to the effective legislation, enforcement of the legislation is crucial. In South Africa, it is the responsibility of the Department of Labour Inspectorate to enforce health and safety legislation (Smallwood, 2007; CIDB, 2009a). It is also essential to note that many stakeholders in the construction fraternity have taken issues of health and safety seriously, for instance, employer associations like the Master Builders South Africa (MBSA), the Master Builders Association (MBA), the Construction Industry Development Board (CIDB), as well as the South African Federation of Civil Engineering Contractors (SAFSEC). The contributions towards promoting health and safety by these institutions have been remarkable, from raising awareness on health and safety, training and doing competitions. It is a fact that such professional and voluntary institutions play a critical role in promoting health and safety in construction (Smallwood, 2007; CIDB, 2009a).

The media have also been remarkable in this regard, evidenced by wide publications of health and safety in construction. The general public and the workers have become aware of the injuries and fatalities taking place in the construction industry, due to poor health and safety practices. In the same way, tertiary institutions could also contribute significantly to this cause, by providing courses in health and safety in the construction industry, either within the engineering and built environment courses, or as separate programmes. It is important to note that trade unions like the Building Construction and Allied Workers Union (BCAWU) have not done much in promoting health and safety in construction. This means that employee associations should play a role in empowering their members by raising awareness in terms of health and safety (CIDB, 2009a).

2.7.2 Construction Firms and Projects

Firms in the construction industry include consultants (designers, project managers, quantity surveyors, etc.), suppliers, contractors and manufacturers. Consultants are the ones who manage projects on their client's behalf, thus, they should actively contribute to health and safety in construction, especially at the designing and procurement phases. Contractors are able to influence health and safety in various ways which include when assessing tenders, pre-qualifying contractors on health and safety, as well as during deliberations on project duration. In the same way, the materials product manufacturers and the suppliers could for example also contribute to improving health and safety by using pallets, precast concrete panels and pre-fabricated timber roof trusses, etc. (CIDB, 2009a).

For the procurement of construction projects, the following standard forms (conditions) of contract are widely utilised in the construction industry in South Africa:

- Principal Building Agreement or Minor Works (published by the Joint Building Contracts Committee (JBCC)).
- General Conditions of Contract (GCC) for Construction Works (the South African Institution of Civil Engineering).
- NEC3 Engineering and Construction Contract (ECC) (the Institution of Civil Engineers).
- Conditions of Contract for Construction for Building and Engineering Works (the International Federation of Consulting Engineers, FIDIC).

The standard forms of contract highlighted above indicate that different forms of contract subject to the laws of their respective countries. The JBCC does not make clear reference to health and safety, but it indicates that the parties associated with the contract need to comply with the regulations, laws and by-laws that have to do with the implementation of the works. The JBCC however makes reference to the appointment of principal agent whose duties include ensuring a site that complies with H&S requirements. Similarly, the GCC also does not make special reference to health and safety, but it only mentions the requirements for reporting accidents. The ECC and FIDIC originate from overseas and to some extent, they make special reference to health and safety, despite that the terminology and referencing are not aligned with the South African requirements for health and safety legislative framework (CIDB, 2009a). In the context of the above, it is possible to revise the standard forms of contract, so as to more directly integrate reference to health and safety in construction, the Construction Regulations, the contractors' obligations and also make provisions for additional health and safety requirements that are client driven.

2.7.3 Construction Health and Safety Responsibilities

For improved performance in health and safety, it is important that all the parties involved put a concerted effort in the project. As a measure to prevent the occurrence of construction accidents, the International Labour Organization (2002) contends that it is vital to develop a single authority with the ultimate responsibility of determining the overall health and safety policy and harmonising standards. According to ILO (2002), a safety policy should incorporate the following aspects:

- Developing awareness of, and promoting OH&S as a positive factor for enhanced productivity so as to show that “safety pays”.
- Undertaking measures to incorporate OH&S in all organisations’ business plans, thereby encouraging the organisations to become health and safe.
- Communicating information regarding safety norms, as well as dangerous substances, products and mechanisms to workplace groups.
- Undertaking special reviews of environmental risks to health and safety in the informally operated sectors.

Laryea and Mensah (2010) point that the regulatory agencies, clients, contractors and employees are the main stakeholders responsible for health and safety in construction. Although their responsibilities may differ in this regard, their different inputs help create a safety environment that is free from accidents. Outlined below is a descriptive summary of their responsibilities:

- ***Clients*** - Smallwood (2002) observes that clients can successfully influence health and safety in construction, as their positive role includes influencing contracts and lowering injury rates. This is because clients influence how work is implemented. Laryea and Mensah (2010) concur with Smallwood (2002) and further state that clients are responsible for assessing the project undertaken and also the work environment, to be able to determine the appropriate personal protective equipment (PPE) to be used by the employees. The Business Roundtable (1991, cited in Smallwood, 2002) recommends the following actions for the clients:
    - Becoming committed to construction health and safety;
    - Financially supporting contractors’ efforts towards health and safety;
    - Making health and safety part of the criteria for pre-qualification;
    - Scheduling health and safety requirements before the bidding process;

- Structuring documentation for the equal provision for health and safety by contractors;
- Having formal health and safety programs, using permit systems for potentially hazardous activities, designing contractor health and safety coordinator, as well as recording, reporting and investigating accidents; and
- Conducting regular health and safety audits during the construction process and adopting a partnering approach.

- ***Main contractor*** - the contractor should demonstrate their commitment through strong realisation of safety compliance to safety requirements and ensure that everyone in the organisation is certain about their safety and health responsibilities (Zin and Ismail, 2012). Laryea and Mensah (2010) further state that the main contractor is responsible for checking that all sub-contractors are complying through the provision of PPE for their employees.

- ***Regulatory agencies*** - regulatory agencies are responsible for enacting regulations to ensure the safety of the construction project, in terms building it, using and maintaining (Laryea and Mensah, 2010). Occupational safety and health requirements such as the OSHA (1993), together with the Construction Regulations (2003), are examples of the Government's commitment towards regulatory compliance and being realised as a key defence against hazards in construction (Zin and Ismail, 2012).

- ***Employees*** - they (workers) are responsible for complying with the set rules and regulations which include the proper wearing of personal protective equipment (PPE) e.g. hardhats, goggles, etc., taking care of equipment and reporting defects. Workers also need to avoid unsafe acts and be able to identify or assess potential hazards on sites.

2.7.4 Construction Accident Statistics

The analysis of health and safety performance in the construction industry should be based on the accident statistics. The Compensation for Occupational Injuries and Diseases Act (No. 130 of 1993) stipulates that all construction industry employers ought to be registered, either with the Compensation Commissioner which operates within the Department of Labour (DoL), or the Federated Employers' Mutual Assurance Company Limited (FEMA). Employers are thus expected to report any kind of occupational injuries within seven days of occurring,

while occupational diseases should be reported within fourteen days of diagnosis. The reported statistics are then collected either by the Compensation Commissioner, or FEMA and then made available to the public (CIDB, 2009a). However, accessing and comparing these statistics is a difficult task because of the various ways in which the statistics are collected and interpreted. For example, FEMA includes in its statistics, construction related motor-vehicle accidents, whilst the DoL statistics do not include these as they are directly reported to the South African Police Service (SAPS). Another disheartening factor is that the statistics available from the Compensation Commissioner's website are outdated. Despite this limitation with the statistics, they however provide a good image of what is happening in the construction industry (CIDB, 2009a). The statistics are presented hereunder, split between those that were collected prior to and after the promulgation of the H&S Construction Regulations in 2003.

The accidents statistics presented in this section cover the period from 2000 – 2003, before the H&S Construction Regulations 2003 were promulgated in South Africa, as provided by the Federated Employers' Mutual Assurance (FEMA). The year 2003 has been included under statistics prior to the promulgation of the regulations, as it is not anticipated that H&S performance would have improved immediately when the legislation was adopted. The statistics in Table 2.1, reveal a low decrease in accidents from 51 fatalities in the year 2000 to 47 fatalities in 2003, which reflects a difference of 4 fatalities; and 7,033 (year 2000) to 6,772 (year 2003) non-fatal accidents. These statistics exclude motor-vehicle accidents, as these do not fall under the Department of Labour (DoL), but the South African Police Service (SAPS).

Table 2.1: Construction Health and Safety Statistics (Before Regulations 2003)

Year	2000	2001	2002	2003
Fatal	51	50	39	47
Non-fatal	7,033	6,196	6,287	6,772
Total	**7,084**	**6,246**	**6,326**	**6,819**

(Adapted: FEMA, 2013)

An in-depth analysis of the statistics provided by FEMA indicate that:

- The dominant causes of injuries included those in which the victims were struck by, fell on to different levels and slip or over-exertion.

- The main causes of fatalities included those in which the victims were struck by, fell on to different levels and caught in, on, between.

The accident statistics indicated that to further enhance accident prevention at work sites, especially those involving high rise construction, there was the need to concentrate on two areas, hazards relating to working at heights and falling objects. Hence, the enforcement efforts of the DoL focused specific attention on these two areas. Following the declaration of the Construction Regulations in July 2003, it is understood that the effects or results of the new legislation would not have been realised immediately after introduction, hence, the researcher acquired the statistics of construction accidents that occurred nationally pre and post FIFA (Federation of International Football Association) world cup construction of stadia and related infrastructure over a six-year period (2007-2012) from FEMA, as it is expected that the regulations would have been implemented by then.

Table 2.2: Construction Health and Safety Statistics (After Regulations 2003)

Year	2007	2008	2009	2010	2011	2012
Fatal	40	34	42	33	25	28
Non-fatal	9,589	9,974	9,384	8,134	6,975	7,110
Total	**9,629**	**10,008**	**9,426**	**8,167**	**7,000**	**7,138**

(Adapted: FEMA, 2013)

The accident statistics presented in Table 2.2 show that since the promulgation of the construction regulations, there was a decrease in accidents on construction sites, both fatal and non-fatal. These statistics exclude motor-vehicle accidents. Though the results portray a decrease in the number of accidents over the period under review, the fact that accidents continue to occur on construction sites remains a matter of concern.

The above statistics affirm the assertions by different authors on the obtaining situation of health and safety performance in South Africa. For example, a health and safety survey conducted by the Construction Industry Development Board (CIDB) in 2009 confirmed that accidents continue to take place on construction sites, despite the many initiatives to prevent or reduce their occurrences. Smallwood and Haupt (2005) argue that the continuing poor performance of the construction industry in terms of diseases, injuries, fatalities, accidents and the overall non-participation by key project stakeholders, provide adequate reasons for a new

approach to health and safety in the industry. The new approach saw the promulgation of the consolidated construction H&S legislation known as the Construction Regulations on 18 July 2003.

2.7.5 Health and Safety Problems on Construction Sites

The researcher's observation of various construction sites in randomly selected areas of Johannesburg and the surrounding revealed that some contractors, more especially the Small and Medium Enterprises (SMEs), do not conform to the requirements of health and safety. This problem is compounded by the Department of Labour (DoL) Inspectorate responsible for enforcing the laws pertaining occupational health and safety (OH&S), as the officials do not pay regular site visits and thus, enforcement of the Construction Regulations is lacking. This observation was also confirmed by Geminiani, *et al.* (2013) who investigated the performance and effectiveness of the DoL occupational health and safety Inspectorate in South Africa. The findings of the study revealed that the DoL Inspectorate was not an effective means of assuring and enforcing compliance, according to the contractors who participated in the study. It was also observed that the large construction companies do make efforts to comply with the H&S requirements as they normally have a designated safety officer on site and the H&S plan would be available, despite the fact that the contents thereof differ from company to company, given that there is no standard format that has yet been adopted by the construction industry. The workers do wear personal protective equipment (PPE), though they sometimes have a tendency of not complying with this requirement, albeit being provided by their employers. It was observed that the workers seem to lack the capacity to assess personal risk on site hence, the unsafe acts they make. The next section presents the financial impacts of accidents.

2.8 Financial Impacts of Accidents

2.8.1 Cost of Accidents

Mthalane, *et al.* (2008) conducted a study to assess the impact of site accidents and notes that besides the human cost of suffering accidents, the economic effects can be far more surpassing. Accidents in the work environment are financially costly, they interrupt the flow of work and cause human suffering (Lehto and Salvendy, 1991). The costs associated with equipment damage and injuries, as well as the financial loss as a result of schedule disruptions, worker compensation and insurance hikes, all negatively affect the profitability of

any operation, the cost of replacing labour and that of investigations after the accident (Zwi, *et al.,* 1988; Haslam, *et al.,* 2005; Abudayyeh, *et al.*, 2006). Agumba and Haupt (2008) reveal a shocking report that construction accidents in South Africa are liable for about 3.5% of its gross domestic product (GDP), which translates to about R30 billion. However, according to SACPCMP (2012), the cost of accidents in South Africa is estimated between R2.6 – R3.5 billion per year. Agumba and Haupt (2008) assert that occupational diseases and accidents in construction result in huge costs on South Africans.

Mthalane, *et al.* (2008) highlight that construction accidents have adverse economic and social impacts on both the employers and workers alike. These costs might be avoided or reduced through effective safety practices on construction sites. Abudayyeh, *et al.* (2006) argue that injuries can directly affect the individuals involved in the accident and on the work itself. The effects include the suffering of the accident victims, delays in construction, losses in productivity, higher insurance premiums as a result of the injuries, as well as the possibility of liability lawsuits for all individual parties involved in the construction project. On the other hand, there are also indirect effects, for instance, the late delivery of the project implies that the contractor might lose revenue. On the part of the workers, reduced morale might result in low productivity. Thus, the cost implications associated with illnesses and injuries can hugely affect the construction organisation. The fact is that organisations cannot afford to insure against all the costs associated with accidents. However, preventing accidents from happening is possible, which would save the organisation in terms of finance, time and causing harm (Haupt and Pillay, 2008). It is important to note that clients are responsible for bearing the costs associated with accidents.

Haupt and Pillay (2008) observe that a lot of research investigated the costs associated with ill-health and occupational accidents and not much has been done in terms of assessing the economic benefits of health and safety. Haupt and Pillay (2008) thus argue that accidents are avoidable. Preventing accidents yields positive results in terms of performance and economic benefits.

Considering the fact that designers are mostly concerned with optimising value, it means they should also contribute to efforts towards the mitigation of accidents (Smallwood and Haupt, 2005). The cost of accidents (CoA) can either be direct or indirect, thus, collectively constituting the total CoA. The CoA refers to the monetary measure that relates to all stakeholders, as it can be calculated as a percentage of organisation business volume or the value of the completed construction (Smallwood and Haupt, 2005; Pillay and Haupt, 2008;

CIDB, 2009a). The direct and indirect costs of accidents are explained in the section that follows.

2.8.2 Direct and Indirect Costs

Direct costs are those directly attributed to or associated with injuries. They are typically the costs covered by workers' compensation insurance premiums. For example, direct costs entail medical, ambulance service, treatment, hospitalisation, disability benefits, etc. Direct costs are well comprehended and can be quantified with some degree of accuracy (Smallwood and Haupt, 2005; Hinze, 2006; CIDB, 2009a). Contrary to direct costs, indirect costs are the responsibility of the contractors and are the most elusive component of the costs of construction worker injuries. Indirect costs can be considered as those that are hidden, or for which no historical record is kept. Smallwood and Haupt (2005) report that research done in South Africa determined the indirect costs to be 14.2 times the direct costs. Unfortunately, there are no means of retrieving the information, so as to precisely associate them with injuries. The most obvious indirect costs are those associated with the injured construction worker. When a worker sustains an injury, it is standard practice for the injured worker to continue to earn his wages whilst undergoing treatment. Upon return to work, it is very likely that consequent to the injury, the worker would not function at maximum productivity. For example, indirect costs include the cost of lost time of injured worker, reduced productivity due to anxiety by other workers, cost of lost time by management attending to the accident, cost of overhead, loss of profit due to reduced worker productivity, litigation costs, investigation time, etc. (Hinze, 2006; Mthalane, *et al.,* 2008; Pillay and Haupt, 2008; CIDB, 2009a). The occurrence of accidents on site has inevitably the potential damage to a company's reputation.

Haslam, *et al.* (2005) argue that the issue of safety in the construction industry has been a concern for a long time. In this view, the country still has a lot to learn from the past. In the construction industry, accidents result in continuous costs to the workers, employers and the society as a whole. In determining the CoA, Pillay and Haupt (2008) confirm that indirect costs surpass direct costs associated with accidents and therefore pointed that in reality, these costs are just but a slice of the costs involved. The next section presents the key legislation on health and safety in South Africa.

2.9 South Africa – Key Legislation on Health and Safety

The law regulating occupational health and safety in South Africa is an amalgamation of common law and statutory provisions. South Africa, in common with other countries, has legislated extensively on occupational health and safety. Despite this body of legislation, common law contractual, delictual and criminal provisions, still play important roles. The health and safety law at work can conveniently be divided into two categories: those laws designed to prevent the occurrence of accidents, as well as those designed to compensate the victims of industrial accidents. The legislative framework concerned with health and safety in South Africa comprise the Constitution, the Occupational Health and Safety Act 85 of 1993 (OHSA), the associated Construction Regulations of 2003 and the Minerals Act 50 of 1991. It is thus imperative to familiarise with the abovementioned pieces of legislation so as to appreciate the role of the State in reducing the occurrences of accidents on construction sites (Smallwood, 2007; CIDB, 2009a). Drawing from research findings at a legislative level, South Africa is not lacking in terms of health and safety legislation (Smallwood and Haupt, 2005; CIDB, 2009a). The Act (OHSA) makes provision for the formulation of the health and safety Regulations which are discussed below.

2.9.1 Construction Regulations 2003

After the Occupational Health and Safety Act in 1993, the Construction Regulations were promulgated in July 2003. The objective of the regulations is to ensure that people in the construction work are doing so in a health and safe environment. Thus, the regulations place the health and safety responsibility on all the people involved in the construction process, clients included. Besides good corporate governance matters, clients are legally obliged to address health and safety in the procurement process, which begins with selecting and appointing who is going to work on the project, as well as the documentation of the contract. This means that the clients are strategically positioned to facilitate health and safety performance improvement, or how the project participants behave, for instance, when pre-qualifying contractors or selecting them, based on health and safety practices (Smallwood and Haupt, 2005).

The Regulations also acknowledge the different roles and responsibilities of each participant in construction process. For instance, designers were previously not required to consider health and safety issues, but they are now mandated to avoid possible risks, just like anyone else involved in the project. Overall, the Construction Regulations are argued to have had positively impacted on how the construction industry operates. The regulations have

increased health and safety awareness amongst the participants and the society in general (Smallwood, 2007). Described below are the main characteristics of the Construction Regulations:

- It shifted from the traditionally prescriptive or “deemed-to-comply” or “command-and-control” approaches, to a more effective performance-based approach in terms of which no standards for compliance are set.
- It redistributed the responsibility of health and safety in construction away from the contractor to all the participants in the construction process, as well as from the client through to the final end-user.
- The regulations compelled health and safety management as a requirement into the planning and design of all construction projects.
- The regulations emphasise the identification of construction hazards, as well as the evaluation of risks to eradicate, avoid or minimise perceived risks.
- Health and safety issues should not just be considered during the construction of the project, but from the beginning, starting with project inception until the facility is demolished. This means health and safety should still be considered during operation, utilisation and maintenance periods.

International research highlights that stakeholders like the clients, the designers, project managers and quantity surveyors, all influence and can positively contribute to health and safety. The Construction Regulations 2003 stipulate the need for participation by all the relevant stakeholders for the effective implementation of health and safety. The regulations thus create an integrated approach to health and safety by involving all the stakeholders.

Baxendale and Jones’ (2000) study on the implementation of the Construction (Design and Management) Regulations 1995 in the United Kingdom reveal that the principal contractors who were interviewed were aware of their duties, while the regulations stimulated them to comply with health and safety. The participants also noted that compliance with the regulations is a learning process, even for those who enforce them. In addition, it was also found that some small to medium sized principal contractors faced some challenges during the preparation for the construction phase of health and safety plans, while the contractors also had to prepare risk assessments. However, there were some irregularities in terms of content and format, as clients imposed the responsibility for the regulation onto the main contractors.

Smallwood and Haupt's (2005) survey to determine the perceptions of primarily engineers regarding the Construction Regulations gathered that the contractors were perceived as the main contributors to health and safety, while quality management systems implementation complemented health and safety. In that study, 61% of the respondents argued that the Construction Regulations resulted in major improvements in health and safety in the industry.

The researcher also randomly studied the profiles of five of grade 9 building contractors registered with the Construction Industry Development Board (CIDB), paying special attention to their H&S policies. However, none of their policies was cited as having been developed as a consequence of the Construction Regulations 2003, or made any explicit reference to the H&S regulations. Instead, the contractors cited their policies to be adhering to the International Organization of Standardisation (ISO) for example ISO9001, ISO14001 and ISO30001. They did however, register that they were committed to complying with all relevant legislations in the country. During the time of this study, the Construction Regulations had been in force for just more than ten years as per the promulgation date stated above. There is however, not much literature available on how the Construction Regulations have impacted on the health and safety on construction sites in South Africa. Neither has there been any survey covering the ten year-period in which the regulations have been in force, hence, the significance of this study in establishing that information. Although this research was initially concerned with the implementation of Construction Regulations 2003, it is worthwhile to note that amendments to these Regulations have since been effected. The Construction Regulations Amendment of 2013 were promulgated on 10 February 2014[6]. The New Construction Regulations 2014 amendments are briefly discussed hereunder.

2.9.2 The New Construction Regulations 2014

Whilst the researcher was at an advanced stage with this research, the Department of Labour (DoL) promulgated the Construction Regulations 2014, in an effort to improve the effectiveness of the Construction Regulations and minimise the occurrence of accidents on construction sites. The Construction Regulations 2014 have since superseded the Construction Regulations 2003. The aim of the amendment is to better define the grey areas in the legislation, to improve the level of competence in construction and to place more responsibility on the client for H&S in future. Some of the amendments include the following[7]:

[6] http://www.labour.gov.za

[7] http://www.engineeringnews.co.za/article/construction-safety-set-to-improve-with-proposed-amendments-2009-09-18

- H&S practitioners that work in construction have to register with The South African Council for the Project and Construction Management Professions (SACPCMP). This was gazetted on 31 May 2013 and the commencement of registration as a Professional Construction Health and Safety Agent effective from 01 August 2013.
- Client expected to obtain a construction permit from DoL, while the responsibility previously rested with the construction contractor to inform the department of planned construction. The client therefore becomes more responsible for the H&S of construction workers.
- Medical certificate of fitness requirements has been reviewed to be less onerous.
- The function of the approved inspection authority (AIA) has been revised. Although AIA's already existed in the Construction Regulations 2003, their goal was never adequately explained. Professionally registered private consultants will be required to serve as AIA's and assist the DoL in enforcing the legislation.

Of note is that the Construction Regulations 2014 were promulgated by the Minister of Labour, accompanied by the Minister of Public Works on 10 February 2014.

2.9.3 Occupational Health and Safety

The legal requirement of health and safety in the workplace is a complex and difficult subject. Risk is a part of human activity. No society can guarantee its members absolute protection from illness, injury or death at work, or in other aspects of their daily lives. Societies make judgements as to the level of risk they consider acceptable. These are policy decisions which would also take into account factors such as economic development and the social cost of industrial injury and illness. This balancing lies at the heart of the structure of the OHSA: the duties it imposes are limited by the test of what is reasonably practicable. A society's commitment to providing its workers with health and safe working conditions can be measured in two ways: (a) by the quality of safety legislation enacted, (b) by the level of resources allocated to the policing and enforcement of that legislation, including the penalties imposed on those who break or ignore the law. Public awareness of occupational health and safety as an issue is erratic. It is stimulated by major disasters, tragically frequent in South Africa's mining and construction industries. These incidents highlight the effect of OH&S on the community at large (OHSA, 2008).

2.9.4 The Occupational Health and Safety Act (85 of 1993)

The health and safety regulation can be divided into two categories: those that are designed to prevent accident occurrence, and those designed to compensate the victims of industrial accidents. The legislative framework concerned with health and safety in the South African context comprises the Constitution (1996), the Occupational Health and Safety Act (85 of 1993), the associated Construction Regulations (2003) and the Minerals Act (50 of 1991). It is thus imperative to be familiar with all the above pieces of legislation, to understand the role of the State in undertaking measures to reduce the occurrences of accidents on construction sites.

Occupational health and safety (OHS) inspection and enforcement in the commerce and industry, is the responsibility of the DoL. However, the mining and energy production are under the Department of Minerals and Energy. The principal statutory legislation on health and safety is the Occupational Health and Safety Act (85 of 1993), which provides for the health and safety of persons at work, as well as for the health and safety of persons who use plant and machinery, the protection of persons against hazards to health and safety which might result from the activities of persons at work. The OHS also indicates the need for an established advisory council for occupational health and safety, whose objective is to provide for matters connected therewith. The impact of immigrant workers on occurrence of accidents is discussed below:

2.10 Impact of Immigrant Workers on Occurrence of Accidents

Foreigners are regarded as those people who do not reside in their country of origin. Foreign workers then refer to those people who do not possess citizenship in the country where they are employed. In the US, UK and Australia, they are referred to as migrant workers, while in Japan they are called foreign workers (Kartam, *et al*., 2000; Guldenmund, *et al.,* 2013). However, according to the *Oxford Advanced Learner's Dictionary*, an immigrant worker is defined as a one who comes to live and work in a country from another country, whilst migrant worker is defined as a worker who moves from one place to another within the same country in order to find work (Hornby, 2010). The reason why most foreign workers are prone to occupational accidents is because of different languages, lifestyle, culture and limited education and training in terms of health and safety (Cheng and Wu, 2013). This observation also applies to South Africa, given that there are eleven official languages. This implies that a Xhosa speaking worker from the Eastern Cape Province might have a challenge working in

Limpopo province where the dominating languages are Northern Sotho, Tsonga and Venda or in Western Cape where the dominating language is Afrikaans, for example.

In South Africa, most construction organisations employ immigrant workers. These people from various ethnic groups and nationalities understand other people's behaviours and express themselves differently from those of other countries. Such differences can result in misunderstandings on the issues of health and safety (Choudhry, *et al*., 2007).

Most of the immigrant workers do not possess any special skills, are not trained and therefore inexperienced, which makes them ready to take up any kind of job opportunities in order to support their livelihoods (Kartam, *et al*., 2000; Cheng, *et al.*, 2013). A study conducted by Ismail, *et al*. (2012) in Bangladesh reveals that most construction organisations employ these immigrants who could have left their countries for searching employment elsewhere, thus, the employers engage them because they endure most of the working conditions, are hardworking and are not so picky. The fact is that the employers tend to take advantage of the cheap labour from these migrant workers and give them small daily wages which the local residents do not accept. In this view, the immigrant workers become vulnerable as they work in unhealth conditions and receive a minimum wage. These issues could affect them and might contribute to occupational accidents. Guldenmund, *et al.* (2013) argue that immigrant workers are therefore a vulnerable group of workers.

The health of foreign labour is also a factor contributing to accidents in the work place. According to Ismail, *et al*. (2012), most immigrant workers do not report sicknesses, fearing that they would be dismissed from their jobs. They also cannot take medical leave as they think they might be replaced or might not be paid, because most of the contracts which provide wages are based on the "no-work-no-pay" basis. Even if they are not physically fit, most of the foreign workers fear that they might be dismissed and then lose their jobs, thus, they compromise their health and safety. Essentially, most of them are not even aware of the health and safety provisions of the countries in which they reside, while at the same time they might have limited interaction with their fellow employees, regarding health and safety issues. Again, as foreigners, they often do not get the opportunity to undertake safety training programs and activities (Guldenmund, *et al.*, 2013). Sometimes when training courses are offered, the foreign workers might not understand if the courses are delivered in the native languages. The fact is that most foreign workers lack the adequate knowledge regarding their rights as far as health and safety is concerned, while at the same time they are also not affiliated to any labour unions which could defend their rights (Kartam, *et al*., 2000). Owing to the mobility of foreign workers

within the industry, special efforts are needed to ensure that these workers are adequately trained in safety, so that they are knowledgeable and understand their roles in preventing accident in construction worksites.

2.11 Conclusion

The literature reviewed in this chapter has highlighted the essence of health and safety in the construction industry, both locally and internationally. The fact is, therefore, health and safety remain a cause for concern to all the stakeholders, despite the existence of enabling health and safety legislations. It has been indicated in literature that the main causes of most occupational accidents in the construction industry are largely attributed to management negligence or inadequate worker safety awareness. Having achieved the objectives of this chapter as outlined in the introduction of the chapter, the next chapter describes the research design and methodology.

3 CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter presents the research design and methodology. The descriptive and explanatory research designs used in the study are explained and their suitability motivated. The study used the mixed method approach, that is, both the quantitative and qualitative research approaches were employed. This chapter therefore also justifies the use of this research approach. The population for the study is specified and the sampling techniques used in selecting the research participants are explained. The data collection methods employed in the study are also outlined. The chapter also explains in detail, the methods used to analyse the data. The ways in which reliability and validity of the main research instrument were promoted in the study are also appraised. Essentially, this chapter justifies the methods and techniques used in the study.

3.2 Research Objectives

The research design and methodology are carefully chosen to ensure the research objectives of the study are effectively addressed. The research objectives of the study are therefore restated as follows:

- ❒ To assess the awareness and understanding of the Construction Regulations amongst the clients, consultants and contractors within the construction industry.
- ❒ To measure the level to which the clients, consultants and contractors are performing their health and safety responsibilities, as stipulated in the Construction Regulations.
- ❒ To evaluate the level of commitment to the Construction Regulations by the South African construction industry stakeholders.
- ❒ To investigate why the implementation of the Construction Regulations has not contributed to the decline in the occurrence of accidents on construction sites in South Africa.

3.3 Research Design

Fox and Bayat (2012) state that a researcher collects data in order to solve the research problem under investigation. In order to be able to collect the data required, a researcher first

needs to create the appropriate research design. Fox and Bayat (2012) describe research design as the actual plan, in terms of which the researcher obtains research participants or subjects and collect data from them. In the research design, the researcher has to define what he/she is going to do with the research participants, in order to reach the conclusions related to the research problem. Gill and Johnson (2010) emphasise that it is important to be clear whether the intention is to test a theory deductively by explaining cause and effect relationships among a set of phenomena, or whether the aim is to assess the attributes of the population of subjects. A consideration of these issues determines the type of research design that can be used in a study. The research designs that can be used in studies include exploratory research, descriptive research and explanatory research. These research designs are expounded in the next sub-sections.

3.3.1 Exploratory Research Design

It is a research design that seeks to explore an area that has never been investigated, or where very little is known about the area (Gill and Johnson, 2010; Howitt and Cramer, 2011). This research design is therefore used when researchers intend to create an initial understanding of a phenomenon. Bhattacherjee (2012) argues that exploratory research does not lead to a clear and accurate understanding of the research problem, but it can give a foundation for a future in-depth study. Thus, exploratory research can be followed by explanatory and descriptive research for a better understanding of the phenomenon. The causes of accidents on construction sites has been previously researched (Smallwood and Haupt, 2005; Smallwood, 2007).

3.3.2 Descriptive Research Design

Descriptive research is aimed at describing in detail, the characteristics of a phenomenon that is under investigation (Gill and Johnson, 2010; Howitt and Cramer, 2011). This is corroborated by Kumar (2011), who explains that descriptive research seeks to systematically describe a phenomenon, problem, situation, or provide descriptive information about attitudes of people towards a policy. It can, therefore, be concluded that descriptive research seeks to understand a prevailing situation in respect of an identified problem. It employs descriptive analysis in the form of frequency distribution, measures of central tendency and measures of dispersion to understand the prevailing situation (Mackey and Gass, 2005; Gill and Johnson, 2010).

3.3.3 Explanatory Research Design

Explanatory research is done to understand why and how there is a relationship between variables of interest (Gill and Johnson, 2010; Kumar, 2011). Bhattacherjee (2012) is also of the opinion that explanatory research seeks to identify causal factors of an outcome. For instance, the research design might seek to understand why there is increased unemployment in the face of declining gross domestic product. Explanatory research is therefore used to understand the nature of relationships between variables and the significance of those relationships. Inferential analysis covering correlation analysis and regression analysis is normally used in the explanatory research (Mackey and Gass, 2005).

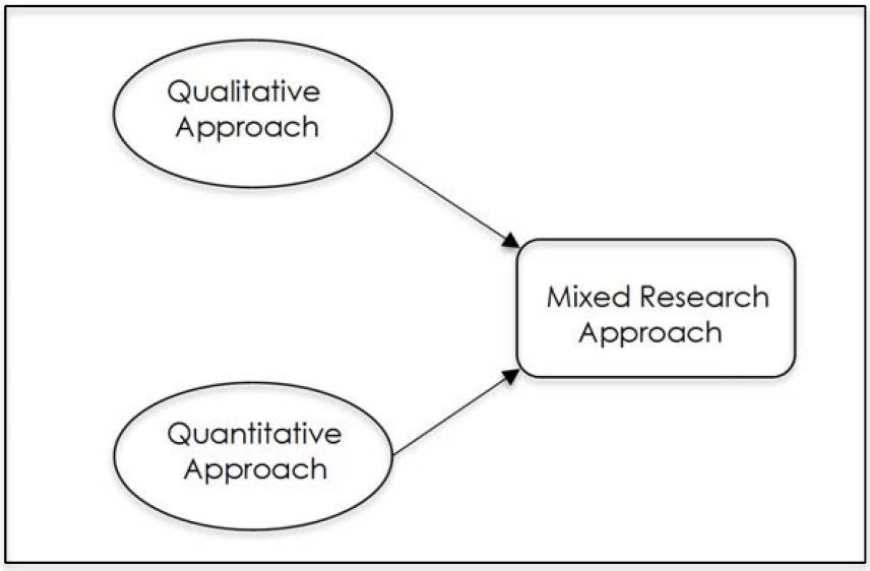
3.3.4 Justification for using the Descriptive and Explanatory Research Designs

The study employed both the descriptive and the explanatory research designs. Descriptive research design was used to understand the extent of the awareness and understanding of the Construction Regulations by the clients, the contractors and the consultants in the Gauteng Province's construction sector. The descriptive research design was also employed to determine the extent to which the construction sector's stakeholders are complying with their roles, as stipulated in the Construction Regulations. On the other hand, explanatory research was employed to understand the nature and significance of the relationship between the adoption of Construction Regulations and the level of accidents on construction sites in South Africa. Thus, explanatory research was used to understand the causal effect of adoption of the Construction Regulations in reducing or eradicating accidents on construction sites.

3.4 Research Methodology

Research methodology refers to the systematic procedures for conducting a research (Singh, 2006). Singh (2006) further identifies research methodology tasks undertaken by a researcher as including identifying the research problem, conducting literature review, formulating the hypotheses, formulating the procedures for testing the hypotheses, collection of data, data analysis, interpretation of results, conclusions and recommendations on addressing the research problem. However, knowing the research procedures or the tasks is not the end in achieving research objectives. The research procedures ought to be applied appropriately for the best results. There are three categories of research methodologies that are depicted in Figure 3.1, which depicts the relationship amongst the three research approaches.

Figure 3.1: Research Methodology Approaches



(Adapted from: Muijs, 2004)

These three research methodology approaches are explained in the next sub-sections:

3.4.1 Qualitative Research Approach

Qualitative research can be defined as research that is based on descriptive data that normally does not rely on statistical procedures (Bhattacherjee, 2012). Thus, qualitative research is concerned with collecting non-numeric data that can richly describe the phenomenon under evaluation. Mackey and Gass (2005) view qualitative research as aimed at studying research participants in their natural settings to get a holistic picture of the phenomenon under investigation. Thus, qualitative research does not try to control variables under investigation, or to limit the views of the research participants. In fact, qualitative research is an open-ended process and is not overly structured like the quantitative research (Mackey and Gass, 2005). The approach is also inductive in nature as it seeks to develop new theories rather than confirming relationships posited in existing theories (Monfared and Derakhshan, 2015). Monfared and Derakhshan (2015) further explain that qualitative research approach uses small sample due to the need to collect detailed and rich data. The data collection methods used in the qualitative approach are interviews and observations that are time consuming when using a large sample (Monfared and Derakhshan, 2015).

Despite the qualitative approach making it possible for a researcher to collect detailed and rich data to address the identified research problem, the approach has disadvantages that may negatively affect the credibility of the research findings. According to Choy (2014), qualitative research is time consuming and it promotes subjectivity from both the researcher and the research participants. It can, therefore, be argued that qualitative research may be inappropriate to use in situations whereby the researcher has limited time to conduct the study, or in studies where objectivity is fundamental in addressing the research problem. The use of small sample also makes the qualitative approach unsuitable for generalising the research findings to the whole population (Monfared and Derakhshan, 2015). This is because small samples cannot be representative of the whole population. The qualitative research approach was incorporated into the study, as the study sought both objectivity and subjectivity.

3.4.2 Quantitative Research Approach

The quantitative research is a deductive approach that seeks to investigate relationships between variables to confirm relationships postulated in existing theories (Monfared and Derakhshan, 2015). Large samples are employed in data collection, as the approach also seeks to generalise research findings to the whole population (Monfared and Derakhshan, 2015). The approach is concerned with collecting numerical data or structured data that can easily be quantified (Choy, 2014). Thus, quantification of data is a major feature of the quantitative research approach. The numerical data or structured data are analysed through statistical techniques and the results are presented in tables, graphs, descriptive statistics and inferential statistics (Mackey and Gass, 2005). The presentation of research findings in graphs and tables, as well as the use of inferential statistics, makes it possible to infer the findings from a sample to the whole population. According to Mackey and Gass (2005), the quantitative research approach is also associated with promoting objectivity and collecting data from a large sample. The use of large samples selected at random makes it possible for the research findings to be generalised to the population, as the selected sample is deemed to be representative. The promotion of objectivity by the approach enhances the credibility of the research findings in addressing the research problem that would have necessitated the study.

The quantitative research approach has been preferred due to the need to generalise the research findings to the whole population of construction stakeholders in the Gauteng Province. Generalisation of the research findings was of importance in the study, as the study

sought to determine the extent of construction industry stakeholders' awareness and understanding of the Construction Regulations, the extent of the stakeholders' compliance with the roles stipulated in the regulations and the impact of the regulations on reducing the number of accidents on construction sites in the industry. It was impractical to collect data from all the construction industry stakeholders based in the Gauteng Province due to the enormity of the population size. Thus, data were collected from a large representative sample to make generalisability of the findings possible.

The quantitative research approach was also found to be suitable to the study due to its feature of promoting the collection of structured data (Choy, 2014). The collection of structured data was necessary in the study, as all the important variables for the study are well articulated in the Construction Regulations and existing literature. Diversion from these factors would have contributed to the collection of subjective data compromising the reliability and validity of the research findings. Thus, the use of the quantitative research approach was also motivated by the need to promote the reliability and validity of the research findings, in order for the study to contribute to the reduction of accidents on construction sites in the Gauteng Province.

However, the quantitative research approach is not without challenges or limitations. The structured nature of the approach may lead to some relevant variables being left out of the investigation (Choy, 2014). If relevant variables are left out of the evaluation, this might make the research findings insufficient to fully address the research objectives or to address the research problem. Mackey and Grass (2005) also argue that controlling variables in the quantitative research may influence research participants to give responses that they think they are expected to give. This can limit the reliability and validity of the research findings.

3.4.3 Mixed Research Approach

The depiction of research methodologies in Figure 3.1 indicates that the quantitative and qualitative research approaches are different from each other. However, the depiction further indicates that the mixed research approach is linked to both the quantitative and the qualitative research approaches. In fact, the mixed research approach entails the use of both the quantitative and qualitative research approaches in a study (Singh, 2006). The use of the mixed research approach indicates that the quantitative and the qualitative research approaches can complement each other if they are used properly. The gain of using the mixed research approach is taking advantage of the benefits of both approaches, while neutralising

the weaknesses of each of them (Johnson and Onwuegbuzie, 2004). This makes it reasonable for researchers to employ the hybrid research method approach. However, the mixed research approach also has disadvantages that can make it to be inappropriate to use in some studies or situations. The major weaknesses of the mixed research approach are that it is expensive and time consuming (Johnson and Onwuegbuzie, 2004). However, the mixed research approach was thus relevant for this study, as the objectives of the study sought both objective and subjective answers.

3.5 Research Strategies

There are various research strategies that can be used in research. They include experimental research, survey research, case study, action research, grounded theory, ethnography and archival research (Saunders, *et al.*, 2009). The choice of the research method is determined by the research methodology employed for the study (Saunders, *et al.,* 2009). This study was both quantitative and qualitative, thus, the research strategies compatible with the mixed method approach were appropriate. Case study, grounded theory and ethnography were ignored as they are associated with the qualitative research (Saunders, *et al.,* 2009). Although experimental and action research can be used in a quantitative research, they were also found to be inappropriate for this study. Experimental research involves the manipulation of independent variables to determine the effect of manipulation on the dependent variables (Neuman, 2014). However, Bhattacherjee (2012) points out that laboratory experiments are easy to administer, but field experiments are not easy, as it is difficult to manipulate treatments and control for extraneous effects. Experimental field research was therefore ignored in this study, due to the difficulty of administering it. According to Saunders, *et al*. (2009), action research is aimed at improving the organisational change process by identifying issues of concern. This study is not focused on addressing organisation change process and this led to the action research strategy not being used in the study. The survey research strategy that was used in the study is explained and justified in the next section.

3.5.1 Survey Research

The survey research strategy involves the systematic collection of data by the use of questionnaires and interviews to understand people's attitudes, preferences and behaviour (Neuman, 2014). Neuman (2014) further points out that the survey research is appropriate in exploratory, descriptive and explanatory research designs. Survey research is most appropriate when people are used as the units of analysis (Bhattacherjee, 2012). The

research problem might be related to the people as individuals, or to the organisations that they are attached to. According to Saunders, *et al.* (2009), survey research is used to collect data from a sizable population or from a sample that may be representative to the population. This research strategy can be suitable in situations whereby the researcher is seeking to collect large amounts of data from a large population (Saunders, *et al.,* 2009).

The survey research has been used in this study, as a result of its strengths that are suitable in addressing the research objectives of this study. It is the most appropriate strategy for collecting data from a large population, as it allows for utilising of a representative sample (Bhattacherjee, 2012). The population for this study, as explained in section 3.4.6 is large and it necessitated the use of the survey research. Bhattacherjee (2012) further argues that the survey research strategy is economic in terms of time and financial cost. Thus, the strategy can be employed when the researcher is having the limitation of time and financial resources. There was limitation of time for this study and this made the strategy suitable. Saunders, *et al.* (2009) are also of the opinion that the survey research is appropriate for collecting quantitative data that are analysed by descriptive and inferential analysis. This study collected quantitative data that were then quantified for descriptive and inferential analysis, as well as qualitative data that were coded into themes. The survey research strategy was therefore regarded as the most appropriate strategy for the study.

3.6 Target Population

Population can be defined as the complete universe of people or objects that are of interest to the study (Greener, 2008). According to Kumar (2011), the population of a study are all the targeted units of analysis for data collection, in order to address the identified research problem. It is, therefore, recommended that the researcher defines the population before proceeding with the study (Kumar, 2011). A population may be specific in size, or it might be impractical for the researcher to know the specific population size. However, where it is difficult to specify the size of the population, the characteristics of the population units of analysis should be clear (Howitt and Cramer, 2011). The population for this study included contractors based in the Gauteng Province and registered under the different grades with the CIDB. Table 3.1 presents the population size for the different classes of contractors registered with CIDB, as well as the aggregated population size.

Table 3.1: Population for the Study

Population Group	Size
Contractors (Grade 9)	22
Contractors (Grade 8)	41
Contractors (Grade 7)	101
Total	**164**

The above population size of 164 contractors was also augmented by clients and consultants who were linked to the current and completed construction projects in the Gauteng Province, those that were being executed (or already executed) by the contracting companies of the 164 contractors. The clients included those from both the private and public sectors, while the consultants included the quantity surveyors, health and safety practitioners, project managers and architects. The population size of 164 contractors, that was augmented by the clients and consultants for the projects being or already executed by the contracting companies for the 164 contractors, could not be used entirely in the study, due to the limited time and financial resources. This brings in another important element of research, that of sampling. The sampling procedure for the research participants is explained in the next section.

3.6.1 Sampling and Sample Size

Sampling is defined as a statistical process of selecting a subset of the population for the purpose of investigating the population to make inferences (Gill and Johnson, 2010; Bhattacherjee, 2012). Sampling is suitable when it is impractical for the researcher to work with the entire population due to the enormous size (Bhattacherjee, 2012). The researcher might have limited time and financial resources to collect data from the enormous population (Saunders, *et al*., 2009). Sampling was applied in this study, as a result of enormity of the population size.

There are two broad categories of sampling, namely probability and non-probability sampling. Probability sampling is concerned with selecting a representative sample for the purpose of generalising the research findings to the whole population (Gill and Johnson, 2010; Howit and Cramer, 2011). Population elements have therefore an equal chance of being selected (Saunders, *et al.*, 2009). On the other hand, in non-probability sampling, the population

elements have unequal chance of being selected (Bhattacherjee, 2012). In fact, the probability of selecting the population elements is unknown in non-probability sampling (Howitt and Cramer, 2011). Thus, non-probability sampling is not used in situations where researchers seek to generalise the research findings to the population. This study seeks to generalise the research findings to the whole population of contractors, clients and consultants in the Gauteng Province. The probability sampling method was therefore used in the study.

The probability sampling methods that can be employed in a study are simple random sampling, systematic sampling and stratified random sampling (Saunders, *et al*., 2009). In simple random sampling, all the population units have an equal probability of being selected and are selected randomly using random tables or computerised random numbers (Kumar, 2011). This method does not recognise the different groups in a population. Simple random sampling was ignored in this study due to its failure of recognising the different groups in the population.

In systematic sampling, the population is first arranged in order, followed by a random selection of the first sample element and then proceeding with selecting every n^{th} element of the population using a fixed interval (Gill and Johnson, 2010; Bhattacherjee, 2012). This method ensures there is no over-representation of either small or big size elements of the population (Bhattacherjee, 2012). This method is therefore only applicable if the population elements can be arranged orderly by size. The population for this study cannot reasonably be arranged by size and thus, the systematic sampling method was ignored.

In stratified sampling, the population is first divided into distinct homogeneous groups and then simple random sampling is applied to select members in each group (Howitt and Cramer, 2011). This method ensures that the different population groups are represented in the sample (Saunders, *et al*., 2009). The stratified random sampling was employed in the study, as the population for the study was made up of distinct homogeneous groups. First the population of contractors was made up of grade 9, grade 8 and grade 7 contractors. Stratified sampling was used to select 10 contractors from each group to reach a sample size of 30 contractors. Stratified sampling was further used to select 10 clients divided between the public and the private sector clients. The 50 consultants were also chosen by employing the stratified sampling to ensure that all the available professions of consultants were represented. The distribution of the selected consultants is shown in Table 3.2.

Table 3.2: Distribution of Consultants

Profession	Size
Project Managers	10
Architects	10
Quantity Surveyors	10
Engineers	10
Health & Safety Practitioners	10
Total	**50**

The use of stratified random sampling promoted the representation of all the groups in the population. However, it is important to note that the selection of clients and consultants was first linked to the 30 randomly selected contractors before applying the stratified sampling.

The size of a sample is determined by the size of the population, the researcher's confidence level and the level of sample error that is acceptable to the researcher (Saunders, *et al*., 2009). On the other hand, Neuman (2014) argues that if a researcher seeks to generalise research findings, then a large sample should be selected at random. The selection of a large sample at random minimises sample error (Neuman, 2014). Greener (2008) is of the view that a large sample that gives a normal distribution is a minimum of 30 objects or people, that are selected at random. This study sought to generalise the research findings to all the contractors, consultants and clients in the Gauteng Province. Accordingly, a sample size of 30 contractors was considered large enough to generalise the research findings to all the contractors in the Gauteng Province. Sampling was further performed to select 50 consultants and 10 clients that are linked to the construction projects currently being executed, or those that have already been executed by the 30 selected contractors. Thus, the aggregated sample size used in the study is 90 contractors, consultants and clients.

3.7 Data Collection Instrument: The Questionnaire

The questionnaire was used for data collection, as it is regarded as a suitable research instrument for the quantitative research (Kumar, 2011). Muijs (2004) points out that using a questionnaire to collect data is a not an advantage in itself, as there is need for the researcher to formulate appropriate questions to evaluate the phenomenon under investigation. There are

many types of questionnaires that can be used to collect primary data. Saunders, *et al.* (2009) identify self-administered questionnaires (which are completed by the respondents) and the interviewer administered questionnaires that are completed by the interviewer or researcher. The study employed the self-administered questionnaires due to the limitation of time that made the interviewer administered questionnaires inappropriate (Muijs, 2004). Self-administered questionnaires were also preferred as they promote anonymity, unlike the interviewer administered questionnaires (Kumar, 2011). The self-administered questionnaires are further divided into internet-mediated questionnaires, mail questionnaires and hand-delivered questionnaires (Saunders, *et al*., 2009). The internet-mediated questionnaires are posted and completed on online platforms, mail questionnaires are posted by post to the research participants and hand-delivered questionnaires are delivered in person by the research or research assistant (Saunders, *et al*., 2009). Hand-delivered questionnaires were used in the study, as the researcher wanted to create a close rapport with the research participants to improve the response rate.

Questionnaires can either use open-ended questions or closed-ended questions (Muijs, 2004). Open-ended questions give the research participants freedom of giving responses of their choice without any limitation (Saunders, *et al*., 2009). However, this can lead to the research participants to divert the study into issues that are not focused on the research objectives. Despite this weakness of though, the researcher included both closed-ended, as well as open-ended questions in the questionnaire. The objective was to gather quantitative findings on the subject, as well as the participants' views or opinions regarding the matter. This assisted with getting responses that directly spoke to the issues related to the research problem. The questions that sought quantitative information were largely Likert-scale type of questions which required the respondents to choose from five responses ranging from strongly disagree, disagree, not sure, agree and strongly agree, while the qualitative questions were open-ended so that the participants provided their thoughts about the issue of health and safety in construction.

The questionnaire was made up of five sections. The first section comprised questions aimed at understanding the attributes of the participants who took part in the study. These attributes included their educational qualifications, employment status, gender, profession, number of years in the construction sector and the nature of projects the respondents have worked in. The remaining four sections focused on the four objectives of the study. The second section had questions to measure the respondents' awareness and understanding of the Construction Regulations, while the third section focused on the roles of the consultants, clients and the

consultants as stipulated in the regulations. The questions in the third section were intended to measure the extent to which the clients, contractors and the consultants were performing roles stipulated in the Construction Regulations. The fourth section comprised questions measuring the commitment of the clients, contractors and consultants to the Construction Regulations. Their commitment was evaluated through the implementation of the regulations and training of employees on the regulations by the firms. Finally, the fifth section had questions that evaluated if the adoption of the Construction Regulations has led to a decrease in occurrence of accidents at construction sites in South Africa.

The study used a self-administered questionnaire as already mentioned. Questionnaires are known for low response rate (Muijs, 2004). For this reason, strategies should be put in place to enhance the response rate of the research instrument whenever it is used for data collection. This is because lower response rate reduces the validity of the research instrument (Singh, 2006). The response rate can be improved by making the questionnaire short and using an attractive layout (Saunders, *et al.,* 2009). The response rate can also be enhanced by attaching an informative cover letter to the questionnaire (Singh, 2006). Saunders, *et al.* (2009) are also of the view that response rates for questionnaires can be enhanced by continuously reminding the research participants to complete the questionnaires in time and pilot testing of the questionnaire. The response rate for the questionnaire for this study was improved by attaching an informative cover letter, requesting respondents to complete the questionnaire, making the questionnaire short, using an attractive layout and pilot testing of the research instrument. The cover letter contained the purpose of the study, significance of the study, instructions on how to complete the questionnaire, indicating that participation in the study is voluntary, guaranteeing confidentiality and anonymity to the research participants, contact number that could be used by respondents for further enquiries and thanking the respondents in advance for taking part in the study (Kumar, 2011).

After the questionnaire was designed and pilot tested, it was then delivered in person by the researcher to the selected sample units. The delivery of the questionnaire in person was also done to enhance the response rate of the research instrument, following the creation of a close rapport with the research participants. However, the research participants completed the questionnaire at their own, without the assistance of the researcher or research assistant. The researcher and the research assistant only returned to collect the questions upon being completed. The researcher distributed the questionnaire to five members of each of the contractor's site personnel, namely Contracts Director, Contracts Manager, Contracts Surveyor, Site Agent and SHE Manager or Officer. Appointments with the five members from

each contractor on site were made telephonically to have the questionnaires self-administered by the researcher. Also, clients both from public and private sector and consultants formed part of the second sample of the survey. Tables 3.3 and 3.4 illustrate the targeted samples of the survey, to whom the researcher administered the questionnaire.

Table 3.3: Survey Sample 1 - Contractors

Item	Contractors by Grading	Registered Currently	Target Sample	Percentage
1	CIDB Grade 9 Contractors	22	10	33.33%
2	CIBD Grade 8 Contractors	41	10	33.33%
3	CIDB Grade 7 Contractors	101	10	33.33%
Total		**164**	**30**	**100.00%**

Table 3.4: Survey Sample 2 – Clients and Consultants

Item	Clients & Consultants	Target Sample	Percentage
1	Property / Development Managers	10	16.67%
2	Health and Safety Practitioners	10	16.67%
3	Project Managers	10	16.67%
4	Architects	10	16.67%
5	Quantity Surveyors	10	16.67%
6	Engineers	10	16.67%
Total		**60**	**100.00%**

The aim of the research was to assess the awareness of the respondents on health and safety Construction Regulations on construction sites in South Africa. Thus, the majority of the research questions were anchored on this research objective. The intention of the survey was to select respondents representing a wide spectrum of organisations, with different manpower and financial limitations.

3.7.1 Secondary Sources

The researcher also did some analysis of secondary source of data on construction accidents that occurred nationally pre and post FIFA (Federation of International Football Association) world cup construction of stadia and related infrastructure over a six-year period (2007-2012)

on construction sites within Gauteng Province, as recorded by the Federated Employers' Mutual Assurance Company Limited (FEMA) in conjunction with the Department of Labour (DoL). The accident statistics were collected to establish the trend of accidents, i.e. accidents that are prevalent and those that are uncommon as well as to establish if accidents have indeed declined following the introduction of the Construction Regulations.

3.8 Pilot Testing

Pilot testing is a small-scale study conducted to improve a research instrument before the actual comprehensive study (Mackey and Gass, 2005). Saunders, *et al.* (2009) argue that a questionnaire has to be pilot tested before data collection in order to refine it. According to Mackey and Gass (2005), pilot testing of the questionnaire assists with avoiding conducting a costly comprehensive study and to collect credible data during the actual study. Pilot testing can also be used to gauge the time required for completing a research instrument, improve instructions, addressing ambiguity in the questions, identifying omissions in the questions, improving layout and addressing sensitive questions (Saunders, *et al.,* 2009). Saunders, *et al.* (2009) are of the view that a pilot study should be conducted with a group of experts in the area that is being investigated or by a small group of research participants with the same characteristics as the research participants to be used in the actual comprehensive study.

The questionnaire of this study was pilot tested on nine respondents made up of equal numbers of consultants, contractors and clients. The nine respondents were chosen in Johannesburg and Midrand, conveniently by identifying construction sites that were close and easily accessible to the researcher. The pilot testing led to identifying grammatical errors, ambiguity in questions and improving the sequencing of the questions. The addressing of these issues enhanced the reliability and validity of the research instrument.

3.9 Reliability and Validity of Research Instrument

A questionnaire should be designed and administered in a way that promotes reliability and validity of the collected data (Saunders, *et al.,* 2009; Gill and Johnson, 2010). Reliability and validity of the collected data are central to the value of a study. Researchers are therefore expected to promote reliability and validity, for their studies to be worthy the time and financial resources spent on them. The next two sub-sections explain the concepts of reliability and validity, as well as how the concepts have been ensured in the study.

Reliability refers to the consistency of the research instrument over time, if it is used to measure the same variables under the same conditions (Greener, 2008). Thus, a research instrument is regarded as reliable if it gives the same results and if the study is repeated several times under the same conditions. It is, therefore, important to note that reliability does not entail accuracy of the research instrument, but simply consistency. Reliability can be divided into four types, namely internal consistency reliability, test-retest reliability, split-half reliability and inter-rater reliability (Saunders, *et al*., 2009). Internal consistency reliability measures consistency of different items of the same construct (Kumar, 2011). The internal consistency is confirmed if the respondents rating the different items of a construct measure them in the same way as they are related. Split-half reliability measures the consistency of two halves of a construct measure (Saunders, *et al*., 2009). Saunders, *et al.* (2009) point out that two halves should have similar scores when measured, if the research instrument is reliable. Test-retest reliability relates to measuring of the same construct twice over different times (Bhattacherjee, 2012). Reliability of the research instrument is validated if the two measurements produce almost similar results. Finally, inter-rater reliability is when two or more independent observers measure a construct independent from each other (Bhattacherjee, 2012). The research instrument is also confirmed to be reliable if the two independent raters or observers produce almost the same results.

In the study, reliability was promoted by pilot testing the research questionnaire, which led to the elimination of ambiguous questions and the removal of terminology that was difficult to understand. Elimination of subjectivity in the study by using closed-ended questions and basing the questions on aspects in the Construction Regulations, or aspects that are reported in the existing literature also enhanced the reliability of the questionnaire. According to Saunders, *et al*. (2009), reliability is measured by using Cronbanch alpha. Accordingly, reliability was assessed using Cronbach alpha in this study.

On the other hand, validity can be defined as the extent to which a research instrument measures what it claims to measure (Howitt and Cramer, 2011). Neuman (2014) views validity as how well the research instrument confirms the reality that is already known. Thus, unlike reliability, validity is concerned with the accuracy of the research instrument. Lack of validity therefore makes the results to be false or incompatible with the known truth. Just like reliability, validity can be grouped into different categories. According to Neuman (2014), there are four types of validity, namely construct validity, content validity, criterion validity and internal validity.

Internal validity is the ability of a research instrument to measure what the researcher wants to measure (Kumar, 2011). A valid questionnaire ought to measure the reality that the researcher intends to measure. The extent to which questions in a research instrument cover all the areas of concern that are supposed to be covered to address the research problem is the content validity (Saunders, *et al*., 2009). A valid research instrument should therefore comprise adequate questions to address all the issues the researcher intended to measure. Criterion-related validity is concerned with the extent to which the questions in the research instrument can predict a future outcome (Howitt and Cramer, 2011). Saunders, *et al.* (2009) argue that a valid research instrument has to be able to accurately predict future outcome of behaviour. Construct validity is the extent to which questions in the research instrument measure the constructs the researcher intended to measure (Neuman, 2014). A valid research instrument should therefore comprise questions that measure the relationships between variables that are postulated in the research hypotheses of the study.

Pilot testing of the questionnaire was also done to improve the validity of the research instrument. The pre-testing of the questionnaire was partly intended to evaluate if the questions in the research instrument were exhaustive in addressing the issues of health and safety on construction sites in the Gauteng Province. Allowing research participants to complete the questionnaires at their own time of appointment was also used to enhance validity of the research instrument. Finally, validity was also enhanced by attaching an informational cover letter to the questionnaires. The outlining of the purpose and significance of the research in the cover letter was essential in getting accurate responses from the research participants. This study used Pearson correlation to assess the validity of the research instrument. This is corroborated by Saunders, *et al.* (2009) who explain that correlation analysis is an appropriate way of measuring construct and criterion-related validity.

3.10 Data Analysis Strategies

Stata 13 has been used as the analytical statistical software. The quantitative research methodology employed in this study requires that quantitative analysis techniques be used for analysing the collected data. Two major quantitative analysis techniques are descriptive and inferential analysis (Bhattacherjee, 2012). The two analysis techniques were used in this study and are explained in the following sub-sections.

3.10.1 Descriptive Statistics Method

Descriptive analysis can be described as statistically describing, aggregating and presenting the constructs on which an investigation was focused (Bhattacherjee, 2012). This method was employed to provide a general overview of the results as it gives an idea of what is happening (Fellows and Liu, 2007; Wellman, *et al.*, 2007). Descriptive analysis assisted with measuring the awareness and understanding of the Construction Regulations by clients, consultants and contractors, the commitment of the three stakeholders in adopting the regulations and the impact of the adoption of the regulations on reducing accidents on construction sites in South Africa. The responses acquired are presented in percentages in relation to the total number of respondents that participated in the survey. The frequency distribution, measures of central tendency and measures of dispersion are variations of descriptive analysis that have been used in the study to describe aspects of the collected data (Bhattacherjee, 2012). Frequencies measure the number of times a phenomenon occurs (Mackey and Gass, 2005). The frequency distribution results are presented in graphs and tables. Mackey and Gass (2005) explain that measures of central tendency include mode, median, mean and outliers. Mean has been used in the study to understand the arithmetic average of scores presented in graphs and tables (Mackey and Gass, 2005). Measures of dispersion measure the variability in the scores of the constructs under investigation (Bhattacherjee, 2012). Range of scores has been used as a measure of dispersion in the research.

3.10.2 Inferential Statistics Method

Bhattacherjee (2012) defines inferential analysis as the statistical testing of hypotheses. According to Mackey and Gass (2005), inferential statistics make it possible for a researcher to generalise the research findings from the sample to the population. Inferential statistics were used to determine the correlation between the level of accident statistics and awareness of the Construction Regulations, as well as between the level of accident statistics and the implementation of Construction Regulations. The inferential statistics were also used to determine the correlation between accident statistics and commitment to Construction Regulations. The significance of the correlation between the variables was also evaluated using inferential statistics by way of probability values (p values). The significance of the correlation between the variables was also evaluated using inferential statistics (Naoum, 2007; Gill and Johnson, 2010).

3.11 Ethical Considerations

Research ethics can be defined as the moral principles that should be adhered to by researchers when conducting studies (Greener, 2008). Research ethics are made important by the fact that research participants and the researcher have different interests in the study. Adherence with the research ethics by the researcher is therefore intended to protect the interests of the research participants (Greener, 2008). Researchers are required to comply with research principles by professional bodies and research committees at universities for their studies to be approved (Howitt and Cramer, 2011). Failure to comply with research ethics can result in the researcher being reported to professional bodies for penalties (Howitt and Cramer, 2011). Complying with research ethics can also enhance the credibility of the study in the eyes of the public or the research participants (Greener, 2008). In fact, the targeted research participants would be willing to participate in a study if the researcher is complying with the research ethics (Greener, 2008). It is, therefore, of paramount importance for the researcher to be ethical during the course of conducting a study. Existing research ethics were complied with in this study. The next sections explain how the ethics were adhered to.

It is the requirement of the university for students to get ethical clearance before proceeding with data collection (Greener, 2008). An ethical clearance form was completed by the researcher and ethical clearance was granted by the university's research committee upon being satisfied with the researcher's ethical conduct. The granting of the ethical clearance by the university research committee gave the researcher the go-ahead to proceed with the research. Research participants ought to be given adequate information about the study, in order to make informed decisions about participating in the study (Bhattacherjee, 2012). In fact, it is unethical for a researcher to coerce research participants to take part in the study or trick them into participating (Bhattacherjee, 2012). The research participants of this study were given all the pertinent information of the study, through a cover letter that was attached to the questionnaire for them to make informed decisions about participating. The attachment of the informational cover letter assisted the research participants with understanding the purpose of the study, the fact that participation was voluntary and that their rights to confidentiality and anonymity would be respected in the study. The cover letter also made it clear that the research participants had the right to withdraw from the study at any time when they felt their rights were being violated.

Respecting of anonymity entails the concealing of the identity of the research participants in the research report, while confidentiality entails the respecting of the privacy of the respondents by keeping their private information secure (Saunders, *et al.,* 2009). Saunders, *et al.* (2009)

argue that the rights of the research participants ought to be respected in the research report by respecting their confidentiality and anonymity. No names of research participants and their companies had been reported in the research report, in order to conceal their identity. The private information of the research participants is also not reported in the research report, in order to protect them.

Researchers are required not to expose the research participants to any form of harm (Howitt and Cramer, 2011). The harm can either be in the form of physical harm of emotional harm (Kumar, 2011). There was no possibility of physical harm to the research participants who participated in this study. However, the possibility of emotional harm was a reality through sensitive questions. Pilot testing of the research instrument was also aimed at eliminating sensitive questions from the research instrument. Thus, the study complied with avoiding emotional harm to the respondents.

Researchers are also expected to be honest during the course of conducting a study (Greener, 2008). The honest conduct can be through recording data objectively, using appropriate research methods in conducting the study and not misleading readers in the research findings (Greener, 2008). Researcher bias in data collection was eliminated in the study by using self-administered questionnaires. The research participants completed the questionnaires on their own without undue influence from the researcher. The bias of the research participants was eliminated by the use of close-ended questions. Suitable research methods were employed in the study. All the research methods used in the study have been justified by what is reported in existing literature on research design and methodology. Finally, the reported research findings are the true outcome from the quantitative analysis employed in the study. Thus, the research findings have not been falsified.

3.12 Conclusion

This chapter outlined the research design and methodology that were used in the study. The study used the explanatory and descriptive research designs, as well as the quantitative research methodology that is compatible with the two research designs. The survey research strategy was used as the guiding strategy in data collection. A questionnaire which was compatible with survey strategy and the quantitative and qualitative research approaches was used in collecting data from a sample size of 30 contractors, 50 consultants and 10 clients who were selected at random. Two quantitative analysis methods, namely descriptive and inferential analysis, were used to make sense of the data that were collected. The results from the quantitative and qualitative analysis are presented and discussed in the next chapter.

4 CHAPTER FOUR: DATA PRESENTATION AND ANALYSIS

4.1 Introduction

The previous chapter discussed the research methods that were used in the data collection. This chapter presents the results from the descriptive analysis and inferential analysis. The results are further discussed and interpreted in the context of the existing literature. This chapter consists of three sections. Section one presents the results of quantitative descriptive data analysis, section two provides quantitative inferential data analysis whilst section three presents qualitative data analysis and the integration of quantitative and qualitative results. The research findings are discussed in four categories which are demographic information, participants' awareness of construction regulations, the extent of compliance with roles in construction regulations, the level of commitment to implement construction regulations and the impact of implementation of construction regulations on occurrence of accidents on construction sites. However, the response rate of the study is first discussed in this chapter, to evaluate the extent to which the research findings can be generalised.

4.2 SECTION 1 – QUANTITATIVE DESCRIPTIVE ANALYSIS

Section one begins by presenting the reliability test results. Cronbach's alpha test was performed to measure the reliability of the constructs. Thereafter, the demographic information of the respondents is provided. Descriptive data analysis comprises frequency distribution, standard deviations, means, graphs and pie charts.

4.2.1 Demographic Profiles of Respondents

To reiterate, descriptive data analysis involves calculating the measures of central tendency and the variation of the data, frequency or percentage distribution and graphic representation of data, which includes pie charts, bar diagrams, histograms, and graphs.

The questionnaire was divided into two sections, namely Part 1: Demographic information and Part 2: Questions that covered the research questions.

Part 1 of the questionnaire collected data on respondents' demographic profiles, including their gender, profession, academic qualifications, years in the construction industry and training in Construction Regulations related courses. A total of 132 responses were received out of target sample of 210 respondents and included in the analysis, giving a response rate of 62%.

4.2.2 Reliability

According to Leedy and Ormrod (2010), reliability is often used in connection with measurement. The reliability of a research study results informs whether a researcher would expect to acquire similar findings if she or he tried again in a similar way (Ary, *et al.,* 2009). Reliability is regarded as the tendency of the respondent to answer in a similar or common fashion to an identical query. Reliability is mainly adversely affected by the unstable errors, as these generate a low reliability in measuring instruments.

A good measure should be reasonably reliable, it should yield consistent results. When measurements are unreliable, it may lead to two problems (Leedy and Ormrod, 2010). Low reliability may imply that the measure is not valid and when researchers conduct statistical analyses, such as correlations, to assess how scores on a variable are related to scores on another variable, the relationship becomes weaker as the reliability of one or both variables becomes smaller. Alternatively, when a researcher has unreliable measures, relationships between variables usually appear to be weaker (Warner, 2009). The reliability in this study was assessed using Cronbach's alpha coefficient, where alpha coefficients greater than 0.7 were accepted and this is illustrated in Table 4.1.

Table 4.1: Reliability Test Results

Serial No.	Construct	Cronbach's Alpha
1	Awareness	0.72
2	Extent of Performance (Clients)	0.75
3	Extent of Performance (Consultants)	0.85
4	Extent of Performance (Contractors)	0.97
5	Commitment	0.95
6	Implementation of Construction Regulations	0.87
Average		**0.85**

The above alpha coefficients of greater than 0.7 indicate that the measurements of the questionnaire used in this study's data collection were consistent. If the research instrument is to be tested repeatedly on a population with the same characteristics, almost the same study results will be confirmed. Thus, the results of this study are reliable.

4.2.3 Response Rate

The sampling design of the study was primarily focused on selecting 30 contractors, 10 contractors from each of the target grades of 9, 8 and 7 as per CIBD registration, 10 clients and 50 consultants. However, only 19 contractors, 6 clients and 31 consultants participated in the study. This means the response rate was 63% for contractors, 60% for clients and 62% for consultants. Table 4.2 presents the overall response rate for the three classes of the research participants.

Table 4.2: Response Rate

Sample	Response	Non-Response	Target	Response Rate	Non-Response Rate
Contractors	19	11	30	63%	37%
Clients	6	4	10	60%	40%
Consultants	31	19	50	62%	38%
Total	**56**	**34**	**90**	**62%**	**38%**
Response Rate	**62%**	**38%**	**100%**		

Figure 4.1: Response Rate

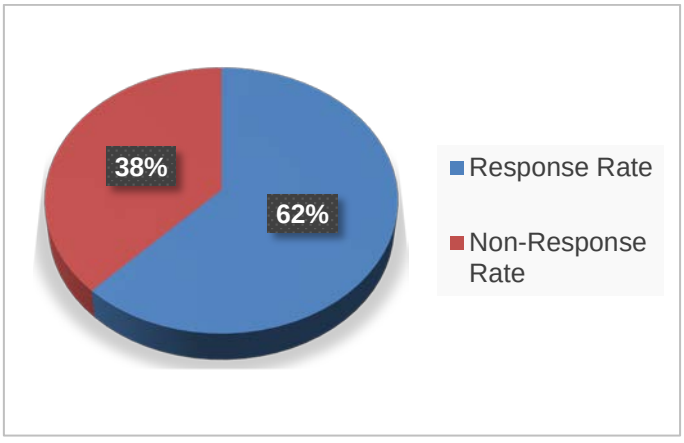


Figure 4.1 indicates that the overall response rate for the study was 62%. Response rate for questionnaires are generally low (Gill and Johnson, 2010; Bhattacherjee, 2012). Saunders, *et al.* (2009) argue that the acceptable response rate for questionnaires should be a minimum of 35%. The overall response rate of 62% for this study is above the recommended low response rate for questionnaires. This means that the sample error, as a result of non-response rate, is within the acceptable range. The results can therefore be generalised to the contractors, consultants and the clients in the Gauteng Province.

4.3 Part 1 - Participants' Demographic Information

The research instrument had 7 questions measuring the demographics of the research participants. The results from the demographic questions are presented and discussed in this section. An evaluation of the demographic characteristics of the research participants is important in order to determine the extent to which the research findings can be generalised to the population (Gill and Johnson, 2010; Howitt and Cramer, 2011; Bhattacherjee, 2012; Fox and Bayat, 2012). The results in the next sub-sections are therefore to determine the extent to which the findings of this study can be inferred to contractors, clients and consultants in the Gauteng Province.

4.3.1 Gender Distribution

Of the 132 respondents who participated in the study, 92 of them (70.0%) were males, whilst 40 (30.0%) were females. This indicates that the construction industry is currently dominated by males. The gender distribution of the research participants is depicted in Figure 4.2 and Table 4.3.

Figure 4.2: Gender Distribution

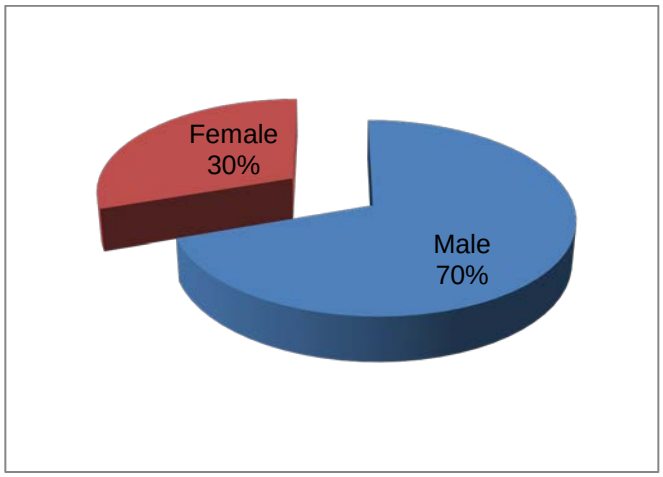


Table 4.3: Gender Distribution

Serial No.	Gender	Frequency	Percentage (%)
1	Male	92	70
2	Female	40	30
Total		**132**	**100**

Thus, the results of the study are skewed towards the views of the male research participants. However, the inclusion of both male and female research participants indicates that the research findings can be inferred to both male and female representatives of the contractors, the clients and the consultants.

4.3.2 Participants' Professions

Table 4.4 represents the professions of the representatives of the contractors, the consultants and the clients that participated in the study.

Table 4.4: Participants' Distribution of Professions

Ser. No.	Profession	Frequency	Percentage (%)
1	Development Manager	4	3.0
2	Project Manager	7	5.3
3	Architect	5	3.8
4	Quantity Surveyor	6	4.5
5	Property Manager	2	1.5
6	Engineer	7	5.3
7	Contracts Director	19	14.4
8	Contracts Manager	19	14.4
9	Health and Safety Consultant	6	4.5
10	Site Agent	19	14.4
11	Safety, Health and Environmental Officer	13	9.8
12	Health and Safety Manager	6	4.5
13	Contracts Surveyor	19	14.4
Total		**132**	**100.0**

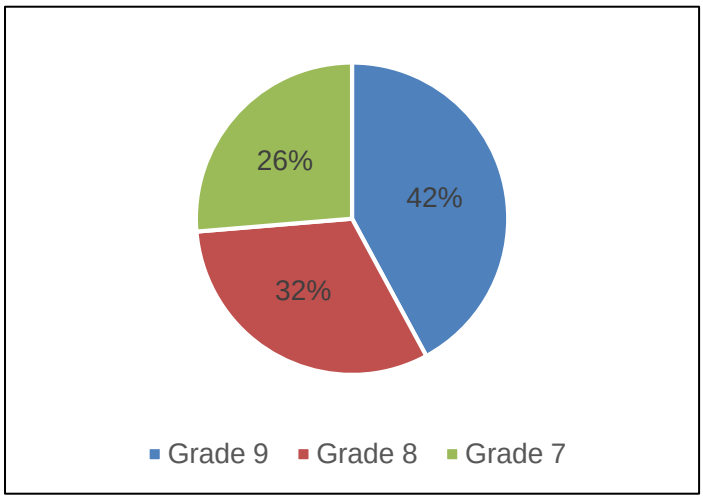
The results above reveal that the research participants were distributed across 13 professions that are critical in the construction sector. The most represented participants were the contracts managers, contracts directors, site agents and contracts surveyors, who had a representation of 14.4% each. The least represented were property managers (1.5%), followed by development managers (3.0%) and then the architects (3.8%). Safety, health and environmental officers (SHE) amounted to 9.8% of the research participants, while project managers and engineers were represented by 5.3%. Quantity surveyors, health and safety consultants, as well as the health and safety managers were each represented by 4.5% in

the group of the participants. The research findings can therefore be generalised to the 13 classes of professionals working in the Gauteng Province. These professions cover property development, project management, architecture, quantity surveying, health and safety, engineering and contract management.

4.3.3 Grading of Contractors

The research participants representing contractors were asked to specify the CIDB (Construction Industry Development Board) grading level for their company. There are 3 classes of grades, namely grade 9, 8 and 7. In terms of value of work undertaken by the different grades of contractors, grade 9 contractors execute projects exceeding R130 million, grade 8 contractors execute projects between R40 and R130 million, whilst grade 7 contractors qualify to undertake projects ranging between R10 and R40 million. Figure 4.3 depicts the distribution of the participants' companies in the 3 grades.

Figure 4.3: Grading Distribution



Grade 9 contractors were the most represented, with a representation of 42%, followed by grade 8 contractors who were represented by 32%. Thus, grade 7 contractors were the least represented companies, with a representation of 26%. The results of the study are slightly skewed towards the views of representatives from grade 9 companies. However, the research findings can be inferred to the 3 classes of the contractors, since all the grades were represented in the group of the research participants.

4.3.4 Participants' Academic Qualifications

Table 4.5 summarises the educational qualifications for the representatives of the clients, the contractors and the consultants who participated in the study.

Table 4.5: Participants' Academic Qualifications

Ser. No	Academic Qualification	Frequency	Percentage (%)
1	Doctorate	0	0.0
2	Masters	8	6.1
3	Bachelor	62	47.0
4	National Diploma	52	39.4
5	Other	10	7.5
Total		**132**	**100.0**

Figure 4.4: Academic Qualification

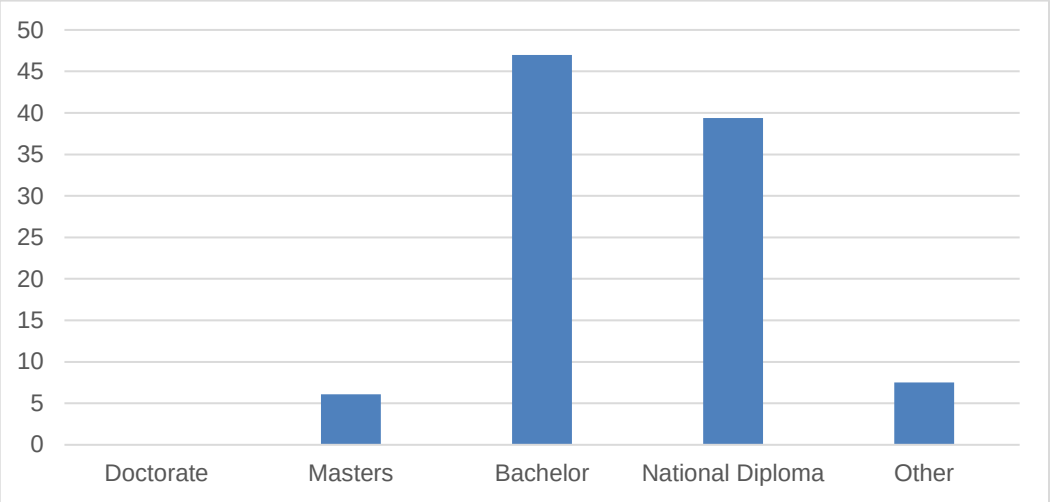


Table 4.5 and Figure 4.4 show the frequency distribution for the participants' academic qualifications. Most of the research participants held Bachelor's degrees (47%), followed by the holders of National Diploma (39.4%). Respondents who held a Master's degree were 6.1% and 5% held the National Certificate. The least represented participants held an Honour's degree (3%) and there were no respondents holding Doctorate degrees. The results of the study are therefore largely dominated by the views of the holders of Bachelor's degree and National Diploma Certificate. The research findings of the study can therefore be

generalised to the holders of Master's degree, Bachelor's degree, Honour's degree, National Diploma and National Certificate that are attached to the contractors, clients and consultants in the Gauteng Province. The results cannot, therefore, be inferred to holders of Doctorate degrees in the Gauteng Province.

4.3.5 Duration of Employment in the Construction Industry

Table 4.6 indicates that most of the respondents had been in the construction industry for over 5 years, the majority having been in the industry for 5 – 10 years (30.3%), 11 – 20 years (29.5%) and 21 – 30 years (18.9%). The results are therefore revealing that the research findings can be generalised to professionals that had worked for less than 5 years to more than 30 years in the construction sector. Table 4.6 illustrates this description.

Table 4.6: Number of Years in Construction Industry

Ser. No	Years	Frequency	Percentage (%)
1	<5	21	15.9
2	5 – 10	40	30.3
3	11 – 20	39	29.5
4	21 – 30	25	18.9
5	>31	7	5.3
Total		**132**	**100.0**

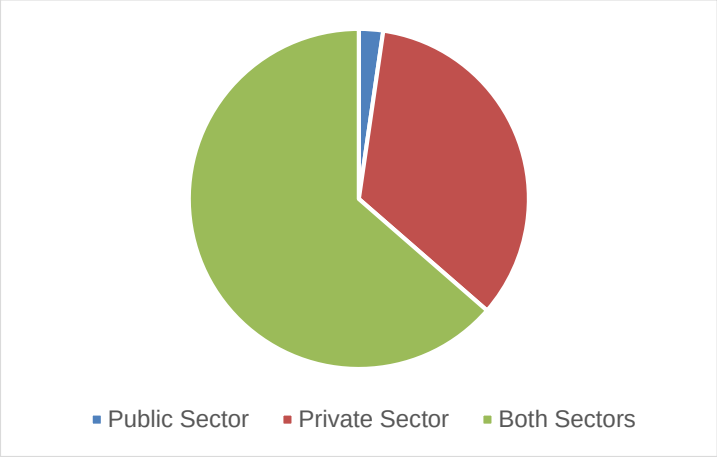
4.3.6 Nature of Projects

The majority of the projects that the participants were engaged in were both public and private (63.6%), as shown in Table 4.7 and Figure 4.5. All the research participants were employed on a full-time basis. There were no research participants who were either employed on part time basis, or unemployed. The findings of the study can therefore be generalised to professionals in project management, property development, health and safety, quantity surveying, contracts management and architecture engineering, who were employed on a full-time basis in the Gauteng Province.

Table 4.7: Nature of Projects

Ser. No	Nature	Frequency	Percentage (%)
1	Public Sector	3	2.3
2	Private Sector	45	34.1
3	Both Sectors	84	63.6
Total		**132**	**100.0**

Figure 4.5: Sector of Employment



4.3.7 Training in Construction Regulations Related Courses

Table 4.8 indicates that most of the respondents (74.2%) had been trained in Construction Regulations related courses, whilst 20.5% had not been trained and 5.3% were not sure. Given that the majority of the research participants had been trained on Construction Regulations, this implies that they gave informed answers on the study's questions. This also enhanced the credibility of the answers provided by these research participants. The findings of the study can therefore be generalised to both professionals in the Gauteng Province's construction sector, who would have been trained and not trained on Construction Regulations.

Table 4.8: Construction Regulations Training

Ser. No	Response	Frequency	Percentage (%)
1	Yes	98	74.2
2	No	27	20.5
3	Unsure	7	5.3
Total		**132**	**100.0**

4.4 Part 2 – Health and Safety Practice and Legislation

4.4.1 Level of Awareness and Understanding of the Construction Regulations

The research instrument had 8 questions which sought to evaluate the respondents' level of awareness and understanding of obligations stipulated in the Construction Regulations. The results from the 8 questions are presented and interpreted in this section.

Sub-Question 1

What is the level of awareness and understanding of the obligations of Construction Regulations in South African construction industry?

Note:

Scale of 1-5, 1 = never, 2 = rarely, 3 = sometimes, 4 = very often and 5 = always were used on questions 8 to 11.

Scale of 1-5, 1 = very low, 2 = low, 3 = moderate, 4 = high and 5 = very high were used on question 12.

Scale of 1-5, 1 = strongly disagree, 2 = disagree, 3 = unsure, 4 = agree and 5 = strongly agree were used on questions 13 and 14.

Table 4.9: Level of Awareness and Understanding

Ser. No.	Question	1	2	3	4	5	Mean (std. dev.)
8	Have you ever heard of the construction regulations?	1 (.8)	3 (2.3)	15 (11.4)	45 (34.1)	68 (51.5)	4.3 (.8)
9	Are there any available training opportunities on the Construction Regulations?	4 (3.0)	19 (14.4)	32 (24.2)	42 (31.8)	35 (26.5)	3.6 (1.1)
10	Do you think it must be compulsory for any entity involved in the construction industry to have training and understanding of the Construction Regulations?	0 (0.0)	0 (0.0)	6 (4.5)	25 (18.9)	101 (76.5)	4.7 (.5)
11	Are there any challenges in the implementation of the health and safety regulations?	4 (3.0)	19 (14.4)	67 (50.8)	29 (22.0)	13 (9.8)	3.2 (.9)
12	What is your level of understanding of the requirements of the Construction Regulations?	2 (1.5)	9 (6.8)	30 (22.7)	62 (47.0)	29 (22.0)	3.8 (.9)
13	In your opinion, do you think the Construction Regulations are easy to implement?	1 (.8)	19 (14.4)	47 (35.6)	56 (42.4)	9 (6.8)	3.4 (.8)
14	Do you think there are sections in the Construction Regulations that should be changed or modified?	34 (25.8)	31 (23.5)	40 (30.3)	22 (16.7)	5 (3.8)	2.5 (1.1)
Total							**3.7 (.6)**

NB: Bracketed ** - Percentage; Not bracketed * - Frequency

Results in Table 4.9 for question 8 reveal that only 0.8% of the respondents had never heard about the construction regulations, 2.3% rarely heard about the regulations and 11.4% sometimes heard about the construction regulations. Most of the research participants (51.5%) always heard about the construction regulations followed by 34.1% that very often heard about the regulations. Thus, 99.2% of the respondents had some knowledge of the construction regulations as they have heard about them. It can therefore be concluded that

the majority of construction industry players in the Gauteng Province are aware of the construction regulations. Knowledge of construction regulations improves the health and safety awareness of the majority of the construction industry players. This is because the construction regulations acknowledge the roles of different players in enhancing health and safety of stakeholders in the construction industry (Smallwood, 2007; CIDB, 2009a). Baxendale and Jones (2000) argue that awareness of the construction regulations acts as a stimulus to comply with related health and safety regulations.

Results in Table 4.9 for question 9 confirm that 3% of the research participants were of the perception that there are never training opportunities on the construction regulations, 14.4% believed the training opportunities are rarely there and 24.2% were of the opinion that the training opportunities are sometimes there. The largest proportion of the respondents (31.8%) believed that the training opportunities are very often there followed by 26.5% that perceived that the training opportunities are always there. Thus, the view of the majority of the research participants was that there are training opportunities on construction regulations for construction industry players in the Gauteng Province as only 3% of the research participants were emphatic that the training opportunities are non-existent. The availability of training opportunities to the majority of the players in the construction industry can help with better understanding of the regulations for most of the players in the Gauteng Province. The better understanding of the regulations is critical in reducing the rate of accidents at construction sites (CIDB, 2009a). It is therefore crucial for stakeholders in the construction industry to undergo training on construction regulations to reduce rate of accidents in the province.

The importance of undergoing training on construction regulations was supported by the majority of research participants as confirmed by results for question 10 in Table 4.9. Research participants that believed that it is always important for every entity involved in construction to undergo training were 76.5% followed by 18.9% that were of the opinion that every entity involved in construction ought to very often undergo training on the regulations. The remaining proportion of 4.5% of the respondents was of the opinion that entities in the construction industry always have to take part in training on construction regulations. Thus, all the research participants were in agreement that entities in the construction industry ought to take part in training on construction regulations to a certain degree. This indicates that almost all players in the Gauteng Province's construction industry value the training on construction regulations. This is likely due to the importance of knowledge of the regulations in reducing the rate of accidents in the industry (CIDB, 2009a).

The research participants were also asked if there are any challenges faced in the implementation of health and safety regulations. Only 3% of the respondents were of the view that challenges are never experienced when implementing the health and safety regulations while 14.4% believed that rarely the challenges are faced. Most of the research participants (50.8%) perceived that sometimes challenges are experienced when implementing the regulations followed by 22% who were of the view that very often challenges are experienced when implementing health and safety and regulations. The remaining proportion of 9.8% had a belief that always challenges are faced when implementing the construction regulations. The results therefore indicate that the majority of construction industry players in the Gauteng Province are experiencing challenges in implementation of the construction regulations. The prevalence of the challenges in the implementation of the regulations may explain the high accident rates in South Africa despite the adoption of the construction regulations (FEMA, 2013). This indicates that the rate of construction industry accidents cannot simply be reduced by adoption of the construction industry. There is also a need to manage the challenges that are experienced in the implementation process.

The respondents were further asked of their level of understanding on the requirements of the construction regulations. Respondents who were of the view that they had very low understanding of the requirements of the construction regulations were 1.5% and 6.8% were of the view that they had low understanding of the requirements of the regulations. Research participants that perceived they had moderate understanding were 22.7% while 22% believed that they had very high understanding. The highest number of the respondents (47%) was of the view that they had high understanding of the construction regulations. Thus, 69% of the respondents believed that they had high and very high understanding of the construction regulations. Based on the view of 69% of the respondents, it can thus be concluded that the majority of players in the Gauteng Province's construction industry believe that they have high and very high understanding of the construction regulations. The high and very high understanding of the construction regulations is necessary in improving health and safety in the industry which in turn can bring down the accident rate (Smallwood, 2007; CIDB, 2009a). The perceived high and very high understanding of the construction regulations can be attributed to the availability of training opportunities on the regulations.

The consultants, contractors and clients that took part in the study were further asked if they think construction regulations are easy to implement. Respondents that strongly disagreed and disagreed that the construction regulations are easy to implement were 15.2% (0.8% plus 14.4%) while 35.6% were not sure. The remaining proportion of 49.2% (42.4% plus 6.8%)

strongly agreed and agreed that the construction regulations are easy implement. A minority of clients, contractors and consultants therefore believe that it is difficult to implement the construction regulations. This can be as a result of the challenges associated with implementation of the regulations (FEMA, 2013). However, there is a large proportion of clients, contractors and consultants that are not sure if implementation of the regulations is easy. This indifference may be attributed to mixed experience in the implementation of the construction regulations. The clients, consultants and contractors might have implemented part of the regulations easily and the other part not so easily. The results point out that the largest number of clients, consultants and contractors in the Gauteng Province's construction industry find it easy to implement the construction regulations. This may be as a result of the availability of training opportunities on the construction regulations.

In the last question Table 4.9, the respondents were asked if there are sections in the construction regulations that should be changed. The largest proportion of 49.3% (25.8% plus 23.5%) of the respondents strongly disagreed and disagreed that there are sections of the construction regulations that require changing. Thus, most of the clients, consultants and contractors in the Gauteng Province's construction industry have confidence in the construction regulations in enhancing health and safety in the industry such that they see no need of amending the construction regulations. A proportion of 30.3% of the respondents were not sure if there are sections of the construction regulations that need to be amended. This indifference can be as a result lack of knowledge for all the sections of the construction regulations which makes it difficult for the respondents to be in agreement or disagreement with the statement. Research participants that strongly agreed and agreed that there are sections in the construction regulations that require amending were 20.5% (16.7% plus 3.8%). Thus, there are a minority of clients, consultants and contractors in the Gauteng Province's construction industry that believe the construction regulations have to be amended for them to be effective in enhancing health and safety in the industry. The need to amend the construction regulations may be supported by Smallwood (2007); Seevaparsaid-Mansingh and Haupt (2008) who argue that despite the existence of health and safety regulations accidents have continued unabated. Deficiencies in the construction regulations may be reason accidents in the construction industry continue to occur.

4.4.2 Extent of Performance by the Clients, Consultants and Contractors

The research instrument had 4 questions which sought to establish the respondents' extent to which the clients, consultants and contractors performed their roles as stipulated in Construction Regulations. The results from the 4 questions are presented and interpreted in this section.

Sub-Question 2

To what extent are the clients, consultants and contractors performing their roles as stipulated in the Construction Regulations?

Question 16

According to the Construction Regulations, clients, designers and contractors have some duties to fulfil in order to ensure compliance with the Regulations. On that note, the participants were asked if they were performing any of the roles listed in the tables below.

Note:

On a scale of 1-5, 1 = strongly disagree, 2 = disagree, 3 = unsure, 4 = agree and 5 = strongly agree was used on this question. **Are you performing the following roles during the course of your duties?**

16.1 Clients

Table 4.10: Performance of Roles by Clients

Ser. No.	Question	1	2	3	4	5	Mean (std. dev.)
16.1.1	Perform risk assessment for intended construction project.	0 (0)	0 (0)	2 (33.3)	1 (16.7)	3 (50.0)	4.2 (1.0)
16.1.2	Include the health and safety specification in the tender documents.	0 (0)	1 (16.7)	1 (16.7)	2 (33.3)	2 (33.3)	3.8 (1.2)
16.1.3	Appoint contractors with the necessary competences and safety measures.	0 (0)	0 (0)	0 (0)	4 (66.7)	2 (33.3)	4.3 (.5)

16.1.4	Ensure the appointed contractors have the necessary health and safety plan.	0 (0)	0 (0)	1 (16.7)	3 (50.0)	2 (33.3)	4.2 (.8)
16.1.5	Ensure periodic health and safety audits are conducted on the contractors.	0 (0)	0 (0)	1 (16.7)	4 (66.6)	1 (16.7)	4.0 (.6)
16.1.6	Stop contractors from executing a project that poses a threat to the health and safety of persons on site.	0 (0)	0 (0)	0 (0)	3 (50.0)	3 (50.0)	4.5 (.5)
16.1.7	Avail sufficient or additional information in the case of change in project scope.	0 (0)	0 (0)	1 (16.7)	3 (50.0)	2 (33.3)	4.2 (.8)
16.1.8	Provide a report to the provincial director when a fatality or permanent disabling injury occurs on site.	0 (0)	0 (0)	2 (33.3)	1 (16.7)	3 (50.0)	4.2 (1.0)
16.1.9	Ensure all appointed contractors are cooperating and complying with the health and safety Regulations.	0 (0)	0 (0)	1 (16.7)	2 (33.3)	3 (50.0)	4.3 (.8)
16.1.10	Appoint a competent agent to act as a representative where a construction work permit or notification of construction work is required.	0 (0)	0 (0)	1 (16.7)	1 (16.7)	4 (66.6)	4.5 (.8)
16.1.11	Ensure that the agent manages health and safety on site and that he/she is registered with a suitable statutory body.	0 (0)	0 (0)	0 (0)	3 (50.0)	3 (50.0)	4.5 (.5)
Total							**4.2 (.4)**

NB: Bracketed ** - Percentage; Not bracketed * - Frequency

Clients play a significant role in construction health and safety (Smallwood, 2002). Results in Table 4.10 are largely indicating that clients that took part in the study perform roles stipulated in the construction regulations. The largest proportion of 66.7% (50% plus 16.7%) of the respondents strongly agreed and agreed that they perform risk assessment for intended construction projects. However, 33.3% were unsure if they perform risk assessment for intended construction projects. It can therefore be concluded that most of the clients in Gauteng Province's construction industry assess risks in intended projects. However, there

are also a large proportion of clients in the province that are not sure if they are assessing risks for intended construction projects. This indifference might be as a result of lack of specific objectives focused on risk assessment in intended construction projects.

The clients that took part in the study were also asked if they incorporate health and safety specifications in the tender documents for pricing by the contractors. Clients that were in disagreement that they include health and safety specifications in tender documents were 16.7%. The failure to include health and safety specifications in tender documents by a minority of clients may lead to increased accidents on construction sites in the Gauteng Province. However, the majority of the clients in the Gauteng Province's construction industry are incorporating health and safety specifications in tender documents which is crucial in reducing accidents at construction sites (Laryea and Mensah, 2010). This was confirmed by 66.6% (33.3% plus 33.3%) of the responding clients that strongly agreed and agreed that they incorporate health and safety specifications in the tender documents. The remaining minority (16.7%) of the clients that took part in the study were not sure if they include health and safety specifications in the tender documents.

All the clients in the Gauteng Province's construction industry appoint contractors with necessary competence and safety measures. This was confirmed by 100% (66.7% plus 33.3%) of the responding clients that strongly agreed and agreed that they appoint contractors with the necessary competence and safety measures. The appointment of contractors with the necessary competence and safety measures in crucial in successful completion of the projects as well as ensuring health and safety at the construction sites (Smallwood, 2002).

The clients that participated in the study were also asked if they ensure that the appointed contractors have health and safety plan. A minority of 16.7% of the clients were not sure if they ensure that the appointed contractors have health and safety plan whilst 83.3 (50% plus 33.3%) were of the view that they appoint contractors with health and safety plan. Thus, the majority of clients in the construction industry of the Gauteng Province appoint contractors with health and safety plan. This is crucial in reducing rate of accidents at the construction sites.

The clients were also asked if they ensure that periodic health and safety audits are conducted on the contractors. The respondents that were in agreement that they ensure that periodic health and safety audits are conducted on contractors were 83.3% (66.6% plus 16.7%) while 16.7% were not sure. These results point out that the majority of clients in the

Gauteng Province's construction industry take an active role in ensuring health and safety audits are conducted periodically on contractors. Conducting health and safety audits on contractors is critical in lowering injury rate at the construction sites (Smallwood, 2002). Majority of the clients in the province are therefore actively involved in lowering injury rates at construction rates through ensuring conducting of health and safety audits on contractors.

All clients (100%) that took part in the study were of the opinion that they stop contractors from executing a project that poses a threat to the health and safety of persons on site. This was in accordance with 50% of the clients that strongly agreed and the other 50% that agreed that they stop contractors from executing projects that pose a threat to health and safety of persons on site. Discontinuing of projects that pose a threat to the health and safety to people on site is crucial in reducing injury rate at the construction site (Smallwood, 2002). It can thus be concluded that all clients in the construction industry of the Gauteng Province are actively involved in reducing rate of accidents on construction sites by stopping construction projects that pose a risk to people on site.

The study also evaluated if clients availed sufficient or additional information in the case of change in project scope. There were no clients that were in disagreement while 16.7% were not sure if they provide additional information in the case of change in the project scope. Thus, 83.3% (50% plus 33.3%) were in agreement that they provide additional information in the case of change in project scope. Provision of additional information by the clients is important to ensure successful completion of the construction project by the contractor in the face of change in project scope. The contractors have to be given all pertinent information relating to the change in project scope for them to also change their project implementation plan. Most of clients in the Gauteng Province's construction industry are therefore setting contractors for successful completion of the projects by providing additional information in the case of change in project scope.

The participating clients were also asked if they provide a report to the Department of Labour provincial director in the case of a fatality or if a permanent disabling injury occurs at a construction site. There were no clients that were in disagreement that they provide the report to the provincial director while 33.3% were not sure. The clients that were in agreement that they provide a report to the provincial director in the case of a fatality or disabling permanent injury were therefore 66.7% (50% plus 16.7%). The results are therefore indicating that the majority of clients in the province's construction industry provide a report to the provincial director whenever fatality or disabling permanent injury occurs at a construction site. This

helps with maintaining accurate accident rates at construction sites in the Gauteng Province's construction industry.

The study also investigated if the clients ensure all appointed contractors are cooperating and complying with health and safety regulations. The least represented clients (16.7%) were not sure if they are performing the role of ensuring the appointed contractors cooperate and comply with the health and safety regulations while 83.3% (33.3% plus 50%) were in agreement that they are performing the role. It can therefore be concluded that the majority of clients in the province are ensuring that the appointed contractors are cooperating and complying with health and safety regulations. This is crucial in eliminating or reducing the prevalence of accidents at the construction sites in the province (Smallwood, 2002).

The study also evaluated if the clients appoint a competent agent to act as a representative where a construction work permit or notification of construction work is required. No clients were in disagreement that they appoint an agent to act as their representative while 16.7% were neutral. The remaining proportion of 83.3% (66.6% plus 16.7) of the responding clients were in agreement that they appoint an agent as a representative where a construction work permit or notification of construction work is required. Thus, the majority of clients in the province are complying with the requirement of appointing competent agents to act as representative where construction work or notification of construction work is required. The compliance by the majority of the clients is essential in ensuring health and safety at the construction sites.

The responding clients were further asked if they ensure that the appointed agent manages health and safety at construction site and that he or she is registered with a suitable statutory body. All the responding clients (50% plus 50%) were of the view that they ensure that the appointed agent manages health and safety at the construction site and that he or she is registered with a suitable statutory body. Thus, clients in the Gauteng Province's construction industry ensure the appointed agents manage health and safety at construction sites and that the agents are registered with a suitable statutory body. This will further assist clients with contributing to the reduction in injury rates at the construction sites in the Gauteng Province.

16.2 Consultants / Designers

Table 4.11: Performance of Roles by Consultants

Ser. No.	Question	1	2	3	4	5	Mean (std. dev.)
16.2.1	Provide and demonstrate to the client a suitable, sufficiently documented and coherent site-specific health and safety plan.	0 (0.0)	1 (3.2)	3 (9.7)	9 (29.0)	18 (58.1)	4.4 (.8)
16.2.2	Open and keep on site a sufficiently documented health and safety file.	1 (3.2)	4 (12.9)	3 (9.7)	12 (38.7)	11 (35.5)	3.9 (1.1)
16.2.3	Appoint sub-contractors with the necessary competences and resources to execute work safely.	2 (6.5)	0 (0.0)	7 (22.6)	10 (32.3)	12 (38.7)	4.0 (1.1)
16.2.4	Ensure all sub-contractors cooperate with each other in complying with the Regulations.	2 (6.5)	1 (3.2)	2 (6.5)	17 (54.8)	9 (29.0)	4.0 (1.0)
16.2.5	Ensure employees undergo health and safety induction training pertaining to hazards prevalent on site before commencing work.	2 (6.5)	1 (3.2)	9 (29.0)	11 (35.5)	8 (25.8)	3.7 (1.1)
16.2.6	Ensure visitors undergo health and safety induction training pertaining to hazards prevalent on site and provides them with personal protective equipment.	2 (6.5)	3 (9.7)	4 (12.9)	13 (41.9)	9 (29.0)	3.8 (1.2)
16.2.7	Keep records of all health and safety inductions conducted on site and make file available for inspection by an inspector, client or his agent.	2 (6.5)	1 (3.2)	2 (6.5)	9 (29.0)	17 (54.8)	4.2 (1.1)
Total							**4.0 (.8)**

NB: Bracketed ** - Percentage; Not bracketed * - Frequency

Consultants also play a crucial role in ensuring health and safety at construction sites (CIDB, 2009a). The Construction Regulations provide a list of roles that are supposed to be performed by the consultants in pursuit of promoting health and safety at construction sites. The extent to which consultants comply with roles stipulated in the Construction Regulations is shown by the results in Table 4.11.

The consultants were first asked if they provide and demonstrate to the client a suitable, sufficiently documented and coherent site-specific health and safety plan. Only 3.2% of the responding consultants were in disagreement that they provide a suitable, sufficiently documented and coherent site-specific health and safety plan to the client while 9.7% were not sure. A minority of consultants that are failing to provide an appropriate construction site health and safety plan might be contributing to poor health and safety at construction sites in the Gauteng Province. However, the majority of consultants in the Gauteng Province are contributing to improved health and safety at construction sites through provision of appropriate construction site specific health and safety plan. This is corroborated by 87.1% (29% plus 58.1%) of the responding consultants that were in agreement that they provide a suitable, sufficiently documented and coherent construction site specific health and safety plan.

The study further evaluated if the consultants open and keep a sufficiently documented health and safety file on construction site. A small proportion of 16.1% (3.2% plus and 12.9%) were in disagreement that they open and keep a sufficiently documented health and safety file on construction site while 9.7% were not sure if they open and keep the file. It can be concluded from the results that there is a minority of consultants in the Gauteng Province that are failing to open and keep a sufficiently documented health and safety file on construction site. The non-performance of this role by a minority of consultants contributes to poor health and safety at construction sites in the Gauteng Province. However, the majority of consultants are contributing to improved health and safety at construction sites in the province by opening and keeping a sufficiently documented health and safety file at construction sites. This is supported by 74.2% (38.7% plus 35.5%) of the responding consultants that were of view that they open and keep a sufficiently documented health and safety file at construction site.

The responding consultants were also asked of their views on whether they appoint sub-contractors with the necessary competences and resources to execute work safely. A mere 6.5% of the respondents were in disagreement that they appoint sub-contractors with the necessary competences and resources to do work safely whilst 22.6% were neutral. Thus, there are a minority of consultants in the construction industry of Gauteng Province that are not appointing-contractors with the necessary competences and resources to execute project work safely. If the disagreement by this minority means the consultants are appointing incompetent and deficiently resourced sub-contractors, some construction projects are likely to be completed unsuccessfully as well as with high rate of injury rate. The majority of the consultants (71%) that took part in the study were in agreement that they appoint sub-

contractors with the necessary competences and resources to execute project work. This makes it valid to suggest that the majority of consultants in the Gauteng Province's construction industry appoint sub-contractors with the necessary competences and resources to execute project work. Cheng, *et al*. (2004) argue that sub-contractors work closely with workers at the construction sites which makes it important for the sub-contractors to be competent and resourceful in order to execute the project work safely. Most of the consultants in the Gauteng Province's construction industry are therefore putting measures in place to protect employees that are working closely with sub-contractors.

The study also evaluated if consultants ensure that all sub-contractors cooperate with each other in complying with the regulations. Monitoring the cooperation of sub-contractors is important as sub-contractors are perceived to overlook the importance of H&S and sometimes violated safety practices for the purpose of keeping up with the project schedule (Cheng*, et al.*, 2004). Respondents that strongly disagreed and disagreed they ensure that all sub-contractors cooperate with each other in complying with regulations were 9.7% (6.5% plus 3.2%) whilst 6.5% were unsure. The remaining proportion of 83.8% (54.8% plus 29%) strongly agreed and agreed that they ensured that all sub-contractors cooperate with each other in complying with the regulations. Thus, the majority of the consultants in the province are ensuring that all sub-contractors involved in construction projects work for the common good in enhancing health and safety of workers at construction sites.

An assessment was also made to determine if the consultants ensure that employees undergo health and safety induction training pertaining to hazards prevalent on site before commencing work. Consultants that were not sure were 29% while 9.7% (6.5% plus 3.2%) were in disagreement. There is therefore a small proportion of consultants in the Gauteng Province's construction industry that are not ensuring that employees undergo induction training on health and safety pertaining to hazards that are common at construction sites before work begins. Failure to make employees undergo this training exposes the employees to these hazards which in-turn has the effect of increasing the injury rate at the construction sites. Nevertheless, the majority of consultants in the province's construction industry are actively taking a lead in limiting the possibility of injury to employees due to hazards that are prevalent at construction sites. This is corroborated by 61.3% (35.5% plus 25.8%) of the responding consultants that strongly agreed and agreed that they ensure employees undergo health and safety induction training pertaining to hazards that are prevalent at the construction sites.

Construction Regulations do not only focus on protecting employees at construction sites but also visitors that come from time to time. The consultants that took part in the study were therefore also asked if they ensure that visitors undergo health and safety induction training pertaining to hazards prevalent on site as well as providing visitors with personal protective equipment. A mere 16.2% (6.5% plus 9.7%) of the consultants were in disagreement that they send visitors for induction training and give the visitors protective equipment while 12.9% were neutral. Thus, only a minority of consultants in the Gauteng Province's construction industry are failing to send visitors for inductive training and giving them protective equipment to protect them from hazards prevalent at the construction sites. The remaining 70.9% (41.9% plus 29%) of the consultants were in agreement that they ensure visitors undergo health and safety induction training and give the visitors protective personal equipment to protect them from hazards that are common at construction sites. Thus, visitors at construction sites for the majority of the consultants are protected from common hazards due to the induction training and giving them personal protective equipment.

Finally, the consultants were asked if they keep records of all health and safety inductions conducted on site and make the file available for inspection by an inspector, client or his agent. A proportion of 9.7% (6.5% plus 3.2%) strongly disagreed and disagreed that they keep records of all health and safety inductions conducted on site and make the file available for inspection by an inspector, client or his agent while 6.5% of the consultants were unsure. The remaining proportion of 83.8% (29% plus 54.8%) of the consultants were in agreement that they keep records of all health and safety inductions conducted on site and make the file available for inspection by an inspector, client or his agent. Thus, the health and safety induction training for the majority of consultants in the Gauteng Province's construction industry are maintained in records and the records are available for inspection by relevant stakeholders.

16.3 Contractors

Table 4.12: Performance of Roles by Contractors

Ser. No.	Question	1	2	3	4	5	Mean (std. dev.)
16.3.1	Provide and demonstrate to the client a suitable, sufficiently documented and coherent site-specific health and safety plan.	0 (0.0)	3 (3.2)	10 (10.5)	29 (30.5)	53 (55.8)	4.4 (.8)
16.3.2	Open and keep on site a sufficiently documented health and safety file.	0 (0.0)	5 (5.3)	11 (11.6)	29 (30.5)	50 (52.6)	4.3 (.9)
16.3.3	Appoint sub-contractors with necessary competences and resources to execute work safely.	4 (4.2)	8 (8.4)	14 (14.7)	33 (34.7)	36 (37.9)	3.9 (1.1)
16.3.4	Ensure all sub-contractors cooperate with each other in complying with the Regulations.	4 (4.2)	8 (8.4)	19 (20.0)	41 (43.2)	23 (24.2)	3.8 (1.1)
16.3.5	Ensure employees undergo health and safety induction training pertaining to hazards prevalent on site before commencing work.	6 (6.3)	13 (13.7)	11 (11.6)	31 (32.6)	34 (35.8)	3.8 (1.2)
16.3.6	Ensure visitors undergo health and safety induction training pertaining to hazards prevalent on site and provide them with personal protective equipment.	7 (7.4)	14 (14.7)	13 (13.7)	21 (22.1)	40 (42.1)	3.8 (1.3)
16.3.7	Keep records of all health and safety inductions conducted on site and make file available for inspection by an inspector, client or his agent.	6 (6.3)	17 (17.9)	5 (5.3)	30 (31.6)	37 (38.9)	3.8 (1.3)
16.3.8	Ensure that all employees have a valid medical certificate of fitness specific to the construction work to be performed as issued by an occupational health practitioner.	15 (15.8)	13 (13.7)	6 (6.3)	27 (28.4)	34 (35.8)	3.6 (1.5)
Total							**3.9 (1.1)**

NB: Bracketed ** - Percentage; Not bracketed * - Frequency

Contractors are critical in promoting health and safety at construction sites as they work closely with employees (Zin and Ismail, 2012). Construction Regulations has a list of roles that are supposed to be performed by contractors in pursuit of health and safety of employees and visitors.

The representatives of contractors that took part in the study were first asked if they provide and demonstrate to the client a suitable, sufficiently documented and coherent site-specific health and safety plan. Only 3.2% of the contractors' representatives were in disagreement that they provide and demonstrate to the client a suitable, sufficiently documented and coherent site-specific health and safety plan whilst 10.5% were unsure. The remaining proportion of 86.3% (30.5% plus 55.8%) of the contractors' representatives were in agreement that they provide and demonstrate to the client a suitable, sufficiently documented and coherent site-specific health and safety plan. It can thus be concluded that the majority of contractors in the Gauteng Province's construction industry are managing to provide and demonstrate to the client a suitable, sufficiently documented and coherent site-specific health and safety plan. Thus, these contractors are managing to meet the health and safety requirements of clients as stipulated in the Construction Regulations.

An assessment was also made if the contractors open and keep on site, a sufficiently documented health and safety file. Only 5.3% of the contractors' representatives were in disagreement that they open and keep on site, a sufficiently documented health and safety file while 11.6% of the respondents were unsure. The remaining proportion of 83.1% (30.5% plus 52.6%) of the contractors' representatives strongly agreed and agreed that they open and keep on site, a sufficiently documented health and safety file. Thus, the majority of contractors in the Gauteng Province's construction industry maintain records for health and safety related to specific construction site. Site-specific health and safety makes it possible for contractors to ensure that health and safety measures for every construction site are in place. This is important in reducing injury rate for each construction site.

The study also evaluated if contractors appoint sub-contractors with necessary competences and resources to execute work safely. Appointment of sub-contractors with necessary competences and resources to execute project work safely is critical since the sub-contractors work closely with employees at the construction sites (Cheng*, et al.*, 2004). Only 12.6% (4.2% plus 8.4%) of the contractors' representatives were in disagreement that contractors appoint sub-contractors with necessary competences and resources to execute work safely while 14.7% were unsure. There is, therefore, a minority of contractors in the Gauteng

Province that are not appointing sub-contractors with necessary competences and resources to execute work safely. These contractors may be appointing incompetent and unresourceful sub-contractors that may expose employees and visitors to the hazard of being permanently injured or killed. However, the majority of the contractors in the province are ensuring that the health and safety of employees and visitors through appointing of competent and resourceful sub-contractors that can execute project work safely. This was confirmed by 72.6% (34.7% plus 37.9%) of the responding contractors' representatives that strongly agreed and agreed that they appoint sub-contractors with necessary competences and resources to execute work safely.

The contractors' representatives that took part in the study were also asked if they ensure that all sub-contractors cooperate with each other in complying with the regulations. Laryea and Mensah (2010) argue that it is the responsibility of the main contractor to ensure that the sub-contractors are conforming to the health and safety regulations. A small proportion of 12.6% (4.2% plus 8.4%) of the contractors' representatives strongly disagreed and disagreed that they ensure that all sub-contractors cooperate with each other in complying with the regulations whilst 20% were unsure. Thus, the remaining 67.4% (43.2% plus 24.2%) of contractors' representatives were in agreement that they ensure that all appointed sub-contractors cooperate with each other in complying with the regulations. The contractors therefore have a responsibility of ensuring that sub-contractors complement each other in ensuring the health and safety of employees and visitors. Thus, the majority of contractors in the Gauteng Province are promoting the health and safety of employees and visitors by ensuring that sub-contractors complement each other in ensuring the health and safety of employees and visitors.

It was also assessed if contractors in the Gauteng Province are ensuring that employees undergo health and safety induction training pertaining to hazards prevalent on site before commencing work. A proportion 20% (6.3% plus 13.7%) contractors' representatives strongly disagreed and disagreed that they are ensuring that employees undergo health and safety induction training pertaining to hazards prevalent on site before commencing work while 11.6% were not sure. These results indicate that there is a large number of contractors in the Gauteng Province that are failing to promote the health and safety of employees by making the employees to undergo health and safety induction training pertaining to hazards prevalent on site before commencing work. This has an effect of increasing injury rate of employees at the construction rates. Nonetheless, 68.4% (32.6% plus 35.8%) were in agreement that they ensure that employees undergo health and safety induction training pertaining to hazards

prevalent on site before commencing work. It can thus be concluded that that the majority of contractors in the Gauteng Province are actively involved in reduction of injury rate for employees through making the employees to undergo health and safety induction training pertaining to hazards prevalent on site before commencing work.

It is not only employees that ought to be protected from hazards prevalent at construction sites but also visitors. The contractors' representatives were therefore also asked if they ensure visitors undergo health and safety induction training pertaining to hazards prevalent on site and provide them with personal protective equipment. A proportion of 22.1% (7.4% plus 14.7%) strongly disagreed and disagreed that they ensure that visitors undergo health and safety induction training pertaining to hazards prevalent on site and provide them with personal protective equipment whilst 13.7% were unsure. There is therefore a large proportion of contractors in the Gauteng Province that are failing to promote the health and safety of visitors through ensuring that visitors undergo health and safety induction training pertaining to hazards prevalent on site and providing visitors with personal protective equipment. This may lead to a high injury rate for visitors visiting construction sites in the province. However, the majority of the contractors (64.2%) in the province are promoting the health and safety of visitors by making them to undergo induction training as well as giving them personal protective equipment. The efforts of the majority of the contractors are positive in reducing the injury rate of visitors at construction sites doted around the Gauteng Province.

The representatives of the contractors were further asked if they keep records of all health and safety inductions conducted on site and make file available for inspection by an inspector, client or his agent. Respondents that were in disagreement that they keep records of all health and safety inductions conducted on site and make file available for inspection by an inspector, client or his agent were 24.2% (6.3% plus 17.9%) while 5.3% were not sure. Most of the respondents (70.5%) were in agreement that they keep records of all health and safety inductions conducted on site and make file available for inspection by an inspector, client or his agent. The induction training for both employees and visitors for the majority of the contractors in the Gauteng Province is therefore maintained in records for inspection by stakeholders of interest. It is therefore easy for various stakeholders to verify the contractors' compliance with the need to make visitors and employees undergo induction training and wear protective equipment.

Finally, the representatives of the contractors were asked if they ensure that all employees have a valid medical certificate of fitness specific to the construction work to be performed as issued by an occupational health practitioner. A large proportion of 29.5% (15.8% plus 13.7%) of the contractors' representatives were in disagreement that they ensure that all employees have a valid medical certificate of fitness specific to the construction work to be performed as issued by an occupational health practitioner whilst 6.3% were not sure. Thus, there are a large number of contractors in the Gauteng Province that are making employees to work on construction sites without the recommended valid medical certificate of fitness specific to the construction work performed by the employees. This practice exposes the employees to work even when they are not supposed to work due to poor health which may increase the possibility of them getting injured at work. However, 64.2% (35.8% plus 28.4%) of the contractors' representatives were of the view that they ensure that all employees have a valid medical certificate of fitness specific to the construction work to be performed as issued by an occupational health practitioner. Thus, the risk of employees working with poor health is eliminated or reduced on construction sites of the majority of the contractors in the Gauteng Province. This, therefore, further limits the possibility of injury to employees due to poor health.

4.4.3 Commitment for Implementation of the Construction Regulations

The research instrument had 11 questions evaluating the respondents' level of commitment to the implementation of the Construction Regulations. The results on the 13 questions are presented and interpreted in this section.

Sub-Question 3

What is the level of commitment to the implementation of the Construction Regulations in the South African construction sector?

Note:

Scale of 1-5, 1 = strongly disagree, 2 = disagree, 3 = unsure, 4 = agree and 5 = strongly agree was used on questions 18, 25 to 27.

Scale of 1-5, 1 = never, 2 = rarely, 3 = sometimes, 4 = very often and 5 = always was used on questions 19 to 21, 28 and 29.

Scale of 1-5, 1 = very low, 2 = low, 3 = moderate, 4 = high and 5 = very high was used on questions 22 to 24.

Table 4.13: Level of Commitment to Construction Regulations

Ser. No.	Question	1	2	3	4	5	Mean (std. dev.)
18	Has your organisation domesticated the Construction Regulations to its standard operation procedures (SOPs)?	4 (3.0)	14 (10.6)	30 (22.7)	47 (35.6)	37 (28.0)	3.8 (1.1)
19	Does your organisation offer any toolbox talks to employees about the Construction Regulations?	17 (12.9)	20 (15.2)	23 (17.4)	28 (21.2)	44 (33.3)	3.5 (1.4)
20	Do your employees receive training on the Construction Regulations and their implementation?	19 (14.4)	23 (17.4)	34 (25.8)	38 (28.8)	18 (13.6)	3.1 (1.3)
21	Does your organisation schedule further training for inducting new employees on the Construction Regulations?	24 (18.2)	29 (22.0)	29 (22.0)	30 (22.7)	20 (15.2)	3.0 (1.3)
22	What is your level of formal training for people working directly with the implementation of the Construction Regulations?	6 (4.5)	19 (14.4)	47 (35.6)	38 (28.8)	22 (16.7)	3.4 (1.1)
23	What is the level of implementation of the Construction Regulations obligations and requirements in your firm?	5 (3.8)	15 (11.4)	34 (25.8)	46 (34.8)	32 (24.2)	3.6 (1.1)
24	What is the level of adherence to the Construction Regulations in the construction industry?	4 (3.0)	18 (13.6)	51 (38.6)	38 (28.8)	21 (15.9)	3.4 (1.0)
25	Do you think it is necessary that the Construction Regulations are adhered to?	0 (0.0)	0 (0.0)	2 (1.5)	33 (25.0)	97 (73.5)	4.7 (.5)
26	Is it compulsory for your organisation to adhere to the Construction Regulations?	7 (5.3)	17 (12.9)	8 (6.1)	41 (31.1)	58 (43.9)	4.0 (1.2)
27	Do you think inspections are helpful in your organisation's drive to implement the Construction Regulations?	8 (6.1)	18 (13.6)	27 (20.5)	39 (29.5)	40 (30.3)	3.6 (1.2)
28	Does your organisation get inspections on the implementation and adherence to the Construction Regulations?	26 (19.7)	27 (20.5)	36 (27.3)	27 (20.5)	16 (12.1)	2.9 (1.3)
Total							**3.5 (.9)**

NB: Bracketed ** - Percentage; Not bracketed * - Frequency

Commitment to the implementation of the health and safety regulations is essential in ensuring the successful implementation of the regulations (Zin and Ismail, 2012). The commitment to implementing the regulations can drive entities operating in the construction industry to come up with appropriate implementation plan as well as to have the devotion to successfully implement the developed plan.

The respondents were asked if their organisations have domesticated the construction regulations to the organisations' standard operation procedures (SOPs). A small proportion of 13.6% (3% plus 10.6%) of the respondents strongly disagreed and disagreed that their organisations have domesticated the construction regulations in the organisations' standard operation procedures while 22.7% were not sure. The results therefore indicated that there is a minority of clients, consultants and contractors in the Gauteng Province's construction industry that have not domesticated the construction regulations as part of their standard operation procedures. Domesticating the construction regulations as part of the standard operation procedures is standardising the construction regulations as part of the organisational culture. ILO (1999) argues that health and safety regulations can successfully be implemented by making them to be part of the organisational culture. Failure by the minority of the clients, consultants and contractors to domesticate the construction regulations might therefore lead to unsuccessful implementation of the regulations. However, there is a majority of clients, consultants and contractors that are can still manage to successfully implement the construction regulations as a result of domesticating regulations into the standard operating procedures. This was confirmed by 63.6% (35.6% plus 28%) of the respondents that were of view that their organisations have domesticated the construction regulations in the organisations' standard operating procedures.

The study further evaluated if organisations in the Gauteng Province's construction industry offer any toolbox talks to employees about the construction regulations. According to the results, 12.9% were of the view that their organisations never offer any toolbox talks to employees about the construction regulations, 15.2% of the respondents believed that their organisations rarely offer the toolbox talks and 17.4% were of the opinion that their organisations sometimes offer the toolbox talks to employees. The remaining respondents of 21.2% and 33.3% believed that their organisations were very often offering toolbox talks and always offering toolbox talks to the employees, respectively. It can thus be concluded that only 12.9% of the organisations that took part in the study did not offer any toolbox talks to employees about the construction regulations while 87.1% of the organisations offered toolbox talks to employees about the regulations to different degrees. It is, therefore,

concluded that the majority of organisations in the Gauteng Province's construction sector increase awareness of the construction regulations among employees by offering toolbox talks. The improved awareness can assist with enhancing the adoption and acceptance of the construction regulations by the employees (Smallwood, 2002). In fact, the majority of organisations in the industry are showing commitment to the construction regulations by enhancing awareness of the regulations through toolbox talks.

It was also assessed if organisations are offering employees training on the construction regulations and their implementation. Only 14.4% of the respondents were of the view that their organisations never offer employees training on the construction regulations and their implementation. Thus, there is a minority of organisations in the Gauteng Province's construction industry that are not training their employees on construction regulations and their implementation. Failure to offer training to employees can lead to employee resistance to the adoption and implementation of the construction regulations (Cummings and Worley, 2008). This can in-turn make a few of these organisations to fail to successfully implement the regulations. However, the majority of organisations in the industry can successfully implement the construction regulations as they are offering varying extent of training to employees on the regulations and their implementation. This is supported by 17.5%, 25.8%, 28.8% and 13.6% of the respondents that were of the view that their organisations rarely, sometimes, very often and always offer training to employees about the construction regulations and their implementation to employees, respectively.

The research participants were also asked if their organisations schedule further training for inducting new employees on the construction regulations. A minority of the respondents (18.2%) were of the view that their organisation never schedules or arrange further training for inducting new employees on the construction regulations. Thus, there is a minority of organisations in the Gauteng Province's construction sector that are showing lack of commitment to the construction regulations by failing to offer new employees induction training on the regulations. Nevertheless, the majority of organisations in the province are showing varying levels of commitment to the construction regulations as they offer induction training to different extents. This was confirmed by 22%, 22%, 22.7% and 15.2% of the respondents that were of the perception that their organisations rarely, sometimes, very often and always schedule induction training for new employees on the construction regulations, respectively. The varying level of commitment in offering induction training to new employees may be critical in reduction of injury rates for the new personnel.

The study also investigated the levels of formal training for people working directly with the implementation of the construction regulations in organisations in the Gauteng Province's construction industry. A minority of 4.5% of the respondents were of the view that their organisations offer very low level of formal training to people involved directly with implementation of the regulations while 14.4% believed their organisations offer low level of formal training to the employees that are involved in implementation of the regulations. The respondents that believed their organisations offer moderate formal training on regulations to people involved directly with implementation of the regulations were 35.6% while 28.8% were of the perception that high formal training is offered by their organisations. Finally, 16.7% of respondents believed their organisations offered very high formal training to people directly involved in the implementation of the construction regulations. The results therefore indicate that organisations in the construction industry of Gauteng Province have varying levels of commitment to the construction regulations as shown by different levels formal training they offer to people involved directly with implementation of the regulations. It is worthy to note that the majority of the organisations (64.4%) show above moderate level of commitment to the successful implementation of the construction regulations.

The consultants and representatives of contractors and clients that participated in the study were also asked about the level of implementation of the construction regulations obligations and requirements in their organisations. Respondents that perceived that the level of implementation of the construction regulations obligations and requirements in their organisations was very low were 3.8% while 11.4% believed the level of implementation was low. A proportion of 25.8% of the respondents were of the opinion that the level of implementation of the construction regulations was moderate in their organisations while 34.8 were of the view that the level of implementation was high. Eventually, 24.2% of the research participants had a belief that the level of implementation of the construction regulations in their organisation was very high. Thus, the results point out that organisations in the Gauteng Province's construction industry have varying levels of commitment to the construction regulations. However, the majority of the organisations have high or very high commitment as confirmed by 59% (34.8% plus 24.2%) of the respondents that believed their organisations have high and very high commitment to implementation of the regulations.

The research participants were further asked about the level of adherence to the construction regulations in the construction industry. A minority of 16.6% (3% plus 13.6%) were of the view that the adherence to the construction regulations was very low and low while 38.6% believed it was moderate. The remaining proportion of 44.7% (28.8% plus 15.9%) of the respondents

was of the belief that the levels of adherence to the construction regulations in the construction industry were very high and high. The results further indicate there is a varying level of adherence to the construction regulations in the construction regulations. However, the adherence is skewed towards moderate, high and very high adherence.

It was further assessed if it is necessary to adhere to the construction regulations. There were no respondents that were in disagreement that the construction regulations have to be adhered to while 1.5% were not sure. The remaining proportion of 98.5% (25% plus 73.5%) of the respondents was in agreement that it is necessary to adhere to the construction regulations. The view of the majority of the respondents in line with existing literature that suggests that adherence with health and safety regulations is necessary in order to reduce rate of accidents at construction sites as well as reducing costs related to poor health and safety (ILO, 1999; Smallwood, 2002; Hinze, 2006; WHO, 2007).

The research participants were also asked if it is compulsory for their organisations to adhere to the construction regulations. It is odd that there were research participants that were in disagreement that it was compulsory for their organisations to adhere to the construction regulations. There were 18.2% (5.3% plus 12.9%) of respondents that strongly disagreed and disagreed that it was compulsory for their organisations to adhere to the construction regulations. The view of this minority is in contrast with reality as the construction regulations are promulgated under the Health and Safety Act of 2003. This makes them to be compulsory for every organisation operating in the construction industry. The ignorance of a minority of organisations in the construction industry might be leading to reduced commitment on the regulations by these organisations. Nonetheless, 75% (31.1% plus 43.9%) of the research participants believed it is compulsory for their organisations to adhere to the construction regulations. The view of the majority of the research participants is therefore in line with the legal standing of the need to adhere to the construction regulations. Thus, most of the organisations in the Gauteng Province's construction industry might be committed to the construction regulations due to the view they hold that it is compulsory for them to adhere to the regulations.

The study also investigated if the respondents think that inspections are helpful in their organisations' drive to implement the construction regulations. A moderate proportion of 19.7% (6.1% plus 13.6%) of the respondents were in disagreement that inspections are helpful in their organisations' drive to implement the construction regulations whilst 20.5% were not sure. Thus, a minority of organisations in the construction industry of Gauteng

Province believe that inspections are unhelpful in their drive to implement the construction regulations. The negativity of the inspections might lead the few organisations to be less committed in the implementation of the construction regulations. The largest proportion of 59.8% (29.5% plus 30.3%) of the respondents strongly agreed and agreed that inspections are helpful to their organisations' pursuit of implementing the construction regulations. Thus, the majority of organisations in the province's construction industry may be motivated to implement the regulations by the conducted inspections.

The study also evaluated if the organisations that took part in the study get inspections on the implementation and adherence to the construction regulations. The largest proportion of 40.2% (19.7% plus 20.5%) of the research participants believed that their organisations never and rarely get inspections on the implementation and adherence to the construction regulations. Thus, a large number of organisations in the construction industry are hardly or never inspected on their implementation and adherence to the construction regulations. This lack of inspections can be a contributory factor to high accident rates despite the existence of the construction regulations (FEMA, 2013). The limited inspections can also lead to reduced commitment to implementation and adherence to the construction regulations. Another proportion of 27.3% of the respondents were of the view that sometimes inspections are performed on their organisations while 20.5% believed that very often the inspections are performed. The remaining proportion 12.1% of the respondents perceived that the inspections on implementation and adherence to the construction regulations are always conducted on their organisations. Thus, 59.9% of the respondents confirmed that their organisations are inspected to some varying degrees on the implementation and adherence to the construction regulations. The inspections on most of the organisations in the construction industry may assist the organisations with implementing the construction regulations in full which might further assist with reducing the injury rates at the construction sites.

4.4.4 Impact of Implementation of the Construction Regulations

The research instrument had 5 questions evaluating the respondents' understanding of the impact of the implementation of the Construction Regulations. The results from the 5 questions are presented and interpreted in this section.

Sub-Question 4

Has the implementation of the Construction Regulations led to a decline in occurrence of accidents on construction sites in South African through change in attitude and behaviour?

Note:

Scale of 1-5, 1 = strongly disagree, 2 = disagree, 3 = unsure, 4 = agree and 5 = strongly agree was used on questions 31 to 34.

Table 4.14: Impact of Implementation of Construction Regulations

Ser. No.	Question	1	2	3	4	5	Mean (std. dev.)
31	Do you think the adherence to the Construction Regulations add value to the implementation of any construction project?	0 (0.0)	4 (3.0)	20 (15.2)	55 (41.7)	53 (40.2)	4.2 (.8)
32	Has your organisation realised any change in the attitudes of the employees following training on the Construction Regulations?	4 (3.0)	18 (13.6)	36 (27.3)	49 (37.1)	25 (18.9)	3.6 (1.0)
33	Has your organisation observed any employee behaviour change after training on the Construction Regulations?	3 (2.3)	22 (16.7)	34 (25.8)	51 (38.6)	22 (16.7)	3.5 (1.0)
34	Has the implementation of the Construction Regulations led to a decline in occurrence of accidents on construction sites in South Africa?	9 (6.8)	10 (7.6)	36 (27.3)	38 (28.8)	39 (29.5)	3.7 (1.2)
Total							**3.7 (.9)**

NB: Bracketed ** - Percentage; Not bracketed * - Frequency

The adoption of the construction regulations was intended by policy makers to improve the health and safety of employees and visitors at the construction sites (CIDB, 2009a, Smallwood, 2007). Results in Table 4.14 are on whether the implementation of the

construction regulations have led to any positive changes in health and safety at construction sites in the Gauteng Province.

The respondents were asked if the adherence to the construction regulations has added value to the implementation of any construction projects in their organisations. Only 3% disagreed that adherence to the construction regulations has added value to the implementation of construction projects in their organisations while 15.2% were unsure. The largest proportion of 81.9% (41.7% plus 40.2%) of the respondents was in agreement that the adherence to the construction regulations has added value to the implementation of construction projects in their organisations. It can therefore be suggested from the view of the majority of the respondents that most of the organisations in the Gauteng Province's construction industry are ripping benefits associated with the adherence to the construction regulations. This finding is associated with existing literature which indicates that the adherence to construction regulations may lead to improved health and safety as well as reduction in costs related in poor health and safety (Smallwood and Haupt, 2005; Hinze, 2006).

Results in Table 4.14, confirm that 16.6% (3% plus 13.6%) of the research participants were in disagreement that their organisation realised change in the attitudes of the employees following training on the construction regulations while 27.3% were unsure. However, 56% (37.1% plus 18.9%) of the respondents strongly agreed and agreed that their organisation realised change in the attitudes of the employees following training on the construction regulations. Thus, the majority of organisations in construction industry of Gauteng Province are witnessing a change in attitudes of employees towards health and safety following employees' training on construction regulations. The change in attitudes of employees in the most of the organisations is important since poor attitudes towards health and safety are known for driving high rate of accidents (Abdelhamid and Everett, 2000; Toole, 2002).

Table 4.14 is also confirming that 19% (2.3% plus 16.7%) of the respondents were in disagreement that their organisations have observed change in employee behaviour after training of the employees on the construction regulations while 25.8% were unsure. The remaining proportion of 53.5% (36.8% plus 16.7%) of the research participants strongly agreed and agreed that their organisations have observed change in employee behaviour after training of the employees on the construction regulations. The view of the majority of the respondents is in line with the view of Tam, *et al*. (2004) who argue that training of employees leads to change in employee behaviour towards health and safety. Thus, most of the organisations in the Gauteng Province's construction industry are experiencing a positive

change in employees' behaviour after training them on construction regulations. This positive change in behaviour is crucial in improving health and safety (Toole, 2002).

Finally, the research participants were asked if the implementation of the construction regulations led to a decline in occurrence of accidents on construction sites in South Africa. Respondents that were in disagreement that the implementation of the construction regulations led to a decline in occurrence of accidents on construction sites in South Africa were 14.4% (6.8% plus 7.6%) whilst 27.3% were not sure. The majority of the respondents (58.3%) (29.5% plus 28.8%) was in agreement that the implementation of the construction regulations led to a decline in occurrence of accidents on construction sites in South Africa. In accordance with the view of the majority of respondents it can thus be concluded that the adoption of the Construction Regulations has led to an improved health and safety of employees and visitors at construction sites across South Africa. If construction regulations are implemented effectively, organisations should experience a decline in accidents or injury rates (Smallwood, 2007). The view of the minority of the research participants are indicating that there are still organisations that are struggling with accidents at construction sites despite having implemented the construction regulations. This might be as a result of limited adherence to the implemented construction regulations.

4.5 SECTION 2 – QUANTITATIVE INFERENTIAL DATA ANALYSIS

Inferential analysis is used to draw inferences about the data.

4.5.1 T - Test

The t distribution was used to compare the mean scores on the Likert scale with the "unsure" score of 3, which was the mid-point between agree and disagree by applying the one-sample t test.

$$T = \frac{\overline{X} - \mu}{S/\sqrt{n}}$$

Where $\overline{X}$ is the mean score, μ is the assumed mean value (in this case, it equals to 2.5), *S* is the standard deviation of the scores, *Xi's* (where i = 1, 2, …, *n*) and *n* is the sample size.

This was done by testing the null hypothesis that the mean score for a particular statement was not equal to 3. If the difference between the two values was statistically significant from zero, and provided the mean score calculated from the data was less than 3, then this would provide a scientific proof that the respondents disagreed with the statement. If the difference was not significant, it would mean that they were “unsure”. On the other hand, if the difference was significant and the mean score was more than 3, then it would imply that the respondents agreed with the statement. The level of significance used was 0.05.

4.5.1.1 Clients

There was not enough data to perform the “t” - test on the answers given by the respondents from clients.

4.5.1.2 Consultants

The “t” - test results for consultants are presented below.

One-Sample Test (Test Value = 3)

Table 4.15: Mean Scores for Consultants' Roles

Designer’s roles as stipulated in Construction Regulations	N	Mean	Std dev.	Std error
Provides and demonstrates to the client a suitable, sufficiently documented and coherent site-specific health and safety plan.	31	4.42	.801	.15
Opens and keeps on site a sufficiently documented health and safety file.	31	3.90	1.14	.20
Appoints sub-contractors with necessary competences and resources to execute work safely.	31	3.97	1.11	.20
Ensures all sub-contractors cooperate with each other in complying with the Regulations.	31	3.97	1.05	.19
Ensures employees undergo health and safety induction training pertaining to hazards prevalent on site before commencing work.	31	3.71	1.10	.20
Ensures visitors undergo health and safety induction training pertaining to hazards prevalent on site and provides them with personal protective equipment.	31	3.77	1.18	.21
Keeps records of all health and safety inductions conducted on site and make file available for inspection by an inspector, client or his agent.	31	4.23	1.15	.21
Overall Average Score	**31**	**4.00**	**.78**	**.14**

All the mean scores in Table 4.15 for the roles of consultants stipulated in the construction regulations are above 3. T-test results are given in Table 4.16 to assess if the agreement of performing the roles stipulated in the construction regulations is significant.

Table 4.16: T-Test Results for Consultants' Roles

					95% Confidence Interval of the Difference	
Designer's roles as stipulated in Construction Regulations	**T**	**Df**	**Prob.**	**Mean Diff.**	**Lower**	**Upper**
Provides and demonstrates to the client a suitable, sufficiently documented and coherent site-specific health and safety plan.	9.79	30	.000	1.42	1.12	1.72
Opens and keeps on site a sufficiently documented health and safety file.	4.43	30	.000	.90	.49	1.32
Appoints sub-contractors with necessary competences and resources to execute work safely.	4.85	30	.000	.97	.56	1.37
Ensures all sub-contractors cooperate with each other in complying with the Regulations.	5.14	30	.000	.97	.58	1.35
Ensures employees undergo health and safety induction training pertaining to hazards prevalent on site before commencing work.	3.59	30	.001	.71	.31	1.11
Ensures visitors undergo health and safety induction training pertaining to hazards prevalent on site and provides them with personal protective equipment.	3.67	30	.001	.77	.34	1.21
Keeps records of all health and safety inductions conducted on site and make file available for inspection by an inspector, client or his agent.	5.95	30	.000	1.23	.81	1.65
Overall Average Score	**7.12**	**30**	**.000**	**1.00**	**.71**	**1.28**

According to the probability values of the coefficient estimates, the respondents agreed with all the statements at the 5% level of significance. All the probabilities are less than 0.05. In addition, in general, they agreed that the consultants were performing their roles as stipulated in the construction regulations.

4.5.1.3 Contractors

The results concerning contractors are shown below.

One-Sample Test (Test Value = 3)

Table 4.17: Mean Scores for Contractors' Roles

Contractor's roles as stipulated in Construction Regulations	N	Mean	Std dev.	Std error
Provides and demonstrates to the client a suitable, sufficiently documented and coherent site-specific health and safety plan.	95	4.39	.80	.08
Opens and keeps on site a sufficiently documented health and safety file.	95	4.31	.88	.09
Appoints sub-contractors with necessary competences and resources to execute work safely.	95	3.94	1.12	.12
Ensures all sub-contractors cooperate with each other in complying with the Regulations.	95	3.75	1.05	.11
Ensures employees undergo health and safety induction training pertaining to hazards prevalent on site before commencing work.	95	3.78	1.25	.13
Ensures visitors undergo health and safety induction training pertaining to hazards prevalent on site and provides them with personal protective equipment.	95	3.77	1.33	.14
Keeps records of all health and safety inductions conducted on site and make file available for inspection by an inspector, client or his agent.	95	3.79	1.30	.13
Ensures that all employees have a valid medical certificate of fitness specific to the construction work to be performed as issued by an occupational health practitioner.	95	3.55	1.49	.15
Overall Average Score	**95**	**3.91**	**1.05**	**.11**

All the mean scores in Table 4.17 for the roles of contractors stipulated in the construction regulations are above 3. T-test results are given in Table 4.18 to assess if the agreement of performing the roles stipulated in the construction regulations is significant.

Table 4.18: T-Test Results for Contractors' Roles

Contractor's roles as stipulated in Construction Regulations	t	Df	Prob.	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Provides and demonstrates to the client a suitable, sufficiently documented and coherent site-specific health and safety plan.	16.87	94	.000	1.39	1.23	1.55
Opens and keeps on site a sufficiently documented health and safety file.	14.52	94	.000	1.31	1.13	1.48
Appoints sub-contractors with necessary competences and resources to execute work safely.	8.16	94	.000	.94	.71	1.16
Ensures all sub-contractors cooperate with each other in complying with the Regulations.	6.93	94	.000	.75	.53	.96
Ensures employees undergo health and safety induction training pertaining to hazards prevalent on site before commencing work.	6.09	94	.000	.78	.52	1.03
Ensures visitors undergo health and safety induction training pertaining to hazards prevalent on site and provides them with personal protective equipment.	5.62	94	.000	.77	.50	1.04
Keeps records of all health and safety inductions conducted on site and make file available for inspection by an inspector, client or his agent.	5.90	94	.000	.79	.52	1.06
Ensures that all employees have a valid medical certificate of fitness specific to the construction work to be performed as issued by an occupational health practitioner.	3.59	94	.001	.55	.24	.85
Overall Average Score	**8.42**	**94**	**.000**	**.91**	**.69**	**1.12**

According to the probability values of the coefficient estimates, the respondents agreed with all the statements at the 5% level of significance. In addition, in general, they agreed that the contractors were performing their roles as stipulated in the construction regulations.

Level of Implementation (Test Value = 3)

The results for the level of implementation are shown below.

Table 4.19: Mean Scores for Impact of Implementation

Impact of Implementation of the Construction Regulations	N	Mean	Std dev.	Std error
Do you think the adherence to the Construction Regulations add value to the implementation of any construction project?	132	4.19	.80	.07
Has your organisation realised any change in attitude of employees following training on the Construction Regulations?	132	3.55	1.04	.09
Has your organisation observed any employee behaviour change after training on the Construction Regulations?	132	3.51	1.03	.09
Has the implementation of the Construction Regulations led to a decline in occurrence of accidents on construction sites in South Africa?	132	3.67	1.18	.10
Overall Average Score	**132**	**3.7292**	**.87**	**.08**

All the mean scores in Table 4.19 for the impact of implementation of the construction regulations are above 3. T-test results are given in Table 4.20 to assess if the perceptions on the impact of implementation of construction regulations are significant.

Table 4.20: T-Test Results for Impact of Implementation

					95% Confidence Interval of the Difference	
Contractor's roles as stipulated in Construction Regulations	**T**	**Df**	**Prob.**	**Mean Difference**	**Lower**	**Upper**
Do you think the adherence to the Construction Regulations add value to the implementation of any construction project?	12.98	131	.000	1.39	1.13	1.41
Has your organisation realised any change in attitude of employees following training on the Construction Regulations?	8.71	131	.000	1.31	1.01	1.36

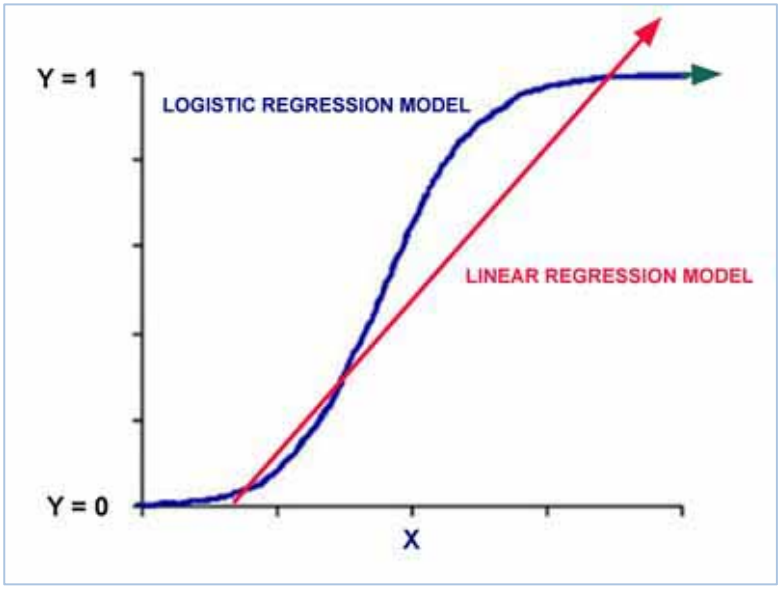
Has your organisation observed any employee behaviour change after training on the Construction Regulations?	10.68	131	.000	.94	1.11	1.26
Has the implementation of the Construction Regulations led to a decline in occurrence of accidents on construction sites in South Africa?	9.73	131	.000	.75	.93	1.21
Overall Average Score	**10.53**	**131**	**.000**	**1.10**	**1.05**	**1.31**

According to the probability values of the coefficient estimates, the respondents agreed with all the statements at the 5% level of significance. In addition, in general, they agreed that the perceptions about the implementation of the construction regulations led to a decline in the occurrence of accidents at construction sites in South Africa, through changes in attitude and behaviour.

4.6 Logistic Regression

The logistic function is normally applied to identify the underlying factors of a categorical variable. The logistic curve depicted in Figure 4.6 is usually used to model categorical or binary dependent variables coded 0 or 1 because (unlike the linear regression function) 0 and 1 bound the logistic function.

Figure 4.6: Logistic Curve



The logistic function is used to predict the probability of an event, which is a particular value of y, the dependent variable. Let π_i be the probability that an individual *i* will for example, perform his or her roles as stipulated in the construction regulations. We can model this probability in terms of the *log odds* of performance, called the *logit,*

$$\log it(\pi_i) = \log\left(\frac{\pi_i}{1-\pi_i}\right) \qquad (1)$$

The *logistic regression model* fits the log odds by a linear function of the independent variables (or the factors that affect performance, the event).

$$\log it(\pi_i) = \alpha + x_{i1}\beta_1 + ... + x_{ij}\beta_j + ... + x_{ip}\beta_p \qquad (2)$$

Where α is the intercept and β_j is the regression coefficient associated with the independent variable x_j and the effect of x_j on the log odds (performance).

In the first logistic regression analysis of the study the dependent variable (Y) is the commitment to the construction regulations while the independent variable (X) is the level awareness and understanding of the construction regulations. In the second logistic regression analysis of the study, the dependent variable (Y) is the implementation of the construction regulations while the independent variable (X) is the awareness and understanding of the construction regulations. In the third logistic regression analysis, the dependent variable (Y) is the performance of roles stipulated in the construction regulations while the independent variable (X) is the awareness and understanding of the construction regulations. Thus, in this study an evaluation has been made on the prediction of performance of roles, commitment to the construction regulations and implementation of the construction regulations by level of awareness and understanding of the construction regulations.

Table 4.21: Correlation Matrix

		Awareness	Consultant Performance	Contractor Performance	Commitment	Implementation
Awareness	R	1	.182	.629**	.652**	.582**
	Prob.		.327	.000	.000	.000
	N	132	31	95	132	132
Consultant Performance	R	.182	1	.b	.482**	.383*
	Prob.	.327			.006	.033
	N	31	31	0	31	31
Contractor Performance	R	.629**	.b	1	.779**	.644**
	Prob.	.000			.000	.000
	N	95	0	95	95	95
Commitment	R	.652**	.482**	.779**	1	.764**
	Prob.	.000	.006	.000		.000
	N	132	31	95	132	132
Implementation	R	.582**	.383*	.644**	.764**	1
	Prob.	.000	.033	.000	.000	
	N	132	31	95	132	132
**. Correlation is significant at the 0.01 level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						

In the correlation analysis results in Table 4.21, where:

R – is the correlation coefficient, measuring the strength and direction of relationship between paired variables;

Prob. – is the probability which measures the significance of the correlationship between paired variables; and

N – is the number of people that responded to the questions.

The correlation coefficients (R) between awareness of construction regulations and the four variables of performance of contractor's roles, performance of consultant's roles, commitment to roles in the construction regulations and implementation of the construction regulations are positive. This means an increase in the awareness of construction regulations leads to an increase in performance of contractor's roles, performance of consultant's roles, commitment

to the roles in the construction regulations and implementation of the construction regulations by both consultants and contractors.

According to Saunders, *et al*. (2009), correlation coefficients of greater than 0 up to 0.3 signify a weak positive correlation and above 0.3 up to 0.7 signify a moderate positive correlation between paired variables. The correlation coefficient of 0.182 between awareness of construction regulations and performance of consultant's roles therefore signifies that the positive relationship between awareness of the construction regulations and performance of consultant's roles is weak and insignificant. The insignificance of the relationship is confirmed by a probability value of 0.327 which is above 0.05. However, the correlation coefficients of 0.629, 0.652 and 0.582 entail a moderate positive relationship between awareness of construction regulations and performance of contractor's roles, commitment to roles in the construction regulations and implementation of the construction regulations, respectively. The moderate positive relationships between awareness of construction regulations and the other three variables are confirmed by the probability value of 0.000 to be significant. This means awareness of the construction regulations can be used significantly to improve performance of contractor's roles, to significantly improve commitment to the roles by both contractors and consultants, and to significantly enhance implementation of the contractor's and consultant's roles.

Logistic regression was further used to investigate the significance of the relationships between awareness and understanding of the obligations of the construction regulations, and the extent at which the contractors are performing their roles as stipulated in the construction regulations, their level of commitment to the implementation of the construction regulations, and their perceptions about the implementation of the construction regulations. The scores for dependent variables of roles of consultants, roles of contractors, commitment to the implementation of construction regulations and perceptions of implementation of construction regulations were divided into two groups of low level scores and high level scores. This was done to change the data from categorical data to dichotomous data. The division of the scores into two groups of high level and low level was necessitated by the fact the logistic regression uses dichotomous dependent variable (or outcome variable) taking the values of 0 and 1. In the roles of contractors and consultants and on impact of implementation of construction regulations, strongly disagree and disagree were treated as the low level scores (denoted by 0) while strongly agree and agree were treated as the high level scores (denoted by 1). In the commitment to the implementation of construction regulations, never and rarely scores (or very low and low) were treated as the low level scores denoted by 0 while very often and always (or

high and very high) were treated as the high level scores denoted by 1. The scores of unsure, sometimes and moderate were ignored as they signify no association between variables.

However, the scores of the independent variable, awareness and understanding of construction regulations, were maintained as categorical data. This is because independent variables in logistic regression ought to be categorical data or continuous data.

4.6.1 Commitment

In this analysis, the hypothesis to be tested is that the level of commitment for implementation of the Construction Regulations is positively associated with the level of awareness and understanding of the obligations of the Construction Regulations.

Table 4.22: Regression Results – 1

Model Summary		
-2 Log Likelihood	**Cox & Snell R Square**	**Nagelkerke R Square**
121.32	.13	.18

Variables in the Equation

Variable	B	S.E.	Wald	Df	Prob.	Exp (B)
Awareness	1.852	.500	13.698	1	.000	6.375
Constant	-2.606	.896	8.469	1	.004	.074

Where: **B** is the coefficient for constant or simply the intercept in the null model;
S.E. is the standard error around the coefficient for the constant;
Wald is the Wald chi-square test that tests the null hypothesis that the constant is equal to 0;
Df is the degree of freedom for the Wald chi-square test;
Prob is the probability value; and
Exp (B) is the exponentiation of the B coefficient which is an odds ratio.

The Nagelkerke R square statistic of 0.183 indicates that the model explains about 18% of the variation in the dependent variable. The awareness variable is highly significant (b=1.852,

p=.000<.01). The odds ratio for the low level of awareness and understanding of the obligations of the construction regulations (6.375) is higher than that of high level of awareness and understanding of the obligations of the construction regulations, which implies that the clients, the consultants and the contractors with a low level of awareness and understanding of the obligations of the construction regulations were more likely to have a low level of commitment to the regulations, than those with a high level of awareness and understanding of the obligations.

4.6.1.1 Implementation of Construction Regulations

In this analysis, the hypothesis to be tested is that the perceptions about implementation of the Construction Regulations led to a decline in the occurrence of accidents on construction sites in South Africa, through changes in attitude and behaviour, is positively associated with the level of awareness and understanding of the obligations of the Construction Regulations.

Table 4.23: Regression Results – 2

Model Summary		
-2 Log Likelihood	**Cox & Snell R Square**	**Nagelkerke R Square**
130.234	.076	.107

Variables in the Equation

Variable	B	S.E.	Wald	Df	Prob.	Exp (B)
Awareness	1.332	.450	8.767	1	.003	3.789
Constant	-1.466	.777	3.556	1	.059	.231

The Nagelkerke R square statistic of 0.107 indicates that the model explains about 11% of the variation in the dependent variable. The awareness variable is highly significant (b=1.332, p=.001<.01). The odds ratio of the low level of awareness and understanding of the obligations of the construction regulations (3.789) is higher than that of high level of awareness and understanding of the obligations of the construction regulations, which implies that the clients, the consultants and the contractors with low levels of awareness and understanding of the obligations of the construction regulations were more likely to have poor

perceptions about the implementation of the construction regulations, than those with high levels of awareness and understanding of the obligations of the construction regulations. When the level of commitment was regressed on all the other independent variables, the following results in the table were obtained.

Table 4.24: Regression Results – 3

Model Summary		
-2 Log Likelihood	**Cox & Snell R Square**	**Nagelkerke R Square**
60.099	.169	.251

Variables in the Equation

Variable	B	S.E.	Wald	Df	Prob.	Exp (B)
Awareness	-.210	.863	.059	1	.808	.811
Extent of performance	-.641	1.414	.206	1	.650	.527
Commitment	2.340	.744	9.897	1	.002	10.384
Constant	-1.217	2.875	.179	1	.672	.296

The Nagelkerke R square statistic of 0.251 indicated that the model explains about 25% of the variation in the dependent variable. However, only the commitment variable is significant (b=2.340, p=.002<.01) at the 1% level. The odds ratio of the low levels of commitment to the construction regulations (10.384) is a lot higher than that of high levels of commitment, which implies that the clients, consultants and the contractors with low levels commitment for the construction regulations were more likely to have poor perceptions about the implementation of the construction regulations, than those with high levels of commitment.

4.6.2 Performance

In this analysis, the hypothesis to be tested is that the extent at which the contractors were performing their roles as stipulated in the Construction Regulations is positively associated with the level of awareness and understanding of the obligations of the Construction Regulations.

Table 4.24: Regression Results - 4

Model Summary		
-2 Log Likelihood	**Cox & Snell R Square**	**Nagelkerke R Square**
52.57	.24	.39

Variables in the Equation

Variable	B	S.E.	Wald	Df	Prob.	Exp (B)
Awareness	2.99	.74	16.42	1	.000	19.8
Constant	-3.08	1.06	8.510	1	.004	.046

The Nagelkerke R square statistic of 0.385 indicated that the model explains 38.5% of the variation in the dependent variable. The odds ratio of the low level of awareness and understanding of the obligations of the construction regulations (19.8) was far higher than that of awareness and understanding of the obligations of the construction regulations, which implies that the contractors with higher levels of awareness and understanding of the obligations of the construction regulations were more likely to perform their roles as stipulated in the construction regulations, better than those with high levels of awareness and understanding of the obligations.

4.7 SECTION 3: QUALITATIVE DATA ANALYSIS

Question 15 - In your opinion, what should be done to bring awareness and understanding of the obligations of the Construction Regulations in the South African Construction Industry?

Different suggestions were made on what should be done to bring awareness and understanding of the obligations of the Construction Regulations in the South African Construction Industry. They include education and training, enforcement of Construction Regulations and other initiatives.

The majority of the respondents (about 81%) suggested that all stakeholders of the construction industry should be educated and trained about the Construction Regulations to bring awareness and understanding of the obligations of the Construction Regulations in the South African Construction Industry. The participants in the study indicated that compulsory

education and training programmes or refresher courses should be offered or organised by the DoL (Department of Labour) and/or CIDB (Construction Industry Development Board) to all stakeholders, for them to understand their obligations and responsibilities on a regular basis, for example, every year or two years. These may be in the form of forums or seminars or even conferences. This would help to explain the importance of construction regulations to the stakeholders. Some participants also highlighted the fact that awareness campaigns by bodies such as SAPOA (South African Property Owners Association) or the Department of Labour could also be launched to bring awareness of the regulations to members. These may be in the form of road shows or articles on health and safety regulations published in newspapers.

The need for better enforcement of the regulations from the Department of Labour should be taken seriously. A respondent suggested that the government and local municipalities could conduct more site inspections and/or surveys, and perhaps give more powers to the consultants to enforce the regulations and issue notices, or review consultants' reports in order to notice any recurring issues on specific sites. It should be compulsory for all project designers or engineers to submit health and safety reports on their designs prior to initiation of construction, failing of which, companies that do not adhere to the regulations should be discredited or de-registered. Other initiatives include:

- Innovative ways of encouraging contractors to adhere to the safety construction regulations, for example, giving them incentives;
- Sending regular updates by emails to all members of ECSA (Engineers Council of South Africa) and other engineering bodies;
- Clearly defining construction regulations in tender documents in order to price and allow for enough and correct resources; and
- Making regular reminders, etc.

Question 19 - In your opinion, to what extent are the clients, consultants and the contractors performing their roles, as stipulated in the Construction Regulations?

The respondents noted that, unlike small companies, larger companies do train their employees and tend to comply with the construction regulations of health and safety more than smaller contractors do. Seven (10.4) out of 67 respondents who answered this question said that the contractors do not exercise health and safety procedures.

The reasons provided for this included:

- *"Many clients, contractors and consultants are not aware of their required roles regarding the construction regulations."*

Some clients, contractors and consultants disregard, or are in denial, have no interest, or are ignorant about the regulations. The personnel also ignore warnings to adhere to health and safety of workers. Some respondents had this to say in this regard:

- *"Unless you do work for institutions / clients that have very strict requirements, then nobody really pays attention to these".*

- *"Clients often ignore the requirements and just appoint health and safety consultants at a late stage to tick legal box. Clients / agents do not provide timeous proper specifications that are aligned with the construction regulations. The competency of many health and safety consultants are not up to the required standards and its own problems."*

- *"Currently, on site, the focus is on production and achieving targets, and so, compliance with the regulations does not seem to be a priority with construction companies."*

- *"Site personnel view health and safety as a waste of time and resources."*

Eighteen (26.9%) respondents said that the compliance with health and safety construction regulations is low for the following reasons, as pointed by some respondents:

- *"The move in the new regulations to shift the duty of care and accountability up the project value chain to the client was a good theory; however, the uptake from the client's side has been slow. The industry is also extremely price sensitive and the current tough trading conditions make competition for tenders extremely competitive. Clients are not likely to place major emphasis on health and safety in their awarding criteria."*

- *"There is a need for regular checks to monitor the implementation of these regulations and that cost constraints cause compliance to be low, as some contractors perform their roles to keep project expenditure on health and safety requirements to a minimum to maximise profit."*

Eighteen (26.9%) respondents also reported that sometimes, companies comply with construction regulations for the following reasons:

- *"Health and safety specifications are not included in the tender documents for pricing, even though safety is costly."*
- *"Clients are unsure of what is required of them."*
- *"Not all company employees are aware of the Construction Regulations."*
- *"Clients do not insist on adherence to the Construction Regulations."*
- *"Consultants tend to shift the responsibility to the contractor."*
- *"Compliance is associated with costs and projects are cost-driven, hence, sometimes companies compromise in order to maximise profits."*

In view of the above, there is a need for better cooperation between contracting parties and the design teams to discuss the overall site health and safety procedures before major works commence. Alternatively, if health and safety specifications are included in tender documents for pricing, compliance would improve. Eight (11.9%) of the participants said that compliance with the construction regulations is fair, which might be due to the lack of knowledge on the relevant people's roles and responsibilities.

Sixteen (23.9%) respondents indicated that the compliance is satisfactory or high, as the contractors were trying to balance the effectiveness of safety regulations against the project costs and the clients were engaging health and safety consultants who ensured compliance on the site. The project managers also complimented compliance, but sometimes their priorities were on production, thereby compromising the health and safety construction regulations. The designers however, still needed to do more on that aspect. One of the respondents said this:

- *"The contractors are trying to meet just the required minimum standard, due to the insufficient planning and funds available."*

Question 30 - In your opinion, how could the level of commitment to the implementation of the Construction Regulations in the South African construction sector be improved?

According to the results, the most important opinions were education and training, enforcement and compulsory adherence, as well as management involvement. Seven respondents suggested that the level of commitment to the implementation of the Construction Regulations in the South African Construction sector could be improved by giving incentives to the construction companies that adhere to the construction regulations, or those companies with least incidents. Clients could also give incentives and/or the Department of Labour either, in the form of black economic empowerment scores, tax rebate or letters of good standing or through ratings.

The majority of the respondents suggested that awareness, for example, through education and training in terms of workshops, talks, seminars or conferences could help stakeholders to make sure they understand their requirements and the benefits of the regulations. There should also be certificates with expiring periods. One respondent argued that:

- *"An examination system should be instituted for all legal appointees, as well as an approval of induction content by the principle agent."*

Some of the respondents suggested that awareness could be used to improve the level of commitment, especially as far as small size contractors are concerned. Small contractors need to be made aware that they are accountable for the implementation of the construction regulations. It was also recommended that adherence to construction regulations should be compulsory and that there should be enforcement or prosecution by the Department of Labour (including inspections and penalties). Their recommendations included the following:

- *"Only organisations complying with the construction regulations should qualify a contractor to operate. It should be mandatory for contractors to be registered with accredited health and safety institutions."*

- *"The government must introduce more stringent laws to deal with companies that don't comply with the construction regulations and the law enforcement (Department of Labour) inspectors must ensure that those who don't comply are prosecuted; and the Department of Labour must be more involved and vigilant. We need more inspections or visits from the Department of Labour to guide and advise."*

- *"There should be stricter policing and penalties or prosecution for non-compliance."*

- *"Contractors should have mandatory entry level for construction workers and occupational, health and safety systems in place that could be implemented in accordance with the construction regulations. This should be included as a main requirement for the contracts."*

- *"Compulsory inspection to all individuals on the construction project and the associated accreditation to become an employer requirement for all employed and/or engaged staff."*

- *"A legal body should be appointed to investigate and audit adherence and the implementation of construction regulations, a situation where penalties are incurred by non-complying organisations."*

- *"There should be a requirement for registration of construction companies with the CIDB (Construction Industry Development Board) and a point system that influences grading with the CIDB. Non-complying contractors should be downgraded."*

Some of the respondents were of the opinion that compliance efforts should start with management, for it to take a leading role and then, it would filter down to the workers at the site. Management should drive it and make a commitment to adhere to the regulations implementation. This would involve the following: Management, as part of the tendering process, should have a systems approach that integrates occupational health and safety into the company's organizational structure, and support and encouragement from top management to ensure the commitment of the workers on site.

Four respondents suggested that conformance to the regulations should be part of the awarding criteria; that contractors should be awarded tenders not only based on their price and other things like BEE (Black Economic Empowerment) Certificate, but also on their disabling injury frequency rate (and lost time). In other words, health and safety policies should be part of the contract award process. in the same way, five respondents suggested that health and safety plans should be included in the project budget, while health and safety specifications should be incorporated in the tender documents for contractors to ensure commitment.

Other things that were suggested included the following:

- *"The implementation of the construction regulations and monitoring should be more thorough and regular by the local or/and national authorities."*

- *"Because the interpretation and ambiguity in the regulations create confusion and conflict, there is a need to clarify and update the regulations by the Department of Labour."*

- *"Smaller contractors should stop disregarding health and safety regulations, and contractors in general should comply with the regulations as a necessary cost."*

- *"The commitment of all involved in the construction industry is needed and should be improved and driven by the CIDB."*

- *"The Department of Labour should assist contractors with the construction regulations compliance."*

- *"The construction industry should develop strategies of encouraging role players to commit themselves to the implementation of the regulations."*

Question 35 - In your opinion, how could the Construction Regulations be implemented to ensure a decline in the occurrence of accidents on construction sites in South Africa?

The common responses that emerged from the respondents included education and training, Department of Labour to take a lead, management support, welfare for workers, provision of incentives and engaging competent persons to manage the works as required by the Regulations.

It was suggested that the Department of Labour should take a lead in the occupational health and safety procedures. Proper monitoring on the part of the client and the department's enforcement, regular site visits and inspection to ensure strict implementation of the regulations should be emphasised. This should be a thorough routine workplace inspection and follow up on non-conformances, coupled with monetary fines, depending on the nature and severity of transgression. Regular visits (may be once a month) can be made by inspectors from the local municipalities. The Department of Labour should ensure the implementation of the construction regulations by all involved in the construction industry.

It was suggested by one respondent that:

- *"The level of compliance by large contractors is extremely good, however, the challenge is with smaller contractors. The Department of Labour acknowledges that over 60% of incidents is amongst small and medium enterprises, however the regulations tend to target the larger contractors who have mature and developed health and safety systems in place."*

The Department of Labour Inspectorate should be stricter to non-complying companies and more vigilant on sites. This calls for cooperation between the Department of Labour and CIDB to ensure the proper implementation of the regulations. There should be a minimum requirement stipulated by Department of Labour and CIDB to ensure proper implementation. The concerned regulatory bodies have to drive the process by increasing their presence on the construction sites. Officials from the Department of Labour should not only visit the construction sites when there is an accident, but should do more frequent visits to reinforce compliance of the health and safety legislation. The Provincial Director should be given notice when a project commences, so that he or she prepares to send inspectors to monitor compliance. Alternatively, full time independent consultants could be appointed to monitor sites that are high risk by doing health and safety audits and inspection.

According to the majority of the respondents, everyone needs to understand the benefits of the regulations, starting from the bottom, so compulsory and aggressive education and training is a necessity and should be mandatory. This should be done on a regular basis to make sure that everyone concerned is aware and understands the construction regulations. Examination may be involved. The Department of Labour and the South African Council for the construction industry should spearhead this, regarding the Project and Construction Management Professions. In line with this, one respondent had this to say:

- *"At the senior and somewhat supervisory level, the understanding is there, however, at the worker level, the understanding is overruled by other human factors, that is, understanding, skill level, aptitude, literacy, will to adhere, personal pressures etcetera, which impacts on individuals at the coal face. There is a high turnover of workforce in the industry, which impacts on that as well."*

Awareness campaigns and making employees to sign engagement forms that make them liable to adhere to the construction regulations was also recommended. The responsibility should be borne by everyone involved in any construction project at every level. Communication from consultancy team, down to the general worker through site meetings, toolbox talks, etcetera, is fundamental. Ensuring that all project risk assessments are communicated to everyone and having incident recalls on site to prevent incident recurrences, ensuring adequate supervision on site, on job training and doing planned task observations might also help. In addition, CIDB should assist its members to understand the regulations, in order for them to comply. The culture of compliance with the regulations has to be instilled by the management. All industry players have to appreciate the benefits of injury-free construction projects in order to ensure that they continue with the implementation of the regulations. They must also be reminded all the time.

Eight respondents suggested that non-complying companies should be penalised and their grading status with CIDB reviewed. They should also lose their letters of good standing with the Department of Labour. It was argued that imposing stiff or harsh penalties to non-complying contractors would set a good example. Six respondents were of the view that construction companies should include the construction regulations in their policies and contractors should be awarded tenders based on these health and safety policies. There should also be high commitment on the side of the management, in providing proper resources when implementing the regulations. In addition, it should be compulsory for contractors to submit health and safety environmental plans as part of contract requirements. Although including an implementation budget in the tender documents by contractors would increase project costs, the good thing is that a reward would be realised.

Three respondents advised that all the contractors should have yearly renewable compliance certificates and the CIDB should consider compliance with the regulations when registering a company. Eighteen respondents suggested that the construction regulations could be implemented with management support through an occupational, health and safety system. The system could be maintained, monitored and evaluated by accredited independent institutions. There is also the need for a far more holistic approach to safety in the sector by all parties. Practical procedures should be developed and applied to ensure that a company complies with the regulations and monitors the effects of implementing the procedures. In addition, companies should improve the welfare of workers to eliminate issues like fatigue due to extended working hours and also provide them with incentives.

There should be a paradigm shift amongst all industry stakeholders to take the construction regulations seriously. Contractors should be encouraged by regulatory bodies to comply with regulations. For example, CIDB can formulate scoring criteria that reward complying contractors when being graded and provide incentives to contractors that comply and report injury free statistics from their projects. Contractors should engage competent persons to manage responsibilities and works as required by the regulations.

4.8 Integration of Quantitative and Qualitative Analysis

From the analysis in this chapter, it is evident that quantitative research answers questions such as how many, when and what, whereas qualitative research answers questions like why and how. Quantitative research is good at testing the relationships between variables, while qualitative research provides explanations about these relationships by answering questions like why and how things happen the way they do. While quantitative methods collect data in numbers, qualitative methods collect data in words. The data analysis in quantitative research uses mathematics and mathematical statistics to analyse the data and therefore, tends to miss out on the detail of information and so the tendency is to leave out gaps in the conclusions made about the solutions to the research problems or answers given to the research questions. However, because in quantitative research we use standardised methods and techniques and collect data in numbers, we tend to obtain studies that are more objective. On the other hand, there is a lot of subjectivity in qualitative research since philosophically, qualitative researchers assume that there are many subjectively derived realities and it is very difficult for the researcher to separate his or her biases on the phenomena being investigated from the study. So, the research and conclusions made about the issues being investigated in the study tend to be subjective, but more comprehensive since the data are more in-depth or detailed, (Gill and Johnson, 2010; Howitt and Cramer, 2011; Bhattacherjee, 2012; Fox and Bayat, 2012).

Based on the abovementioned, it is always better to combine the two methodologies in a single study, for them to complement each other. While quantitative research leaves gaps in the information provided in the study, it comes with its objectivity and on the other hand, while qualitative research tends to bias the study with its subjectivity, it comes with its comprehensiveness. The mix of the two approaches therefore tends to result in a more comprehensive study.

4.9 Conclusion

This chapter presented results of the study from the quantitative and qualitative analysis. Two quantitative analysis methods, namely descriptive analysis and inferential analysis were used to make sense of the data that were collected. The results were further discussed and interpreted in the context of existing literature. The research findings were discussed in four categories which are demographic information, participants' awareness of construction regulations, their extent of compliance with roles in construction regulations, their level of commitment to implement construction regulations and the impact of the implementation of the construction regulations on the occurrence of accidents. The next and last chapter of the research presents the discussions, conclusions and recommendations.

5 CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this last chapter of the research, the results of the study are discussed, after which conclusions and recommendations are made. This is done by firstly focusing on the findings from the literature review, followed by the findings from the data collected using the questionnaire. The chapter also recommends possible future studies that could be conducted in line with the same topic and concept.

5.2 Discussion of Results

The results, as presented in the previous chapter, did achieve the objectives that the study set out to investigate. This is evident from the response rate from all the sectors that were sampled. The response rate achieved for the study means that the sampling error is acceptable. This means that the results of the sample can be used to make generalisations for the study population. However, the sample is skewed in that more males were interviewed as compared to females. This, however, has no major impact on the results as the study was not necessarily gender sensitive.

5.2.1 Objective 1: To assess the awareness and understanding of the Construction Regulations amongst the clients, consultants and contractors within the construction industry.

The findings of the study indicated that the respondents were aware and had heard about the Construction Regulations. This is a critical step in understanding the requirements of the regulations. It shows that the regulations have been widely publicized. The construction industry made it possible that almost all stakeholders know about the Construction Regulations.

It is not only important to know about the regulations. Apart from the awareness, there are opportunities for training on the regulations. This awareness revealed amongst the industry players improves the compliance to health and safety regulations. Due to the availability of training opportunities, the construction industry has an opportunity to develop and improve understanding of the regulations. The majority of the respondents were aware of the available training opportunities on the regulations which also gives

the confidence in the reliability of the responses and information obtained. However, some of them were not trained, which gives room for training needs that may also improve the compliance in future. There is a need to improve training within the industry, especially if professionals have more than 5 years in-field experience and have no training on the regulations.

All of the respondents recommended that it must be compulsory for any entity involved within the construction industry to undergo training and education on the Construction Regulations. This indicates the significance of the regulations in preventing accidents and fatalities in the construction industry.

The majority of the respondents indicated to have been in the construction industry for more than 5 years. This indicates that there is a great understanding of the regulations by the professionals. Thus, the information can be generalized to professionals that have worked for more than 5 years.

5.2.2 Objective 2: To measure the level to which the clients, consultants and contractors are performing their health and safety responsibilities, as stipulated in the Construction Regulations.

In order for certain establishments to comply with the requirements of the Construction Regulations, there are certain traditions and activities that must be engraved within the culture of their operations. The second objective of the study was to gather information and assess if such the entities do perform the duties outlined in the Construction Regulations.

The results of the study indicated that clients adhere to the requirements of the regulations as indicated by the low standard deviation, while at the same time there were no responses along the strongly disagree and disagree scales. This is evident with the appointments of relevant personnel that translates into holistic systems implementation and successful project implementation. This shows that the clients adhered to the requirements of the Construction Regulations. On the other hand, the consultants/designers indicated slightly different results. However, these results do not necessarily mean they are the opposite of the clients. The standard deviation is still low, which indicates uniformity and no extreme values or practices among the consultants. There is adherence to documentation, as depicted by the higher

percentages in safety plan, health and safety plan, as well as pre-work requirements, appointment of competent contractors and sub-contractors, induction of employees, to mention but a few. These higher percentages indicated the participants' willingness to adhere to the requirements of the Construction Regulations.

As the implementation agent in the construction sector, the contractor is the most vulnerable to accidents and fatalities. Thus, their adherence to the Construction Regulations aimed at reducing incidents is paramount. The main challenge among contractors is making sure that sub-contractors cooperate amongst one another. The documentation for contractors was also outstanding, as witnessed by a low standard deviation of 0.8.

5.2.3 Objective 3: To evaluate the level of commitment to the Construction Regulations by the South African construction industry stakeholders.

The results of the study indicated that organisations involved in the construction industry understand the requirements of the Construction Regulations, with the majority of the respondents having domesticated the regulations into standard operation procedures (SOPs). This engraves the requirements of the Construction Regulations into the culture of the entities, thus achieving the objectives of the regulations. SOPs cultivate a culture of compliance within contractors and the other stakeholders. SOPs are important in facilitating continuity for the entity in terms of legal compliance and make compliance to be easy to implement.

The standard deviation indicates the general consensus with regards to commitment and domestication of the Construction Regulations in terms of SOPs, toolbox talks, training on the Construction Regulations, etc. The study indicated that there was commitment to the implementation of the regulations. This was evidenced by the provision of training for the entities, as well as the evaluation of the effectiveness of the regulations on the day to day activities of the construction industry. It is evident from the results that there was great commitment to the implementation of the regulations. However, there is need to improve second party audits or inspections, as illustrated by 19.7% which may make entities not to comply, if not undertaken regularly.

5.2.4 <u>Objective 4</u>: To investigate why the implementation of the Construction Regulations has not contributed to the decline in the occurrence of accidents on construction sites in South Africa.

The implementation of the Construction Regulations has transformed the culture of project implementation in the construction industry in South Africa. Most of the participants agreed that the implementation of the regulations adds value to the delivery of construction projects. Training on the regulations resulted in changing the attitudes of workers in the implementation of the regulations. It was also noted that attitude and behaviour change also contributed to the decline of accidents and fatalities on construction sites.

5.3 Objectives Achieved

The study was successful in achieving all its objectives, as outlined in section 1.5. Together with the response rate, the distribution of gender and professions, the study also gathered information from a variety of respondents, which gave credibility to the analysis.

The quantitative analysis of the data indicates that the consultants were performing their roles as stipulated in the Construction Regulations. The results also indicated that there occurred some changes in attitude and behaviour, due to the implementation of the Construction Regulations. The correlation analysis further summarised that the clients, consultants and contractors with a low level of awareness and understanding of the obligations of the Construction Regulations were more likely to have a low level of commitment to the regulations, than those with a high level of awareness and understanding of the obligations.

Furthermore, the clients, consultants and contractors with low level of awareness and understanding of the obligations of the Construction Regulations were more likely to have poor perceptions of the implementation of the Construction Regulations, than those with high levels of awareness and understanding of the obligations of the Construction Regulations.

5.4 Limitations of the Study

The focus of this study has been the awareness of the construction health and safety regulations by the stakeholders in the construction industry. The study was limited to assessing the level of awareness, as well as the attitude of the relevant stakeholders, to the health and safety regulations of the construction industry. Moreover, the study was only limited to a selected case study in the Gauteng Province. From the researcher's perspective, the study could have also explored the element of risk management in construction health and safety by highlighting the measures being put into place to minimise risks in the construction industry.

5.5 Recommendations for Future Studies

Given the results achieved, the following recommendations are proposed for future studies:

- The involvement of management of construction companies as part of the tendering process and having a systems approach that integrates occupational health and safety into company organisational structure, could be explored. The respondents articulated that if senior management was fully involved in health and safety issues and the implementation of the Construction Regulations, then compliance would improve.
- Also, focus on strategies that can be implemented to encourage compliance to Construction Regulations by all stakeholders.

5.6 Conclusion

This chapter summarised the study, as well as the findings. The findings of the study highlighted the fact that health and safety in the construction industry should also be prioritised by all the relevant stakeholders (Hinze cited in Geminiani and Smallwood, 2008: 10). It has been noted that a health and safe culture are essential for any organisation to become compliant with the legislation. In that view, education, training and development of all the stakeholders is of paramount importance. It however starts with the management of construction companies. It was also noted that the Department of Labour Inspectorate must enforce health and safety legislation, in order to improve compliance by all the concerned parties.

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8 APPENDICES

Appendix A: Cover letter to respondents

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT, UNIVERSITY OF THE WITWATERSRAND

School of Construction Economics and Management

03rd May 2017

Dear Respondent,

You are being invited to participate in a research project seeking to establish the extent of involvement by Construction Industry practitioners and stakeholders in Health and Safety (H&S) in South Africa. The attached questionnaire should take about 10 to 15 minutes to complete.

Your participation in this survey is voluntary and I wish to assure you that your responses will not be identified with you personally. For this reason, you are encouraged not to put your name on the questionnaire.

Please, send the completed questionnaire to my Wits student email address: Gcinithemba.Masimula@students.wits.ac.za or gmasimula@outlook.com for the attention of the student, Gcinithemba Masimula.

Should you have any questions or concerns about completing the questionnaire, kindly contact undersigned on +2783 379 1854 or through the emails stated above.

I am looking forward in anticipation to your assistance and thank you in advance for your participation.

Yours Sincerely.

Gcinithemba Masimula

Attached: 6 paged questionnaire

Appendix B: Sample of Questionnaire

QUESTIONNAIRE TO ASSESS STAKEHOLDERS' AWARENESS OF THE CONSTRUCTION HEALTH AND SAFETY REGULATIONS ON CONSTRUCTION SITES IN SOUTH AFRICA

Please answer the following questions by crossing (x) the relevant block or writing down your response in the provided space

PART 1: DEMOGRAPHICS DATA

1. What is your gender? Male ☐ Female ☐

2. What is your current profession?

Development Manager		Project Manager		Architect		Quantity Surveyor	
Property Manager		Engineer		Contracts Director		Contracts Manager	
Health & Safety Consultant		Site Agent		SHE Officer		Other	

If other, please specify : _____

If Contractor, please indicate your company's CIDB Grading : Grade 9 ☐ Grade 8 ☐ Grade 7 ☐

3. What is your highest qualification?

Doctorate		Masters		Bachelor		National Diploma		Other	

If other, please specify : _____

4. How long have you been involved in the construction industry?

< 5 years		6-10 years		11-20 years		21-30 years		> 31 years	

5. What is your current employment status and sector?

Full-time		Part-time		Unemployed	
Public Sector		Private Sector		Other	

If other, please specify : _____

6. Select the nature of projects that you have worked on.

Public Sector		Private Sector		Both	

7. Have you been trained in Construction Regulations related courses?

Yes		No		Unsure	

PART 2: HEALTH AND SAFETY PRACTICE AND LEGISLATION

SUB-QUESTION 1 : What is the level of awareness and understanding of the obligations of the Construction Regulations within the South African construction industry?

On a scale of 1-5, 1 = never, 2 = rarely, 3 = sometimes, 4 = very often and 5 = always

8. Have you ever heard of the Construction Regulations?

1	2	3	4	5

9. Are there any available training opportunities on the Construction Regulations?

1	2	3	4	5

10. Do you think it must be compulsory for any entity involved in the construction industry to have training and understanding of the Construction Regulations?

1	2	3	4	5

11. Are there any challenges in the implementation of the health and safety regulations?

1	2	3	4	5

On a scale of 1-5, 1 = very low, 2 = low, 3 = moderate, 4 = high and 5 = very high

12. What is your level of understanding of the requirements of the Construction Regulations?

1	2	3	4	5

On a scale of 1-5, 1 = strongly disagree, 2 = disagree, 3 = unsure, 4 = agree and 5 = strongly agree

13. In your opinion, do you think the Construction Regulations are easy to implement?

1	2	3	4	5

14. Do you think there are sections in the Construction Regulations that should be changed or modified?

1	2	3	4	5

15. In your opinion, what should be done to bring awareness and understanding of the obligations of the Construction Regulations in the South African Construction Industry?

_____

_____

SUB-QUESTION 2 : To what extent are clients, consultants and contractors performing their roles as stipulated in the Construction Regulations?

16. According to the Construction Regulations, Clients, Designers and Contractors have some duties to fulfil in order to ensure compliance with the Regulations.

On a scale of 1-5, 1 = strongly disagree, 2 = disagree, 3 = unsure, 4 = agree and 5 = strongly agree, Are you performing the following roles in the course of your duties?

Statement		1	2	3	4	5
16.1 Client *[To be completed by clients only]*						
16.1.1	Perform risk assessment for intended construction project.					
16.1.2	Includes the health and safety specification in the tender documents.					
16.1.3	Appoints contractors with necessary competences and safety measures.					
16.1.4	Ensures the appointed contractors have the necessary health and safety plan.					
16.1.5	Ensures periodic health and safety audits are conducted on contractors.					
16.1.6	Stops contractors from executing a project that poses a threat to the health and safety of persons on site.					
16.1.7	Avails sufficient or additional information in the case of change in project scope.					
16.1.8	Provides a report to the provincial director when a fatality or permanent disabling injury occurs on site.					
16.1.9	Ensures all appointed contractors are cooperating and complying with the health and safety Regulations.					
16.1.10	Appoints a competent agent to act as a representative where a construction work permit or notification of construction work is required.					
16.1.11	Ensures that the agent manages health and safety on site and that he/she is registered with a suitable statutory body.					

Statement		1	2	3	4	5
16.2 Designer (Consultant) *[To be completed by designers / consultants only]*						
16.2.1	Incorporates the project health and safety specification submitted by the client in the tender documents for pricing by contractors.					
16.2.2	Compiles a report to the client outlining all relevant health and safety information about the design of the relevant structure that may affect pricing before invitation for tenders.					
16.2.3	Informs the client in writing of any known or anticipated dangers or hazards relating to the construction work.					
16.2.4	Avails all relevant information required for the safe execution of the work upon being designed.					
16.2.5	Refrains from incorporating anything in the design of the structure necessitating the use of dangerous procedures or hazardous materials.					
16.2.6	Ensures that all temporary works are adequately designed in order to support all anticipated vertical and lateral loads.					
16.2.7	Stops contractors from proceeding with work that is contrary to health and safety designs when mandated to do so by the client.					

Statement		1	2	3	4	5
16.3 Contractor *[To be completed by contractors only]*						
16.3.1	Provides and demonstrates to the client a suitable, sufficiently documented and coherent site specific health and safety plan.					
16.3.2	Opens and keeps on site a sufficiently documented health and safety file.					
16.3.3	Appoints sub-contractors with necessary competences and resources to execute work safely.					
16.3.4	Ensures all sub-contractors cooperate with each other in complying with the Regulations.					
16.3.5	Ensures employees undergo health and safety induction training pertaining to hazards prevalent on site before commencing work.					
16.3.6	Ensures visitors undergo health and safety induction training pertaining to hazards prevalent on site and provides them with personal protective equipment.					
16.3.7	Keeps records of all health and safety inductions conducted on site and make file available for inspection by an inspector, client or his agent.					
16.3.8	Ensures that all employees have a valid medical certificate of fitness specific to the construction work to be performed as issued by an occupational health practitioner.					

17. In your opinion, to what extent are clients, consultants and contractors performing their roles as stipulated in the Construction Regulations?

_____

_____

SUB-QUESTION 3 : What is the level of commitment in terms of implementing the Construction Regulations in the South African construction industry?

On a scale of 1-5, 1 = strongly disagree, 2 = disagree, 3 = unsure, 4 =agree and 5 =strongly agree

18. Has your organisation domesticated the Construction Regulations to its standard operation procedures (SOPs)?

1	2	3	4	5

On a scale of 1-5, 1 = never, 2 = rarely, 3 = sometimes, 4 = very often and 5 = always

19. Does your organisation offer any toolbox talks to employees about the Construction Regulations?

1	2	3	4	5

20. Do your employees receive training on the Construction Regulations and their implementation?

1	2	3	4	5

21. Does your organisation schedule further training for inducting new employees on the Construction Regulations?

1	2	3	4	5

On a scale of 1-5, 1 = very low, 2 = low, 3 = moderate, 4 = high and 5 = very high

22. What is your level of formal training for people working directly with the implementation of the Construction Regulations?

1	2	3	4	5

23. What is the level of implementation of the Construction Regulations obligations and requirements in your firm?

1	2	3	4	5

24. What is the level of adherence to the Construction Regulations in the construction industry?

1	2	3	4	5

On a scale of 1-5, 1 = strongly disagree, 2 = disagree, 3 = unsure, 4 =agree and 5 =strongly agree

25. Do you think it is necessary that the Construction Regulations are adhered to?

1	2	3	4	5

26. Is it compulsory for your organisation to adhere to the Construction Regulations?

1	2	3	4	5

27. Do you think inspections are helpful in your organisation's drive to implement the Construction Regulations?

1	2	3	4	5

On a scale of 1-5, 1 = never, 2 = rarely, 3 = sometimes, 4 = very often and 5 = always

28. Does your organisation get inspections on the implementation and adherence to the Construction Regulations?

1	2	3	4	5

29. Do your employees receive training on the Construction Regulations and their implementation?

1	2	3	4	5

30. In your opinion, how could the level of commitment for the implementation of the Construction Regulations in the South African construction sector be improved?

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SUB-QUESTION 4 : What are the effects of implementing the Construction Regulations on sites?

On a scale of 1-5, 1 = strongly disagree, 2 = disagree, 3 = unsure, 4 = agree and 5 = strongly agree

31. Do you think the adherence to the Construction Regulations add value to the implementation of any construction project?

1	2	3	4	5

32. Has your organisation realised any change in attitude of employees following training on the Construction Regulations?

1	2	3	4	5

33. Has your organisation observed any employee behaviour change after training on the Construction Regulations?

1	2	3	4	5

34. Has the implementation of the Construction Regulations led to a decline in occurrence of accidents on construction sites in South Africa?

1	2	3	4	5

35. In your opinion, how could the Construction Regulations be implemented to ensure a decline in occurrence of accidents on construction sites in South Africa?

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Thank you very much for your participation.