

Construction is a dangerous and risky business. This is due to the nature of its activities and the high accident rates. The Health and Safety Act, more especially the Construction Regulations is in place to eliminate the potential hazards during design and construction phases and reduce the consequential risks thereof. However, the importance of the construction regulations seems to have been overlooked in South Africa. As a result, the number of accidents and fatalities witnessed has been rapidly increasing. Towards improving the Health and Safety practices in construction, this book investigates the causes of contractors' non-compliance with the health and safety procedures and the subsequent effects of such non-compliance on the construction project as well as the country's socio- economy. This book is essential for construction companies, government authorities, decision makers and researchers concerned with Health and Safety issues in construction.

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9 783844 300314 978-3-8443-0031-4

Health and Safety in Construction

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Towards Improving Health and Safety Practices in Construction

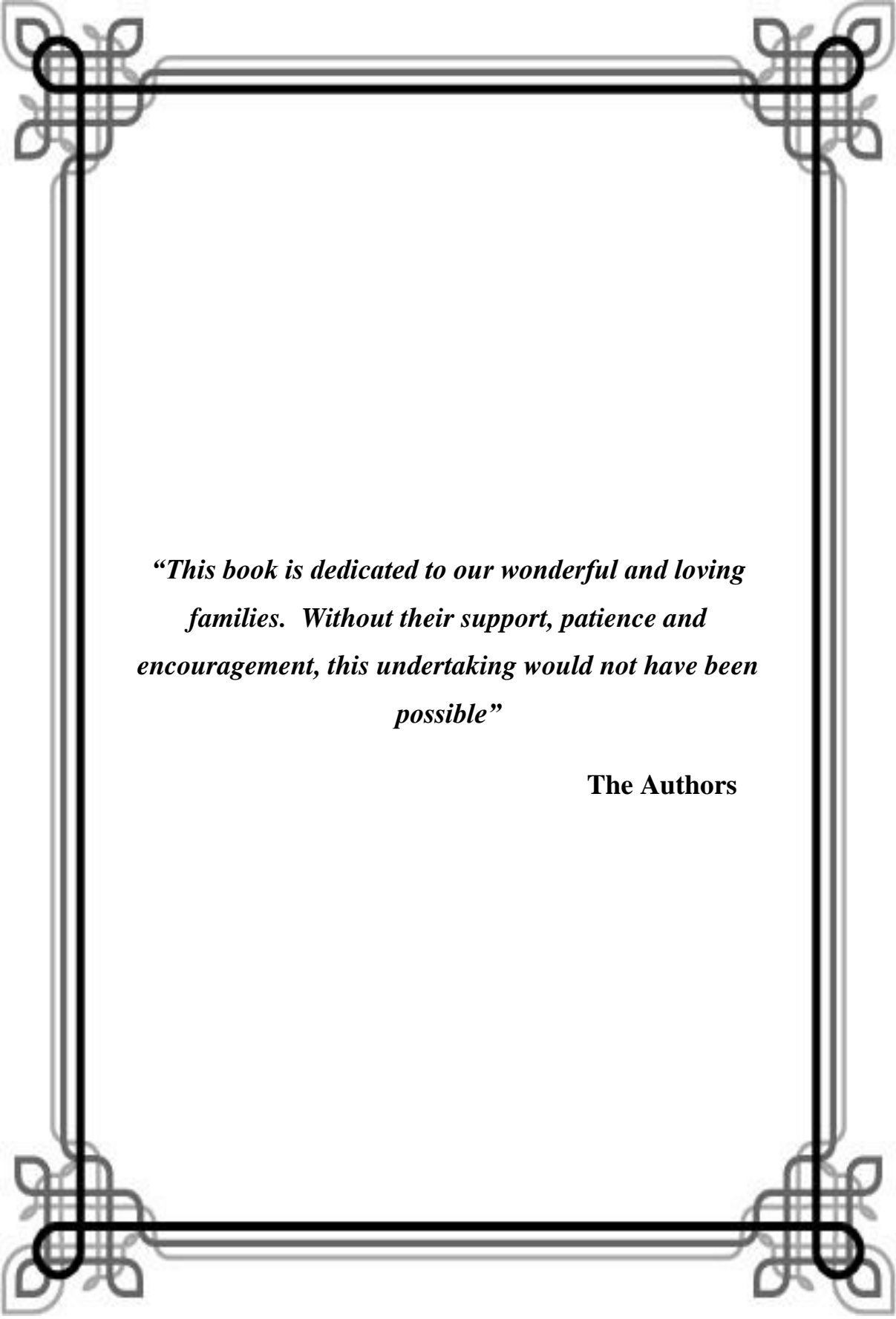
Investigating the Causes and Effects of Contractor's
Non-Compliance with Health and Safety Regulations
in South Africa



Summary

Construction is a dangerous and risky business. This is due to the nature of its activities and the high resultant accident rates. The Health and Safety Act, more especially the Construction Regulations is in place foremostly to eliminate the potential hazards during design and construction phases and reduce the consequential risks thereof. However, the importance of the construction regulations seems to have been overlooked in South Africa. As a result, the number of accidents and fatalities witnessed has been rapidly increasing and has necessitated the investigation for the reasons for contractor's non-compliance with the Health and Safety regulations. The aim of this research is to investigate the causes of non-compliance with the health and safety procedures by contractors and the subsequent effects of such non-compliance on the construction project as well as the country's socio economy. In order to achieve the abovementioned aim the researchers used both a qualitative and quantitative approach. The research makes use of the following methodologies; analysis of literature pertaining to health and safety, evaluation of a survey questionnaire completed by contractors and health and safety officers and assessment of five structured interviews that have been conducted with two safety officers and three health and safety representatives, those of which were chosen for their experience and knowledge of the health and safety practices on sites. The research findings revealed that contractors are non-compliant with health and safety policies, with the main focus being on smaller contracting firms who do not employ proper safety supervision. Furthermore, a problem lies with labourers who neglect safety in the execution of their duties because project productivity takes priority. An action plan was developed from the findings of the research to improve the compliance of contractors with the health and safety procedures on construction sites, thereby reducing the causes of site incidents and its effects.

Keywords: Health and Safety Act, Contractors, Construction regulations, Non-compliance, Incidents.



“This book is dedicated to our wonderful and loving families. Without their support, patience and encouragement, this undertaking would not have been possible”

The Authors

Table of Contents

Contents		Page No.
Summary		i
Dedication		ii
Table of Contents		iii
List of Figures		vi
List of Tables		vi
List of Abbreviations and Terminology		vi
Chapter 1 Introduction		
1.1	Introduction	1
1.2	Background to Research	1
1.3	Problem Statement	2
1.4	Research Hypothesis	2
1.5	Research Aim and Objectives	3
1.6	Research Motivation and Rationale	3
1.7	Research Methodology	3
1.8	The Study Limitations	4
1.9	Research Originality and Achievements	4
1.10	Research Findings, Output and Recommendations	5
1.10.1	Findings from the Literature Review	5
1.10.2	Findings from the Survey Questionnaire	5
1.10.3	Findings from the Structured Interviews	6
1.10.4	Research Output	7
1.10.5	Research Recommendations	7
1.11	Structure of the Dissertation	8
1.12	Conclusion	10
Chapter 2 Research Methodology		
2.1	Introduction	11
2.2	Research Approach and Process	11
2.2.1	Research and the Research Approach	11
2.2.2	Research Process	13
2.3	Research Methodology and Methods	13
2.3.1	Research Methodology Definition	13
2.3.2	Research Methods Definition	13
2.3.3	Research Aim and Objectives	15
2.3.4	The Nature and Characteristics of the Research	15
2.4	The Relationship between the Research Methods and Objectives	15
2.5	Data Collection	16
2.5.1	Literature Review	16
2.5.2	Survey Questionnaire	17
2.5.2.1	Survey Questionnaire Sampling	18
2.5.2.2	Survey Questionnaire Distribution	19
2.5.3	Structured Interviews	19
2.5.3.1	Structured Interview Sampling	19
2.6	Justification for the Research Methodology Adopted	19
2.6.1	Reasons for selecting contractors	21
2.6.2	Reasons for selecting site safety officers	21
2.7	Hypothesis Testing	21

Table of Contents

2.8	Research Credibility, Reliability and Validity		21
	2.8.1	The Credibility of Research Findings	21
	2.8.2	Reliability	22
	2.8.3	Validity	22
	2.8.4	Reliability and Validity of the Research Methods	22
	2.8.5	Reliability and Validity of the Research Findings	23
2.9	Conclusion		23
Chapter 3		Literature Review	
3.1	Introduction		24
3.2	General Overview of the Health and Safety Act 85 of 1993		24
3.3	Clauses Pertinent to the Study		24
	3.3.1	Clause 6(6): Supervision	24
	3.3.2	Clause 7(1, 4): Risk Assessment	24
	3.3.3	Clause 8(2): Fall Protection Plan	26
3.4	Roles of Contractor, Sub-contractor and Health and Safety Officers		26
3.5	Falls and Fall Protection		29
	3.5.1	Types of fall accidents	30
	3.5.2	Fall-related deaths and injuries	30
	3.5.3	Causes of fall incidents	32
	3.5.4	Fall protection systems	33
		3.5.4.1 The construction regulations	33
		3.5.4.2 Safety harness	34
		3.5.4.3 Catch nets	35
		3.5.4.4 Scaffolds	36
		3.5.4.5 Roofs	36
		3.5.4.6 Working platforms	37
		3.5.4.7 Openings and edges	37
3.6	Methods Used to Promote and Ensure Compliance		37
	3.6.1	Risk Assessments for activity – Site specific	38
	3.6.2	Method statement	38
	3.6.3	Safe working Procedure	38
	3.6.4	Health and safety inductions before proceeding to site	38
	3.6.5	Toolbox talks	38
	3.6.6	Encourage participation of safety strategies	39
3.7	Management systems for safe construction		39
	3.7.1	Risk Management	39
3.8	Accident Reaction and First Aid		41
3.9	Health and Safety Training		45
	3.9.1	Induction training	46
	3.9.2	Job specific training	47
	3.9.3	Supervisory and Management Training	47
	3.9.4	Specialist training	48
3.10	Personal Protective Clothing		49
3.11	Effects of Site Incidents on the Project Itself		51
	3.11.1	Cost of accidents (CoA)	52
	3.11.2	Benefits of reduced Cost of accidents	55
3.12	Conclusion		56

Table of Contents

Chapter 4		Data Analysis			
4.1	Introduction			57	
4.2	Response Rate			57	
	4.2.1	Survey Questionnaire		57	
	4.2.2	Structured interviews		58	
4.3	Analysis of Data			58	
	4.3.1	Analysis of Survey Questionnaire Responses		58	
	4.3.2	Analysis of Interviews Responses		75	
4.4	Conclusion			81	
Chapter 5		Conclusions and Recommendations			
5.1	Introduction			82	
5.2	Contribution to the Original Body of Knowledge			82	
5.3	Research Overview			82	
	5.3.1	Problem Statement		82	
	5.3.2	Research Aim and Objectives		83	
	5.3.3	Research Methodology		83	
5.4	Findings of the Research			84	
	5.4.1	Literature Review		84	
	5.4.2	Survey Questionnaire		85	
	5.4.3	Structured Interviews		86	
5.5	Testing the Research Hypothesis			87	
5.6	Action Plan for Complying with H&S Regulations (APCHSR)			87	
	5.6.1	Definition		87	
	5.6.2	Need for an Action Plan		88	
	5.6.3	Description of the Action Plan			88
		5.6.3.1	Problem Definition		89
		5.6.3.2	Objectives Establishment		89
		5.6.3.3	Action Development		90
		5.6.3.4	Action Implementation		91
		5.6.3.5	Evaluation and Feedback		92
	5.6.4	Benefits and Limitations of the Action Plan		93	
5.7	Research Recommendations			93	
	5.7.1	Recommendations to contracting firms		93	
	5.7.2	Recommendations to Government		95	
	5.7.3	Recommendations for further research		95	
5.8	Closing Comments			96	
References				96	
Bibliography				101	
Appendices				102	

Table of Contents

List of Figures		
Figure No.	Title	Page No.
Figure 2.1	Research Process	14
Figure 2.2	Sample Calculator	18
Figure 3.1	Safety Harness and Assembly	35
Figure 3.2	Catch Nets	35
Figure 3.3	Correct Scaffold Assembly	36
Figure 3.4	Incorrect Use of Scaffolding	36
Figure 3.5	Correct Use of Lifelines and Harnesses	49
Figure 3.6	Hard Hat, Ear Muffs, Gloves and Spectacles	50
Figure 3.7	Standard PPE when Working with Heavy Duty Power Tools	50
Figure 4.1	Safety Officers' Order of Responsibilities	59
Figure 4.2	Correct Personal Protective Equipment at Heights	61
Figure 4.3	Success Factors for a Project	63
Figure 4.4	Types of Accidents on Construction Sites	71
Figure 4.5	Causes of Site Accidents	72
Figure 4.6	Effects of Accidents on Construction Sites	75
Figure 5.1	Action Plan	88

List of Tables		
Table No.	Title	Page No.
Table 2.1	The Relationship between the Research Methods and Objectives	16
Table 3.1	H&S Accidents by Cause: FEMA	31
Table 3.2	Construction Health and Safety Claims and Fatalities	31
Table 3.3	Factors Contributing to the Occurrence of Accidents	33
Table 4.1	Relationship between Sample Size and the Types of Enterprises	57
Table 4.2	Relationship between Responses Received and the Types of Enterprises	57

List of Abbreviations and Terminology	
<i>APCHSR:</i>	Action Plan for Complying with H&S Regulations
<i>Contractor:</i>	A person or a firm that agrees to furnish materials or perform services at a specified price, especially for construction. * For purposes of this research a contractor refers to both main and sub-contractors.
<i>DoL:</i>	Refers to the South African Department of Labour
<i>DSTI:</i>	Daily Site Task Identification
<i>Duckboards:</i>	A boardwalk or slated flooring laid on a wet, muddy and cold surface; usually used in plural.
<i>Earthmoving machines:</i>	Heavy and light machines that are used for various civil engineering and construction projects, e.g. excavators, cranes, bulldozers and loaders.
<i>Fall Protection Plan:</i>	A plan designed to enable recognition of the fall hazards on the job and establish the procedures that are to be followed in order to prevent falls to lower levels.
<i>Gangways:</i>	A passageway for entering, leaving or going past.
<i>H&S:</i>	Health and Safety
<i>Health & Safety officer:</i>	A person who plans, co-ordinates and implements a comprehensive occupational H&S programme.

Table of Contents

<i>Housekeeping:</i>	The daily clearing of all debris, materials and equipment after work has ceased.
<i>ILO:</i>	International Labour Office
<i>Induction:</i>	The act or process of inducting or bringing in; introduction; entrance; beginning; commencement.
<i>Project Stakeholders:</i>	They are the individuals and organisations who are actively involved in the project or whose interests may be positively or negatively impacted by the project.
<i>MBA:</i>	Master Builders Association
<i>PPE:</i>	Personal Protective Equipment
<i>Regulations:</i>	Procedures or rules set in place to maintain control of the workforce and the policies employed by an enterprise.
<i>Risk:</i>	The chance or likelihood of a hazard causing harm or damage to a person, property or the environment.
<i>Risk Assessment:</i>	Identification, evaluation and estimation of the levels of risks involved in a situation.
<i>SACQSP:</i>	South African Council for Quantity Surveying Professionals
<i>Safety:</i>	Condition of being protected from or likely to cause danger, risk and injury, etc.
<i>Safety devices:</i>	Device designed to prevent injury or accidents.
<i>Scaffolds:</i>	A temporary platform either supported from below or suspended from above on which workers sit or stand when performing tasks at heights.
<i>SHEQ:</i>	Safety, Health and Environmental Quality
<i>Site:</i>	It is an area of ground in which the execution of works is carried out.
<i>Site supervisor:</i>	Refers to site personnel who observe and direct the labourers in carrying out the execution of works.
<i>Supervision:</i>	To watch over an activity or task being carried out by somebody and ensure that it is performed correctly.
<i>Tender:</i>	Bidding process that is open to all qualified bidders and where the sealed bids are opened, usually in public, for scrutiny and are chosen on the basis of price and quality.
<i>Toeboards:</i>	A vertical barrier at floor level that is erected along exposed openings, such as a floor openings, platforms or runways.
<i>WC:</i>	Workers' Compensation
<i>Works:</i>	Refers to the construction works carried out on site.

1.1 Introduction

This chapter introduces the work done throughout this research. It will comprise of background to the research, research aim and objectives, research hypothesis and problem statement, as well as the research methodology to be adopted. Research motivation and rationale, the study limitations and the originality and achievements of this study will be highlighted. The research findings, output and recommendations will also be mentioned and this chapter will conclude with the structure of the dissertation.

1.2 Background to the Research

The Occupational Health and Safety Act 85 of 1993 summarize the Act as follows:

“To provide for the health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery; the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work; to establish an advisory council for occupational health and safety; and to provide for matters connected therewith.” (LexisNexis Group, 2006, p5).

The Occupational Health and Safety Act encapsulates all the health and safety (H&S) regulations for good practice in the workplace. As part of this study, reference is made to the section regarding construction regulations. Certain sections of these regulations will be highlighted further in this research report. Construction is a very accident prone industry where the resulting injuries can have dire consequences. Common incidents that occur on site include falling from heights, cutting off of limbs due to mishandling of heavy equipment, objects falling from heights, electric shocks from cables, personnel being affected by demolition works, caving in of excavations, and those related to cranes and heavy-lifting machinery (Hughes & Ferrett, 2005).

Some of the causes of these incidents incurred by workers are fatigue, lack of discipline, carelessness and distractions. Those caused by senior management are that of ignorance, lack of training and poor communication (Laney, 1982). In the event that some misfortune occurs standard protocol needs to be actioned immediately. Every incident needs to be firstly reported to a member of management or safety officer. If a person is injured it is considered to be an injury on duty. A medical examination is done to assess the severity of the accident and thereafter the person is compensated for. If there is damage to plant and

equipment the site manager assesses the damage and the matter is then reported to senior management where it is costed. Depending on the cause of the incident, a hearing may be held after investigation of the incident and the issue addressed thereafter (IRCA, 2003).

Overall the effects of such incidents are very costly. Smallwood (1997) states that occupational disease, fatalities and injuries cause human suffering that not only affect the person directly involved, but also affect the project risk which is manifested in the increased cost of construction, damage to the environment, non-conformance to quality standards and scheduled overruns. As a result it is imperative that all participants contribute to achieving a 'zero accident' outcome. Each member of the client, design and construction teams influences and contributes to the occupational H&S on site. They are uniquely positioned to integrate H&S into all aspects of the design and construction process (Smallwood, 1997). However, contractors predominate in terms of the perceived extent to which stakeholders can contribute to H&S (Smallwood & Haupt, 2005).

It is also apparent that adequate allowance for H&S during tendering has been a controversial issue as some contractors feel that if they make a provision for H&S they may run the risk of losing the tender to a contractor who has not allowed for H&S (Smallwood, 2005).

1.3 Problem Statement

The construction regulations of the H&S Act are in place for the protection of all participants involved in the construction process. However, recent statistics depict a 5% increase in the number of fatalities from 2007 to 2008. Furthermore, 2008 statistics show that 68% of incidents were of a non-fatal nature (Smallwood *et al.*, 2009). This is largely due to the negligence of the workforce, contracting parties and site supervisors (Holt, 2001). Dangers are ever present on construction sites therefore it is imperative to find better means of maintaining safety.

1.4 Research Hypothesis

There is no direct relationship between non-compliance by South African contractors' with clauses 6(6), 7(1; 4) and 8(2) of the construction regulations and the causes of site accidents and the direct and indirect costs as a result of such accidents.

1.5 Research Aim and Objectives

The aim of this study is to investigate the causes and effects of non-compliance with the H&S procedures by contractors in the South African construction industry.

In order to achieve the abovementioned aim a research methodology is developed to accomplish four objectives.

- (1) Investigating the H&S Act, policies used to promote and ensure compliance within sites, hazard and prevention methods and management systems for safe construction.
- (2) Defining the causes and effects of non-compliance with H&S procedures and determining practices on construction sites.
- (3) Assessing the practicality of the H&S plans and investigating their view towards eliminating contractor's non-conformance with H&S procedures.
- (4) Developing an action plan to enhance the effectiveness of contractors' H&S plans in South Africa.

1.6 Research Motivation and Rationale

Research into the causes and effects of non-compliance with the H&S procedures on construction sites by South African contractors is justified because of the following reasons:-

- To create awareness to all stakeholders.
- To remove the general public perception that accidents are acceptable.
- To encourage further studies in this domain.
- To improve existing action plans used to curb non-compliance by contractors.
- To shed some light on the significant impact of these incidents on the construction project and the economy at large.

1.7 Research Methodology

A collaboration of qualitative and quantitative research methodologies is adopted to achieve the study aim and objectives. The research introduces the specific area to be investigated by using an extensive literature review. An in-depth appraisal of published material relating to safety performance in the construction industry will provide a basis for the researchers' investigation. The literature review will also briefly address issues

concerning the focus clauses 6(6), 7(1; 4), 8(2) and discuss the causes and effects of non-compliance thereof.

A survey was conducted to determine whether contractors are compliant with the practices laid out as a regulation on site. A survey questionnaire comprising of two sections was issued out to contractors and H&S officers for completion of their relevant sections. The participants involved in the survey were from the KwaZulu-Natal (KZN) region.

Structured interviews were conducted with two H&S officers and three H&S representatives to gain a more practical insight into their understanding and application of safety management systems in the execution of their duties.

1.8 The Study Limitations

This research has been limited due to the following factors:

- Only KZN contracting firms were analysed, therefore the effects due to non-compliance are not explored in its entirety for South Africa.
- The validity and extent of the information supplied to us by the respondents is questionable.
- Only clauses (6) supervision, (7) risk assessments and (8) fall protection of the H&S Act are investigated.

1.9 Research Originality and Achievements

- This research enables contractors to pinpoint the flaws within site management and identify the shortcomings of their relevant H&S plans.
- This research led to the development of an action plan to counteract the ineffectiveness of existing H&S plans.
- Previous research has not focused on the areas of concern described in this report, i.e. contractor based.
- Clauses contained in the construction regulations discussed in this research have not been highlighted in construction literature previously.
- A paper has been published in the SACQSP Quantity Surveying conference, 2009, Durban, South Africa in October 2009.

1.10 Research Findings, Output and Recommendations

1.10.1 Findings from the Literature Review

- The H&S Act states that all companies must comply with the fundamental principles relating to the implementation of an H&S plan.
- Contractors are responsible for the supervision of his employees in ensuring their safety with regard to their working environment and procedures. He should appoint a supervisor to constantly monitor his labour force when he is unable to.
- Risk assessments must be conducted to identify all the hazards present on site and thereafter the findings must be incorporated into the H&S plan to be implemented. Similarly, the contractor is also responsible for the preparation of a fall protection plan to which all fall related matters can be traced and compared.
- The most common accidents that occur on construction sites are falls, stepping or striking against objects, mishandling of machinery, fires and explosions. These accidents are mainly due to the negligence of labourers'.
- Contractors and safety officers should incorporate and implement risk assessments, a method statement of the company's beliefs and values, safe working procedures, H&S inductions, and toolbox talks in their plans if they wish to effectively eradicate the occurrences of accidents on construction sites.
- An accident reaction system, training of both employers and employees and ensuring the correct use of personal protective equipment at all times is imperative in the development of an effective H&S plan.
- The costs of accidents are not tracked by contractors and therefore exceed expectations by the end of a project.

1.10.2 Findings from the Survey Questionnaire

- Majority of the companies briefed those employees who worked at elevated positions. A small percentage did not feel the need to, since employees go for inductions.
- All the companies surveyed ensured that their employees wore the correct personal protective equipment. Furthermore, only 44% stated the correct equipment to be used at heights whilst the remaining 56% did not specify as such. However, out of 27 responses 24% stated that site accidents were caused by labourers not using their personal protective equipment.

- Companies do implement an H&S plan comprising a fall protection plan, risk assessments, training and the emergency procedures to be adopted in the event of an accident. It was also noted that while risk and hazard identification received attention every day, a considerable percentage only briefed employees when a fatality/injury occurred or at an induction.
- From the responses, the following accidents predominate on construction sites (listed according to rank): Stepping or striking against objects, minor cuts and bruises, falls from heights, cutting off of limbs and electric shocks. These were predominantly due to the lack of awareness and concentration, and non-usage of personal protective equipment.
- The six crucial effects of site accidents are (listed according to rank): insurances, compensation to affected parties, repairs to damages, loss of productivity during an accident, loss of productivity by the injured party and professional fees for medical care.

1.10.3 Findings from the Structured Interviews

- Safety officers are primarily responsible for the site inspections, ensuring compliance with the H&S plan, constant monitoring of existing precautions, providing a communication link between labour and management and providing a statement of witness for incidents.
- In the opinion of the interviewees', compliance is generally not up to par. This is attributed to the fact that upper management focus is more on production and there is a general disregard for the safety aspects. Furthermore, the areas in which contractors ensure compliance include site establishment requirements, the provision of personal protective equipment and the provision of workman's compensation. It was noted that supervision is not one of these areas.
- Non-conformance with safety procedures is attributed mainly to the negligence by H&S officers and upper management. This is due to their lack of commitment, poor leadership and production driven goals. The lack of training by supervisors and their failure to inform employees of risk assessments are also areas of concern.
- The core issues faced by H&S officers are the double standards of management, i.e. insufficient training of labour, lack of supervision and the choice of 'fly-by-night' contractors which all compromise safety on site.

- The most common site accidents were hand injuries through cuts and abrasions, objects falling on labourers, falls from heights and trip fall hazards. The frequency of first aid cases treated were found to be a daily occurrence, while more serious incidents occurred approximately once every fortnight.
- There is a need to develop a protocol for testing the competency, experience, education and managerial skills of employees. Compulsory audits for peer assessment and the inclusion of a daily non-conformance reporting system to the director of the firm are proposed changes to improve the H&S plans on sites.

1.10.4 Research Output

- This study reveals the major challenges faced by contractors in ensuring that compliance is maintained on sites.
- Further incorporated is the awareness given to all participants with regards to the adherence of optimum H&S practices in South Africa.
- An action plan is developed which when implemented properly shall assist contracting companies in ensuring that compliance is maintained at all times.
- This research will add to the body of knowledge in the related topics, with reference to the contractor's level of commitment to the H&S regulations.

1.10.5 Research Recommendations

Recommendations to contracting firms

- Firms should make it their priority to educate and increase the awareness of all involved of the causes and effects of site incidents as these incidents impact other workers, the project and the country's economy.
- Construction companies should take a more proactive approach towards implementing the H&S plans on site through integrating H&S procedures into overall project management plans. The operations division should incorporate the H&S principles as a priority in their daily schedule.
- Firms who employ sub-contractors should scrutinize their safety record and policies before appointing them.
- Contractors should continuously brief their labour force to maintain proper safety procedures on site and this can be achieved through repetitive teaching.

- Construction companies are advised to adopt the action plan developed by this research as an approach to reduce the causes and effects of non-compliance on construction sites.

Recommendations to government

- A larger fine should be imposed on contractors who fail to comply with the H&S provisions. Also fines should be charged in the defaulting parties' personal capacity. This should be legislated.
- The responsibilities of the site supervisors should be legislated.
- Government should instate a system to allow for the constant monitoring and evaluation of the competence of the Department of Labour officers to ensure that these individuals execute their duties with due diligence.
- Government should create a skills development programme, to ensure that workers are properly trained and competent before engaging in construction activities thereby reducing the related risk.

Recommendations for further research

- Research should be conducted following this report to investigate whether improvements have been made within the construction industry in terms of H&S compliance.
- The same study should be conducted with other construction industry professionals to evaluate their input into the maintenance of good working systems in H&S practices in South Africa.
- The possibility of a government driven initiative where all H&S education related matters of the workers, be it private or public, are addressed to ensure that workers reach acceptable levels of competency before being discharged for work purposes.

1.11 Structure of the Dissertation

This report will adopt the following structure breakdown:

- Chapter 1: *Introduction*: Introduces the research question and outlines the path the dissertation takes to reach its conclusion. It is structured as follows:-
 - Background to the Research
 - Problem Statement
 - Research Hypothesis

- Research Aim and Objectives
 - Research Motivation and Rationale
 - Research Methodology
 - The Study Limitations
 - Research Originality and Achievements
 - Research Findings, Output and Recommendations
 - Structure of the Dissertation
- Chapter 2: *Research Methodology*: Explains the methods used in this research to collect and analyse data to achieve the aim and objectives of this study. The following are discussed:-
- Research Approach and Process
 - Research Methodology and Methods
 - The Relationship between the Research Methods and Objectives
 - Data Collection
 - Justification for the Methodology Adopted
 - Hypothesis Testing
 - Data Analysis
 - Research Credibility, Reliability and Validity
- Chapter 3: *Literature Review*: Reviews the body of knowledge developed during previous research. It comprises of:-
- Health and Safety Act 85 of 1993
 - Clauses Pertaining to the Research
 - Role of Principal Contractors, Sub Contractors and Safety Officers
 - Causes of Non-Compliance by Contractors
 - Falls and Fall Protection
 - Methods Used to Promote and Ensure Compliance
 - Management Systems for Safe Construction
 - Accident Reaction and First Aid
 - Health and Safety Training
 - Protective Clothing
 - Effects of Site Incidents on the Project Itself

- Chapter 4: Data Analysis: Comprises the results of applying the research methods adopted in this study.

The following are included:-

- Response Rate
 - Analysis of Survey Questionnaire
 - Analysis of Interviews
 - Summary of Findings
-
- Chapter 5: *Conclusions and Recommendations*: An action plan is derived to improve the compliance by South African contractors with the construction regulations. Conclusions are gathered from the data analysis and the recommendations made are based on these conclusions. Further research areas are also suggested. It consists of:-
 - Contribution to the Original Body of Knowledge
 - Research Overview
 - Findings of the Research
 - Testing the Research Hypothesis
 - Action Plan for Complying with H&S Regulations (APCHSR)
 - Need for Action Plan
 - Benefits and Limitations of Action Plan
 - Research Recommendations
 - Areas for Further Research

1.12 Conclusion

This chapter creates a reference point for the interpretation of the literature review and data analysis to follow. The research aim and objectives, background to the research, research hypothesis and problem statement have been established. The research methodology to be adopted has been defined. Research motivation and rationale, study limitations, originality and achievements, the research findings, output and

2.1 Introduction

This chapter discusses the research methodology adopted to achieve the aim and objectives of this study. It will comprise of the research approach and process, research aim and objectives and research methodologies that have been adopted. A justification for the research methodology adopted and the relationship between the research methods and objectives will reinstate the credibility of this research.

2.2 Research Approach and Process

2.2.1 Research and the Research Approach

Academically, research is defined as a systematic study or process of enquiry that is aimed at increasing the sum of human knowledge. For the research to hold true it has to be distinct and each section explained fully on its own (Holt, 1998). There are two widely used paths which form the basis of the research conducted by those in the construction industry, qualitative and quantitative approaches (Holt, 1998).

A qualitative approach is described as a systematic and objective location, evaluation and synthesis of evidence, using methodologies in order to establish facts about the certain misconceptions and draw conclusions on such (Walliman, 2005). Holt (1998) mentions that this approach involves a complex approach as the process involves analyses of various informants' opinions and comprehensive data. Qualitative methodologies make use of the following approaches but are not limited to them:

- Descriptive approach - describes what the problem is after careful review of data related to the study. This allows the reader to fully ascertain what the issues relating to the topic are, and as a result the reader is thereafter persuaded into choosing the topic that seeks to solve the problem.
- Explanation approach - fully explains to clear the matter in the briefest way so that the reader can create the full picture in his mind. It explains why something happens or happened as well as the causes and effects of such a happening.

Since this research seeks to investigate the causes and effects of non-compliance by South African contractors with the H&S regulations, it can be partially viewed as explanatory in the form of exposing the procedures followed when the incident has occurred.

Qualitative methods explore the relationship of events, their views and opinions which do not include numerical data. It attempts to examine the situations in order to establish what the norm is by using textual instead of numerical data.

Quantitative approach is defined as the investigation into the problems society has through testing the hypothesis using numerical or statistical approaches. This approach is regarded as one that is analytical in nature because statistics form the basis of tests which are formulated for the testing of the hypothesis. Data gathered using the quantitative approach is derived from surveys and statistical tests (Holt, 1998).

Furthermore, Holt (1998) comments that there are many research methods that exist with surveys, experiments and case studies being the most widely used within the property and construction industry for research purposes. Leedy (2005) mentions that the nature of the data used, the objectives of the study together with the questions formulated will significantly affect one's choice of the method to be followed.

Walliman (2005) states that:

- Surveys are one of the most important elements of research although it is criticized for its narrow approach as interviewees will answer according to their own experiences. It is essential that the questions to be asked are kept as simple as possible for statistical purposes.
- Experiments have an advantage of allowing the researcher to artificially control the outcome of the experiment through ensuring that the constituents are appropriate for the purposes of yielding the preferred outcome. This approach has been criticized as not being investigative since the person who conducts the experiment knows what to expect and therefore controls the outcome rather than discovering the underlying issues that propel such to happen.
- Case studies are preferred when the research will involve extensive use of data to present various ideas to offer a wider understanding of the subject.

Furthermore Holt (1998) discusses the importance of formal and informal interviews as one of the commonly used methods for conducting research. Since the structure of a survey is almost the same as that of an interview, the two can be used instead of the other and vice versa. In this regard the research report adopts a quantitative approach as it

makes use of statistics gathered from the survey questionnaire responses from contractors and H&S officers. Structured interviews were also carried out to assess the effectiveness of H&S plans implemented on sites.

Walliman (2005) states that the research methodology should not be restricted to one method of data collection for the purpose of research as it may result in bias to that particular method. Holt (1998) agrees that the use of different methods to collect data for the purposes of research will prove more reliable than when it is only restricted to one method.

2.2.2 Research Process

The research process is a systematic guide for obtaining findings, data collection, developing data analysis as well as formulating the conclusion. The research process adopted for this study is depicted in figure 2.1. The systematic structure of objectives is set in such a way that they compliment one another and they afford a flow in the research through ensuring that the objectives interlink whilst remaining interdependent.

2.3 Research Methodology and Methods

2.3.1 Research Methodology Definition

Leedy (2005) defines research methodology as the philosophy, system of methods and principles used in a particular discipline to achieve and satisfy the research aim. It incorporates all the methods adopted and applied in order to achieve the aims of the study and this becomes the framework to be followed when conducting the research (Holt, 1998). Research methodology can be classified into two sections, i.e. qualitative and quantitative approach as explained under research and research approach segment of this report (2.2.1).

2.3.2 Research Methods Definition

Leedy (2005) refers to research methods as the established and particular form of procedure to be followed for accomplishing or approaching an objective in a systematic way. These methods are linked with the objectives of the research and thus satisfy the aim of the research.

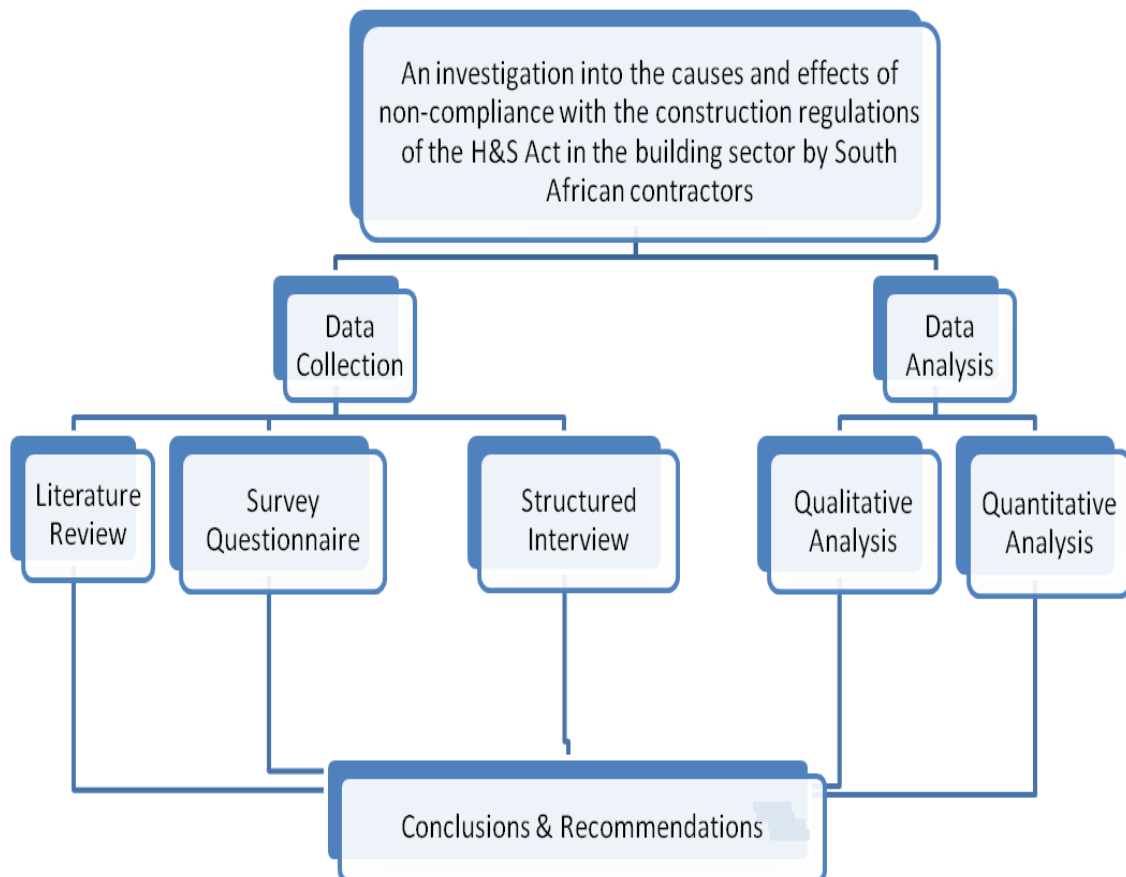


Figure 2.1 Research Process

2.3.3 Research Aim and Objectives

The aim of this study is to investigate the causes and effects of non-compliance with the H&S procedures by contractors in the South African construction industry. In order to achieve the abovementioned aim a research methodology is developed to accomplish four objectives.

- (1) Investigating the H&S Act, policies used to promote and ensure compliance within sites, hazard and prevention methods and management systems for safe construction.
- (2) Defining the causes and effects of non-compliance with H&S procedures and determining practices on construction sites.
- (3) Assessing the practicality of the H&S plans and investigating their view towards eliminating contractor's non-conformance with H&S procedures.
- (4) Developing an action plan to enhance the effectiveness of contractors' H&S plans in South Africa.

2.3.4 The Nature and Characteristics of the Research

This research is an investigative study and attempts to collaborate with contractors, safety officials, i.e. Department of Labour (DoL) as well as Government to integrate a system which will improve the obvious non-compliances that exist in the construction industry. These non-conformances are often ignored or not investigated further which ultimately result in abnormally high H&S accident statistics.

An action plan for the incorporation of these ideals into the H&S practices is formulated and should be adopted by all influential parties mentioned.

2.4 The Relationship between the Research Methods and Objectives

Table 2.1 depicts the relationship between the research objectives and the research methods adopted for this study. The links shown in this table is essential to understanding the flow of this research.

Table 2.1: The Relationship between the Research Methods and Objectives

Research Methods		Research Objectives			
		1	2	3	4
Data Collection Methods	Literature Review	◇			◇
	Survey Questionnaire		◇		◇
	Structured Interviews			◇	◇
Data Analysis Method	Quantitative		◇		
	Qualitative	◇	◇	◇	◇

2.5 Data Collection

Data collection is the most fundamental activity in the research process. This section describes the procedures that were used to conduct this research.

2.5.1 Literature Review

Literature review is regarded as the primary or preceding reading done by the researcher to acquire relevant and sound information pertaining to the study that is to be conducted. It is also aimed at exposing the recent critical issues that have developed within relevance to the proposed research to ensure that further research can be recommended in areas having been diagnosed as lacking (Holt, 1998). The literature review was used to achieve the first objective, i.e. investigating the H&S, policies used to promote and ensure compliance within sites, hazard and prevention methods and management systems for safe construction.

The review includes the following:-

- Review of the H&S Act to make known the obligation of South African contractors.
- The focus clauses pertaining to this study in the following areas of concern:
 - Supervision
 - Risk assessment
 - Fall protection plan
- The role of safety supervisors and safety officers.
- The most common causes of accidents and the current methods used to counteract their prevalence on construction sites.

- Methods used to promote and ensure compliance to establish the techniques employed by contractors and their practicality in use.
- Management of safety systems. The most common safety systems are reviewed.
- Accident and first aid and the procedures adopted in response to any accident that may occur on site. This also sheds light on some of the effects that result from an accident.
- Safety training.
- The standard personal protective clothing and gear information.
- A brief discussion of the effects of non conformance on the project as well as the South African economy concludes the literature review.

Sources of literature comprised books, journals, government reports, H&S Organisation reports, South African legislation, articles, unpublished dissertations, published theses as well as seminar and conference documents. These sources were retrieved from the University of KwaZulu-Natal Library, industry tutors, online search libraries and engines, and seminars attended.

2.5.2 Survey Questionnaire

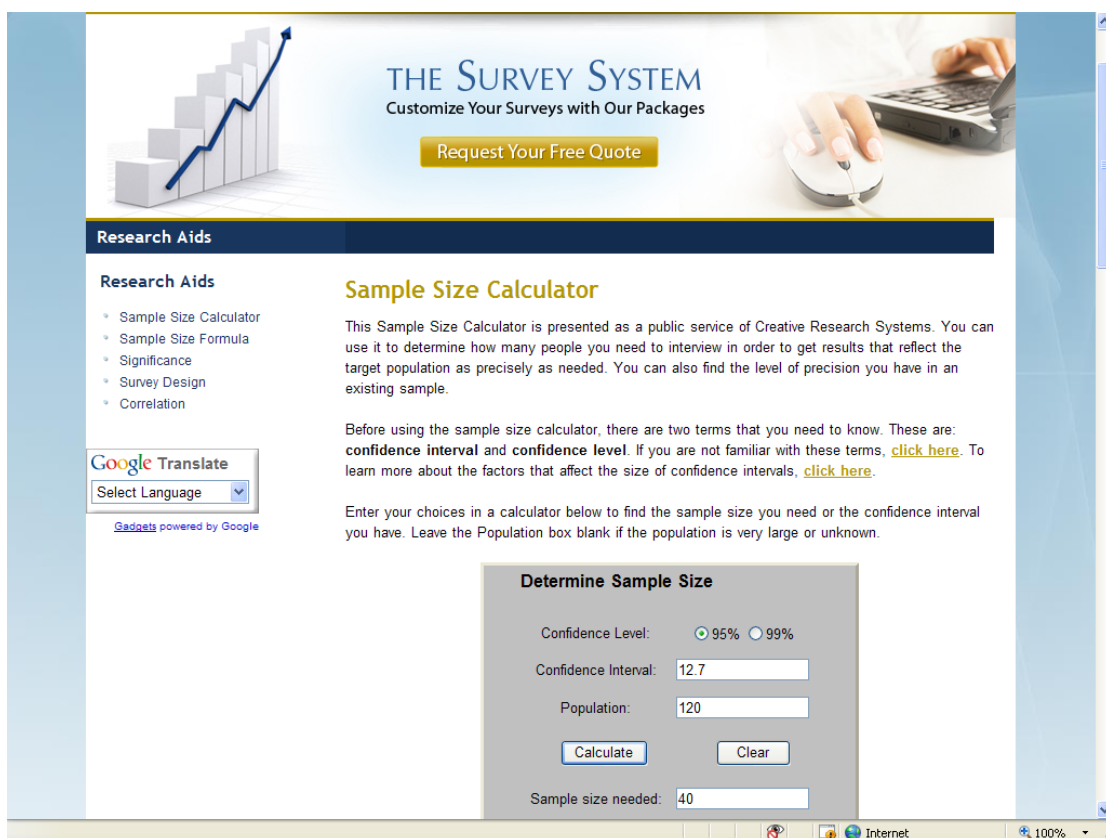
A survey questionnaire is defined as a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents (Leedy, 2005). Although they are often designed for statistical analysis of the responses, this is not always the case. Questionnaires are advantageous over some other types of surveys in that they are cheaper, do not require as much effort from the researcher in the way of verbal or telephone surveys, and often have standardized answers that make it simple to compile and analyze data. However, such standardized answers may frustrate respondents (Leedy, 2005).

The survey questionnaire was used to achieve the second objective, i.e. defining the causes and effects of non-compliance with H&S procedures and determining practices on construction site. A survey questionnaire was sent out to three types of enterprises, i.e. small, medium and large. Contractors and site safety officers completed their relevant sections of the questionnaire. The survey questionnaire was used to gain insight into the working conditions on site and to evaluate the implications and compliance with the construction regulations by all parties concerned, the main focus being on clauses 6(6);

7(1,4) and 8(2). These clauses make specific reference to supervision procedures to be adopted, risk assessments to be executed and the adequacy of fall protection plans respectively. This survey questionnaire uses a qualitative approach to gather the honest opinions of those partaking in the survey and is a quantitative means of obtaining data when responses are tallied and thereafter analysed.

2.5.2.1 Survey Questionnaire Sampling

The participants were selected by referring to the list of building contractors registered within the Master Builders Association (MBA, 2009) of South Africa. The researchers then made use of the sample calculator (The Survey System, 2009) to establish a suitable sample size to be used in order to arrive at a well substantiated conclusion. The resultant sample size was 40. A few unlisted companies were also included to back up a low response. The unlisted companies were chosen from the yellow pages as well as through random site visit selection in Kwazulu-Natal. All contractors were selected for their expertise and knowledge pertaining to the construction industry and the topic of focus in this study.



The screenshot displays the 'THE SURVEY SYSTEM' website interface. At the top, there is a navigation bar with the text 'THE SURVEY SYSTEM' and 'Customize Your Surveys with Our Packages', along with a 'Request Your Free Quote' button. Below this, a 'Research Aids' section lists various tools, including 'Sample Size Calculator'. The 'Sample Size Calculator' section provides an introduction to the tool and explains the terms 'confidence interval' and 'confidence level'. It includes a 'Determine Sample Size' form with the following inputs: Confidence Level (95% selected), Confidence Interval (12.7), Population (120), and a 'Calculate' button. The result shown is 'Sample size needed: 40'. A Google Translate widget is visible on the left side of the page.

Figure 2.2 Sample calculators (The Survey system, 2009)

A confidence level of 95%, when combined with a population of 120 contracting companies yielded a suitable sample size of 40 participants.

2.5.2.2 Survey Questionnaire Distribution

The selected companies were then contacted telephonically or by a physical meeting to request their participation in the survey. On acceptance of such, survey questionnaires were distributed to the participants via fax, e-mail and on-site administration. Researchers kept in contact with selected participants to ensure a timeous response.

2.5.3 Structured Interviews

Interviews are defined as an instrument of social interaction where one person asks a number of questions to another and the other person answers directly to the questions as they are asked. An interview can be structured, semi-structured or unstructured depending on the method that proves suitable to the interviewer for data collection. However, they all involve direct interaction between two or more people to ensure the passing of data from one party to another (Walliman, 2005).

Structured interviews were conducted with industry professionals to achieve the third objective, i.e. to assess the practicality of the H&S plans and investigate their view towards eliminating contractor's non-compliance with H&S procedures.

2.5.3.1 Structured Interview Sampling

Interviewees were selected as advised by industry tutors for their extensive knowledge in this particular field of study. Two H&S officers were interviewed as well as three H&S representatives from the construction industry. All interviewees were selected as they were co-operative and eager to be of assistance. These interviews were conducted in person and the data was recorded using a Dictaphone which enabled the researchers to carefully analyze the information from these interviewees at a later stage without missing any important facts that could have gone unheard.

2.6 Justification for the Research Methodology Adopted

On analysis of the information gathered for the literature review, many authors such as Smallwood & Haupt (2005), Sa (2005) and Geminiani & Smallwood (2008) noted that industry stakeholders constantly make claims as to who should take responsibility for the

accidents that occur on construction sites, each having their own opinion as to who it should be. Furthermore, research into the statistics related to accidents occurring as a result of construction activities confirmed abnormally high fatality rates in South Africa as well as internationally. It was evident that these statistics followed the same trend from as far back as ten years ago.

The literature review provided an overview of the development of the research topic and revealed that previous studies were conducted and offered solutions to reduce the number of accidents and fatalities on construction sites. However, these are not heeded as the H&S statistics reflect an ongoing battle with ensuring a 'zero accident' working environment.

In order to establish where the problem lies in dealing with the abovementioned issues, both a qualitative and quantitative approach had to be adopted.

This is justified as stakeholders' opinions and perspectives had to be gathered and analysed in order to develop an action plan to reduce the non-compliance with the construction regulations. This was achieved through use of a survey questionnaire and interviews that were carefully structured to come to a substantiated conclusion of contractor diligence in complying with H&S procedures specified by the H&S Act. This combined a qualitative and quantitative approach to obtain stakeholders' opinions and thereafter analyse and interpret them as statistics to test the research hypothesis.

Literature comprising studies that were based on recent cases within the construction industry were used to investigate the H&S Act, policies that are being used presently to promote and ensure compliance within sites, as well as hazard prevention methods and management systems that have already been implemented for safe construction. Analysis of this existing data involves use of a qualitative approach that takes into consideration real life events and outcomes that have been documented. This is more specifically referred to as an explanatory approach.

This study adopts an optimum collaboration of both qualitative and quantitative methodologies by making use of structured interviews and a survey questionnaire to

validate the perception hypothesized and evaluates the effectiveness of contractors' H&S plans used.

2.6.1 Reasons for selecting contractors

- To assess whether or not there is compliance of the highlighted clauses by contractors.
- To gain contractors' perception of their labour force's compliance.
- To ascertain whether they think site accidents and fatalities have consequential significant effects.

2.6.2 Reasons for selecting site safety officers

- To gain knowledge into the reporting structures employed when an accident has occurred.
- To gain their perception of whether or not there is compliance by contractors, subcontractors and labourers.
- To gain insight into the difficulties they are faced with in implementing effective safety management systems.

2.7 Hypothesis Testing

"There is no direct relationship between non-compliance by South African contractors' with clauses 6(6), 7(1; 4) and 8(2) of the construction regulations and the causes of site accidents and the direct and indirect costs as a result of such accidents."

This hypothesis was set in the negative manner which allowed for a more conclusive substantiation. In this manner the proof is more defined therefore use was made of a survey questionnaire, personal structured interviews and literature review.

2.8 Research Credibility, Reliability and Validity

2.8.1 The Credibility of Research Findings

Credibility is based on the interplay between elements of integrity, expertise, sound judgment, relationship sensitivity, and likability. It is also a cue that is used in selecting the peripheral route to decision-making (Changing minds, 2009). This study highlights the researchers' interest in the health and safety of others. The source information is

generated from industry professionals who are expert in their fields and due recognition is given to these professionals.

2.8.2 Reliability

Reliability has to do with the quality of measurement. Consistency and repeatability is vital for accurate results (Research Methods, 2009). Researchers' ensured that all data collected were from credible resources. Researchers' had to be very subjective when sifting through the correspondence of survey questionnaires since the honesty of participants is questionable.

2.8.3 Validity

Validity is an indication of how sound your research is. It applies to the methods of your research. Validity in data collection means that your findings truly represent the phenomenon the researcher is claiming to measure and that they are solid claims (Validity, 2009). It poses a problem for any research since it is difficult to measure the level of truth in the data. For this study, researchers had to control every possible factor that could threaten the research's validity.

2.8.4 Reliability and Validity of the Research Methods

The following strategies were adopted in this study to increase the reliability and validity of the research methods:

- **Literature Review:** A variety of literature from source authors was reviewed and principle authors were contacted to aid our discussions. Only valid points with their supporting data were taken and thoroughly referenced as such.
- **Survey Questionnaire:** To maximize the responses, researchers attached a covering letter containing all relevant details about the study and what is required. It was reiterated that confidentiality was a high priority and there would be no bias or prejudice against unfavourable answers.
- **Structured Interviews:** The following format was adopted when conducting interviews with the relevant professionals as highlighted by Saunders *et al.*, (2003):-
 - Opening the interview;

- Using appropriate language;
- Questioning;
- Listening;
- Testing and summarizing understanding;
- Behavioural cues;
- Recording data.

2.8.5 Reliability and Validity of the Research Findings

- To attain the most viable findings, researchers outsourced other relevant data along with the prescribed outputs.
- Peer review was performed by the researchers and supervisors and industry professionals also read through and gave the researchers feedback on their thoughts.
- Researchers developed an action plan from the findings. This is to be integrated into the current systems.
- A paper has been published in the SACQSP Quantity Surveying conference, 2009, Durban, South Africa in October 2009.

2.9 Conclusion

This chapter has clearly defined the term research, research approaches and research aim and objectives for this study. Furthermore, the research methodology for the research has been adopted, justification for the research methodology provided, the research process and the relationship between the research methods and objectives stated and the statement of credibility, reliability and validity given.

3.1 Introduction

This chapter aims to create an understanding of the H&S Act and the implications of such on construction projects. The focus clauses are discussed and this lays the foundation for the more important issues that follow. The literature review will further elaborate on the role of contractors and safety officers, falls and fall protection, methods used to promote and ensure compliance, management systems for safe construction, accident reaction and first aid, H&S training, protective clothing and the effects of site incidents on the project.

3.2 General Overview of the Health and Safety Act 85 of 1993

The H&S Act ensures that there are fundamental standards to which the performance of companies and factories employing persons for production are expected to comply with and be monitored against. This act further provides for the fundamental principles to be achieved on sites by contractors and states that every company must prepare and implement an H&S plan for the protection of workers against hazards and potential risk of injuries and accidents.

3.3 Clauses Pertinent to the Study

The following clauses are adapted from the Occupational Health and Safety Act and Regulations in LexisNexis Group (2006):

3.3.1 Clause 6(6): Supervision

Clause 6 refers to contractors' obligation to ensure supervision of the works and employees in general to ensure healthy and safe working conditions for his workforce. Clause 6(6) requires the contractor to upon consideration of the size of the project and the likely hazards and risks related thereto appoint a full or part-time safety officer whose duty shall be to assist in ensuring that the safety regulations are adhered to and in case any question arises as to whether the safety officer is needed or not, the matter shall be referred to the inspector whose decision shall be final.

3.3.2 Clause 7(1, 4): Risk Assessment

Clause 7 refers to the risk assessment procedures the contractor is required to perform, prior to the commencement of the works.

Clause 7(1) stresses the importance of contractor's cooperation in allowing the risk assessments to be performed by a competent individual prior to commencement of the work so as to identify the potential risks associated with the construction work. This is done to ensure that all relevant risks are documented and integrated to form part of the H&S plan implemented on that particular site. A clear approach needs to be defined as to how the risks and hazards found will be monitored and mitigated as the case maybe to ensure that the sites are kept accident and injury free.

Some of the other requirements include:

- Performing risk investigation and identification appropriate to the site
- Analysis of the risks found
- A documented plan to reduce, monitor and control the risks and hazards found
- A monitoring plan
- A review plan

Risk assessment becomes an integral part of the H&S plan because it is only when the risks and hazards likely to occur are identified for that particular site, that the plan becomes appropriate. After all the assessments have been done and documented, the monitoring plan provides a standard form for mitigating, controlling or reducing the hazards that may arise in relation to the site. Review of the plan from time to time yields feedback that shows how accurate the plan is when measured against reality and any discrepancy found can be adjusted accordingly to rectify any shortfalls.

Clause 7(4) requires that the contractor disseminates information pertaining to the risks and hazards to all his employees as well as management personnel. The contractor is further required to ensure that all employees under his control are trained and instructed by a competent person regarding appropriate hazards and all the work related procedures prior to commencement of any work. This ensures that all employees know what to expect and how to carry out work to ensure that such risk and hazards are mitigated. This clause in summary, seeks to ensure that the contractor performs all his obligations to his employees with regards to H&S and that the contractor shall ensure that all his employees are kept abreast of the potential hazards at all stages in the construction process.

3.3.3 Clause 8(2): Fall Protection Plan

Clause 8 requires that the contractor prepare a fall protection plan with which the control of all fall related matters shall be traced and be compared against. This plan seeks to ensure that the contractor recognises discrepancies that result due to non-compliance with the provisions of the H&S Act by any project stakeholder. As a result steps can be taken to remedy or rectify these discrepancies. Furthermore, the contractor is required to assign a competent person to draw up a fall protection plan to ensure that the safety of all individuals working at heights is not compromised. It stresses the importance of adhering to the protection plan drawn up so that all discrepancies that may arise can be easily identified and dealt with in due cause. Further included in the clause are the methods or steps to be taken to ensure that the fall protection plan remains intact and is followed so that when a review is done at the end of the project, notable causes of non-conformity can be avoided in future projects.

Clause 8(2) requires a contractor to conduct and incorporate the risk assessment of all elevated work into the fall protection plan to ensure that all risks associated with working at elevated locations are identified and dealt with. The clause further states that the contractor should ensure:

- That a mitigating, reducing or controlling factor is put in place to deal with all relevant hazards that are attributable to working at elevated positions.
- The plan incorporates the process of assessing the physical and physiological fitness of all employees working at elevated positions.
- All the records of the employees and training programmes carried out are included in the preparation of the fall protection plan.
- Relevant procedures for inspection, testing and maintenance of all fall protection equipment are incorporated into the fall protection plan.

3.4 Roles of Contractor, Sub-contractor and Health and Safety Officers

Construction Regulations put into place by the Minister of Labour governs the actions and responsibilities of all those present on construction sites in South Africa. Contractors and safety officers therefore need to address issues of H&S according to this schedule in the execution of their duties. Management is therefore legally required by law to enforce Occupational H&S and ensure that their workers are not injured (Geminiani & Smallwood, 2008).

Main contractors are responsible for the following in the execution of their duties (LexisNexis Group, 2006):

- Provide all sub-contractors appointed with relevant sections of the H&S specifications.
- Appoint each contractor in writing.
- Ensure that each contract implements and maintains the H&S plan and that periodic audits are done at least once a month.
- Stop any work by a sub-contractor which is not in accordance with the H&S plan.
- Provide the sub-contractor with sufficient H&S information and appropriate resources when changes are made to design or construction.
- Ensure that every sub-contractor is registered with a compensation fund or a licensed insurer.
- Ensure that provision has been made by all contractors in their tenders for the cost of H&S.
- Discuss and negotiate contents of the H&S plan with the sub-contractor.
- Ensure a copy of the H&S plan is made readily available.
- Ensure that an H&S file is opened and kept on site and is readily available.
- To hand over a consolidated H&S file to client upon completion of the work.
- Make available an updated list of all sub-contractors on site accountable to him as well as the type of agreement between parties and the work being done.
- Ensure that the sub-contractor to be appointed has the necessary competencies and resources.

Sub-contractors are responsible for the following (LexisNexis Group, 2006):-

- Ensure that the sub sub-contractor to be appointed has the necessary competencies and resources.
- Shall co-operate with the principal contractor in accordance with the Act.
- Provide the main contractor with any information which might affect the H&S of any person or which might justify a review of the H&S plan.

The duties and responsibilities of **safety officers** are not specified in the H&S Act. However Levitt & Samelson (1994) recognize their basic goal as encouraging management to adopt effective ways to keep the workforce safe and healthy as they carry out their daily activities.

Safety officers merely advise, guide, monitor and support the decisions made by top management with regard to site safety as safety on the construction site is not the responsibility of safety professionals' but that of the site managers, superintendents and foremen (Levitt & Samelson, 1994).

Activities executed by safety professionals toward achieving the abovementioned goal include (Levitt & Samelson, 1994):

- Introduction of H&S considerations into planning at all stages of the project construction cycle.
- Working with all levels from top management to labourers to ensure that everyone is in agreement and will adhere to the H&S plan.
- Development of orientation and training programs.
- Encouragement of people at all levels to participate in appropriate training courses.
- Advising on record-keeping systems for use by management by which supervisors can be held accountable for H&S.
- Monitor themselves or help those responsible monitor the insurance claims and reserves.
- Assist in monitoring of H&S performance through job inspections, work procedure analysis, near-miss incidents, accident and injury record analyses, safe behaviour observation and other methods adopted on that specific site.
- Keeping their organizations updated on H&S matters as well as new management methods for integration of H&S into total job performance.
- Working together with other safety professionals to develop cooperative industry-wide programs and materials.

Legislation states that a safety officer should be appointed at the early design stage where his input could be used to improve and refine the scheme design (Section 6, clause 6). However, in an interview with Mr. Moodley (2009), a safety officer for a large enterprise main contractor at a local Durban site, he says that this is not done in practice as safety officers are usually appointed at a later stage after the design has been completed and construction begins. The International Labour Organisation (ILO) in Occupational Safety and Health Series (1979) further provides for general obligations of supervisors and safety officers:

Supervisors

- In small projects a supervisor should be appointed if more than two workers are employed.
- His main task is to prevent workers from engaging in unauthorised action that is strictly prohibited by safety regulations as this will endanger both themselves and their workmates.

Safety officers

- Acts as an instructor and advises the employer in the carrying out of safety measures.
- His primary duty is to monitor the workers constantly to see that they use their safety equipment in the correct manner and work in a safe way.

“The decisive step towards the inclusion of safety and health in the construction work will only be taken when all the parties involved in the process (workers, employers, designers, clients) become aware that the imperatives of occupational safety and health on the one hand, and of economic efficiency on the other, are not only non-contradictory but convergent.” (López-Valcárcel, 2001, p6)

From the above statement it is evident that proper implementation of H&S procedures during construction activities will only be possible if there is full co-operation among all parties involved in the construction project.

3.5 Falls and Fall Protection

The construction industry generates a disproportionate number of fatalities, injuries and disease relative to any other industry in South Africa. These occur as a result of accidents due to the ever present hazards on construction sites (Smallwood, 2004). This is because construction work involves numerous occupational risks, such as work at heights (use of scaffolding, gangways and ladders; work on roofs); excavation work (use of explosives, earthmoving machines); lifting of materials (use of cranes, hoists), and so on, which are specific to this type of industry (López-Valcárcel, 2001).

The most common accidents that occur as identified by Davies & Tomasin (1990) are:

- Falls
- Stepping or striking against objects
- Strain due to lifting and carrying objects and machinery
- Mishandling of machinery
- Electric shocks
- Injury due to earthmoving vehicles
- Fires and explosions

3.5.1 Types of fall accidents

Many authors agree that falls is by far the main cause of incidents. This includes people falling from heights (roofs, scaffolds, working platforms, ladders and floor openings), people falling on the same level and plant and material falling and striking them, as well as people falling into open trenches and shafts (Occupational Safety and Health Series, 1979; Davies & Tomasin, 1990; Holt, 2001; Sa, 2005; Ghule, 2008). Ghule (2008) indicated that the majority of the falls in the construction industry occur from roofs, with ladders ranking second and scaffolds in third place.

3.5.2 Fall-related deaths and injuries

According to the ILO, as stated in Smallwood *et al.* (2009), “*one in every six work-related fatal accidents occurs on a construction site.*” (Smallwood *et al.*, 2009, p1). Davies & Tomasin (1990) comment that each year 70-80% of all fatalities and 35-40% of all injuries are attributable to the amount of falls that occur on construction sites. It is shocking to realize that of these falls, a considerable number of persons are killed by falling from only small heights (Occupational Safety and Health Series, 1979). Federated Employers' Mutual Assurance Company Limited (FEMA) cited in Smallwood *et al.* (2009), states that the second highest number of claims were for injuries caused by falls onto different levels (14%). Also, the FEMA recognized falls on to different levels (17%) as the third highest cause of fatalities in the construction industry. These statistics are depicted in the table 3.1 and give a clear indication that falls occurring on construction sites significantly contribute to the H&S statistics in the South African industry.

Furthermore, the number of construction related accidents in the KZN region ranks as the third highest in the country as shown in table 3.2. In this regard, this research is justified in determining why these occurrences are more frequent in this region as compared with others by analyzing the H&S systems and practices employed on KZN construction sites to follow.

Table 3.1 H&S Accidents by cause: FEMA (Smallwood *et al.*, 2009)

Description	2006		2007	
	Number of claims	Number of fatalities	Number of claims	Number of fatalities
Accident type N.E.C	43	1	95	3
Striking against	788	1	975	0
Struck by	4 031	17	4 474	10
Caught in, on, between	872	4	877	4
Fall onto same level	200	0	516	1
Fall onto different levels	1 254	18	1 406	10
Slip or over-exertion	1 131	1	683	0
Contact with temperature extremes	89	1	92	0
Inhalation, absorption, ingestion	80	3	199	4
Contact with electrical current	14	1	36	0
Unclassified / not sufficient data	31	0	21	0
Motor vehicle accident	651	27	857	28
TOTAL	9 184	74	10 231	60

Table 3.2 Construction H&S Claims and Fatalities: recorded by the FEMA (Smallwood *et al.*, 2009)

Province	2006		2007	
	Number of Claims	Number of Fatalities	Number of Claims	Number of Fatalities
Gauteng	4 257	32	5 143	30
KwaZulu-Natal	1 207	13	1 311	10
Eastern Cape	943	7	929	7
Boland	1 577	12	1 629	6
Western Cape	827	3	814	1
Kimberly & Northern Cape	28	0	43	0
Free State	345	7	362	6
TOTAL	9184	74	10231	60

3.5.3 Causes of fall incidents

Labourers are prompted to make the right decision to use their personal protective equipment (PPE) at all times but this is not heeded. They forget, decide not to wear it, or do not use or wear it correctly. They view PPE as uncomfortable and unnecessary due to the expected short exposure time. Furthermore, it decreases their productivity as the equipment is sometimes restrictive and tends to get in the way. This may prove detrimental if they slip, trip and fall from their high working position (Holt, 2001; Sa, 2005).

In a study of the causes of accidents on construction sites by Abdul Hamid *et al.* (2008), it was found that the following were the dominating cause of accidents:

- Workers' negligence
- Failure to obey work procedures as well as incorrect work procedures
- Nature of work being performed (work at heights)
- Equipment without safety devices
- Poor site management
- Lack of workers' knowledge and skills
- Negative attitude of workers
- Failure to use their PPE

The study also revealed that the causes of accidents were related more to the employees rather than their employers as suggested by the results of the human element/factor (17.17%) and unsafe methods (18.9%) as compared to management (15.8 %). Other factors of concern were identified as being unsafe equipment (17.1%), unique nature of industry (17%) and job site conditions exposed to (13.5%). To elaborate, unsafe methods referred to the incorrect procedures and work styles practiced by the workers, human factors referred to the negligence of the workers in doing their assigned activities as well as their unsatisfactory body conditions such as tiredness, illness, and alcohol and drug consumption. In addition, the negative attitudes of workers' are seen in their stubbornness to use the safety equipment, loss of attention and concentration when doing their work and assuming that safety is not important. These elements significantly affect the efficiency of the works and contribute to the occurrence of site accidents.

This study also revealed the three dominating types of accidents occurring on construction sites to be falls (22.2%), stepping on objects (18.2%) and struck by falling objects (17.1%).

These were attributed to poor fall protection and poor house keeping or poor work method, e.g. failure to secure materials during hauling or lifting. In a study conducted by Sa *et al.* (2009) regarding risk factors for falls from heights between two types of roofing enterprises, it was noted that fall accidents still occur in spite of the use of fall protection devices. The results showed that this was due to the incomplete connection of personal fall arrest systems, improper use of safety devices and use of old safety devices.

Table 3.3 Factors contributing to the occurrence of accidents (Kitumbo & Kirenga, 2001)

Work situation includes	Environment includes	Safety system includes
<ol style="list-style-type: none"> 1. Human errors 2. Technical failure 3. Inadequate information 4. Personal deviation from safe practices 5. Disturbance in material flow 	<ol style="list-style-type: none"> 1. Intersecting of parallel activities 2. Bad housekeeping 3. Disturbance from the environment 	<ol style="list-style-type: none"> 1. Failure of active or passive safety system 2. Inadequate guarding 3. Insufficient personal protective equipment

3.5.4 Fall protection systems

3.5.4.1 The construction regulations

Included in the regulations is Clause 8 pertaining specifically to fall protection.

Section 4 of Clause (8) states:

“Notwithstanding the provisions of subregulations (1) and (2), the contractor shall ensure that-

- (a) all unprotected openings in floors, edges, slabs, hatchways and stairways are adequately guarded, fenced or barricaded or that similar means are used to safeguards any person from falling through such openings;*
- (b) no person works in an elevated position, unless such work is performed safely as if working from a scaffold or ladder;*
- (c) notices are conspicuously placed at all openings where the possibility exists that a person might fall through such openings*
- (d) fall protection and fall arrest equipment is-*

- (i) *suitable and of sufficient strength for the purpose or purposes for which it is being used having regard to the work being carried out and the load, including any person, it is intended to bear; and*
 - (ii) *securely attach to a structure or plant and the structure or plant and the means of attachment thereto is suitable and of sufficient strength and stability for the purpose of safely supporting the equipment and any person who is liable to fall;*
- (e) *fall arrest equipment shall only be used where it is not reasonably practicable to use fall prevention equipment; and*
- (f) *suitable and sufficient steps shall be taken to ensure, as far as is reasonably practicable, that in the event of a fall by any person, the fall arrest equipment or the surrounding environment does not cause injury to the person.”* (LexisNexis Group, 2006, p52). The following fall protection systems are proposed by the ILO in Occupational Safety and Health Series (1979):

3.5.4.2 Safety harness

A safety harness includes all PPE that is used to ensure the safety of persons working at heights who are in danger of falling during their work. It includes safety belts with lifelines, retaining belts, safety ropes, protective appliances and rope unwinders.

Safety belt with lifeline

This is the most commonly used safety harness and is suitable for protection against falls from small heights. Safety ropes (hemp or perlon) can be attached and secured to a point above the workplace.

Retaining belts

These are used to protect persons from falling from great heights as well as ensure that they are not injured by being held.

Protective appliances

These are fastened above the workplace and allow the persons roped to them to alter their distance as they wish from the fastening point to the desired working height, while the rope remains taut so that no loops form.

Rope unwinders

Rope unwinders are used for emergency descents from elevated workplaces. This is an automatic device which lowers the rope at a suitable speed.

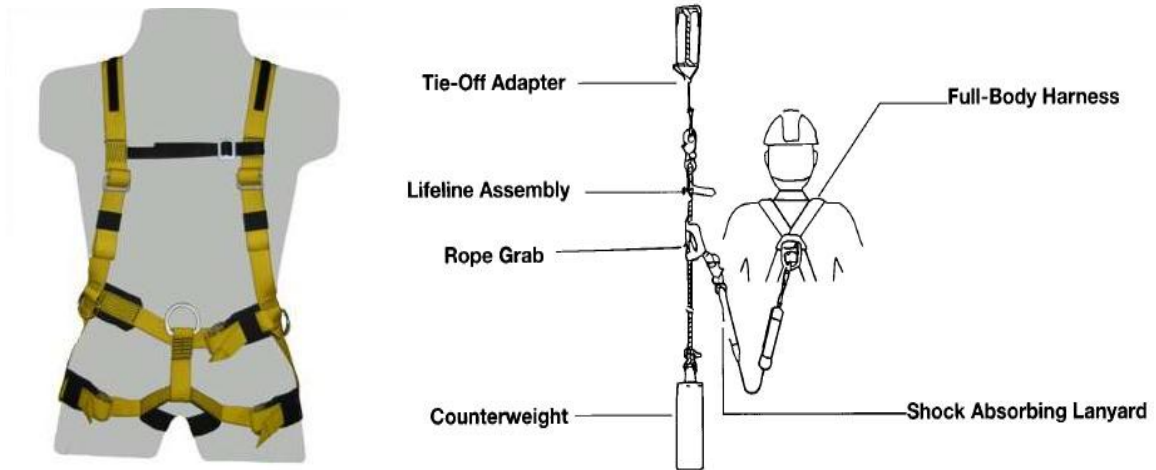


Figure 3.1 Safety Harness and Assembly

3.5.4.3 Catch nets

Catch nets, like safety harnesses, are an effective means of protection of persons against falls in building operations. They are used in the building of halls, houses, factories, chimneys and towers. The catch has advantages over the protective scaffold as they are more elastic thus reducing the possibility of injury.



Figure 3.2 Catch Nets

3.5.4.4 Scaffolds

A general requirement is that scaffold floors 2m above the ground, and openings in them, should be fenced with two-rail railings and toeboards to prevent falls of persons, materials, tools, etc.

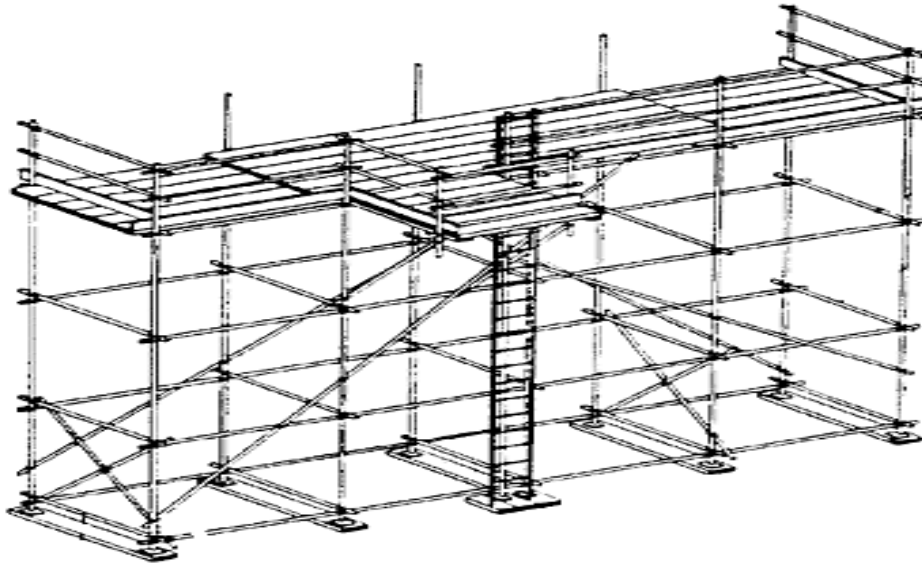


Figure 3.3: Correct Scaffold Assembly



Figure 3.4: Incorrect Use of Scaffold

3.5.4.5 Roofs

Workers on roofs should always be equipped with a safety belt and life line that serves to secure him and prevent him from falling off the roof. A man should always be on standby to render aid if necessary, even if the work is for a short duration.

3.5.4.6 Working platforms

These are movable working structures, designed to carry one person, having one surface area and usually only one height for all purposes. The floor and edge protection shall be the same as for scaffolds. Precautions for prevention of falls through openings and into trenches can be summarised as follows:

3.5.4.7 Openings and edges

Openings in floors are sometimes covered by a piece of ply or metal sheet and this is said to be a common cause of fatalities as people fall into the void when these covers are accidentally moved. All holes shall be properly secured, protected and covered and fastened so that the cover cannot be easily moved. Demarcations and warning signs can be used to clearly indicate the dangers present.

Solid guardrails shall be installed where falls of 2m or more could occur instead of using fall protection. These protect the labourers working near the edges from falling over. Protection against objects falling from levels above should also be provided. Barriers using sheeting below guardrails down to floor level is an effective means of protection. Insisting that workers tie and secure their tools and equipment to them physically, using a lanyard is a useful technique (Holt, 2001).

Labourers fall into trenches, some more than 2m deep. This is very dangerous as the impact of the fall can kill or injure them severely or materials and equipment could fall and crush them. Materials and equipment should not be left close to the edges of excavations and should be stored away from the working area when not in use. Edges should be protected by rigid barriers if trenches are more than 2m deep (Davies & Tomasin, 1990).

3.6 Methods Used to Promote and Ensure Compliance

Although it cannot be quantified, it can be inferred that the construction regulations have had a positive impact on reducing H&S accidents (Smallwood *et al.*, 2009). Contractors and safety officers should adopt and implement the regulations stated in the legislation to effectively eradicate the occurrences of fatalities and injuries on their sites. The following methods are some of the ways in which contractors and safety officers can further enhance their control procedures (IRCA, 2003).

3.6.1 Risk Assessments for activity – Site specific

Risk assessments should ideally be performed stringently before the start of the project and constantly during the project. Reason being is that a number of tragic events could occur at any time with the heavy duty power tools being used by labourers daily. The risk assessment is there not only to protect the workforce but the contractor as well because in the event that something were to happen, the contractor would not be held liable because the contractor, being a reasonable man, had checked for possible threats of danger.

3.6.2 Method statement

The method statement of a company is a declaration of all companies' beliefs and values. The value of its employees should be of the utmost importance. Therefore it has to be frequently visited to ensure that it is maintained and supported throughout the project.

3.6.3 Safe working Procedure

By making sure all people working at heights are equipped and knowledgeable about their safety harness and the correct way of wearing their protective gear. The safety officers have to ensure that all participants are guarded against the ever present dangers on construction sites.

3.6.4 Health and safety inductions before proceeding to site

There is no need to elaborate the importance of the induction. It serves as indemnity to the employer that the workers know the risks involved in their line of work and agree to abide by the rules set out. These inductions also screen each person to verify if they are medically and physically fit for the task at hand.

3.6.5 Toolbox talks

It has been noted that many sites undergo a weekly ritual of gathering a congregation of labour and explaining to them the hazards of their environment. And while one may contest that this procedure is monotonous, some of the labour need to be constantly reminded so that they know how their actions impact the people around them. These toolbox talks, in order to be effective, should be held at least once every week.

3.6.6 Encourage participation of safety strategies

It has been found that word of mouth communication is more effective than rote learning. Therefore management should try to make their safety talks and instructions as interesting enough without being condescending, so that it can encourage workers to help out their fellow man. They should make training sessions freely available to willing participants so that it can be practiced throughout their career.

3.7 Management systems for safe construction

3.7.1 Risk Management

“Risk Management is considered to be a relatively “new” technology that exists within the framework of any business operation, however it is actually as old as time.” (IRCA, 2003, p3). History demonstrated that it became a popular management tool since the early 1970’s. In early times it focused primarily on insurance risks and then further progressed to managing business risks. Issues such as market risks; financial risks; resource risks and other speculative risks were considered.

As this technology continued to evolve, experts in this field realized that it could be applied as a management tool in just about any field. These evolutions led to the realization of pure risks, and demonstrated how such pure risks promoted to the management of speculative risks. This led to the inclusion of Safety, Health and Environmental risks which existed within the framework of “total risk management”. It should be further noted that quality management is also a vital component of risk management and all four components become an important business management tool. This is commonly known as SHEQ management (IRCA, 2003).

After investigation, it was found that the following management systems are in place at larger sites:

- ISO 9001 [Quality Management Systems]
- ISO 1400 [Environmental Management Systems]
- Regulations

Together these form a formidable trio that is used to prevent incidents from happening. There are also techniques practiced for the unforeseen that may occur.

ISO 9001 [Quality Management Systems]

The international standard can be used by management parties to assess the organizations ability to meet customer, statutory and regulatory requirements applicable to the product and the organizations own requirements. The quality control manager has a process of monitoring and measurement that he has to perform in order to keep to standards. If there is a discrepancy, it has to be recorded and the appropriate action has to be undertaken as a corrective measure (SANS 9001, 2008)

ISO 1400 [Environmental Management Systems]

This international standard specifies requirements for an environmental management system to enable an organization to develop and implement a policy and objectives which take into account legal requirements and information about significant environmental aspects (SANS 1400, 2005). Here too, the proper corrective action will have to be effected in the event of a nonconformance.

Regulations

According to Ugwu & Haupt (2007), there are several techniques used to evaluate the sustainability of the systems employed. These authors illustrate five method classifications ranging from Method A to Method E. For management systems Method A- Credit based scoring systems, Method C- Comparison of benchmark and other available options and Method E- which is based on the assessors own judgment are most prevalent. A further discussion below illustrates how each method is utilized in the management systems.

Method A: Credit based scoring systems

The H&S of a site is difficult to quantify. This method is adopted for these types of indicators.

Method C: Comparison of benchmark and other available options

This method is used with no reference to legislation. Contractors would use this to quantify the cost due to non conformance by working out the maximum percentage score for each assessment criterion. If the results have adverse effects then the score would be zero.

Method E-which is based on the assessors own judgment

Here the assessor judges the contract data and verifies if the contents are adequate for the site , and can also assess the effectiveness of the behaviours and collaborative working that enhances the quality control. The score is based on the assessor's judgment.

3.8 Accident Reaction and First Aid

The construction industry is one that could be described as a high risk industry because there is a high risk of accidents and incidents occurring. However, in order to determine or prevent an accident, preventive measures must be taken. The first step of these preventive measures is to identify the cause and more specifically, the root cause of the accidents (Abdul Hamid *et al.*, 2008).

The investigation and recording of incidents and accidents at work is important because these occurrences rarely originate from a single cause and many turn out to be quite complex in that they involve multiple, interrelated casual factors. They can occur whenever significant deficiencies, oversights, omissions or unexpected changes occur. There is therefore a value in recording such information and data as it helps to prevent more serious events in the future (Hughes & Ferret, 2005).

Incidents and accidents, whether they cause damage to property, or more seriously, injury or ill health to people, should be properly and thoroughly investigated to allow an organization to prevent a recurrence. Good investigation is a key element to making improvements in H&S performance (Hughes & Ferret, 2005).

Accident investigation should be carried out by supervisors, foremen, site agents, safety officers or any other individual with sufficient status and knowledge to make recommendations that will be respected by the organization. The person to lead any investigation will be the foreman or supervisor of the person or area involved because they would tend to have the best knowledge about the working environment and employee. These professionals should have a personal interest in preventing further incidents and accidents, and take immediate action over the work situation to communicate effectively with employees concerned.

The investigation should be carried out as soon as possible after the accident to allow the maximum amount of information to be obtained.

This is important because:

- factors regarding the incident will be fresh in the minds of the witnesses,
- physical conditions have had less time to change, and
- more people are likely to be available for information purposes.

Immediate information from the person involved often tends to be the most useful (Bryant, 1984).

According to Hughes & Ferret (2005), there are four basic elements to a sound investigation:

1. Collect facts about what has occurred.
2. Assemble, and analyse the information obtained.
3. Compare the information with acceptable industry and company standards and legal requirements to draw conclusions.
4. Implement the findings and monitor progress.

The aim of the investigation should be to explore the situation for possible underlying factors as well as the obvious causes of the accident. Information should be gathered from all possible sources in order to obtain the best solution out of an unfortunate situation.

Investigation is not intended to be a mechanism for allocating blame. There are often strong emotions associated with significant injury or losses and it is all too easy to look for someone to blame without considering the reasons why the person behaved in such a manner. Accident investigation is rather based on the logic that all incidents and accidents have causes, whether direct or indirect, that can be discovered through investigation and corrective action can be taken in order to eliminate future accidents (Hughes & Ferret, 2005).

There are many benefits from investigating accidents and incidents. These include (Roberts-Phelps, 1999):

- The prevention of similar events occurring again. Where the outcomes are serious injuries, the enforcing authorities are likely to take a tough stance if previous warnings have been ignored.
- The prevention of business losses due to disruption immediately after the event, loss of production, loss of business through a lowering of reputation or inability to deliver, and the costs of criminal and legal actions.
- Improvement in employee morale and general attitude to H&S particularly if they have been involved in the investigations.
- Improving management skills to improve H&S performance throughout the organization.

At this juncture it would be useful to analyze the standard health, safety and environment accident procedures which are used by various construction companies in South Africa.

The following has been adapted from The Standard Accident Procedure (2006):

Potentially dangerous incidents

For incidents which have the potential to cause harm or danger, cause property or environmental damage or a major accident, the action to be taken would be to:

- record all the details of the incident,
- secure the area and ensure the area is safe, and
- switch off and lockout the machinery involved to ensure that no further injury or damage can take place.

The person that should be immediately informed of a minor incident would be the supervisor of the individual or area involved. For major incidents, the project's H&S officer should be informed, as well as the site agent or manager and in some cases the Divisional H&S Department.

Minor injuries

For minor injuries not requiring doctor or hospital treatment, the injury is to be treated by the trained first aider on site or where applicable, the injured person should be taken to the closest first aid clinic for treatment. It is also important to ensure that the cause of the injury is addressed and that the supervisor and H&S officer is notified of the incident.

With regard to injuries which require the individual to receive medical treatment from either a doctor or a hospital:

- The trained first aider is to render assistance and the injured person is to be taken to the nearest doctor or hospital.
- The cause of the injury is to be addressed.
- The area and/or machinery are made safe.

In all cases the immediate supervisor, H&S officer, site agent, divisional head office and the Divisional H&S Department are notified of the injury.

Serious injuries

Due to the construction industry being a high accident risk industry, it is also necessary to investigate the reaction procedures for more serious injuries. These injuries would include fractures or amputations, temporary or permanent disablement and injuries which lead to unconsciousness. Incidents described as serious would be machinery fracturing or failing, machinery running out of control, the uncontrolled release of a dangerous substance, the uncontrolled release of a substance under pressure and any other majorly hazardous incidents.

For such incidents, the following procedure is to be followed:

- The trained first aider is to render assistance
- If neck or back injuries are suspected then the injured is to be stabilised while an ambulance is called.
- If an ambulance or emergency services are called, ensure that measures are taken to flag them down and to direct them to the incident due to some sites being quite far inland from the road.
- If possible the injured is to be taken to the nearest hospital, doctor, or clinic.
- Nobody is to disturb the scene of the accident unless for further rescue purposes.
- And it is important to take photographs of the scene and note down names of eyewitnesses.

In all cases the immediate supervisor, H&S officer, site agent, divisional head office, the Divisional H&S Department, the Regional Labour Department and the client or client's

representative should be informed of the incident. The Divisional H&S Department must be notified telephonically within twenty four hours of the incident and they will in turn notify the Regional Labour Department within seven working days.

Accidents resulting in a death or fatality

For incidents which result in a death or fatality on site, an ambulance or other emergency service should be called, the body should be covered and the scene left undisturbed unless for further rescue purposes or to make the area safe. Once again it is important to take photographs of the scene, note down the names of the eyewitnesses and not to make any statements to any person or the media until the police and labour department have been informed. It is quite obvious that once again all persons with interests pertaining to the site, up to Regional Labour Department should be informed of the accident.

It is important that an organization provide a proper system for the reporting and recording of accidents. The type of accident needs to be reported, a proper record has been made, regular analysis of events to check for trends in performance and the types of accidents or injuries that occur and monitoring of the system to make sure that it is implemented satisfactorily.

3.9 Health and Safety Training

H&S training is a very important aspect of the H&S programme and it is also a legal requirement according to the H&S Act for employers to provide such training to all their employees. Training is required for employees at various levels during different stages of their careers or the project life cycle depending on the nature of the job that individuals will be undertaking.

Training is required on recruitment, at induction or on being exposed to new or increased risks due to:

- Being transferred to another job or given a change in responsibilities.
- The introduction of new work equipment or changes of use in existing work equipment.
- The introduction of new technology.
- The introduction of a new system of work or the revision of an existing system of work.

- An increase in the employment of more vulnerable employees (young or disabled persons).
- Particular training required by the organisation's insurance company (e.g. specific fire and emergency training).

Additional training may be required following a single or series of near misses, the introduction of new legislation, the issuing of an enforcement notice or as a result of a risk assessment or safety audit (Hughes & Ferrett, 2005). There are several different types of training, these include induction training, job specific training, supervisory and management training and specialist training. Risk assessment, fall protection plan training and supervision training are all legal requirements and fall within the scope of the aforementioned types of training.

3.9.1 Induction training

Induction training should always be provided to new employees, trainees, subcontractors and in some instances, contractors. Such training should cover the aspects of pay, conditions, quality and H&S. It is useful that the employee signs a record to state that he has received such training should there be a legal claim against the organization at a later stage.

Most induction training programmes include the following topics:-

- The H&S policy of the organization including a summary of the organization and arrangements including employee consultation.
- A brief summary of the H&S management system including the name of the employee's direct supervisor, safety representative and source of H&S information.
- The employee's responsibility for H&S including any general H&S rules (e.g. smoking prohibitions).
- The accident reporting structure or procedure of the organization and the location of the nearest first-aider.
- The fire and other emergency procedures including the location of the nearest assembly point.
- A summary of any relevant risk assessments and safe systems of work.
- The location of welfare, canteen facilities and rest rooms.

There are additional organization specific items which may need to be covered and included in the induction. These are (Hughes & Ferrett, 2005):-

- Internal transport routes and pedestrian walkways.
- The correct use of PPE and maintenance procedures.
- Manual handling techniques and procedures.
- Details of any hazardous substances in use and any procedures relating to them.

The items stated cover the majority of the material which needs to be stressed during induction. There are instances however, where the induction training content could be analyzed and be subjected to review should the conditions pertaining to that particular construction project change.

3.9.2 Job specific training

Job specific training or 'toolbox training' is a form of skill training and is often done 'on the job'. This type of training explains the details and intricacies of a safe system of work for a particular job and is carried out to ensure that employees undertake their job in a safe manner. In addition to normal safety procedures, emergency procedures and the correct use of PPE also needs to be included and covered. The results of risk assessments are very useful in this type of training because common causes of human errors discovered during accident investigation, standard safety checks and maintenance requirements can be addressed during this period. It is also common for this type of training to follow an operational procedure in the form of a checklist which the employee can sign after having received the training. One should note that new employees should be closely supervised for some time after the training has been completed. Fall protection plan training will fall under the scope of job specific training as employees need to be taught how to work at heights while ensuring the safety of those around them as well as themselves.

3.9.3 Supervisory and Management Training

Supervisory and management H&S training follows similar topics to those contained in the induction training but are done on a more in-depth basis. There is more emphasis on H&S law. There has been considerable research over the years into the failures of managers that have resulted in accidents and other dangerous incidents.

These failures include:

- Lack of H&S awareness, enforcement and promotion.
- Lack of consistent supervision of and communication with employees.
- Lack of understanding of the extent of the responsibility of the supervisor.

H&S training for all levels of management right up to the board of directors is important as it keeps everybody informed of the legal requirements with regard to H&S, accident prevention techniques, changes in the law and it encourages members of the organization to monitor H&S standards.

3.9.4 Specialist training

Specialist H&S training would refer to training which is not job specific but rather to the training required for a specific activity. The training courses for these activities are usually provided by specialist organizations and graduates are presented with a certificate of completion or 'certificate of training'. Some examples of specialist training include first aid, fire prevention, fork-lift driving, scaffold inspection, statutory H&S inspection and crane operation.

To illustrate an example of such a training procedure, a typical fork lift driver's course would include (Hughes & Ferrett, 2005):-

- General use of the controls
- Loading and unloading procedures
- Driving up or down an incline
- Speed limits
- Pedestrian awareness, especially in areas where pedestrians and vehicles are not segregated
- Security of the vehicle when not in use
- Daily safety checks
- And re-fuelling or battery charging and emergency procedures

From the above, it is apparent that training is a vital aspect of any H&S programme. It is important to note that such programmes need to be constantly reviewed, updated and the methods to deliver training monitored in order to ensure that they are effective.

3.10 Personal Protective Clothing

Personal protective clothing or PPE would refer to protective clothing, or other gear designed to protect the wearer's body or clothing from injury by electrical hazards, heat, chemicals, and infection, for job-related occupational safety and health purposes (Hughes & Ferrett, 2005).

PPE is to be used as a control measure. It will not eliminate the hazard and will present the wearer with the maximum health risk if the equipment fails. Successful use of PPE relies on good user training, the availability of the correct equipment at all times, and good supervision and enforcement.

There are several types of personal protective equipment, such as:

- safety boots
- hearing protection
- eye protection
- hard hats
- hand protection
- protective clothing
- safety harnesses or belts



Figure 3.5 Correct use of lifelines and safety harness

Specialist PPE would be required in certain circumstances, with different types of gloves being used for the handling of chemicals and another type for the handling of steel. Respiratory protection would also vary for hazardous dusts, fumes and solvents.



Figure 3.6 Hard hat, ear muffs, gloves and safety goggles

Eye protection comes in three forms, they are, spectacles, goggles and face visors. Spectacles are suitable for low-risk hazards, goggles are better used for dust and solvent vapours because they fit tightly around the eyes. Visors offer protection to the face as well as the eyes and do not steam up so readily in hot and humid environments.

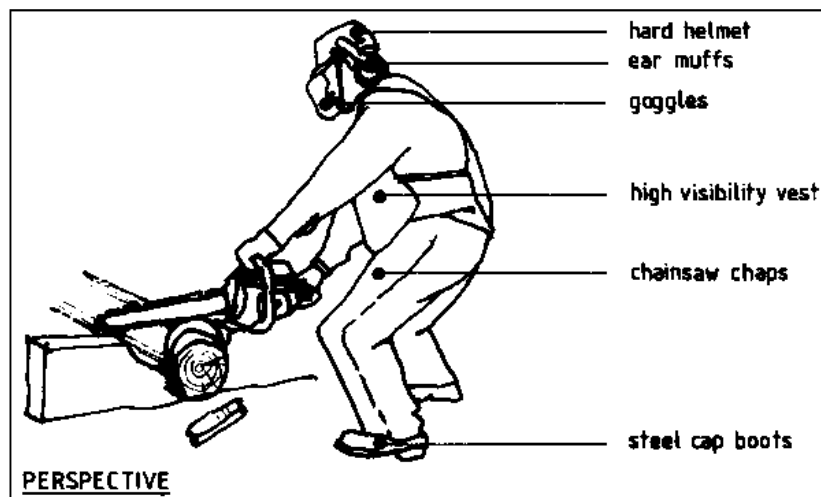


Figure 3.7 Standard PPE when working with heavy duty power tools

It is necessary that employees wear and use PPE when instructed to do so by a person with authority and employers shall ensure that the PPE provided is:-

- Suitable for its intended use.
- Correctly sized and fitted to the individual user.
- Used by employees who are trained in its use and understand its performance.
- Correctly stored when not in use.
- Cleaned and checked at regular intervals, usually every time it is used.
- Disinfected and sanitized before use by another person.
- And used by everyone that needs protection.

When selecting PPE, several factors need to be considered. These include the nature of the hazard (the severity of the hazard and its associated risk will determine the quality of protection required), comfort and user acceptability, compatibility with other PPE, training and maintenance requirements and costs (Hughes & Ferrett, 2005).

It is important to note that the appropriate PPE should also be made available to visitors and other members of the public when visiting construction sites. The use of PPE cannot be stressed enough and it is vitally important that site agents and managers lead by example in its use and enforce it even if it means taking disciplinary action against the defaulting individual.

3.11 Effects of Site Incidents on the Project Itself

The three dominating success factors in the execution of a project are time, cost and quality. These factors receive more attention and take preference over safety on construction sites. As a result there is a higher risk of accident occurrence in the construction industry. Top management and clients focus more on profit maximization and do not realise the high costs of accidents until it is too late (Abdul Hamid *et al.*, 2008).

This is because most contractors do not have a cost accounting system to help track the costs of accidents that occur on their site (Levitt & Samelson (1993) cited in Smallwood (2002)). These would prove useful to perform cost-benefit analyses relative to H&S to prove that H&S is indeed a very important factor to consider in the accounting sense.

3.11.1 Cost of accidents (CoA)

The most common costs affecting the overall project include (Smallwood, 1995):

- Compensation insurance for employees
- Damage to materials, plant and equipment
- Damage to environment

Hinze (1997) cited in Smallwood & Haupt (2006) further categorises the cost of construction into direct and indirect costs.

Direct costs are those associated with the treatment of injured parties as well as the compensation insurances provided for the employees in the event of an accident.

The **indirect costs** incurred by contractors include:

- Reduced productivity of injured party
- Reduced productivity of workforce
- Cost of delays
- Costs for provision of supervision
- Costs resulting from rescheduling
- Costs of transportation
- Cost of replacing injured party
- Wages paid while the injured party is non-productive and recuperating

Davies & Tomasin (1996) cited in Smallwood & Haupt (2006) concur that accidents can marginalise the project team's efforts at achieving the project deliverables on time and within budget due to these costs associated with accidents. Furthermore, bad publicity arising out of these accidents may also tarnish the client's name and strain relations among project stakeholders as everyone is quick to blame the other.

In a study of the influence of H&S culture on H&S performance by Smallwood (2002), it was found that the following were manifestations of the negative impact of H&S performance:

- Poor house keeping
- Decline in productivity
- Programme delay

- Increased cost of accidents
- Increased accidents
- Increased compensation insurance claims
- Compensation insurance loading
- Harm to the environment
- Rework
- Non-achievement of quality
- Complications

From the abovementioned manifestations, poor housekeeping (50%) and decline in productivity (50%) ranked the highest with programme delays (40%) and increased costs of accidents (40%) following close by. The fact that two manifestations were not H&S related ranked so high shows the significant impact that H&S has on other project parameters. Furthermore, increased costs of accidents (40%) achieved a higher ranking than increased accidents (30%).

Cost Comparisons of Accidents by FEMA in Pugh (2009):

The Real Costs of Accidents

Every Organisation should have workplace accidents as one of their top five risks (Pugh, 2009). The following examples of case studies show the direct and indirect costs associated with a site accident. These case studies show a direct correlation between profitability and health and safety.

Case Study One

- Scenario:** A 21 year old worker fell through weakened roof sheeting, and was impaled on an iron pole which penetrated his chest.
- Injuries:** Ruptured kidneys, spleen, and pancreas and fractured bones.
- Repercussions:** Patient spent 37 days on life support before dying of sepsis.
- Family:** A young wife and his two year old son.

Indirect costs thereof include:

- First Aid Treatment
- Making area safe
- Staff time to investigate and report accident
- Time spent with inspectors
- Assessing/Rescheduling work activities
- Recovering lost production
- Clean up site
- Lost work time
- Transporting worker to hospital
- Immediate staff downtime
- Meetings to discuss incident
- Consultant's fees to help with investigation
- Repairing damage
- Salary costs of replacements workers
- Company reputation
- Loss of profits
- Loss of skills

Direct costs involved were:

Hospital Fees	R 456, 985. 00
Medical Fees	R 392, 327. 00
Pension to Dependants	R 238, 649. 00
Sundries	<u>R 12, 414. 00</u>
Total cost of claim	R1, 100, 375. 00

In this case, the contractor did not adhere to Clause 8 (2; 4; 5) of the construction regulations. There was an absence of lifelines and fall protection equipment as well as a lack of duckboards.

If these were in place it would amount to a cost of	+/- R14, 000
I.e. Duckboards	+/- R5, 000 – R8, 000
Lifelines and Fall Protection	+/- R6, 000

This example shows that a minimal prevention cost could have prevented the death of the worker or at the very least lessened the injury.

Case Study Two

Scenario: Employee was plastering when he fell from the scaffold and hit his head on a wheelbarrow.

Injuries: Spinal injury resulting in paralysis.

Direct costs involved were:

Hospital Fees (3 months)	R 538, 918. 00
Medical Fees	R 145, 545. 00
Pension to Dependants	100 %
Constant Attendance Allowance	
Total cost of claim	R1, 300, 000. 00

Case two shows the contractor's non-conformance to regulation clauses 14 (Scaffolds) and 8 (fall protection).

Prevention Costs amount to R 7000.00

I.e. Toe boards and guardrails R 7000.00

3.11.2 Benefits of reduced Cost of accidents

In order to achieve proper H&S management, H&S performance needs to be continuously monitored and measured by recording the accident cost per work-hour. Management should use the feedback gathered from these records to reward employees for good H&S performance on site.

Reducing occupational accidents would not only save people's lives, but it would benefit contractors with reductions in workers' compensation (WC) and liability insurance premiums, WC rebates, as well as reductions in the indirect costs of accidents (Levitt & Samelson (1993) cited in Smallwood (2002)). Other benefits include enhanced morale of supervisors and workers, and increased attractiveness to clients as a result of perceived holistic quality. Geminiani & Smallwood (2008) further comment that the pressure placed on the country's monetary situation will be reduced as the excessive amounts of money paid annually to victims of work related accidents decreases.

Levitt & Samelson (1993) cited in Smallwood (2002) maintain that most contractors do not have a cost accounting system that tracks the cost of accidents, which effectively marginalises the undertaking of any cost-benefits analysis relative to H&S. The ability to prove the benefits of H&S is important, as being able to do so reinforces the assumption that 'increased H&S effort will result in a decrease in incidents'.

3.12 Conclusion

This chapter provides an in-depth review of the literature used for this study. It begins with a description of the relevant clauses as per the H&S legislation, then discusses the roles played by Principal contractors, subcontractors and H&S officers on sites, the causes for non-compliance was discussed followed by falls and fall protection, methods used to promote and ensure compliance, management systems for safe construction, accident reaction and first aid, H&S training, PPE and concludes with the effects of site incidents on the project itself.

4.1 Introduction

This chapter aims to analyse all data gathered from the methodologies adopted to form conclusions to the research. It will include the response rate, data analysis of the questionnaire and interviews, and a summary of their collective findings.

4.2 Response Rate

4.2.1 Survey Questionnaire

A survey questionnaire comprising of two sections was distributed to a sample of 40 firms obtained from the MBA website listing. Section A and B were to be completed by the H&S officer and the contractor respectively. The sample was further split into three types of enterprises, i.e. small, medium and large. Table 4.1 illustrates the relationship between the sample size and the types of enterprises selected for this analysis.

Table 4.1 Relationship between the Sample Size and the Types of Enterprises

Total Sample Size	40
Large Enterprise	15
Medium Enterprise	10
Small enterprise	15

Out of the 40 participants, 27 firms were responsive in completing the survey questionnaire. This represents a 67.5% response rate. Table 4.2 illustrates the relationship between the responses received and the type of enterprise each response represented.

Table 4.2 Relationship between the Responses Received and the Type of Enterprise

Firm Type	Total Sample	Response
	40	27
Large Enterprise	15	9
Medium Enterprise	10	6
Small Enterprise	15	12
Percentage	100 %	67.5 %

4.2.2 Structured interviews

Structured interviews were to be conducted with the relevant industry professionals. Two H&S officers and three representatives for the H&S legislation were approached. A 100% response rate was achieved.

Further included in the interview responses were recommendations made by interviewees to help improve the conditions of the work place to ensure that the level of accidents decrease.

4.3 Analysis of Data

4.3.1 Analysis of Survey Questionnaire Responses

Section A: Site Safety Officer

Question 1:

What are your primary responsibilities on site?

Aim:

The aim of this question was to find out where the safety officers' priority lies in their responsibilities with regards to the site supervision and risk assessment clauses as per the H&S Act.

Response:

Out of the 27 respondents, 63% confirmed that they are responsible for all the tasks mentioned, 26% did not specify and the remaining 11% indicated that only some of the responsibilities were applicable to their firm.



Figure 4.1 Safety Officers' Order of Responsibilities

As illustrated in figure 4.1 it can be deduced that site inspection, ensuring compliance of the H&S plan, constant monitoring of existing precautions, providing a communication link between the labour and management and providing a statement of witness for incidents that occur are the intricate facets of a H&S officer's responsibilities.

Question 2:

How regular are your site inspections?

Aim:

This question analyses the frequency of site inspections and seeks to ensure that regular inspections are made in respect to the construction regulations in the H&S Act. It is also asked to establish whether the safety officers deem it necessary to perform site inspections on a regular basis.

Response:

Out of 27 respondents, 33% of the respondents indicated that site inspections were done every day, 30% indicated that it was done once a week, 11% of the respondents specified once in two weeks and the remaining 26% did not employ a safety officer. From this, it is concluded that not enough site inspections are done. By performing inspections once a week, the inherent risks are unseen and not avoided.

Question 3:

Are employees given a brief before working on suspended platforms and heights?

Aim:

The aim of this question was to determine firms' compliance with regards to clause 7(4), i.e. risk assessment, of the construction regulations.

Response:

- 67% of the 27 respondents indicate "YES", they do brief their employees.
- 7% indicate "NO", they do not brief their employees.
- 26% did not find the need to employ a safety officer

The 7% who do not brief employees of the risk involved with heights believe that it is the duty of the safety officer to reiterate this during the induction phase. This poses a problem since it cannot be decisively concluded whether thorough inductions are performed at the start of a project.

Question 4:

What is the correct Personal Protective Equipment for working at heights?

Aim:

This question seeks to establish whether safety officers are aware of the correct PPE used at heights and if they impart this knowledge to workers.

Response:

Out of the 27 respondents:

- 44% stated safety harnesses were quintessential with life lines, hard hats, boots and fall arrest equipment also being mentioned.
- 56% of the respondents did not specify the correct PPE to be used at heights.

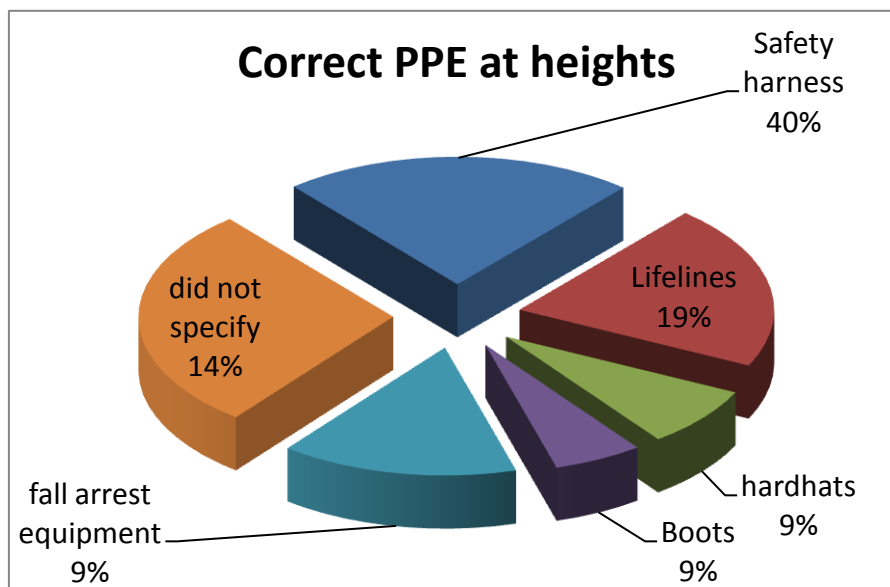


Figure 4.2 Correct PPE at Heights

Figure 4.2 represents the percentage of responses that were specific to with life lines, hard hats, boots and fall arrest equipment.

It cannot be concluded from the survey whether the safety officers did not know of the correct PPE at heights or if they chose not to answer, however 56% of the sample population did not answer. This is cause for great concern and an investigation should be performed to ascertain why this is so.

Question 5:

How often is this equipment inspected for defects?

Aim:

This question analyses the compliance with construction regulation clause 7(1) to assess whether safety officers identify the risks and hazards to which a person may be exposed in the execution of the work.

Response:

Out of 27 respondents, the results showed the following:

- 44% indicated every day
- 19% indicated once a week
- 4 % indicated once in two weeks
- 7% indicated whenever the need arises
- 26% did not specify

Equipment should be inspected for defects and its incorrect use every day. A large portion of companies do instill this into its procedures but from what is shown from the analysis of data, this aspect can be improved.

SECTION B: CONTRACTOR**Question 1:**

Which in your opinion is the 3 most important for the success of your project?

Aim:

This question aims to establish whether contractors realize the importance of implementing safety procedures in the execution of a project and if they make it a requirement for project success.

Response:

From the 27 responses, the 3 most important success factors for their project were (listed according to rank):

- Meeting client’s needs
- Public safety
- Safety of employees



Figure 4.3 Success Factors for a Project

In this regard, firms do realize that safety is an important feature of the job and requires as much dedication as it takes to produce a satisfactory product that meets the clients’ needs.

Question 2:

Do you implement an H&S Plan in the execution of all your projects? If yes, what does this H&S Plan comprise of?

Aim:

This question assesses contractor compliance with the clause 7(1; 4) and 8(2) of the construction regulations which relates to all the items and procedures that are included in the H&S Plan.

Response:

All 27 respondents stated that they do have a Health and Safety Plan which is implemented in their projects. However, of the 27 respondents, 15% did not state any criteria. The remaining 85% all had different outlooks of what an H&S plan should comprise of and specified the following composition:

- fall protection plan
- training procedures to be employed
- emergency procedures
- risk assessments
- health and safety policy
- subcontractors' responsibilities

Following this analysis, researchers found some common links that pertain to all sites. It is essential to note that the safety plans of sites are not all similar and that it is reviewed for each site.

Question 3:

What risk assessments do you perform before you proceed with the works, if any?

Aim:

This question determines whether the correct and complete risk assessments are carried out by contractors as specified in clause 7(1) of the construction regulations.

Response:

- 30% of respondents indicated the DSTI (daily site task identification) form part of the risk assessments carried out on site.
- 48% of the respondents indicated toolbox talks, analysis of conditions when working at heights and on scaffolds, daily site task identification and analysis of the location of the site were used to assess the risks present on site.
- The remaining 22% indicated that no risk assessments were performed.

The issue of sites where no risk assessments are made needs to be addressed regardless of whether it is a small enterprise or not. Risk assessments are performed to eliminate near-miss incidents and control and minimise potential dangers.

Question 4:

Has all of your labour force received adequate training for their specific tasks undertaken?

Aim:

The aim of this question was to establish whether all three types of enterprise exercise care and diligence when training their employees to ensure safe working procedures as specified by clauses 7(4) and 8(1) of the construction regulations.

Response:

All of the 27 respondents indicated that their employees received training for brickwork, plaster, working on scaffolds and erecting and stripping of formwork. Other training programs mentioned included:

- operator courses
- demolishing
- portable electric tool training

Question 5:

What is the frequency of toolbox talks?

Aim:

This question aims to assess contractor responsibility with regard to ensuring that their labour are consistently reminded of hazards and trained to cope with the related work procedures safely before work commences as referred to in clauses 7(1; 4) of the construction regulations.

Response:

- 52% indicated that toolbox talks were carried out once a week
- 37% indicated once in two weeks
- 4% indicated everyday
- 7% indicated whenever the need arises

Toolbox talks are a way of getting the labour force together to discuss pertinent issues regarding their safety. Carrying these out everyday becomes monotonous to employees and they could lose interest, however a once a week ritual is best so that any new ideas can be brought forward immediately.

Question 6:

Is your labour force engaged and responsive to these talks? If no, how could this issue be improved?

Aim:

This question aims to establish whether the toolbox talks carried out by contractors are heeded by the labourers thereby indicating where the problem lies with regard to non-compliance by management and employees.

Response:

- 85% indicated “YES”, the labour force was engaged and responsive
- The remaining 15% indicated “NO”, and proposed that this could be rectified through staff meetings

Question 7:

How often do you brief your employees on the dangers present on site?

Aim:

This question is aimed at assessing contractors' compliance with clause 7(4) which deals with ensuring that all employees are regularly informed of the hazards present on site.

Response:

- 30% of the respondents indicated once a week
- 44% of the respondents indicated everyday
- 19% indicated that employees are briefed of these dangers whenever a fatality/injury occurs
- 7% indicated that employees are briefed of these dangers at induction

Question 8:

Do the employees who work at elevated positions undergo the following?

1. Physical examination
2. Psychological fitness tests
3. Induction

Aim:

This question aims to analyse whether the testing procedures and training programmes specified in clause 8(1) of the construction regulations are performed by contractors for all their employees, especially those who are exposed to conditions of work at elevated positions.

Response:

- 33% of the respondents indicated “YES” for physical examination, psychological fitness tests and induction
- 22% of the respondents indicated “YES” for only physical examination and induction
- 33% of the respondents indicated “YES” for only induction
- 12% of the respondents indicated “NO” for all

It is vital for firms to regularly check the health and safety of their employees so that they can maximize their production. If there is a case of an injury due to negligence, the firm could incur major costs for damages.

Question 9:

Are they supplied with the correct fall protection equipment?

Aim:

This question aims to establish whether all three types of enterprise ensure that their labourers are provided with the correct fall protection equipment thereby promoting safe working procedures on their site in accordance with clause 8(1) of the construction regulations.

Response:

All 27 respondents indicated “YES”, their employees are supplied with the correct fall protection equipment.

Question 10:

How often do you see your employees use their fall protection equipment in the correct way it was intended?

Aim

This question aims to determine where the problem lies with regard to non-compliance with the clause 8(1) of the construction regulations by management and employees.

Response:

- 70% of respondents indicated everyday
- 19% of respondents indicated whenever they see a senior
- 11% of respondents indicated whenever they see the safety officer

Question 11:

How many safety officers do you have on your site?

Aim:

This question is aimed at investigating whether contractors' feel the need to employ a safety officer on their site. The need to appoint a H&S officer is emphasized in clause 6 of the construction regulations.

Response:

Out of 27 respondents:

- 11 respondents employed one safety officer on site
- 5 respondents stated that they had two safety officers on site
- 9 respondents did not employ a safety officer (small enterprise)
- The 2 remaining respondents were large enterprise and indicated that they had 12 and 35 safety officers respectively on site

Question 12:

Is there a safety supervisor on site at all times?

Aim:

This question aims to establish whether contractors ensure that a safety supervisor is always present on site to enforce and implement the H&S Plan when the contractor himself is unable to do so. This is important because if a contractor deems it unnecessary to employ a safety officer, clause 6 of the construction regulations maintains that he is obligated to appoint a safety supervisor to assist in the control of all safety related aspects on the site.

Response:

- 74% of the respondents indicated “YES”, there is a safety supervisor on site at all times.
- The remaining 26% of respondents who indicated “NO” were from small enterprises.

The problem here is that some of the small enterprises have no safety officer or supervisor directly in charge of H&S on their sites. This becomes a legal issue since it is legislated that if there is no safety officer there must be at least one supervisor at all times.

Question 13:

In your opinion is it necessary to employ a safety officer in the different project categories listed below?

Category 1: R 0 - R 500 000

Category 2: R 500 000 - R1 Million

Category 3: R 1 Million - R10 Million

Category 4: R 10 Million and above

Aim:

This question is aimed at determining if contractors base their decision to employ a safety officer on the size of the project to be executed as suggested by clause 6 of the construction regulations.

Response:

- 48% of respondents indicated “YES” for all categories
- 37% of respondents indicated “YES”, a safety officer should be employed only for categories 3 and 4
- The remaining 15% of respondents indicated “YES”, a safety officer should be employed only for categories 2, 3 and 4

Question 14:

Are there medical professionals in the event of an accident occurring?

Aim:

This question aims to assess the extent to which contractors are prepared to respond to accidents that occur on site. Safety of employees should be paramount for project success.

Response:

12 out of the 27 respondents indicated “YES” to having medical professionals on site. The remaining 15 respondents indicated “NO” they did not have a medical team on site. However, people trained to provide first-aid were present on site to offer medical assistance in the event of an accident.

Question 15:

What are the 4 most common accidents that occur on site? (Rank on a scale of 1-5, with 1 being the highest occurrence)

- Falls from heights
- Electric shocks
- Other (Specify)
- Cutting off of limbs
- Stepping or striking against objects

Aim:

This question aims to determine the most common types of accidents that occur on construction sites which is the underlying objective of this study. This will reveal the problem area with regard to non-compliance with the safety procedures employed on site as outlined by the construction regulations.

Response:

From the 27 responses, the following accidents predominate on construction sites (listed according to rank):

- Stepping or striking against objects
- Other- was specified as minor cuts and bruises, etc
- Falls from heights
- Cutting off of limbs
- Electric shocks

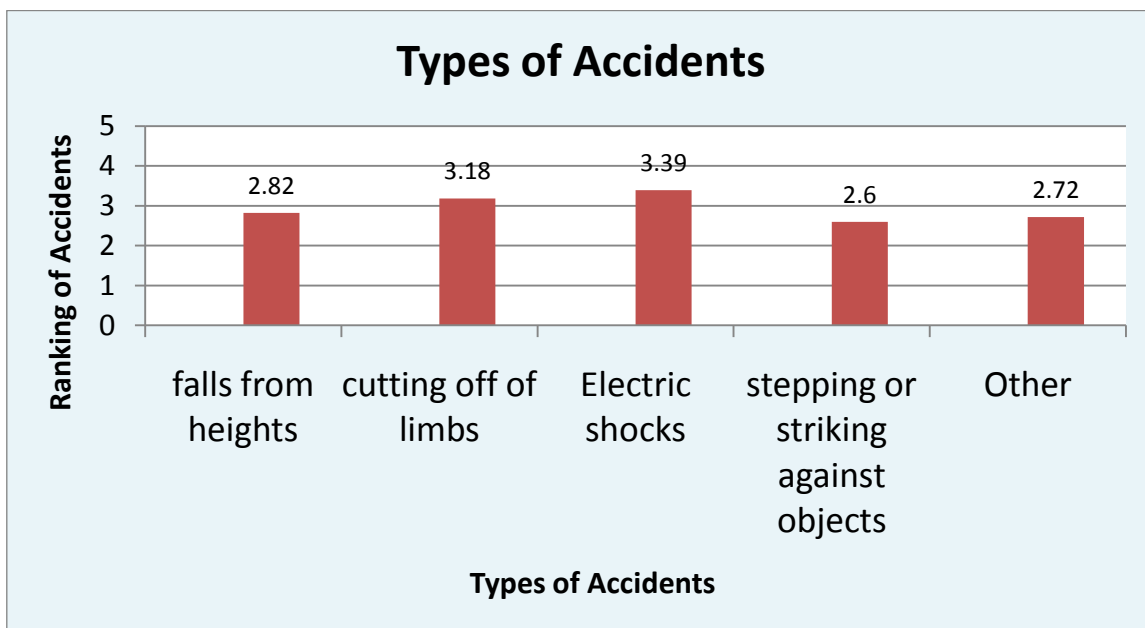


Figure 4.4 Types of Accidents on Construction Sites

Question 16:

What do you think are the main reasons for these occurrences stated above?

Aim:

This question aims to discover the main reasons for the abovementioned accidents. The issue of non-compliance will be assessed as the party responsible for such will be revealed.

Response:

Analysis of the 27 responses reveals the following reasons with the percentage of each occurrence:

- 48% due to negligence and carelessness of labourers
- 13% due to lack of supervision
- 15% due to unskilled labour who have not been educated on safe procedures to be adopted
- 24% due to labourers not wearing their PPE and fall protection equipment

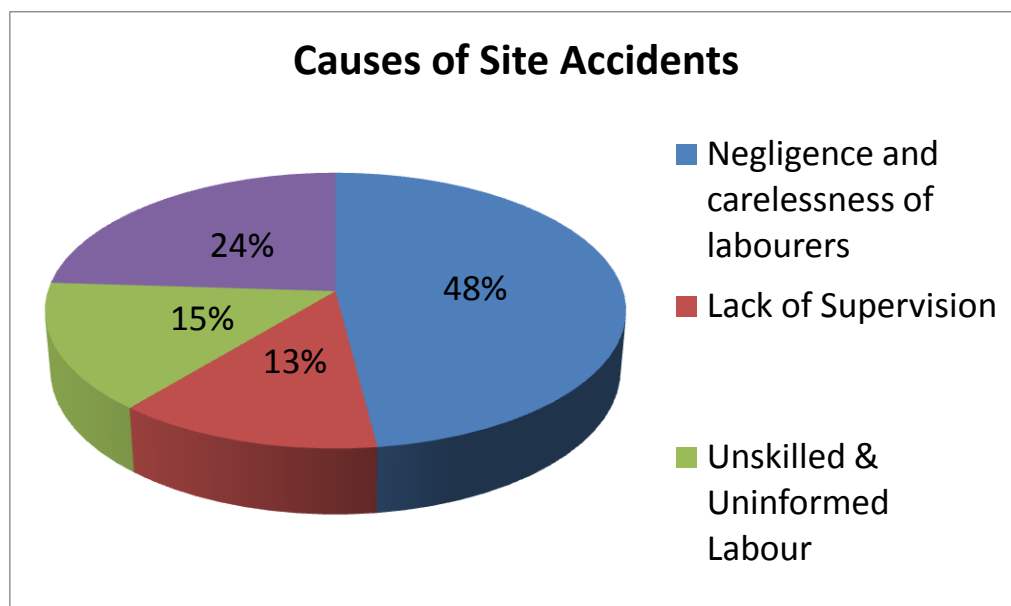


Figure 4.5 Causes of Site Accidents

Question 17:

What is your incident reporting structure?

Aim:

This question aims to establish whether firms' employ a standard reporting structures on construction sites in the event of an accident occurrence.

Response:

From the 27 questionnaires received, the following appears to be the most common set of procedures in response to an accident:

1. Treat the injured.
2. Call the emergency services.
3. Address and make safe the scene of the accident.
4. The accident must thereafter be recorded.
5. Preventative measures must be taken to ensure that the accident does not happen again.

Question 18:

In the case of an accident which of the following are effected with regard to the injured person/s?

- | | |
|---|---------------------|
| 1. Compensation fund | 2. Public liability |
| 3. Special insurances for damage to the works | 4. None |

Aim:

This question aims to assess whether contractors provide for their employees in the form of compensation or medical assistance in the event of an accident occurring.

Response:

Out of 14 respondents:

- 100% indicated compensation fund.
- Furthermore one respondent, from a medium enterprise, indicated additional special insurances would be effected.

Question 19:

For this project, was a provision for Health and safety allowed for in the Bill of Quantities at tender stage?

Aim:

This question aims to establish whether contractors consider H&S at tender stage and realize the need to provide for H&S as they would for any other preliminary item in the bill of quantities.

Response:

All 27 respondents indicated “YES” a provision for H&S was allowed for.

Question 20:

Was this amount adequate cover for the number of accidents that have occurred?

Aim:

This question aims to assess the subsequent cost and effect of accidents that have occurred on construction sites and whether contractors adequately provide for this possibility.

Response:

All 27 respondents indicated “YES” the amount in the Bill of Quantities was sufficient cover for the accidents that occurred.

Question 21:

Which of the following has the most significant effect with respect to the cost of accidents occurring on site? (Please tick 6 most crucial)

- Insurances
- Publicity
- Repair of damages
- Loss of productivity during accident
- Litigation
- Professional fees for medical care
- Replacement of injured party
- Compensation to affected parties
- Public liability
- Non conformance reports
- Loss of productivity by injured party

Aim:

This question was aimed at assessing the costs and effects associated with site accidents and which had the most significant impact on the individual projects of the contractors.

Response:

All 27 respondents had differing selections inclusive of all the effects listed. Analysis of the 27 responses showed that the 6 most crucial effects of site accidents are (listed according to rank):

- Insurances
- Repair of damages
- Compensation to affected parties
- Loss of productivity during accident
- Loss of productivity by injured party
- Professional fees for medical care

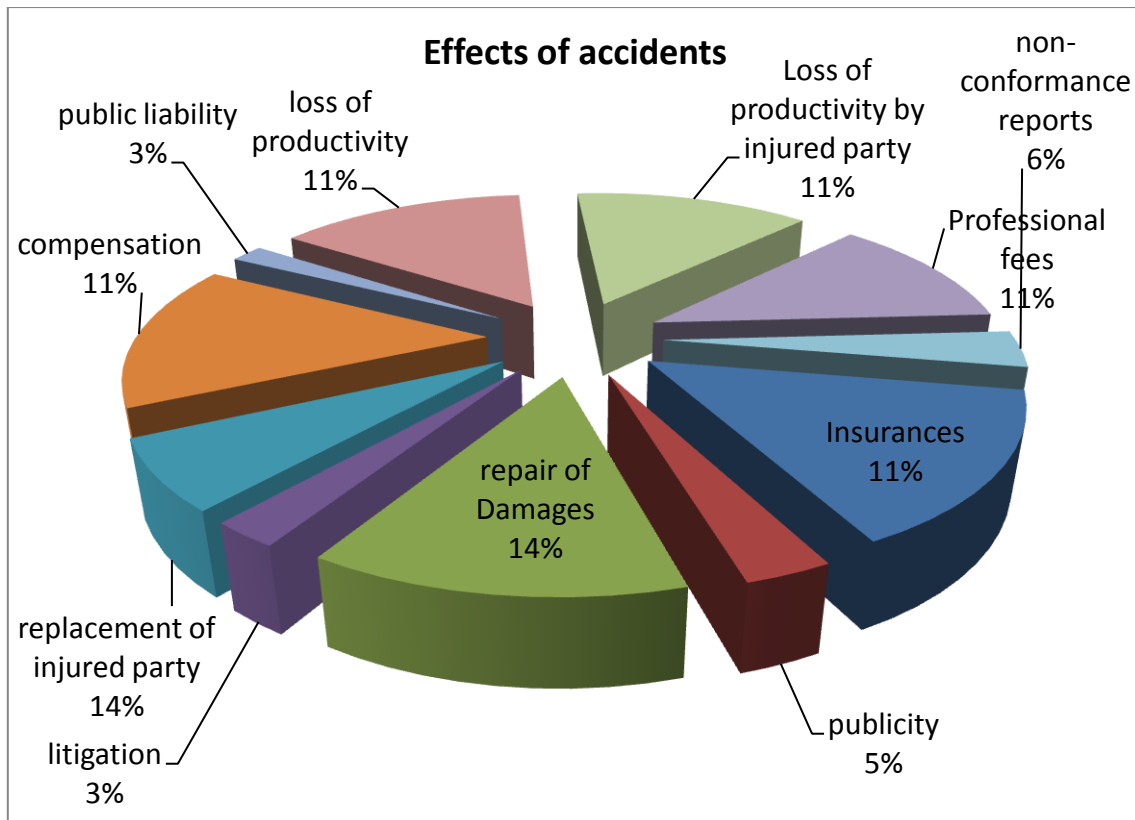


Figure 4.6 Effects of Accidents

4.3.2 Analysis of Interviews Responses

Role of the Safety Officer:

- To identify hazards that can lead to the loss of production.
- To compile risk assessments and liaise with the different departments, i.e. DoL, Department of Health, Fire Department, Department of Environmental Affairs.
- To advise upper management with regards to legal requirements in the execution of each and every task required by law.
- To ensure that everyone is executing their task in their scope of management.
- To execute incident investigation as well as safety training.

Role of the H&S Representative:

- Advise, consult and train the various sectors of manufacturing, industry, commerce, building and government.
- To conduct Health, Safety and Environmental (SHE) legal compliance audits, SHE training and risk assessments.

Proposed changes to be made to the Health and Safety Act or to the safety systems prescribed by it:

The H&S Act, more especially the construction regulations is deemed to be sufficient in attaining a 'zero accident' working environment on construction sites. In theory it can be very effective; however it is still evident that some firms do not meet the minimum legal requirements. Some believed that the regulations were insufficient and those who said it was, added that attaining a 'zero accident' record is impossible and unlikely due to the dangerous nature of the work undertaken. The following are suggestions made by the interviewees:

- Penalties rendered for non-compliance are not enough. This amount should be increased and charged on a personal capacity.
- A higher authority should be responsible for the monitoring of the DoL's performance. During site inspections the DoL is found to be engaged in inappropriate activities, e.g. socializing with management. As a result of this behaviour, non-conformances are overlooked.
- Furthermore, a higher power should do a close out audit on the DoL itself. Safety becomes an issue and no one looks to the DoL to ascertain the reasons why. They do not visit sites regularly and perform site inspections approximately three times a year.
- More emphasis should be placed on the safety supervisors on site with regard to their primary responsibilities.
- More details stipulating exactly what managements' requirements are in terms of this act needs to be addressed.
- There should also be more responsibility on the client so as to ensure contractors are taking all reasonable measures to prevent any incidents.

Proposed changes to the H&S plans of sites to make them more effective:

- There is no provision in the regulation for changes to PPE. Any information that does not appear in the Act can be found in the government gazette that is amended every 3 months.
 - The need to develop a protocol for testing competency, experience, education and people managerial skills.
 - The need to conduct compulsory audits for building sites. In this respect the audits become management and monitoring tools. Auditing systems will allow for people to evaluate other people and their fellow colleagues.
 - Inclusion of a reporting system that involves notifying the director of non conformances to be sent everyday. These should thereafter be followed up to determine if the default was rectified.
 - H&S plans must be modified to become an operational document that must be used on a day to day basis. Simplicity is the key.
 - Behavioural based safety – different skill and knowledge levels. Workers don't know the finer details and to counteract this evaluation testing should be done to evaluate their shortfalls. Take him back for a re-training should the need arise.
 - H&S must be reviewed especially when new operations are effected as well as when the structure changes. This occurs when the risk assessments are performed. At the moment H&S plans are not reviewed regularly.
- There are 3 types of risk assessments done i.e.
 - **Baseline risk assessment** – provides an overview of all the potential risks and hazards on site.
 - **Issue based risk assessment** – site specific
 - **Continuous risk assessments** – break up of issued based risk assessments.
- The client should continuously encourage the contractor and ensure that his compliance with the procedures laid out in the H&S plan is monitored.
 - SHE must be incorporated into the H&S plan. Sites have plant, diesel and environmental degradation that could affect the health of workers.
 - Security requirements should be included for protection against theft, vandalism, etc.

Preparation of new H&S plans and reviewing of existing H&S plans to improve systems:

- One cannot review existing plans because it is not site specific. A review has to be executed on a plain untouched land, so that we all the risks involved can be analyzed.
- Existing H&S plans are merely used as a reference point when creating new ones thereby forming a basis.
- Certain principals are generic however it is important to understand that each site contains its own site specific risks, therefore one cannot stick to the exact same plan on each site, and it has to be reviewed.

Views with regard to the compliance of the Construction Regulations on sites:

- The level of compliance is not up to par.
- This is due to the lack of support by upper management as they are more focused on the operations side and disregard safety aspects. Safety is being overlooked because of time frames and production.
- The main areas in which contractors ensure compliance include site establishment, provision of PPE and the provision of workman's compensation for all labourers. Note that supervision is not one of the areas.
- One safety officer stated that his company was committed to zero injuries, accidents and excuses but noted that there were still a lot of gaps. Safety issues are measured, detected and tested on a daily basis.

Most common examples of non-compliance on sites and the parties responsible for such:

- Driven machinery, hoists, lifting tackles, etc. require that before anyone uses the equipment, it has to be tested by the relevant safety authority to ensure that it complies with the regulations applicable- at the moment this is not being done.
- Main reasons for non conformance include lack of commitment by management, disregard for the law by employees, poor leadership by safety officers and production driven goals of management and client.
- Failure of supervisors to train and inform employees of risk assessments.
- Failure of supervisors to enforce the H&S procedures and as a result they do not create a safe working environment.

- Failure to comply with PPE requirements by employees. This is attributed to their lack of understanding of the dangers present and why such measures are important. However PPE is a last resort. There are instances where the use of PPE becomes impractical, e.g. Hardhats at ceilings or damage to ceiling board, causing kinks. Other labourers have a negative attitude and have no regard for their own or others personal safety.
- General Safety regulation 2 refers to PPE and states that equipment must not be altered.
- The choice of sub-contractors, as most of them are appointed without scrutinizing their company policies.

Views on your contribution to the H&S plan as a safety officer or safety representative:

- Key driver of the H&S plan
- Simplification of safety systems to ensure that all levels of skilled labour understand them.
- Improvement of pre-accident prevention methods that already exist.
- Improvement of the accident reporting structure. Not fault finding but fact finding as this brings confidence to the employees to report incidents.
- Contribute to the ritual of 'my brothers' keeper'.
- Contribute to the closing out of accidents.
- Involvement in reviewing of risk assessments.
- Preparation and implementation of the H&S plan.
- Adjustment of the H&S plan as the works progresses.
- Assist employers to become legally compliant and illustrate measures to prevent loss i.e. employee, property, financial.

Measures taken to counteract any irregularities on site:

- All activity is brought to a halt.
- The matter is brought up in the boardroom to brainstorm solutions for the key issues.
- Investigations are conducted in an unbiased manner.
- Training and empowering personnel.
- Encouraging safe working procedures.

- Create awareness of the dangers of non conformance.
- Last resort is to discipline and dismiss if the non compliance persists.
- Enforce fines on those who have defaulted.

To counteract: 3 skills are needed:

- Human skills: Humane with humans
- Technical skill: Understanding what has actually happened by letting the worker educate you.
- Conceptual skills: Determining what the legal requirements are thereafter decide how to go about resolving the issue.

Core issues faced by H&S officers or representatives in executing proper safety procedures at all times on site:

- Double standards of management: One interviewee stated, ‘you can give a certificate but it is worthless if you can’t practice what you preach.’
- Insufficient training: Outdated methods and strategies.
- The lack of supervision
- The choice of ‘fly-by-night’ contractors.
- People who have the old kind of mindset that ill fate will never fall on them.
- Production driven goals which compromise safety on site.

The frequency of accidents tended to on sites:

- First aid cases are treated everyday
- More serious accidents are experienced:
 - Once in a week during weekdays
 - Twice in a fortnight including weekends
 - Reported cases of one medical case and one near miss.

Most common accidents that occur on sites:

- Hand injuries (cuts, abrasions and lacerations)
- Falling objects (including scaffolding and deck collapse) on labourers
- Trip fall hazards
- Falls from heights

4.4 Conclusion

This chapter focused on the analysis of data based on the survey questionnaire and the structured interviews. It discusses the response rate and encapsulates the answers from the questionnaire and the interviews to help the researchers develop a plan of action that follows.

5.1 Introduction

This chapter aims to conclude this study by summarising the research work done. It will present the action plan developed by the researchers as well as the recommendations for the construction industry professionals, government and for further research to improve H&S on construction sites. This chapter will revisit the research hypothesis and research objectives and discusses the results from the methodologies that had been adopted. Conclusions and final comments will be declared.

5.2 Contribution to the Original Body of Knowledge

This research provides a valuable contribution to the original body of knowledge by studying the obstacles that South African contractors are faced with in eliminating the high record of site accidents.

The research further proposes an action plan to help reduce the high statistics associated with negative H&S performance in South Africa.

Costs of accidents are often overlooked by industry stakeholders and this paper seeks to emphasize the significant impact accidents have, not only on the project itself as direct costs but also on the economy at large through excessive claims for the Workmen's Compensation Fund. This will create awareness to industry professionals who will thereafter improve on the H&S culture and the policies and practices adopted by them.

5.3 Research Overview

The following is a brief insight as to the reasons this aspect of safety was chosen. It discusses the problem, researchers' aims and objectives and the method whereby which these objectives were achieved.

5.3.1 Problem Statement

The construction regulations of the H&S Act and its regulations have been partially or wholly disregarded. Dangers are never more present than it is on construction sites and it is imperative to find a way of maintaining compliance with these regulations. Fatalities from statistics in 2007 and 2008 have incrementally increased due to contractors', site supervisors and the workforce's negligence. A better means of maintaining the safety standard is needed.

5.3.2 Research Aim and Objectives

The aim of this study is to investigate the causes and effects of non-compliance with the H&S procedures by contractors in the South African construction industry.

In order to achieve the abovementioned aim a research methodology is developed to accomplish four objectives.

- (1) Investigating the H&S Act, policies used to promote and ensure compliance within sites, hazard and prevention methods and management systems for safe construction.
- (2) Defining the causes and effects of non-compliance with H&S procedures and determining practices on construction sites.
- (3) Assessing the practicality of the H&S plans and investigating their view towards eliminating contractor's non-conformance with H&S procedures.
- (4) Developing an action plan to enhance the effectiveness of contractors' H&S plans in South Africa.

5.3.3 Research Methodology

Qualitative and quantitative research methodologies are adopted to achieve the study aim and objectives.

The research introduces the specific area to be investigated by using an extensive literature review. This also addresses the issues concerning the focus clauses 6(6), 7(1; 4), 8(2) and discusses the causes and effects of non-compliance thereof. Journals and other published material relating to the construction industry's safety performance form the basis for investigation.

A survey was conducted to determine whether contractors are compliant with the practices laid out as a regulation on site. A questionnaire comprising of two sections was issued out to contractors and H&S officers for completion of their relevant sections. The participants involved in the survey were only from the KZN region.

Structured interviews were carried out with industry professionals to gain a more practical insight into their understanding and application of safety management systems in the execution of their duties.

5.4 Findings of the Research

5.4.1 Literature Review

The findings from the literature review are summarized as:

1. The H&S Act states that all companies must comply with the fundamental principles relating to the implementation of an H&S plan and this must be adhered to at all times.
2. Contractors are responsible for the supervision of their employees in ensuring their safety with regard to their working environment and procedures. Also, risk assessments must be conducted to identify all the hazards present on site and thereafter the findings must be incorporated into the H&S plan to be implemented. Similarly, the contractor is also responsible for the preparation of a fall protection plan to which all fall related matters can be traced and compared.
3. The most common accidents that occur on construction sites are falls, stepping or striking against objects, mishandling of machinery, injury caused by earthmoving vehicles, fires and explosions.
4. The main cause of these accidents is negligence on the part of labourers'. They either do not use their PPE because they view it as uncomfortable and impractical or they do not utilize their PPE in the correct manner.
5. Contractors and safety officers should adopt and implement the following methods if they wish to effectively eradicate the occurrences of incidents and fatalities on construction sites:
 - Risk assessments for that particular activity – site specific
 - A method statement of the company's beliefs and values with emphasis on the value of its employees
 - Safe working procedures
 - H&S inductions
 - Toolbox talks
 - The encouragement of practicing safe strategies

6. An accident reaction system, training of both employers and employees and the correct use of PPE is imperative in the development of an effective H&S plan to achieve a safe working environment and excellent H&S performance.
7. The costs of accidents are not tracked by contractors and as a result this amount exceeds expectations by the end of the project. The direct and indirect costs associated with accidents are compensation insurances for employees, damage to materials, plant and equipment, damage to the environment, loss of productivity and bad publicity.

5.4.2 Survey Questionnaire:

The core findings from the survey questionnaire were as follows:

1. A majority of the companies brief those employees who worked at elevated positions. A small percentage did not feel the need to, since employees are inducted when they resume their duties.
2. All the companies surveyed ensured that their employees wore the correct PPE. However, only 44% stated the correct PPE to be used at heights whilst the remaining 56% did not specify as such. 24% of site accidents were attributed to labourers not making use of their PPE when working at heights, using heavy machinery, etc.
3. It was found that all companies implement an H&S Plan in accordance with the requirements of the H&S Act. It was also noted that while risk and hazard identification received attention every day, a considerable percentage only briefed employees when a fatality/injury occurred or at induction. This should rather be an ongoing process to ensure the safety of employees in their workplace.
4. From the 27 responses, the following accidents predominate on construction sites (listed according to rank): Stepping or striking against objects, other- was specified as minor cuts and bruises, falls from heights, cutting off of limbs and electric shocks. These were due to a number of reasons including a 48% lack of awareness and concentration, 24% no use of PPE provided, 13% lack of training and supervision and 15% uninformed labour.

5. Analysis of the 27 responses showed that the 6 most crucial effects of site accidents on a project are (listed according to rank):
 - i. Insurances
 - ii. Repair of damages
 - iii. Compensation to affected parties
 - iv. Loss of productivity during accident
 - v. Loss of productivity by injured party
 - vi. Professional fees for medical care

5.4.3 Structured Interviews

The findings from the interviews can be summarized as follows:

1. It was found that the role of the safety officer is to identify hazards that can lead to the loss of production, compile risk assessments, advise upper management with regards to legal requirements relating to H&S and to execute incident investigation as well safety training.
2. With regards to the proposed changes to the H&S plans of sites to make them more effective, it was found that there was a need to develop a protocol for testing competency, experience, education and people managerial skills. There was also a need to conduct compulsory audits for peer assessment and the inclusion of a reporting system of non-conformance to the director of the firm.
3. Interviewees stated that there are irregularities with regards to compliance with the construction regulations. The lack of support of upper management was attributed to production driven goals and as a result safety aspects were disregarded.
4. The main area in which contractors did not thoroughly ensure compliance was supervision.
5. The main reasons for non-conformance with safety on sites included a lack of commitment by management, poor leadership by safety officers and lack of awareness by management and clients of the importance of optimum H&S practices. Supervisors lacked in the enforcement of H&S procedures such as ensuring correct use of PPE at all times. The poor choice of sub-contractors also

has a negative H&S impact as they are appointed without their company policies being scrutinized.

6. The core issues that H&S officers faced in their execution of proper safety procedures on sites included the double standards of management, i.e. insufficiently trained labour, lack of supervision, the choice of 'fly-by-night' contractors, and a narrow and unwilling mindset which in turn compromised safety.
7. The most common accidents on sites were hand injuries (such as cuts and abrasions), objects falling on labourers, falls from heights and trip fall hazards. First aid cases occurred daily, while more serious incidents were in the ratio of one per every fortnight.

5.5 Testing the Research Hypothesis

The research hypothesis for the purpose of this study is stated as:

“There is no direct relationship between non-compliance by South African contractors’ with clauses 6(6), 7(1; 4) and 8(2) of the construction regulations and the causes of site accidents and the direct and indirect costs as a result of such accidents.”

From the analysis of the data collected it is evident that the research hypothesis has been proven fictitious as results show that accidents do occur as a result of contractor non-compliance, mainly in the form of their employees being negligent, this includes management and the labour force. The additional costs are directly related to these accidents and increase the construction cost by a significant amount.

5.6 Action Plan for Complying with H&S Regulations (APCHSR)

5.6.1 Definition

Action plan is defined as steps or actions that must be taken or performed for a strategy to succeed (Business Directory, 2009). The action plan for complying with the H&S regulations (hereinafter referred to as "the action plan" or the "APCHSR") developed by the authors is an innovative tool to escalate the contractors’ awareness and increase their compliance with the H&S regulations in the South African construction industry.

5.6.2 Need for an Action Plan

The need for the action plan stems from the necessity to set the rules and establish the grounds that enable contractors to comply with the H&S regulations in the South African construction industry. Taking into account present conditions and circumstances, the action plan is an essential tool for reducing current accident and fatality statistics on construction sites.

In addition, it will increase the awareness of the overall impact of accidents and incidents on the project and the economy at large. It will also serve to educate those in the industry who wish to furnish themselves with the appropriate knowledge regarding H&S planning and those who wish to improve their H&S rating. Furthermore, it will help by ensuring the adoption and application of the action plan by top management and employees will assist towards improving the H&S status on construction sites (Thevan *et al.*, 2009).

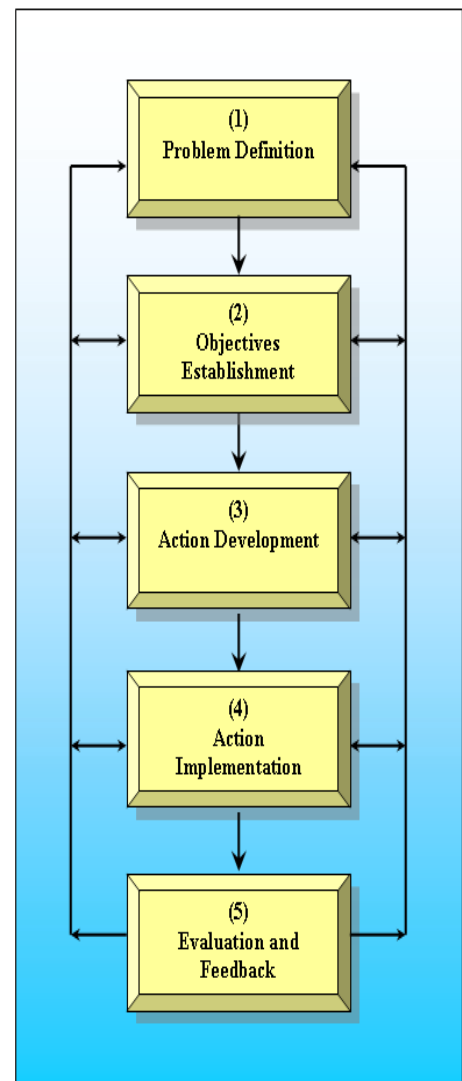


Figure 5.1: Action Plan

5.6.3 Description of the Action Plan

The action plan is a series of steps that needs to be followed if the various individuals involved are serious about developing and implementing a proper H&S plan and reducing the number of accidents prevalent within their organisation. It is a detailed description of the proposed method of identifying risk and problem areas, and ways in which to counteract these by implementing safe systems of work. The action plan consists of five ongoing processes, namely, problem definition, objectives establishment, action development, action implementation and evaluation and feedback as proposed by Thevan *et al.* (2009), see figure 5.1.

5.6.3.1 Problem Definition

This activity aims to define the problems that hinder construction companies from adhering to the H&S regulations. A team has to be formed to identify these problems. This team could comprise of the contracts manager or director on the site, the safety officer, the site foreman or agent and possibly even one of the charge-hands on that particular site. The brainstorming technique could be a useful tool for achieving the aim of this activity. It serves to gather the greatest number of risks and problems facing the workforce and identify those presenting the greatest danger to both the individual and the organisation. Some of the more common areas that need to be considered when identifying potential problems are:

- Manual handling and transporting
- Slips, trips and falls
- Hazardous substances
- The risk of fire
- Plant and equipment maintenance
- Electricity
- Machines and safety equipment

It must also be noted that accidents due to poor safety comes at a price. Apart from the penalties that might be incurred by failing to meet legal H&S requirements, costs to the individual are incurred through lost wages and to the organisation through damages, material and insurance costs and the loss of potential clients. It is therefore necessary to pay special attention to all the problems identified in order to reduce the number of accidents on construction sites. The support of top management is essential for approving this timeframe and resources required for completing this activity (Thevan *et al.*, 2009).

5.6.3.2 Objectives Establishment

Within this activity, the objectives for improving the H&S practice in South Africa through assisting contractors to overcome the identified problems have to be established. Different organisations will face similar problems but the levels of relevance and importance of these problems will vary from one organisation to the next. It is therefore necessary to rank these according to their weighted importance and prevalence. Input from the study team is of prime importance and it will be imperative for the team to create a culture which manages H&S throughout the organisation. This will include the setting out and publication

of an H&S policy and the establishment of an H&S organizational structure. Top management support and consent will facilitate the adoption and implementation of the study results (Thevan *et al.*, 2009).

5.6.3.3 Action Development

After the problems are identified and the objectives are established, it is essential that the study team develops the action plan required. Inputs from different study team members will help build up creative ideas that will achieve the established objectives. During this phase of the process, it is necessary to think more generally about safe procedures and systems of work as well as the methods in which to carry them out (Thevan *et al.*, 2009).

Hughes & Ferrett (2005) define a safe system of work as, “the integration of personnel, articles and substances in a laid out and considered method of working which takes proper account of the risks to employees and others who may be affected, such as visitors and contractors, and provides a formal framework to ensure that all of the steps necessary for safe working have been anticipated and implemented.”

Such systems should be made formal and documented and could be created by (Thevan *et al.*, 2009):-

- having clear procedures relating to the different aspects of a particular type of work;
- having safe procedures relating to the same;
- cultivating the right attitude and learning from past mistakes and accidents; and
- brainstorming sessions using evaluation techniques such as Simple Multi Attribute Rating Techniques to achieve proper decisions relating to the action development.

According to Hughes & Ferrett (2005), the essential features of a safe system of work are forethought and planning. They emphasise the need to ensure that all foreseeable hazards are identified and controlled. In particular, this will involve the scrutiny of:-

- The sequence of operations to be carried out.
- The equipment, plant, machinery and tools involved.
- Chemicals and other substances to which people might be exposed in the course of the work.
- The people doing the work – their skill and experience.
- Foreseeable hazards (SHE) whether to the people doing the work or others who might be affected by it.

- Practical precautions which, when adopted, will eliminate or minimize these hazards.
- The training needs of those who will manage and operate under the procedure.
- Monitoring systems to ensure that the defined precautions are implemented effectively.

5.6.3.4 Action Implementation

When the team develops an action plan, plans for implementation need to thereafter be developed. This will include the training of management and employees and the explanation and education surrounding the strategies required to improve overall H&S performance. Accidents do not just happen. They are usually caused by a combination of factors such as plant, hazardous substances, lack of training and supervision, carelessness and bad habits. It is important to recognise that prevention must be based on an integral system rather than one which deals with each factor in isolation.

The implementation of a successful H&S plan will be essentially up to the management of that organisation. If upper management lead by example and show their employees that they are serious about achieving high standards with regards to H&S, then this attitude will filter through the organisation and will ultimately bring the desired effect. Changing the attitudes of employers and employees of any organisation must not be underestimated because this would represent the first level of change in the attempt to achieve a 'zero-accident' rating (Thevan *et al.*, 2009).

With respect to this, it is a necessity to be informed i.e. taking the time to think and understand the hazards and risks that exist in and around one's workplace, being aware of safety procedures, co-operating with safety representatives and being alert to one's environment. The following guidelines could be used as rules relating to safety on construction sites:

- All work on site must be performed in compliance with the Occupational H&S Act and the construction regulations.
- All persons entering the site are required to act responsibly and to do everything reasonably expected to prevent injuries to themselves and to other persons and to prevent loss to the company.
- Fooling around in the workplace is strictly forbidden.

- Good housekeeping must be the responsibility of every person on site and work areas must be kept free of hazards, waste and rubbish.
- When PPE is issued for any task, it must be used.
- Do remain alert to the dangers in every task which is performed.
- Do report any hazard immediately to your H&S representative or foreman.
- Do report all injuries promptly, no matter how minor.
- Do find out where the fire fighting equipment is and how to use it.
- Do not use or operate any tools or equipment for which you have not been properly trained.
- Do not take chances. If you are in any doubt, ask your immediate supervisor or foreman for guidance.
- Do not transport people or ride on any plant or equipment.

The action plan needs to be implemented in an absolute and thorough manner if it is to be effective for all members of an organisation and will only be successful if there is good communication of such between all levels of that organisation (Thevan *et al.*, 2009).

5.6.3.5 Evaluation and Feedback

It is imperative to evaluate the performance of action taken in order to take any corrective action required. The performance evaluation can be an active procedure in that, work-based inspections and audits, regular H&S committee meetings, feedback from training sessions and the constant review of risk assessments must be incorporated into routine. Records of accidents, work-related injuries as well as near-misses must be evaluated within this system. It is extremely important to review the action plan on a continuous basis in order to improve its effectiveness and to assess whether targets have been met and to identify any shortcomings within that system (Thevan *et al.*, 2009).

The essential elements of a successful H&S plan of action would include the following (Hughes & Ferrett, 2005):

- Leadership and commitment to H&S throughout the organisation.
- An acceptance that high standards of H&S are achievable.
- The identification of all significant hazards facing the workforce and others.
- A detailed assessment of H&S risks in the organisation and the development of appropriate control and monitoring systems.

- An H&S policy statement outlining short and long term objectives.
- Relevant communication and consultation procedures.
- Training programmes for employees at all levels of the organisation.
- Systems for monitoring equipment, processes and procedures.
- The prompt investigation of all incidents and accidents and reports made detailing any necessary remedial actions.

All the stated elements need to be present within the organisation and the chosen system needs to be effective for the APCHSR to be successful. Constant delivery of feedback between the study team and top management regarding the lessons learned will help improve the action plan in future studies for adhering to the H&S regulations.

5.6.4 Benefits and Limitations of the Action Plan

The adoption and implementation of the developed action plan will help improve workers' safety attitude and the elimination of managements' double standards with regard to H&S. In addition, it will help in reducing overall site incidents and accidents. It also serves to achieve and demonstrate legal compliance thus gaining the confidence of Government and its various departments because such compliance demonstrates a genuine commitment towards H&S. Furthermore the action plan will reduce the direct and indirect costs of incidents and accidents if implemented in the correct manner.

On the other hand, the action plan will be ineffective if top management and employees are not willing to co-operate and adopt the developed tool. A lack in the change of attitude of the foremen and employees of the organisation as well as a lack of understanding will lead to poor implementation of the system. A further possible limiting factor is the need for the action plan review to be conducted on a regular basis; if this is not done it might lead to cynicism relating to the H&S action plan (Thevan *et al.*, 2009).

5.7 Research Recommendations

5.7.1 Recommendations to contracting firms

- Construction companies should make it their goal to educate and increase the awareness of all parties involved of the causes and effects of site incidents because these incidents impact other workers, the project and the country's economy. Negative publicity on a construction project due to injuries or loss of

life could have a lasting impression not only on the witnesses, but also on the order books of the company due to the loss of potential clients who will be influenced to take their business elsewhere.

- Firms should take a more proactive approach towards implementing the H&S plans on site through the integration of H&S procedures into the overall project management plans. The operations division should incorporate this into their daily routine. By implementing such plans, the companies will obtain a better safety rating as well as see the effects through a lowered incident rate on their sites.
- Firms who appoint sub-contractors should scrutinize such companies before hiring them. It is often found in industry that such companies rarely provide a proper and comprehensive safety file or plan, their employees are not provided with the necessary training and they do not practice safe work procedures. The choice of so-called 'fly-by-night' sub-contractors could be to the detriment of the principal contracting company if there is an incident due to the negligence of the sub-contractor.
- Contractors must ensure that their labour force always makes correct use of the PPE provided to them; safe construction practice and the encouragement of enforcing such action will reduce accidents caused by carelessness. This will also bring awareness to them and empower them to teach their peers. Furthermore, contractors should continuously brief their labour force to maintain proper safety procedures on site and this can be achieved through repetitive teaching.
- Construction companies are advised to adopt the action plan developed by this research as an approach to improve their H&S practice and reduce the causes and effects of non-compliance on construction site.

5.7.2 Recommendations to Government

- Government is advised to instate a larger fine that will commensurate with non-adhering to H&S regulations. Furthermore, if a labourer is at fault and he is a repeat offender, then the construction company could take action in fining that individual for the non-compliance. It should be noted that if such a system is implemented, it would be important to monitor the system to ensure that the labourers are not taken advantage of and fined unnecessarily. Adopting this system will highlight the importance of each supervisor taking responsibility for his labourers and ensuring the attempt to minimize the number of incidents on construction sites.

- It is also felt that more emphasis should be placed on the responsibilities of the supervisor, in terms of legislature, with regards to the proper implementation of the H&S procedures. Non-compliance with the H&S plan attributed to the negligence or the non-enforcement on the part of the supervisor should lead to him being personally liable for a fine.

- Government should instate a system for monitoring the competence of DoL officers on a regular basis and to ensure that these individuals are carrying out their duties in an efficient and effective manner.

- Government should create a skills development programme, to ensure that workers are properly trained and competent before engaging in construction activities thereby reducing the related risk. This should be more for projects that are government funded.

5.7.3 Recommendations for further research

- A follow up research should be conducted to investigate if there are any improvements within the construction sector in terms of H&S compliance.

- The same study should be conducted with other construction industry professionals to evaluate their input into the maintenance of good working systems in Health and safety practices in South Africa.

- The possibility of a government driven initiative where all H&S education related matters of the workers, be it private or public, are addressed to ensure that workers reach acceptable levels of competency before being discharged for work purposes.

5.8 Closing Comments

This chapter is concluded by the presentation of an action plan as well as the recommendations for construction firms and government. The hypothesis was tested and the objectives revisited. The methodologies involved are briefly discussed, recommendations for further research is presented and is followed by the closing comments.

Although the issue of health and safety has been overtly publicised and emphasized, there still exist misdemeanours and fatalities that occur regularly on sites. These accidents on investigation of the reasons of how it had happened could have been avoided if the standard protocol was duly followed and practiced.

This study focused on the contractors' non-compliance and encapsulates an easily understandable action plan which contractors, whether they are of a small, medium or large scale enterprise, can adhere to. This dissertation exposes the reality of incidents that occur mainly in KZN but those that are also prevalent within South Africa. By no means is this the end of the occurrence of accidents; however it is a step towards prevention and reduction of these events. It is vital to note that Governments' intervention plays a key role in the adoption and implementation of said action plan.

When safety is incorporated as a strategic business value, it serves as a catalyst for achieving excellence in business performance. No company can excel if it does not make safety a way of life and a way of doing business. It is unfortunate that in these economic times, safety spending is the first element to go. Cutting down of safety robs people of their lives and their livelihood.

Safety of workers should be a moral obligation. By safeguarding the workers, contractors can increase the productivity: A happy worker is more productive. There should be an absolute compliance of the safety regulations by all parties involved.

References

- Abdul Hamid, A.R., Abd Majid, M.Z. and Singh, B. (2008) Causes of accidents at construction sites, Malaysian Journal of Civil Engineering, Vol. 20, No.2, pp242-259.
- Bryant, M. (1984) Success with Occupational Safety Programmes, International Labour Organisation Publications, Geneva.
- Business Directory, 2009. Definitions. [Online]. Available: <http://www.businessdictionary.com/definition/action-plan.html> (accessed 17 July 2009)
- Changing Minds. [Online]. Available: http://www.Changing_minds.org (accessed 19 Aug 2009)
- Conductor safety nets. [Online]. Available: http://www.safetynetting.com.au/page/debris_nets.html (accessed 19 Aug 2009)
- Davies, V.J. and Tomasin, K. (1990) Construction Safety Handbook, Thomas Telford, London.
- Geminiani, F. and Smallwood, J.J. (2008) A critical review of the effectiveness of the Department of Labour (DoL) Occupational Health and Safety (OH&S) Inspectorate in relation to the construction industry in South Africa, Research Articles.
- Ghule, S. (2008) Suggested practices for preventing construction worker falls, MSc Building Construction, Thesis, University of Florida.
- Holt, G. (1998) A guide to successful dissertation study for students of the built Environment, 2nd ed., University of Wolverhampton, United Kingdom.
- Holt, A.J., (2001) Principles of Construction Safety, Blackwell Publishing, Oxford.
- Hughes, P. and Ferrett, E. (2005) Introduction to Health and Safety at Work, 2nd ed., Elsevier, Oxford.
- IRCA (2003) Executive Legal Liability Orientation: Occupational Health and Safety Act 85 of 1993, Randburg.
- Kitumbo, H.I., and Kirenga, A.P. (2001) 'Construction industry in Tanzania', in African Newsletter on Occupational Health and Safety Construction and Mining, ed Lewis, P., Vol. 11, No.1, Finnish Institute of Occupational Health Topeliuksenkatu, Finland.
- Laney, J.C. (1982) Site Safety, Construction Press, Essex.
- Leedy, P.D. (2005) Practical research: Planning and design, 8th ed., Pearson Merille Prentice Hall, United States of America.
- Levitt, R.E. and Samelson, N.M. (1994) Construction Safety and Management, 2nd ed., John Wiley & Sons, New York.

References

- LexisNexis Group (2006) Occupational Health and Safety Act and Regulations 85 of 1993 (Full Version), 4th ed, Interpak Books, Pietermaritzburg.
- López-Valcárcel, A. (2001) 'Occupational safety and health in the construction work', in African Newsletter on Occupational Health and Safety Construction and Mining, ed Lewis, P., Vol. 11, No. 1, Finnish Institute of Occupational Health Topeliuksenkatu, Finland.
- Master Builders KwaZulu-Natal.(2009). [Online]. Available: <http://www.masterbuilders.co.za> (accessed 02 July 2009)
- Moodley, A. Personal Interview. April. 06, 2009.
- Occupational Safety and Health Series (1979) Building Work: A compendium of Occupational Safety and Health practice, International Labour Office, Geneva.
- Pugh, T. (2009) Federated Employers' Mutual Assurance Company Ltd (FEMA) Presentation.
- Research methods: Knowledge base. [Online]. Available: <http://www.socialresearchmethods.net/kb/reotypes.php> (accessed Aug 2009)
- Roberts-Phelps, G. (1999) Safety at Work, Gower, England.
- Sa, J. (2005) An investigation of fall protection systems in the roofing industry. MSc in Occupational and Environmental Safety and Health, Thesis, University of Wisconsin-Whitewater.
- Sa, J, Seo, D.C. and Choi, S.D. (2009) Comparison of risk factors for falls from height between commercial and residential roofers, Journal of Safety Research, Vol. 40, pp1-6.
- Saunders M, Lewis P. and Thornhill A. (2003) Research Methods for Business Students, 3rd ed., Pitman Publishing, England.
- Scaffolds. [Online]. Available: <http://www.osha.gov/.../scaffolds/summary.html> (accessed 19 Aug 2009)
- Smallwood, J.J. (1995) The influence of engineers on occupational health and safety. Journal of the South African Institute of Civil Engineering, 4th Quarter, pp15-18.
- Smallwood, J. J. (1997) 'The role of project managers in occupational health and safety', in Safety and Health on Construction Sites, eds Duff R.A., Jaselskis E.J. & Smith G., CIB Working Commission 99, Gainesville, pp186-195.

References

- Smallwood, J. J. (2002) The influence of health and safety (H&S) culture on H&S performance. In: Greenwood, D (Ed.), 18th Annual ARCOM Conference, 2-4 September 2002, University of Northumbria. Association of Researchers in Construction Management, Vol. 1, pp217-26.
- Smallwood, J.J. (2004) The influence of engineering designers on health and safety during construction. Journal of the South African Institution of Civil Engineering, Paper 544, pp2-8.
- Smallwood, J.J. (2005) 'The Construction Regulations-Are clients and designers complying?' Journal of the South African Institute of Civil Engineering.
- Smallwood, J.J. and Haupt, T. (2005) The need for construction health and safety (H&S) and the Construction Regulations: engineers' perceptions. Journal of the South African Institute of Civil Engineering, Vol. 47, No.2, pp2-8.
- Smallwood, J.J. and Haupt, T. (2006) Impact of the South African construction regulations as perceived by project managers. Research Articles, Vol 13, No.2, pp127-144.
- Smallwood, J.J., Haupt, T. and Shakantu, W. (2009) Construction Health & Safety in South Africa: Status & Recommendations, CIDB Report.
- (SANS) South African National Standards 1400. (2005) Environmental Management Systems: Requirements with Guidance for Use. 2nd ed., Standards South Africa, Pretoria.
- (SANS) South African National Standards 9001. (2008) Quality Management Systems: Requirements. 4th ed., Standards South Africa, Pretoria.
- The Standard Accident Procedure. (2006). Health, Safety and Environment Accident Procedure, Section 13.01, Rev 03.
- The Survey System. Sample Size Calculator. [Online].
Available: <http://www.surveysystem.com/sscalc.htm> (accessed 08 April 2009)
- Thevan, D., Maduna, M., Moodley, K., Paruk, M. and Othman, A.A.E. (2009) Investigating the Causes and Effects of Contractor's Non-compliance with the Health and Safety Regulations in South Africa. Paper read at the South African Quantity Surveying Profession Conference, Kwa-Zulu Natal, Durban, October 16.
- Ugwu, O.O. and Haupt, T.C. (2007) Key performance indicators and assessment methods for infrastructure sustainability—a South African construction industry perspective. Journal of Building and Environment, Vol. 42, pp665-680.

References

Validity. [Online]. Available: <http://www.nova.edu/ssss/QR/QR8-4/golafshani.pdf>
(accessed 19 Aug 2009)

Walliman, N. (2005) Your research project: A step-by-step guide for the first time researcher. 2nd ed., Sage Publications, United Kingdom.

Bibliography

Choudry, R.M., Fang, D. and Mohamed, S. (2007) The nature of safety culture: A survey of the state-of-the-art. Safety Science Journal, Vol. 45, pp993-1012.

Judy, P. (1998) The new Oxford dictionary of English. Oxford University Press, Great Clarendon, Oxford.

Likert Scale. (2009). Encyclopedia Britannica. [Online]. Available: <http://www.britannica.com/EBchecked/topic/1085454/Likert-Scale> (accessed 05 June 2009).

APPENDIX A
SURVEY QUESTIONNAIRE

Appendices

SECTION A: SITE SAFETY OFFICER

Safety Officer for:

Project name

- Main contractor
 Sub-contractor

1. What are your primary responsibilities on site? Tick the appropriate box

- Site inspection
 Development of management systems for integration of H&S regulations
 Ensuring compliance with the H&S Plan
 Introduction and updating of H&S considerations at all stages
 Constant monitoring of existing precautions
 Providing a communication link between the labour and management
 Provide a statement of witness for incidents that occur
 Providing non conformance reports for irregularities
 Effecting new procedures to improve current system

2. How regular are your site inspections?

- Once a week Everyday
 Once in two weeks Whenever the need arises

3. Are employees given a brief before working on suspended platforms and heights?

Yes No

4. What is the correct Personal Protective Equipment for working at heights?

5. How often is this equipment inspected for defects?

- Once a week Everyday
 Once in two weeks Whenever the need arises

Appendices

SECTION B: CONTRACTOR

Main contractor
Sub-contractor

Large enterprise
Medium enterprise
Small enterprise

1. Which in your opinion is the 3 most important for the success of your project?

- Meeting client's needs
- Public safety
- Keeping with deadline
- Staying within budget
- Complying with building regulations
- Safety of employees
- Being innovative (creating efficient methods of building)

2. Do you implement an H&S Plan in the execution of all your projects?

Yes No

If yes, what does this H&S Plan comprise of?

3. What risk assessments do you perform before you proceed with the works, if any?

4. Has all of your labour force received adequate training for their specific tasks undertaken?

Brickwork	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Plaster	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Working on scaffolds	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Erecting and stripping formwork	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>

Other, specify _____

Appendices

5. What is the frequency of toolbox talks?

Once a week

Everyday

Once in two weeks

Whenever the need arises

6. Is your labour force engaged and responsive to these talks?

Yes

No

If no, how could this issue be improved?

7. How often do you brief your employees on the dangers present on site?

Once a week

Everyday

Once in two weeks

Whenever a fatality/ injury occurs

At induction

8. Do the employees who work at elevated positions undergo the following?

Physical examination

Yes

No

Psychological fitness tests

Yes

No

Induction

Yes

No

9. Are they supplied with the correct fall protection equipment?

Yes

No

10. How often do you see your employees use their fall protection equipment in the correct way it was intended?

Once a week

Everyday

Once in two weeks

Whenever they see their senior

Whenever they see the safety officer

11. How many safety supervisors and safety officers do you have on your site?

12. Is there a safety supervisor on site at all times?

Yes

No

Appendices

13. In your opinion is it necessary to employ a safety officer in the different project categories listed below?

R 0 - R 500 000	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
R 500 000 - R1 Million	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
R 1 Million - R10 Million	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
R 10 Million and above	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>

14. Are there medical professionals in the event of an accident occurring?

Yes No

15. What are the 4 most common accidents that occur on site? (Rank on a scale of 1-5, with 1 being the highest occurrence)

- Falls from heights
- Cutting off of limbs
- Electric shocks
- Stepping or striking against objects
- Other Specify _____

16. What do you think are the main reasons for these occurrences stated above?

1. _____
2. _____
3. _____
4. _____

17. What is your incident reporting structure?

18. In the case of an accident which of the following are effected with regard to the injured person/s?

- Compensation fund
- Public liability
- Special insurances for damage to the works
- None

Appendices

19. For this project, was a provision for Health and safety allowed for in the Bill of Quantities at tender stage?

Yes No

20. Was this amount adequate cover for the number of accidents that have occurred?

Yes No

21. Which of the following has the most significant effect with respect to the cost of accidents occurring on site? (Please tick 6 most crucial)

- Insurances
- Publicity
- Repair of damages
- Litigation
- Replacement of injured party
- Compensation to affected parties
- Public liability
- Loss of productivity during accident
- Loss of productivity by injured party
- Professional fees for medical care
- Non conformance reports

APPENDIX B
STRUCTURED INTERVIEW

Structure of Interview Questions

1. Please state your role in the Health and Safety sector.
2. In your opinion, is the Health and safety Act, more especially the construction regulations sufficient in attaining a 'zero accident' working environment on construction sites?
3. Do you feel any changes need to be made to the Act or to any safety systems prescribed by it e.g. supervision requirements?
4. Furthermore, in your opinion, can there be any changes made to the Health and Safety plans to make them more effective?
5. Do you review previous Health and Safety plans to improve the systems employed by you each time you work on a different site or is there a standard practice you stick to?
6. What are your views in regard to the compliance of the construction regulations on your site?
7. Have you noticed obvious non-compliance on your site and if any please elaborate? What are the most common? And to who do you think this non-compliance is attributed to, i.e. labourers or employers?
8. How do you view your contribution to the Health and Safety plan as a safety officer?
9. Should you witness any irregularities on site, what measures do you take to counteract these issues?
10. What are the core issues you face as a health and safety officer in executing proper safety procedures at all times on your site?
11. How frequent are the accidents you have tended to on your site?
12. Which are the most common accidents that have occurred?

APPENDIX C
CONFERENCE PAPER

SACQSP2009 - 07

INVESTIGATING THE CAUSES AND EFFECTS OF CONTRACTOR'S NON-COMPLIANCE WITH THE HEALTH AND SAFETY REGULATIONS IN SOUTH AFRICA

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ABSTRACT

Purpose of this paper

This paper aims to investigate the causes and effects of non-compliance with the health and safety procedures by contractors in the South African Construction Industry.

Methodology

Literature review is used to investigate the Health and Safety Act (H&S), policies used to promote and ensure compliance within sites, hazard and prevention methods and management systems for safe construction. A survey questionnaire is used to define the causes and effects of non-compliance with H&S procedures and determine practices on site. Interviews are conducted with two H&S officers to assess the practicality of their plans and with three H&S representatives to investigate their view towards eliminating contractor's non-compliance with H&S procedures.

Findings

The study found that contractors were indeed non-compliant with the H&S regulations. It is found most apparent with the labourers as they failed to use personal protective equipment provided. A point to note, however, was that mainly small construction companies did not consider H&S procedures on their sites as it was deemed unnecessary due to the size and nature of projects undertaken. Furthermore, risk assessments were not performed by a considerable number of respondents as found in the questionnaire analysis.

Research implications

This research shows that compliance with the H&S regulations by South African contractors needs to be improved. It is evident that the high H&S accident statistics is owing to the negligence of those parties directly involved in the project.

Practical implications

The adoption of the action plan developed by this research will increase the compliance of contractor with the H&S procedures in construction sites, thus reducing sites incidents and their effects.

Value

This research adds valuable contribution to the original body of knowledge through the development of an action plan to enforce the compliance with H&S regulations by contractors and to overcome their limitations.

Keywords: Health and Safety Act, Contractors, Construction regulations, Non-compliance, incidents.

1. RESEARCH BACKGROUND AND RATIONALE

Construction is a very accident prone industry where the resulting injuries can have dire consequences. Common incidents that occur on site include falling from heights, cutting off of limbs due to mishandling of heavy equipment, objects falling from heights, electric shocks from cables, personnel being affected by demolition works, caving in of excavations, and those related to crane and heavy-lifting machinery (Hughes & Ferrett, 2005). On one hand, workers are considered to be the cause of site accidents due to their fatigue, lack of discipline, carelessness and distractions. On the other hand, some accidents are attributed to senior management because of its ignorance, lack of training and poor communication (Laney, 1982).

Smallwood (1997) stated that occupational diseases; fatalities and injuries do not only affect the person directly involved, but also affect the project risk which is manifested in increased cost of construction, damage to the environment, non-conformance to quality standards and scheduled overruns.

Each member of the client, design and construction teams influences and contributes to the occupational H&S on site. They are uniquely positioned to integrate H&S into all aspects of the design and construction process (Smallwood, 1997). However, contractors predominate in terms of the perceived extent to which stakeholders can contribute to H&S (Smallwood & Haupt, 2005).

Because of the importance to improve the performance of the H&S practice in the South African construction industry; this paper aims to investigate the causes and effects of non-compliance with the H&S regulations by contractors in South Africa. It adds a valuable contribution to the original body of knowledge through developing an action plan that will help enable contractors to comply with H&S regulations in the South African construction industry.

2. CONTRIBUTION TO THE ORIGINAL BODY OF KNOWLEDGE

This research provides a valuable contribution to the original body of knowledge by studying the obstacles South African contractors are faced with in eliminating the high record of site accidents.

The research later on proposes an action plan to help reduce the high statistics associated with negative H&S performance in this country.

Costs of accidents are often overlooked by industry stakeholders and this study aims to emphasize the significant impact accidents have, not only on the project itself as direct costs but also to the economy at large through excessive claims for the Workmen's Compensation Fund. This will create awareness to industry professionals who will thereafter improve on the H&S culture and the policies and practices adopted by them.

3. RESEARCH ORIGINALITY

- This research enables contractors to pinpoint the flaws within site management and identify the shortcomings of their relevant health and safety plans.
- The research led to the development of An action plan to counteract the ineffectiveness of existing health and safety plans.
- Previous research has not focused on the areas of concern described in this report, i.e. contractor based.
- Clauses contained in the construction regulations discussed in this research have not been highlighted in construction literature previously.

4. RESEARCH METHODOLOGY AND SAMPLING

In order to achieve the abovementioned aim a research methodology is developed to accomplish four objectives.

Appendices

- (1) Investigating the H&S Act, policies used to promote and ensure compliance within sites, hazard and prevention methods and management systems for safe construction. This objective is achieved through literature review.
- (2) Defining the causes and effects of non-compliance with H&S procedures and determining practices on construction site. Survey questionnaires are used to accomplish this objective.
- (3) Assessing the practicality of the H&S plans and investigating their view towards eliminating contractor's non-compliance with H&S procedures. Interviews conducted with relevant professionals are used to accomplish this objective.
- (4) Developing an action plan for enhancing the effectiveness of contractors' H&S plans in South Africa.

Due to the nature of this research and the fact that it deals with contractors, H&S officers on construction sites, purposive sampling was employed to select the questionnaire and interview samples. The survey questionnaire sample was selected from the list of contractors who are registered as members of the Master Builders Association (MBA, 2009) at the KwaZulu-Natal. The list identified 120 contractors. The researchers made use of the sample calculator (The Survey System, 2009) to determine the size of the sample to be used. Contact details of these companies have been collected and the survey questionnaire was sent to them. Structured interviews were conducted with two H&S officers and three representatives for the H&S legislation.

5. LITERATURE REVIEW

5.1 General overview of the H&S Act 85 of 1993

The Occupational H&S Act 85 of 1993 summarises the Act as “to provide for the H&S of persons at work and for the H&S of persons in connection with the use of plant and machinery; the protection of persons other than persons at work against hazards to H&S arising out of or in connection with the activities of persons at work; to establish an advisory council for occupational H&S; and to provide for matters connected therewith.” (Occupational H&S Act and Regulations, 2006).

This document encapsulates all the H&S regulations for good practice in the workplace as (Davies & Tomasin, 1990) reckon that an ideal project constitutes a hundred percent performance on time, cost and quality with zero injuries or disease to employees

The H&S outlines the standards which companies and factories are required to maintain and be monitored against. This act provides the companies and stakeholders with fundamental principles which must be achieved on sites by contractors and thus H&S Plan becomes key to the protection of workers against hazards and potential risk of accidents and injuries even though the law has been the subject of debate (Smallwood et al., 2009).

5.2 Clauses pertinent to the study

The focus clauses of the study are:

- *Supervision*: Clause 6(6)
- *Risk assessment*: Clause (7.1) and;
- *Fall protection plan*: Clause 8

5.3 The roles of contractor, sub-contractor and health and safety officer

Construction Regulations put into place by the Minister of Labour governs the actions and responsibilities of all those working on construction sites in South Africa. Contractors and safety officers are needed to address issues of H&S according to this schedule in the execution of their duties and management is legally required to enforce H&S regulations to ensure safety for their workers (Geminiani and Smallwood, 2008).

5.3.1 Main contractors are responsible for the following in the execution of their duties (Occupational H&S Act and Regulations, 2006).

- Provide all contractors appointed with relevant sections of the H&S specifications and appropriate resources when changes are made to design or construction.
- Ensure that each contract implements and maintains the H&S plan and that periodic audits are done at least once a month.
- Stop any work by contractor which is not in accordance with the H&S plan.
- Ensure that every contractor is registered with a compensation fund or a licensed insurer.
- Ensure that provision has been made by all contractors in their tenders for the cost of H&S.

Appendices

- Discuss and negotiate contents of the H&S plan with the contractor and have a copy readily available.
- Ensure that an H&S file is opened and kept on site and is readily available and shall hand over a consolidated H&S file to client upon completion of the work.
- Ensure that the contractor to be appointed has the necessary competencies and resources.

Even though the duties and responsibilities of safety officers are not specified in the H&S Act Levitt & Samelson (1994) describes them as being encouraging management to adopt effective ways to keep the workforce safe and healthy in the execution of work on sites. Therefore safety officers merely advise, guide, monitor and support the decisions made by top management with regard to site safety

5.3.2 Activities executed by safety professionals toward achieving the abovementioned goal include (Levitt & Samelson, 1994):

- Introduction of H&S considerations into planning at all stages of the project construction cycle.
- Working with all levels from top management to labourers to ensure that everyone is in promotion of H&S plan.
- Development of orientation and training programs and encouraging people at all levels to participate in appropriate training courses.
- Advising on record-keeping systems for use by management to monitor site supervisors for H&S matters as arise.
- Monitor themselves or help those responsible monitor the insurance claims and reserves.
- Assist in monitoring of H&S performance through job inspections, work procedure analysis, near-miss, accident and injury record analyses, safe behaviour observation and other methods adopted on that specific site.

5.4 Falls and fall protection

The construction industry generates a disproportionate number of fatalities, injuries and disease relative to any other industry in South Africa. These occur as a result of accidents due to the ever present hazards on construction sites (Smallwood, 2004). This is because construction work involves numerous occupational risks, such as working at heights, on excavations, work lifting of materials and so on, which are specific to this type of industry (López-Valcárcel, 2001). Davies and Tomasin (1990) identifies the following as leading accidents on sites; falls, stepping or striking against objects, lifting and carrying, machinery, electricity, transport and fires and explosions.

5.4.1 Types of fall accidents

Many authors agree that falls is by far the main cause of incidents which includes people falling from heights; people falling on the same level and plant and material falling and striking them; as well as people falling into open trenches and shafts (Occupational Safety and Health Series, 1979; Davies & Tomasin, 1990; Holt, 2001; Sa, 2005; Ghule, 2008). Ghule (2008) indicated that the majority of the falls in the construction industry occur from roofs, with ladders ranking 2nd and scaffolds 3rd.

5.4.2 Fall-related deaths and injuries

According to the ILO, as stated in Construction H&S in South Africa-Status and Recommendations (2009), 'one in every six work-related fatal accidents occurs on a construction site'. Davies & Tomasin (1990) comment that each year 70-80% of all fatalities and 35-40% of all injuries on construction sites are attributable to falls. Federated Employers' Mutual Assurance Company Limited (FEMA) (as cited in Construction H&S in South Africa-Status and Recommendations, 2009), stated that the 2nd highest number off claims were for injuries caused by fall onto different levels. Furthermore, the FEMA recognised falls on to different levels as the third highest cause of fatalities in the construction industry which clearly indicates the significant contribution falls to these appalling statistics in the South African industry.

5.4.3 Causes of fall incidents

Labourers are prompted to make the right decision to the use of their personal protective equipment (PPE) at all times but this is not heeded. They view PPE as uncomfortable and unnecessary due to the expected short exposure time. Furthermore, they hold that it decreases their productivity as the equipment is sometimes restrictive which proves detrimental if they slip, trip and fall from heights (Holt, 2001; Sa, 2005).

Appendices

In a study of the causes of accidents on construction sites by Abdul Hamid, et al. (2008), it was found that the following were the dominating cause of accidents:

- Workers' negligence and failure to obey work procedures as well as incorrect work procedures.
- Nature of work being performed (work at heights) and equipment without safety devices.
- Poor site management and lack of workers' knowledge and skills.
- Negative attitude of workers coupled with failure to use their PPE.

5.4.4 Fall protection

Propositions in the ILO Occupational H&S Series (1979) suggest safety harnesses, catch nets, scaffolding and opening and edges techniques amongst others, which if followed correctly serve as prevention mechanisms to injuries.

5.5 Methods used to promote and ensure compliance

Although it cannot be quantified, it can be inferred that the Construction regulations have had a positive impact on reducing H&S accidents (Smallwood et al., 2009). Contractors and safety officers should adopt and implement the provisions stated in the regulations to effectively eradicate the occurrences of fatalities and injuries on their sites. The following methods are some of the ways in which contractors and safety officers can use to further enhance their control procedures (IRCA, 2003):

- Risk Assessments for activity – Site specific.
- Method statement.
- Safe working Procedure.
- H&S inductions before proceeding to site and toolbox talks
- Encourage participation of safety strategies.

5.6 Management systems for safe construction

5.6.1 Risk Management

Quality management is a vital component of risk management and all four components become an important business management tool. This is commonly known as SHEQ/QESH management (IRCA, 2003). At most large enterprises the following Management systems are in place: ISO 9001 [Quality Management Systems], ISO 1400 [Environmental Management Systems] and Regulations. Together these form a formidable trio that is used to prevent incidents from happening.

5.7 H&S Training

H&S training is a very important aspect of the H&S programme and it is also a legal requirement according to Act 85 of the 1993 H&S regulations for employers to provide such training. Training is required for employees at various levels during different stages of their careers or the project life cycle depending on the nature of the job that they will be undertaking. Training is required on recruitment, at induction or on being exposed to new or increased risks on site. Additional training may be required following a single or series of near misses, the introduction of new legislation, the issuing of an enforcement notice or as a result of a risk assessment or safety audit (Hughes & Ferrett, 2005).

There are several different types of training, these include induction training, job specific training, supervisory and management training and specialist training. Risk assessment, fall protection plan training and supervision training are all legal requirements and fall within the scope of the aforementioned types of training.

From the above, it is apparent that training is a vital aspect of any H&S programme. It is important to note that such programmes need to be constantly reviewed, updated and the methods to deliver training monitored in order to ensure that they are effective.

Appendices

6. CAUSES OF NON-COMPLIANCE WITH THE H&S REGULATIONS BY CONTRACTORS

Literature review identified the causes of non-compliance with H&S regulations by contractor as follows, see table 6.1.

Table 6.1 Causes of non-compliance with the H&S regulations by contractors

No.	Cause	Reference
1	Loss of concentration of worker	Holt (2001)
2	Refusal to wear PPE by worker	
3	Workers' belief that PPE is unnecessary	
4	Incorrect use of PPE	
5	Old equipment & PPE	Sa (2005)
6	Failure to obey work procedures	Abdul Hamid et al. (2008)
7	Nature of the work(work at high elevation)	
8	Equipment without safety devices	
9	Poor site management	
10	Harsh work environment	
11	Low level of workers knowledge and skills	
12	Attitude of labour	
13	Excessive noise	
14	Poor illumination	
15	Lack of proper training	
16	Deficient enforcement of safety	Sa et al. (2009)
17	Unsafe methods or sequencing of activities	
18	Lack of use of standardised safety devices	Kitumbo and Kirenga (2001)
19	Work situation	
19.1	Human error	
19.2	Technical failure	
19.3	Inadequate information	
19.4	Personal deviation from safe practices	
19.5	Disturbance in material flow	
20	Environment	
20.1	Intercepting of parallel activities	
20.2	Bad housekeeping	
20.3	Disturbance from the environment	
21	Safety system includes:	
21.1	Failure of active/passive safety system	
21.2	Inadequate guarding	
21.3	Insufficient PPE	

Figure 6.1 shows the results of the survey questionnaires completed by contractors and H&S officers with regard to the causes of non-compliance with the H&S construction regulations in KwaZulu-Natal:

Appendices

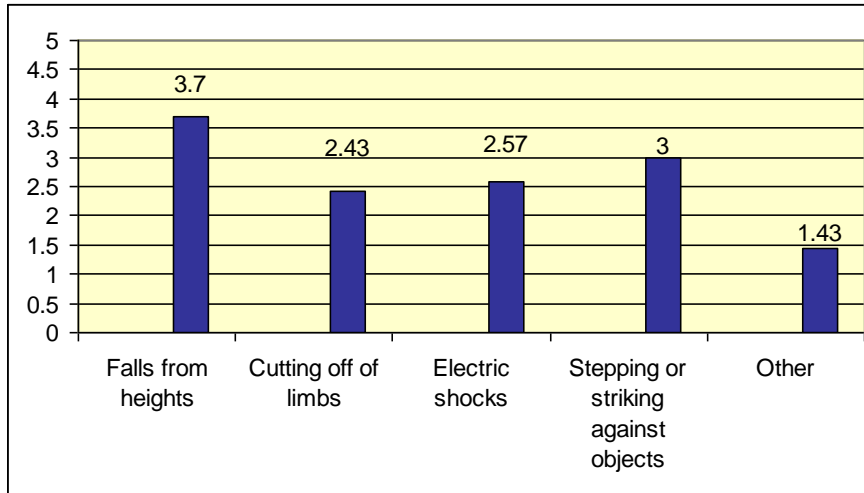


Figure 6.1 Responses of the causes of non-compliance with the H&S regulations

Analysis of the interview carried out with H&S officer revealed that he disagreed with these findings. The interviewee stated that the problem lies with top management. It is due to their double standards that management disregards safety aspects. Deadlines and productivity take priority over implementation of proper safety procedures at all times and supervisors fail to train their employees and make sure they fully understand the risks present on site.

7. EFFECTS OF NON-COMPLIANCE WITH THE H&S REGULATIONS BY CONTRACTORS

Literature review revealed the following as the effects of non-compliance with H&S regulations by contractor, see table 7.1.

Table 7.1 effects of non-compliance with the H&S regulations by contractors

No.	Effects	Reference	
1	Direct Costs		
	1.1	physical injury/fatality to persons	Abdul Hamid et al. (2008)
	1.2	damage to property	
	1.3	Workmen's' compensation	Smallwood (2002, Levitt & Samelson, 1993)
	1.4	Liability insurance premiums	
	1.5	The lowered moral of supervisors & workers	
	1.6	Attractiveness to client as a result of perceived holistic quality	
	1.7	Socio-economic loss to families of the deceased/injured.	
	1.8	Money paid annually to victims of work related accidents	Geminiani and Smallwood (2008)
1.9	Public liability insurances		
2	Indirect Costs borne by contractors	Smallwood and Haupt (2006 cited Hinze, 1997)	
	2.1		reduced productivity by the returned worker/(s) & the workforce
	2.2		Clean up costs
	2.3		Replacement costs lost worker
	2.4		Costs of Delays
	2.5		Costs of supervision
	2.6		Time lost
	2.7		Costs related to rescheduling
	2.8		Costs of transportation for injured party
	2.9		Wages paid for unproductive injured party

Appendices

2.10	Damage to and loss of materials, plant and equipment	Smallwood, J.J.(1995)
2.11	Damage to the environment	
2.12	Human suffering by the injured and his/her family	
2.13	Uninsured cost which are invariably included in the contractors' cost structure	

Smallwood and Haupt (2006) citing Davies and Tomasin (1996) agreed that accidents can marginalize the project team's efforts at achieve the project deliverables on time and within budget due to the direct and indirect costs associated with accidents. It can also lead to substantial bad publicity, which may tarnish the name of the client and strain relations among project stakeholders. Figure 7.1 shows the results of the survey questionnaires completed by contractors and H&S officers with regard to the effects of non-compliance to the H&S construction regulations in KwaZulu-Natal:

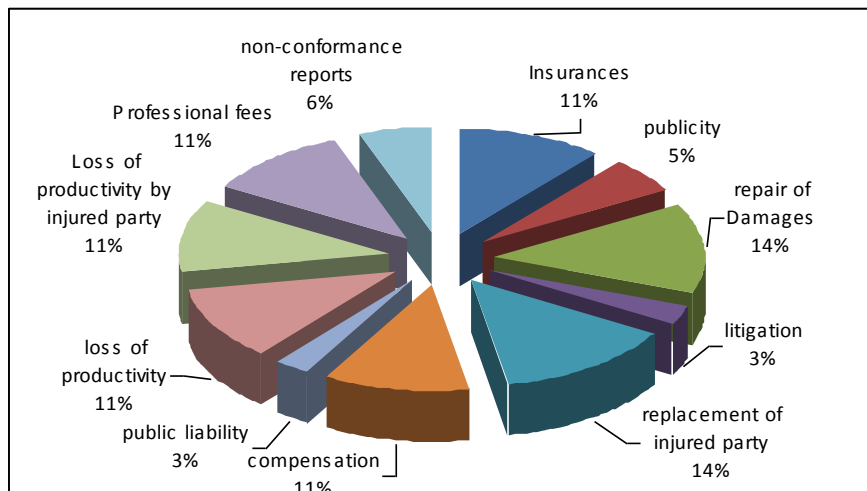


Figure 7.1 Responses of the effects of non-compliance with the H&S regulations

On interview basis with the relevant professionals, it is found that some irrecoverable costs exist. These may not be a proven cost or be quantifiable; however time may reveal that these unaccounted costs could prove significant. On analysis of the interview, it has been noted that the Department of labour (DoL) are at times complacent with regard to the carrying out of thorough site inspections.

8. ACTION PLAN FOR COMPLYING TO H&S REGULATIONS (APCHSR)

8.1 Definition

The action plan for complying to H&S regulations (hereinafter referred to as "the action plan" or the "APCHSR") developed by the authors is an innovative tool to escalate the contractors' awareness and increase their compliance with the H&S regulations in the South African construction industry.

8.2 Need of the action plan

The need for the action plan stems from the necessity to set the rules and establish the grounds that enable contractors to comply with the H&S regulations in the South African construction industry. The action plan is an essential tool for reducing current accident and fatality statistics on construction sites. In addition, it will increase the awareness of the overall impact of accidents and incidents on the project and the economy at large. Furthermore, it will help ensuring the adoption and application by top management and employees towards improving the H&S status in construction sites.

8.3 Description of the action plan

The action plan consists of 5 ongoing processes, namely, problem definition, objectives establishment, action development, action implementation and evaluation and feedback, see figure 8.1.

8.3.1 Problem Definition

This activity aims to define the problems that hinder construction companies from adhering to H&S regulations. A team to identify these problems has to be formed. Brainstorming technique could be used for achieving the aim of this activity. Top management support is essential for approving the timeframe and resources required for completing this activity.

8.3.2 Objectives Establishment

Within this activity, the objectives for improving the H&S practice in South Africa through assisting contractors to overcome the identified problems have to be established. Input from study team is of prime importance. Top management support and consent will facilitate the adoption and implementation of the study results.

8.3.3 Action Development

After the problems are identified and the objectives are established, it is essential that study team develop the action plan required. Inputs from different study team members will help develop creative ideas that will achieve the established objectives. Brainstorming sessions and evaluation techniques such as (Simple Multi Attribute Rating Techniques) have to be used to achieve proper decision.

8.3.4 Action Implementation

When the team develops an action plan, plans for implementation have to be developed. This may include training employees; explain the strategies required to improve performance.

8.3.5 Evaluation and Feedback

It is imperative to evaluate the performance of action taken in order to take any corrective action required. Feeding back the study team and top management with the learned lesson will help improve the action plane in future studies for adhering to H&S regulations.

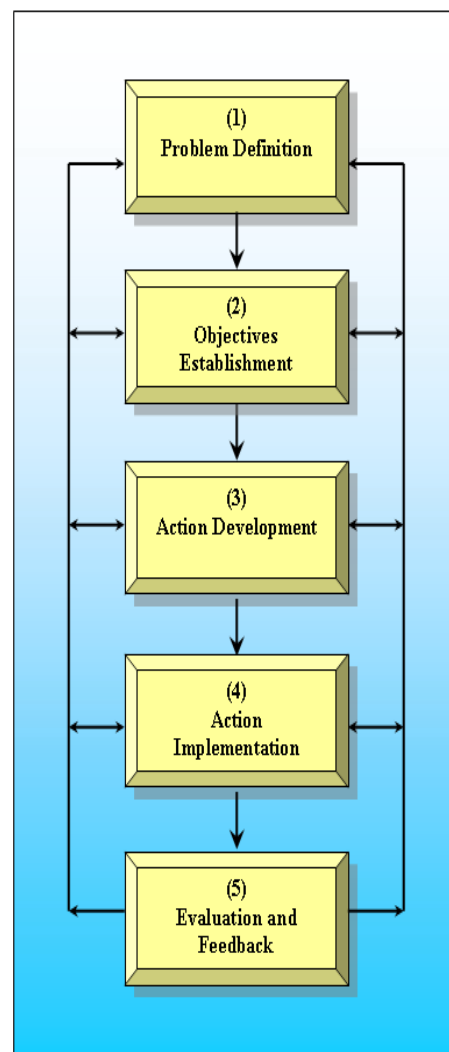


Figure 8.1 Action Plan

8.4 Benefits and Limitations of the action plan

Adoption and implementation of the developed action plan will help improving worker safety attitude and elimination of double standards of management. In addition, it will help in reducing overall site incidents and accidents. Furthermore the action plan will reduce the direct and indirect costs of incidents and accidents. On the other hand, the action plan will be ineffective if top management and employees are not willing to cooperate and adopt the developed tool.

9. CONCLUSIONS AND RECOMMENDATIONS

Health and Safety is one of the greatest challenges that face the South African Construction industry. Although a number of acts and regulations are in place, the number of site incidents increases over the years. Through literature review, survey questionnaire and interviews, the research identified the different causes and effects of non-compliance to the H&S regulation in construction sites. The research recommendations are directed to labour, management and Government.

Appendices

- * Construction companies are responsible for educating their labour force and increasing their awareness of the causes and effects of site incidents on themselves, families, the project and the community at large.
- * Construction companies should take a more proactive approach towards implementing the H&S plans on site through integrating H&S procedures into overall project management plans.
- * Construction companies should appoint safety officers to continuously find and evaluate the shortcomings of their safety plans and re-instate new working solutions.
- * H&S plans should be thoroughly assessed at tender stage by all stakeholders as this could minimise accidents on site thereby reducing the costs significantly.
- * Contractors must ensure that their labour force is properly trained for their specific tasks. This will empower them to teach their peers. Furthermore contractors should continuously brief their labour force to maintain proper safety procedures on sight and this can be achieved through repetitive teaching.
- * Government should instate a system for checking the competence of DoL officers on a regular basis.

REFERENCES

Abdul Hamid, A.R., Abd Majid, M.Z., Singh, B. (2008) Causes of accidents at construction sites, *Malaysian Journal of Civil Engineering*, Vol 20, No.2, pp242-259.

Business Directory, 2009. Definitions: <http://www.businessdictionary.com/definition/action-plan.html>
Davies, V.J. and Tomasin, K. (1990), *Construction Safety Handbook*, Thomas Telford, London.

Geminiani, F. and Smallwood, J.J. (2008) A critical review of the effectiveness of the Department of Labour (DoL) Occupational Health and Safety (OH&S) Inspectorate in relation to the construction industry in South Africa. *Research Articles*, Vol 15. No.2. pp5-28.

Ghule, S. (2008) *Suggested practices for preventing construction worker falls*. MSc in Building Construction, Thesis, University of Florida.

Holt, A.J., (2001) *Principles of Construction Safety*. Blackwell Publishing, Oxford.

Hughes, P. and Ferrett, E. (2005) *Introduction to Health and Safety at Work*, 2nd ed, Elsevier, Oxford.
IRCA (2003) *Executive Legal Liability Orientation: Occupational Health and Safety Act 85 of 1993*, Randburg.

Kitumbo, H.I. and Kirenga, A.P. (2001) 'Construction industry in Tanzania', in: *African Newsletter on Occupational Health and Safety Construction and Mining*, ed Lewis, P., Vol 11, No.1, Finnish Institute of Occupational Health Topeliuksenkatu, Finland.

Laney, J.C. (1982) *Site Safety*, Construction Press, Essex.

Levitt, R.E. and Samelson, N.M. (1994) *Construction Safety and Management*. 2nd ed, John Wiley & Sons, New York.

López-Valcárcel, A. (2001) 'Occupational safety and health in the construction work', in *African Newsletter on Occupational Health and Safety Construction and Mining*, eds Lewis, P., Vol 11, No. 1, Finnish Institute of Occupational Health Topeliuksenkatu, Finland. pp 4-6.

Master Builders KwaZulu-Natal.(2009).[Online] Available: <http://www.masterbuilders.co.za> (accessed July 2009).

Occupational Health and Safety Act and Regulations 85 of 1993 (Full Version), (2006) 4th ed. LexisNexis Butterworths, Pietermaritzburg.

Occupational Safety and Health Series (1979) *Building Work: A compendium of Occupational Safety and Health practice*, International Labour Office, Geneva.

Sa, J. (2005) *An investigation of fall protection systems in the roofing industry*. MSc in Occupational and Environmental Safety and Health, Thesis, University of Wisconsin Whitewater.

Sa, J, Seo, D.C. and Choi, S.D. (2009) Comparison of risk factors for falls from height between commercial and residential roofers, *Journal of Safety Research*, Vol 40, pp 1-6.

Appendices

- Smallwood, J.J. (1995) The influence of engineers on occupational health and safety. *Journal of the South African Institute of Civil Engineering*. 4th Quarter. pp15-18.
- Smallwood, J. J. (1997) 'The role of project managers in occupational health and safety', in *Safety and Health on Construction Sites*, eds Duff R.A., Jaselskis E.J. & Smith G., CIB Working Commission 99, Gainesville, pp. 186-195.
- Smallwood, J. J. (2002) The influence of health and safety (H&S) culture on H&S performance. In: *18th Annual ARCOM Conference*, ed Greenwood, D., Association of Researchers in Construction Management, Vol. 1, pp217-226.
- Smallwood, J.J. (2004) The influence of engineering designers on health and safety during construction. *Journal of the South African Institution of Civil Engineering*, Paper 544, Pp 2-8.
- Smallwood, J.J. (2005) The Construction Regulations-Are clients and designers complying? *Journal of the South African Institute of Civil Engineering*.
- Smallwood, J.J. and Haupt, T. (2005) The need for construction health and safety (H&S) and the Construction Regulations: engineers' perceptions. *Journal of the South African Institute of Civil Engineering*, Vol. 47. No. 2, pp2-8.
- Smallwood, J.J. and Haupt, T. (2006) Impact of the South African construction regulations as perceived by project managers. *Research Articles*, Vol 13. No.2. pp127-144.
- Smallwood, J.J., Haupt, T. and Shakantu, W. (2009) Construction Health & Safety in South Africa: Status & Recommendations (2009), *CIDB Report*. The Survey System. Sample Size Calculator [Online]. Available: <http://www.surveysystem.com> (accessed April 2009).