UNIVERSITY OF KWAZULU NATAL

A Study of Construction Plant and Equipment Health and Safety (H&S) in the Kwazulu-Natal Construction Industry

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COLLEGE OF AGRICULTURE, ENGINEERING AND SCIENCE

DECLARATION - PLAGIARISM

As the candidate's Supervisor I agree to the submission of this thesis.

Signed: .... Date: 25/03/2014

Prof. C. Haupt

I, Naomi Kingu, declare that

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DETAILS OF CONTRIBUTION TO PUBLICATIONS that form part and/or include research presented in this thesis (include publications in preparation, submitted, *in press* and published and give details of the contributions of each author to the experimental work and writing of each publication)

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ABSTRACT

With the increasing rate of infrastructural development in South Africa the accident and fatality rate continues to increase. It then becomes paramount to ensure adherence to H&S regulations so as to mitigate and prevent accidents and fatalities from occurring. The study of Health and Safety associated with plant and equipment is important because the majority of accidents are plant and equipment related.

The study analysed key risks involved in the use of plant and equipment, the nature and severity of accidents and hazards and health risks related to the KwaZulu-Natal road construction industry. Previous studies have focused on the use of an excavator and have not researched particularity the KwaZulu- Natal province road construction industry.

This research consisted of an observation study on twelve road construction sites within KwaZulu-Natal. During visits to these, Health and Safety (H&S) aspects related to plant and equipment, site documentation such as plant maintenance log books, plant certifications as well as safe work procedures were examined. Structured interviews were conducted with construction road contractors, professional engineers and qualified persons in charge of H&S aspects in the twelve sites under the study. The research aimed to investigate how the construction road contractors perceive Health and Safety (H&S) risks associated with plant and equipment and how construction worker health can be improved in road construction.

The study revealed that H&S procedures with regard to the operation of construction plant and equipment were in most cases not adhered to in road construction in KwaZulu- Natal. Furthermore, it was observed that plant operators were not sufficiently trained in H&S before handling plant and equipment. H&S training is paramount including the implementation of H&S procedures. This would improve project performance and the overall South African construction industry.

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DEFINITION OF TERMS

Accidents – an unplanned event which could occur, resulting to persons being injured or ill. Accidents can also cause damages or losses to plant, equipment, property, materials or to the environment (Baxendale and Jones, 2000). Causes of accidents include falls from height, falling materials or objects and moving plant.

Construction Equipment – These include static apparatus such as cranes, hand power tools and concrete mixers. Construction equipment are used to carry out mechanised construction work and are usually on a smaller scale compared to construction plant. (Edwards and Holt, 2009)

Construction Plant – Edwards and Holt, (2009) define construction plant as self-propelled machines used to carry out construction work. These include excavators and their configurations, compaction rollers as well as mobile cranes.

Hazards – The potential to cause harm or something that causes harm. Examples include, chemicals, electricity working at heights as well as working with machinery (Deacon, Smallwood and Haupt, 2004; Creativebias, 2008). Particular hazards can be identified and are associated with particular types of construction work (South Africa, 2003; Jannadi and Almishari, 2003).

Health – According the World Health Organisation (WHO), the definition of health includes the wellbeing of a person and freedom from disease. Some authorities generalise health as the ability of a human being to adapt and self-manage. This adaptation and self-management is in the context of social, physical and emotional challenges. (Huber, et al. 2011)

Risk – Is the likelihood that harm will occur (Deacon, Smallwood and Haupt, 2004). Risks are usually represented by a rating, of the probability of harm by a hazard. Risks can be represented using a Probability/Impact matrix. Risks could be assessed as high, medium or low. Dangerous substances tend to carry higher risk scores and ranges. (Deacon, Smallwood and Haupt, 2004; Venture Navigator, 2008)

Risk Assessment – The construction regulations define risk assessment as "*a programme to determine any risk associated with any hazard at a construction site, in order to identify the steps needed to be taken to remove, reduce or control such hazard*." (South Africa, 2003:2) While the PMBOK (2004) defines risk assessment as a guide to making sensible decisions so that people and assets are protected in practice.

Probability– Probability is defined as the potential impact or chances of something (usually a risk) in occurring. Construction projects carry predicable as well as unpredictable risks. Therefore knowing the likelihood or probability of a risk assists construction professionals in preventing or mitigating that risk (Smith, et al., 2009; Akintoye and MacLeod, 1997; Ang, 2004).

Safety – Safety is the freedom from being exposed to unacceptable risk of physical injury or damage to the health of others (Safety and functional safety, n.d.). According to Jannadi and Almishari (2003), safety is the ability to adapt attitudes and the provision of the appropriate resources in preventing and mitigating risks.

Severity –The measurement of the consequences of a risk is known as the severity (Deacon, Smallwood and Haupt, 2004). According to Jannadi and Almishari, 2003 the severity is the likelihood of an accident due to exposure to hazards. Numerical ratings are usually used to measure the severity of an accident.

CHAPTER 1 – INTRODUCTION

1.1 Study Background

Health & Safety (H&S) risks are one of the most important aspects that contractors need to consider when undertaking a construction project (Agumba and Haupt, 2012; CIDB, 2004; CIDB, 2008; Edwards and Holt, 2009; Smallwood and Haupt, 2005). This research aims to investigate how the construction contractor perceives H&S risks associated with the use of plant and machinery, and how H&S can be improved, specifically with regard to road construction in Kwazulu-Natal. According to Geminiani and Smallwood (2013) construction work is varied and usually done under uncertain and extreme conditions. These conditions include unpredictable climatic conditions. Further, these conditions are usually not favourable in terms of safety to persons as well as for machines (Davis and Tamasin cited by Geminiani and Smallwood, 2013). In factories, work is executed in a controlled environment, as opposed to construction activities which occur outside in constantly changing circumstances that are not easily controlled. Hazards and risks change on a daily basis on construction site, making H&S critical in site management.

Despite the implementation of H&S regulations and contractual standard conditions, the construction industry continues to rank as one of the most hazardous working environments (Agumba and Haupt, 2012; Edwards and Nicholas, 2002; CIDB, 2008). H&S statistics provided by the South African Department of Labour indicate that between the periods of 2004/05 to 2007/08, there had been an increase in accidents by approximately 160 fatalities and 400 non-fatal accidents (CIDB, 2008). According to Agumba and Haupt (2012) occupational accidents and diseases account for approximately 3.5% of the gross domestic product (GDP) in South Africa.

The poor H&S performance of the South African construction industry has raised awareness in a range of stakeholders that includes clients and designers. For example, the national government became involved given the increased rate of construction -related accidents and fatalities (Smallwood and Haupt, 2005). Since construction plant and equipment are major potential contributors of H&S risks and hazards in South African construction (Windapo and Oladapo, 2012; CIDB, 2008), it becomes paramount to prevent or mitigate exposure to plant and equipment associated H&S risks.

When contractors undertake construction projects, exposures to H&S risks are not only inevitable though they can be mitigated or prevented (HSE, 2002 cited by Haupt et al, 2010; Anon., 2006). Contractors entering into a contract automatically accept the risks associated with that contract, making H&S risks one of the important risks which contractors acquire when undertaking a construction project.

While all project stakeholders, namely clients, project managers, engineers, quantity surveyors and architects, should be involved in mitigating H&S it is generally the contractor that is expected to contribute most to project H&S (Smallwood and Haupt, 2005; Smallwood 2000). This is because H&S risks affect the success of the construction project with respect to project parameters; such as cost, quality, time and client satisfaction (Cooper and Phillips, 1997; Akintoye and Macleod, 1997). Furthermore, the absence or inadequacy of H&S risk management structures influences project parameters, productivity and time among other project parameters. (Smallwood and Haupt, 2005; CIDB, 2004)

The study will specifically examine risks associated with the use of plant and equipment with the aim of mitigating them in road construction in the province of KwaZulu-Natal. This focus is of particular relevance given that there has been limited research conducted in this particular area. Previous research has focused primarily on the H&S risks associated with the use of excavators, and not on road construction (Edwards and Holt, 2010; Edwards and Holt 2008). Therefore this research will go a step further by examining the H&S risks involved in the operation of construction plant and equipment in road construction such as the, cold recycler, tractor loader backhoe (TLB), skid-steer loader, front-end loader, vibratory compactor, cold milling machine and rock drilling rigs.

1.2 Infrastructural Development in Kwazulu-Natal

According the World Health Organisation report, the South African road fatality rate is 33.2 per 100,000 of the population, which is higher than the average 19.5 for all middle income countries (Provost, 2011). The South African government has therefore prioritised safety associated with roads by increasing its investments to road fatality reduction (Du Plessis, Jansen and Siebrits, 2013).

The South African Cities Network (SACN) plan includes ensuring the city is productive, well governed, inclusive and sustainable. Since transportation plays a major part in economic development. The nation’s economic and social development depends on the efficient transportation system.

According to the master plan of KwaZulu- Natal (2012), there is a 25 year old Integrated Transport Master Plan (ITMP25) under implementation, which foresees an increase in the number of containers moving to Gauteng from the current 1.75 million a year to 10 million a year, due to the planned expansion of the Durban port system. Infrastructural development in terms of road and railway construction is therefore important to ensure adequate cargo transportation.

The eThekwini Public Transport Plan (PTP) (2005) forms part of the Integrated Public Transport Plan (ITP). These are programmes initiated by the government for the improvement of the KwaZulu-Natal public transport system. The public transport system has a major influence on development and is concurrently affected by development and land use. With this in mind, the provincial vision for KwaZulu-Natal is as follows:

"*To improve the quality of life of public transport users and to enhance the viability of all sectors reliant on public transport within KwaZulu-Natal, through the development of a safe, efficient, effective, economically and environmentally sustainable public transport system which drives the economic and social upliftment of the Province''* (Public Transport Plan (PTP), 2005: p 2.2)

The KwaZulu-Natal Department of Transport has identified one of the key issues and concerns that emerge from this statement as the need for a healthy and safe environment. A significant aspect of a sustainable public transport is that the infrastructure should be maintained with a minimal impact on the environment. This links up with the H&S aspects of the overall transport system during infrastructural development, and maintenance. Road maintenance then becomes part of the plan for insuring maintenance work is also carried out in a healthy and safe way. (Public Transport Plan (PTP), 2005)

1.3 Research Problem

1.3.1 The Statement of the Problem

The research problem may be stated as follows:

The increased demand for and government expenditure on road and related infrastructure might potentially result in numerous accidents and injuries on project sites considering that these projects are executed in an environment characterized by unresearched levels of H&S training, adherence to H&S regulations, proper Risk Management techniques, identification and mitigation of hazards associated with plant and equipment by road construction contractors.

1.4 Study Hypotheses

The study hypotheses are as follows:

1. H&S hazards associated with plant and equipment on road construction sites are not identified by construction contractors.
2. Road construction contractors disregard accidents and injuries associated with plant and equipment on road construction sites.
3. Proper H&S Risk Management is lacking on road construction contractor sites.
4. H&S regulations are neglected on road construction projects.
5. H&S training and management are lacking on road construction sites.

1.5 Study Objectives

The study objectives are:

- To identify the H&S hazards associated with plant and equipment that contractors face in the KwaZulu-Natal road construction industry;
- To determine the nature and severity of accidents and hazards associated with plant and equipment in the KwaZulu-Natal road construction industry;
- To determine whether proper H&S Risk Management processes are followed by road construction contractors;
- To determine whether road constructors comply with H&S regulations on road construction projects; and
- To establish the extent of H&S training and management on road construction sites.

1.6 Research Methodology

In order to achieve the objectives of the study the following research approaches will be adopted:

- A comprehensive review will be done of literature related to H&S as well as plant and equipment operations. Previous studies conducted on construction plant and equipment H&S will be examined to determine any gaps in the research area. These studies will also be used to determine an appropriate research approach as well as selection and design of the research instruments to be used for data collection.
- Structured interviews will be conducted as well as observations on a selected number of construction road sites within the KwaZulu- Natal region. Informational discussions will also be conducted with plant and equipment operators. This will also identify problems or knowledge gaps associated with plant and equipment operation.

- The data will be analysed using relevant statistical techniques and software using SPSS version 21. Open-ended responses will be analysed using the process of content analysis. Conclusions will be drawn based on recurring themes drawn from the participant interviews as well as on-site observations. Recommendations are to be formulated based on the study findings.

1.7 Assumptions

This study is subject to the following assumptions:

- Participants were adequately knowledgeable in the area of research and able to provide sufficient and comprehensive information on for the research.
- Contractors may implement H&S regulations on their sites therefore causing H&S risks involving accidents and fatalities with regard to the operation of earth moving plant and equipment.
- When observations are conducted, it is assumed that the daily operations on site will be unaffected by research being carried out, so far as the purpose of the study is concerned ,so that these operations will be a true reflection of what would normally occur on the study site.

1.8 Ethical Considerations

- While conducting interviews, confidentiality and anonymity of the participants will be assured. The participants will also have the opportunity to withdraw from the study at any time and with no consequences.
- The University of KwaZulu-Natal will approve all research instruments to be used via the Ethical Clearance Committee. See Appendix A: Ethical Clearance Letter.

1.9 Limitations

The study is limited by the following, namely

- The geographical area to be covered will be the province of KwaZulu-Natal and more specifically the Durban region and surroundings. A limited number of road construction projects will be considered for the study. Since these projects might not be representative of all road construction sites the findings might not be generalizable to the KwaZulu-Natal province.
- The majority of potential sites are those where the government is the main client of the construction project. The process of obtaining access to their sites takes a considerable

amount of time which will delay the study in terms of observation and so inhibit obtaining sufficient data. As a consequence only a limited number of sites will be selected for the study.

1.10 Significance

Increased government expenditure on infrastructural rehabilitation and development has led to a significant upsurge in the amount of plant and equipment being employed in the road construction projects. It has therefore become imperative that construction plant and equipment H&S be explored in terms of understanding H&S hazards experienced on site, the severity of these hazards; including ways in which they can be prevented and mitigated in the road construction industry.

The construction environment is a very challenging one. It is constantly changing. Working conditions are often harsh, with high risk activities involving hard physical labour. Working environments vary from isolated sites to heavy traffic sites. H&S related accidents and hazards may often be disregarded in the construction industry, their neglect would affect construction projects and their respective project stakeholders. This also makes the study crucial.

Exposure to H&S risks lead to accidents and fatalities experienced in the construction industry, which need to be avoided or mitigated. The human cost (Smallwood and Venter, 2012; Sawasha, Naoum and Fong, 1999) of this factor also prompted this study. In light of the construction industry skills shortage, the human cost encountered due to the disregard of H&S regulations on sites should alarm project stakeholders. Experienced constructions workers are often injured, disabled or die while performing their duties on site. The strengthening of H&S training, and the implementation of H&S procedures and regulations are paramount importance in reducing the accident and fatality rate on road construction sites. This study addresses these issues and makes recommendations which will hopefully lead to improvement of project performance of the wider South African construction industry.

1.11 Structure of Study

Chapter 1: Introduction

This chapter comprises of the background of the research background, problem statement, study hypothesis, objectives, research methodology, assumptions, study limitations, study delimitations and significance of the study.

Chapter 2: Review of Literature

The literature review comprises of the South African H&S current and relevant H&S regulations, legislation including; training systems in place relevant to road construction. Literature from international and local sources will also be sought to give a broader understanding of the H&S issues in terms of earth moving plant and equipment. This will then lead to an investigation of the current situation in KwaZulu-Natal H&S risks, their nature and severity including; how they are mitigated. A critical assessment will be conducted between the current H&S situation, H&S regulations, legislation including safe work procedures.

Chapter 3: Research Methodology

This chapter describes the research methodology used to test the hypothesis. Observations will be done on a sample of twelve road construction sites. Interviews with contractors, H&S officers including plant and equipment hire managers will also be conducted and transcribed. Data collection methods are discussed.

Chapter 4: Data Collection and analysis

In this chapter the findings of the data analysis are presented, summarised, analysed and evaluated. The findings on H&S risks, their nature and what is being done to mitigate these risks is represented in both text and graphical formats.

Chapter 5: Conclusions and Recommendations

The conclusions of the research are presented and the hypotheses tested. Recommendations are then drawn from the findings of the research conducted.

CHAPTER 2 – A REVIEW OF RELATED LITERATURE

The necessity for infrastructural development has prompted the increased use of mechanisation in construction. This is generally because the use of mechanisation is more economical as project stakeholders seek to lower costs, maintain consistency and increase productivity (Edwards, 2003). However, the use of construction plant and equipment has made it more challenging to entirely remove hazards that occur in a construction project. H&S risks associated with plant and equipment will only increase as infrastructural development upsurges (Edwards and Holt, 2010). Technological advances in construction plant and equipment are also vital in the pursuit of improving H&S aspects in its operation. For example, machine control systems can be further developed to decrease worker exposure to H&S risks (Edwards and Holt, 2009).

H&S statistics provided by the South African Department of Labour during the period of 2004/05 to 2007/08 showed that there had been an increase of accidents about 160 fatalities and around 400 non-fatal accidents (CIBD, 2008). The societal cost of accidents and fatalities is disheartening and this in itself should serve as an alarm to prevent construction accidents and fatalities (Manu et al., 2012). It is therefore vital that current H&S hazards be dealt with today and increasingly in the future (Edwards and Holt, 2010). H&S risks resulting from construction activities should be avoided and mitigated.

This chapter reviews previous studies conducted in H&S associated with associated plant and equipment. It explains the H&S risks associated with plant and equipment, including the nature and severity of accidents and hazards. It then delves into the appropriate H&S Risk Management processes for contractors and how well contractors comply with H&S regulations on road construction projects. It concludes with a discussion of the extent of H&S training and management on road construction sites.

2.1 H&S risks associated with plant and equipment

2.1.1 Plant & Equipment Related Hazards and Accidents

The use of plant and equipment brings with it an increase in production. Unfortunately, this outcome has been at the cost of increasing rate of accidents and injuries on construction sites. Earthmoving plant and equipment are considered to be the most dangerous, causing severe injuries and accidents (Alkass et al., 2013). Given the high risk involved in carrying out construction work, there was an obligation for proper H&S performance associated with the use of plant and equipment (Edward and Nicholas, 2002).

According to the Occupational Safety and Health Administration (OSHA), construction accidents have been classified into *falls, shocks, caught in /between, struck by*, and *other*. These categories were unclear, more especially when it comes to determining the cause of the accident in order to mitigate and prevent that accident from re-occurring. The following describes these categories:

- *Falls* occurred while workers were carrying out activities such as roof work, scaffolding, ladders and beam supports (Hinze, Huang and Terry, 2005). Falls from plant could also cause injuries (Choudhry and Fang, 2008; Edwards and Holt, 2010; Edwards and Holt 2009; Haslam et al., 2005; Edward and Nicolas, 2002; Carson. and Cook, 2000; Mathalane, Othman and Pearl, 2008).
- *Electrical Shocks* accidents included workers being exposed to electrical arcs, contact with power lines via tools , materials or moving equipment (Choudhry and Fang, 2008; Haslam et al., 2005; Hinze, Huang and Terry, 2005).
- *Struck-by* accidents included injuries and fatalities resulting from cave-in's, materials as well as workers being hit by plant or equipment (Lingard, Cooke and Gharaie, 2013; Choudhry and Fang, 2008; McCann, 2006; Riaz, Edwards and Thorpe, 2006; Hinze, Huang and Terry, 2005; Haslam et al., 2005; Mathalane, Othman and Pearl, 2008).
- *Caught-in/between* accidents involved injuries as a result of cave-ins (Choudhry and Fang, 2008 ; Hinze, Huang and Terry, 2005; Haslam et al., 2005), and
- *Other* accidents were associated with fire, poisoning, explosions, toxic gas and natural causes (Choudhry and Fang, 2008; Hinze, Huang and Terry, 2005).

Plant and equipment related hazards expose to both health risks and safety risks.

2.2.2 Health Risks associated with the use of Plant and Equipment

A number of health hazards in road construction have been established. These included exposures to silica-containing dusts, hydrocarbon solvents, lime and cement dusts, and polycyclic aromatic hydrocarbons. In the construction of roads, certain occupations such as road sweeping, cement spreading and spraying of coal tar and bitumen exposed workers to particular health hazards (Darby, 1986). It is expected that the use of machines which had replaced manual labour could help in the improvement of H&S in road construction. However, on the other hand according to Edwards and Nicholas (2002), plant and equipment are considered to be one of the major contributors towards the construction industry's poor H&S image. Nevertheless, due to increasing mechanisation of construction, outputs have become more consistent and resulted in increased productivity (Edwards and Holt, 2010, Edwards and Nicholas, 2002). Health risks involving the operation of plant and equipment on construction sites include the following:

- Burns (Holmes, Gifford and Triggs, 1998),
- Central Nervous System (CNS) (Ringen and Stafford,1996),
- Dust inhalation (Deacon, Smallwood and Haupt, 2005),
- Electrocution (Lingard, Cooke and Gharaie, 2013; Ringen and Stafford,1996),
- Exposure to hazardous chemical substances (Jorgensen, 2013, Holmes, Gifford and Triggs, 1998),
- Fatalities (Edwards and Holt ,2009),
- Fatigue/exhaustion (Gander et al,2009; Deacon, Smallwood and Haupt, 2005),
- Musculoskeletal injuries (Deacon, Smallwood and Haupt, 2005, Holmes, Gifford and Triggs, 1998, Podniece, 2008),
- Noise induced hearing loss (Picard et al., 2008; Deacon, Smallwood and Haupt, 2005),
- Respiratory System (Picard et al., 2008; Ringen and Stafford,1996),
- Sunburn/sunstroke/dehydration (Deacon, Smallwood and Haupt, 2005) and
- Whole body (WBV) and Hand Arm Vibration (HAV) Hazards (Jorgensen, 2013; Edward and Holt, 2010; Deacon, Smallwood and Haupt, 2005).

2.2.3 Safety Risks associated with the use of Plant and Equipment

Construction plant and earth moving machinery are commonly used in most construction projects. Operators of such machinery rank second in terms of accident occurrences. The operations of such construction equipment on sites are amongst the major causes of the largest number of injuries and fatal accidents (CIDB, 2008; Edwards and Nicholas, 2002). Furthermore, studies conducted by Lingard, Cooke and Gharaie, 2013, Hoonakker et al., 2005, Chi et al., 2005 and Haslam et al., 2005, have revealed that the most common major injuries occurred in relation to falls from heights; slips, trips. Other injuries occur as a result of workers being struck by moving or falling objects, moving vehicle or plant. The mere fact that the majority of accidents causing injuries or death involve the use of construction plant and equipment makes it important to note that their use can become hazardous and dangerous (Edwards and Nicholas, 2002). Safety risks usually involve the use of plant and equipment (Edwards and Nicholas, 2002) on construction sites and included but were not limited to the following:

- Boom failure accidents of truck mounted cranes, (Edwards and Holt, 2009),
- Plant collisions or person hit by plant (Edwards and Holt, 2009; Edward and Nicolas, 2002),

- Plant and pedestrian on site risks, (Edwards and Holt, 2009),
- Fatigue cracking on plant booms, (Edwards and Holt, 2009),
- Plant loss of control of engine (Edwards and Holt, 2009 ;Edwards and Holt, 2010),
- Operator's station falls, slips and trips (Edwards and Holt, 2010; Edwards and Holt 2009 Edward and Nicolas, 2002),
- Repetitive motion, stress, strain (Jorgensen, 2013),
- Mechanical hazards; (Edwards and Holt, 2010),
- Machine instability (Edwards and Holt, 2010),
- Power transmission source problems (Edwards and Holt, 2010) and
- Person injured whilst conducting maintenance (Edwards and Nicholas, 2002).

2.3 Contractors compliance with H&S regulations on road construction projects

2.3.1 H&S legislation in relation to construction plant and equipment

A major function of the South African Occupational Health and Safety Act (OHSA) 85 of 1993 was to ensure the protection and wellbeing of persons who used construction plant and equipment, and persons affected by the construction works. One of the duties of employers was to create and maintain a reasonably practical working environment that was nonetheless safe and without risk to the health of employees. To achieve this objective, employers must ensure that precautionary measures were put in place to protect the construction worker. The OHSA promotes that work associated with plant and equipment was performed under supervision by qualified persons and that hazard and risks were understood. This understanding was supported by appropriate training.

Despite H&S regulations, the increasing rate of accidents and fatalities on construction sites had not abated (Jorgensen, 2013; Choudhry and Fang, 2008; Abdelhamid and Everet, 2000). According to the Department of Labour there had been little or no improvement in accident and fatality rates (Windapo and Olapapo, 2012; Agumba and Haupt, 2012; CIDB, 2009). One of the major intentions of the H&S regulations was to ensure that guidelines the use of all plant and equipment include the provision that employers must ensure operators were informed of the H&S hazards. These guidelines contain precautionary measures to ensure that these hazards are mitigated or prevented (Smallwood & Haupt, 2005; South Africa, 1993).

Contractors were required to adhere to the provisions and requirements of Construction Regulations, 2003 in respect of construction works. These regulations were consolidated from the OHSA (Smallwood and Haupt, 2005). The Construction Regulations require operators of construction vehicles and mobile plant be trained and that plant and equipment be in good working order. The contractor was to ensure that all protective systems were in place such as adequate edge protection and that the construction site design minimizes and/or prevents exposure to construction H&S risks (Republic of South Africa, 2003).

2.3.2 Factors that contribute to Construction H&S Risks

In understanding H&S risks associated with plant and equipment, the underlying factors that cause H&S risks should be determined. These factors are likely to affect contractor's compliance with H&S regulations. The following are generally considered the main causes of exposure to H&S hazards that occur on construction sites:

- Management Commitment and Attitudes to H&S (Windapo and Oladapo ,2012 ; Wang and Yuan, 2010; Haslam et al., 2005)
- Cost of H&S compliance (Windapo and Oladapo ,2012)
- Lack of H&S knowledge and training (Windapo and Oladapo ,2012)
- Non – severe penalties for noncompliance (Windapo and Oladapo2012)
- Unsafe conditions (Windapo and Oladapo ,2012; Haslam et al., 2005)
- Worker and work team factors (Haslam et al., 2005)
- Plant and equipment; and materials (Haslam et al., 2005)

2.3.2.1. Management Commitment and Attitudes to H&S

Management commitment and attitudes about H&S played a vital role in the success of H&S program implementation and management within any organization. Donald and Young, (1996) and Siu et al., (2004) suggested that human factors played a significant role in H&S among other factors such as culture and climate. In another study 51% of workers were concerned about whether management took H&S seriously. In the same study, 71% of workers reported that management complied with H&S regulations because they were supposed to comply with the OH&S Act. Further, 87% of workers reported that management needed to show more commitment if they were to be more committed themselves (Geminiani and Smallwood, 2013).

The attitude of management and their commitment towards H&S therefore inevitably affects worker commitment to H&S. Poor attitudes were demonstrated by the lack of H&S awareness (Edwards and Holt, 2007) on construction sites to the extent that H&S is disregarded. Workers were seldom provided with Personal Protective Equipment (PPE). Programme, policy and rules were not effective. No H&S representatives are appointed. H&S inspections and meetings were never conducted. Workers perceive that supervisors do not make H&S a priority. (Windapo and Oladapo, 2012; Haslam et al., 2005)

2.3.2.2 The Cost of H & S noncompliance

According to Windapo and Oladapo (2012) contractors would rather spend on H&S compliance only where the financial cost of non-compliance is higher. Contractors perceive H&S regulations as an “additional burden” to their construction projects. This although contractors’ non-compliance of H&S regulations will actually cost more in real terms than the cost of implementing H&S regulations. According to Smallwood (2004), an estimated value of 5% of the value of completed construction projects is spent on H&S systems. This amount is estimated to be less than the total cost of accidents (CoA) on a construction project (Smallwood, 2004). Further, Baxendale and Jones (2000) and Lancaster et al., (2003) established that the cost of non-compliance on smaller construction sites is much higher than that of larger sites. It has further been established that in the attempt to avoid additional costs, contractors do not comply fully with OHSA (Smallwood, 2004).

a) Direct and Indirect costs of H&S noncompliance

The construction industry’s accident and fatality rate had shown little improvements over the past few years. This is evidenced by the increase in accidents in countries such as the United States (US), where, the costs due to days absent from work due to illness and non-fatal injuries were 71% higher compared to other industries (Smallwood and Haupt, 2005). In the United States of America, a NIOSH report stated that the cost of construction fatalities is R85 billion ($10 billion) for the period between 1992 and 2002 (NIOSH, 2006).

The cost of the consequences of non-compliance can be categorized into direct and indirect costs (Hinze, 1994). The direct costs of H&S non-compliance are associated with the costs of treatment for the injury arising from the accident. This also includes the specific compensation paid out to the worker. As a consequence the firm would have to pay higher workmen’s compensations premiums due to H&S non-compliance. Other direct costs resulting from H&S non-compliance include medical expenses, sick leave administration, lost wages, temporary disability payments as well as hospitalization (Hinze, 2006).

Indirect costs of H&S non-compliance incurred were also known as hidden costs because they were less evident. Research had established that the indirect costs of construction accidents in South Africa can be 14.2 times higher compared to direct costs (Smallwood and Haupt, 2005; Hinze, 2006). Indirect costs in construction projects include: reduced productivity (Smallwood and Venter, 2012), damaging of construction company’s reputation, loss of trust by workers, clean-up costs, replacement costs, transportation costs, wages paid to the injured while idle and costs related to rescheduling of work (Smallwood and Haupt, 2005). Other indirect costs included stand by costs, costs of overtime, administrative costs, and replacement of worker orientation, delay costs (Odeh and Battaineh, 2002) and supervision costs (Levitt and Samelson, 1993).

b) Cost of H&S non-compliance associated with the use of plant and equipment

The employment of construction plant and equipment on construction projects had affected the profitability of companies by affecting its business process. Business processes comprised of work, procedures as well as rules with regard to the completion of tasks. The company aimed to increased productivity, achieve greater client satisfaction as well as improve the quality of construction projects. (Riaz, et al., 2011; Smallwood and Haupt, 2005; Cooper and Phillips, 1997; Edwards, Holt and Harris, 1998). Taking this into consideration, Riaz, et al., (2011) supported by Seeley (1993) claim that the contractor had three options to satisfy plant requirements, namely to:

- Purchase plant,
- Use company-owned plant or
- Hire from external sources.

With this in mind, mitigation and preventative methods should be employed so as to reduce hazard exposures with regard to the use of plant and equipment. However, according to Riaz et al., (2011) in H&S practices associated with the plant and equipment employment, there was a four stage process which the contractor should go through, namely;

- plant selection,
- operator certification,
- risk assessment and
- machine maintenance.

However it was found that these processes were rarely followed and resulted in accidents and fatalities associated with plant and equipment. Reasons for this included that plant and equipment sometimes have to be procured urgently due to demand or unforeseen events (Riaz et al., 2011). Such shortcuts can result in H&S Hazard exposures. It is therefore evident that compliance with H&S regulations would actually save the construction company in terms of cost by the reduction of H&S accidents, fatalities and injuries (Smallwood, 2004; Windapo and Oladapo, 2012).

2.3.2.3 Lack of H&S knowledge and training

Riaz et al., (2011) identified training as a planned and systematic process undertaken by using competent supervision. It aims to improve predetermined skills abilities and knowledge to which is required to carry out a task or activity. The unfamiliarity and ignorance caused by an absence of H&S training by both management and workers were major challenges in the construction industry. Smallwood and Haupt (2005) concur that the inadequacy of H&S education in tertiary institutions leads to the ignorance or insufficient training of future construction managers. Studies conducted in Britain found that tertiary education in H&S provided to architect, designers, engineers , surveyors and other engineering related professions was either unsatisfactory or non-existent (Carpenter et al., 2001; Haslam, 2005). This is also evident in a status report of H&S education in South African Universities stated that recent graduates, who are potential construction professionals, had inadequate H&S training and education. It was established that 84% of other participating programs such as Architecture claimed to have H&S content included in their programs. However, it was found that in the quantity surveying, construction and civil engineering disciplines, 75% had minimal H&S content in their programmes. Haupt (2003) showed that in some of the disciplines, construction H&S was not addressed at all, therefore graduates are not adequately prepared to deal with H&S challenges in the construction industry (Chileshe and Haupt, 2007). Haslam et al., (2005) further suggested that education accreditation bodies need to require adequate standards with regard to H&S education and training. However, considering the findings of the status report of H&S Education in South African Universities, this may not be considered. This is because most educational institutions had an option of whether to include H&S in their programmes and many of them regarded it unfavourably.

The training and knowledge of H&S by management in road construction projects is bound to affect the way they understand and implement H&S regulations. Furthermore, a lack of training and education can lead to an inadequate and weak H&S system implementation (Haupt and Smallwood, 1999). Workers were found to be generally not knowledgeable about the requirements of OHSA. This is mainly because construction workers were usually be inadequately trained and therefore become unaware or ill-informed of the H&S hazards they were exposed to on sites (Windapo and Oladapo; 2012 ; Smallwood 2002).

2.3.2.4 Non – severe penalties for H&S non – compliance

Contractors have to make sure they addressed H&S issues in the event of potential loss associated with labour, plant and equipment as a result of H&S non-compliance. However Windapo and Oladapo (2012) and the CIDB (2009) report found that contractors manage to by-pass the penalties imposed for non-compliance. This leads to contractors continuing to disregard H&S regulations due to fines being considered too low. Furthermore, the construction industry had been known for corruption and as a result contractors are able avoid the penalties for poor H&S on their sites (Windapo and Oladapo, 2012; CIDB, 2009).

2.3.2.5 Unsafe conditions

It was the obligation of the employer to ensure that their workers have taken reasonably practicable steps to mitigate "any hazard or potential hazard to ensure the safety or health" (OHSA, 1993:8). Further precautionary measures relating to the use of plant and equipment should be taken by the employer to ensure the safety or health of persons. However, according to Windapo and Oladapo (2012), unsafe working conditions were one of the factors that caused exposure to H&S risks. According to Haslam et al., (2005) working environment, poor housekeeping and the site layout contributed to half (49%) of construction accidents. The same study revealed that 100% of the accidents resulted from local hazard exposures. These hazard exposures included slips, trips, uneven ground or debris as well as muddy areas. Even when sites were considered well run according to construction industry standards, they were deemed to be unsafe and having poor risk management culture according to other industry standards (Haslam et al., 2005). Despite H&S regulations with regards to unsafe work environment, the H&S condition on sites contributed to the poor H&S rate on construction projects. Unsafe conditions, proper equipment and management were not effectively addressed on construction sites (Haupt, 2001).

2.3.2.6 Worker and work team factors

Studies had established that workers behaviour on site needed to be improved to assist in a safe and healthy environment. However, whether the worker behaviour can be managed by H&S legislation or effective management was questionable (Haupt, 2001). According to Choudhry and Fang, (2008), presently, health and safety in construction is complex more especially when it involves the use of plant and equipment. The use of machinery coupled with attitudes and behaviours towards construction H&S make it an even more complex issue to deal with. Haslam, et al. (2005) and Rasmussen, (1997) found in their studies that unsafe acts contributed greatly towards accidents and fatalities. Unsafe acts are considered to be consequences as well as causes of accidents. In a study conducted by Reason (2007), interviews and focus groups for construction workers discovered that unsafe acts included the following three aspects, namely

- Overlooking safety in respects to heavy workloads and other priorities;
- Taking short cuts in efforts to save cost and time, and
- Inaccurate perception of risk, mainly by invulnerability.

The underlying cause of such actions was considered to be insufficient H&S education and training.

2.3.2.7 Plant and equipment and material conditions

The suitability, usability and the condition of plant and equipment affects construction worker's exposure to H&S hazards exposures (Haslam et al., 2005). Critical stages such as the setting up, the task activity, maintenance as well as movement of plant and equipment can lead to accidents (Haslam et al., 2005). Material packaging, as well its disposal of such material contributed towards exposures to H&S hazardous. Of the incidences noted, fifty six percent (56%) were equipment related whilst twenty seven percent (27%) related to deficiencies in the suitability and condition of materials. Examples of these hazardous exposures included dealing with asbestos, falls from a heights as well as fire hazards resulting from machine operation or material types (Haslam et al., 2005; Mathalane, Othman and Pearl, 2008).

The role of Suppliers in H&S

According to Haslam et al., (2005) there were ways that the supply and delivery of material improved safety. In a study by Bust et al., (2005) of manual handling during installation of highway kerbs, it was established that that suppliers had considered the safety in terms of the supply of materials. For example, the supply of cement in smaller cement bags which could assist workers in handling hazardous materials. However, purchasers did not prioritise H&S. Consequently, suppliers were not encouraged to improve H&S in their products.

Similarly with plant and equipment suppliers, accident studies revealed that equipment is selected on the bases of price and performances (Riaz et al., 2011). Additionally, durability is sometimes considered during purchasing however safety is usually not considered. Constant use and exposures to multiple users of plant and equipment accelerates the depreciation rate of the plant which made plant operation risky. Although a number of accidents featured plant and equipment operating under poor conditions, there was little evidence of consistent and regular maintenance and scheduled inspections. Poor maintenance and design of construction plant and equipment increased hazardous exposures; therefore plant related accidents and injuries also increased (Riaz et al., 2011).

2.4 Nature and Severity of Accidents and Hazards associated with Plant and Equipment

2.4.1 Nature and Severity of Plant and Equipment Hazards and Accidents

In general, the underlining cause of accidents needs to be uncovered (Moosa, Haupt and Haranarain, 2013). This is essential to ensure that accidents do not re-occur and to provide the necessary mitigation and preventative methods and options. According to Hinze et al., (1998), key roles in accident causation need to be identified in order to avoid more accidents. In construction sites, an accident investigation usually stops at a premature level whereby the root causes are insufficiently established. The accident investigations were found to be usually based on theories of accident causation and human error (Shoudhry and Fang, 2008 citing Brouwn, 1995).

Several theories with regard to causes of accidents and injuries were identified which include:

- Accident proneness theory;
- Goals – Freedom – Alertness theory;
- Adjustment stress theory;
- Chain of events (Domino theory);
- Distractions theory (Haslam et al., 2005; Smallwood and Haupt, 2004; Moosa, Haupt and Haranarain, 2013).

These particular theories identified the construction worker as the major reason for the accident or injury occurring. Haupt and Smallwood, (2004), Qureshi, (2007) and Moosa, Haupt and Harinarain, (2013) established that these theories did not reflect the true causes of accidents on construction sites. These theories focused solely on the construction worker being responsible for an accident occurring. However, management and organisational inadequacies had a significant role to play in the performance of H&S systems. People played a significant role in accident causation (Strahlendorf, 2013). The Domino Accident Causation in Figure 1 illustrates that H&S responsibility for an accident trickles down from the director's behaviour to the workers behaviour. It is therefore established that these theories are insufficient for finding the remedy of accident occurrence. Furthermore, over the years, accident models such as the Sequential or event-based, the epidemiological and the systemic theory accident models had been developed to determine the root cause of accidents. The most common accident causation models were the following:

- *Sequential or event-based accidents* were caused in a series of stages. The earliest accident causation was the Domino theory as seen in Figure 2 (Heinrich, 1980). Five stages were identified using this theory namely:

- social environment (those conditions which lead to taking or accepting risks);
  - fault of the person;
  - unsafe acts or conditions (poor planning, unsafe equipment, hazardous environment);
  - accident; and
  - injury. (Qureshi, 2007; Strahlendorf, 2013).
- *Epidemiological theory* was the study of environment factors which result in accidents or diseases. These factors, of which some were latent, manifest in the same space and time frame (Hollnagel, 2002; Qureshi, 2007). The *Swiss cheese accident causation model* identifies the proximal cause of an accident when people fail at the sharp end of the model. These people were usually the ones that interact with the plant and equipment or other technology (Qureshi 2007).
- *Systemic Theory* was based on considering the system as a whole whereby accidents were interconnected networks of events. Various components such as human, technical and environmental exist and interact together in a specific time and space and result in an accident (Hollnagel, 2002; Qureshi, 2007).
- *Combination Theory* argued for a combination of accident causation theories to determine the cause of the accident (Qureshi, 2007; Heinrich, 1941).

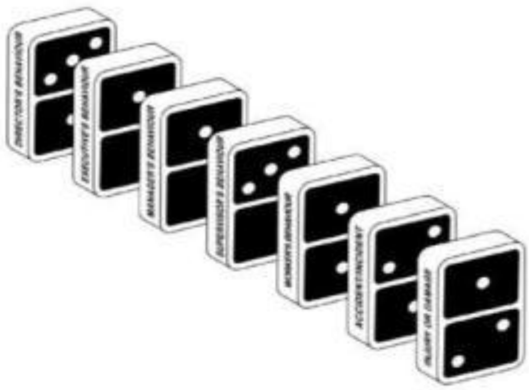

Figure 1: Domino Accident Causation (Source: Strajlendorf, 2013)

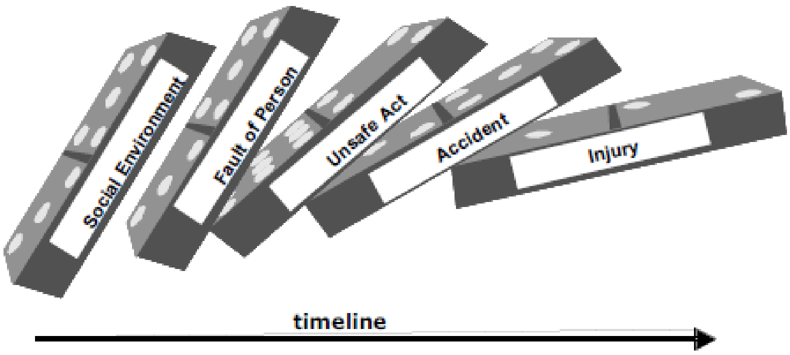

Figure 2: Sequential model of Accident Causation (Domino model) (Source: Qureshi, 2007)

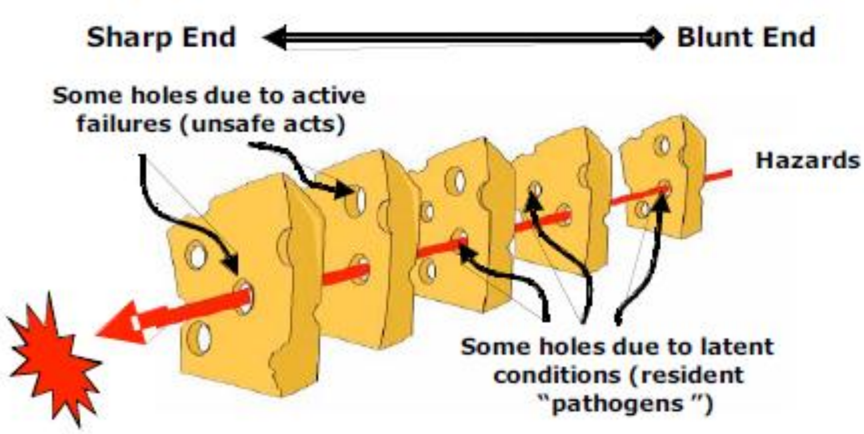

Figure 3: Swiss cheese model of accident causation (Source: Reason, 1997)

Considering the inadequacy of these theories, an accident causation study by Heinrich (1936) cited by Edwards and Holt (2010) acknowledged that accidents were complex and had a multi-causal nature. Heinrich (1936) and Manu et al., (2012) also recognized the need to understand the nature and severity of accidents. Traditional accident modelling systems were inadequate to examine the cause of accidents (Qureshi, 2007). Therefore new systems were developed in order to determine the cause of accidents. This *Complex Socio-Technical accident causation System* used both human and technological factors which included plant and equipment to model the nature and severity of an accident.

The Systems Theoretic approach and the Cognitive System Engineering approaches were known as the *Systemic Accident Models* and consider the accident environment as a whole system. Sequential and the Epidemiological theory focuses linearly whereby one event leads to another (See figures 2 and 3). However the Systems Theoretic approach identifies causes of accidents as complex interactions between elements or systems that lead to accidents. According to Hollnagel and Woods (2005), the cognitive systems engineering approach recognises that it is important to understand what goes right in a system before knowing what went wrong. With the increased employment of automation in the construction industry (Edwards and Holt, 2009) new problems arise when it comes to operating machinery. Human machine systems become complex and further lead to many catastrophic accidents and injuries (Qureshi, 2007).

It is therefore paramount for the construction contractor to understand the root causes of accident as these affect their nature and severity. This understanding can be achieved by examining human-machine systems. It had been established that *Systemic Accident Models* provided a more holistic way of determined accident causations thereby determining their root causes. (Arboleda and Abraham, 2004; Suraji et al., 2001)

2.4.2 Multi –Causal Approach to Accident Investigation

A recently developed multi-causal model, used attempted to identify the root causes of accidents, with the aim of preventing accident reoccurrences (Hamid, et al., 2008) was used to analyse five selected construction site accidents. The model demonstrated that one of the major factors influencing the causes of accidents were shortcomings with regard to plant and equipment. Examples of these short comings included poor plant or equipment design and maintenance (Haslam et al, 2005; Edwards and Nicholas, 2002). This Multi-Causal approach model found differences in the identified root causes were found when compared to those determined using more traditional approaches. For example, differences such as lack of supervision and poor H&S culture were identified using the Multi-Causal approach but were not identified in the original investigations. Their exploratory study concluded that in the effort to identify the causes of accidents, new approaches were needed to improve the effectiveness of accident investigations and preventing accident reoccurrence (Moosa, Haupt and Harinarain, 2013).

Road construction work is considered complex in nature Ringen and Stafford (1996). This complexity becomes even more evident when plant and equipment are involved. To account for this complexity the sophistication of a Multi- Causal Approach is required to determine the root causes of road construction accidents, shaping factors such as team work, materials as well as the employment of plant and equipment. Figure 4 shows the hierarchy of influences in construction accidents, in which construction plant and equipment are one of the major shaping factors in accident causation (Haslam et al., 2005).

Therefore, road construction contractors' decisions concerning accident determination approaches were likely to significantly affect the ways in which sites were managed with regard to construction plant and equipment. A more accurate approach would lead to well informed decisions, which mitigate the severity of H&S risks and their resulting accidents and fatalities.

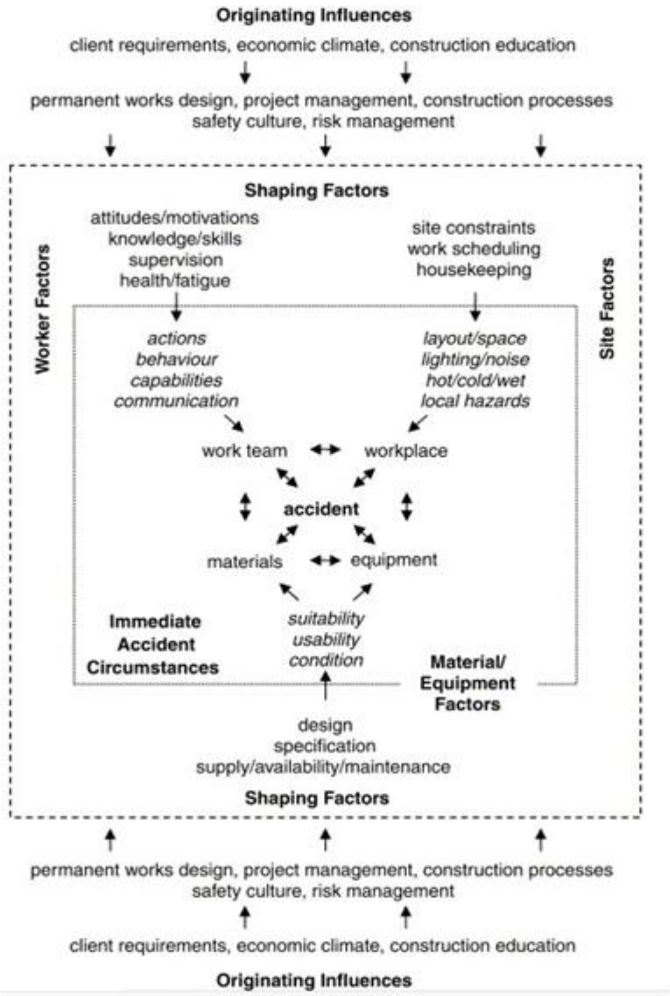

Figure 4: Hierarchy of influences in construction accidents (Source: Haslam, et al., 2005)

2.4.3 Importance of mitigating hazard exposures

With the complex socio-technical system existing in the construction industry due to technological advancement, the need to mitigate H&S hazard exposures is imperative. From the studies of accident causation theories it is evident that traditional theories are inadequate to determine the root causes of construction site accidents. Other theories such as the Multi – Causal approach need to be developed and applied in order to discover appropriate mitigation and preventative methods.

This development and application become of outmost importance when considering the plan of the South African government to increase infrastructure development. Therefore H&S risks involved in construction activities should be avoided and mitigated. In achieving this goal, there would need to be significant improvements in contractors meeting project objectives without compromising the health and safety of their employees. Issues such as the construction industry skills shortages (Makhane and Twala, 2009) and the construction manager meeting project objectives also affect the mitigation of H&S risks.

2.4.3.1 Construction Industry Skills Shortage

Skills shortages in construction have become important factors affecting the sustainability of the construction industry. Given the hazardous working environments, Deacon, Smallwood and Haupt, (2005) confirmed that older workers tended to be at a higher risk of injuries compared to their younger counterparts. Most experienced workers are older people and as the population of a certain area changes, so does the workforce of the particular area which potentially leads to an older work force. If younger workers are being injured and older people are more at risk of injuries, the sustainability of the construction industry would suffer. A study conducted by Haupt (2010) in India, confirmed that due to fewer younger people entering the construction sector, there had been an increase of older workers. The authors go on to say that occupational as well as non-occupational diseases amongst older workers damage the construction industry. Findings of this study stated that older workers were more prone to reporting physical health problems and these were in larger proportions compared to health their younger counterparts. Lower backache was found to be the most prominent health problem across all trades. Older workers were also more severely impacted by the construction work than younger workers. Despite the difficulties faced by older workers, employers did not assign manageable, specific nor easier tasks to older workers.

2.4.3.2 Construction Managers meeting Project Objectives

Construction managers, which included plant managers, were responsible for the planning, procurement, organising and control of a construction project in respect of plant and equipment. They were also in charge of decision making in respect of proposed work, plant to be used, hired or purchased and the fulfilment of project objectives. In the pursuit of these project objectives, construction managers had to ensure that proper H&S mechanisms were in place in order to mitigate plant and equipment associated H&S risks (Edwards and Holt, 2009). Productivity in construction is influenced by H&S aspects. If there was a lack of H&S systems in place, productivity is negatively affected. This may result in an increase in project cost, loss of working days (time) (Sawacha, Naoum and Fong, 1999) or compromise in quality. It is important to note that when construction accidents occur, they result in adverse costs to the construction industry as well as to society (Manu et al., 2012 citing Darshi De Saram and Tang, 2005; Imriyas et al., 2008; Huges and Ferret, 2008). It is therefore paramount and beneficial to both the construction industry in terms of productivity as well as to society in terms of accidents and fatalities, to ensure the application of H&S systems.

2.5 Nature and Severity of H&S Risks Associated with Plant and Equipment

A distinction was made between the Health risks and Safety risks involving the use of plant equipment. According to Weeks (2011), construction industry hazards are categorised into four classes, namely: chemical, physical, biological and social hazards.

- Chemical hazards are usually air –borne and include exposures to fumes or gases.
- Physical hazards include exposures to heat, vibration and noise. Machines employed in construction make exposures to noise very likely. Earth moving machinery such as bulldozers cause vibration hazards.
- Biological hazards –include exposures to micro-organisms or toxic substances. For example excavation workers could contract lung infection called histoplasmosis from a common soil fungus.
- Social hazards – in a constantly changing environment of construction, workers are exposed to long periods away from home. This results in a lack of social support from their families. This is mainly particularly prominent in the road construction industry.

2.5.1 Nature and Severity of Health Risks

A number of health risks and diseases were experienced on construction sites and other hazardous working environments (Geminiant and Smallwood, 2013; Weeks, 2011). Various health risks exist as a result in the prolonged use of machinery. Other exposures occur when working with dangerous chemicals or substances, poisoning, and the risk of stress (Jorgensen, 2013). Health risks associated with the use of plant and equipment included burns which usually affect the skin. For someone to sustain burns to more than 40% total body surface would usually lead to death. Figure 3 shows burns caused by hot bitumen. Central Nervous System (CNS) severities could lead to damage to a part of the brain with serious consequences. Dust inhalation depends on the quantity absorbed and could lead to death by asphyxia. Electrocution can result in death if a high current passes through the heart. If hazardous chemicals are inhaled they can cause internal injuries. Fatigue can cause an operator to collapse and so cause an accident. Musculoskeletal injuries manifest as fractures, tendons and muscle injuries (BC Work Safe, 2008, Podniece, 2008). Figure 6 shows a construction worker with fractured arm. Respiratory injuries include Chronic Obstructive Pulmonary Diseases (COPD) (Karkhanis and Joshi, 2011). Sunstroke and dehydration could cause a worker to collapse on site (Paoletti et al, 2009; Kingu, 2013). Whole body vibration (WBV) consequences include; damage to spine, lumber scoliosis and disc disease. Hand Arm Vibration (HAV) hazards could result in vascular and neurological diseases (Best Practice – Vibration at the Work Site, 2010; Edwards and Holt, 2006). The nature and severity of health related hazards and accidents associated with the use of plant and equipment on construction sites have been summarised in the following table 1:

Table 1: Nature & Severity of Health Risks

Health Risks	Nature And Severity
Burns	Burns usually affect skin. Any part of the body can also be burned. For someone to sustain >40% total body surface, will lead to death despite available treatment. (Vidal-Trecan et al., 2000; Kingu, 2010) Refer to Figure 5 for an example of hot bitumen burns.
Central Nervous System (CNS)	Central Nervous System means brain spinal column and nerves. Severity depends on part affected and what is its function. The brain controls breathing, heart rate, muscular movements and hormone production. So damage of particular part of the brain may have serious consequences. (Bolla,1991; Kingu, 2013)
Dust inhalation	Depending on how much dust is inhaled will affect gaseous exchange which occurs in our lungs. If the dust overwhelms the lung capacity, the consequence is death by asphyxia. (Kingu, 2013; Breum et al., 2003)
Electrocution	Can cause spine Injuries. The person may have internal injuries especially if he or she is experiencing any shortness of breath, chest pain, or abdominal pain. Cardiac arrest can also occur. (Al- Humaidi et al.,2009; Bailey et al., 2001; Greening, 1997)
Exposure to hazardous chemical substances	For example asbestos. This can cause injury or disease depending on the doses inhaled or ingested. (Gamo and Ohnoa, 1998)
Fatalities	Loss of life, rated as catastrophic in nature. For example, a death occurring as a result of collapsed beam from a building. Causes of fatalities also include electrocution, plant or vehicle operation accidents (Janicak, 2008; Beavers et al., 2006).
Fatigue/exhaustion	Can cause the operator to fall off the machine and be injured. Lack of sleep may lead to collapse from exhaustion (Winwood et al., 2005).
Musculoskeletal injuries	Injuries include muscle strains to the neck, back, shoulders, or legs, Tendinitis, Carpal Tunnel Syndrome (CTS) which is pressure from a nerve in the wrist, resulting in numbness, tingling, pain, or weakness in the hand, wrist, or fore-arm (BC Work Safe, 2008, Podniece, 2008). Figure 6 illustrates a construction worker fractured arm.
Noise induced hearing loss	Can cause permanent deafness due to noise exposure (Picard et al., 2008).
Respiratory System	Chronic obstructive pulmonary disease (COPD) and asthma and silicosis can be caused by the inhalation of particles and harmful chemicals. COPD can lead to death (Paoletti et al, 2009).
Sunburn/sunstroke/dehydration	Sunburn can cause skin cancer (Diffey and Norridge, 2009). Sunstroke can lead to a heart attack or even death. Dehydration can cause, for example a worker to faint and fall off a plant therefore causing an accident (Kingu, 2013).
Whole body (WBV) or Hand Arm Vibration (HAV) Hazards	Severe health effects from WBV include damaged spine, lumber scoliosis and disc disease. HBV effects can result in vascular and neurological diseases. (Best Practice –Vibration at the Work Site, 2010).

Figure 5: Hot Bitumen Burns (Source: Weir et al., 2006)

Figure 6: Musculoskeletal Injury (Source: Wook, 2012)

2.5.2 Nature and Severity of Safety Risks

Edwards and Holt (2010) stressed the importance of using a system model that viewed accidents as by-products of a production system. These accidents initiated from pre-construction stages which led to a proximal factor[1] occurring during construction which then results in an accident. Proximal factors were elements which lead to the accident in question. The proximate factors do not necessarily cause the accidents but were the immediate cause for a certain result before the accident occurs. This model is mainly useful in relation to the use of construction plant and equipment (Manu, et al., 2012; Manu, et al., 2010). According to Edwards and Holt (2010) the following safety related risks could arise from the operation of plant and equipment.

[1] Unfortunate event before the occurrence of an accident

Table 2: Nature and Severity of Safety Risks

Number	Safety Risks	Nature And Severity
1	Mechanical	Accidents occur from moving parts; this includes hazards of being struck by a mechanical component of a plant. An example of a mechanical accident is a construction site worker being hit by a moving excavator bucket and becoming injured or dying.
2	Machine instability	Hazards such as rollovers and turnovers of construction plant which are often related to the handling of operation, site topography, and machine configuration including the size, weight or position of the machine attachment. An example is a front end loader rolling over to its side or ending in a ditch or marshy area, injuring the operator.
3	Operator’s station – falls, trips or slips	Operator’s station accidents of this category include falls, strips or slips of the operator from machine, usually caused by objects entering into the operator’s station. The operator and ground workers risk being injured.
4	Failure of control systems	Include improper design of control system in relation to the operator of the plant, including the operator’s visibility and awareness. An example of an accident occurring is a construction site worker being struck as a result of the plant operator’s inadequate visibility.
5	Power transmission source	Failure of power transmission or error can cause hazards in the movement of retrievals or towing or moving material. For example moving material can fall from the plant component and injure a general worker.
6	Other accidents and hazard events	These include: the operator falling from the machine, objects falling into the machine, accidents occurring from the use of attachments and inadequate lifting equipment. The latter two hazards also pose a danger to the construction site pedestrians.

2.6 Proper H&S Risk Management Processes for contractors

2.6.1 Risk Management

Understanding and managing risks in such a versatile industry as construction could be a challenging task considering the H&S issues that could arise in poorly managed construction sites (Zou, Zhang and Wang, 2007). Risk management is defined as a system which aims to identify and quantify all risks to which a business or a project is exposed. Risk management aimed to make well informed decisions to manage or mitigate the risks. (Flanagan and Norman, 1993)

Since risks cannot be eliminated, the success of a project depended on how they were managed. The risk management process involves identifying what could go wrong with regards to project goals and what can be done to prevent this. Risks have a direct impact on the construction project objects therefore, it is important to ensure mitigation of hazard exposures (Zou, Zhang and Wang, 2007). H&S risks therefore needed to be managed in construction projects.

According to Kartam and Kartam, 2001, the process of risk management methods included: risk retention, transfer, mitigation and prevention of risks. A combination of methods can be utilised to manage risks. These risks included those associated with H&S aspects with regard to the use of construction plant and equipment.

2.6.1.1 Risk Management and Road Construction

Road construction work is considered versatile and activities involved certain aspects of risks causing accidents and fatalities (Du Plessis and Siebrits, 2013; Sawacha, Naoum and Fong, 1999). Considering the rate of plant and equipment related H&S risks, it is important for the construction contractor to ensure appropriate decisions are made to reduce H&S risks on road construction sites. Plant and equipment H&S practices could be applied in terms of risk management to ensure appropriate decisions are made with regard to aspects such as plant selection, operator certification, risk assessment and machine maintenance (Riaz, et al., 2011; Gherardi et al., 1998; South Africa, 1993). A study conducted in the United Kingdom developed a H&S data flow diagram to assist in the risk management with regard to plant and equipment used to reduce hazard exposures. It was discovered that unsafe practices relative to management of construction plant and equipment included aspects of the plant itself. This was coupled with management processes and operator competence. The same study concluded that decisions to reduce H&S risks could therefore be made according to a data flow diagram (Riaz, et al., 2011). Riaz, Edwards, Holt, and Thorpe, (2011) identified that construction activity risks could be assessed as part of the H&S process. Risk assessment of plant and equipment formed part of this process. People at risk as well as reliability needed to be considered. Logistics with regard to plant distribution as well as people exposed to construction activities were completed. Routine checks including machinery's life span were also taken into account (Geminiani, Smallwood and Fee, 2012; Riaz, et al., 2011). This qualitative data flow system ensured that plant and equipment H&S hazards were minimised (Riaz, et al., 2011).

2.6.2 H&S Management Structural Hierarchy

Physical process is the key component when it comes to Risk Management (Rasmussen, 1997). In a socio-technical system, human injuries, environmental pollution and financial misfortunes occurred because of the loss of control in this key component of physical processes. H&S risks occurred due to the pressure of the environment and depended on the work processes (Qureshi, 2007). Therefore, risk management was situated in a socio-technical system which included different hierarchy levels as illustrated in Figure 8, namely:

- Level 1 being the government which through legislation monitored and controlled H&S practices in the society. South African road construction industry was monitored using government legislation, OHSA of 1993.
- Level 2 included the regulators and associations which implemented legislation in their respective fields. Parts of these regulations have to do with H&S. The South African local government authorities such as H&S inspectors were in charge of ensuring H&S legislation was implemented on construction sites. (Geminiani, Smallwood and Fee, 2012; South Africa, 1993)
- Level 3 being the company's activities, this includes the way in which it managed and carried out H&S items. Road construction industry including companies, differ in nature and had their own H&S activity management system (Du Plessis and Siebrits, 2013).
- Level 4 being the particular management team of the company involved in task. Each management team in charge of different aspects on a road construction site, for example, H&S team training. According to the OHSA (1993), the contractors were to ensure all H&S systems are in place to ensure a safe work environment.
- Level 5 are the activities carried out by the individual staff and their interactions with technology and process such construction plant and equipment operators. Construction activities were to be carried out safely according to instructions issued by the site supervisor, in conjunction with H&S representative instructions (South Africa, 1993).
- Level 6 describes the application of engineering disciplines involved in designing of potentially hazardous or dangerous equipment and process control operating procedures. Education and training with regard to H&S and other engineering technical skills are applied in this stage (Riaz, et al., 2011; South Africa, 1993).

According to Rasmussen (1997) supported by Qureshi (2007), the management and organisation decisions were important for H&S within a socio-technical system. These decisions trickle down to Level 6 as shown in figure 8, where operations are carried out. A closed system exists in which the lower levels also send information to the upper levels. Disruptive, powerful and changing external factors can influence the socio-technical systems, as shown figure 7. Therefore H&S aspects are encouraged to be implemented at all levels of the Hierarchical model, especially when these levels are in constantly changing environments. Coordination and communications between the levels is then imperative.

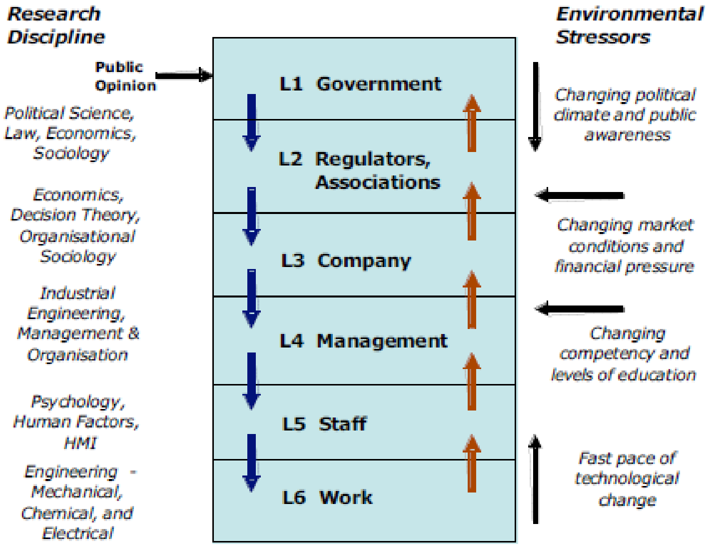

Figure 7: Hierarchical model of socio-technical system (Source: Rasmussen 1997)

The nature and severity of H&S hazard exposures in road construction are considered high. That made it paramount for appropriate risk management methods to be employed to mitigate or prevent the H&S risks. According to Qureshi (2007), high risk technical systems have developed as a result of advances in technology. These highly technical systems exist in a risky environment given that there are political pressures, legislation and the increasing social awareness of H&S (Edwards and Holt, 2007). Rasmussen (1997), argued that current accident causation models were inadequate to measure risks involved in a highly adaptable socio-technical system. Theoretical concepts as well as frameworks for modelling the organisational, management and operational structures are believed to be the basis of accidents prevention. There are two parts of risk management identified by Rasmussen (1997), namely structure and dynamics.

Tummala and Leung (1996) and Tummala et al. (1993), established that in the quest in ensuring project success, the core missions of the Mass Transit Railway Corporation (MTRC) in Hong Kong were health, safety, reliability, time and budget and environmental aspects. A systematic approach consisting of five core elements was necessary, namely:

- Risk or Hazard identification;
- System hazard Analysis;
- Development of action plans;
- Risk evaluation; and
- Risk control and Monitoring.

This systematic approach begins by identifying the potential factors that causes risks including their severity and corresponding consequences (Tummala and Leung, 1996). As the saying goes, a problem well identified is a problem that is half-solved (Luu et al., 2009). This systematic approach is shown in figure 9 where, the risk management process (RMP) is completed in order to evaluate risks as well as monitor them. Plant and equipment associated risks are included in this model in the selection of the best course of action with regards to managing risks (Tummala and Leung, 1996; Commonwealth of Australia, 2005; PMBOK, 2004).

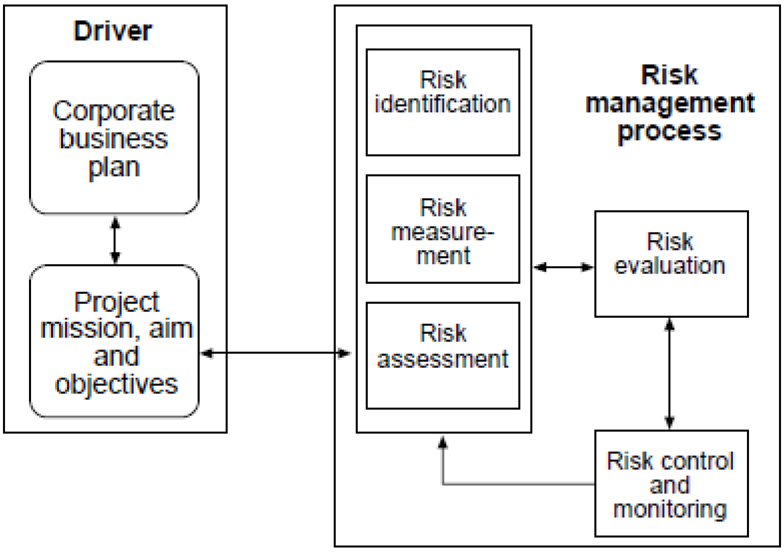

Figure 8: Risk Management Process (RMP) (Source: Tummala and Leung, 1996)

The Risk Management Process (RMP) had also been developed as a qualitative method of risk identification and assessing hazards. The Risk Management Process is similar to the risk management model with regard to hazard identification and discovering all the risks that affect the project including their nature and severity. However the RMP goes beyond the risk management process by ensuring the best course of action. Also it's the preferred method to be used with regards to assessing H&S hazards. This is because H&S risks are intangible and objective information is unavailable. (Tummala and Leung, 1996). Figure 9 shows the project objective of safety and reliability. Under the System hazard analysis, the severity of the hazard is determined, thereafter the hazard probability, followed by assessing acceptability criteria, ranking of hazards and finally the development of action plans.

The road construction industry is complex and dynamic in nature (Tummala et al., 1997). The industry therefore needs to achieve the most suitable plant and equipment for a required job. This can be extremely tasking. More especially because the construction industry as a whole changes daily (Jorgensen, 2013; Alkass, et al., 1988).Tummala et al., (1997). The RMP can therefore be used to evaluate risks in terms of the use of plant and equipment. Decisions such as to owning or hiring can be determined with regards to machinery can be made.

With the road construction industry dynamic nature, information with regard to the site is seldom available (Tummala and Leung, 1996). This is because landscapes and climates are ever changing. It then becomes important to implement an appropriate risk management procedure to achieve project success. Figure 9 illustrate the RMP whereby plant and equipment associated risks can be identified, measured, assessed and controlled. This then assists in the construction business in meeting its mission, aims and project objectives.

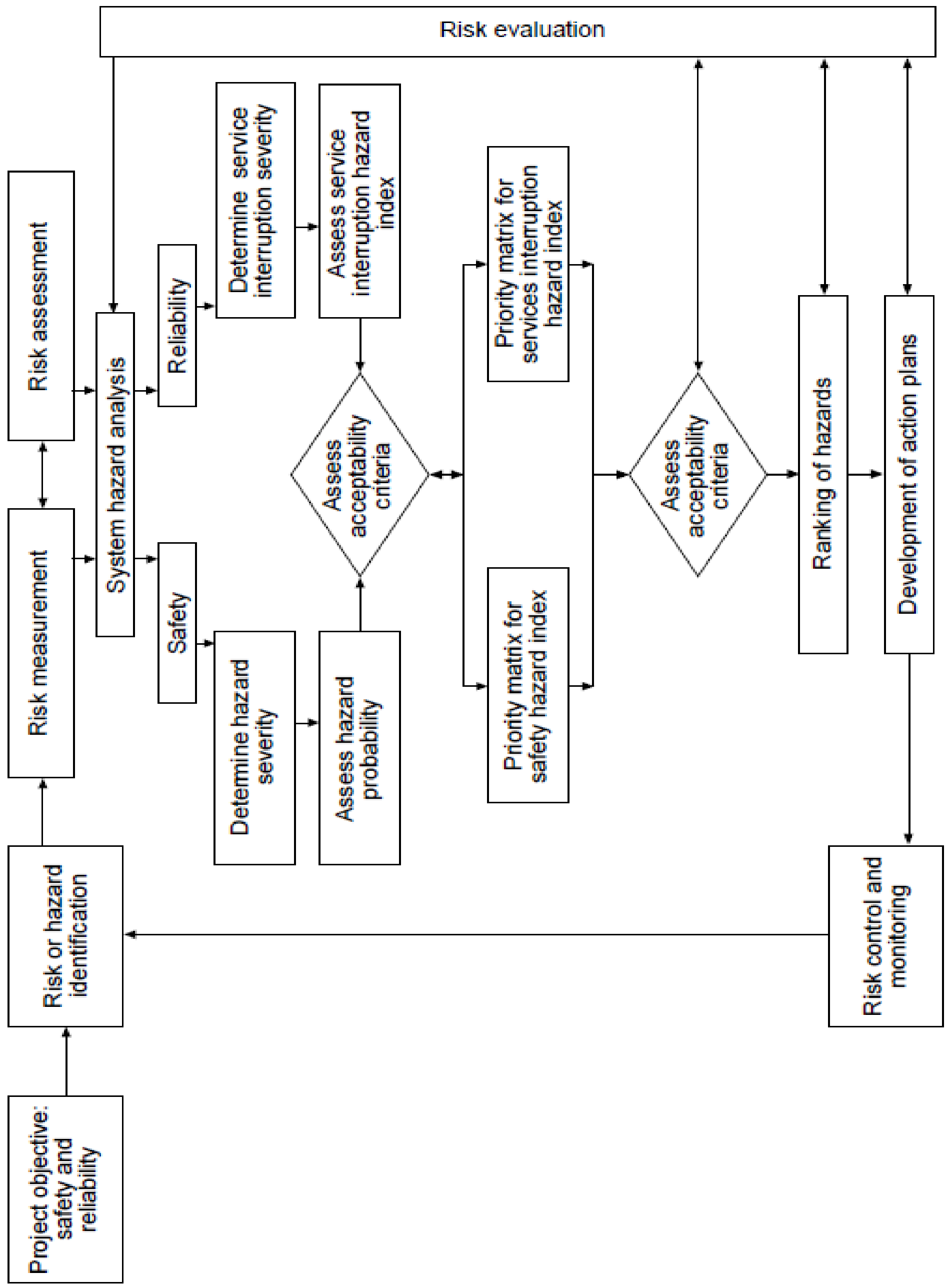

Figure 9: The Risk Management Model (Source: Tummala and Leung, 1996)

2.6.3 Consequence/Impact matrix: Likelihood and Probability

The probability score of a certain hazard occurring can be plotted on an axis, which is usually the vertical axis. The severity of the consequences or impacts is usually on the horizontal axis. As illustrated in Figure 11, the likelihood of a factor occurring ranges from low to high and so do the consequences. According to Deacon, Smallwood and Haupt (2004), depending on the score of a chosen risk, a 1 would mean no intervention, score 2 would require the mitigating the risk by using safe work procedures, score 3 would require the risk to be eliminated, contained or substituted. Score 4 represents a risk to be eliminated, substituted or at least containment, for example working with asbestos; and Score 6 would require elimination at least substitution. Score 9 would require elimination, for example a decision to use a unmaintained or faulty plant such as an excavator. The severity and the likelihood of an accident can be high. (Deacon, Smallwood and Haupt, 2004; Isaac, 1995) In assessing the likelihood and impact of risks, Issac (1995) suggests that the likelihood of risks to be assessed first before the assessment of their consequences or impacts.

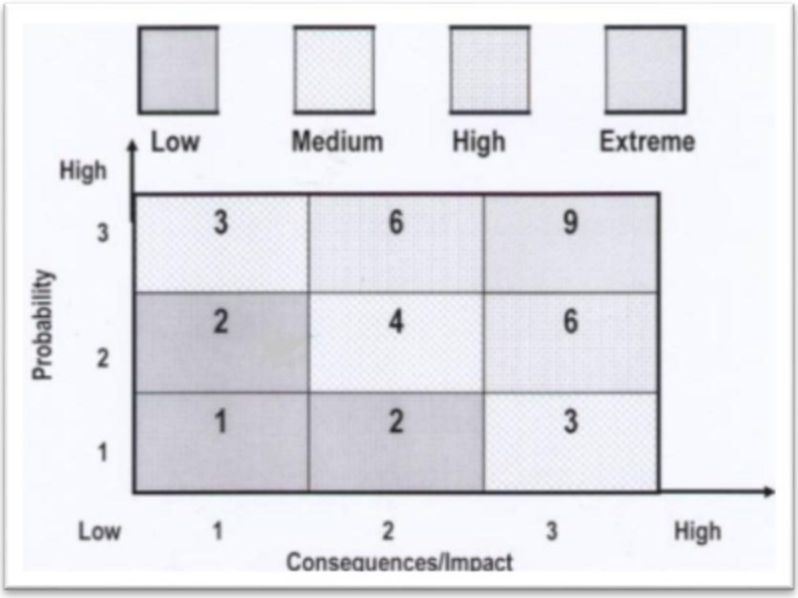

Figure 10: Consequence/Impact matrix (Source: Burke, 2003)

2.6.4 Risk Calculations

Other methods used to quantify risks include the Kinney method. In this method, the severity of an injury and the exposure to the injury are linked to a hazard. The probability of the hazard occurring when exposed is also linked to the hazard. The Kinney method is a universally acceptable numeral method used to calculate risk. (Babut et al., 2011) Steps in calculating risk include determining the severity of an injury by firstly identifying the hazard, then by imagining the accident scenarios to determine the injuries to which the accident leads and finally determining the severity of the injury. Tables are used for risk assessments. The next stage involved determining the probability of the injury: The last stage involves determining the risk by combining Severity and Probability for each scenario and severity. The highest risk found is the risk of the product. This is also known as a Sensitivity Analysis. (Babut et al., 2011) The Kinney method and the sensitivity analysis (Taylor, 2009) can both are used to quantify risk to enable a clear decision of managing and monitoring risks with regard to plant and equipment.

The risk quantification process includes both qualitative and quantitative risk assessment approaches. Plant and equipment associated risks are considered to be high due to their nature; and therefore require a quantitative risk assessment approach. The likelihood and consequences of an action associated with the use of plant and equipment can be determined by using a Consequence/Impact matrix (Luu et al., 2009).

2.7 Quantification of Risks and Consequences of Exposures

The Risk Management process can involve qualitative or quantitative risk assessments. Risk qualification has been explained as the process whereby risks are identified as well as hazards assessed (Tummala and Leung, 1996; Issac, 1995). However, risk quantification involves the determination of the likelihood and consequence of a particular action (Commonwealth of Australia, 2005). Quantitative methods are more specifically employed when:

- There are several risk reduction options were available and their effectiveness is questionable.
- Risk is escalated when plant and equipment spacing is involved;
- Novel technology is involved, resulting to a perceived high level of risk, especially when historical data is unavailable;
- A demonstration of risk levels is required to ensure more consciousness of risks involved in that specific environment; and
- A demonstration was required within the company and stakeholders to show that risks are as low as reasonably practicable.

With regard to construction plant and equipment there are numerous risk reduction options available, such as risk elimination and risk substitution. With the increased employment of hydraulic machine technology, high risks are inevitable more especially when there is little historical information available (Edwards and Nicholas, 2002; Alkass et al., 1988). Demonstrations of risk levels and ways to ensure that these risks are reasonable low are applicable when it comes to the supply, hire and use of plant and equipment. This is because the selection of plant and equipment requires detailed planning including a good judgment of H&S risks. A quantitative risk assessment may be employed when it comes to demonstrating risks to the management team and construction project stakeholders. (Alkass et al., 1988). Therefore based on the risk quantification, a decision can be sought at any phase of the construction process whether to amend the decision or goal, leave or remain unchanged with regards to plant and equipment use.

2.8 The Extent of H&S Training and Management on Road Construction Sites

The construction industry is facing a great challenge in attracting and retaining skilled persons (Kashiwagi and Massner, 2005). Contractors are expected to produce high quality infrastructural outputs with limited labour and with the majority of workers being unskilled (Weeks, 2011). The image of the construction industry has been tarnished by the accidents, unhealthy, unsafe, physically challenging and dangerous environment (Jorgensen, 2013; Lingard and Rowlinson, 2005). In a study conducted by Haslam, et al., (2005) regarding the contributing factors in construction accidents, it was found that this is due to lack and inadequacy of H&S training and education. It was further discovered that *training* is more context specific that gives an individual directive instruction of how to perform a task while *education* equips individuals to analyse a specific situation and respond. A combination of H&S training and education is therefore important to achieve a desirable H&S standard on construction sites.

2.8.1 H&S Training Courses

In respect to H&S training and development a number of courses are available in South Africa. These include: SAMTRAC, NEBOSH, Working at heights, First Aid, Fire Fighting and SHE Legislation. The majority of these training programmes are provided by NOSA. Knowledge and skills are provided in identifying and managing health, safety and environmental risks. NQF Level 2 communication and mathematical literacy programmes are required before enrolling fort any NOSA Training programmes. NOSA is accredited by the Health and Welfare SETA. Other H&S courses include: Safety, Health and Environment Management Training Course – SAMTRAC, NEBOSH, Working at Heights Course, First Aid and Firefighting; and Advanced She Legislation Courses, such as the study of the Compensation for Occupational Injuries and Diseases Act No 130 of 1993 (COID Act) (NOSA, 2011).

2.8.2 Current Dynamics of Construction Industry Labour Market

According to Weeks (2011), women in construction in developing countries compared to men tend to being unskilled occupations. The construction industry is faced with unskilled persons entering the paid labour force. Workers are forced to adapt to the usually unsafe construction working environment (Smallwood and Haupt, 2005). H&S challenges faced as women in the construction industry may also contribute to the shortage of skills.

With the current construction H&S records, it not surprising that there is a decrease in the number of new entrants into the construction industry. The results obtained from a survey of high school student conducted by the National Business Employment Weekly (Liska, 2000) found that construction work as career was ranked 248 out of 250 careers. Insurance actuary was ranked 249 and migrant worker at 250. Furthermore the image of the construction industry has been influenced by the staggering H&S records (Smallwood and Haupt, 2005). This makes the construction industry unattractive to join despite improvements to technology (Liska, 2000). However, the South African government, taking this into consideration had expressed new interest and concern for H&S by placing more emphasis on H&S Acts and Regulations. The amended OHSA has inserted a new clause required that clients play and important role with regard to the allocation of sufficient funding towards H&S (Huang and Hinze, 2006).

Furthermore for persons to perform their duties as H&S or H&S representatives, they must be qualified and registered under the relevant H&S councils. This ensures that persons involved with H&S on construction sites are adequately trained and knowledgeable in that discipline.

2.9 Summary

An increased demand for infrastructural development has resulted in the increased use of plant and equipment. This increase in mechanisation has brought to the forefront the risks that are associated with plant and equipment, thus necessitating the need for an evaluation of H&S practices in infrastructural development.

This chapter elaborated on the H&S risks with regard to construction plant and equipment, contactors need to be in H&S compliance, including H&S legislation associated with plant and equipment. The nature and severity of plant and equipment hazards and accidents made it essential to mitigate these hazard exposures by employing a risk management process. The extent of H&S training and management on road construction sites was also discussed. The following chapters include the Research Methodology used to conduct the study.

CHAPTER 3 – RESEARCH METHODOLOGY

3.1 Introduction

The research process involved:

"a systematic process of collecting, analysing, and interpreting information (data) in order to increase understanding" (Leedy and Ormrod, 2005:2)

The research process is a formal way of solving problems with the objective of enhancing knowledge within the broader community. Sharp, Peter and Howard (2006) stated that research also included the addition to the body of knowledge, which was done by the discovery of insights. According to Grobbelaar, (2000), there are two types of research, namely a *basic research* and *applied research.*

Basic research serves to expand on fundamental knowledge. It is also known as "academic research" or "pure research". On the other hand, applied research is problem based and aims to solve a particular practical social problem. Exploratory, descriptive as well as explanatory research form part of basic research. Basic research aims at eithers support or rejecting theories, *interpreting* changes in a community and explaining *social relationships.* This is done to enhance previous knowledge as mentioned above.

Among other research types, applied research includes the following:

- *Action research* - whereby the people being studied take part in the research.
- *Social- impact assessment* – which forms part of a larger study environment. It also evaluates consequences of a planned social change.
- *Evaluation research* – is used over a wide range of issues and used to solve the issue at hand.

Social scientific research is based on two approaches, namely: *Quantitative* and *Qualitative* approaches (Welman, Kruger and Mitchell, 2005; Leedy and Ormrod, 2005). According to Mouton and Marais (1989:1), supported by Grobbelaar, (2000:87), quantitative approaches is defined as:

"…the approach used by researchers in the social sciences that is more formalised in nature as well as explicitly controlled, with a more carefully defined scope, and that is relatively close to the approach used by researchers in the natural sciences"

Quantitative approaches are more defined and structured. The scope of quantitative research is more controlled in nature and more universal. However, qualitative approach is defined (Ibid) as:

"…that approach in which the procedures are formalised and explicated in a not so strict manner, but in which the scope is less defined in nature and in which the researcher does his or her investigation in a more philosophical manner"

Unlike quantitative approaches which are more structured, qualitative approaches are a less *strict* and have a *less defined* nature. The following paragraphs explore the differences qualitative and qualitative approaches.

3.1.1Quatitative and Qualitative Approaches

The Quantitative approach stemmed from the positivist view based on a philosophical approach, it is also known as logical positivism. Under this approach, research must be limited to what was observed and can be objectively measured. However, qualitative research stemmed from the anti-positive approach (Welman, Kruger and Mitchell, 2005). Anti-positivists argued that although an objective approach could be used to study physical events, this cannot be applied to the study of human behaviour (Leedy and Ormrod, 2005).

Differences between quantitative approach and qualitative approaches included the following:

- Qualitative approaches looked at the data which could not be measured or quantified. Quantitative approaches sought the emphasis on the measurement and analysis between relationships, an investigation of processes did not occur in this approach (Welman, Kruger and Mitchell, 2005; Collins, 2000; Casley and Kumar, 1988).
- Qualitative research evaluates subjective data consisting of what is produced by the minds of the respondents. Subjective data is presented in a language format in context of the respondent's environment, as opposed to number format found in objective data (Walliman and Baiche, 2003). Quantitative research evaluates objective data which consists of numbers (Welman, Kruger and Mitchell, 2005; Leedy and Ormrod, 2005; Collins, 2000).
- Complex structured methods are used in analysing quantitative data. This is used to either confirm or disprove hypotheses. It gives less room for bias in the results. However, in qualitative research, the analysis of data collected is more progressive and is more flexible and exploratory. This assists the researcher in obtaining a deeper understanding of the research subject (Welman, Kruger and Mitchell, 2005; Collins, 2000).
- Qualitative research seeks to understand the research from an insider's point of view by being involved subjectively while in quantitative research the investigation process is carried out from an outsider's perspective, whereby the research process is objective and detached (Welman, Kruger and Mitchell, 2000; Collins, 2000).

- Quantitative researchers keeps the research process as stable as possible while the qualitative approach is more dynamic and changeable (Welman, Kruger and Mitchell, 2000; Collins, 2000).
- In quantitative research, the investigation and the structure of the research are controlled. The approach can be described as particularistic. Whilst in qualitative research, a holistic approach is adapted. Examples of these include observations, interviews and case studies (Welman, Kruger and Mitchell, 2005; Collins, 2000).
- According to Stainback and Stainback (1984) (cited by Welman, Kruger and Mitchell, 2000), both qualitative and quantitative research aims to provide valuable and valid results. While quantitative data focuses on reliability, qualitative data focuses on the validity of the investigation (*Ibid.)*.
- Larger numbers of cases are obtained in quantitative research. The analysis of the research is usually based on statistical importance. Qualitative research usually focusses on small sample sizes (Welman, Kruger and Mitchell, 2000).

3.1.2 Triangulation

The process of triangulation research is where both qualitative and quantitative approaches are employed. This is also known as the multiple method approach. Researchers have found that although quantitative and qualitative methods differed, they complemented each other. The process of triangulation involved various measuring instruments for collecting data. These included direct observations, interviews and content analysis. These techniques were used to measure the same variables and should yield identical results (Collins, 2000).

3.1.3 Quantitative Methods

According to Grobbelaar (2000) quantitative approaches are more structured and controlled in nature. The sample of the study is usually accurately defined and more specific, as opposed to random sampling in qualitative approaches. The scope of quantitative method is considered universal. The method of collecting quantitative data is usually by means of a questionnaire. With this approach the following can be noted (*Ibid.)*:

- Quantitative methods ensure that the social and natural were studied in the same manner
- Scientific knowledge was captured was factually based from what was observed
- The knowledge gained from a quantitative research process is considered to be value-free

- Measuring instruments are employed for the conceptualisation of concepts.
- Data collection techniques in quantitative research include structured questionnaires and schedules
  Simple cross-tabulation analysis techniques, as well as complex analysis techniques can be used to analyse the data collected.

3.1.4 Types of Qualitative Methods

Various qualitative approaches were available with regards to conducting research. Commonly used approaches included participant observations, in-depth interviews, focus groups and case studies. Each method could have been adopted to obtain a specific type of data.

- *Observations* – this involved the capturing of data of behaviours occurring in their natural environments. There were two types of observations, namely participant and non-participant observations (Welman, Kruger and Mitchell, 2005).
- *Interviews* – this included the collection of information by means of the individual's personal histories, experiences as well as perceptions. Interviews were conducted in cases where the matter investigated was sensitive in nature. Qualitative interviews could be informal, conversational, topic-focused or semi-structured (Casley and Kumar, 1988).
- *Focus groups* – this method was usually employed whereby the data being collected was prominent to a specific group of people, for example, broad overviews of cultural groups or subgroups (Welman, Kruger and Mitchell, 2005).
- *Case studies* – were types of qualitative research applied when there was a limited number of units for analysis, for example, if only one unit is available for study (Welman, Kruger and Mitchell, 2005).

3.2 Qualitative Research Methodology

The researcher opted to use the qualitative research approach for the following reasons:

- Road construction had a diverse and ever-changing environment where contractors moved from one site to another. The construction project was unpredictable. Road construction site projects in the KwaZulu-Natal region are considered rare therefore finding a site which met the researcher's criteria was a challenge. The strict requirements of the quantitative approach could not have been employed given the limited number of available road construction sites as well as the nature of road construction environment.
- The nature of the study, being on H&S, was considered subjective as opposed to the objective nature of a quantitative research approach. Considering the changeability of

road construction projects, qualitative methods were used as they catered for a more dynamic and changeable environment.

- The researcher aimed at identifying H&S risks associated with plant and equipment, and understanding the nature and severity of H&S risks on road construction sites. The researcher opted to use observations as well as interviews.
- Considering the complex nature and diversity of road construction sites, a qualitative approach was chosen.
- The researcher could have opted for triangulation whereby both qualitative and qualitative methods would have been used, however, considering the limited sample (twelve sites) available for the study, a qualitative methodology was chosen. This was because quantitative methods generally required a large sample size.

The researcher used both observations and interviews. The main source of data was structured interviews. Observations were conducted to validate the participants' responses to the interview questions.

3.2.1 Interviews

3.2.1.1 Interview Design

Interviews are a data collection method that made use of the personal contact with the participant or interviewee. There were structured, unstructured interviews, in-depth interviews as well as focus group interviews.

- *Structured interviews* involved specific questions asked and were similar to those used in a questionnaire. Structured interviews generally contain closed questions. (Du Plooy, 2000).
- *Unstructured interviews* were usually used in an explorative research. This was done usually to identify important variables, or generate hypotheses for further investigations. Unstructured interviews generally contain open ended questions. (Welman, Kruger and Mitchell, 2005).
- *Semi-structured interviews* resembled the structured interviews but some of the questions were open-ended to encourage the respondents to express themselves (Casley and Kumar, 1988).
- *In-depth interviews* differed from face to face interviews because the main aim was to obtain in-depth information. (Du Plooy, 2000) The interviewer does not have a predetermined set of questions although the researcher had to have clear aspects to be explored (Welman, Kruger and Mitchell, 2005).

- *Focus Group interviews* were also known as group interviews (Du Plooy, 2000). A group of individuals are brought together to express their views on a specific set of questions. (Welman, Kruger and Mitchell, 2005; Mertens, 2009; Du Plooy, 2000; Leedy and Ormrod, 2005).

a) Interview Schedule

Interview schedules are used when conducting for structured interviews. The interviewer compiles a set of questions based on a questionnaire which has been previously compiled. The interviewer is restricted to that set of questions and does not deviate from them. Questions from the interview schedule are read and the responses are recorded. Answers are usually pre-coded. Furthermore the interviewer is encouraged to ensure that questions are asked in the same voice tone to decrease the chances of biasness. (Welman, Kruger and Mitchell, 2005)

b) Telephonic interviews

According to Du Plooy, (2000), telephone interviews advantage includes:

- No expenditure in terms of travels, accommodation. There are however telephone charges.
- Data is obtained quickly
- Respondents do not have time to rethink their answers therefore more accurate answers are obtained.
- If required, interviewers can be monitored; this is often easier than when interviews are conducted face to face.

c) Limitations of telephone interviews

Bias is a problem with regard to telephonic interviews. Biasness can occur when the interviewer holds a bias opinion towards the interviewee because of the respondent's demographics, for example gender, age or race. (Du Plooy, 2000)

3.2.1.2 Types of Interview Questions

There are several types of interview questions, namely, closed open-ended questions. Closed questions tend to have a fixed number of answers. These types of questions are mainly used when conducting telephonic interviews, when the respondents do not have the questions printed in front of them. Closed questions do not usually have a long list of options. On the other hand, open-ended questions encourage respondents to express their feelings, attitudes and sentiments. (Welman, Kruger and Mitchell, 2005; Du Plooy, 2000)

3.2.1.3 Strengths and Limitations of Interviews

According to Du Plooy, (2000), interviews are considered to be an interaction between people. Therefore, interviews and interpersonal communications are considered similar. However, there are both advantages and disadvantages to conducting interviews. Interviews enjoyed the following advantages.

- More information was obtained due to interviews being more flexible.
- Unclear questions could be clarified because interviews were a two way communication.
- Additional information could be obtained.
- The interviewer and the interviewee could establish a personal relationship, which assisted the interviewer in gathering further information at a later date.
- Non-verbal communication could be noted and observed.

Interviews suffer from the following disadvantages or limitations due to bias (Du Plooy, 2000):

- Bias can occur due to demographics, this where the interviewer affects the participant's answers due to demographic factors. The interviewee could respond differently to the interviewer's questions depending on their (interviewer's) race, gender or age.
- There could be also biasness on the interviewer's responses to the interviewee's answers, for example the interviewer shaking or nodding their head.

For the purposes of the research, structured interviews were conducted. The interview schedule contained both closed and open-ended questions which assisted the respondents to express their opinions. An interview schedule was used as a form of data collection. The interview schedule were sent to participants who requested them so that they could familiarise themselves with the questions. The respondents had the option of filling out the interview schedule or being interviewed.

Structured interviews were used because of the nature of the study being H&S, which was considered very sensitive in nature. An interview schedule was used to ask a standard set of questions. The interviewer. Open ended questions allowed the participant to express their feelings and opinions freely without being limited to a predetermined response. The participants were encouraged to elaborate through the use of open-ended questions. This assisted in providing a deeper understanding of the H&S aspects on site as well as H&S issues associated with plant and equipment use on road construction sites. The interview schedule contained five main sections namely; General; Risk and Risk Management; Compliance; Training; Exposure to H&S risks; and Mitigation and Prevention of H&S risks.

3.2.2 Observation Study

3.2.2.1 Types of Observation Studies

Types of observation studies depend on the researcher's participation level. There are two types of observations namely participant and non-participant observations. Participant observation occurred when the researcher were involved with the group being observed. If the researcher, for example, in a group that was being observed attended the social activities with the group being observed, the researcher had become a participant. Therefore, the researcher was performed a *participant observation*. If, on the other hand, the researcher just recorded what was being observed, then *non-participant observation* has been conducted. In a non-participant observation, the group being observed might or might not know that they were being observed (Welman, Kruger and Mitchell, 2005; Du Plooy, 2000).

3.2.2.2 Reactive versus nonreactive observations

Observations can also be classified as either reactive or nonreactive. Reactive observations influenced the behaviour of the participants while non-reactive observations did not. Reactive observations therefore affect the reliability of the observation study, more especially if the participants knew that they were being observed. Non-reactive observations are also known as non-participant observation since the researcher did not participate in the activities of the group. This however could still have affected the participants' behaviour, regardless of the researcher's passivity. This possible influence was because the observer intervened in the participant's privacy. However observations, whereby the participant did not know about the observer are known as *unobtrusive* observations. Unobtrusive observations are considered to be more objective since the group knew the observer was present but did not know why. The researcher was also distant from the participants or groups and unresponsive to interactions within the group.
In terms of the observation conducted, the researcher opted to conduct a non-participant observation study as opposed to a participant observation. The researcher was not involved in the daily activities of the site. However, participants were informed about the researcher conducting the study as well as the nature of the study.

The observer intervened in the participants' privacy and this influenced their behaviour. Therefore, a reactive observation was conducted. Although a passive role was played by the observer making no attempts to manipulate the situation, as well as by the researcher adopting a distant approach towards participants, an unobtrusive observation did not occur. Perhaps because of the gender of the researcher and the nature of the study, the participants seemed to be extra cautious with regard to the researcher being on site. This occurred more specifically with regard to issues involving H&S. This caused the participants to be reactive to the observer.

3.2.3 Observation Design

Non- verbal recordings of occurrences on site were captured by observations conducted. This allows the researcher to gather information about the site without asking direct questions. Informal talks with plant operators regarding during their lunch breaks provided an in-depth understanding of the nature of H&S hazards faced during plant operation. Information obtained from speaking to operators became supplementary to the information obtained from interviews. This passive role facilitated data being collected more easily and directly.
Observations were carried out using the following criteria. Please see Appendix C for more detailed observation spread sheet:

- H&S Hazards associated with plant and equipment on sites
- Contractors regarding or disregard accidents and injuries associated with plant and equipment on sites.
- Accident investigation procedures.
- H&S Risk Management implemented on sites.
- Implementation of H&S regulations on site.
- H&S training and management talks conducted on site. For example, toolbox talks.
- Steps taken to prevent or mitigate H&S hazards
- Other observations associated with plant and equipment H&S.

3.2.3.1 Observer Bias

Observation studies were not error free. Shortfalls could occur if the observer recorded events subjectively. Errors could also occur if the observer did not record every detail that described the object or situation observed (US Food and Drug Administration, 2005). In this study, observer bias was reduced by ensuring that details were recorded as accurately as possible. The researcher used a note book and camera when observing the participants. The note book and camera recorded and stored the details of the sites observed. Particular sites were visited more than once to ensure all details were recorded as well as to obtain a better understanding of the conditions of the sites.

3.4 Population and Sampling

3.4.1 Population

The population is regarded as:

"*The study of the object consisting of individuals, groups, organisations, human products and events or the conditions to which they are exposed*" (Welman, Kruger and Mitchell, 2009:52**).** Welman, Kruger and Mitchell, (2009) also state that the unit of analysis, is used to determine the research conclusions. Units of analysis include the: individual persons, groups, organisations or institutions, human products or events (Van Rensburg, 2000).

3.4.2 Sample

According to Van Rensburg, (2000:149) a sample "*is a part of a whole"* it forms a portion of the population. To understand a population, a sample is studied. Sampling, however distinguishes between probability samples and non-probability samples *(Ibid).* Probability samples can determine the probability of an element being included in the sample or not included. On the other hand, in non-probability samples, the researcher cannot determine the probability of that element to be included in the sample *(Ibid*). Therefore the representation of the population by the sample may or may not be accurate (*Ibid*).

Probability sample examples include the following:

- *Simple random samples*- are considered one of the most basic sampling methods. Elements within a sample component have an equal probability of being included in the sample (Van Rensburg, 2000).
- *Stratified random samples* - The population is divided into sample groups called strata. Each element is then grouped in a stratum. The division of the groups may be an element such as, for example gender. Random sampling is conducted for each group or stratum (Welman, Kruger and Mitchell, 2009; Van Rensburg, 2000).
- *Systematic samples* - this consists of drawing every *f* of the population in a certain sample size. A list of the population is sorted and then a sample size is determined (Van Rensburg, 2000).

- *Cluster samples* **-** In certain cases where the population is large, therefore needing a large –scale survey. This therefore requires the group to be divided into clusters (Welman, Kruger and Mitchell, 2009; Van Rensburg, 2000).

Non-probability samples include the following:

- *Accidental or incidental samples* **–** This method of sampling is also known as convenience sampling. Elements of the sample are collected based on the accessibility of the researcher. These elements are collected until the researcher is satisfied with regard to sample size. (Welman, Kruger and Mitchell, 2009**)**
- *Quota samples* **–** is similar to the stratified sampling, except; when it comes to the final selection of elements. The selection of elements is not random. Each stratum formed, is represented in the sample, proportionally to the sum of the population (Van Rensburg, 2000).
- *Purposive samples* **–** This method is also known as judgmental sampling. A sample is selected that can be judged from the total population. The researchers' knowledge and the availability of information plays an important role in the selection of the sample. This method is commonly used in qualitative research. (Van Rensburg, 2000)
- *Snowball samples* **–** Earlier respondents play an important role in obtaining more participants. These respondents are used to identify potential respondents to the researcher. (Ibid)
- *Self-selection samples* **–** an individual identifies their desire to become part of the study. This is usually due to the individual's opinions about the research objectives (Welman, Kruger and Mitchell, 2009).
- *Convenience samples* **–** This method is also known as the haphazard sampling. This occurs for cases which are easy to obtain the desired sample. Biasness could easily occur, since the sample is obtained simply because of convenience (Welman, Kruger and Mitchell, 2009).

Purposive sampling was used to select twelve road construction sites. The sites were chosen to obtain relevant information to achieve the objectives of the study. These sites were visited to conduct observation studies of construction activities involving plant and equipment. They were selected based on the accessibility of the researcher to these sites as well as the availability and willingness of persons involved with regard to the site.

Initially contractors were the main focus of the interview questionnaire. However, as the study progressed it was found that it was also helpful to include other construction professionals as well as interview consultants working in the project. This was done to achieve a more holistic picture of the H&S aspects of plant and equipment that were relevant to each level.

3.5 Criteria Governing the Admissibility of Data

Empirical research data was obtained from the interviews conducted as well as from the observations. Construction managers and H&S officers were interviewed on site. Prior arrangements were made for these persons to be on site for the interview or an office venue (including public venues such as a coffee shop). The participants and the researcher first had a general conversation on operations of the project and the background of their companies before proceeding with the interview questions. The researcher informed the participants on the research background and the purpose before signing up to participate. Interview questions were structured in such a way that detailed answers were sought. Where yes or no answers were used these were leading questions towards a later more detailed answer.

Site observations were conducted by the researcher remaining on site for the duration of the construction works. A day comprising of approximately eleven hours was the observation time. While observing other members of the project, such as plant and equipment, operators were informally interviewed or asked questions about their work. Time was spent in the site offices to view and understand H&S documentations regarding plant and equipment on site. Documents studied and obtained included the following:

- Plant and Equipment Checklist
- Plant and Equipment Maintenance Log
- H&S Training Certificates
- Accident Report
- Risk Assessment Reports
- Plant & Equipment Hire Report or records
- Plant Operator licenses
- Plant hiring invoices

3.6 Data Reliability and Validity

According to Welman, Kruger and Mitchell, 2005, *validity* is defined as the extent of which the research findings demonstrate what is actually happening .in a situation. Validity in qualitative research is considered important, because the objective of the study must be represented in the research investigations. While *reliability* is linked to the credibility with regards to the findings of the research. In order for the research to be credible, it needs to stand against closest scrutiny (Welman, Kruger and Mitchell, 2005). The study objectives included the identification of H&S risks, H&S Risk Management systems, regulations as well as the how contractors pursue to mitigate H&S risks in the road construction industry. Furthermore, part of the study included an observation study to validate the findings of the interviews conducted on site. This means an observation check was made if what was said is actually happening on site. This made the research valid.

Test –retest Reliability

The research finding reliability of the instrument used (interview schedule: Appendix B) were administered on two occasions. A consultant engineer and a H&S officer were asked questions from the interview schedules. Questions which were found to be unclear were elaborated on. The time taken to ask and respond to the interview questions was also noted. Therefore the interview schedule was revised. At a later stage these respondents were asked to be interviewed. This tested if the information obtained would not deviate from the initial respondent's answers. Thereby the interview schedule reliability was tested. Some of the interviews conducted did not include the use of a dictaphone. Participants had the option of being recorded and the majority opted not being recorded. This worked to the researcher's advantage because the researcher felt participants where more free to speak without being recorded. Therefore more accurate data was obtained. This assisted in obtaining more accurate information from the participant. .

3.7 Data Analysis

3.7.1 Data Collection Methods

Data was collected by means of structured interviews on site as well as non-participant observational studies. Participants were informed about the nature of the study. An observation spread sheet was used to take notes about the H&S issues encountered during construction activities on site. Video footage of the machinery in operation as well as photographs of the sites was taken. Additional information was obtained from project managers and plant operators. A demonstration of how the plant should be correctly used was also given for a better understanding of the risks involved in their operations.

The data collected from the twelve sites, by means of structured interviews, were recorded in a MS Word document. The observations on the twelve sites were based on notes and recordings taken on sites during site visits. The data obtained from interviews and observations was then analysed and interpreted using thematic analysis. The Dey's (1993) model of analysing qualitative data was used to analyse and interpret data obtained. This model involves the process of "fragmentation" and "connecting". Firstly, the data analysis process involved fragmenting the data in order to come up with themes. Secondly, the data was connected which consisted of the linking up of themes both across and within the interviews and observations conducted. Relevant and recurring themes from the “fragmenting” and “connecting” process were extracted and analysed using diagrams and tables. Conclusions and recommendations were derived from the information obtained from the processed data. The researcher followed up on contractors and H&S officers via email and telephone. Contractors and H&S officers were very co-operative in answering the interview questions and they also provided further information regarding the site such as the site’s general operations. Observations were also conducted in a successful way. Most participants were willing to assist the researcher in studying the information on site as well as to view any area of their site. Valuable information was also gathered by the researcher through physical observation at construction sites. Suitably qualified persons responsible for the H&S aspects with regards to plant and equipment used on site were interviewed.

3.7.2 Thematic Content Analysis (TCA)

Thematic analysis “*is the method for identifying, analysing, and reporting partens (themes) within data. It minimally organises and describes your data set in (rich) data.*’ (Braun and Clarke, 2006: 1)

Thematic Content Analysis (TCA) was a “descriptive presentation of qualitative data” (Anderson, 2007: 1). Thematic analysis was commonly used as a method whereby deeper level meanings and explanations were sorted, thereby establishing a detailed account of a particular subject or theme. The researcher had to obtain an intensive knowledge of literature in order to identify themes within the data. The following phases were followed in terms of analysing the data obtained from interviews (Braun and Clarke, 2006).

Phase 1: Familiarising with the Data

This step consisted of familiarising with the data by engaging with the data and intensive studying and examining the data. Repeated reading is done of the interview questions and listening to the recorded interviews conducted. The transcribing process can also form part of familiarising with the data. During this phase, themes are developed and a coding system is established. The transcribing of verbal data was done in writing, so as to conduct the thematic analysis. The time taken in transcribing was not wasted; since the researcher got to understand the and actively write down the convention.

Phase 2: Generating initial themes

For the purposes of this research, the themes established were theory driven as well as data driven. Some of the themes were derived from the literature and the rest based on the respondent's answers. The distinction of themes was done manually as well as using computer programmes Microsoft EXCEL and IBM SPSS version 21, to assist with this. Common themes were formatted bold to initially identify the themes. Common themes were then grouped and the number of occurrences was marked using the number '1' in EXCEL. Relationships and patterns between the data was also sorted.

Phase 3: Searching for themes

Themes were then established using tables, having one name allocated to each theme. There were also themes with sub-themes. At this stage, the significance of each theme was also established.

Phase 4: Reviewing themes

After establishing each category (themes) by highlighting the key words or phrases from the text highlighted or made bold, these categories were revised as the data was put into Microsoft EXCEL. Missing categories were then identified.

Phase 5: Defining and naming themes

A detailed map of the themes was established. The processes of define and refine was completed by demining the "essence" of what the theme was all about.

Phase 6: Production of the report

When all the themes were fully worked out or established, the final analysis of the themes was done by means of a write up report of findings. This process simplified the data collected in such a way that the reader could fully understand and give the analysis meaning and validity.

3.7.3 Combination of Observations and Interviews

Interviews were conducted on the sites which were observed. Construction managers were also asked questions about the operation on sites and why they did what they did. This method was used to analyse interview answers. It also involved a systematic observation and recording procedure for measurable description.

3.7.4 Specific Treatment of Research Problem

Primary data obtained from interviews and observations were served to obtain answers on the following research problem that “Construction accidents and hazards involving plant and equipment and their associated injuries can be prevented and mitigated in the KwaZulu-Natal construction industry”. The data needed to resolve this question was obtained from interview sessions and divided into categories.

3.7.5 Treatment and Interpretation of Data

Data from the completed questionnaires was captured in a Microsoft EXCEL sheet and all answered questions were included in a MS Word document as well as SPSS version 21. Observations made on site were also recorded in a MS Word document. Recurring themes were established within the content recorded. The data collected was analysed and interpreted in graphical pie charts and tables. Ratios, percentages and relationships were established as well as analysed. Ratios and percentages are discussed in detail to solve the hypothesis of the study, thereby arriving at a conclusion as well as recommendations. SPSS Statistics (version 21) software was used to analyse the data from the closed questions. The central measures of tendency, such as means, deviations and frequencies, were determined.

3.8 Summary

This chapter expounded on the research method used to conduct the study of construction plant and equipment. It identified the type of data collected as well as the methodology used to collect data. The next chapter focuses on the analysis of the data collected to solve the hypothesis questions.

CHAPTER 4 – ANALYSIS OF DATA

4.1 Introduction

This chapter explains the process by which data was analysed and the data itself is presented. Data analysis and interpretation were interrelated and formed a continuous process as the qualitative study progressed. Data requires analysis for conclusions and recommendations to be drawn from the tested hypotheses. A general description of the sample is given, and then content analysis and observations are presented. The analysis of the data and observations were divided into categories which are as follows:

- the H&S hazards associated with plant and equipment;
- the nature and severity of accidents and hazards;
- the H&S risk management processes;
- the road contractors’ compliance with H&S regulations; and
- the extent of H&S training and management on road construction sites.

4.2 General description of the sample

The study involved twelve road construction sites. On each site, different professionals were interviewed. The researcher sought road industry persons in managerial positions who could respond concerning aspects of H&S and site operations. The relative contribution of each site to the total study sample is shown in Table 3. Most (15%) of the respondents were from site 1, while sites 2, 5 and 6 each made up 10% of the sample. The least number of respondents were from sites 3, 7 and 11, each providing 5% of the total sample. The differences in the number of participants could be attributed to the project size and complexity. The work undertaken in sites 1, 2, 5 and 6 were on a greater scale and budget than the other sites and therefore, they involved larger professional teams.

Table 3: Distribution of participants per site

Site	Number of participants	Percentage (%) of sample
Site 1	6	15%
Site 2	4	10%
Site 3	2	5%
Site 4	3	8%
Site 5	4	10%
Site 6	4	10%
Site 7	2	5%
Site 8	3	8%
Site 9	3	8%
Site 10	3	8%
Site 11	2	5%
Site 12	3	8%
Total	**39**	**100%**

A total of 39 participants were interviewed. It is evident from Table 4 that there were more interviews done with H&S officers (31%) than with other on-site personnel. They were also the persons mainly referred to in terms of their knowledge of H&S. Project and site managers were the next largest group (28%).

Prima facie, the presence and range of professionals on each site could be expected to depend on the expertise needs of that site. For example, site 1 was an extremely complex and high cost project which had a wide range of professionals and numerous workers on site. In contrast sites 3, 7 and 11 had a limited number of persons in managerial positions. However on most sites, H&S officers or their representatives and Site Managers tended to be present because they were actively involved in daily site operations. Additionally, the nature of the road construction environment being highly stressful, most individuals were under severe time constraints and refused to participate on that basis.

Table 4: Distribution by occupation

Participant Sample	Number	Percentage (%) of sample
Health and Safety Officers	12	31%
Project and Site Managers	11	28%
Site Staff	3	8%
Contracts Manager, Operations and Transport Manager	4	10%
Engineers	4	10%
Health and Safety Manager/Consultant	3	8 %
Foreman	1	3%
Traffic Safety Officer	1	3%
Total	39	100%

A distinct trend was noticed. In general individuals who met the study criteria were reluctant to participate in the study. This was particularly observed in individuals who were not explicitly involved with H&S as part of their jobs. Most of them referred the researcher to the H&S officer despite meeting the study criteria. Another observation was that some potential participants would first browse through the questionnaire, and then admit that they were not knowledgeable about H&S.

Therefore despite multiple call-backs and the assurance of anonymity, the study experienced high refusal rates. "*High refusal rates are a major source of error*" (Aaker, Kumar and Day, 2006: 230), as those who refuse to participate in the study are likely to be very different from those who cooperate. This is evidenced by the fact that a substantial number of individuals in the population being studied self-selected to exclude themselves due to their lack of H&S knowledge. Additionally, fear was generally main reason for refusal and it is strongly suspected by the researcher that it played a role in this case (Aaker, Kumar and Day, 2006).

Furthermore, as H&S officers made up the majority of the sample, their responses were highly susceptible to "*prestige seeking and social desirability response bias*" (Aaker, Kumar and Day, 2006:232). It was likely that due to their position these respondents were tempted to distort their answers in ways that they believed would enhance their prestige in the eye of the interviewer who was seen as a representative of the University of KwaZulu-Natal which might well have been associated with the government and the government being the client in most sites. Their responses were guarded against portraying their project site as performing poorly in terms of H&S (Aaker, Kumar and Day, 2006).

Potential participants' responses also made the process of studying plant and equipment H&S risks impaired *"the root of the problem highlights the problem*". This was particularity relevant with one of the sites that never participated. One particular manager mentioned that he should be contacted after two weeks by then he would have the H&S problems sorted out. Another site had some political influence and involvement and therefore the researcher encountered problems in terms of access to the site.

4.3 H&S hazards associated with Plant and Equipment

4.3.1 Plant and Equipment most frequently used

Participants were asked, in their personal capacity, what plant and equipment they used most frequently in their projects. Their responses are shown in Table 5.Trucks and tippers, tractor loader backhoes (TLBs), smooth drums, pad foot rollers and graders, were the five most frequently used plant and equipment on the projects accounting for 92%, 83%, 83%, 83% and 67% respectively. An Australian study conducted by Lingard, Cooke and Gharaie (2013), found that excavators/backhoes, trucks, cranes and compacts/rollers were most frequently involved in fatal accidents. In this study TLBs and trucks were found to be most frequently used on sites (92% and 83% respectively). These pieces of equipment ranked first and second in terms of accident causation rate. Therefore, the most frequently used plant were also the most dangerous types of equipment. Naturally, the more frequently a plant or equipment is used, the greater the chances of an accident occurring from its use. Therefore persons responsible for plant and equipment need to take extra precautions to ensure appropriate risk management systems are in place for such machinery.

Further, it is evident that Site 1 had the largest proportion (53%) of identified plant and equipment used on the sample road construction projects. Site 8 had the next largest proportion (46%) with Site 2 having 42% of the identified plant and equipment on these projects. The smallest proportion (21%) was on Sites 7 and 11. This was expected, more especially since, sites 7 and 11 were considered to smaller and less complex in nature according to the researcher's observations.

Table 5: Plant & Equipment per site Equipment per site

Plant & Equipment	Sites													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	Total	%
Trucks	x	x	x	0	x	x	x	x	x	x	x	x	11	92
Tractor Loader Backhoe (TLB)	x	x	x	x	x	x	0	x	x	x	0	x	10	83
Smooth drum roller	x	x	x	x	x	x	x	x	x	x	0	0	10	83
Pad foot roller	x	x	x	x	x	x	x	x	x	x	0	0	10	83
Graders	x	x	x	x	x	x	0	x	0	x	0	0	8	67
Skid steer loader	x	x	x	0	0	0	0	x	x	x	0	x	7	58
Excavators	x	x	x	0	0	0	0	x	0	x	0	x	6	50
Water Cart	x	x	x	x	x	x	0	0	0	0	0	0	6	50
Concrete Mixers	x	x	0	0	0	0	0	x	x	x	0	x	6	50
Bulldozer	x	x	x	x	0	x	0	0	0	0	0	0	5	42
Compressor	x	x	0	0	0	x	0	x	0	x	0	0	5	42
Paver	0	0	0	x	x	x	x	0	0	0	0	0	4	33
Recycler	0	0	0	x	x	x	x	0	0	0	0	0	4	33
Forklift	0	0	0	0	0	0	0	0	x	x	x	x	4	33
Jack Hammer	0	x	0	0	0	0	0	x	0	x	0	x	4	33
Mobile Cranes	0	0	0	0	0	0	0	x	x	0	0	x	3	25
Milling Machine	0	0	0	0	x	x	x	0	0	0	0	0	3	25
Batch Plant	x	0	0	0	0	0	0	x	x	0	0	0	3	25
Sprayers	0	0	0	0	0	0	0	0	x	0	0	x	2	17
Cherry Picker (hydraulic platform)	x	0	0	0	0	0	0	0	0	0	0	x	2	17
Fuel Dozer	x	0	0	0	0	0	0	0	0	0	x	0	2	17
Drilling Rig	x	0	0	0	0	0	0	0	0	0	0	0	1	8
Mobile Pumps	0	0	0	0	0	0	0	0	0	0	x	0	1	8
Crane operating Trucks	0	0	0	0	0	0	0	0	0	0	x	0	1	8
Front End Loader	0	0	0	0	0	0	0	0	0	0	x	0	1	8
Twin steers	0	0	0	0	0	0	0	x	0	0	0	0	1	8
Mechanical Broom	0	0	0	0	0	x	0	0	0	0	0	0	1	8
Container cranes	0	0	0	0	0	0	0	0	0	0	1	0	1	8
Total (plant and equipment)	**15**	**12**	**9**	**8**	**9**	**11**	**6**	**13**	**10**	**10**	**6**	**10**		
% of identified plant and equipment used	**53 %**	**42 %**	**32 %**	**28 %**	**32 %**	**39 %**	**21 %**	**46 %**	**35 %**	**35 %**	**21 %**	**35 %**		

4.3.2 Plant and Equipment owned and hired

Respondents were then asked to indicate whether they usually hired or owned the plant and equipment that they reported as being on their site. Table 6 lists the plant and equipment that was owned. Rollers in the form of smooth drum and pad foot rollers were typically owned by 75% of the sites. Trucks were owned by 67% of the sites. Just more than half (58%) sites owned TLBs while half (50%) owned both graders and water carts.

Table 6: Plant and equipment owned breakdown within each site

Plant and Equipment	Sites												
Owned	1	2	3	4	5	6	7	8	9	10	11	12	Total	%
Smooth drum roller	x	x	x	x	x	x	x	0	x	x	0	0	9	75
Pad foot roller	x	x	x	x	x	x	x	0	x	x	0	0	9	75
Trucks	x	x	x	0	0	0	x	0	x	x	x	x	8	67
Tractor Loader Backhoe (TLB)	x	x	x	0	0	x	0	0	x	x	0	x	7	58
Graders	x	x	x	x	x	x	0	0	0	0	0	0	6	50
Water Cart	x	x	x	x	x	x	0	0	0	0	0	0	6	50
Skid steer loader	x	0	x	0	0	0	x	0	x	x	0	0	5	42
Paver	0	0	0	x	x	x	x	0	0	0	0	0	5	42
Bulldozer	x	x	x	0	0	x	0	0	0	0	0	0	4	33
Excavators	x	x	x	0	0	0	0	0	0	0	0	0	3	25
Concrete Mixers	x	0	0	0	0	0	0	0	x	x	0	0	3	25
Recycler	0	0	0	x	x	0	0	0	x	0	0	0	3	25
Forklift	0	0	0	0	0	0	0	0	0	x	x	x	3	25
Milling Machine	x	0	0	0	0	x	x	0	0	0	0	0	3	25
Compressor	x	0	0	0	0	0	0	x	0	0	0	0	2	17
Jack Hammer	0	0	0	0	0	0	0	0	0	x	0	x	2	17
Mobile Cranes	0	0	0	0	0	0	0	x	0	0	0	x	2	17
Batch Plant	0	0	0	0	0	0	0	0	x	0	0	0	1	8
Sprayers	0	0	0	0	0	0	0	0	x	0	0	0	1	8
Drilling Rig	x	0	0	0	0	0	0	0	0	0	0	0	1	8
Mobile Pumps	0	0	0	0	0	0	0	0	0	0	x	0	1	8
Twin steers	0	0	0	0	0	0	x	0	0	0	0	0	1	8
Mechanical broom	0	0	0	0	0	x	0	0	0	0	0	0	1	8
Container cranes	0	0	0	0	0	0	0	0	0	0	x	0	1	8
Cherry Picker (hydraulic platform)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Dozer	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crane operating Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Front End Loader	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (plant and equipment)	13	8	9	6	6	9	7	2	9	8	4	5		
% of identified plant and equipment owned	46%	29%	32%	21%	21%	32%	25%	7%	32%	29%	14%	18%		

4.3.2.1 Comparisons between owning and using of plant and equipment on each site

Site comparisons were made between plant that were owned and those which were hired. It was important to note that some of the participants' responses differed relative to which plant were owned and which were hired. Some participants reported that they both hired and owned certain plant or equipment.

Site 1

On site 1, 53% (Table 5), plant and equipment identified in this study were used. Of the plant and equipment used, 46% (Table 6) were owned while 36% (Table 7) were hired. This site mostly owned smooth drum rollers, pad foot rollers, trucks, TLBs, graders, water carts and skid-steer-loaders. Hired plants included trucks, TLBs and excavators. Therefore on this site, most plant and equipment were owned.

Site 2

Table 5 shows that 42% of plant and equipment were used on this site. Twenty nine (29%) of plant and equipment was owned and an equal proportion were hired. Machinery owned consisted of smooth drum rollers, pad foot rollers, trucks, TLBs, graders and water carts. Hired machines on this site were mostly trucks, TLBs, smooth drum rollers and pad foot rollers and excavators. Therefore on this particular site plant and equipment owned and hired were equal.

Site 3

On this site, 32% of plant and equipment were identified to be used (Table 5). From Table 6, 32% of machinery were owned. Owned plant and equipment from these sites were smooth drum rollers, pad foot rollers, trucks, TLBs, graders and water carts. There were no plant and equipment hired on this site (Table 7). Therefore on this site plant and equipment were mostly owned. Site 1 also had mostly owned plant and equipment which also included TLBs, graders, trucks and water carts.

Site 4

Identified plant and equipment used on this site was 28% (Table 5). Machinery owned were 21% (Table 6) and some of these were smooth drum rollers, pad foot rollers and pavers. Plant and equipment hired was 18%. Hired plant and equipment included: trucks, TLBs and smooth drum rollers (Table 7). Similar to sites 1 and 3, plant and equipment were usually owned. The type of plant and equipment owned also included the TLBs and trucks.

Site 5

On this site, plant and equipment that was identified to be used were 32% (Table 5). Owned plant and equipment as shown in Table 6, was 21%. Plant owned on this site were mostly, smooth drum rollers, pad foot rollers, grader as well as water carts. Hired plant and equipment were 29%. These plants included trucks, TLB and smooth drum rollers. On this site more plant was hired than owned.

Site 6

This site had 39% of identified usage of plant and equipment (Table 5). Owned machinery consisted of 32% (Table 6). Examples of plant owned on this site were TLBs and pavers. From site observations machinery such as the paver were the most used. Hired plant and equipment

(25%) also included the paver (Table 7). Other hired machinery included graders and smooth drum rollers. Therefore on this site, the majority of the plant and equipment were owned. This was similar to sites 1, 3 and 4. Owned plant, which these sites also have included graders and TLBs.

Site 7

Twenty one present (21%) of machinery were identified to be used (Table 5). Owned plant and equipment consisted of 25% (Table 6). Examples of such machinery included, trucks and skid steer loaders. Hired plant and equipment consisted of 21% (Table 7). Examples included trucks and TLBs. On this site, plant and equipment were mostly owned. This was similar to sites 1, 3, 4 and 6.

Site 8

According to Table 5, identified plant and equipment used consisted of 46%. Plant and equipment that were reported to be owned were only 7% (Table 6) while those hired were 39% (Table 7). Machines owned included compressors and mobile cranes (Table 6). Trucks, TLB's, excavators and smooth drum rollers were among the machines that were hired (Table 7). More plant was hired than owned. This is the same situation as on site 5, whereby plants hired included trucks, TLBs and smooth drum rollers.

Site 9

Identified plant and equipment on this site were 35% (Table 5). Those that were owned consisted of 32% (Table 6). According to Table 7, only 4% of plant and equipment were hired. This clearly indicated that there were more owned plant on this site. Examples of owned plant included: TLBs and trucks. Sites 1, 3, 4, 6 and 7 also had mostly owned plant and equipment. TLBs and trucks were amongst the owned machinery utilised on these sites.

Site 10

From this site 35% of the identified plant and equipment were used (Table 5). Machinery that were owned were 29%, which is similar to site 2. Hired plants were 21% (Table 7). Machinery owned included TLBs and trucks. Similar to sites 1, 3, 4, 5, 7 and 9, this site had mostly owned plant and equipment. TLBs and trucks were found to be the most commonly owned machinery.

Site 11

Plant and equipment used on this site consisted of 21% (Table 5). Owned (Table 6) and hired machined (Table 7) both consisted of 14%. Examples of machines owned included trucks and forklifts (Table 6). Trucks and front end loaders were examples of machines that were hired (Table 7). This is the same situation as on site 5 and 8, where trucks were hired.

Site 12

On this site there were 35% of plant and equipment that were identified to be used (Table 5). Owned plant and equipment consisted of 18% (Table 6). Examples of owned plant included trucks and TLBs. Table 7 depicts machinery 25% of plant were hired machines included trucks, excavators, TLBs as well as skid steer loaders. Therefore on this site, there were more hired plant and equipment than owned. This was similar to sites 5 and 8 where trucks were commonly hired.

Overall, in each site comparison, it was deduced that mostly the smooth drum roller and the pad foot rollers were owned while trucks and TLBs and excavators were hired. It was also discovered that sites 1 (46%), 3 (32%), 4 (21%), 6 (32%), 7 (25%), 9 (32%) and 10 (29%), generally owned their plant and equipment while sites 5(29%), 8(39%) and 12 (25%) generally hired them. Larger and more complex sites were likely to both own and hire their plant and equipment.

Table 7: Plant and equipment hired breakdown within each site

Plant and Equipment Hired	Sites													
	1	2	3	4	5	6	7	8	9	10	11	12	Total	%
Trucks	x	x	0	x	x	x	x	x	x	0	x	x	10	83
Tractor Loader Backhoe (TLB)	x	x	0	x	x	x	x	x	0	0	0	x	8	67
Smooth drum roller	0	x	0	x	x	x	x	x	0	x	0	0	7	58
Pad foot roller	0	x	0	x	x	x	x	x	0	x	0	0	7	58
Graders	x	x	0	0	x	x	0	x	0	x	0	0	6	50
Excavators	x	x	0	0	0	0	0	x	0	x	0	x	5	42
Skid steer loader	x	0	0	0	0	0	0	x	0	x	0	x	4	33
Paver	0	0	0	x	x	x	x	0	0	0	0	0	4	33
Water Cart	x	x	0	0	x	0	0	0	0	0	0	0	3	25
Recycler	0	0	0	0	x	x	x	0	0	0	0	0	3	25
Bulldozer	x	x	0	0	0	0	0	0	0	0	0	0	2	17
Forklift	0	0	0	0	0	0	0	x	0	0	0	x	2	17
Mobile Cranes	0	0	0	0	0	0	0	x	0	0	0	x	2	17
Milling Machine	x	0	0	0	0	x	0	0	0	0	0	0	2	17
Mobile Pumps	0	0	0	0	0	0	0	x	0	0	0	x	2	17
Jack Hammer	0	0	0	0	0	0	0	x	0	0	0	0	1	8
Cherry Picker (hydraulic platform)	x	0	0	0	0	0	0	0	0	0	0	0	1	8
Fuel Dozer	x	0	0	0	0	0	0	0	0	0	0	0	1	8
Drilling Rig	0	0	0	0	0	0	0	0	0	x	0	0	1	8
Crane operating Trucks	0	0	0	0	0	0	0	0	0	0	x	0	1	8
Front End Loader	0	0	0	0	0	0	0	0	0	0	x	0	1	8
Concrete Mixers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compressor	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Batch Plant	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sprayers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Twinsteers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mechanical broom	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Container Crane	0	0	0	0	0	0	0	0	0	0	x	0	0	0
Total (plant and equipment)	10	8	0	5	8	7	6	11	1	6	4	7		
% of identified plant and equipment owned	36 %	29 %	0 %	18 %	29 %	25 %	21 %	39 %	4 %	21 %	14 %	25 %		

From Table 7, it is evident that 83% of the sites hired their trucks. It is likely that the most frequently used plant are hired as opposed to being owned as per Table 6 (Trucks = 67%). TLB's were the next most frequently hired plant with 67% of the sites hiring them (Table 7).

From this analysis it can be deduced that smooth drum rollers and pad foot rollers (Table 7=75%) were mostly owned while from Table 6, they were the least hired (58%). A study conducted by Lingard, Cooke and Gharaie (2013) found that these type of machines were amongst the lowest in terms of incident involvement. Graders had a 50% chance of being owned as well as being hired. This shows that they both had an equal chance in terms of being owned or hired. According to a study conducted by McCann (2006), these machines accounted for 33% of deaths which was less compared to the truck related deaths (68%) and loader related deaths (36%). Whether these machines are owned or hired they still contribute highly to the number of incidences on construction sites. Therefore their maintenance and inspections should be considered a priority before usage.

According to Tables 7 and 8, water carts had a 50% chance of being owned and a 25% chance of being hired. It had been observed that road construction works required the frequent use of these type of machines. Usage involved cooling the road by spraying water using these plants on roads to help reduce dust on sites. H&S hazards exposures such as dust inhalation were reduced by the occasional use of this plant. Observations also revealed that sites that used the cold recycler frequently utilised it in conjunction with the water cart for road rehabilitation purposes. It was considered more cost effective for the road construction contractor to own as opposed to hire this type of plant because of its frequency in usage.

According to Tables 6 and 7, 25% of sites used excavators that were owned while 42% hired this plant. Studies revealed that site accidents usually involved the use of excavators (Edwards and Holt 2010; Lingard, Cooke and Gharaie 2013). Therefore excavators being hired must be improved in the conditions of excavators before being hired and employed on road construction sites.

According to the OHSA of 1993, it is the ultimate duty of the contractor to ensure that plant and equipment meet all the H&S requirements. If plant and equipment is hired, then the health and safety mandate is shared with the plant and equipment supplier. Unless otherwise specified in writing, the hiring of plant and equipment has the effect of delegating to the supplier part of the H&S requirements that must be complied with.

Section 10 of the OHSA, which covers the general duties of "*manufacturers and others regarding articles and substances for use at work*", directly, refers to the responsibilities of suppliers of plant and equipment. It states that suppliers are responsible for providing information with regard to; the use of the supplied plant and equipment, the H&S risks associated with the plant and equipment; the conditions necessary to ensure that the use plant and equipment will be safe and the procedures to be followed in case of an accident. Additionally, suppliers are to ensure that the plant and equipment complies with all the prescribed H&S requirements and will be safe without risks to health when properly used.

In discussions with two plant and equipment suppliers who manufactured, owned and hired out plant and equipment, the importance of suppliers in meeting H&S requirements was highlighted. They were aware of the role that they played in ensuring understanding how their products should be used. They were highly knowledgeable about H&S and international H&S trends. It was clear that they endeavored to incorporate H&S in their design and manufacture. One supplier stated:

"*H&S is a big thing, especially in Australia, and Europe including the United Kingdom, they are making safety aspects of plant and equipment very strict, for example the angle of the stairs leading to the plant must be exact*."

This supplier had a mechanical engineering background and also advised that emissions were very important in relation to H&S and the environment. For example, asphalt emissions, after a period of time could affect the lungs and breathing.

"*Some sites have hot bitumen delivered on site at a hundred (100) Degrees Celsius, which helps with workability and is safer in terms of inhaling hazardous chemical substances*".

This supplier also gave an example of some of the research his firm was working on, which was the position of the operator, who should be stationed at a higher position for better visibility and safety.

It was observed that contractors seemed to be more flexible with owned plant and equipment in terms of H&S safety compliance. When the plant and equipment was hired they were more meticulous in ensuring H&S requirements were met. H&S certification of the plant and equipment were checked and had to be met as required. They were strict about adherence to maintenance schedules. Additionally contractors demanded timely H&S compliance from their suppliers. On the other hand, when the plant and equipment was owned H&S measures such as maintenance could be postponed if dealing with it immediately was an inconvenience. Additionally, more attention was given to cost considerations of H&S adherence. A study conducted on the UK construction industry found similar trends with regard to plant and equipment hired from external sources. Riaz et al. (2011) observed that in all the cases studied, hired plant and equipment had to pass a rigorous H&S screening process before being approved for use.

For contractor-owners an organised maintenance strategy was important to ensure maximum plant and equipment reliability. This had the long term benefits of lower costs as break downs were minimised, as well as efficiency and thus productivity being maximised (Edwards, Holt and Harris, 1998). Unfortunately, research has identified that maintenance frameworks, once developed are not followed very well, "*a reactive, ad hoc maintenance policy is usually what happens in practice* (Edwards, Holt and Harris, 1998:8)."

One of the key reasons for this identified by Edwards, Holt and Harris (1998:8) is that, "*some managers believe that savings can be made by deferring maintenance costs to a later date"*. Furthermore, being an owner, operation introduces other variables into the decision making process, some of which may be considered to be of a higher priority than the H&S objective. This means that a balancing act which wasn't in play before has to be achieved as "*although operationally efficient plant is an economic necessity in a successful construction company, the final maintenance strategy should be viewed conservatively to ensure that it does not obscure the real objectives of company* (which is usually) *profit*" (*Ibid*). Therefore when plant and equipment were hired that was likely to have positive H&S implications, since it effectively adds an additional accountability layer ensuring that H&S regulations are being followed (Edwards, Holt and Harris, 1998).

According to Tables 6 and 7, there appears to be an almost even split between plant and equipment owned and hired. Tables 7 and 8 show that plant and equipment such as water carts (50%), skid steer loaders (42%), pavers (42%) and bulldozers (33%) were owned by the contractors while excavators (42%), cherry pickers (8%), front end loaders (8%) and fuel dozers (8%) tended to be hired. Cold recyclers (50%) and graders (50%) were both likely to be either hired or owned. Frequently used plant and equipment such as trucks and tippers (83%) and TLBs (67%) were generally hired. While the smooth drum rollers (75%) and pad foot rollers (75%) were mostly to be owned.

4.3.2.2 Comparison between Large and Small Projects

Data on Table 8 illustrates the project sizes in accordance to observations made by the researcher. Sites were therefore categorised into Large and Small projects. Sites 1 to 6 and 12 projects were larger and considered to be more complex compared to sites 7 to 11. Larger projected tended to have more professionals, ground workers and operators working on sites. This was simply from observations. Smaller projects had fewer people on site and sometimes consisted of only two professionals who managed the site. Larger sites also showed more machine usage compared to the smaller sites. According to Table 8, construction plant and equipment on larger sites tended to be owned (Sites 1, 3, 4 and 6). However, site 2 had an equal number of plant and equipment owned and hired. Site 5, which was also considered to be a large project typically, had hired (8) plant and equipment. Of the five small sites, three sites (sites 7, 9, 10) owned their plant and equipment. Site 8 had mostly hired their plant while site 11 had an equal number of plant and equipment being owned and hired.

It is evident from Table 8, that the majority of the projects had plant and equipment that were owned as opposed to be being hired. Only two sites mostly hire plant while another two had a split between hiring and owning. From Table 8 it is noticed that site 1, which was a large project had a very slight difference between plants owned (13) and hired (10). Site 3, which was also a large project, had more owned machinery (9) and none were hired (0). However, site 8, which was considered to be a small project, had mostly hired plant (11), while it had the least owned plant and equipment (2).

Table 8: Large and Small Projects Compared

Site	Project Size	Owned (Table 7)	Owned/Hired	Hired (Table 8)
2	Large	8	Both	8
11	Small	4	Both	4
5	Large	6	Hired	8
8	Small	2	Hired	11
12	Large	5	Owned	7
4	Large	6	Owned	5
3	Large	9	Owned	0
6	Large	9	Owned	7
1	Large	13	Owned	10
7	Small	7	Owned	6
9	Small	9	Owned	1
10	Small	9	Owned	6

Note: This data has been derived from Tables 7 and 8

4.3.3 Hazards associated with Plant and Equipment on site

Evidently from Figure 11, 41% of respondents reported mechanical failure as one of the most frequently occurring hazards. This was double the number that reported hazards such as Chemical / Diesel Spillage and Road traffic hazards. Hazards involving falling material was mentioned 15% by participants. The least common hazards involved dust inhalation as well as Bitumen hazards (3%). An equal number of respondents were unaware of hazards.

This finding relates to the importance of plant and equipment maintenance. According to Riaz et al. (2011) shortcuts were often taken with regard to machinery maintenance. Maintenance skimping could result in hazard exposures due to poor machine condition, including wear and tear. It is important that machine maintenance is held in high regard. Further, findings include that hazards such as chemical or diesel spillage (21%) and road traffic hazards (21%) should also be identified by the road construction contractors.

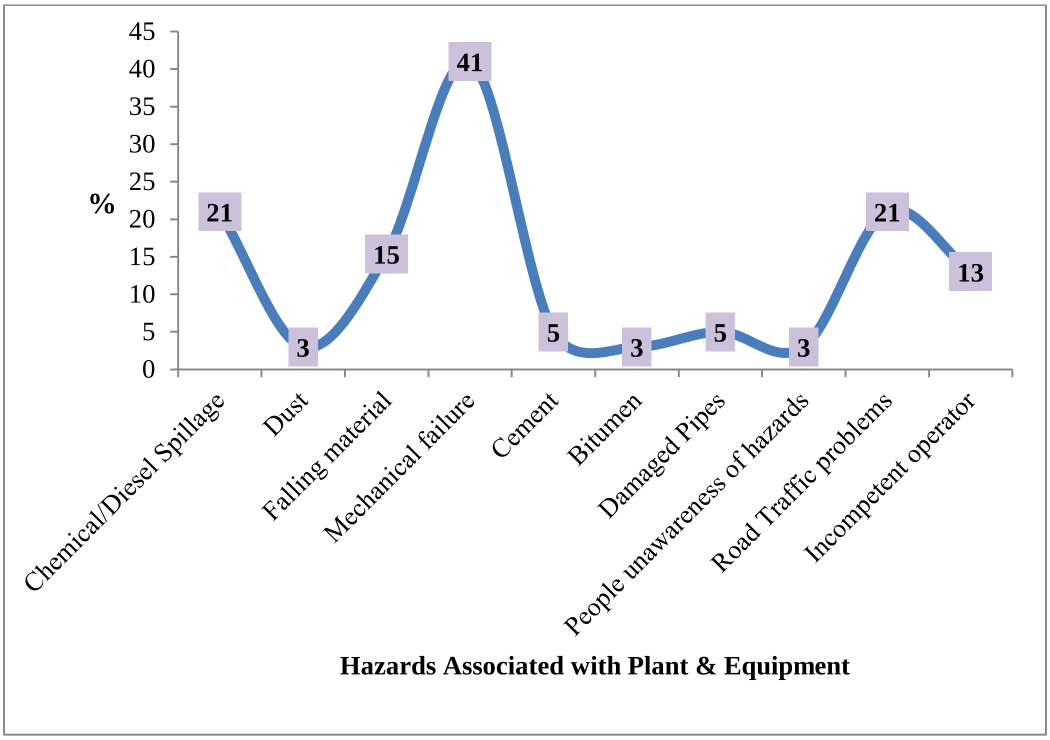

Figure 11: Plant & Equipment Hazards

4.4 The nature and severity of accidents and hazards associated with Plant and Equipment

4.4.1 Plant and Equipment related injuries

According to Table 9, of the ten accidents reported to have occurred on the various sites most half occurred on Site 1. Two accidents happened on each of sites 10 and 11.

Table 9: Accident/Injury Occurrence

Site	Accident/Injury occurrence
1	5 (42%)
2	1 (8%)
3	1 (8%)
4	0
5	0
6	1(8%)
7	0
8	0
9	0
10	2 (17%)
11	2 (17%)
12	0
Total	12 (100%)

4.4.2 Accident Explanations

Accident 1 (Site 1)

"…..excavator was working on a high cut, while it was grabbing material, the rock hit, fell and knocked the door and side mirror. The operator was unharmed but had a scratch, First Aid treatment was conducted…"

The excavator was working on a high cut. This means that the operator was working with layer works and materials. It has been established by Haslam et al. (2005) that material packing and disposals can contribute towards H&S hazards and therefore could result to an accident. Therefore the accident could be attributed to material on site and site topography (Edward and Holt (2010). This therefore falls under machine instability due to external materials.

Accident 2 (Site 1)

"..Rocks fell from higher up the Rock face onto Excavator…"

Site topography also played a role here in terms of rocks falling from a higher elevation to the excavator. According to Edwards and Holt (2010), this is categorised under safety hazards associated with machine instability. Falling rocks can cause the excavator, in this case, to become unstable and risk overturning.

Accident 3 (Site 1)

***"…**ADT Truck fell down… rock fell because the bin was jammed. The load was too heavy, the operator was unharmed..."*

This accident involves the use of a truck. The truck load was too heavy and therefore the bin jammed, this is an example of a machine failure. Edwards and Holt (2010) mentioned mechanical hazards that occur from moving components of a machine. These components include buckets.

Accident 4 (Site 1)

"..12 Tonne Truck offloading anchors, picked up load using a crane truck, used the wrong gear lever and out riggers collapsed. The truck was damaged (mirror on right side), the operator was fine…"

A wrong gear lever was used causing the machine riggers to collapse. This was an example of fatigue. This can affect the decisions made by the operator and therefore lead to an accident (BC Work Safe, 2008).

Accident 4 (Site 1)

"….not major… minor… there was a rock that fell on the truck. Excavator slipped from the top of the mountain. It was hanging from something. What happens is that it uses the bucket to prevent it from falling, it doesn't usually happen…"

The respondent assumed that this accident was minor. This might mean that there are worse cases that had occurred on sites and when compared to this was considered "*not major*". An excavator hanging from a cliff using a bucket could have catastrophic consequences. These could include worker injuries, property damage, machinery damage as well as the destruction of completed work on site. Excavators are one of the most commonly used construction plants (Edwards and Holt 2010; Lingard, Cooke and Gharaie 2013). These plants present some unique hazards. For example the use of ancillary equipment such as the bucket, more specifically if quick-hitch connectors are used. This could result in the excavator being unstable when being operated. (Edwards and Holt, 2010; Gürcanli, Müngen and Akad, 2008)

Accident 5 (Site 1)

"….Heard of one - rock fell and hit the wind screen of an excavator…. Didn't hurt the operator. The windscreen was smash and gab…"

This accident was due to site topography (Edwards and Holt 2010). The location of the site plays a significant role in hazard exposures. If the operator was not in the excavator, an injury or fatality could have occurred. However because the excavator operator was in the plant, it protected him. From this accident, it could be learned that it would be helpful to improve plant components to improve H&S.

Accident 6 (Site 2)

"…Grader... reverses on the private car. No one injured only the car was damaged…"

The grader reversing caused a public vehicle to be damaged. The accident could have occurred because of the grader operator's negligence. Operator's incompetence may have been the main cause of the incident (Windapo and Oladapo, 2012; Haslam et al., 2005).

Accident 7 (Site 3)

"*Public vehicle entering the site even though there was signage. Vehicle was damaged slightly by one of the construction vehicles…an excavator. People are ignorant, they happen in every site. All we need to do is keep informing the community. Keep on communication between public and contractor…"*

This accident resulted mainly because of persons not adhering to signage put up by the road construction contractor. Traffic problems were a common complaint among participants of the study. These usually involved public vehicles entering into the construction site or going past the sites above the speed limit. This appears that road accidents and injuries have has become problem worldwide as well as in South Africa (Du Plessis, Jansen and Siebrits, 2013). In this accident, an excavator was involved which damaged the public vehicle. This puts construction vehicles, including their operators at risk.

Accident 8 (Site 6)

….near misses. People not stopping at the stop/go, they say they didn't see the board..."

Near misses are potential accidents. These should be taken seriously and solutions to be sought to prevent future events becoming accidents (Riaz, et al., 2011).

Accident 9 (Site 10)

"...property damage. Machine gets too close to property, wall damage…."

Property damaged, the respondent did not reveal which machinery was involved. This accident could have also occurred due to mishandling of retrievals (Edwards and Holt, 2010). This then caused the machine to damage the surrounding property.

Accident 10 (Site 10)

"….the guy operating the waker (compactor) put his knee against it. It cut him open. Rushed to the hospital, incident report….. Report was taken to the department of labour. ….Forms filled….IOD forms. Two weeks off work with compensation was given……"

This is regarded as the most serious injury reported from all sites. Musculoskeletal injury could have resulted from the negligence of the operator. He might not have adequately known how to operate the compactor. It could have also been a result of fatigue or exhaustion (BC Work Safe, 2008).

Accident 11 (Site 11)

"...container damaged - *bashing one container and another collided…."*

Container damaged, the respondent did not reveal which machinery was involved however a collision occurred. This accident could have also occurred due to mishandling of retrievals (Edwards and Holt, 2010).

Accident 12 (Site 11)

"...some staff did get burned on their limbs from hot bitumen which is transferred through the pumps…."

Burns due to exposures to bitumen are common in road construction sites, due to workers constantly working with this hazardous substance. A number of factors could have caused this accident, including machine failure, operators incompetence or unsafe working conditions (Windapo and Oladapo, 2012; Haslam et. al., 2005).

4.4.3 Plant and equipment involved in accidents

From the 12 accidents reported, Figure 12 illustrates the most common involved plant and equipment in accidents. It appears that excavators were the most involved in accidents. Accidents involving this machine occurred 5 times amongst the 12 reported accidents (42%). Property damage as well as accidents involving private vehicles occurred, each made up 17% of total reported accidents.

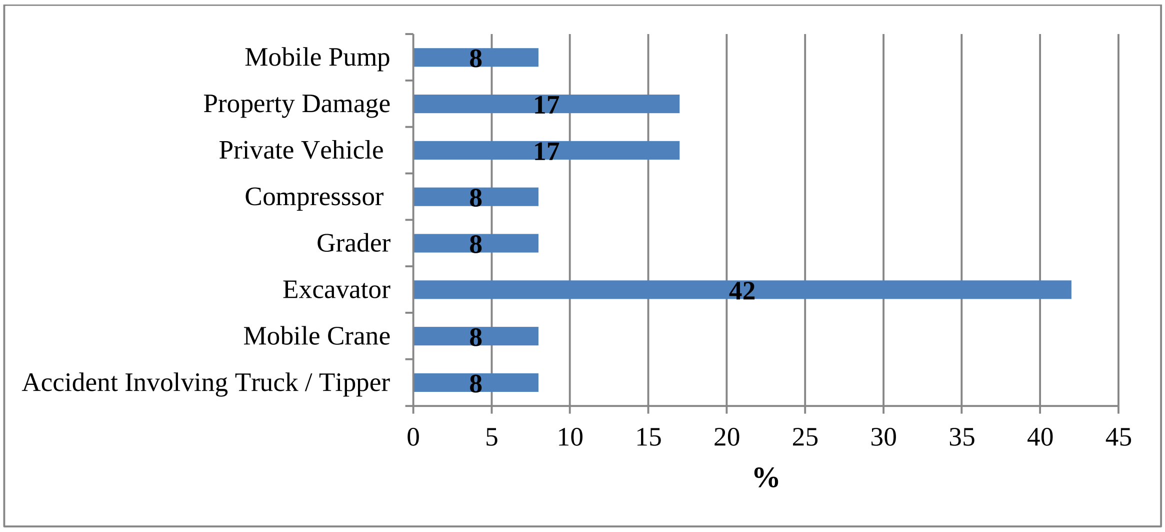

Figure 12: Plant and Equipment involved in Accidents

4.4.4 Health problems associated with Plant and Equipment

Respondents were asked about the nature and frequency of health problems that their workers had experienced while working on any of their sites. From a fixed list (Table 10) of health problems, they had the options of answering “Yes,” “No” or “Unsure.” Some respondents did not answer this question for some of the listed health problems. The percentage is calculated from the total number of respondents that answered that part of the question and “count” refers to the number of times a specific health problem was marked “Yes”, “No” or “Unsure” by a respondent.

From Table 10 it appears that the most prevalent (44%) health problem was dust inhalation. The question about this health problem was answered by all study participants (39), of which 17 respondents answered that “yes,” their workers did experience dust inhalation. The least prevalent health hazard (3%) involved the Central Nervous System and electrical shocks on sites.

Health problems related to dust inhalation and the respiratory system are meant to be mitigated by the proper use of dust masks, which were available to all workers during site observations. This was especially important on site 6, after cement spreading and when the cold recycler worked on the road, the researcher had to use a dust mask (Figure 61). The dust mask was experienced by the researcher as uncomfortable especially so in the hot environment. It was difficult to breathe and the mask kept falling out of position. It was noted that most workers preferred to not use dust masks, some however stated that they drank milk as a protective measure against lung diseases.

There is a wealth of research indicating that dietary factors do play a role in the development of chronic diseases (World Cancer Research Fund, 2007). Milk contains vitamin D and other nutrients that may be beneficial for lung function, however it is also high in fats and that may have mixed effects on lung function. Only limited studies have looked at the overall associations of dairy intake with lung density and lung function (Jiang et al., 2010).

The results of epidemiological studies assessing the influence of milk intake on cancer development have been ambiguous, most probably due to the complex mixture of the components in milk. It was noted that although fats in general tend to promote tumor development there is evidence that some ingredients in milk do possess inhibitory effects. For example there is some evidence that individual milk fats could hinder cancer development, there is also substantial evidence that calcium (found in milk) protects against colon cancer. Some recent studies also suggest that milk can help inhibit cancer of the tongue, esophagus, lung and bladder. However, confirmatory studies and further investigations are still required (Tsuda et al., 2000).

Jiag et al. (2010) examined the cross-sectional relationships between dairy intake and computed tomography (CT) lung density and lung function. They found that higher low-fat dairy intake but not high-fat dairy intake was associated with moderately improved CT lung density. This distinction is particularly important as can be shown by Mettlin (2006), who found that there is a two-fold (Relative Risk = 2.14) increase in lung cancer risk in participants who reported consuming full cream milk three or more times daily compared to those who reported never drinking full cream milk. Conversely, participants who reported the consuming reduced-fat milk three or more times daily were found to experience a significant protective effect (Relative Risk = .54).

A study conducted by Toivanen (2011) investigated among other food stuffs, bovine milk as *a source of preventive antiadhesive material against serious meningitis- and respiratory infection-associated pathogens*." (Toivanen, 2011: p.60)

It was found that some molecules in milk possess anti-adhesive effects against bacteria (including meningitis). These molecules have the potential to reduce the spread of bacteria because the initial attachment of the pathogen to the human body is interrupted. He also reported that milk has been found to inhibit the actions of toxins of various bacteria and viruses (Toivanen, 2011).

This evidence suggests that there are clear benefits from drinking milk, however drinking milk is unlikely to eliminate the need for dust masks.

Table 10: Accidents and Injuries

Accident/Injury	YES	No	Unsure	Respondents who answered about this Problem			
	Count	Percentage	Count	Percentage	Count	percentage	
Dust Inhalation	17	44%	17	44%	5	13%	39
Sunburn/Sunstroke /dehydration	10	26%	24	61%	4	10%	38
Whole Body Vibration (WBV) and Hand Arm Vibration Hazards	9	23%	25	64%	5	13%	39
Exposure to Hazardous Chemical Substances	9	23%	27	69%	3	8%	39
Fatigue/ Exhaustion	8	20%	26	66%	5	13%	39
Musculoskeletal Injuries	6	15%	29	74%	4	10%	39
Respiratory System	6	15%	28	72%	4	10%	38
Noise Induced hearing loss	4	10%	27	69%	8	20%	39
Burns	2	5%	34	87%	3	8%	39
Fatalities	2	5. %	34	87%	3	8%	39
Central Nervous System (NC) injuries	1	3%	33	85%	5	13%	39
Electrocution or electrical shock	1	3%	35	90%	3	8%	39

Haslam et al. (2005) discuss problems arising from the quality of PPE on construction sites by stating that whereas PPE was supposed to help workers carry out work in a comfortable and a safe way, persons interviewed mentioned that PPE could be a hindrance to productivity. The researcher's experience and participant's report confirm that finding. One participant from site 9 mentioned, '*sometimes a bricklayer, for example rather use their own hands... "* rather than use gloves when bricklaying.

On most sites, participants complained about PPE being uncomfortable. For example on site 6, only the researcher, spotter and engineer wore dust masks and the rest of the workers did not find it necessary to do so. The researcher asked the foreman why this was the case and if workers were provided with dust masks.

The foreman responded by saying that they were provided with all necessary PPE, including dust masks, but they did not wear them. Indeed the researcher found that one of the operator's dust masks was on his vehicle chair. This was supported by the following quotes from a participant H&S Officer on site number 9:

"Some people do not wear their PPE. They only wear their overalls and reflectors'

"*Appropriate PPE needs to be allocated for different persons…. for example the size of safety boots for a person working with cement … give them higher boots…"*

Haslam et al. (2005), pointed out that a fundamental aspect of H&S on sites, should be in the provision of appropriate, comfortable PPE for each worker on site. This will encourage workers to wear PPE and therefore improve H&S on construction sites.

4.4.5 Severity of Consequences of exposure to health hazards

Respondents were asked to rate the severity of the consequences of health-threatening exposures experienced by construction workers on road construction sites on a scale of 1-5 where 1=None/Zero, 2=Minor, 3=Moderate, 4=Major and 5=Catastrophic. Their responses ranked according to the means are shown in Table 11.

Table 11: Severity of Consequences of exposure to health hazards

Health Hazard	Number	Frequency 1	2	3	4	5	Mean	Std. Dev.	Rank
Fatalities arising from using plant and equipment on site	38	19 (50%)	2 (5%)	4 (10%)	1 (3%)	12 (32%)	2.61	1.81	1
Dust inhalation arising from using plant and equipment on site	37	8 (22%)	10 (27%)	11 (30%)	5 (13%)	3 (8%)	2.59	1.21	2
Noise induced hearing loss arising from using plant and equipment on site	38	11 (29%)	13 (35%)	5 (13%)	5 (13%)	4 (10%)	2.42	1.33	3
Respiratory System arising from using plant and equipment on site	38	13 (35%)	12 (32%)	5 (13%)	4 (10%)	4 (10%)	2.32	1.34	4
Exposure to hazardous chemical substances arising from using plant and equipment on site	38	15 (40%)	8 (21. %)	8 (21. %)	3 (8%)	4 (10%)	2.29	1.35	5
Sunburn/sunstroke/dehydration arising from using plant and equipment on site	38	12 (32%)	12 (32%)	8 (21%)	4 (10%)	2 (5. %)	2.26	1.18	6
Fatigue/exhaustion arising from using plant and equipment on site	38	18 (47%)	5 (13%)	8 (21%)	4 (11%)	3 (8%)	2.18	1.35	7
Burns arising from using plant and equipment on site	38	22 (58%)	4 (10%)	2 (5%)	4 (10%)	6 (16%)	2.16	1.59	8
WBV or HAV arising from using plant and equipment on site	38	14 (37%)	13 (34%)	4 (10%)	6 (16%)	1 (3%)	2.13	1.17	9
Musculoskeletal injuries arising from using plant and equipment on site	38	18 (47%)	6 (16%)	10 (26%)	3 (8%)	1 (3%)	2.03	1.15	10
Electrocution arising from using plant and equipment on site	38	21 (55%)	6 (16%)	5 (13%)	1 (3%)	5 (13%)	2.03	1.42	10
Central nervous system arising from using plant and equipment on site	38	26 (68%)	4 (11%)	2 (5%)	2 (5%)	4 (11%)	1.79	1.38	12

Overall, rankings showed that the severity of consequences of fatalities was considered the greatest, but even that was given a severity mean of only 2.61. This suggests that participants considered the severity of health problems as low. This is concerning and suggests that further research is needed to find how construction professions view the severity of the consequences of health problems. This might also show that participants might have not fully understood the question and instead wanted to ensure that anything to do with H&S (which in most cases is attached to sensitive and negative perceptions) was low on their sites. This was typical example of "*Prestige seeking and social response bias*" in which participants tried to look for ways to impress the interviewer so as to enhance their prestige and social desirability (Aaker, Kumar and Day, 2006:232). Time, pressure and fatigue were factors particularly when answering this question. As the interview proceeded the accuracy of what was said by participants declined. Participants tended to group interview questions and responded on a similar scale. In this case the lowest scales seemed particularly appealing and therefore were frequently chosen. Participants tended to give abrupt answers and avoided asking for clarifications so as to shorten the interview process (Aaker, Kumar and Day, 2006). Therefore under more comfortable, ideal conditions whereby time and fatigue were not factors, participants would have been able to answer appropriately. The expected response for this question in terms of severity should have therefore been on higher scales indicating major (scale =4) or catastrophic (scale =5). The second ranking health problem was dust inhalation arising from use of plant and equipment on site. This shows that respondents recognised that dust inhalation health problems can be severe. Breum et al, (2003) gave dust inhalation as an example of a disease that could result to death by asphyxia. The third ranked health problem was noise induced hearing loss arising from using plant and equipment on site. Studies showed that workers who were exposed to noise had an increased risk of being involved in an accident (Picard et al., 2008). The severity of the consequences of this health problem was therefore considered seriously by participants. The fourth ranked health problem consequence was respiratory system. According to Picard et al. (2008), inhalation of harmful particles could result to diseases such as chronic obstructive pulmonary disease (COPD), asthma or silicosis. The severity of consequences of fatigue/exhaustion arising from using plant and equipment on site was ranked 7th. The mean was 2.18 which lies in the rage between the consequences of fatalities (mean=2.61) and those of Central Nervous System (mean=1.79). The least ranked severity of consequences was central nervous system which ranked 12, followed by electrocution and musculoskeletal injuries both ranking 10. This showed that these hazards exposures are least likely to occur and therefore the severity of consequences of these health problems were not considered serious.

4.4.7 Safety problems associated with Plant and Equipment experienced by workers

4.4.7.1 Frequency of safety problems

Respondents were asked about the nature and frequency of safety problems that their workers had experienced while working on any of their sites. From a fixed list (detailed below) of safety problems, they had the options of answering “Yes,” “No” or “Unsure.” It must be noted that some respondents did not answer this question for all (or any) of the listed safety problems. The percentage is calculated from the total number of respondents that did and “count” refers to the number of times a specific safety problem was marked “Yes” by a respondent. Their responses are shown in Table 12.

Table 12: Frequency of Safety Problems Experienced on sites

	YES	NO	UNSURE	Respondents who answered this Safety Problem			
Safety problem	**Count**	**Percentage**	**Count**	**Percentage**	**Count**	**Percentage**	**n**
Mechanical	26	68%	9	24%	3	8%	38
Machine instability	15	40%	21	54%	2	5%	38
Operators station - falls, trips or slips	8	21%	26	68%	4	11 %	38
Power transmission source	7	18%	28	74%	3	8%	38
Failure of control system	4	11 %	30	81%	3	8%	37
Other Accidents and Hazards	1	4%	22	88%	2	8%	25

The most frequently occurring safety problem reported was mechanical, i.e. 68% of respondents said that they experienced safety problems of a mechanical nature on their sites. The second most frequently indicated safety problem was machine instability (40%). The next safety problem encountered was related to the operators’ station - falls, trips or slips (21%). This is unsurprising as according to Hinze, Huang and Terry (2005) one of the major causes of accidents and injuries associated with plant and equipment involve falling.

The respondents were given the option to specify other safety problems that were not included on the list. Only one respondent did so and of the respondents that answered that part of the question (25), 88% of them marked “No” they did not experience any other safety problems.

“Routine maintenance” was mentioned by this respondent as the “other” safety problem encountered. For example, regular routine cold recycler maintenance should typically be done on a daily basis on site 4. However, this type of maintenance was not done as often as it should and therefore presented a frequent safety problem, the consequences of something going wrong with the recycler due to poor maintenance could be catastrophic.

According to Table 13, all sites reported to have experienced mechanical problems, except site 12. With regard to mechanical instability all sites except sites 3, 6 and 12 had experienced this problem. Operator's station falls, trips or slips while working on site had occurred on sites 1, 5, 7, 8, 9 and accounted for 42%. Failure of Control Systems (25%) had been encountered on sites 1, 5 and 9. Power Transmission source problems (33%) had also been experienced on sites 1, 5, 6 and 9. Participants were asked if there were any other plant and equipment related problems and a participant from site 6 reported that there were problems experienced with the cold recycler. Sites 1, 5 and 9 had the most occurrence of safety problems, accounting for 83%. Site 12 did not experience any safety problems (0%).

Table 13: Frequency per site Safety problems

	Sites													
Safety Problems	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total**	**Percentage (%)**
Mechanical Problems while working on site	x	x	x	x	x	x	x	x	x	x	x	0	12	100%
Mechanical Instability while working on site	x	x	0	x	x	x	0	x	x	x	x	0	9	75%
Operator's station - falls, trips or slips while working on site	x	0	0	0	x	0	x	x	x	0	0	0	5	42%
Failure of Control Systems while working on site	x	0	0	0	x	0	0	0	x	0	0	0	3	25%
Power Transmission source problems while working on site	x	0	0	0	x	x	0	0	x	0	0	0	4	33%
Other plant and equipment related problems while working on site	0	0	0	0	0	x	0	0	0	0	0	0	1	8%
Total	5	2	1	1	5	3	2	3	5	2	2	0		
Percentage (%)	83 %	33 %	17 %	17 %	83 %	50 %	33 %	50 %	83 %	33 %	33 %	0%		

4.4.7.2 Severity of safety problems associated with plant and equipment

Respondents were asked to rate the severity of the consequences of safety-threatening exposures experienced by construction workers on road construction sites on a scale of 1-5 where 1=None/Zero, 2=Minor, 3=Moderate, 4=Major and 5=Catastrophic. Their responses ranked according to the means are shown in Table 14.

Table 14: Severity of consequences (safety problems)

Ratings of severity of consequences (safety problems)	Number	Frequencies					Mean	Std. Dev.	Rank
		1	2	3	4	5			
Mechanical problems arising from using plant and equipment on site	37	6 (16%)	17 (46%)	8 (22%)	3 (8%)	3 (8%)	2.46	1.12	1
Operators station falls, trips or slips arising from using plant and equipment on site	37	12 (32%)	11 (30%)	7 (19%)	4 (11%)	3 (8%)	2.32	1.27	2
Other safety problems arising from using plant and equipment on site	8	4 (50%)	1 (12%)	1 (12%)	1 (12 %)	1 (12%)	2.25	1.58	3
Failure of control systems arising from using plant and equipment on site	37	18 (49%)	6 (16%)	5 (13%)	3 (8%)	5 (14%)	2.22	1.47	4
Machine instability arising from using plant and equipment on site	37	16 (43%)	8 (22%)	8 (22%)	2 (5%)	3 (8%)	2.14	1.27	5
Power transmission source arising from using plant and equipment on site	37	17 (46%)	8 (22%)	9 (24%)	2 (5%)	1 (3%)	1.97	1.09	6

Mechanical difficulties arising from using plant and equipment on site were regarded as having the most severe consequences minor to moderate (mean=2.46). Operators' Station Falls, trips or slips had the next severe consequences tending toward minor (mean=2.32). Other safety problems were considered less next severe (mean=2.22). On site 6 for example, one participant, stated that approximately 30 000 picks needed to be replaced each day. Maintenance of the milling machine and the cold recycler was paramount to avoid damage to plant components. According to Riaz et al. (2011), scheduled plant maintenance is rarely or inadequately followed in practice. This is usually due to plant being needed urgently to cater for production demands. The findings of this research appear to confirm research conducted by Riaz et al, (2011), that mechanical difficulties can be a result of improper or inadequate plant maintenance. Operator's station falls, trips or slips ranked second showing that this should also be taken into consideration. According to Edwards and Holt (2010) this kind of mishap is related to access into the operator station for example rocks or other materials falling into the operator's station causing accidents and injuries.

4.5 H&S risk management process of road construction contractors

4.5.1 The presence of a H&S Officer

Respondents were asked if there was an H&S officer present on site. As shown in Table 15, all sites reported that there was an H&S officer present on site. However, the researcher's validated observations painted a slightly different picture. Table 16 is colour coded to show the observed presence of at least one H&S officer as well as the degree to which the officer was present. Green was used where at least one H&S was observed to be present and regularly available on site. Amber was used when an H&S officer was observed to be occasionally present on site, while red was for sites where no or very little H&S officer presence was observed during the researcher's numerous site visits.

Table 15: H&S Officer/Representative on Site

Site	H&S Officer/ representative present on Site
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	Yes
8	Yes
9	Yes
10	Yes
11	Yes
12	Yes

Table 16: Observed Presence of at least one H&S Officer and level of Presence

Site	Observed Presence of H&S officer (s)
1	Green
2	Green
8	Green
10	Green
12	Green
9	Green
6	Amber
11	Amber
3	Red
4	Red
5	Red
7	Red

Site 1

All respondents in site 1 indicated that there was at least one H&S Officer present. Observations confirmed that there were in fact two H&S officers on site. This was considered a complex project. Site work included bulk earthworks, concrete drainage, layer works, bridges as well as short creating and gabion walling. Explosives were used occasionally while layering. Hazards on this site included snakes and rocks falling from higher elevations. The researcher had observed some rocks falling and workers screaming to stay clear. The site manager was extra cautious when the researcher was on site due to the known hazards which present potential accidents. From Table 16, this site was considered to have a good presence of a H&S officer and therefore superior H&S risk management on site (Table 16: green).

Site 2

All respondents in site 2 indicated that there was at least one H&S officer present. Observations confirmed that there were in fact two H&S officers on site. The site was also considered complex, but less so than site 1 in terms of operations. The scope included mainly of layer works. There were site topography dangers such as rocks falling however snakes and the use of explosives were not significant on this site. This site was also considered to have a good presence of a H&S officer (Table 16: green) therefore risk management was better compared to other sites.

Site 3

The H&S officer was not on site (Table 16: red). He was found on another site which was not part of the study. As the project on Site 3 was winding down the responsible H&S officer was focusing mostly on the new project on another site. The project scope on this site included layer works, road drainage systems and installation of gabion walls. The researcher observed and was informed that the project was nearing completion. Even though the project was nearing completion, there were a considerable amount of plant on the site, such as excavators, tractor loader back hoes (TLBs) and trucks. It was established that because of the project stage, the H&S officer was no longer considered to be required on site and therefore had been sent to another site. In terms of risk management, the site would have suffered from this lack of a H&S officer present on site. The use of equipment such an excavator, TLB and trucks could still pose hazards even at this final stage of the project, considering they are some of the most dangerous plant (Lingard, Cooke and Gharaie, 2013).

Site 4

On this site there was no H&S officer although all participants on this site (Table 16: red), declared that there was a H&S officer on site. Machinery used included the cold recycler, pad foot rollers and smooth drum rollers. Management on this site were most reluctant to provide H&S information a problem during data collection because H&S issues were apparently regarded as confidential by most employees. There was no site office and most documents including the safety file were in the head office. If an accident or injury had occurred, the foreman would have to take responsibility.

Site 5

All respondents in site 5 indicated that there was at least one H&S Officer present. The researcher's observations confirmed that there was a H&S officer responsible for this site. However the H&S officer was only available on certain occasions such as site meetings which on this site occurred on a monthly basis (Table 16= red). However, site operations were considered not as complex as on sites 1 and 2, and the H&S officer was not present during the researcher's observations on the site. Work scope consisted of road rehabilitation using a cold recycler, pad foot roller, smooth drum rollers and water carts. In one particular visit the project manager of the site mentioned about pipe bursts one for bitumen the other for water. Both pipes were connected to the cold recycler. If a worker came into contact with the hot bitumen, that could cause severe burns. When there was no H&S officer on site, the risk management in terms of hazards and accidents was questionable.

Site 6

From this site 12% of participants stated that there was a H&S officer on site. When the researcher asked where the H&S officer was, it was mentioned that he was on another site approximately 20 kilometers away (Table 16: Amber). The researcher made attempts to find the H&S officer on the observation days but was unsuccessful. The researcher had to contact the H&S officer via email and through the consultant engineer to get responses to the H&S questions regarding the site. It was observed that it took considerable effort and time to get hold of the H&S officer. Therefore if an accident was to occur on site it would have been difficult to get the H&S officer directly involved in resolving H&S issues. This would have included arranging for the injured worker to obtain first aid or medical attention. After that the H&S officer would have to complete an accident report and arrange for precautions to be taken to avoid future accidents and injuries.

Site 7

In terms of H&S Officer presence, Table16 shows red for this site. From the researcher's observations, it was considered that the H&S was never present on site. The site technician was in charge of the whole operation of the site including the procurement of materials. Materials included gravel coated with bitumen delivered in large trucks. Machinery used included the paver, smooth drum roller and pad foot roller. Occasionally the paver needed maintenance; it was observed that this was done daily, before operation and during lunch times. This process could be a dangerous one for the site foreman who was responsible for this equipment. If an accident was to occur, there was no one qualified in H&S. The presence of a H&S officer was considered necessary to manage H&S risks on this site.

Site 8

The H&S officer was always on site and worked in the site office (Table 16=green). According to site observations, this site was not considered very complex compared to sites 1 and 2. The scope involved paving work, lifting containers and concrete pouring. Although this site was not complex it was surprising that the H&S officer was always on site and was involved in the daily operations of the site. If an accident occurred, the H&S officer would have been able to be actively involved in its management.

Site 9

This site was rated as having adequate H&S presence. (Table 16=Green).The site conditions were unsatisfactory. When participants were asked if there was a H&S officer on site, they all agreed to this. During site observations, it was indeed discovered that there were two H&S officers on site. Machines used on this site included the TLB, skid steer loader and trucks. If an accident had occurred, H&S officers would be able to attend to the incident. Naturally the presence of the H&S officers suggests better H&S risk management.

Site 10

There was a H&S officer on this site and a H&S consultant who occasionally visited it. According to Table 16, this site is considered on the green area in terms of H&S risk management. All respondents agreed that there was a H&S officer present on site. During observations it was found that the site was relatively small compared to the other sites and that a limited number of plant was used. Plant included TLB, compactor and skit steer loader. There was a site office where the H&S file was held.

Site 11

In this site, participants stated that there were H&S officers on site. Site observations conducted by the researcher concluded that there was one H&S officer. This officer would visit this site, about once every two weeks. There was no H&S officer on site during observations nor was a H&S file found on this site. Site operations included the use of pumps which produced hot bitumen, and were therefore considered dangerous. It was surprising to find that there was no H&S officer on site to manage H&S issues.

Site 12

There was an H&S officer on site who dealt with all H&S related problems on site. In Table 16 the site was considered on the green zone and therefore rated well in terms of H&S risk management. Site operation included the use of trucks, TLB and cranes. Machinery on the site worked in close proximity. This could therefore increase the likelihood of accidents.

In general 50% of the sites had a H&S officer on site. However with the other half of the sites observed, 33% had no H&S officer on site and the remaining 17% had site officers who were not permanently on these sites. In terms of H&S risk management, the construction contractor has to ensure the reduction of risks on site. A risk management process is in place to ensure that proper decisions are made in terms of the employment of plant and equipment. According to Riaz, et al., (2011), decisions such as plant selection, certification, and machine maintenance as well as risk assessment are all part of risk management. H&S risk management would therefore be difficult to implement if the H&S officer will be absent from the site.

4.5.2 Methods used to Identify H&S Hazards

Participants were asked how they identify H&S Hazards on their site. Their responses are represented in figure 13:

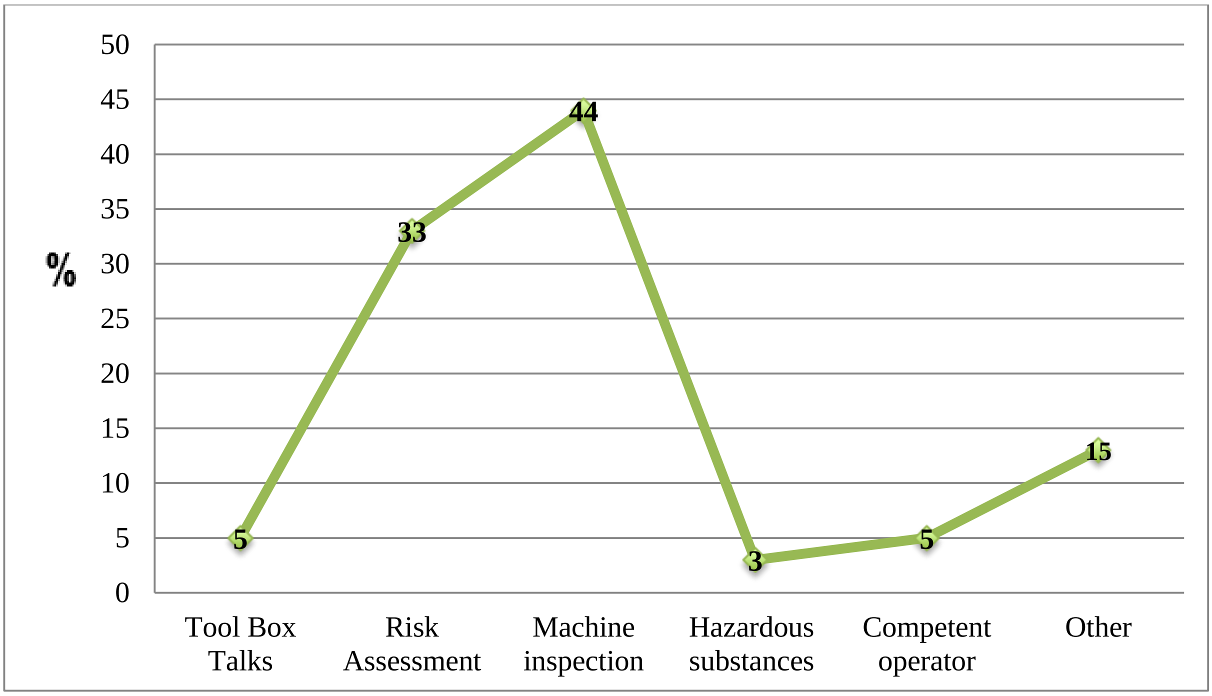

Figure 13: Identification of Hazards

Forty-four percent (44%) reported that they used machine inspections as a method of identifying hazards. Thirty three percent (33%) of respondents mentioned that the adoption of a risk assessment was done to identify hazards on their sites. Five percent of respondents (5%) cited a risk assessment while 5% said they used on-site Tool Box Talks.

The remaining methods of identifying hazards included involvement of H&S officer who brought attention of hazards identified on site; and mechanical engineers checking for any hazards associated with plant and equipment. However, one respondent mentioned that they were "*not aware of any hazards …the contractor is in charge of this…..*". This respondent also mentioned that audits were submitted to the contractors on site and then the H&S officer took over the responsibility of identifying hazards.

4.5.3 Mitigation and Prevention of H&S Risks

4.5.3.1 Reasons why plant and equipment related accidents occur

Participants of the study were asked were asked to provide reasons why they thought plant and equipment related accidents occur. Their responses were as per Figure 14.

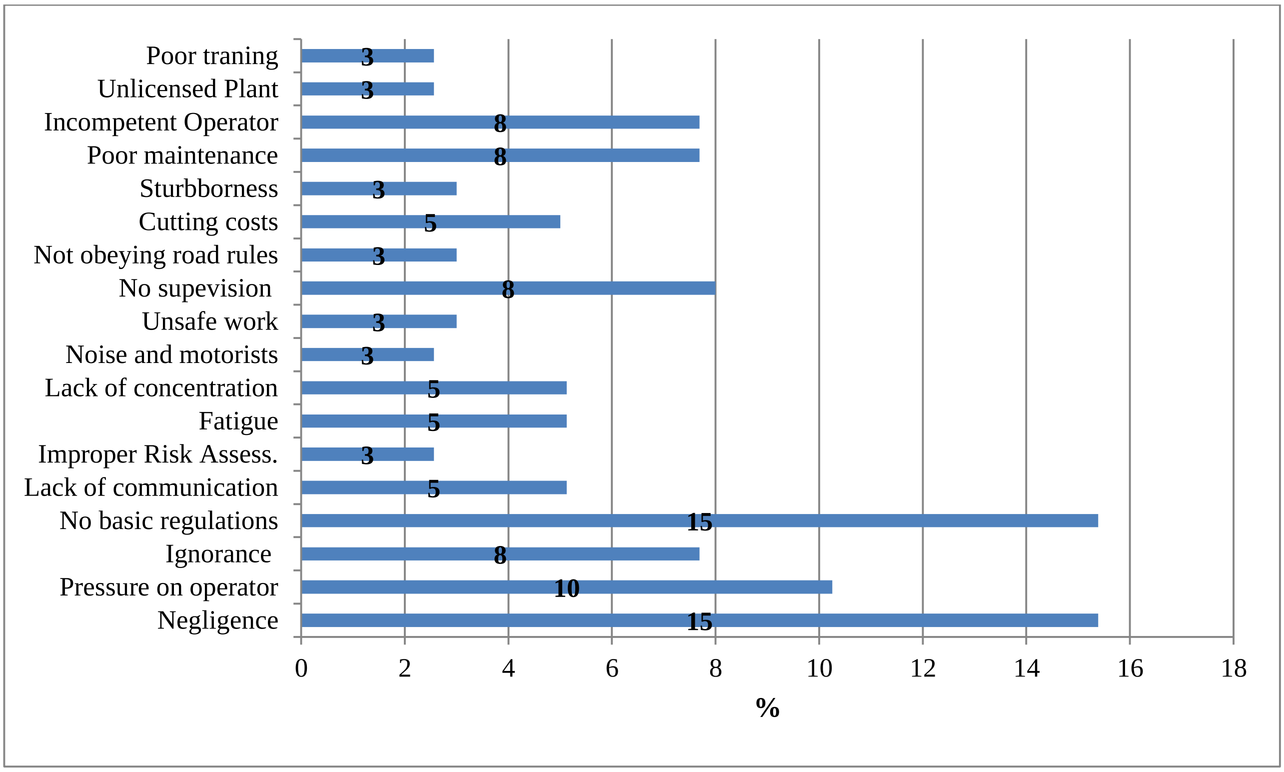

Figure 14: Why plant and equipment related accidents occur

According to Figure 14, Negligence of both management and operators was considered to be the main reason for accidents occurring it was usually caused by management not enforcing proper H&S regulations (15%). Operator ignorance also considered one of the main causes of plant and equipment related accidents. One of the professionals mentioned that operators usually experience pressure from management (10%) by wanting to please management. Operators might even say, "*I don't think it's safe"* or might not be so confident with operating a specific type of equipment. Another reason which participants mentioned, include cutting costs (5%) in the aim of increasing productivity. Companies wanted to reduce costs by not sending their operators for H&S courses or updated courses on plant operation. Companies also sought to reduce costs by subjecting their workers to unhealthy and unsafe working conditions for the purpose of increased productivity. However, according to Rikhardsson and Impgaard (2004), H&S costs as results of accidents have a negative effect on the company and productivity. Therefore disregarding H&S does not save cost to the company but has an opposite effect to the company. Road construction professionals should therefore be aware of direct and indirect cost to the company due to accidents and fatalities.

4.5.3.2 Mitigation and Prevention Systems Hazards

The figure 15 shows the mitigation and prevention systems used by participants to prevent hazard exposures. From this figure it was found that 23% of respondents make use of Daily Safe Task discussions prior to the commencement of work. This was reported by the majority of respondents. The second most common prevention system included Risk Assessment (RA), which consisted of 21%. Daily checklists were used by 13% of the respondents, which made it the third used method for mitigating hazards exposures. Induction and operator training was rated 10%. The least used mitigation and prevention methods included. H&S officer checks before plant leaves depot (5%), sign boards, amber lights, cones to separate road works (5%), Methods statements (5%) and Environmental Impact Assessments prior project (5%).

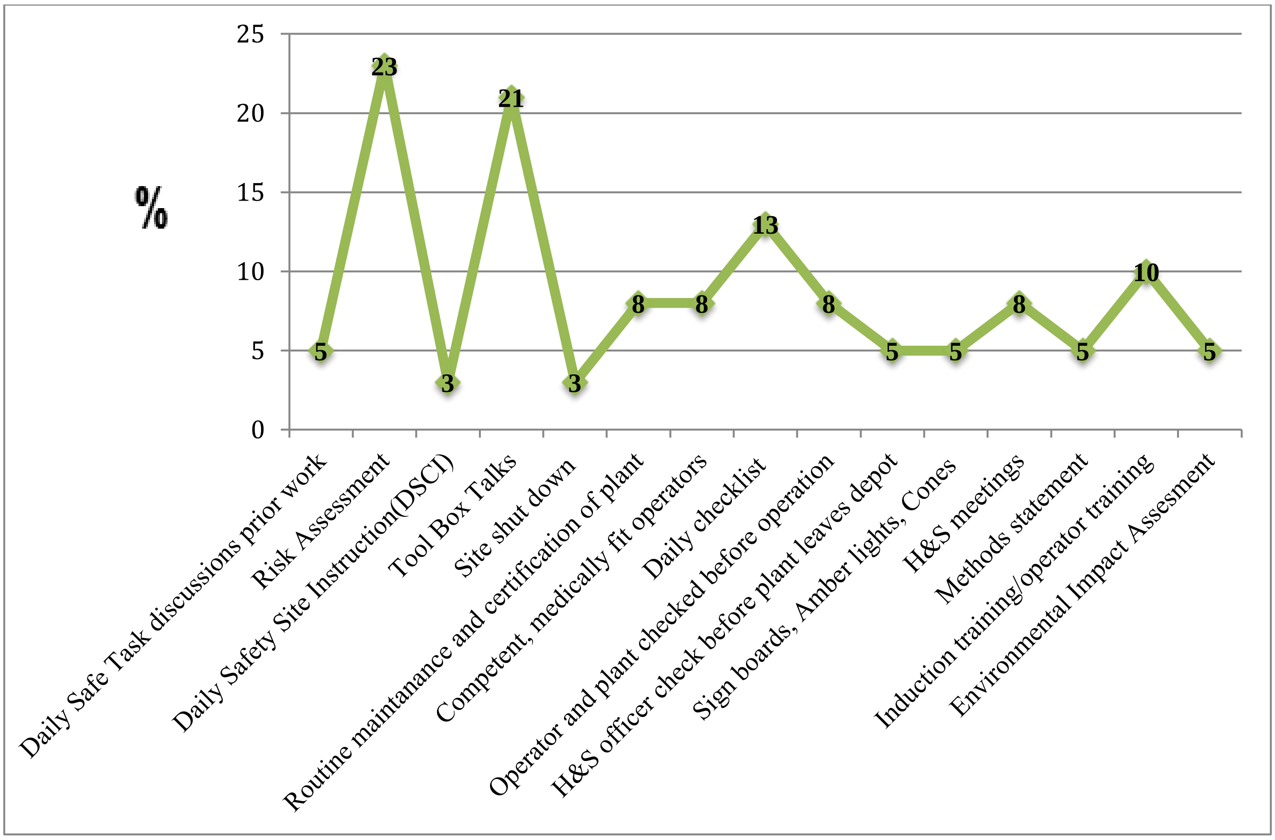

Figure 15: Mitigation and Prevention of Hazards

4.5.2.3 Reporting and Investigation Process

Respondents were asked to describe the reporting and investigation process in the event of an accident or injury occurring on their site. From Figure 16, it appears that 51% of respondents used an Incident report in the event of an accident while 46% stated that the H&S officer, team leader and site manager were informed. Participants also stated that depending on the severity of an injury, First Aid was performed (26%) or an ambulance was called and the injured person\s were taken to hospital. Twenty six percent (26%) of participants reported that an investigation process was undertaken; this included taking photographic evidence of the aftermath of the incident. Respondents also mentioned that the police and local authorities were involved (15%) in the investigation process. Investigations followed meetings with involved persons and management (8%) and measures of how to prevent such accidents in future accidents (10%). Records were kept for use in preventing future accidents (8%). Reports of fatal accidents were taken to Department of Labour (8%).

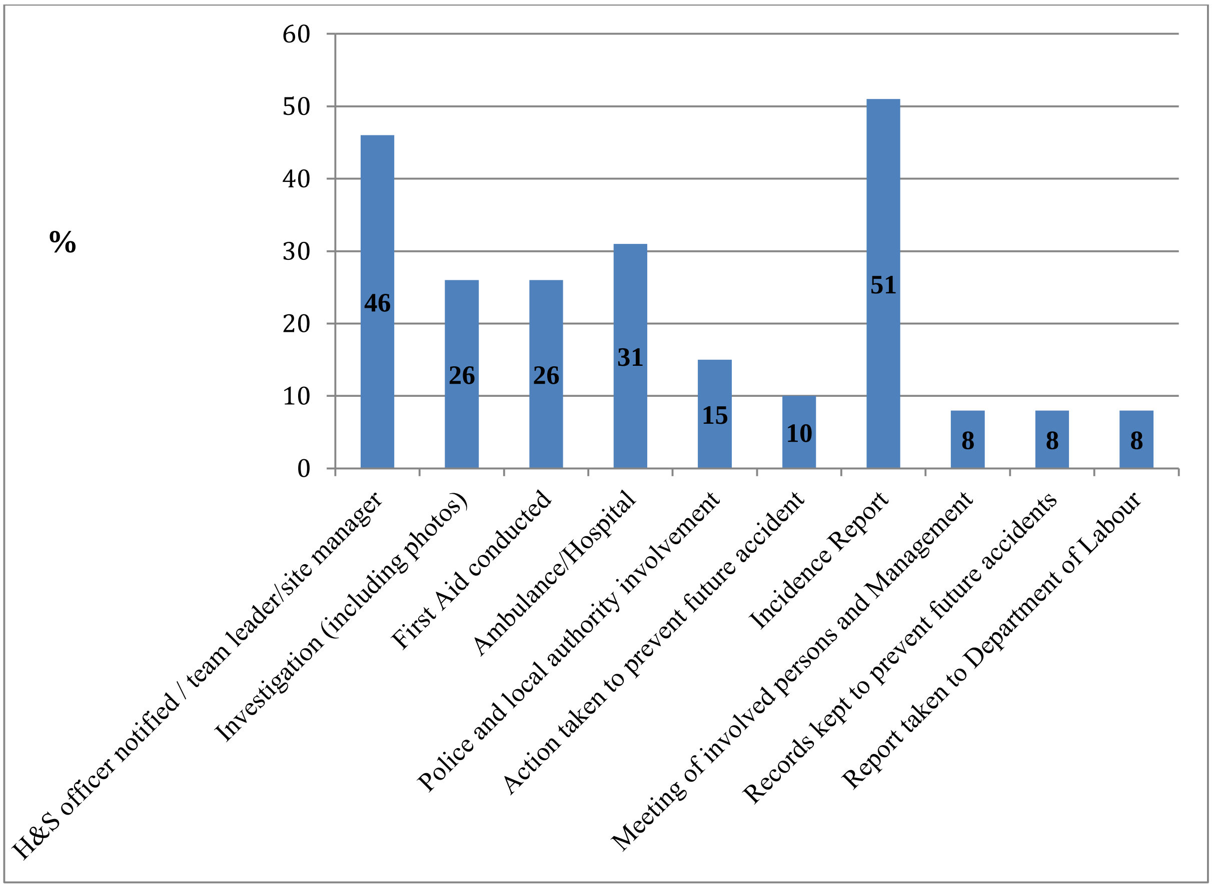

Figure 16: Incident reporting and investigation

Some respondents stated the following:

"Safety Officer needs to know about the incident. First aid is done. We need to report to the safety rep. If necessary, they will check how severe the problem with first aider is… Safety reps on site report to H&S officer…"

"Kinda difficult to explain... H&S officer will do an investigation. Every morning there is a tool box talk to follow procedures. For example, we check breath and see if persons are not under the influence of alcohol…… Tip truck device is used to check speed….. All help is implemented to avoid accidents. The more mistakes we make, they lead to permanent damage….."

"Reported to me….. Report to police station…. Case number is given... Insurance company if operator is hurt, fill in an IOD form… Compensation, investigation conducted by company. Meeting with operator, drivers, to explain what could have been done to prevent that…"
"Forensic investigation, Barricade the area, take photos, statement of what happened and mechanical checks, call labour department…"

An "Annexure 1" document shown in Appendix D was used by construction contractors for the recording and investigation of incidents is divided into four main sections, namely:

- Section A: Recording of incident
- Section B:Investigation of the Above incident
- Section C: Action taken be responsible person ; and
- Section D: Examination of Record by Safety Committee

H&S officers are usually responsible in the filling in of the incident report. A typical report will have details on the type of injury sustained (for example fracture or burn) the body affected and the nature of exposure in terms of the type of work which was being performed when the incident happened.

Section B of the report includes a short description of the incident, suspected cause of incident and. recommended steps taken to prevent its recurrence.

Section C reports the action taken by the employer to prevent the recurrence of a similar incident. While section D provides remarks and viewpoints from the H&S committee.

It is a requirement by the OHSA (1993) that when an incident occurs a reporting and investigation must be conducted. The purpose of this regulation is to prevent future exposures to hazards and thereby prevent future accidents and consequences of fatalities.

From site 2, for example in reference to an incident report (Appendix C), Section B, revealed what was filled by the H&S officer. Under subheading, "*Short description of incident"*. The statement was as follows:

"Employee jump from the vehicle then he got hurt on his face and arm."

Under subheading, "*Suspected cause of incident*" it was reported that:

"*The employee was not think straight to risk with his life like this and he did not wait until the vehicle stopped (His negligence).*

Under subheading, "*Recommended steps to prevent recurrence*" it was reported that:

"*All employee must not use the vehicle without the canopy immediately – And when are inside they must all sit down, not on the sides of the vehicle. Also wait to stop*."

The statements made by the H&S officer reveal two things:

- Firstly the description of the incident was very brief, the report only provided about three lines to fill this in. This supported that accident investigations were regarded as superficial in nature and do not fully aim to improve safety (HSE, 2003; Riaz et al., 2011)
- Secondly in the sections for providing the suspected cause of incident and recommended steps to prevent recurrence sections. These mainly provided information of who was at

fault instead of aiming at disclosing accident contributing factors (*Ibid).* This implies that accident investigations were usually seen as based on human error (Shoudhry and Fang, 2008 citing Brouwn, 1995).

The question "*why*" the accident happened was not answered in the incident report. It was merely concluded that it was the employee's negligence. There might be other reasons why this particular worker had to sit on the outside and not inside the vehicle. This worker might be ensuring the material or equipment at the back of the vehicle was secure. Therefore it would be helpful in include in the investigation process to answer the question of why an accident had occurred, thereby addressing the accident underlining causes (Moosa, Haupt and Harinarain, 2013). Hinze et al. (1998) identified key roles in accident causation. One of the reasons accidents occur was that an accident investigation stops prematurely and root causes might not fully established.

From the incident report (Appendix D), under section C, the action taken by employer to prevent recurrence of a similar action it, contained the following:

- *That tool box talks should be conducted to train employees and*
- *That all employees should not use a vehicle without a canopy*

In preventing accident reoccurrence, ideally the root causes need to be established. In this incidence that was not the case, suggesting a deficient accident investigation process (Hinze et al 1998).

Riaz et al (2011) stated that, as part of the H&S plan, a data flow analysis for accident investigation could be adopted. An accident investigation process should therefore include a full investigation by the safety department to determine the root causes. The management team should be provided post-accident actions, lessons learned and an executive summary of the incident, which will be the basis for determining accident preventive methods. These preventative methods should be communicated to stakeholders and other construction companies.

According to the findings, it is indicative that Riaz et al (2011) stated H&S plan with regards to accident prevention such as a data flow analysis was not applied. Therefore better methods such as these should be incorporated in the accident investigation process to decrease the accident and fatality rate.

4.5.2.4 H&S Project Meetings

Respondents were asked if H&S project meetings were held on site (Table 17). The majority of respondents reported that they were. Only two persons stated that there were no H&S meetings on site. It is possible that the majority wanted to appear as following H&S procedures by distorting their answers (Aaker, Kumar and Day, 2006). However, most respondents mentioned that H&S was a major part of a project meeting. On the other hand it was also possible that some respondents were unaware of the H&S project meetings.

Table 17: H&S Project Meetings

Site	H&S Meetings held on site	Percentage %
1	Yes	8.33%
2	Yes	8.33%
3	Yes	8.33%
4	Yes	8.33%
5	Yes	8.33%
6	Yes/No	8.33%
7	Yes	8.33%
8	Yes	8.33%
9	Yes	8.33%
10	Yes	8.33%
11	Yes/No	8.33%
12	Yes	8.33%
Total	**12**	**100%**

4.5.2.5 Frequency of H&S Project Meetings

Respondents were asked how frequently these H&S meeting were held. Table 18 Participants responded as follows:

Table 18: Frequency of H&S meetings

Frequency	Percentage rate (%)
Daily	24%
Weekly	22%
Monthly	41%
Unsure	3%
Twice a month	5%
Quarterly	5%
Total	100%

The modal group (41%) of respondent had monthly H&S meetings while 24% stated that they had daily H&S project meetings and 22% reported weekly meetings.

4.5.2.6 H&S Meetings not held on site

Participants were asked if meetings were not held and to provide reasons if this was the case. Two respondents stated that they were no H&S project meetings on site and the following were their reasons:

"…Depends on size of project…"

"…Check list is conducted..."

The reasons provided indicate that the project size has an effect of whether H&S meetings are held or not.

4.5.2.7 Follow up procedures in place to ensure that H&S items are actioned

Participants were asked what follow up procedures were used to ensure that H&S items are actioned. Figure 17 illustrates their responses.

The majority modal group of respondents (13%) stated that instructions with regard to H&S were given to the appropriate person during meetings or site walkabout meetings. Ten percent (10%) of respondents stated that a time frame was given to persons responsible for that specific item to be completed. Another 10% mentioned that safety audits were done as a H&S follow up procedure. Risk assessments as well as Tool box talks were reported by 8%. Other responses included a Daily Site Inspection (DSI) (5%); a report is issued (5%) which contains instructions on H&S items to be actioned. Five percent (5%) of respondents stated that a H&S officer was responsible in ensuring H&S items were actioned. Other responses (3%) included that a chairperson of a committee followed up H&S items. Hazards being identified and preventative measures been taken (3%) was also considered as a follow up method.

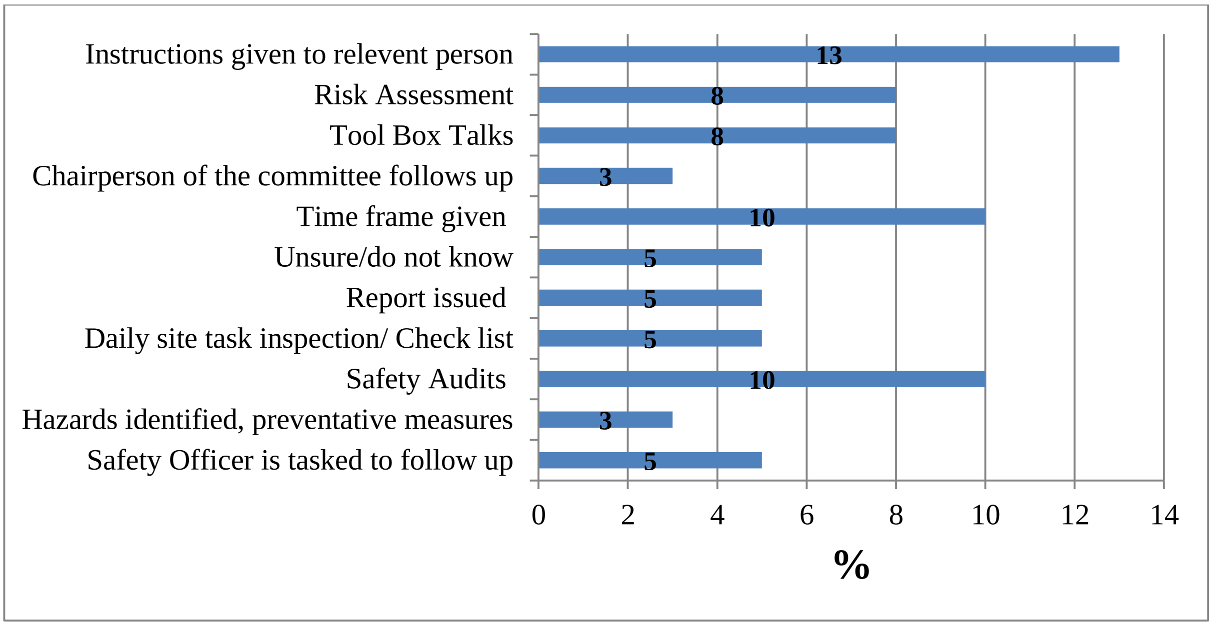

Figure 17: Follow up procedures for H&S items

4.5.4 H&S Sub-contractor Committees

4.5.4.1 Sub-contractor internal H&S Committees

Table 19 illustrated the percentage who said that sub-contractors had their own internal H&S committees. The majority (53%) of respondents mentioned that they did so.

Table 19: Sub-contractor internal H&S Committees

Sub-contractor internal H&S Committees	Percentage rate (%)
Yes	53%
No	36%
Unsure	11%
Total	100%

Participants were also asked if sub-contractors had their own sub-contractor internal H&S Committees and if not, why that was the case. According to Figure 18, 67% of respondents reported that sub-contractor safety representatives were joined with the principal contractor. The pie-chart also showed that 17% of respondents reported that they had a small site and so no sub-contractor committee meetings were held. Therefore H&S committees were unnecessary. Other participants reported that they do everything and that they do have sub-contractors (8%) but they must interact with them to ensure they do everything correctly. Another reason why there were no sub-contractor meetings was that there could be a duplication of meetings (8%).

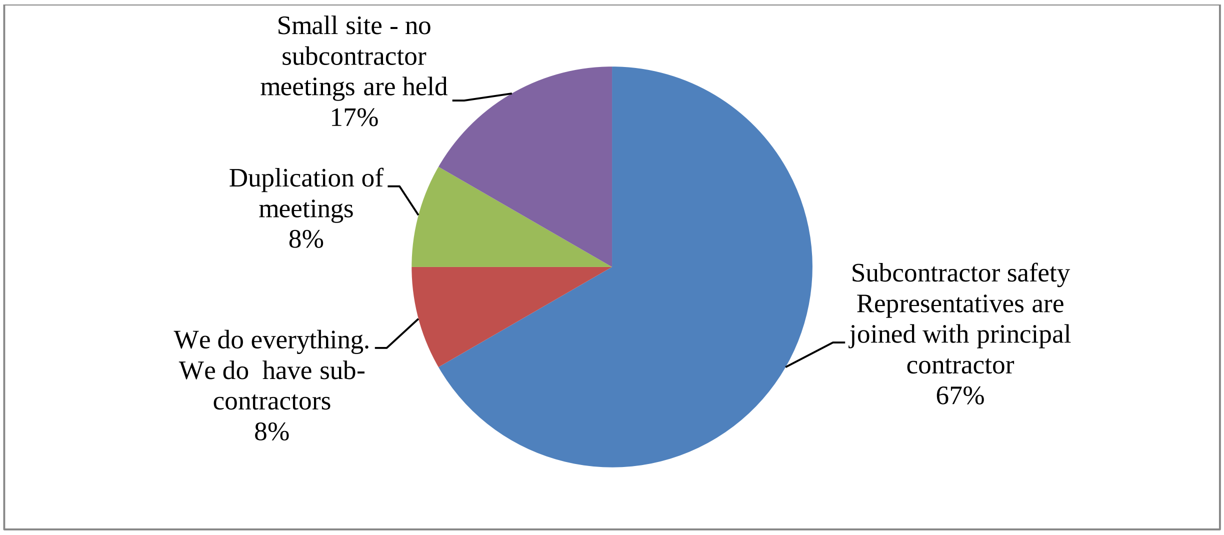

Figure 18: Sub-contractor H&S Committee

4.5.4.2 Sub-contractor and H&S Committee meetings

Interviewees were asked if sub-contractors have their own internal H&S committee meetings. Table 20 summarised their responses. It shows that 61% of respondents reported to have sub-contractor internal H&S committee meetings.

Table 20: Sub-contractor internal H&S committee meetings

Sub-contractor internal H&S committee meetings	Percentage rate (%)
Yes	61%
No	31%
Unsure	8%
Total	100%

4.5.4.3 Frequency of sub-contractor meetings

Interviewees were asked to report the frequency of sub-contractor H&S committee meetings. Participants generally had monthly (39%) sub –contractor H&S committee meetings (Table 21).

Table 21: Frequency of sub-contractor meetings

Frequency of sub-contractor meetings	Percentage rate (%)
Daily	18%
Weekly	29%
Monthly	39%
Unsure	7%
Twice a year	4%
Quarterly	4%
Total	100%

4.5.4.4 Sub-contractor meeting minutes forwarded to the principal contractor

Participants were also asked if sub-contractor meeting minutes were forwarded to the principal contractor. Table 22 shows that most (80%) respondents stated that they forwarded sub-contractor meeting minutes to the principal contractor.

Table 22: Meeting minutes forwarded to the principal contractor

Sub-contractor minutes forwarded to the principal contractor	Percentage rate (%)
Yes	80%
No	11%
Unsure	9%
Total	100%

4.5.4.5 Internal H&S committee meetings not held

Respondents were asked if sub-contractors H&S Committee meetings were not held they should provide reasons of why that was the case. According to Figure 19, the majority of the sites mentioned that they ensure that team talks occur on site which includes sub-contractors (54%). An operational manager mentioned:

"…Yes,… team talk meeting. Minutes forwarded to principal contractor. Safety is explained in meetings which are signed by them (sub-contractor). So that they don't blame management if action is taken against them…"

Figure 19 also reveals that 21% of respondents thought that theirs was a small site and therefore sub-contractor meetings could not occur. Other participants mentioned that sub-contractors were a separate entity (12%).

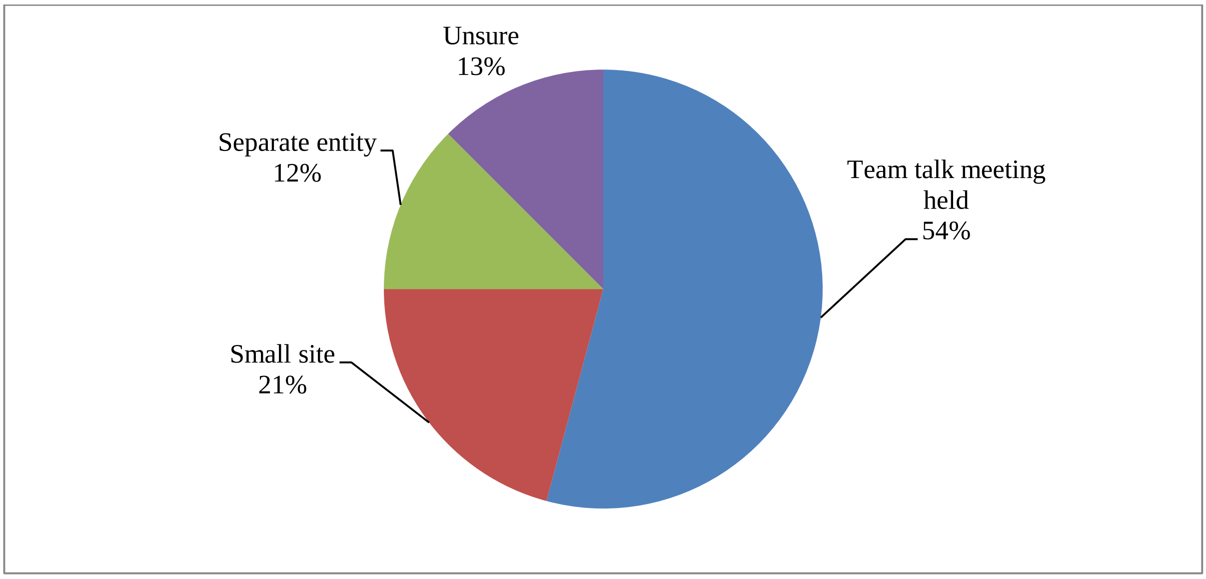

Figure 19: Sub-contractor meetings

4.5.5 Measures in place to ensure plant and equipment related accidents are mitigated

4.5.5.1 Measures in place to ensure accidents are mitigated or prevented

Participants were asked what measures were in place to ensure that plant and equipment related accidents were mitigated or prevented. The content analysis revealed that there was a language problem in identifying the differences between hazards and accidents. The majority of the respondents skipped question 29 saying that question 24 asked the same thing, the questions were as follows:

Question 24

What systems are in place to ensure that plant and equipment related hazards are mitigated?

Question 29

What measures are in place to ensure that plant and equipment related accidents are mitigated or prevented from happening?

In layman's terms the questions are similar, but in relation to H&S, this is a professional jargon used by respondents. This is more especially with H&S officers who participated in the interviews. This is interesting because they (H&S officers) should have been familiar with the differences. Their inability to see the difference casts doubts on their familiarity with H&S concepts.

According to Figure 20, 33% of participants stated that combined tool box talks was the main way of ensuring accidents are mitigated on their sites while 31% of respondents stated that they relied on routine maintenance and certification of plant and equipment. It was also found that 30% of the respondents believed that Safety Work Procedures such as check list and the completion of method statements were utilised to reduce plant and equipment related accidents. Respondents mentioned that they used Risk assessments tools (23%) and continuous employee H&S training facilitated to combat accidents. Other methods used included the use of sign boards, better PPE (10%); supervision (7%), Daily Safety Site Instructions (DSTI) (8%), ensuring employees were competent (5%); and adequate lighting and less congestions on sites (3%).

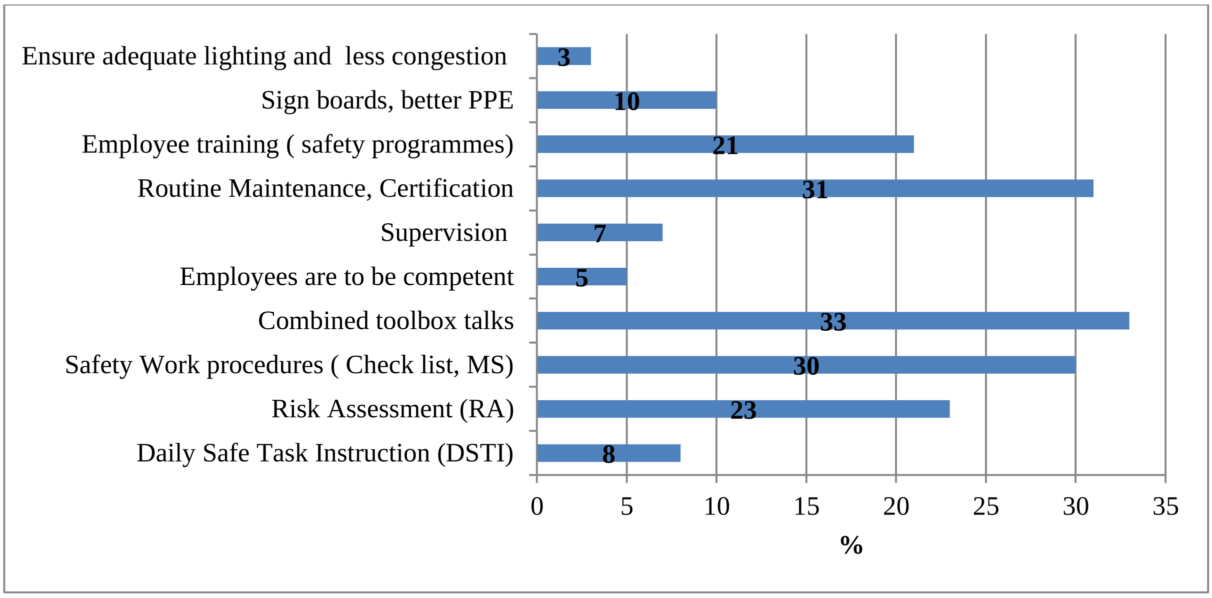

Figure 20: Measures in place for accident are mitigated or prevented

4.5.5.2 Suggested measures in place to ensure accidents are mitigated or prevented

In the interview schedule, this question served to inform the researcher of suggestions which participants had to mitigate plant and equipment related H&S risks. Participant's responses were represented in Figure 15.

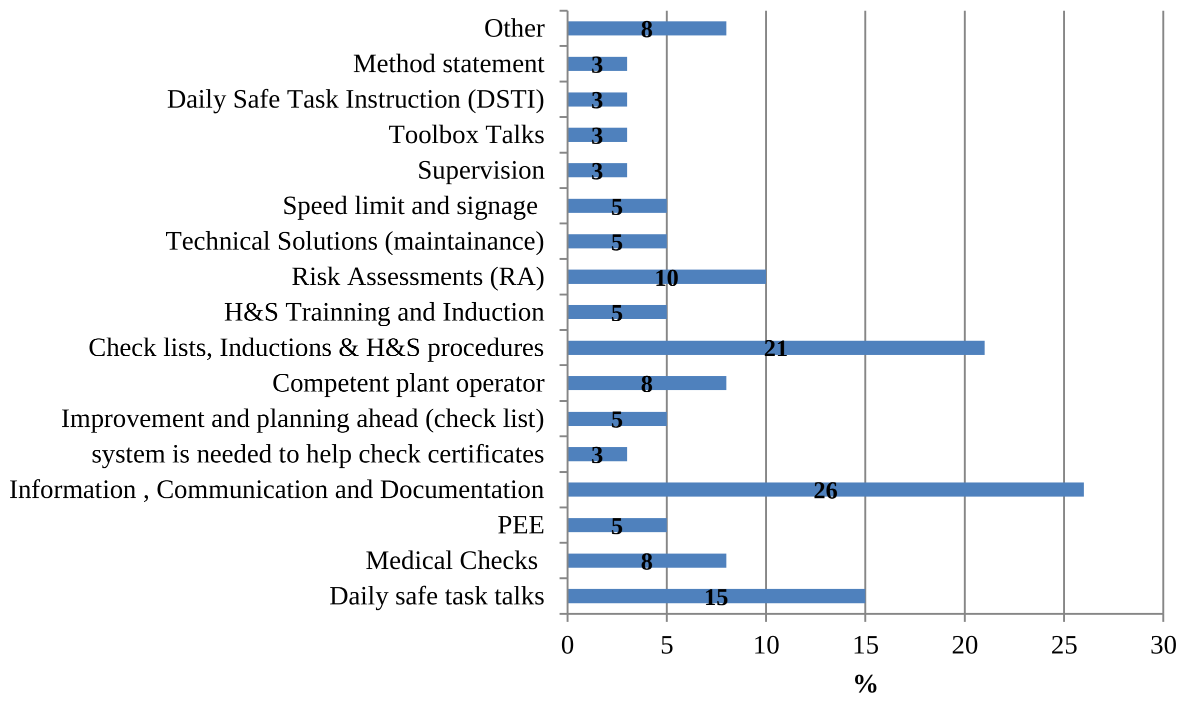

Figure 21: Suggested measures for accident mitigation or prevention

According to Figure 21, the most often mentioned mitigating measure was H&S information and communication and documentation (26%). The following were some of the quotes when asked about suggested measures that can be taken:

"Information - Everyone needs to know and be aware and know what is happening and carry on knowledge from site to site. That's why the company has a zero tolerance…."

"Working in community…. communication with people to be away from site…. In regulation they need to follow the speed limit to keep safety..."

Respondents also mentioned check lists, inductions and following H&S procedures (21%) as a way of preventing accidents from occurring. Daily safe task talks (15%) were amongst the favoured method of accident mitigation. Risk assessments (10%) and operator medical checks (8%) were also ranked highly amongst participants.

4.6. Road contractor's compliance with H&S regulations on road construction projects

4.6.1 Basic Construction H&S regulations followed on site

Participants were asked to explain why they thought basic construction H&S regulations were not followed on site. An operational Manager from site 3 mentioned that basic construction H&S regulations were not diligently followed. Whilst, a site administrator from site 1 claimed that H&S regulations were indeed followed on site. This participant also made a note that their H&S officer gets audited within the company and by the consultancy firm involved in the project. As shown in Figure 22, 97% of respondents mentioned that basic construction H&S regulations were followed on sites.

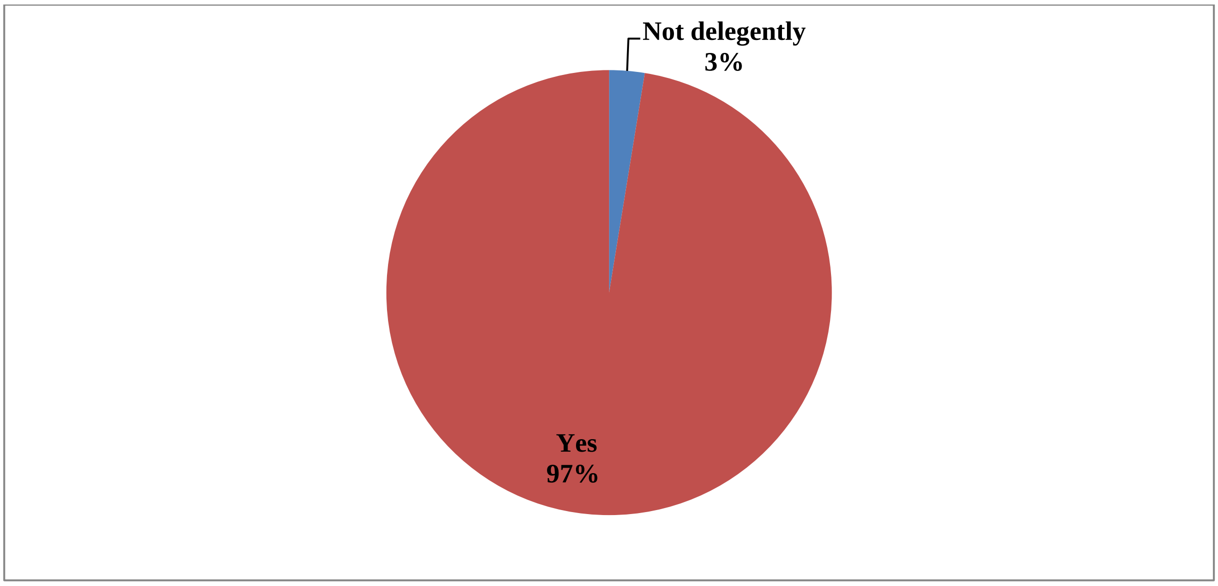

Figure 22: Basic Construction H&S Regulations

4.6.2 The most frequent violations of H&S Construction Regulations

Participants were asked what were the most frequent violations of H&S construction regulations. Their responses were summarised in Figure 23.

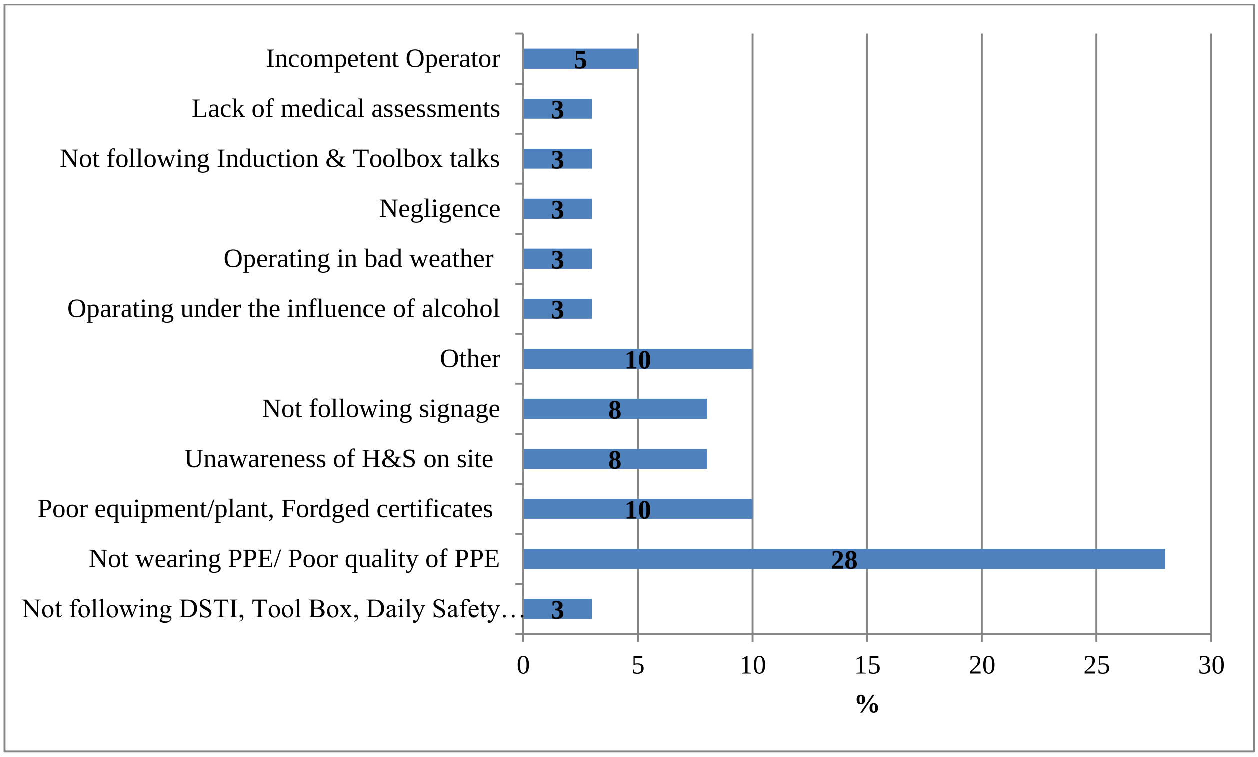

Figure 23: H&S regulation violations

The most frequently mentioned violation of H&S regulations was not wearing PPE or the poor quality of PPE was frequent violation. It was also noted that 10% of respondents reported that the poor condition of plant and equipment while forged certificates were also a frequent H&S regulation violation. Other H&S regulation violations included: The use of an incompetent operator (5%), not following signage (8%). It was also reported that operator lack of medical assessments (3%), persons not adhering to induction and tool box talks (3%), employee negligence (3%), operating in bad weather conditions (3%), operating under the influence of alcohol (3%); and not following Daily Safety Task Instructions (DSTI) (3%).

According to the OHSA, it is the responsibility of the employer amongst other duties to provide for all necessary protective clothing and equipment for construction workers.

…Taking such steps as may be reasonably practicable to eliminate or mitigate any hazard or potential hazard to the safety or health of employees, before resorting to personal protective equipment… (South Africa, 1993:8)

From the OHSA, PPE forms part of ensuring the safety and health of employees was paramount. A poor quality of PPE or its absence therefore violates this H&S construction regulation. PPE quality also hinders production (Haslam et al. 2005). It was notable that participants mentioned this problem as the most frequent violation. The attitude of management and their commitment towards H&S could play a role here.

Other studies confirm that workers were seldom provided with PPE by management (Windapo and Oladapo, 2012; Haslam et al., 2005). The attitude and of management and commitment can be linked to the lack of H&S awareness on construction sites (Edwards and Holt, 2007). This plays a significant part to the consideration of H&S, seeing that a negative image of H&S was portrayed by management might make employees also disregard H&S (Windapo and Oladapo, 2012; Haslam et al., 2005)

4.6.3 Inspection and Verification of Certification of plant and equipment operators

Respondents were asked if they regularly inspected and verified certification of plant and equipment operators. According to Table 23, 69% of respondents stated that they regularly inspected and verified plant and equipment operators.

Table 23: Inspections and verifications

Yes/No	Inspections and verifications	Percentage rate (%)
Yes	27	69%
No	12	31%
Total	39	100.%

4.6.3.1 Frequency of Inspection and Verification of Certification

Respondents were asked how frequent they inspected and verified plant and equipment operator certification. Table 24, illustrated that 41% of participants did this task on a daily basis while only 10% did the task on a monthly basis.

Table 24: Frequency of Inspection and Verification of Certification

Frequency	Percentage rate (%)
Daily	55%
Weekly	7%
Twice a week	4%
Monthly	14%
Every three months	4%
Randomly	7%
Yearly	7%
Unsure	2%
Total	100%

4.6.3.2 Certification, Inspection and Verification Records

Participants were asked if they did plant and equipment operator certification inspections and verifications, and if so, where they kept these records. Figure 24 shows that 95% of respondents stated that they kept inspection and verification records in the safety file on site. While 5% of respondents reported that these records were kept in an off-site office. However 10 persons did not answer this question means suggesting that they did not perform inspections nor write up verification of plant and equipment operator certificates.

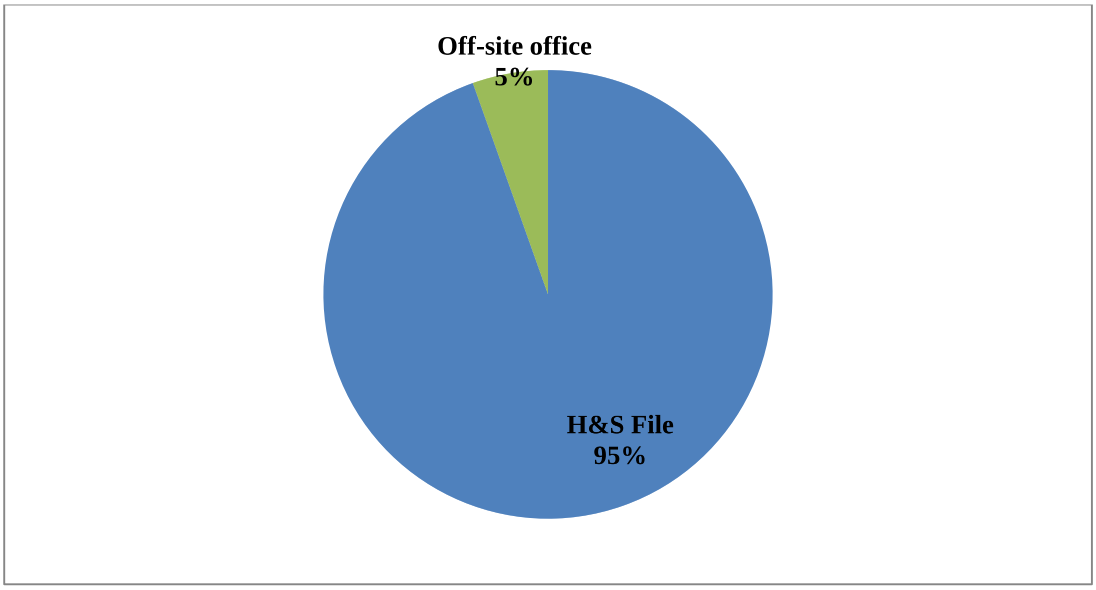

Figure 24: Certification Inspection and Verification Records

4.6.3.3 Operator is not certified or does not have proof of certification

Participants were asked what happens when an operator is either not certified or does not have proof of certification. Figure 25 illustrates their responses.

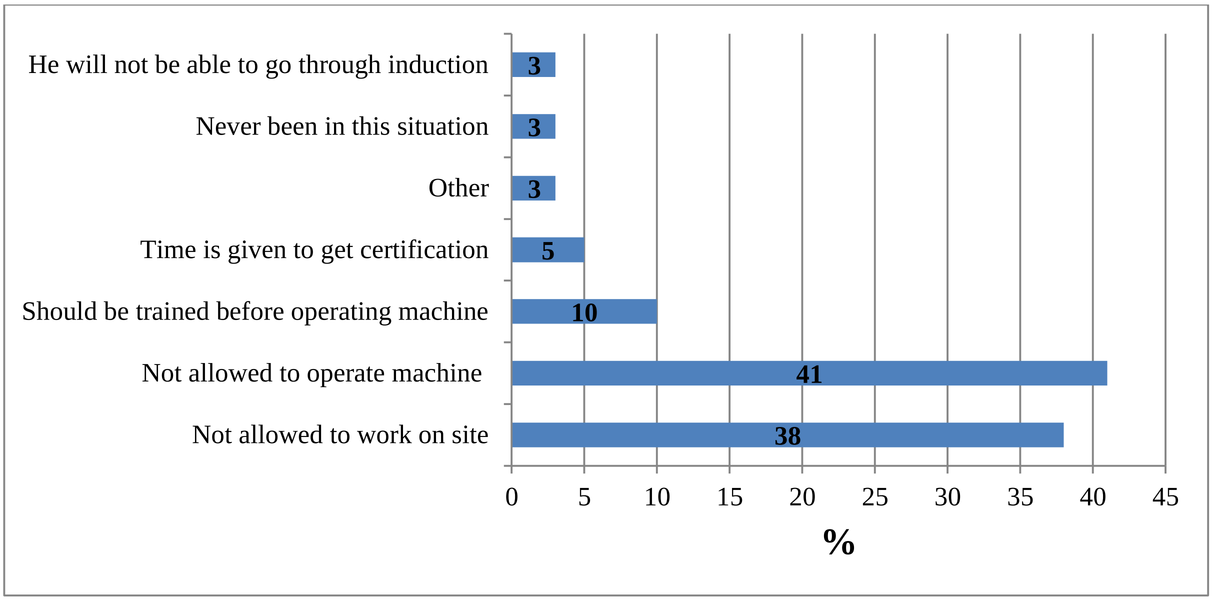

Figure 25: Proof of certification

According to Figure 25, 41% of respondents stated that operators that were not certified or did not have proof of certification were not allowed to operate the machine. Thirty eight (38%) of respondents stated that operators were not allowed to work on site. For example, a Traffic Safety Officer from site 6 stated:

"*…He will not be allowed to operate any machinery and depending on the circumstances, may be asked to leave site"*

A foreman who managed site 6, stated:

"….He does not work. Look for another job. The grader for example is 2.2 millions, cannot give incompetent operator…."

A project manager from site 12 sated:

"..Not sure- stop doing that work. Not compliant with safety rules

This showed the importance of plant and equipment operator certification prior to operation. The site foreman from site 6 expressed the monetary value of a grader being R2.2 million. It was also observed, that participants looked shocked and had no tolerance for non-certified plant and equipment operators. The project manager from site 12 also informed the researcher that an operator not having certification was a violation to H&S construction regulations.

4.6.3.4 Inspection and Verification of maintenance Records

Participants were asked if they inspected and verified the maintenance records of plant and equipment they used. Table 25 represents their responses.

Table 25: Maintenance record inspections and verifications

Maintenance records inspections and verifications	Percentage rate (%)
Yes	74%
No	26%
Total	100%

From Table 25 it appears that the majority (74%) of respondents claimed to inspect and verify plant and equipment maintenance records. While 26% did not inspect and verify plant and equipment maintenance records. A H&S officer, from site 12 did not answer this question with a yes or no response. The following was quoted from this particular respondent:

"…They go for service, I don't inspect… workshop inspect on request…"

4.6.3.5 Frequency of inspection and verification of maintenance records

The interviewer asked the frequency of inspection and verifications of maintenance records Responses obtained are summarised in Table 26. It shows that 39% of respondents said that they inspected and verified plant and equipment maintenance records on a daily basis while 19% claimed that they did this task weekly.

Table 26: Inspection and verification of maintenance records

Frequency of inspection and verification maintenance records	Percentage (%)
Daily	39%
Weekly	19%
Twice a week	3%
Monthly	10%
Once a month	3%
Every three months	7%
Twice a month	3%
Randomly	7%
Yearly	3%
Unsure	3%
Every six months	3%
Total	100%

4.6.3.6 Plant and Equipment Maintenance Records

Participants were asked if they inspected and verified maintenance records and where they kept these records. Their responses were summarised in the pie-chart shown in Figure 26. It shows that 91% of plant and equipment maintenance records were kept on an on-site H&S office. Three percent (3%) of the participants had a company plant yard where maintenance records were kept while an equal number stated that they were unsure.

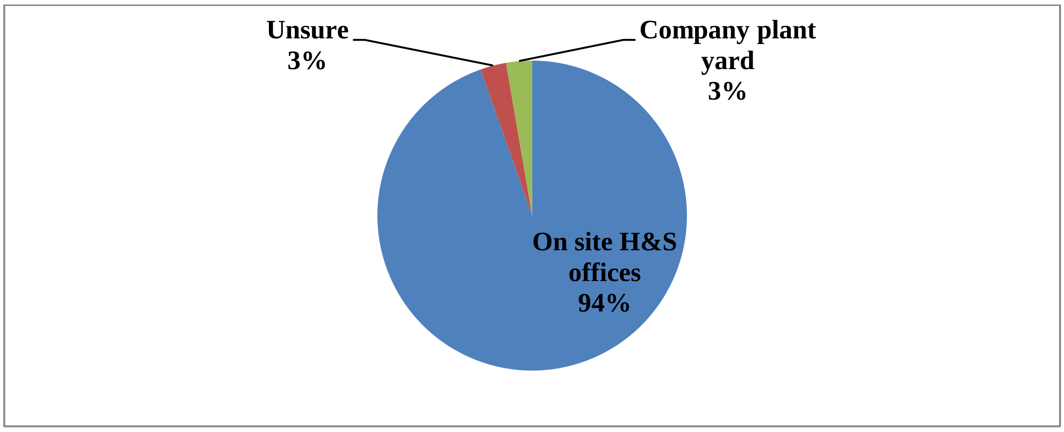

Figure 26: Plant and Equipment maintenance, certificate or license records

4.6.3.7 Action taken towards not-up-to date maintenance records, certificates or licenses

Interviewees were asked what they did about plant and equipment that did not have up-to-date maintenance records, certifications or licenses. Their answers are illustrated in Figure 27. The modal group 33% stated that when plant and equipment maintenance, certificates or licenses were not up-to-date then the plant and equipment was taken off-site. Respondents (26%) also said the plant was not used and taken off site. Some participants 8% did not deal with reports related to plant and equipment. Other participants mentioned that it is the responsibility of the contractor to deal with plant and equipment records. Respondents who stated this were mostly consultant engineers.

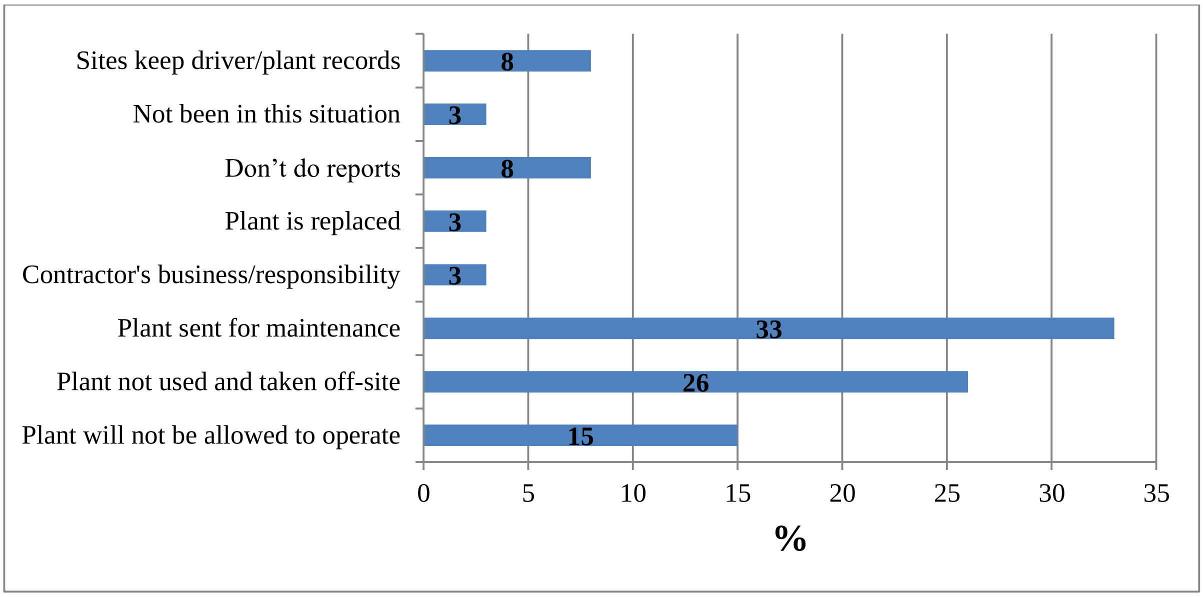

Figure 27: Plant and Equipment un-updated Maintenance Records

4.6.3.8 Principal contractors and sub-contractors inspections

Interviewees were asked whether principal contractors and sub-contractors inspect and kept records of inspections of construction plant and equipment. Table 27 shows that 97% of respondents reported that principal contractors and sub-contractors inspected plant and equipment and kept records of these inspections.

Table 27: Principal contractors and sub-contractors inspections

Principal Contractors and sub-contractors inspections	Percentage rate (%)
Yes	97%
No	3%
Total	100%

4.6.3.9 Why principal contractors and sub-contractors do not inspect and keep records

Respondents were also asked why principal contractors and sub-contractors do not inspect and keep records of plant and equipment on their sites. The majority of respondents did not answer this question, since they answered yes to the previous question, whether principal contractors and sub-contractors inspected and kept records of inspections of construction plant and equipment.

Operations managers from site 2 stated that only principal contractors kept maintenance records. The operations manager from site 3 made a note that subcontractors on their site were under their wing, therefore records were also kept with the principal contractors. However sub-contractors have their own plant and equipment inspections on a daily basis. The following quotes refer:

Site 2

"…Only principal contractors keep records, they also have daily inspections..."

Site 3

"…The sub-contractor are our babies, when inspection comes all files are checked including sub-contractors.."

4.6.3.10 Records of inspections of construction plant and equipment

The interviewer asked if principal contractors and sub-contractors inspected plant and equipment and if they did, where they kept records of these inspections. Figure 28 illustrates that 64% of respondents reported to have kept their plant and equipment inspection record in the H&S Site Office. Plant and equipment inspection files (8%) were also used to keep inspection records. Other records were kept in a master file in company's head offices (10%).

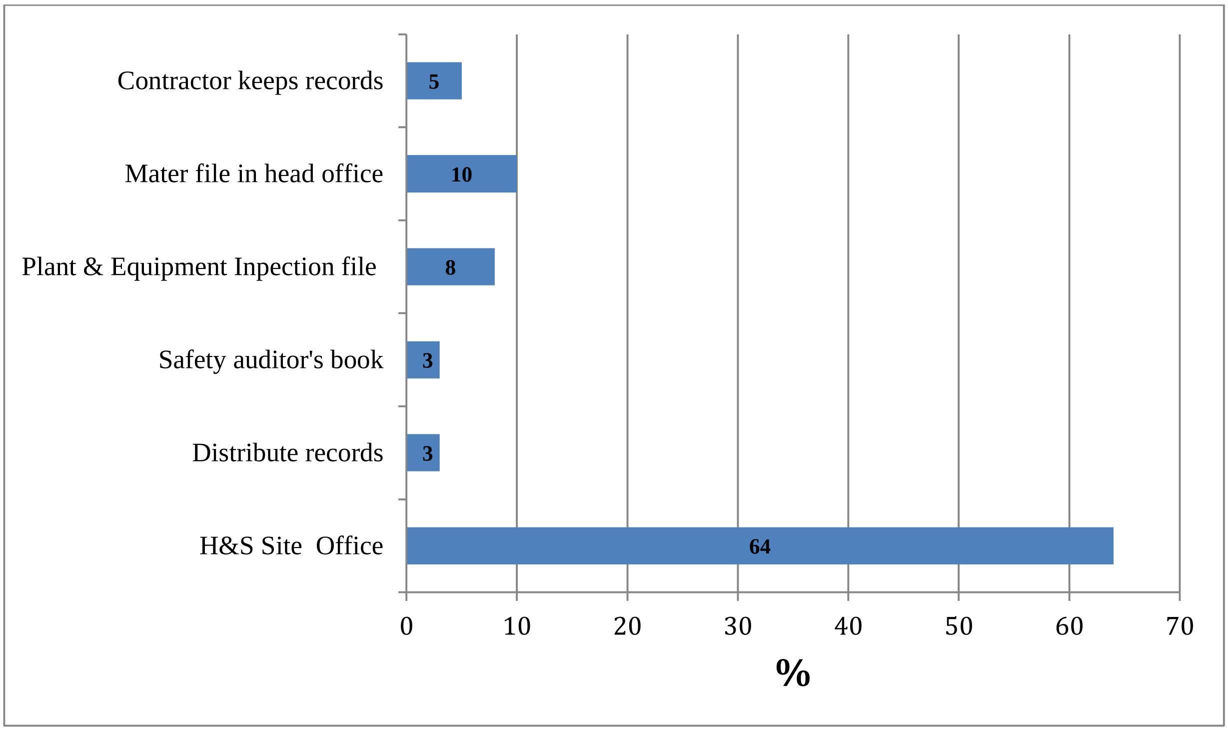

Figure 28: Records of inspections of construction plant and equipment

4.7 Extent of H&S training and management on road construction sites

4.7.1 Position held in organization and experience in construction H&S

Cross tabulation between the positions held in the organisation and experience in construction H&S is shown in Table 28. It seemed that all H&S officers were experienced in construction H&S (31%). Most of the other personnel claimed to have experience in various aspects of construction H&S. A total of 79% of all participants claimed experience in construction H&S. It was expected that 100% of the participants would have had experiences given that their position required H&S understanding and implementation. However, a safety net still existed as all sites had at least one individual (such as an H&S Officer) who was specifically responsible for the H&S aspects of the project.

Table 28: Position Held in Organisation & Previous Training in H&S

Previous training in construction H&S						
	Total participants	%	Yes	%	No	%
Health and Safety Officers	12	31%	12	31%	0	0%
Project and Site Managers	11	28%	9	23%	2	5%
Site Staff	3	8%	0	0%	3	8%
Contracts Manager, Operations and Transport Manager	4	10%	3	8%	1	3%
Engineers	4	10%	2	5%	2	5%
Health and Safety Manager/Consultant	3	8%	3	8%	0	0%
Foreman	1	3%	1	3%	0	0%
Traffic Safety Officer	1	3%	1	3%	0	0%
Total	39	100%	31	79%	8	21%

The comparison of position held in the organisation with construction plant and equipment H&S experience is shown in Table 29. Of the H&S officers, only 31% were experienced with construction H&S, specific to plant and equipment. All Safety Manager/Consultants had previous training associated with plant and equipment H&S (8%). The majority of Project and Site Managers claimed to be experienced in plant and equipment H&S (28%). While 10% of Contracts Managers, Operations and Transport Managers were experienced in H&S, 5% of the same group said that they had no experience with aspects of H&S plant and equipment. All Engineers reported to have no experience with regard to construction plant and equipment training.

This analysis shows that the majority of professionals were untrained in construction plant and equipment H&S aspects. This might help to explain the high accident and fatality rate experienced in the construction industry with regard to construction plant and equipment. This is also evidenced by Edwards and Holt, (2010) and Alkass et al. (2013) who found that the majority of accidents and fatalities experienced on construction sites were due to mismanagement as well as to improper use of construction plant and equipment.

Table 29: Position held & plant and equipment H&S experience

Previous training in plant and equipment H&S						
	Total participants	%	Yes	%	No	%
Health and Safety Officers	12	31%	8	21%	4	10%
Project and Site Managers	11	28%	4	10%	7	18%
Site Staff	3	8%	1	3%	2	5%
Contracts Manager, Operations and Transport Manager	4	10%	2	5%	2	5%
Engineers	4	10%	0	0%	4	10%
Health and Safety Manager/Consultant	3	8%	3	8%	0	0%
Foreman	1	3%	0	0%	1	3%
Traffic Safety Officer	1	3%	0	0%	1	3%
Total	39	100%	18	46%	21	54%

4.7.2 Management H&S training

According to Table 30 all participants claimed that managers had been trained in H&S. On sites 5 and 6, 25% of respondents thought that management were untrained in H&S. Half of respondents on sites 7 and 11 and the other half thought that management were untrained in H&S. Overall participants on all sites thought that site management had been trained in H&S. For example, on sites 1, 2, 3, 8, 9 and 10 had a “yes” response rate of 100%. This showed that the majority of persons in management positions were trained with regards to H&S.

Table 30: Management H&S training courses

Name of site	Management staffs taken any H&S training courses			
	Yes	%	No	%
1	6	100%	0	0%
2	4	100%	0	0%
3	2	100%	0	0%
4	3	100%	0	0%
5	3	75%	1	25%
6	3	75%	1	25%
7	1	50%	1	50%
8	3	100%	0	0%
9	3	100%	0	0%
10	3	100%	0	0%
11	1	50%	1	50%
12	3	100.00%	0	0%

4.7.2.1 Management Staff and H&S training courses

From Table 31 it is evident that 90% of persons claimed that management had taken H&S training courses. When participants who had not taken any H&S training were asked why this was the case, most did not respond. Those who did respond gave these responses:

"From management- is not detailed as H&S officer training.... They just highlight what the manager needs to know. SAFCE, plant hire associations have training- not as detailed as H&S officer"

"I have applied to attend that course"

"Only induction"

''Not sure, would not know... ask managers'

"Safety management, fire fighting, first aid"

"We don't need to. Constructors do this normally"

Participant's responses showed that most were unsure about H&S training in management levels and said that it is the responsibility of the H&S officer to deal with aspects of H&S in a project. Only one manager attended SAFCE plant hire association training. A resident engineer stated that they did not need to undertake any H&S training, because contractors normally do take these courses.

Table 31: Management Training

	Management Training	Percentage Rate (%)
Yes	35	90%
No	4	10%
Total	39	100%

4.7.2.2 H&S Training

Participants were asked what previous training in construction H&S they had undergone, Figure 29 illustrates their responses. Safety Health and Environment (SHE) had the highest consisted of 44%. Safety and Management training was at 28%. Risk Assessment and management/ Root cause analysis as well as OHSA Legal Liability at 18% while First Aid and SAMTRAC were at 15%.

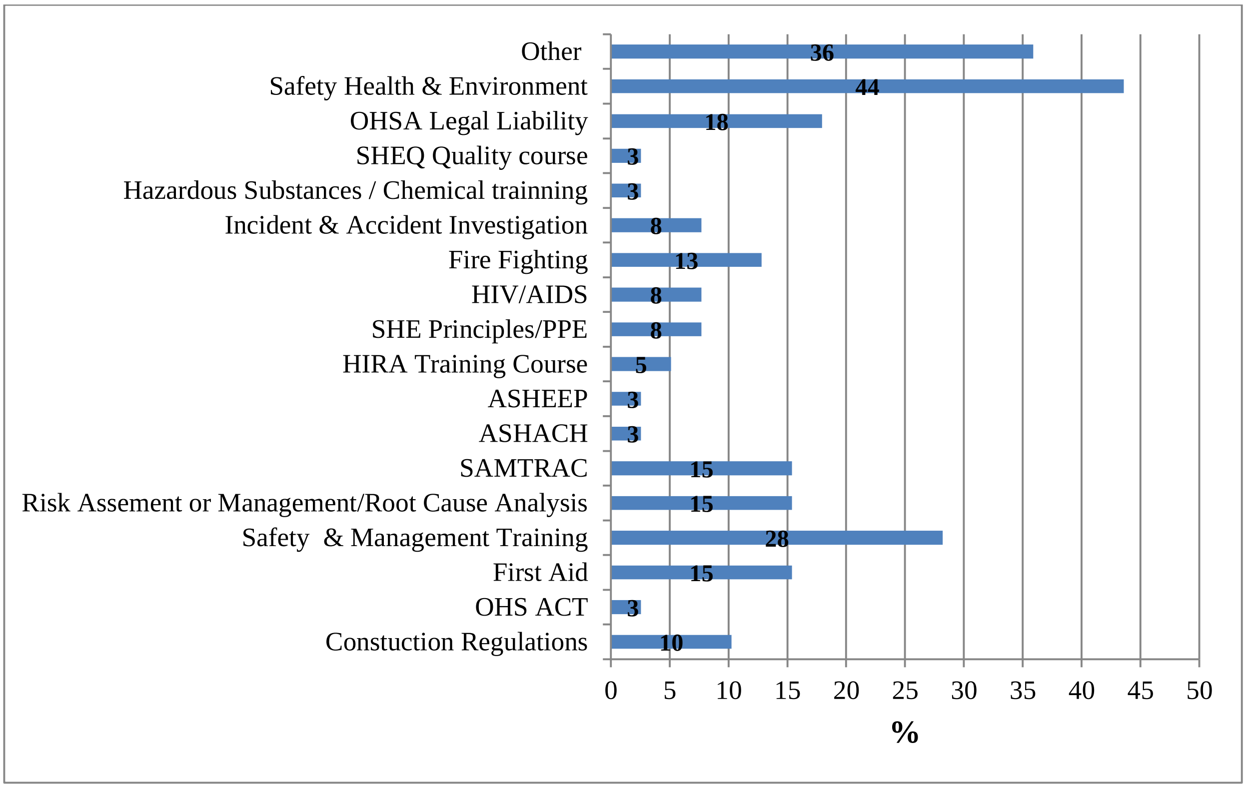

Figure 29: Construction H&S

The numbers of H&S courses done were numerous and had a wide range of content within the programmes. The researcher observed that there was no specific standard of H&S courses which participants took and therefore there were different levels as well as inconsistencies between the courses taken.

4.7.2.3 Construction Plant and Equipment H&S

Respondents were asked if they had previous plant and equipment H&S related training. They were asked to provide details of any course taken in relation to this. Figure 30 illustrated their responses.

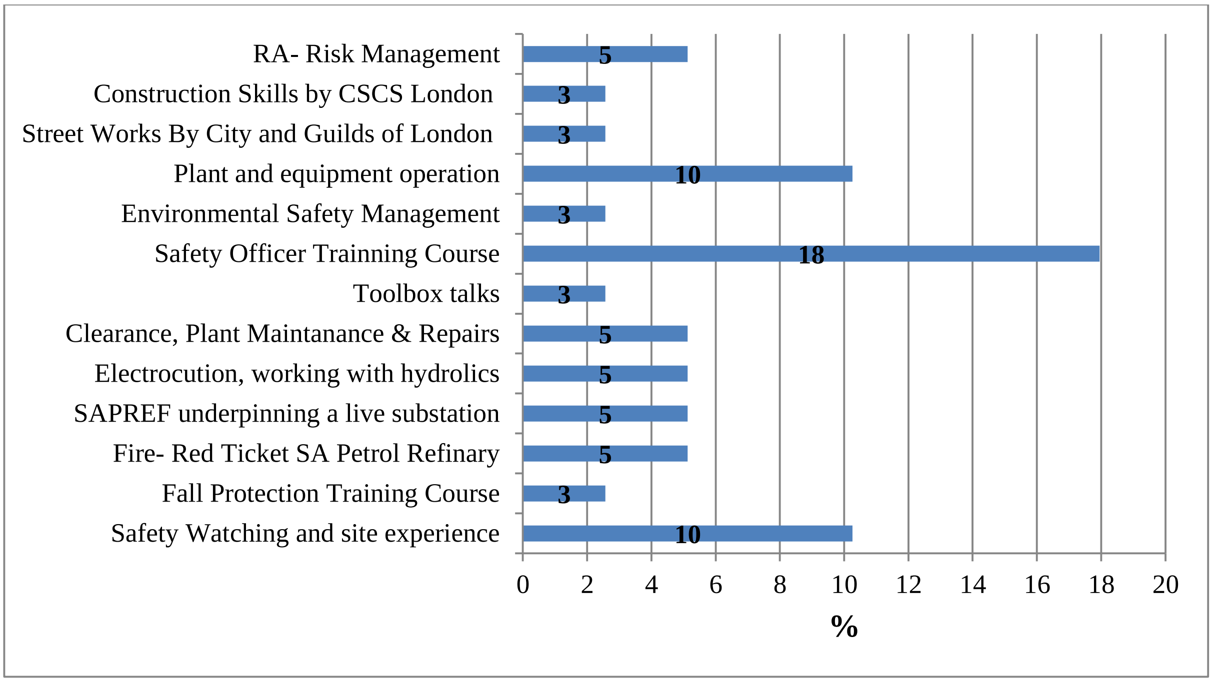

Figure 30: Training in Construction Plant and Equipment H&S

Figure 30 shows that 18% had Safety Officer Training, this was expected given that the majority of respondents were H&S officers. Safety watching and site experience as well as plant and equipment operations both consisted of 10%.

4.7.2.2 Operator H&S Training

Participants were asked if operators had taken any H&S training courses. Table 32 indicates their responses.

Table 32: Distribution of operator H&S training

Name of site	Operator H&S training			
	Yes	%	No	%
1	6	100%	0	0.00%
2	3	75%	1	25%
3	1	50%	1	50%
4	2	67%	1	33%
5	4	100.00%	0	0.00%
6	1	25%	3	75%
7	1	50%	1	50%
8	2	66%	1	33%
9	2	66%	1	33.00%
10	3	100%	0	0.00%
11	1	50%	1	50%
12	1	33%	2	67%

From table 32, it appears that overall, 33% of participants from the 12 sites confirmed that operators were trained in H&S or had taken H&S courses. On sites 1, 5 and 10 all respondents stated that their plant operators were trained in H&S. On sites 3, 7 and 11 half said the operators were untrained. While on site 6, 75% of participants admitted that their plant and equipment operators are untrained with regard to H&S.

4.7.2.3 Plant and equipment operators H&S training

Participants were asked if their plant and equipment operators took any H&S training courses. Their responses were summarised in Table 33. The majority of participants (72%) stated that operators had been trained in H&S aspects while 28% stated that their operators where not trained in H&S.

Table 33: Operator H&S Training

	Operator H&S Training	**Percentage Rate (%)**
Yes	28	72%
No	11	28%
Total	**39**	**100%**

4.7.2.4 Operator H&S training

Plant and equipment Training obtained by road construction operators was summaried in Figure 31. It was deduced that the majority of plant and equipment operators had undergone for H&S training in relation to plant and equipment (26%). Tool box talks and Safety talks were common forms of providing plant and equipment operators H&S training (18%). Safety in the Work Place (SWP) and hazard identification consisted of 10%. Some respondents did not have any of this information (10%).

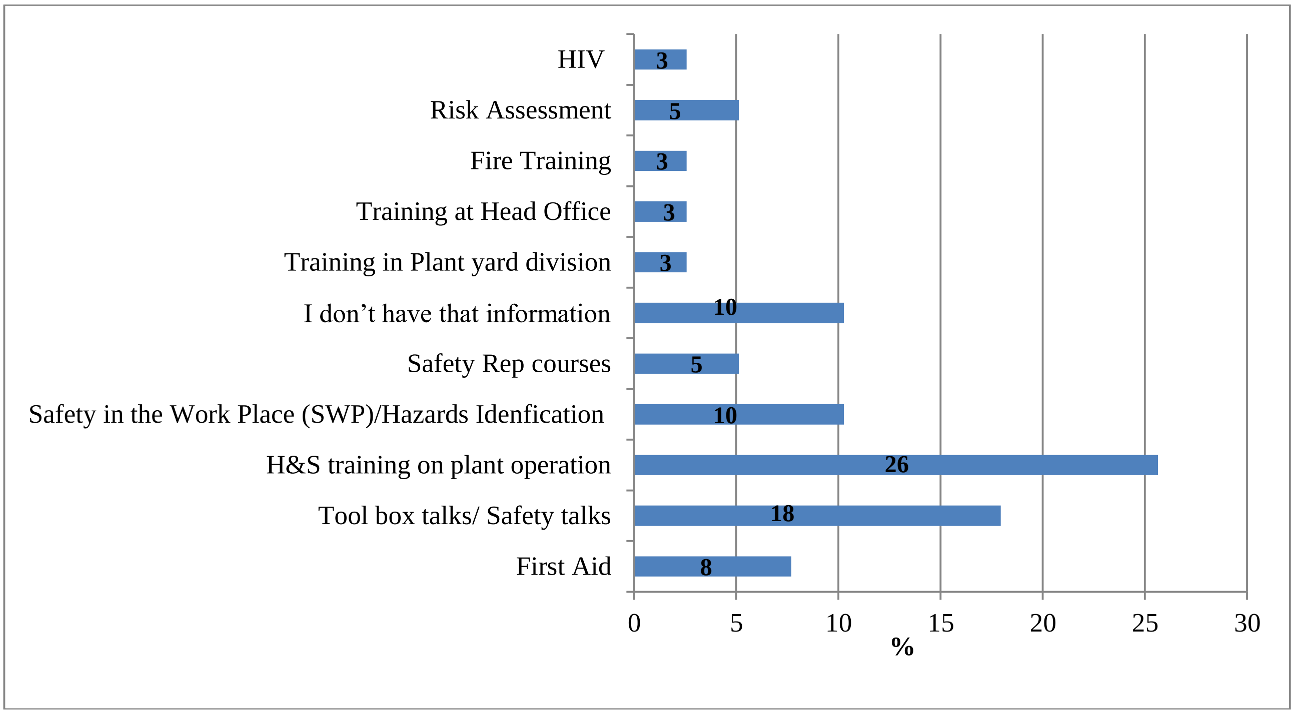

Figure 31: Plant and Equipment Operator Training

4.7.2.5 Frequency of operators H&S training

Participants were also asked the frequency of operator training. Their responses were summarised in Tale 34. The modal group (39%) stated that operators go for H&S courses in relation to the plant and equipment they operate on a yearly basis.

Table 34: Frequency of Operator Training

Operators Training	Frequency	Percentage (%)
Yearly	15	39%
Twice a year	2	5%
Unsure	1	3%
Every 2 months	1	3%
Every 3 months	1	3%
Weekly	5	13%
Every 2 years	2	5%
Monthly	1	3%
Daily	1	3%
Total	29	74%
Non applicable	10	27%
Total	39	100%

4.7.2.6 Reasons for Operators not taking H&S training courses

Reasons given to explain why plant and equipment operators were not taken to H&S training were summarised in Figure 32.

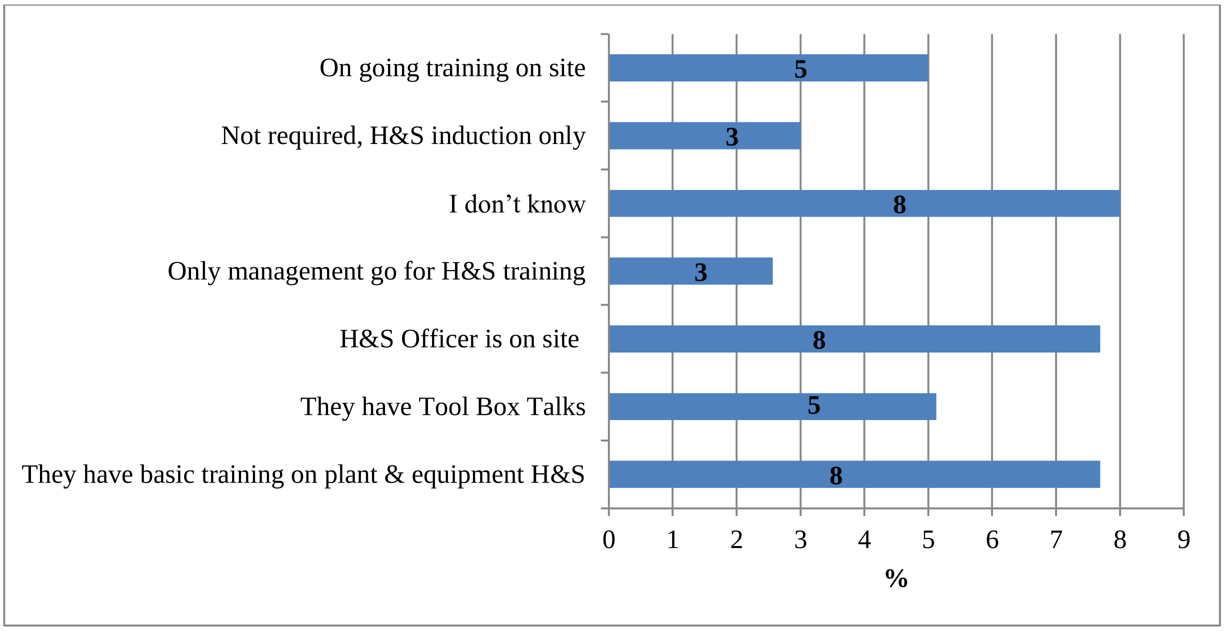

Figure 32: Why operators did take H&S training

Figure 32 illustrates that 8% of respondents said that plant and equipment operators have basic training on H&S and therefore do not undergo specific H&S training. A H&S officer from site 3 stated: "*They just do operator safety training as part of the operations training. They don't do a specific H&S training...*"

It is also noticed that a significant number of participants (8%) said that they were not knowledgeable in this aspect. A manager from site 11 responded by saying "*I don't know, my company did not pay for that...*"

Another significant number of respondents said that H&S Officers were present on site and therefore plant and equipment operators therefore do not need to go for H&S training (8%).

A site manager from site 4 said: "*Their position is operator not H&S... If elected to be H&S then they can go for training..*"

A transport manager from site 7 answered that "*...because the H&S officer is present in all jobs – he does safety talk with them these are tool box talks...*"

The site and transport manager's responses indicate that plant and equipment operators were thought to not need to undergo H&S training mainly because they are not H&S officers. It also appears that they consider on-site H&S training (5%) and tool box talks (5%) as significant H&S training for plant and equipment operators

4.8 Site to Site Comparisons

Comparisons were made between each site with regard to the following points: H&S officer and plant and equipment accidents on site; as well as accidents and presence of H&S officers. Each site was given a site profile which included the observations dates, project characteristics, project amount and general information. Comparisons were made and specific hazards on those sites were explained from site observations.

4.8.1 H&S officer and plant and equipment accidents on site

According to the Table 35, the presence of an H&S officer had a significant impact on the amount of site accidents. The table gives for each site, whether accidents occurred on that site as well as the level of H&S Officer presence (Green, Amber or Red). As explained in section 4.5 of the dissertation, the researcher's observations included a colour coded display of the degree of H&S officer presence, green sites represented sites where H&S officers were present and regular available on site. Amber represented H&S officers who were observed to be occasionally present on site while Amber was used where no or very little H&S officer presence was observed. Table

35 represents each site and their respective colour code (Green, Amber or Red. These were divided into samples A, B and C accordingly. Sample A (Green sites) included sites 1, 2, 8, 9 and 12. Sample B (Amber sites) included sites 6 and 11 while sample C (Red sites) were sites 4, 5 and 7. The differences in site performance between sites would be therefore determined by means of site sample comparisons.

Table 35: Site Sample Comparison

Site	Sample A- Green sites	Sample B – Amber sites	Sample C – red sites
	There were 8 reported accidents on 67% of the sites.	There were 3 reported accidents on 25% of the sites.	There was 1 reported accident on 8 8% of the sites.
1	5 (42%)	n/a	n/a
2	1 (8%)	n/a	n/a
3	n/a	n/a	1 (8%)
4	n/a	n/a	No reported incident (0%)
5	n/a	n/a	No reported incident (0%)
6	n/a	1(8%)	n/a
7	n/a	n/a	No reported incident (0%)
8	No reported incident (0%)	n/a	n/a
9	No reported incident (0%)	n/a	n/a
10	2(17%)	n/a	n/a
11	n/a	2(17%)	n/a
12	No reported incident (0%)	n/a	n/a

4.8.2 Accidents and presence of H&S officers

From Table 35, correlations were sought between the presence of an H&S officer or representative and occurrence of accidents. This was to establish whether the presence of a H&S Officer or representatives reduced accident occurrence. Table 35 shows that all sites had a H&S officer or representative on site, making correlation difficult to establish. However site observations helped in determining a correlation. Table 36 illustrates the participants position held and whether they stated there was an H&S Officer or not. Tables 35 and 36 will be used to determine the differences between sites as well as similarities.

Table 36: Position held versus H&S presence

Site	Observed Presence of H&S Officer	Position held by participants and their responses on H&S Officer presence		Participants responses on presence of H&S officer		Participants responses on presence of H&S officer %	
		Yes	No	Yes	No	Yes	No
1	Green	Site Manager, H&S Officer, Construction site supervisor, Engineer, Site Administrator, Site Clerk	none	6	0	100%	0
2	Green	Operations manager, 2 X H&S Officer, Resident Engineer	none	4	0	100%	0
8	Green	Site Manager, Site Engineer, H&S Officer	none	3	0	100%	0
10	Green	Safety Manager/ Consultant, H&S Officer, Site supervisor	none	3	0	100%	0
12	Green	H&S Officer, Safety Manager/Consultant, Assistant Project Manager	none	3	0	100%	0
9	Green	Safety Manager/ Consultant, 2X H&S Officer	none	3	0	100%	0
6	Amber	Foreman, Traffic Safety Officer, Senior civil technician, H&S Officer	none	4	0	100%	0
11	Amber	Safety Manager/Consultant, Manager	none	2	0	100%	0
3	Red	Contracts Manager, H&S Officer	none	2	0	100%	0
4	Red	Project Manager, Site manager, H&S Officer	none	3	0	100%	0
5	Red	Contracts Manager, H&S Officer, Student Technician	Site Technician	3	1	75%	25%
7	Red	Transport Manager, Technician	none	2	0	100%	0

4.8.2.1 Site 1

a) Site Profile

Observation dates	12th ,13th , 21st and 22nd June 2013; 2nd October 2013
Project Characteristics	Bulk earthworks, concrete drainage, layer works, bridges as well as short creating and gabion walling. The project was divided into four phases. Phase 4 was completed. Length of the road was 2715 kilometers. The project is on-going and includes bridge construction. Blasting was done occasionally.
Project Amount	R 93.44 Million
General Information	On this site all machinery[2] was at work especially the bulldozer, excavator, pad foot compactor and trucks. The resident engineer had informed the researcher that he needed some paperwork to be done on site; this was mainly checking the layer works and the filling.

b) Comparisons

On site 1, all of respondents stated there was a H&S officer on site and observations confirmed that there were in fact two H&S officers on site. This was mainly because of the nature and complexity of the project (Table 36).

Despite the presence of H&S officers, 83% of respondents on this site confirmed that accidents had occurred since the commencement of the project. The finding that there were two H&S officers on site yet there were accidents occurring on site is quite interesting. This shows that the size and complexity of the project play a part in the number of accidents on road construction sites. This makes sense given that there is more room for error on large and complex site (Table 35). It is also interesting to note that despite several accidents occurring on this site, the site was catogorised green (Table 35). This meant that the H&S officers were present and regularly available. The respondents of this site also knew of the presence of the two H&S officers, this displayed site awareness in respect to H&S. Further, it was observed that the H&S officer was actively involved in each aspect of the site works.

H&S hazards on site included the following:

- Pedestrian hazard of slipping from loose material on site.
- Machine slipping to the edge of the road.

- People working on clearing out loose material at risk of rock falling from above.
- Falls were common on site especially resulting from the consumption of alcohol, there was an incident on one site when an outsider got to an unsafe place on a cliff more 7 – 10 m in height and died. He was reportedly intoxicated and may have fallen head first.
- A potential hazard was created by children always around the site area, including one of about 4 years old hanging on the outside of the bridge fence while another one was hitting his hands. The resident engineer told them to stop it. On another other occasion the researcher found a child playing near the completed phase one of the project despite the signage put in place. However no accidents were experienced in this area.
- The biggest challenge was communication and co-ordination with the community. Stealing was common place on the site (sand and aggregate). There were four security guards during the night to prevent thefts.
- Working with explosives for bulk layer works was a daily occurrence and this put the community as well as construction workers at risk.
- When working with gabion walls some of the workers did not have protective ropes to secure them. If a worker did not keep a proper grip, this could result in a fall to the bottom of the valley. This could result in severe injury or even death depending on the fall.
- During rock drilling persons on site needed to move around and near the rock drilling rig. This posed risks of someone being stuck between the rig and the turning component.

 **Figure 33: Explosives**	 **Figure** 34**:Tractor Loader Backhoe**
Working with explosives on site. An explosive expert worked on this particular site and required a transport of explosive permit.	Tractor Loader Backhoe (TLB) collecting cement packages. This plant is hanging on the edge of a steep incline and risks tipping over.

 **Figure 35: Excavator**	 **Figure 36: Consultant Engineers**
Excavator working on unlevelled ground. This plant risks tipping or falling over the cliff. Other hazards include the bucket fitting the spotter.	Gabion walls. Consultant engineers measuring walls without harnesses. If they fell this could cause musculoskeletal injuries or death.

4.8.2.2 Site 2

a) Site Profile

Observation date	08th, 15th,16th,17th, 18th,19th, 20th July 2013
Project characteristics	Bulk earthworks and layer works. Construction phase 70% complete. Concrete drainage work and final layers (3rd – 4th layer) Terramesh walls 70% complete. Soil filling behind terramesh walls. Soil reinforced by parraweb straps. The length of project 3 kilometers completed by 1/11/2013, jobs are phased to every 3 kilometers.
Project amount	R 40 million
General Site Information	Machinery[2] utilised included tractor loader backhoe, grader, skid-steer loader and an excavator. The site was at full capacity as with most days.

b) Comparisons

In site 2, table 36 shows a response rate of 100% of participants mentioned that there were H&S officers on site. These participants all knew about the presence of the H&S officer on site. This was confirmed by the researcher's observation that there were two site H&S officers on site. Table 35 shows that despite their (H&S officers) presence, 50% of the respondents knew of the occurrence of site accidents. There was an 8% rate of accident occurrence on this site (Table 35). It was also observed that some of the workers had poor H&S attitudes. Although management was committed to H&S (Windapo and Oladapo, 2012; Haslam et al., 2005), some workers found the H&S wear (Personal Protective Equipment) uncomfortable and a nuisance. This is evidenced by one of the foreman saying that he did not like wearing the reflective jacket. He would only wear if the H&S officer was on site and he would pretend to have one of the operator's reflective vests (this was done by him taking it off the seat of a parked construction plant and waving it whenever the H&S officer appeared on site). However the other 50% stated that they do not know of any accidents that had occurred on site (Table 35). This shows that approximately half the professionals on site did not know about the incidences on site. The researcher categorised this site green (Table 35) considering that one of the H&S officer was present on this site as well as activity involved in the day to day activities of the site. The H&S officers seemed to be really invested in ensuring the workers wear the appropriate PPE. From site observations it was concluded that, the H&S officer following up on worker's PPE does assisted in the improvement of H&S. However workers also play an important role in adhering to H&S regulations.

H&S hazards on site included the following:

- A bulldozer and excavator were working in a borrow pit. The bulldozer was scraping off material used for layer works. Hazards when working with the bulldozer on an incline included the plant slipping or losing grip with the surface. When the excavator was loading material into the trucks, if the excavator operator were fatigued or did not keep focused, the excavator bucket could strike the truck driver.
- Terramesh walls being built and hand compactor used. Compaction on this was done using both a hand compactor as well as a smooth roller. Personnel working on the gabions had protective PPE however the constant movements of the pad-foot roller, the skid-steer loader as well as the TLB could become hazardous. A plant could strike one of the workers putting stones into the wire mesh.
- Umgeni soil was being spread by an excavator and personnel working with rakes in the same area could cause injuries if a person were struck by the excavator bucket.
- Two flag-people were working with the grader while stabilising the road. The stabilising process consisted of a mix of G2 soil with cement to form the base of the road which gave it strength. This process was followed by a smooth roller compacting where the grader had spread the soil and cement mixture. The movement of grader and the smooth roller intertwined. This plant moved at a fast rate about 30 -40 kilometers per hour. Site workers were continually moving around as and there were other vehicles present. This created hazards of the plant or and vehicle collision as well as onlookers from the community being struck by construction vehicles or plant.

 **Figure 37: Bulldozer and Excavator**	 **Figure 38: Excavator and Terramesh wall**
Bulldozer and excavator. Hazards involve the bulldozer tipping over the hill or borrow pit onto trucks or excavator. Spotters by the side of the road risk injury.	Excavator and Terramesh wall workers. Excavator bucket may fail and roll over the hill causing injury or death.
 **Figure 39: Tractor Loader Backhoe (TLB) near site office**	 **Figure 40: Grader**
Tractor Loader Backhoe (TLB) near site office. Offloading wire mesh and other material. Hydraulic system used may fail and can cause injuries to workers. Workers on site do not fully adhere to Personal Protective Equipment.	Grader – levelling material for stabilising purposes. Blade used is considered dangerous if worker is exposed to it. Worker may lose limbs if machine is in operation and worker is near the blade.

 **Figure 41:Excavator and skid-steer loader**	 **Figure 42: Truck**
Excavator and skid-steer loader- Movements of the excavator are rapid and can cause musculoskeletal injuries to workers building gabion walls	Truck offloading material to the below road area. Risks involved material falling into other machinery[2] or persons being struck by the vehicle. Other hazards involve being buried by material
 **Figure 43: Smooth drum roller**	 **Figure 44: Car parked near machine**
Smooth drum roller vibrates on the surface of the road. Prolonged exposures to WBV hazards could cause diseases.	Car parked near machinery. Workers at the edge of the wall are exposed to risks being knocked by plant or falling over the gabion walls

4.8.2.3 Site 3

a) Site Profile

Observation dates	22nd July and 12th August 2013
Project Characteristics	Road Construction work. Layer works and drainage works. Observations where conducted during the final stages of the project therefore other plant and equipment such as the grader had already been used and taken off site. The project was due for completion in October 2013
Project Amount	R33 Million
General Site Information	Machinery utilised included TLBs, grader, skid-steer loader and an excavator. The site was near completion and final layer works and drainage work was being completed.

b) Comparisons

Table 36 shows that 100% of participants confirmed the presence of an H&S officer on site. However of the respondents interviewed on site 50% reported construction plant and equipment accident occurrence. An equal number did not know about any plant and equipment incidences or accidents (Table 35). It was also observed that the H&S officer was the participant who did not know about any incident. The operations manager was the one who mentioned about a particular accident involving a public vehicle. Site observations confirmed the presence of a H&S officer. This shows that approximately half the professionals on site did not know about the incidents on site. Following, site observations, this site was categorised red in terms of the presence of the H&S officer (Table 36), meaning that the H&S officer was unavailable on the construction site. This indicates that the H&S management of this site did not seem adequate, in terms of communication of site incidences as well as H&S awareness. The manager mentioned that the reason why the H&S was not on site was because he was needed on another project. This posed a H&S problem in the event of an incident.

H&S hazards on site included the following:

- The work was done section by section to allow traffic to flow. If there was a hydraulic pipe bust. Procedures are in place to ensure work carried out is safe. This was done using risk assessment techniques

- Contractors adhered to H&S regulations and seek to prevent any accidents and exposure to hazards. The researcher was informed that there were two H&S officers responsible for that site. However one was on site the other had moved to work in another site. Further to this, induction training is conducted to all working on site and all visitors. Plant checklist, (Appendix E) and medical health care (Occupational Health Certificate of Fitness) were carried out.
- There was a safety file on site. All documents were included such as workers certificates. Plant and equipment checklist. Two H&S officers' certificates were also included in this file.
- Managers appeared strict with regard to safety. Workers all wore their PPE as observed by the researcher. The site was fairly managed.

 **Figure 45: Truck and Excavator**	 **Figure 46: Tractor Loader Backhoe (TLB) moving material**
Excavator bucket swinging rapidly when loading material into the truck- health risks include exposures to HAV and WBV	TLB- moving rock material to another part of the site.- rapid movements by the excavator could injure the "spotter"

4.8.2.4 Site 4

a) Site Profile

Observation dates	04th June 2013; 20th – 22nd May 2013
Project Characteristics	Road Rehabilitation work involving a cold recycler and milling machine. Work includes stabilising, which is a process of layering, cement, mixing soil and compacting the road material. There was no site office. Site meetings occur at a nearby filling station.
Project Amount	Unknown
General Site Information	Machinery used included the recycler and water carts. The project experienced set delays due to temperature problems. This was vital for machinery such as the cold recycler to be used.

b) Comparisons

Table 36 shows that of all respondents from site 4 confirmed the presence of a H&S officer on site (100%). As shown in Table 35, according to all participants on this site, no accident had occurred on site, since the commencement of the project. This was a new site and there was as yet no site office. The researcher's observations had, however confirmed that there was an H&S officer responsible for this site however the he was only available on certain occasions such as site meetings which on this site occurred on a monthly basis. This site was on the red category (Table 35) on the basis of the H&S officer presence. As per site observation was, this site had all plant and equipment on site for the commencement of the project. Some of these machines were being used on site such as the water cart. According to Table 35, this site was categoriesed red. This was because the H&S was usually not on site. 100% of the participants on this site knew of the H&S officer (Table 36). There were also no reported incidences on this site. This meant that the presence of the H&S officer on this site had little influence on the H&S status of the site.

H&S hazards on site included the following:

- There was generally no induction conducted on this site. Works were at a slow rate because of road temperature was below 25 degrees Celsius. Tool box talks were conducted on site. There were a number of site problems however H&S and accidents were not the main focus.

- In site meetings, H&S was addressed as part of the agenda. The only issue raised under this topic included bust bitumen pipes. The project manager raised this issue and sought for their replacement.
- A 2.5 meter wide Wirtgen milling machine was use for the pulverisation process
- A grader was used for stabilising. Cement was spread. The process involved a row of machinery such as the water tank, bitumen tanker and recycler. The smooth roller is the next machine or the pad foot roller to compress the mixture. The grader was used to cut appropriate levels. A smooth roller was used once again to give the layer a smooth finish.

 **Figure 47: Milling machine**	 **Figure 48: Water cart**
Milling machine- parked near site offices.	Water cart storing water to cool the road as well as to limit dust hazards by dampening the road.
 **Figure 49: Diesel Truck and Pad foot roller**	 **Figure 50: Site machinery at lunch time**
Diesel trucks, next to a HAMM pad foot compactor. Hazards involving diesel can occur.	Site machinery at during lunch time. Hazards include persons sleeping or having lunch under or next to machinery

4.8.2.5 Site 5

a) Site Profile

Observation dates:	05th June 2013; 22nd June 2013
Project Characteristics	Road rehabilitation using the Cold Recycler grader, pad foot and smooth roller.
Project Amount	Unknown
General Site Information	This site consisted of road repairs from the base layer. The cold recycler was mainly used on this site for the works. This machine had been over used and parts needed replacement, causing project delays.

b) Comparisons

With reference to table 36, 75% of participants in the study mentioned that there was a H&S officer on site. However on all the 12 sites researched, some of the participant did not think there was a H&S officer on site (25%). On this site the Site Technician stated that there was no H&S officer on site. This particular participant may have been telling the truth possibly because he was not in a managerial position and therefore did not want to alter answers to meet the industry norms by following basic H&S regulations. This finding meant that persons working on sites may also be ignorant with regard to H&S issues. The professionals' lack of knowledge also influences H&S practice on site. This is particularly evident when it comes to their commitment and attitudes towards H&S (Windapo and Oladapo, 2012; Haslam et al., 2005). Although there was a poor presence of the H&S officer on site, participants responded that there had been no accidents since the commencement of the project (Table 35). The presence of the H&S apparently had little significance towards the H&S performance of the site. The construction foreman was the main manager on site. This particular foreman refused to be interviewed after being told the nature of the study. It was assumed that the foreman saw that he was incapable of answering the interview questions. He referred the interviewer to their head office to speak to management.

H&S hazards on site included the following:

- Traffic hazards were the most likely to occur on this site. There were sufficient road traffic signs and plant and equipment were parked near the sign man
- Worn out bitumen pipes were one of the major concerns on the site. The project manager kept on stressing on this issue, demanding replacement as well as back up pipes. The site works had stop

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Figure 51: Flagman</td><td>
Figure 52: Grader blades</td></tr>
<tr><td>Flagman holding up a stop sign</td><td>Grader- sharp blades cutting down road layers</td></tr>
<tr><td>
Figure 53: Cold Recycler</td><td>
Figure 54: Water tack and recycler</td></tr>
<tr><td>Cold Recycler working with cement which had already been laid out before hand</td><td>Water tank connected with recycler. The water is mixed with bitumen to create form bitumen which is placed onto the road.</td></tr>
</table>

 **Figure 55: Picks on a recycler**	 **Figure 56: Safety red button on cold recycler**
Picks on recycler. These dig into the road. These can pin down a person into the road and can result to paralysis or death	Safety red button on cold recycler. This can be used by persons other than the operator for an emergency stop
 **Figure 57: Safety signage**	 **Figure 58: Hydraulic system on cold recycler**
Safety wear signage on machinery for the cold recycler operator.	Hydraulic system on cold recycler. Hydraulic systems have replaced numeric systems for safety purposes.

 **Figure 59: Bitumen and water pipes**	 **Figure 60:Worn out bitumen pipes**
Bitumen and water pipes coming from the Witgren Cold Recycler machine.	Worn out Bitumen pipes. These were used to connect the cold recycler with the water cart.

4.8.2.6 Site 6

a) Site Profile

Observation dates	21^{st} - 22^{nd} August 2013
Project Characteristics	Road rehabilitation of provisional road. Machine used included the cement spreader, milling machine, cold recycler and grader.
Project Amount	Unknown
General Site Information	The main process involved on this project was stabalising. The milling machines, cement spreader as well as the water cart were main machines used on this site.

b) Comparisons

Participants on this site responded that there was a H&S officer on their site (100%) as shown on table 36.This site had been put in the Amber category with respect to H&S. This meant that the H&S was occasionally available. Reported site accidents on this site (Table 35) accounted for 8%. Observations by the researcher showed that H&S was taken very seriously by employees. Although the H&S officer occasionally available on site, he was indeed present on the dates of observation and was involved on site operations. There was a site office; however no documents were kept in there. This container office was mainly for equipment storage. This site was doing well, on first appearance, however the occasional presence of the H&S officer could be detrimental because if an incident were to occurs, the H&S officer might not be available. However the site seemed to be doing well because there were no accidents on sites and it was observed that employees were provided with the necessary PPE. Employees also aimed to follow basic H&S regulations.

The H&S hazards on site included the following:

- Private vehicles not adhering to traffic rules, mainly given by signage put up by the construction contractor. This puts road construction employees as well a plant and equipment on site at risk.

 **Figure 61: Truck cement spreader**	 **Figure 62: Cold Recycler and water cart**
A truck cement spreader was used to distribute the cement on road layers. The spotter was wearing protective overalls, reflective jacket and a dust mask. Over exposure to cement dust particles could result in chronic obstructive pulmonary diseases (COPD).	Cold Recycler and water cart co-joined. Site foreman overseeing the job.

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<td>
Figure 63: Cold Recycler and public road</td>
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Figure 64: Grader cutting layers and public road</td>
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<td>Cold Recycler following the water cart. Road usage on the right side for private vehicles.</td>
<td>Grader laying material. Private vehicles moving past construction works.</td>
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<td>
Figure 65: Fuel being fed into cold recycler</td>
<td>
Figure 66: Connecting water pipe</td>
</tr>
<tr>
<td>Cold recycler operator putting fuel into his vehicle. The plant must not be operational while this activity takes place. Hazards include sparks (e.g. from a cigarette) that could cause a fire.</td>
<td>Employee reconnecting the water pipe from the cold recycler to the water cart.</td>
</tr>
</table>

4.8.2.7 Site 7

a) Site Profile

Observation dates	19^{th} - 20^{th} August 2013
Project Characteristics	Road rehabilitation work included working with a milling machine, paver and smooth drum rollers.
Project Amount	Approximately 1million
General Site Information	The project involved the use of a paver for road repairs. Dangerous materials were used such as hot bitumen for this process. This was a national road and private vehicles moved at high speeds.

b) Comparisons

On this site 100% of participants reported that they had not experienced any site accidents since the commencement of the project. This is shown in Table 35. Table 36 shows that all participants stated that there was a site officer on site (100%). However, the researcher observed that there was no H&S officer on site. It was mentioned by one of the consultant engineers on site that this is because he was in charge of many other sites.

In terms of H&S officer presence, this site was categorised red. As on sites 4 and 5, although there was a poor presence of the H&S officer there were no reported site accidents (Table 35). The site technician was the main person in charge on this site. She was in charge of the daily running management of the site. The transport manager was mainly responsible for the trucks and he also drove one of the trucks carrying a mixture of gravel and hot bitumen. This mixture was deposited onto the paver. The paving machine receives the mixture, mixes this a spiral-like blade then spreads the mixture onto the road. Workers with spades also assist in the unleveled parts of the road. The compactor then follows the paver in compact the mixture.

Occasionally the technician would check the temperature of the gravel and bitumen mixture on the trucks. The temperature of this mixture is usually ranges between 135 to 180 degrees Celsius. The temperature was regularly checked to maintain consistency and required strength of the mix.

Hazards involved on this site include employees getting burnt when in contact with the hot bitumen mixture. For example, when measuring the poured mixture layered (40mm deep). The researcher had asked about this and some of the workers had shown their hands having being burnt. The road was very hot and over exposure from such conditions could cause skin diseases and sunburn/dehydration (Deacon, Smallwood and Haupt, 2005). Other hazards involved persons being knocked by public vehicles at the stop n and go points controlled by flag men. Workers also risked being run over by the paver while seeking shade during lunch times. The paver might start moving and the blades could injure persons.

If an accident were to occur the H&S officer would have been unreachable for immediate on-site response. The technician on site, foreman as well as the transport manager would have to deal with the incident. The most likely person to deal with the incident would have been the transport manager whom is only knowledgeable in SHEQ quality.

H&S hazards on site included the following:

- Employees occasionally used gloves when operating machinery. The bitumen and gravel mixture got onto their hands. Diesel fuel was used to clean the bitumen off the hands. This is risky because chemicals get absorbed into the skin.
- Cleaning the paver occurred after the machine was used and parked on the site of the road. This process is done using a long chisel and using diesel fuel. The foreman and operator usually did the cleaning. However other workers were also involved in the process.
- Paver blade failure can occur and could result in employees being hurt when using the spade when applying the wearing course.
- Moving smooth drum roller could strike employees if the operator’s vision was impaired.

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Figure 67: Truck and paver</td>
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Figure 68: Paver</td>
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<tr>
<td>Truck off-loading gravel (stone) and hot bitumen mixture into paver machine.</td>
<td>Mouth of the paver machine used for receiving hot bitumen mixture from the trucks.</td>
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</table>

 **Figure 69: Workers using spades**	 **Figure 70: Smooth drum roller**
Workers filling in spots with hot gravel and bitumen mixture using spades. Gloves were rarely used when performing this activity.	Smooth drum roller used to compact the road after bitumen and gravel mixture was laid on the road. Water was used to cool the road while compacting.

4.8.2.8 Site 8

a) Site Profile

Observation Date	19th June 2013
Project Characteristics	Works included the use of mobile cranes, bulldozers as well as pavers. Rod repairs included drainage work. Cutting and sealing of joints, removal of panels.
Project Amount	Approximately 1.3 million
General Site Information	The project was at its fifth stage. The end of the last phase was the 16 of August 2013. Plant used included the mobile crane.

b) Comparisons

This site was similar to site 7 in that all participants agreed that there had been no accidents on site (table 35). Table 36 shows that the all participants stated that there was a H&S officer on site (100%). It was observed that, the H&S officer was indeed on site and all management functions established in the site office. This site was therefore categorised in the green zone.

The H&S officer was involved in the daily running of the site. Compared with most sites observed, this site seemed to be doing very well in terms of H&S performance. It should however be noted that this site was of a smaller scale than other sites. Therefore the occurrence of an accident from commencement of the project was less likely. Further, the H&S officer had all documentation with regards to the H&S on site. If an accident were to occur, the H&S officer would have been instantly ready to deal with the situation.

Furthermore, the client on this site was strict with regard to H&S considering the intensive induction undergone by the interviewer as well as multiple check points. These check points included a breath test to check intoxication and a check for appropriate PPE. It was also noted that all participants knew of that there was a H&S officer on site. This showed that employees were aware of H&S issues and could easily refer to him if there was a H&S concern. The researcher also observed that management on this site worked better in terms ensuring productivity. Therefore having the management team, including a H&S officer on site improved the H&S attitudes and commitment.

H&S hazards on site included the following:

- The removal of reinforced panels in poor condition could cause an accident.
- Working and handling pre-mix concrete in a limited space provided by the client was challenging to the contractor. This is because risk is increased when working with machinery in a small space.

 **Figure 71: Mobile crane**	 **Figure 72: Concrete mixer**
Mobile crane lifting 400mmx400mm deep unreinforced concrete panels. Workers risk being struck by hooking attachment of the mobile crane.	Ready mix concrete was poured onto prefabricated formwork.

4.8.2.9 Site 9

a) Site Profile

Observation dates	11th April 2013 and 9th October 2013
Project Characteristics	Work on site included new road construction, surfacing, compaction and road drainage. The milling machine was used earlier during the project.
Project Amount	R600 million
General Site Information	At the period of observations the project was half way completed (11April 2013), the project was nearing completion stages in October 2013.

b) Comparisons

This site was similar to site 8 in terms of the presence of a H&S officer on site (Table 36) and similarly, there had not been any accidents on site (Table 35). It was noted that all participants knew about the presence of the H&S officer. Observations confirmed that, they were in fact H&S officers, two were always on site the other was a Safety Manager/ Consultant as well as the H&S officer. This Safety Manager/ Consultant was in charge. This justified placing this site on the green category indicating that the H&S officer was always on site.

One of the safety officers was a consultant who was not based on site but checked regularly on the H&S aspects of the site. The other two H&S officers worked under his leadership and supervision. This helped in the H&S risk management. There have been no reported accidents on this site, suggesting that having several persons knowledgeable in H&S assisted in the H&S performance of the site.

H&S hazards on site included the following:

- Risks involved the movement of the TLB and the skid-steer loader throughout the site. Ground workers used the same road as the one for moving vehicles and therefore workers are exposed to the risk of being hit by construction vehicles.
- Some of the plant operators had been hired, especially the cargo trucks with a fork lifting attachment at the back. These were used to carry sets of concrete blocks to a desired area on site. One risk involved the operator falling off the elevated seat. Another risk would be fork end striking another plant or person on site.
- Dust Inhalation and Fatigue were likely to be experienced by workers and operators as well as being exposed to Chemical Substances such as diesel fuel. Other exposures included Sunburn, Sunstroke and Dehydration, which had been experienced on site.

- The site H&S officer was present on a daily basis and involved with the daily activities of the site. The majority of the operators and ground workers had their Personal Protective Equipment (PPE) which included a reflective jacket.

 **Figure 73: Skid-steer loader**	 **Figure 74: Tractor Backhoe Loader**
Skid-steer loader being maintained by mechanic on site.	TLB carrying mesh reinforcements. Workers were in close proximity to the plant and risked injury.
 **Figure 75: Crane operating truck**	 **Figure 76: Concrete mixer and Fork lift**
Crane operating truck used to offload concrete blocks	Mixers on site used for mixing concrete. Fork lift parked on elevated ground

4.8.2.10 Site 10

a) Site Profile

Observation dates	12th April 2013 and 9th October 2013
Project Characteristics	This project included approximately four kilometers of leveling and compacting as well as layer works.
Project Amount	Approximately R6 million
General Site Information	This was a relatively small project and had reached 99% completion. About 10 employees were on site.

b) Comparisons

Table 36 showed that all respondents reported that there was a H&S officer on site (100%). This meant that respondents knew about the H&S aspects of the site as well as knowing about the officer responsible. As on site 9, there was a safety manager and consultant to oversee H&S aspects on this site. However neither was found on site. There was another site H&S officer managing H&S risks on site. Accidents had occurred earlier in the project, however H&S systems were ensured to be in place by the H&S officer. This was a small site compared to sites 1 and 2. The likelihood of an accident occurring was supposed to be less, especially since there was a H&S officer on site. However this site was categorised green in terms of H&S officer presence, on Table 35 which also specified that 17% of accidents had happened on this site.

The H&S hazards on site included the following:

- Visibility on this particular site was compromised because of poor housekeeping. There were piles of sand, gravel, broken bricks, and other construction materials. There was unlevelled ground in some parts of the site which made it harder and dangerous for moving vehicles, more especially the TLB, which risked tipping over. There were trenches on the edges of the compacted road which were demarcated.
- Dust Inhalation, Fatigue, Sunburn and Dehydration were common risks on site. These were regarded to be severe when they occurred.
- Management was very strict about all persons on site having appropriate (PPE). The H&S officer ensured that plant and equipment were checked before operation as well as during the day. All persons had to undergo induction training before entering the site.

 **Figure 77: Tractor Loader Backhoe**	 **Figure 78: Tractor Loader Backhoe Operator**
TLB carrying material on site. The site topography made it difficult for the machine to keep stable.	TLB operator demonstrating to the researcher how to operate the machine. This operator was considered very experienced.
 **Figure 79: Tractor Loader Backhoe safety instructions**	 **Figure 80: Personal Protective Equipment (PPE)**
TLB safety instructions for TLB operators, stating: before leaving the operators seat, turn the engine off and connect the parking break, lay equipment to the ground and remove the key from the dash board.	The H&S officer was always present on site and workers had appropriate PPE.

4.8.2.11 Site 11

a) Site Profile

Observation dates	13th April 2013
Project Characteristics	Road repairs included the removal of containers. A Container crane to remove containers before road repair works
Project Amount	unknown
General Site Information	Considerable small site with only two mangers. This site mostly used trucks and forklifts.

b) Comparisons

According to observations on site, there was a H&S officer however; he was not always on site. Despite the part-time availability of the H&S officer on this site, 17% of reported accidents had occurred on this site (Table 35). As on sites 9 and 10 there was an appointed safety manager and consultant to oversee the safety aspects. At the time of observation there was only a manager on site therefore this site was included in the Amber category (Table 35). The safety manager reportedly kept on stressing to the manager about poor H&S in terms of housekeeping. Further, there had been an accident involving workers being burnt by hot bitumen.

The H&S hazards on site included the following:

- Trucks, front-end loaders as well as the Container crane were in constant motion and reflective jackets were compulsory when workers were on site. Ground workers risked being struck by moving vehicles.
- Burns and Chemical Exposures were common risks and were judged moderate to major severity when they occurred. Musculoskeletal Injuries were more likely to occur due to constant movement of construction vehicles and plant. Site mobile plant and vehicles moved at a speed between 20 to 60 kilometers per hour and injuries could be severe if a ground worker were to be struck or if an operator fell from or under a moving vehicle.
- The H&S officer was generally dissatisfied with the way the site was being managed in terms of H&S. This was mainly because of unnecessary obstructions to moving vehicles

and to ground workers. These obstructions included empty bottles, cartons and plastic objects on the roadway and near site offices.

 **Figure 81: Poor H&S site house keeping**	 **Figure 82: Container crane**
Site was not kept well, there was rubbish and debris. Site conditions were poor and this increased the risk chances of accident.	Road repairs included the removal of containers. A Container crane to remove containers before road repair works.
 **Figure 83: Front End Loader**	 **Figure 84: Truck**
Front end loader used on site. In the background a worker is using a breaker without PPE.	Trucks on is site driving at 40 - 60 kilometers per hour on site.

4.8.2.12 Site 12

a) Site Profile

Observation date	11th October 2013
Project Characteristics	Site was located near commercial buildings. The site was congested with vehicles and employees.
Project Amount	Unknown
General Site Information	Heavy plants were used throughout the project, which included TLBs as well as cherry pickers. This site was considered hazardous because of congestion.

b) Comparisons

Observations from this site confirmed that there was a H&S officer or consultant. The H&S officer usually managed the site from the on-site company offices. This site was similar to site 1, 2, 8 9 and 10 and 11 in terms of the presence of a H&S on site (Table 35) placing it in the green category in terms of H&S presence (Table 36). There had been no accidents on site (Table 35 according to the participants on site. All participants knew there was a H&S officer on site. This meant that the H&S officer was available to attend to H&S incidences. This site was therefore considered one of the best performing in terms of H&S risk management and since there was no accident from the commencement of the project the H&S record was considered good

The H&S hazards on site included the following:

- The rapid movement of construction vehicles such as trucks, TLB's and cherry pickers. This coupled with the congestion placed greater risks on employees working on site.
- The lighting was insufficient, making visibility difficult for operators to see workers working on the ground levels. Persons on site risk being struck by construction vehicles.

	
Figure 85: Insufficient lighting and Congestion	**Figure 86: Cherry picker**
Insufficient lighting on site made it difficult for operators and workers to see. Congestion of vehicles and materials could have caused increased risks of accidents.	Cherry picker used for workers to be elevated to do short-creating on vertical surface of the site. This prevented rocks from falling causing injury or deaths.

4.5 Summary

Sites 1, 2, 8, 9, 10 and 12 all had a good H&S officer presence so these sites were categoriesed green. Site 1 and 2 performed well in terms of H&S management mainly because of the on-site presence of the H&S officers. However, due to the complexity and length of the project (which sometimes is years), site accidents had been experienced on these sites. Site 10 was considered to be a small site and had an on-site H&S officer. This site therefore stood a greater chance of preventing on-site accidents, however it had experienced plant and equipment related accidents.

Further, according to Table 35, sites that were in the green category and had not experienced any site accidents included sites 8, 9 and 12. Therefore in terms of H&S risk management, they had performed well. However, it was noted that site 12, although had not experienced accidents, had high risk for an accident to occur due to the congestion and insufficient lighting on site. This leaves sites 8 and 9, amongst the twelve sites were considered performing well in terms of H&S risk management.

Overall, each site experienced a variety of H&S hazards, therefore confirming and complexity of road construction projects and the differences between them. This was in line with other studies confirming that H&S in construction was considered to be more complex when the use of machinery was involved (Choudhry and Fang, 2008; Ringen and Stafford, 1996). This therefore caused increased hazard exposures as well as plant and equipment related accidents occurring on construction sites, more especially in larger and complex sites.

The next chapter summarises the findings from this chapter, tests the hypothesis, draws conclusions and makes recommendations.

CHAPTER 5 – CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This study aimed at revealing the state of road construction plant and equipment in the province of KwaZulu-Natal. Participants of the study tended to be guarded in their responses. There was a general wariness about the implications of the information being presented and the site H&S perception being created (Aaker, Kumar and Day, 2006). However, sufficient information was obtained to address the following problem statement:

The increased demand for and government expenditure on road and related infrastructure might potentially result in numerous accidents and injuries on project sites considering that these projects are executed in an environment characterized by unresearched levels of H&S training, adherence to H&S regulations, proper Risk Management techniques, identification and mitigation of hazards associated with plant and equipment by road construction contractors.

The objectives of the study were:

- To identify the H&S hazards associated with plant and equipment that contractors face in the KwaZulu-Natal road construction industry;
- To determine the nature and severity of accidents and hazards associated with plant and equipment in the KwaZulu-Natal road construction industry;
- To determine whether proper H&S Risk Management processes are followed by road construction contractors;
- To determine whether road constructors comply with H&S regulations on road construction projects; and
- To establish the extent of H&S training and management on road construction sites.

5.2 Hypotheses testing

5.2.1 Hypothesis 1: H&S hazards associated with plant and equipment on road construction sites are not identified by construction contractors.

Site observations revealed that machines were often sent for repairs by construction contractors. H&S hazards related to plant and equipment most commonly involved the use of excavators. Also common during road construction were hazards related to public vehicles. These hazards were predominantly due to non-adherence to construction road signage. It was further discovered that trucks, smooth drum rollers as well as pad foot rollers were the most frequently used plant and equipment and thus were naturally more involved in accidents.

Plant and equipment were discovered to be almost as likely to be hired as to be owned, therefore regulations regarding proper H&S should adequately cover both. Additionally, mechanical failure was found to be amongst the highest contributors to hazards and accidents on road construction sites with 41% of respondents citing it. This highlights the key issue of plant and equipment maintenance which should be given serious attention before plant and equipment are employed. Understanding of how machines work so as to assist in their efficient maintenance can reduce the likelihood of mechanical failure and accident occurrence. This becomes economically advantageous in terms of reducing societal impacts caused by direct and indirect costs associated with accidents and fatalities. Examples of direct costs include costs due to loss of time and medical expenses. Indirect socio-economic costs include damage to the reputation of the company and creating a negative image of the industry as a whole making it unattractive as a career choice. Given the existing skills shortage the lack of new entrants into the sector will only exacerbate an already desperate situation.

The study found that construction contractors played a key role in identifying H&S hazards associated with plant and equipment. Furthermore, the majority of respondents were aware of hazards and accidents that had occurred on site. The hypothesis that H&S hazards associated with plant and equipment on road construction sites are not identified by construction contractors is rejected.

5.2.2 Hypothesis 2: Road construction contractors disregard accidents and injuries associated with plant and equipment on road construction sites

In this regard, the study asked respondents about the nature and severity of accidents and hazards associated with plant and equipment. This served the dual purpose of garnering information as well as a way to gauge contractor’s knowledge and attitudes towards accidents and injuries associated with plant and equipment.

It was found that larger and more complex construction sites naturally had the most accidents and hazards. The most common accidents and hazards were due to the interaction of plant and equipment with site topography, operator error as well as private vehicles. A serious accident which involved an excavator slipping was categorised as minor by a respondent; this was an interesting attitude observation that hinted that construction personnel may be desensitised to accidents and injuries.

Road construction contractors were knowledgeable of health problems experienced on their sites. Dust inhalation, sun related injuries, vibrations, exposure to hazardous chemical substances and fatigue were the most listed health problems. However, in ranking the severity of the consequences of these health hazards, respondents tended to rank severity levels very low, sometimes even illogically so. For example, 50% of respondents ranked the severity of fatalities arising from using plant and equipment as 1 (None/Zero). The severity mean of all the health hazards was below 3 (moderate).

Respondents were also knowledgeable about safety problems associated with plant and equipment that their workers had experienced while working on their sites. The most frequently cited safety problem was mechanical, which were accidents that occurred from moving parts, followed by machine instability. Machines were often sent for repairs by construction contractors. Observations also confirmed on-site maintenance by mechanics to ensure machines were in good working order. Mechanical problems were also rated to have the most severe consequences of exposure with a mean severity rate of 2.46 (less than moderate). This is similar to the low severity that the respondents gave for health hazards exposures.

A big part of accident and injury prevention and safety is the appropriate use of PPE. Respondents were knowledgeable on the quality of PPE as well as on different types of PPE for different specific construction activities. Workers' refusal to wear PPE was a key issue raised by participants, with many attempts being implemented to mitigate this problem. It was found that worker noncompliance was due to the discomfort that they experienced when wearing PPE which may then negatively affect productivity. Contractors tended to be very frustrated with the workers because the workers disregarded PPE but they were also aware that the primary issue is the design of PPE, which should be both safe and comfortable.

It is therefore found that construction contractors and professionals do try to take into consideration the necessary precautions in preventing plant and equipment related accidents and injuries. The hypothesis that construction contractors disregard accidents and injuries associated with plant and equipment is rejected.

5.2.3 Hypothesis 3: Proper H&S Risk Management is lacking on road construction contractor sites.

The presence of the H&S officer is paramount in ensuring proper H&S risk management in construction sites. All sites had at least part-time presence of an H&S officer; however their presence was not always felt. Sites were categorised into green, amber and red status to indicate the degree of H&S presence on site. It was found that 50% of the sites had an H&S officer who was present and available on their sites, these sites were categorised green. Amber sites, which meant that H&S officers were occasionally available, were few (17%). However, 33% of sites were classed as red for having very little presence or no presence of the H&S officer.

The most common method used to identify H&S hazards were plant and equipment inspections. Mitigation and prevention systems on sites generally included the use of a Daily Safe Task discussions prior the commencement of work as well as Risk Assessments. An incidence report was usually completed in the event of an accident as well as the notification of the H&S officer or team leader on site. All these tasks were predominantly carried out by the H&S officer.

H&S project meetings were held on site, these meetings were mostly held on a daily basis. Meeting follow up procedures included giving instructions to the relevant person as well as safety audits. H&S officers were the main people who would ensure that H&S items were carried out. Additionally, subcontractors had their own H&S committees as well as committee meetings which were conducted mostly on a weekly basis. Meeting minutes were forwarded to the principal contractor of the site. This meant that subcontractors were aware of H&S issues on their sites.

Observations and participants responses revealed that routine maintenance as well as tool box talks were carried out by relevant persons to mitigate and prevent plant and equipment related accidents. To perform these tasks, the main instruments used included the obtaining of information, communication and documentations of H&S items. However, despite the presence of H&S officers and H&S instruments used to mitigate these H&S risks, plant and equipment related accidents still occurred. This meant that the level of H&S risk management was present but inadequate, and thus must be improved. Therefore the hypothesis that proper H&S Risk Management is lacking on road construction contractor sites could not be rejected.

5.2.4 Hypothesis 4: H&S regulations are neglected on road construction projects

When participants were asked if construction H&S regulations were followed on site, the majority agreed. However, a small percentage of participants (3%) mentioned that they were followed but not diligently. Respondents also mentioned that not wearing PPE and poor quality of PPE were the most common H&S construction regulation violations. Plant and equipment in poor condition as well as forged certificates were also considered a common violation.

The majority of respondents inspected and verified certificates of plant and equipment operators. This exercise was mostly done on a daily basis. Record of certificate inspection and verifications were generally kept in the H&S file. In addition to this, operators were not allowed to operate their machine nor work on site if they did not have proof of certification. This ensured that defective plant and equipment were not operational on site.

The majority of respondents inspected and verified plant and equipment maintenance records. These inspections were mainly done on a daily basis while inspection records were kept in the on-site H&S office. If plant or equipment did not have up-to-date maintenance records, they were usually sent to be maintained and not used on site. This revealed the level of strictness towards H&S regulations being followed on road construction sites. Principal contractors and subcontractors mentioned that they inspected plant and equipment and kept records of these inspections and these records were mainly kept in the H&S site office. Therefore the hypothesis that H&S regulations are neglected on road construction projects is rejected.

5.2.5 Hypothesis 5: H&S training and management are lacking on road construction sites

All H&S officers were experienced in construction H&S. Most participants were experienced in construction H&S. These participants were mainly trained in Safety Health and Environment (SHE) as well safety management. Plant and equipment training was mainly completed by H&S officers. Safety watching, obtaining site experience as well as training in plant and equipment operation were considered to be common construction H&S experiences amongst participants.

The majority of participants stated that plant and equipment operators were trained in H&S. Training on plant operation and toolbox talks were the most common training amongst plant and equipment operators. It was also found that plant operators were taken to H&S training courses on a yearly basis. However a minority of respondents stated that one of the reasons plant and equipment operators were not taken to H&S courses was because there was a H&S officer on site who was responsible for H&S aspects of the site. Another reason given was that operators had on-site safety talks and these were considered sufficient.

The presence of the H&S officer made a significant impact on the H&S performance on a site. However in this study it was found that although sites 1, 2 and 10 had a H&S officer who was present and available, construction site accidents still occurred. It was also found that the complexity and duration of the project played a role in the H&S performance of the site. When a project was complex and lengthily, the chances of the occurrence of an accident evidently increases. Given the construction industry’s complex and dynamic nature, construction companies need to ensure that they use the most suitable plant and equipment for their projects. Therefore high risk technical systems have to be developed. These technical systems are subject to and impacted by political pressures and social awareness issues surrounding H&S systems employed on road construction projects. Political and societal pressures in South Africa include the need to ensure a healthy and safer working environment, which goes hand in hand with the provisions of the OHSA.

With regard to H&S training and management, although participants claimed to be trained in construction plant and equipment, the H&S officer was considered the responsible person to deal with H&S. When the researcher asked about H&S training for operators, the H&S officer was generally considered responsible for all H&S aspects. Observations made by the researcher also confirmed this.

The hypothesis that H&S training and management are lacking on road construction sites is rejected. However, the current H&S training and management can be improved.

5.3 Recommendations

This study aimed to establish plant and equipment H&S risks encountered by road construction contractors in the province of KwaZulu-Natal. Due to the nature of the topic, it could be said that trying to get to the root of the problem was the problem. People were not really free to discuss H&S related issues. Therefore process of studying plant and equipment H&S risks was impaired. There appeared to be a strong disassociation between reported and actual H&S management. Furthermore social desirability became an important issue when conducting H&S research studies. The social impacts of road construction accidents and fatalities include the loss of trust in the construction industry as a whole which could result in limiting the number of new skilled and unskilled entrants into the sector. It would therefore be beneficial for the regulatory framework to be enforced by the various government departments to mitigate H&S hazard exposures associated with plant and equipment. This becomes particularly important given the commitment of government to increase investment in roads and related infrastructure.

Contractors should ensure that they appropriately identify H&S plant and equipment related risks using relevant risk management systems for their specific project. Contractors should also ensure that proper checking systems are in place to ensure that employees wear their provided PPE. The quality of PPE plays an important role in the level of productivity of the employee. For example, persons working with cement should be provided with knee height construction site boots. This is to reduce exposures to the cement mixture while working. An improvement in the quality of dust masks is also required to allow for proper breathing and comfort while being worn.

Employees will therefore be more comfortable in their work clothes and this will assist in the level and quality of productivity in road construction projects.

In addition to this, plant and equipment safety could be enhanced to promote the level of safety. Suppliers have recently provided intelligent systems in monitoring work and therefore assist in creating a safe working environment for both the operator and other employees on site. Systems could be employed when working with plant and equipment and could include the following:

- This technology allows for the machine to operate independently. The operator can be in the machine for back-up safety reasons. This also ensures consistency and quality of the work completed while making the operator's job easier and safer.
- An adoption of autonomous construction machines also allows for automated supporting documentation which assists in project progress monitoring. A print out of the work completed can be made showing progress as well as the amount of work outstanding. The quality of work can also be monitored using this technology, such as the level of compaction done by a smooth drum roller. Therefore the compaction results in a good, homogeneous spreading of materials on road layers.
- Another example of using technology to promote safety include the use of mechanically safe machine components, ergonomics as well as ensuring machine usage is environmentally friendly. Improvements of machines can therefore also create higher quality work and save costs by using a monitoring system to ensure that, for example when using the smooth drum roller, when the final compaction is reached the operator is notified. This would save compaction time, reduce costs as well as prevent over-compaction on road layers.

Findings showed that accidents mainly involved the use of an excavator. Therefore there should be emphasis on this particular plant to improve H&S. Improvements on H&S training with regard to the use of an excavator should therefore be implemented by road construction contractors. This may also include placing more emphasis on the H&S training of excavator operators during induction and toolbox talks. It was also noted that public vehicles had a tendency to be involved in construction site accidents. Accidents involving public vehicles were mainly due to public vehicle drivers not adhering to the stop/go and speed limit signage displayed. This was considered to be one of the greatest challenges faced by road construction contractors. A proper system should be implemented to ensure that traffic rules are adhered to examples could include the employment of a traffic police levying heavy traffic areas on road construction sites.

Improvements need to be made to the current risk assessment process to incorporate systems to assist in preventing future road construction site accidents. As per Hypothesis 3, current Risk Management systems in place were inadequate. Therefore road construction professionals should explore and integrate other methods and tools such as the Multi – Causal Approach and H&S data flow diagrams to determine root causes of accidents and fatalities.

A H&S course should be incorporated in the curriculum of university students, as a separate subject, this will improve the knowledge of construction professionals and therefore reduce the number of accidents and fatalities experienced. There must also be a relevant H&S course for each professional. This would assist in the division of H&S risk management on construction sites. The responsibility of H&S should not merely rest upon the H&S officer; there should be a promotion of H&S activity sharing amongst professionals. Hence an appropriate level of H&S education amongst professionals is required. The inclusion of construction H&S topics into the curricula of built environment programs at universities will provide the framework for modelling the construction organisational, management and operational structures that will form the basis of accidents mitigation and prevention on construction sites.

Furthermore, the co-operation between the government and road construction contractors should be encouraged in the improvement of H&S management systems for future infrastructural development of the KwaZulu-Natal province. This will assist in the reduction and mitigation of accident and injuries on road construction sites.

The KwaZulu-Natal government has committed to providing an economically sustainable public transportation system. Consequently, expansion and rehabilitation of the current infrastructure are required. With this in mind, there needs to be a drastic increase in the implementation of construction H&S standards on these types of projects in the province. If this is not achieved, the societal and economic costs will be enormous. The consequences of poor H&S performance by the sector and the associated high rate of accidents will result in negative views of the current government's commitment to and performance in terms of ensuring the quality of life of the nation as well as the sustainability of the construction industry. This would in turn affect the much needed economic and social upliftment of the province.

5.4 Recommendations for further research

Future research should ensure that interviews are conducted without the interviewee signing the interview instrument. This will assist in the response rate seeing that H&S is a sensitive subject and help to make participants feel more comfortable in providing information. This will also assist in assuring anonymity. During the study, this manifested in the way that respondents answered some of the questions. It was discovered that there was a need by participants to appear favorable in the eyes of the interviewer.

The study would have benefited from a longer observation period. This would have allowed for a larger sample size allowing a deeper and broader understanding of H&S aspects on road construction sites.

A more intense survey on construction plant and equipment suppliers could be conducted. Suppliers' plant assembly workshops can be observed to gain insight on H&S aspects of construction plant and equipment.

Further research is required in how to improve the quality of PPE to match specific tasks of road construction employees. For example, higher quality of dust masks for extreme conditions are required on road construction sites. This will assist in the reduction of exposures to health hazards, such as the inhalation of cement dust which to could cause risks of chronic obstructive pulmonary diseases (COPD).

Further research is required to investigate 'alternative' preventative measures to health risk exposures experienced on construction sites, particularly the effect of diet in mitigating these risks.

Taking into consideration these research recommendations, education programmes for construction personnel need to be evaluated and improved.

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APPENDIX A – ETHICAL CLEARANCE LETTER

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

6 May 2013

Ms Naomi Eliwaza Kingu 206523825
College of Agriculture, Engineering and Science
Howard College Campus

Protocol reference number: HSS/0233/013M
Project title: A Study of Construction Plant and Equipment Health and Safety (H&S) in the KwaZulu Natal Construction Industry.

Dear Ms Kingu

Expedited approval

I wish to inform you that your application has been granted Full Approval through an expedited review process.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. Please note: Research data should be securely stored in the school/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

....
Professor Steven Collings (Chair)

/px

cc Supervisor: Professor TC Haupt
cc Co supervisor: Mrs N Harinarain
cc Academic leader research: Dr Leigh Jarvis
cc School Administrator: Mrs Kim Henry

Humanities & Social Sc Research Ethics Committee
Professor S Collings (Chair)
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Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

INSPIRING GREATNESS

APPENDIX B – INTERVIEW LETTER AND SCHEDULE

UNIVERSITY OF KWAZULU-NATAL™
INYUVESI YAKWAZULU-NATALI

24 June 2013

Confidentiality Agreement for Research Project:
A Study of Construction Plant and Equipment Health and Safety (H&S) in the KwaZulu-Natal Construction Industry.

To whom it may concern:

I, Naomi Kingu, am currently registered for studies leading to the Masters in Construction Management. A requirement to be met in the awarding of the Masters in Construction Management is that an approved research project should be undertaken leading to a submission of a dissertation.

The study involves a site observation which will determine key risks involved in the use of plant and equipment, the nature and severity of accidents and hazards; and H&S risks that contractors face associated with the use of plant and equipment in the KwaZulu-Natal road construction industry. This analysis will be used to determine how H&S risks associated with plant and equipment can be prevented or mitigated. Information gathered in this study will include data retrieved by means of interview questions that is requested to be completed.

Please note that only summary data will be included in the report and that your name will not be included. Your anonymity and confidentiality is of utmost importance and will be maintained throughout the study. Your participation for site observation and being interviewed is completely voluntary. You also have the right to withdraw at any time during the study.

Please note that this investigation is being conducted in my personal capacity. Should you need to contact me regarding any aspect of this research, you can do so either by e-mail on: 206523525@stu.ukzn.ac.za or telephonically on: 071 603 1315

My academic supervisor is Prof. Theo Haupt, based in the School of Engineering on the Howard campus of the University of KwaZulu-Natal. He can be contacted by e-mail at: haupt@ukzn.ac.za or telephonically at: 031 260 2687 or 021 902 0302

I appreciate the time and effort it will take you to participate in this study. I would highly appreciate your participation, as it would help me to complete this research project.

Regards,

Naomi Kingu (student number 206523825) | Supervisor: Prof Theo Haupt

Property Development
School of Engineering
College of Agriculture, Engineering and Science, University of KwaZulu-Natal
Postal Address: Private Bag X54001, Durban, 4000
Telephone: +27 (0) 31 2602687 **Facsimile:** +27 (0) 31 2601411 **Website:** www.ukzn.ac.za

Please complete the section below:

I ……………………………………………………………….. (Full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

Signature of Participant…………………………………..………

Date…………………………………………………………..……..

Property Development
School of Engineering
College of Agriculture, Engineering and Science, University of KwaZulu-Natal
Postal Address: Private Bag X54001, Durban, 4000
Telephone: +27 (0) 31 2602687 **Facsimile:** +27 (0) 31 2601411 **Website:** www.ukzn.ac.za

[N.Kingu; mobile: 071 603 1315; email: 206523825@stu.ukzn.ac.za]

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

A STUDY OF CONSTRUCTION PLANT AND EQUIPMENT HEALTH AND SAFETY (H&S) IN THE KWAZULU NATAL PROVINCE

Interview Questions:

A. GENERAL

1. What position do you currently hold in your organization (your job title)?

2. How long have you been in this position?

3. Have you had any previous training in construction H&S? (please tick)

Yes		No	

3.1 If yes, please provide details of the training courses you did and when

4. Have you had any previous training in construction plant and equipment H&S? (please tick applicable box)

Yes		No	

4.1 If YES, please provide details of the training courses you did and when

5. What plant and equipment do you use most frequently on your projects?

5.1
5.2
5.3
5.4
5.5

6. Using the numbers in Question 5 for reference indicate whether you own these or rent/hire them (Please tick appropriate box)

Plant/Equipment	Own	Hire
5.1		
5.2		
5.3		
5.4		
5.5		

B. RISK AND RISK MANAGEMENT

7. Is a H&S officer/representative present on site? (Please tick applicable box)

Yes		No	

7.1 If not, why not?

8. What method/s do you use to identify hazards associated with plant and equipment?

9. What hazards are associated with plant and equipment on your site?

10. From the commencement of this project, have there been any plant and equipment related injuries or accidents on site? (Please tick applicable box)

Yes		No	

10.1 If yes, please give details of the incident/s:

C. COMPLIANCE

11. Do you think that basic construction H&S regulations relative to the proper use of plant and equipment are being followed on site? (Please tick applicable box)

Yes		No	

11.1 If NO, explain why not.

11.2 What are the most frequent violations of these regulations that you have encountered on this project?

12. Do you regularly inspect and verify the certification of plant and equipment operators? (Please tick applicable box)

Yes		No	

12.1 If so, how often do you inspect and verify?

12.2 If YES, where do you keep records of these inspections?

13. What happens when an operator is either not certified or does not have proof of certification?

14. Do you inspect and verify the maintenance records of the plant and equipment you use?

14.1 If so, how often do you inspect and verify?

14.2 If YES, where do you keep records of these inspections?

15. What do you do about plant and equipment that do not have up-to-date maintenance records, certifications or licences?

16. Do principal contractors and sub-contractors inspect and keep records of inspections of construction plant and equipment? (Please tick applicable box)

Yes		No	

16.1 If NO , why not?

16.2 If YES, where do you keep copies of these inspections?

D. TRAINING

17. Have management staff taken any H&S training courses? (Please tick applicable box)

Yes		No	

17.1 If NO, why not?

17.2 If YES, please provide details of the training courses and when they were taken

18. Have plant and equipment operators taken any H&S training courses?

Yes		No	

18.1 If YES, please provide details of the training courses and when they were taken

18.2 If YES, how frequently are they sent on these courses?

18.3 If NO, why not?

E. EXPOSURE TO HEALTH AND SAFETY RISKS

19. Have any of your workers who work with plant and equipment experienced any of the following health problems while working on any of your sites? (Please tick appropriate box)

Accident/Injury	Yes	No	Unsure
19.1 Burns			
19.2 Central Nervous System (CNS) Injuries			
19.3 Dust Inhalation			
19.4 Electrocution or electrical shock			
19.5 Exposure to hazardous chemical substances			
19.6 Fatalities			
19.7 Fatigue/exhaustion			
19.8 Musculoskeletal Injuries			
19.9 Noise Induced hearing loss			
19.10 Respiratory System			
19.11 Sunburn/sunstroke/dehydration			
19.12 Whole body vibration (WBV) or Hand Arm Vibration Hazards			

20. On a scale of 1 to 5, rate the severity of consequences of the following health problems arising from using plant and equipment on your site; where 1 = None/zero, 2 = Minor, 3 = Moderate, 4 = Major, 5 = Catastrophic (Please tick appropriate box)

Accident/Injury	1	2	3	4	5
20.1 Burns					
20.2 Central Nervous System (CNS) Injuries					
20.3 Dust Inhalation					
20.4 Electrocution or electrical shock					
20.5 Exposure to hazardous chemical substances					
20.6 Fatalities					
20.7 Fatigue/exhaustion					
20.8 Musculoskeletal Injuries					
20.9 Noise Induced hearing loss					
20.10 Respiratory System					
20.11 Sunburn/sunstroke/dehydration					
20.12 Whole body vibration (WBV) or Hand Arm Vibration Hazards					

21. Have your workers working with plant and equipment experienced any of the following safety problems while working on any of your sites? (please tick appropriate box)

Safety Problem	Yes	No	Unsure
21.1 Mechanical			
21.2 Machine instability			
21.3 Operator's station – falls, trips or slips			
21.4 Failure of control systems			
21.5 Power transmission source			
21.6 Other			
21.7 If other, please specify:			

22. On a scale of 1 to 5, rate the severity of the consequences of the following safety problems arising from using plant and equipment on your site; where 1 = Non/zero, 2 = Minor, 3 = Moderate, 4 = Major, 5 = Catastrophic (Please tick appropriate box)

Safety Problem	1	2	3	4	5
22.1 Mechanical					
22.2 Machine instability					
22.3 Operator's station – falls, trips or slips					
22.4 Failure of control systems					
22.5 Power transmission source					
22.6 Other					
22.6 Other, please specify and rate:					

F. MITIGATION AND PREVENTION OF H&S RISKS

23. Why do you think plant and equipment related accidents occur?

24. What systems are in place to ensure that plant and equipment related hazards are mitigated?

25. Describe the reporting and investigation process in the event of an accident or injury occurring on site?

26. Are project H&S meetings held on site?

Yes		No	

26.1 If so, how frequently are these project H&S meetings held?

26.2 If meetings are not held, why not?

26.3 What follow up procedures are in place to ensure that H&S items are actioned?

27. Do sub- contractors have their own internal H&S committees? (Please tick applicable box)

Yes		No	

27.1 If NO, why not?

28. Do sub- contractors have their internal H&S committee meetings? (Please tick applicable box).

Yes		No	

28.1 If meetings are held, how frequently are they held?

28.2 If meetings are held, are minutes forwarded to the principal contractor?

Yes		No	

28.3 If meetings are not held, give reasons?

29. What measures are in place to ensure that plant and equipment related accidents are mitigated or prevented from happening?

30. What would you suggest plant and equipment related H&S risks can be mitigated?

Thank You

APPENDIX C – OBSERVATION SPREADSHEET

SITE OBSERVATION STUDY

Details	
Project Name	A STUDY OF CONSTRUTION PLANT & EQUIPMENT HEALTH AND SAFETY IN THE KWAZULU NATAL PROVINCE
Institution	UNIVERSITY OF KWAZULU NATAL
Students Name	Naomi Kingu
Student Number	206523825

Details	
Email address	206523825@ukzn.ac.za
Mobile	0716031315
Telephone Number	0312601780

Project Name	
Location	
Start Date	
End Date	
Project Amount	
Progress to date (what stage)	
Length of road to date	
Total length of road project	
Observation start time	
Observation end time	
Site office tel number /email	

Observations Conducted

1. What H&S hazards associated with plant and equipment do contractors face on site?	
2. Do contractractor regard or disregard accidents and injuries associated with plant and equipment? Eg. What is done when an accident occurs?	

3. Is proper H&S Risk Management implimented on site? Eg. Is there a safety file or other relevant records?	
4. Are H&S regulations implimented on site? If so, how?	
5. Is H&S training and management conducted?	
6. What is been done to prevent or mitigate H&S hazards?	
7. Other observations associated with plant and equipment H&S:	

APPENDIX D – INCIDENT REPORT

ANNEXURE 1

Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)

REGULATION 9 OF THE GENERAL ADMINISTRATIVE REGULATIONS

Recording and Investigation of Incidents

A. RECORDING OF INCIDENT

1. Name of employer
2. Name of affected person
3. Identity number of affected person
4. Date of incident 19-06-2013 5. Time of incident 16H30
6. Part of body affected

✓ Head or Neck	Eye	Thumb	Finger	Hand
✓	Foot	Leg	Internal	Multiple

7. Effect on person

Sprains or strains	Contusion or Wound ✓	Fractures	Burns	Amputations
Electric shock	Asphyxiation	Unconsciousness	Poisoning	Occupat. Disease

8. Expected period of disablement

0-13 days	2-4 weeks	4-8 weeks	8-52 weeks	>52 weeks permanent disablement	Fatal

9. Description of Occupational Disease N/A

10. Machine/process involved/type of work performed/exposure** Nothing ~~been~~ on the even. Employee was in a Venicle. on his way home.

11. Was the incident reported to the Compensation Commissioner and Provincial Director?* Yes ✗
12. Was the incident reported to the police?* Yes ✗
13. SAPS office and reference NO

*to be completed in the case of a fatal incident

** In case of a hazardous chemical substance indicate substance exposed to

B. INVESTIGATION OF THE ABOVE INCIDENT BY A PERSON DESIGNATED THERETO

1. Name of investigator
2. Date of investigation 19-06-2013 ~~Safety Off~~
3. Designation of investigator Safety Officer
4. Short description of incident Employee jump from the vehicle then he got hurt on his face and arm.
5. Suspected cause of incident The Employee was not think straight to risk with his life like this, and he did not wait until the vehicle ~~to~~ stoped(His Neglegency)
6. Recommended steps to prevent a recurrence – All employee must not use the Vehicle without the Conopy immediatly – And when are inside they must all sit down, not on the sides of the vehicle. also wait to stop

Signature of investigator 21-06-2013 Date

C. ACTION TAKEN BY EMPLOYER TO PREVENT THE RECURRENCE OF A SIMILAR INCIDENT

–Tool box talk take the place to train all Employees
– All employees are stopped ~~to~~ using a vehicle without a Conopy.

Signature of employer 21-06-2013 Date

D. REMARKS BY HEALTH AND SAFETY COMMITTEE

Remarks

Signature of Chairman of health and Safety Committee Date

APPENDIX E – PLANT CHECKLIST

Safety & Maintenance Checklist:

Material Handlers

SAFETY.CAT.COM™

Operator/Inspector__________________ Date______________ Time_______________
Serial Number__________________ Machine Hours_________________

What are you inspecting?	✓	What are you looking for?	✓	Evaluator Comments

For more information, please refer to the Operation and Maintenance Manual or any other applicable manuals and instructions for this product. If you have questions, please contact your local Caterpillar dealer.

FROM THE GROUND

Work Tool		Excessive Wear or Damage, Leaks		
Boom and Stick		Excessive Wear or Damage		
Implement Cylinders		Excessive Wear, Damage, Leaks		
Underneath of Machine		Final Drive Leaks, Damage		
Overall Undercarriage		Packing/Debris buildup		
Idlers & Rollers		Leaks, Damage, Wear		
Drive Sprockets		Wear, Damage, Loose Bolts		
Track Assembly		Tightness, Damage, Bent or Broken Shoes		
Swing Bearing		Damage, Loose or Missing Bolts		
Tires		Excessive Wear or Damage, Foreign Objects		
Steps and Handholds		Condition and Cleanliness		
Overall Machine		Loose of Missing Nuts & Bolts, Loose Guards, Cleanliness		

ENGINE COMPARTMENT

Engine Oil		Fluid Level		
Swing Drives		Fluid Level		
Engine Coolant		Fluid Level		
Air Filter		Restriction Indicator		
Radiator		Debris, Damage, Leaks		
All Hoses		Cracks, Wear Spots, Leaks		
All Belts		Tightness, Wear, Cracks		
Overall Engine Compartment		Trash or Dirt Buildup, Leaks		

ON THE MACHINE, OUTSIDE THE CAB

Fuel Tank		Fuel Level, Damage, Leaks		
Hydraulic Oil Tank		Fluid Level, Damage, Leaks		
Fire Extinguisher		Charge, Damage		
Windshields Wipers & Washers		Wear, Damage, Fluid Level		
Batteries & Hold Downs		Cleanliness, Loose Bolts & Nuts		

INSIDE THE CAB

Falling Object Guard		Damage		
Seat		Adjustment		
Seat Belt & Mounting		Damage, Wear, Adjustment		
Horn, Backup Alarm, Lights		Proper Function		
Overall Cab Interior		Cleanliness		

HTTP://SAFETY.CAT.COM/CHECKLISTS V0611.2

CATERPILLAR

APPENDIX F – PERSONAL PROTECTIVE EQIPMENT ISSUE

CONTROL OVER PERSONAL PROTECTIVE EQUIPMENT

PERSONAL PROTECTIVE EQUIPMENT ISSUE

NAME:	CO. NO.:	SITE:

CONDITIONS OF ISSUE

1. PPE will be issued at expense of the Company.
2. PPE remains the property of the Company and must be handed back on termination of service.
3. Loss or wilful damage to PPE may result in disciplinary action being taken against the employee after an investigation.
4. I will immediately report if PPE issued to me is lost or damaged.
5. I will wear/use PPE issued to me where and whenever required to do so.
6. I understand that it is a legal requirement to wear PPE and that refusal to do so can lead to disciplinary procedures being instituted.
7. I have received training on the use and limitations of PPE.

I understand and accept all the conditions of issue above.

SIGNATURE: **DATE:**

Overall	Conti. Suit Pants	Conti. Suit Top	Dust Coat	Apron	Hard Hat	Gum Boots	Safety Shoes	Gloves	Safety Goggles	Face Shield	Welding Hood

Self Cont. Respi-rator	Respi-rator	Dust Mask	Hearing Protec-tion	Safety Belt	Thermal Suit	Thermal Jacket	Jersey	Socks			

In terms of General Safety Regulation 2 of the Occupational Health and Safety Act of 1993, you have been issued with protective equipment as above. You will, in terms of the above Regulation, make use of such protective equipment whilst working on the premises of Nampak. Failure to wear such protective equipment is an offence and on conviction you may be fined up to R50 000 or be imprisoned for up to 12 months, or both.

IT IS YOUR RESPONSIBILITY TO SAFEGUARD YOUR EQUIPMENT.

Ngokomthetho wezokuphepha wesibili (2) wokusenza ngempilo nokuphepha ka 1993, unikezelwe ngezingubo zokuzivikela nokusebenzisa okungenhla. Ngokomthetho ongenhla umelwe ukuba nesiqiniseko sokusenenzisa izingubo zokuzivikela uma usebenza emagcekeni. Ukwehluleka ukugqoka okuzivikela kuyicala elingaquholela kwinhlawulo eyizinkulungwane ezingamashumi ayisihlanu zamarandi (R50 000) noma uboshwe isikhathi esiyizinyanga eziyishumi-nambili (12 months), noma kokubili.

UMLANDO NGEZINGUBO ZOKUZIVIKELA.

APPENDIX G – RISK ASSESSMENT RECORDS

Risk assessment records

Hazard /work Activity Assessed	Bitumum spray
	Spraying

Who May Be Harmed

Employees	X	Official Visitors	X	Operator and helper		
Subcontractors	X	General Public	X			

SIGNIFICANT RISKS	H	M	L	
Slip, trip in the ground.				
Inhaling objects				
Obstruction of emergency access / exit routes				
Damage vehicle				
H-high risk M –medium risk L –Low	(tick box)			

CONTROL MEASURES
• Proposed operating area to be checked in advance for suitability • Placing the signs on the layer works road, 100 metres in between. • Placing the flagman's • Placing 2 stop and go both sides. • Controlling traffic in 1 side of the road. • Operatives must we appropriate PPE . • The employees must drink lot of work when the weather is hot. • A safe access routes will be available between the vehicles. • Consideration will be given to the need for eye protection in addition to eye protection. Also kneepads and other protective clothing or devices for those applying the Butumnum spray. • Regular checks to be made on the temperature and levels • Unsafe checks to be made at the end of every day • Precautions taken to prevent the incident to happen on the road.

INFORMATION INSTUCTION AND TRAINING
Selection of operatives may be required who have experience of the work and are physically fit.
Information instructions and induction to be provided to employees which should include tool box talk and emergency procedures and first aid.

PERSONAL PROTECTIVE EQUIPMENT						
Gloves	X		Overalls	X		Respiratory Protection
Safety Boots	X		Ear plugs	X		Dust masts
Safety Glasses	X		Goggles /visor	X		Respirator
Remember PPE is always last resort						

[redacted] *Consultants*

RISK ASSESEMENT FORM **(To be submitted prior to project commencement)**		
ACTION PLAN		
Action Required	***Responsible Person***	***Date for Completion***
Training Staff in Risk Assessment	***Neil Gordan***	

RISK ASSESSMENT COMMUNICATION REGISTER

Date: ____________ 2012 Trainer / Facilitator: ____________

RISK ASSESSMENT TOPIC: ____________ Place: ____________

Acknowledge receiving awareness TRAINING in the above risk assessment and that I have been trained. I fully understand the related instructions and will comply with the assigned requirements and procedures, including the wearing of the necessary Personal Protective Equipment.

No.	FULL NAME & SURNAME	SIGNATURE	No.	FULL NAME & SURNAME	SIGNATURE
1			8		
2			9		
3			10		
4			11		
5			12		
6			13		
7			14		

RA Ref: 3084
Review Date: 1st July 2012

DATE 7th JULY 2011

RISK RATING	
MEDIUM	✓

PROJECT. .

RISK ASSESSMENT: LIFTING AND HOISTING (TLB Excavators used for lifting)

PPE	CONTROL MEASURES	POTENTIAL HARZARDS (CONSEQUENCES)	H	M	L
 Helmet  Safety Boots  Gloves  Hi-Vis Vest	1. Excavators to be used as cranes will comply with Regulations 97(1) (a), 98, 99 and 100 of the 2001 Construction Regulations and the Seventh Schedule of these Regulations. 2. Excavators safe working load must be greater then the foreseeable weight of loads to be lifted. 3. No persons are allowed to stand or work within the operating radius without the operator's permission. 4. Loads must not be slewed over personnel, vehicle cabs or site huts. 5. A banksman is to be used where driver's vision is impaired or where operating in congested areas. 6. The safe working load will be clearly marked on the excavator, and a table of safe working loads will be clearly visible to the driver, it must not be exceeded. 7. The machine will be on firm, level base, and the lifts will be carried out with the boom parallel to the machine tracks or wheels. 8. A trained slinger to be used to ensure lifting equipment is suitable and safe lifting techniques are used. 9. Lifting Inspection Register (form CR4B) must be available and up to date. 10. Certification of drivers must be checked to ensure their competence (FAS Construction Skills Certification Scheme or approved equivalent). 11. Lifting will be supervised to ensure the stability of the machine and the load.	Unplanned release or dropping If load.		✓	
		Boom striking overhead obstruction.		✓	
		Persons struck by machine boom etc.	✓		
		Objects falling from boom/bucket			✓

EXTRA PRECAUTIONS!	WARNING!!! BE ON THE LOOK – OUT FOR PEOPLE/ PROPERTY/TRAFFIC/VISITORS IN THE AREA!
1. Driver to have FAS Construction Skills Certification Scheme card or other approved training card. 2. Excavator driver by uncertified operatives is not permitted, this also applies to subcontractors.	

APPENDIX H – SITE SAFETY INDUCTION

SAFETY INDUCTION CHECKLIST –TPT EMPLOYEES, VISITORS, CONTRACTORS (INCLUDING LABOUR BROKERS)
DOCUMENT SHERQ RS GLD 005 – Annexure 1

Employee Name:	**ID:**
Date Inducted :	**Company:**
Designation:	**Safety Experience:**

The following instructions were given to the above by the TPT Training Department in conjunction the TPT: Safety Department.

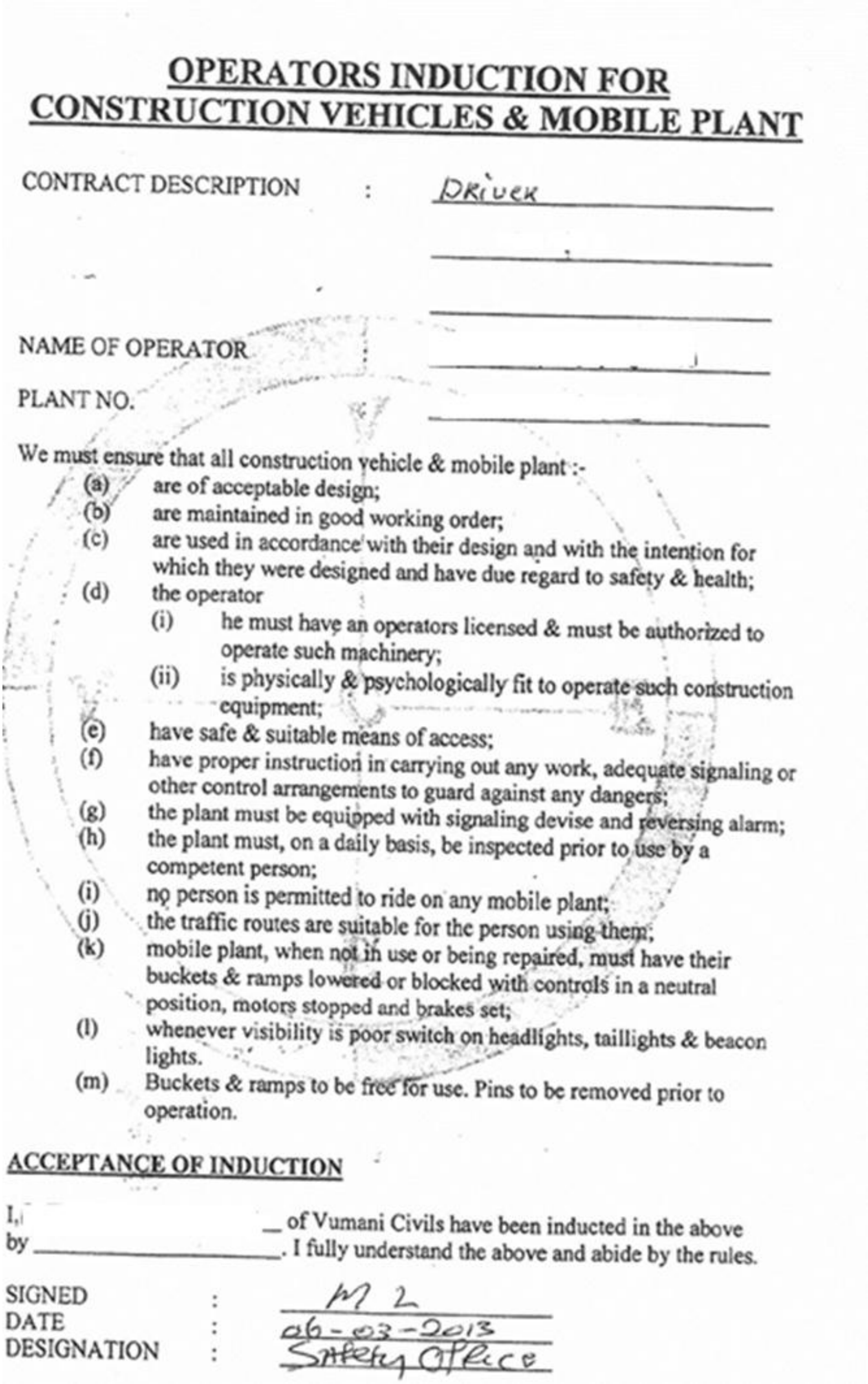
Items Discussed	Initial	Items Discussed	Initial
SHERQ / Security Policy statement		Requirements-Work Permits	
SHERQ Organizations & Importance – employee & employer obligation		Safety Enforcement Systems – Reward & Penalty System	
Site Medical and First Aid Facilities		Driving Rules & Requirements	
Reporting of occupational injuries and diseases (Injury Experiences)		Quality Assurance and Control	
OHS Act, COID Act , RSR, NNR NEMA Maritime etc		Safe Operating Procedures	
Lockout Procedures		Planned Job Observations	
Emergency Evacuation Procedures – Assembly Points & Alarms		Fire Safety Management – signage Equipment & location	
Access Control Procedures		Drug and Alcohol Policies	
DCT Rules		MSDS and Emergency Procedures	
SHERQ Committee and Representation		Personal Protective Equipment	
SAFETY DVD		Orientation of operational areas	

Note: It is the responsibility of the Departmental Head to conduct Safety induction training for their employees who are requested to work and make them aware of all hazards in the Durban Container Terminal.

Conducted by: ____________________________**Employee Signature:** ______________
SHEQ OFFICER

DCT/OSHEQ/FORM/267 REV: 00 Page 1 of 2

APPENDIX I – OPERATORS INDUCTION FOR CONSTRUCTION VEHICLES & PLANT



OPERATORS INDUCTION FOR CONSTRUCTION VEHICLES & MOBILE PLANT

CONTRACT DESCRIPTION : DRIVER

NAME OF OPERATOR :

PLANT NO. :

We must ensure that all construction vehicle & mobile plant :-

(a) are of acceptable design;
(b) are maintained in good working order;
(c) are used in accordance with their design and with the intention for which they were designed and have due regard to safety & health;
(d) the operator
  (i) he must have an operators licensed & must be authorized to operate such machinery;
  (ii) is physically & psychologically fit to operate such construction equipment;
(e) have safe & suitable means of access;
(f) have proper instruction in carrying out any work, adequate signaling or other control arrangements to guard against any dangers;
(g) the plant must be equipped with signaling devise and reversing alarm;
(h) the plant must, on a daily basis, be inspected prior to use by a competent person;
(i) no person is permitted to ride on any mobile plant;
(j) the traffic routes are suitable for the person using them;
(k) mobile plant, when not in use or being repaired, must have their buckets & ramps lowered or blocked with controls in a neutral position, motors stopped and brakes set;
(l) whenever visibility is poor switch on headlights, taillights & beacon lights.
(m) Buckets & ramps to be free for use. Pins to be removed prior to operation.

ACCEPTANCE OF INDUCTION

I, __________ of Vumani Civils have been inducted in the above by __________. I fully understand the above and abide by the rules.

SIGNED : M 2
DATE : 06-03-2013
DESIGNATION : Safety Office

APPENDIX J – ENVIRONMENTAL AUDIT

ENVIRONMENTAL AUDIT

Project Reference	
Date of Audit	2013 -25-02
Name of Auditor	

ENVIRONMENT AUDIT SUMMARY

Poor = not complying with the majority of requirements or causing significant environmental impact/s
Fair = complying with majority of requirements and not causing any significant impact/s
Excellent = complying with all the requirements and undertaking extra effort to minimise the impact on the receiving environment.

Category	Rating	Comments
A. General Administration	excellent	is in a good condute
B. Housekeeping & Materials Storage	excelent	site is clean
C. Waste Management	excellent	waste dump is provided
D. Stormwater Management	excellent	yes it is
E. Pollution & Hazardous Materials Control	excelent	watercart is available on site.
F. Construction Vehicles, Plant & Machinery	excellent	constraction vehicle are in a good condition
G. Soil & Spoil Management	excellent	is available
H. Sensitive Areas	poor	Not protected
I. Flora & Fauna	excellent	plant and animals are protected
J. Rehabilitation & Landscaping	excellent	Are not too bad
K. Construction Staff	excellent	contraction staff are enough

OVERALL RATING	
CONCLUSION WITH PREVIOUS AUDIT	

CONCLUSION
we are improving the standard of health safety and environmental management within the site

APPENDIX K – TRANSPORT OF EXPLOSIVE PERMIT

Page 1 of 2

ORIGINAL

CESRP833C / 5384605

SOUTH AFRICAN POLICE SERVICE

EXPLOSIVES SECTION

Reference No : 28/1/2/1 / 22156
Allocation Date : 2013-05-22
Date Issued : 2013-05-22
Enquiries: SERG NS JALI

Transport Permit 2013-05-22

[Issued in terms of Chapter 6 of the Regulations under the Explosives Act, 1956]

TTP 146825

Permission is hereby granted to : MAIZE WHOLESALERS CC T/A PONGOLA WHOLESALERS
Trading as : PONGOLA WHOLESALERS
Postal Address : PO BOX 674, PONGOLA, 3170
Physical Address : 237 KLASIE HAVENGA STREET, PONGOLA
Telephone : BUSINESS 034 413-1220

to obtain from : AEL MINING SERVICES LIMITED - RIDGEVIEW DEPOT
and convey to : UMGABABA P728. S30°07.548 E030°43.019

.e undermentioned quantities of explosves in 6 consignment(s):

Quantity	Unit of Measure	Explosives Description	Group
6	Bags	ANFEX EXPLOSIVE	1
4	Reels	DETONATING FUSE	10
5	Unit	ELECTRIC DETONATORS (ALL TYPES)	10
2	Unit	DETONATING RELAYS	

Delivery Schedule : ONE CONSIGNMENT PER DAY
Method of Transport : ROAD

Method of transport by ROAD: Per vehicle licensed in terms of regulation 6.38.1 with fleet vehicles or

Registration	Chassis	Engine	Model Year	Description
NPG7736	AHTDR22G105525832		2013	

which must be transported in one consignment for groups 1-4 and another for groups 6A & 10. REG. 6.9 refers.

This permit expires on **2013-06-21** and must accompany the consignment to its final destination.

The grantor, the State and/or its employees shall in no way be liable for damage, loss or injury sustained by any person or persons which in any way may be attributed to the transport of explosives in accordance with this permit or otherwise.

After issuance of every consignment the attached certificate must immediately be completed by the supplier. The purchaser must ensure the certificate is completed correctly, and must thereafter sign for receipt of the consignment.

SOUTH AFRICAN POLICE SERVICE
CRIMINAL RECORD AND CRIME SCENE MANAGEMENT
EXPLOSIVES SECTION
2013 -05- 22
PROVINCIAL COMMANDER
KWAZULU-NATAL
SOUTH AFRICAN POLICE SERVICE

5384605 SERG NS JALI
for Chief Inspector of Explosives
Cell 0795295091

SOUTH AFRICAN POLICE SERVICE
CRIMINAL RECORD AND CRIME SCENE MANAGEMENT
EXPLOSIVES SECTION
2013 -05- 22
DURBAN
KWAZULU-NATAL
SOUTH AFRICAN POLICE SERVICE

Private Bag X624, PRETORIA, 0001 pta-explosives@saps.org.za Tel +27 12 393-2748/55/63 Fax +27 12 323-1711

APPENDIX L – OCCUPATIONAL HEALTH CERTIFICATE

OCCUPATIONAL HEALTH CERTIFICATE OF FITNESS

NAME: ____________ **COMPANY:** ______________ **SITE:** Various

Position: Excavator Operator **Date of examination:** 09/01/2013

ID Number: ______________ **ExpiryDate:** 2014/01/09

SPECIAL EXAMINATIONS:

Audiometry: PLH 1.5% Spirometry/Peek Flow: FEV1 105%
Chest x-ray______________ ECG______________
Visual Screening: ✓ Heat Stress Height Evaluation ✓
Blood Tests:______________ Other:_____ Physical Evaluation ✓
(The above has undergone specific test and a Medical Examination as requested according to the relevant Occupational Exposure profile specifications as supplied.)

IS RECOMMENDED FOR PLACEMENT: ✓

IS NOT RECOMMENDED FOR PLACEMENT: ______________

PENDING RESULTS: ______________

PLACED WITH FOLLOWING RESTRICTIONS:
Please circle:

May not work in :	**May not drive following:**	**May not work on/at/with**
Noise Zone	Codes A1.A.B or EB	Heights, open water, fire
Respiratory risk area	Codes C1, C, EC1 or EC	electricity or moving machinery
Heat Stress area	Other	

IN CASE OF RESTRICTIONS EMPLOYER TO GIVE A COPY TO EMPLOYEE/ AREA SUPERVISOR/PLANT MANAGER/HR MANAGER:

1. EMPLOYEE 2. SUPERVISOR 3. PLANT MANAGER 4. HR MANAGER

Name:______________
Designation:______________
Date:______________
Signature:______________

REFERRAL:

NIL ✓ VISION________ AUDIOLOGIST________ DOCTOR/GP________

MEDICAL EXAMINER:

Date JHM

DOCTOR IN OCCUPATIONAL HEALTH: (DOH)

Date
Name:

Occupational Health Practitioner
Tel.: (031) 250 455[illegible] Cell.: 084 31[illegible] 293
PR No. 088 000 0081582

APPENDIX M – CERTIFICATE OF COMPETENCE

Certificate of Competence

This is to certify that

Identity Number

Has received the necessary training in Safe Operation and General Maintenance and has been assessed as competent in the operation of

Steel Drum Roller

Date of Issue:
04.05.2012

Valid to:
04.05.2014

Certificate No:
1205043

Instructor
Assessor Reg. No.:
17 - QA/ASS/1314/07

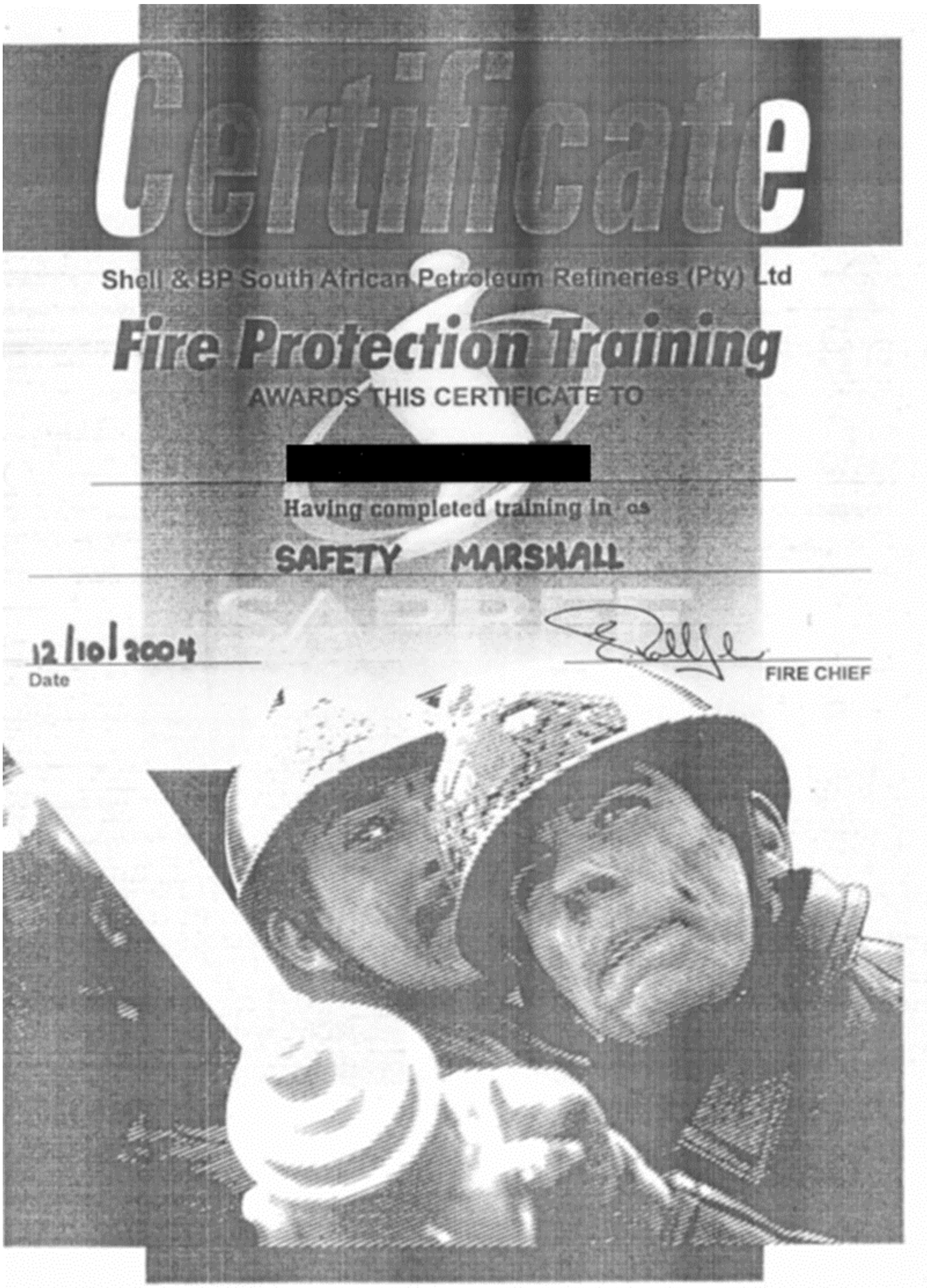
Trainer Registration
925045QL

Company Registration Number CK 2008/100650/23
12 Falcon Place Pinetown 3610

SAQA

ETDP·SETA

APPENDIX N – FIRE PROTECTION TRAINING



Certificate

Shell & BP South African Petroleum Refineries (Pty) Ltd

Fire Protection Training

AWARDS THIS CERTIFICATE TO

[redacted]

Having completed training in as

SAFETY MARSHALL

12/10/2004
Date

FIRE CHIEF

APPENDIX O – OPERATOR APPOINTMENT FORM

Company ______________________ Site ______________________________

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993

APPOINTMENT: LIFTING MACHINE OPERATOR

Construction Regulation 21

(1)(d) A Contractor shall ensure that all construction vehicles and mobile plants are operated by workers who:-

(i) have received appropriate training and been certified competent and been authorised to operate such machinery; and

(ii) are physically and psychologically fit to operate such construction vehicles and mobile plant by being in possession of a medical certificate of fitness.

Appointment

I, ______________________________________, representing the employer, hereby appoint ______________________________________, to operate a lifting machine appropriate to your current certificate of competency at:_____________ _______________ (Site).

Specific Duties

1. To check the lifting machine daily by using the checklist.
2. Ensure all lifting equipment is available and safe to use.
3. To report all faults timeously.
4. Where necessary, to work in conjunction with a trained banksman.

Signature: ________________________ Date: _________________

Designation: ______________________

ACCEPTANCE

I, _______________________________, hereby accept the above appointment.

Signature: ________________________ Date: _________________

3.38 Lifting Machine Operator

APPENDIX P – TOOL BOX TALK FORM

TOOLBOX TALK

NO: 10 **DATE:** 11/03/2013

SUBJECT: Working with plant and machinery

1. When working with large plant, ensure that the operator can always see you.
2. Be responsible for yourself and fellow workers.
3. Ensure you are wearing the PPE provided to you.
4. Do not hang onto or fide on any machines.
5. Please report any machines that are damaged or any operator that is not obeying the sites safety rules.
6. Obey all safety and traffic signage.

Duration: 10min

____

Safety Officer

APPENDIX Q – CONTENT ANALYSIS

		3.1 If yes, please provide details of H&S training courses you did and when	Construction Regulations	OHS ACT	First Aid	Safety & Management Training	Risk Assessment or Management/Root Cause Analysis
Site 1	Site Manager	**Construction Regulations, OSH Act, Risk Assessment**	**1**	**1**			**1**
Site 1	Health & Safety Officer	**SAMTRACK, SHE principles, Risk Assessment, Legal Liability, Construction Regulations, HIV/ AIDS, Scaffolding Inspector, First Aid Training**	**1**				**1**
Site 1	Construction Site Supervisor	**General management courses, Environment, First Aid, Fire, Confined Space Entry, live substances,** excavations, de-excavations**, working with heights, safety to do with pipe jacking**	**1**		**1**	**1**	
Site 1	Assistant Resident Engineer	N/A					
Site 1	Site Administrator	**Tool box talks, PPE, any hazards**, Because of snakes every site is different			**1**		
Site 1	Site Clerk	**EC -cronos system** 2013, **First Aid** 2013, **Financial manager** 2001				1	
Site 2	Operations Manager/director	**Save a life College, General Safety on**				1	1

		site, Risk Assessment, PPE					
Site 2	Health & Safety Officer	**Safety Officer training course, Incident and Accident Investigation, Fire and First Aid, Hazardous Substances**					
Site 2	Health & Safety Officer	**ASHACH, Intro to SAMTRAC, SAMTRAC**					
Site 2	Resident Engineer	**OHSA**					
Site 3	Contracts Manager	**Manager course, H&S responsibility** , **OHSA** and responsibility as contractor, Clients involved in H&S				1	
Site 3	Health & Safety Officer	**Safety Management,** 2008; **Risk Assessment Training,** 2008; **Incident and Accident Investigation,**2009; Advanced Safety Training, **Trained paramedic**				1	1
Site 4	Project Manager	**First Aid and Site Safety** done in 2010				1	
Site 4	Site Manager	**Basic Fire Fighting , First Aid, OHSA** 2 years ago					
Site 4	SHE Officer	**Fire Fighting. First Aid, Safety**					
Site 5	Site Technician	N/A					
Site 5	Contracts Manager	N/A					

Site 5	SHE Officer	**Fire fighting, First Aid, safety**			1		
Site 5	Student Technician	N/A					
Site 6	Foreman (Managed the site)	**Basic H&S Training** 2010, **First Aid** 2010			1		
Site 6	Traffic Safety Officer	**Basic H&S Training** 2012					
Site 6	Senior civil technician (consultant)	N/A					
Site 6	SHE Officer	**Fire fighting, First Aid, Safety**				1	
Site 7	Transport Manager	**SHEQ Quality course 2011**					
Site 7	Technician	N/A					
Site 8	Site Manager	**General Safety Regulations By SHEF International, Root Cause Analysis By IRCA ,HIRA Training Course By IRCA ,Legal Liability – Executive Course By IRCA,IRCON By IRCA**				1	1
Site 8	Senior H&S officer	**SAPREF, SHEMTRAC**					
Site 8	Site Engineer	**HIRA Training** 2011, **Construction Regulations** 2011, **Legal liability** 2013	1				
Site 9	Safety Manager/Consultant	**Safety Health Environment, Occupation Environmental Training Practitioner, Asbestos, Scaffolding, Skills**					

		Development Facilitator					
Site 9	Safety Officer	**Applying SHE practices in the workplace, Introduction to SAMTRAC, First Aid, Fire Fighting, Risk Management, Chemical Training, Evacuation Training**				1	1
Site 9	Safety Officer	**SAMTRAC NOSA, ASHEEP, Intro to SAMTRAC**					
Site 10	Safety Manager/Consultant	**Safety Health Environment, Occupation Environmental Training Practitioner, Asbestos, Scaffolding, Skills Development Facilitator**					
Site 10	H&S Officer	**Level 1 officer COSTA complete (H&S course), Medical Training, 1, 2, 3. Fire, Legal aspects H&S**					
Site 10	SHE Supervisor/Safety Rep/First Aid	**First Aid 2012, Safety Rep** 2011**, Safety Officer 2012, Asbestos Handling 2013, HIV 2011, Scaffolding Erection and inspection** 2012.				1	
Site 11	Safety Manager/Consultant	**Safety Health Environment, Occupation Environmental Training Practitioner, Asbestos, Scaffolding, Skills Development Facilitator**					

Site 11	Manager	N/A					
Site 12	Safety Officer	**SAMTRAC** 2001; **Safety Management** 2001; **First Aid** 2003,**Safety rep** 2005, **Hazard Investigation**,2005			1		
Site 12	Senior Site Supervisor	**General management courses, Environment, First Aid, Fire, Confined Space Entry, live substances, excavations, de-excavations, working with heights, safety to do with pipe jacking**			1	1	
Site 12	Assistant Project Manager	**H&S Research (**Courses in Varsity)					
		TOTAL	4	1	6	11	6
		PERCENTAGE	10	3	15	28	15

		3.1 If yes, please provide details of H&S training courses you did and when	SAMTRAC	ASHACH	ASHEEP	HIRA Training Course	SHE Principles/PPE
Site 1	Site Manager	**Construction Regulations, OSH Act, Risk Assessment**					
Site 1	Health & Safety Officer	**SAMTRACK, SHE principles, Risk Assessment, Legal Liability, Construction Regulations, HIV/ AIDS, Scaffolding Inspector, First Aid Training**	**1**				
Site 1	Construction	**General management**	**1**				**1**

	Site Supervisor	**courses, Environment, First Aid, Fire, Confined Space Entry, live substances,** excavations, de-excavations**, working with heights, safety to do with pipe jacking**					
Site 1	Assistant Resident Engineer	N/A					
Site 1	Site Administrator	**Tool box talks, PPE, any hazards**, Because of snakes every site is different					**1**
Site 1	Site Clerk	**EC -croons system** 2013, **First Aid** 2013, **Financial manager** 2001					
Site 2	Operations Manager/director	**Save a life College, General Safety on site, Risk Assessment, PPE**					
Site 2	Health & Safety Officer	**Safety Officer training course, Incident and Accident Investigation, Fire and First Aid, Hazardous Substances**					
Site 2	Health & Safety Officer	**ASHACH, Intro to SAMTRAC, SAMTRAC**	1	1			
Site 2	Resident Engineer	**OHSA**					

Site 3	Contracts Manager	**Manager course, H&S responsibility** , **OHSA** and responsibility as contractor, Clients involved in H&S					
Site 3	Health & Safety Officer	**Safety Management,** 2008; **Risk Assessment Training,** 2008; **Incident and Accident Investigation,**2009; Advanced Safety Training, **Trained paramedic**					
Site 4	Project Manager	**First Aid and Site Safety** done in 2010					
Site 4	Site Manager	**Basic Fire Fighting , First Aid, OHSA** 2 years ago					
Site 4	SHE Officer	**Fire Fighting. First Aid, Safety**					
Site 5	Site Technician (Consult Engineer)	N/A					
Site 5	Contracts Manager	N/A					
Site 5	SHE Officer	**Fire fighting, First Aid, safety**					
Site 5	Student Technician	N/A					
Site 6	Foreman (Managed the site)	**Basic H&S Training** 2010, **First Aid** 2010					

Site 6	Traffic Safety Officer	**Basic H&S Training** 2012					
Site 6	Senior civil technician (consultant)	N/A					
Site 6	SHE Officer	**Fire fighting, First Aid, Safety**					
Site 7	Transport Manager	**SHEQ Quality course 2011**					
Site 7	Technician	N/A					
Site 8	Site Manager	**General Safety Regulations By SHEF International, Root Cause Analysis By IRCA ,HIRA Training Course By IRCA ,Legal Liability – Executive Course By IRCA,IRCON By IRCA**				1	
Site 8	Senior H&S officer	**SAPREF, SHEMTRAC**					
Site 8	Site Engineer	**HIRA Training** 2011, **Construction Regulations** 2011, **Legal liability** 2013				1	
Site 9	Safety Manager/Consultant	**Safety Health Environment, Occupation Environmental Training Practitioner, Asbestos, Scaffolding, Skills Development Facilitator**					

Site 9	Safety Officer	**Applying SHE practices in the workplace, Introduction to SAMTRAC, First Aid, Fire Fighting, Risk Management, Chemical Training, Evacuation Training**	1				1
Site 9	Safety Officer	**SAMTRAC NOSA, ASHEEP, Intro to SAMTRAC**	1		1		
Site 10	Safety Manager/Consultant	**Safety Health Environment, Occupation Environmental Training Practitioner, Asbestos, Scaffolding, Skills Development Facilitator**					
Site 10	H&S Officer	**Level 1 officer COSTA complete (H&S course), Medical Training, 1, 2, 3. Fire, Legal aspects H&S**					
Site 10	SHE Supervisor/Safety Rep/First Aid	**First Aid 2012, Safety Rep** 2011**, Safety Officer 2012, Asbestos Handling 2013, HIV 2011, Scaffolding Erection and inspection** 2012.					
Site 11	Safety Manager/Consultant	**Safety Health Environment, Occupation Environmental Training Practitioner, Asbestos, Scaffolding, Skills Development Facilitator**					
Site 11	Manager	N/A					

Site 12	Safety Officer	**SAMTRAC** 2001; **Safety Management 2**001; **First Aid** 2003,**Safety rep** 2005, **Hazard Investigation**,2005	1				
Site 12	Senior Site Supervisor	**General management courses, Environment, First Aid, Fire, Confined Space Entry, live substances, excavations, de-excavations, working with heights, safety to do with pipe jacking**					
Site 12	Assistant Project Manager	**H&S Research (**Courses in Varsity)					
		TOTAL	6	1	1	2	3
		PERCENTAGE	15	3	3	5	8

			HIV/AIDS	Fire Fighting	Incident & Accident Investigation	Hazardous Substances / Chemical training
Site 1	Site Manager	**Construction Regulations, OSH Act, Risk Assessment**				
Site 1	Health & Safety Officer	**SAMTRACK, SHE principles, Risk Assessment, Legal Liability, Construction Regulations, HIV/ AIDS, Scaffolding**	**1**			

		Inspector, First Aid Training				
Site 1	Construction Site Supervisor	**General management courses, Environment, First Aid, Fire, Confined Space Entry, live substances,** excavations, de-excavations**, working with heights, safety to do with pipe jacking**				
Site 1	Assistant Resident Engineer	N/A				
Site 1	Site Administrator	**Tool box talks, PPE, any hazards**, Because of snakes every site is different				
Site 1	Site Clerk	**EC -cronos system** 2013, **First Aid** 2013, **Financial manager** 2001				
Site 2	Operations Manager/director	**Save a life College, General Safety on site, Risk Assessment, PPE**				
Site 2	Health & Safety Officer	**Safety Officer training course, Incident and Accident Investigation, Fire and First Aid, Hazardous Substances**	1	1	1	1
Site 2	Health & Safety Officer	**ASHACH, Intro to SAMTRAC, SAMTRAC**				
Site 2	Resident Engineer	**OHSA**				

Site 3	Contracts Manager	**Manager course, H&S responsibility** , **OHSA** and responsibility as contractor, Clients involved in H&S				
Site 3	Health & Safety Officer	**Safety Management,** 2008; **Risk Assessment Training,** 2008; **Incident and Accident Investigation,**2009; Advanced Safety Training, **Trained paramedic**			1	
Site 4	Project Manager	**First Aid and Site Safety** done in 2010				
Site 4	Site Manager	**Basic Fire Fighting , First Aid, OHSA** 2 years ago				
Site 4	SHE Officer	**Fire Fighting. First Aid, Safety**				
Site 5	Site Technician (Consult Engineer)	N/A				
Site 5	Contracts Manager	N/A				
Site 5	SHE Officer	**Fire fighting, First Aid, safety**		x		
Site 5	Student Technician	N/A				
Site 6	Foreman (Managed the site)	**Basic H&S Training** 2010, **First Aid** 2010				
Site 6	Traffic Safety Officer	**Basic H&S Training** 2012				
Site 6	Senior civil technician (consultant)	N/A				
Site 6	SHE Officer	**Fire fighting, First Aid, Safety**		1		

Site 7	Transport Manager	**SHEQ Quality course 2011**				
Site 7	Technician	N/A				
Site 8	Site Manager	**General Safety Regulations By SHEF International, Root Cause Analysis By IRCA ,HIRA Training Course By IRCA ,Legal Liability – Executive Course By IRCA,IRCON By IRCA**				
Site 8	Senior H&S officer	**SAPREF, SHEMTRAC**				
Site 8	Site Engineer	**HIRA Training** 2011, **Construction Regulations** 2011, **Legal liability** 2013				
Site 9	Safety Manager/Consultant	**Safety Health Environment, Occupation Environmental Training Practitioner, Asbestos, Scaffolding, Skills Development Facilitator**				
Site 9	Safety Officer	**Applying SHE practices in the workplace, Introduction to SAMTRAC, First Aid, Fire Fighting, Risk Management, Chemical Training, Evacuation Training**		1		
Site 9	Safety Officer	**SAMTRAC NOSA, ASHEEP, Intro to SAMTRAC**				

Site 10	Safety Manager/Consultant	**Safety Health Environment, Occupation Environmental Training Practitioner, Asbestos, Scaffolding, Skills Development Facilitator**				
Site 10	H&S Officer	**Level 1 officer COSTA complete (H&S course), Medical Training, 1, 2, 3. Fire, Legal aspects H&S**		1		
Site 10	SHE Supervisor/Safety Rep/First Aid	**First Aid 2012, Safety Rep** 2011**, Safety Officer 2012, Asbestos Handling 2013, HIV 2011, Scaffolding Erection and inspection** 2012.	1			
Site 11	Safety Manager/Consultant	**Safety Health Environment, Occupation Environmental Training Practitioner, Asbestos, Scaffolding, Skills Development Facilitator**				
Site 11	Manager	N/A				
Site 12	Safety Officer	**SAMTRAC** 2001; **Safety Management 2**001; **First Aid** 2003,**Safety rep** 2005, **Hazard Investigation**,2005			1	

Site 12	Senior Site Supervisor	**General management courses, Environment, First Aid, Fire, Confined Space Entry, live substances, excavations, de-excavations, working with heights, safety to do with pipe jacking**		1		
Site 12	Assistant Project Manager	**H&S Research (**Courses in Varsity)				
		TOTAL	3	5	3	1
		PERCENTAGE	8	13	8	3

		3.1 If yes, please provide details of H&S training courses you did and when	SHEQ Quality course	OHSA Legal Liability	Safety Health & Environment	Other
Site 1	Site Manager	**Construction Regulations, OSH Act, Risk Assessment**				
Site 1	Health & Safety Officer	**SAMTRACK, SHE principles, Risk Assessment, Legal Liability, Construction Regulations, HIV/ AIDS, Scaffolding Inspector, First Aid Training**		**1**		**1**
Site 1	Construction Site Supervisor	**General management courses, Environment, First Aid, Fire, Confined Space Entry, live substances,** excavations, de-excavations**,**		**1**		**1**

		working with heights, safety to do with pipe jacking				
Site 1	Assistant Resident Engineer	N/A				
Site 1	Site Administrator	**Tool box talks, PPE, any hazards**, Because of snakes every site is different				**1**
Site 1	Site Clerk	**EC -cronos system** 2013, **First Aid** 2013, **Financial manager** 2001				
Site 2	Operations Manager/director	**Save a life College, General Safety on site, Risk Assessment, PPE**			1	
Site 2	Health & Safety Officer	**Safety Officer training course, Incident and Accident Investigation, Fire and First Aid, Hazardous Substances**			1	
Site 2	Health & Safety Officer	**ASHACH, Intro to SAMTRAC, SAMTRAC**		1		
Site 2	Resident Engineer	**OHSA**				
Site 3	Contracts Manager	**Manager course, H&S responsibility** , **OHSA** and responsibility as contractor, Clients involved in H&S		1	1	
Site 3	Health & Safety Officer	**Safety Management,** 2008; **Risk Assessment Training,** 2008;			1	1

		Incident and Accident Investigation,2009; Advanced Safety Training, **Trained paramedic**				
Site 4	Project Manager	**First Aid and Site Safety** done in 2010			1	
Site 4	Site Manager	**Basic Fire Fighting , First Aid, OHSA** 2 years ago				
Site 4	SHE Officer	**Fire Fighting. First Aid, Safety**				
Site 5	Site Technician (Consult Engineer)	N/A				
Site 5	Contracts Manager	N/A				
Site 5	SHE Officer	**Fire fighting, First Aid, safety**			1	
Site 5	Student Technician	N/A				
Site 6	Foreman (Managed the site)	**Basic H&S Training** 2010, **First Aid** 2010			1	
Site 6	Traffic Safety Officer	**Basic H&S Training** 2012			1	
Site 6	Senior civil technician (consultant)	N/A				
Site 6	SHE Officer	**Fire fighting, First Aid, Safety**			1	
Site 7	Transport Manager	**SHEQ Quality course 2011**	1			
Site 7	Technician	N/A				
Site 8	Site Manager	**General Safety Regulations By SHEF**		1		1

		International, Root Cause Analysis By IRCA ,HIRA Training Course By IRCA ,Legal Liability – Executive Course By IRCA,IRCON By IRCA				
Site 8	Senior H&S officer	**SAPREF, SHEMTRAC**				1
Site 8	Site Engineer	**HIRA Training** 2011, **Construction Regulations** 2011, **Legal liability** 2013		1		
Site 9	Safety Manager/Consultant	**Safety Health Environment, Occupation Environmental Training Practitioner, Asbestos, Scaffolding, Skills Development Facilitator**			1	1
Site 9	Safety Officer	**Applying SHE practices in the workplace, Introduction to SAMTRAC, First Aid, Fire Fighting, Risk Management, Chemical Training, Evacuation Training**				1
Site 9	Safety Officer	**SAMTRAC NOSA, ASHEEP, Intro to SAMTRAC**				1
Site 10	Safety Manager/Consultant	**Safety Health Environment, Occupation Environmental Training Practitioner, Asbestos,**			1	1

		Scaffolding, Skills Development Facilitator				
Site 10	H&S Officer	**Level 1 officer COSTA complete (H&S course), Medical Training, 1, 2, 3. Fire, Legal aspects H&S**		1	1	1
Site 10	SHE Supervisor/Safety Rep/First Aid	**First Aid 2012, Safety Rep** 2011**, Safety Officer 2012, asbestos Handling 2013, HIV 2011, Scaffolding Erection and inspection** 2012.			1	1
Site 11	Safety Manager/Consultant	**Safety Health Environment, Occupation Environmental Training Practitioner, Asbestos, Scaffolding, Skills Development Facilitator**			1	1
Site 11	Manager	N/A				
Site 12	Safety Officer	**SAMTRAC** 2001; **Safety Management 2**001; **First Aid** 2003,**Safety rep** 2005, **Hazard Investigation**,2005			1	
Site 12	Senior Site Supervisor	**General management courses, Environment, First Aid, Fire, Confined Space Entry, live substances, excavations, de-excavations,**			1	1

		working with heights, safety to do with pipe jacking				
Site 12	Assistant Project Manager	**H&S Research (**Courses in Varsity)			1	
		TOTAL	1	7	17	14
		PERCENTAGE	3	18	44	36

		4.1 If YES, please provide details of the training in plant and equipment H&S courses you did and when.	Safety Watching and site experience	Fall protection Training Course		Fire- Red Ticket SA Petrol Refinery	SAPREF underpinning a live substation	Electrocution, working with hydraulics	Clearance, Plant Maintenance & Repairs
Site 1	Site Manager	N/A	n/a	n/a		n/a	n/a	n/a	n/a
Site 1	Health & Safety Officer	**Safety Watching, Fall protection Training Course**	1	1					
Site 1	Construction Site Supervisor	**Fire- Red Ticket SA Petrol Refinery, SAPREF underpinning a live substation, Underground fuel pipes, electrocution, working with hydraulics,** 2012				1	1	1	
Site 1	Assistant Resident Engineer	N/A	n/a	n/a		n/a	n/a	n/a	n/a

Site 1	Site Administrator	Any plant on site that related to admin, Costs of the plant and Equipment, Suppliers- dealing with them, supply Local --> P&E -> **Clearance, Plant Repairs**							1
Site 1	Site Clerk	**Basically Maintenance, Basic Procedures** 2008							1
Site 2	Operations Manager	Safety reps are appointed by NOSA rated operations manager. As a contractor you know what operations are conducted. Consultants carry out causes with NOSA, 2 days. **Toolbox talks know documents in place for plant operation.** I need to know if you are **competent operator** in doing your work. Especially when auditors come and check. Safety reps are appointed by operations manager. As a contractor you know what operations are conducted							
Site 2	Health & Safety Officer	**Safety Officer Training Course**, 2009							
Site 2	Health & Safety Officer	**UNISA Health and Safety Management** 2012, 19 modules							
Site 2	Resident Engineer	N/A							
Site 3	Operations Manager	**Environmental Safety Management, OHSA**							

Site 3	Health & Safety Officer	**H&S Training + operations.** The operator must have at least 5 years of experience on a normal dozer. Studied machines, **H&S officer checks the daily previse checklist which is done weekly**							
Site 4	Project Manager	never had to drive machines but knowledgeable and involved in the **H&S management of operators**							
Site 4	Site Manager	Knowledgeable and involved in the **H&S management of operators** Safety officer did training							
Site 4	SHE Officer	Blank (N/A)	n/a	n/a		n/a	n/a	n/a	n/a
Site 5	Site Technician (Consult Engineer)	N/A	n/a	n/a		n/a	n/a	n/a	n/a
Site 5	Contracts Manager	N/A	n/a	n/a		n/a	n/a	n/a	n/a
Site 5	SHE Officer	(N/A)	n/a	n/a		n/a	n/a	n/a	n/a
Site 5	Student Technician	(N/A)	n/a	n/a		n/a	n/a	n/a	n/a
Site 6	Foreman (Managed the site)	Boss started with plant operation and recycling for him. **Can operate any machine on site. If one man is sick, operations do not stop**							

Site 6	Traffic Safety Officer	N/A	n/a	n/a		n/a	n/a	n/a	n/a
Site 6	Senior civil technician (consultant)	N/A	n/a	n/a		n/a	n/a	n/a	n/a
Site 6	SHE Officer	N/A	n/a	n/a		n/a	n/a	n/a	n/a
Site 7	Transport Manager	**Asphalt course and stabilising courses,** production management 2012							
Site 7	Technician	N/A	n/a	n/a		n/a	n/a	n/a	n/a
Site 8	Site Manager	**Street Works By City and Guilds of London 7/05/2007, GIMT by GIMT1/09/ 2006, Construction Skills by CSCS London 06/09/2007, Civil Engineering Degree**							
Site 8	H&S officer	N/A	n/a	n/a		n/a	n/a	n/a	n/a
Site 8	Site Engineer	N/A	n/a	n/a		n/a	n/a	n/a	n/a
Site 9	Safety Manager/Consultant	**RA- Risk Management**							
Site 9	Safety Officer	Site Training which includes **plant and equipment, check list certificate**							
Site 9	Safety Officer	Worked on site	1						
Site 10	Safety Manag	**RA- Risk Management**							

	er/Consultant								
Site 10	H&S Officer	Trained to **manage , Insect machine, certifications**							
Site 10	Site Supervisor/Safety Rep/First Aid	Blank (N/A)	n/a	n/a		n/a	n/a	n/a	n/a
Site 11	Safety Manager/Consultant	**RA- Risk Management**							
Site 11	Manager	N/A	n/a	n/a		n/a	n/a	n/a	n/a
Site 12	Safety Officer	**Drill and power tools, 2013; DEWALT, Power toll safety awareness and vibration** , H&S awareness, vibration H&S	1						
Site 12	Construction Site Supervisor	**Fire- Red Ticket SA Petrol Refinery, SAPREF underpinning a live substation, Underground fuel pipes, electrocution, working with hydraulics,** 2012				1	1	1	
Site 12	Assistant Project Manager	**Practices** not specific to plant and equipment	1						
		TOTAL	4	1		2	2	2	2
		PERCENTAGE	10	3		5	5	5	5

		4.1 If YES, please provide details of the training in plant and equipment H&S courses you did and when.	Toolbox talks	Safety Officer Training Course	Environmental Safety Management	Plant and equipment operation
Site 1	Site Manager	N/A		n/a	n/a	n/a
Site 1	Health & Safety Officer	**Safety Watching, Fall protection Training Course**				
Site 1	Construction Site Supervisor	**Fire- Red Ticket SA Petrol Refinery, SAPREF underpinning a live substation, Underground fuel pipes, electrocution, working with hydraulics,** 2012				
Site 1	Assistant Resident Engineer	N/A	n/a	n/a	n/a	n/a
Site 1	Site Administrator	Any plant on site that related to admin, Costs of the plant and Equipment, Suppliers-dealing with them, supply Local --> P&E ->**Clearance, Plant Repairs**				
Site 1	Site Clerk	**Basically Maintenance, Basic Procedures** 2008				

Site 2	Operations Manager	Safety reps are appointed by NOSA rated operations manager. As a contractor you know what operations are conducted. Consultants carry out causes with NOSA, 2 days. **Toolbox talks know documents in place for plant operation.** I need to know if you is **competent operator** in doing your work. Especially when auditors come and check. Safety reps are appointed by operations manager. As a contractor you know what operations are conducted	1			
Site 2	Health & Safety Officer	**Safety Officer Training Course**, 2009		1		
Site 2	Health & Safety Officer	**UNISA Health and Safety Management** 2012, 19 modules		1		
Site 2	Resident Engineer	N/A				
Site 3	Operations Manager	**Environmental Safety Management, OHSA**			1	

Site 3	Health & Safety Officer	**H&S Training + operations.** The operator must have at least 5 years of experience on a normal dozer. Studied machines, **H&S officer checks the daily previse checklist which is done weekly**		1		
Site 4	Project Manager	never had to drive machines but knowledgeable and involved in the **H&S management of operators**		1		
Site 4	Site Manager	Knowledgeable and involved in the **H&S management of operators** Safety officer did training		1		
Site 4	SHE Officer	Blank (N/A)	n/a	n/a	n/a	n/a
Site 5	Site Technician (Consult Engineer)	N/A	n/a	n/a	n/a	n/a
Site 5	Contracts Manager	N/A	n/a	n/a	n/a	n/a
Site 5	SHE Officer	(N/A)	n/a	n/a	n/a	n/a
Site 5	Student Technician	(N/A)	n/a	n/a	n/a	n/a
Site 6	Foreman (Managed the site)	Boss started with plant operation and recycling for him. **Can operate any machine on site. If one man is**				1

		sick, operations do not stop				
Site 6	Traffic Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 6	Senior civil technician (consultant)	N/A	n/a	n/a	n/a	n/a
Site 6	SHE Officer	N/A	n/a	n/a	n/a	n/a
Site 7	Transport Manager	**Asphalt course and stabalizing courses,** production management 2012				1
Site 7	Technician	N/A	n/a	n/a	n/a	n/a
Site 8	Site Manager	**Street Works By City and Guilds of London 7/05/2007, GIMT by GIMT1/09/ 2006, Construction Skills by CSCS London 06/09/2007, Civil Engineering Degree**				
Site 8	H&S officer	N/A	n/a	n/a	n/a	n/a
Site 8	Site Engineer	N/A	n/a	n/a	n/a	n/a
Site 9	Safety Manager/Consultant	**RA- Risk Management**				
Site 9	Safety Officer	Site Training which includes **plant and equipment,**		1		1

		check list certificate				
Site 9	Safety Officer	Worked on site				
Site 10	Safety Manager/Consultant	**RA- Risk Management**				
Site 10	H&S Officer	Trained to **manage , Insect machine, certifications**		1		
Site 10	Site Supervisor/Safety Rep/First Aid	Blank (N/A)	n/a	n/a	n/a	n/a
Site 11	Safety Manager/Consultant	**RA- Risk Management**				
Site 11	Manager	N/A	n/a	n/a	n/a	n/a
Site 12	Safety Officer	**Drill and power tools, 2013; DEWALT, Power toll safety awareness and vibration** , H&S awareness, vibration H&S				1
Site 12	Construction Site Supervisor	**Fire- Red Ticket SA Petrol Refinery, SAPREF underpinning a live substation, Underground fuel pipes, electrocution, working with hydraulics,** 2012				
Site 12	Assistant Project Manager	**Practices** not specific to plant and equipment				
		TOTAL	1	7	1	4

		PERCENTAGE	3	18	3	10

		4.1 If YES, please provide details of the training in plant and equipment H&S courses you did and when.	Street Works By City and Guilds of London	Construction Skills by CSCS London	RA- Risk Management
Site 1	Site Manager	N/A	n/a	n/a	n/a
Site 1	Health & Safety Officer	**Safety Watching, Fall protection Training Course**			
Site 1	Construction Site Supervisor	**Fire- Red Ticket SA Petrol Refinery, SAPREF underpinning a live substation, Underground fuel pipes, electrocution, working with hydraulics,** 2012			
Site 1	Assistant Resident Engineer	N/A	n/a	n/a	n/a
Site 1	Site Administrator	Any plant on site that related to admin, Costs of the plant and Equipment, Suppliers- dealing with them, supply Local --> P&E ->**Clearance, Plant Repairs**			
Site 1	Site Clerk	**Basically Maintenance, Basic Procedures** 2008			
Site 2	Operations Manager	Safety reps are appointed by NOSA rated operations manager. As a contractor you know what operations are conducted. Consultants carry out causes with NOSA, 2 days. **Toolbox talks know documents in place for plant operation.** I need to know if you is **competent operator** in doing your work. Especially when auditors come and check. Safety reps are appointed by			

		operations manager. As a contractor you know what operations are conducted			
Site 2	Health & Safety Officer	**Safety Officer Training Course**, 2009			
Site 2	Health & Safety Officer	**UNISA Health and Safety Management** 2012, 19 modules			
Site 2	Resident Engineer	N/A			
Site 3	Operations Manager	**Environmental Safety Management, OHSA**			
Site 3	Health & Safety Officer	**H&S Training + operations.** The operator must have at least 5 years of experience on a normal dozer. Studied machines, **H&S officer checks the daily previse checklist which is done weekly**			
Site 4	Project Manager	never had to drive machines but knowledgeable and involved in the **H&S management of operators**			
Site 4	Site Manager	Knowledgeable and involved in the **H&S management of operators** Safety officer did training			
Site 4	SHE Officer	Blank (N/A)	n/a	n/a	n/a
Site 5	Site Technician (Consult Engineer)	N/A	n/a	n/a	n/a
Site 5	Contracts Manager	N/A	n/a	n/a	n/a
Site 5	SHE Officer	(N/A)	n/a	n/a	n/a
Site 5	Student Technician	(N/A)	n/a	n/a	n/a

Site 6	Foreman (Managed the site)	Boss started with plant operation and recycling for him. **Can operate any machine on site. If one man is sick, operations do not stop**			
Site 6	Traffic Safety Officer	N/A	n/a	n/a	n/a
Site 6	Senior civil technician (consultant)	N/A	n/a	n/a	n/a
Site 6	SHE Officer	N/A	n/a	n/a	n/a
Site 7	Transport Manager	**Asphalt course and stabalizing courses,** production management 2012			
Site 7	Technician	N/A	n/a	n/a	n/a
Site 8	Site Manager	**Street Works By City and Guilds of London 7/05/2007, GIMT by GIMT1/09/ 2006, Construction Skills by CSCS London 06/09/2007, Civil Engineering Degree**	1	1	
Site 8	H&S officer	N/A	n/a	n/a	n/a
Site 8	Site Engineer	N/A	n/a	n/a	n/a
Site 9	Safety Manager/Consultant	**RA- Risk Management**			1
Site 9	Safety Officer	Site Training which includes **plant and equipment, check list certificate**			
Site 9	Safety Officer	Worked on site			
Site 10	Safety Manager/Consultant	**RA- Risk Management**			1
Site 10	H&S Officer	Trained to **manage , Insect machine, certifications**			

Site 10	Site Supervisor/Safety Rep/First Aid	Blank (N/A)	n/a	n/a	n/a
Site 11	Safety Manager/Consultant	**RA- Risk Management**			
Site 11	Manager	N/A	n/a	n/a	n/a
Site 12	Safety Officer	**Drill and power tools, 2013; DEWALT, Power toll safety awareness and vibration** , H&S awareness, vibration H&S			
Site 12	Construction Site Supervisor	**Fire- Red Ticket SA Petrol Refinery, SAPREF underpinning a live substation, Underground fuel pipes, electrocution, working with hydraulics,** 2012			
Site 12	Assistant Project Manager	**Practices** not specific to plant and equipment			
		TOTAL	1	1	2
		PERCENTAGE	3	3	5

		<u>7.1 If not, why not?</u>	Contractor responsible
Site 1	Site Manager	N/A	
Site 1	Health & Safety Officer	N/A	
Site 1	Construction site supervisor	N/A	
Site 1	Assistant Resident Engineer	N/A	
Site 1	Site Administrator	N/A	

Site 1	Site Clerk	N/A	
Site 2	Operations Manager	N/A	
Site 2	Health & Safety Officer	N/A	
Site 2	Health & Safety Officer	N/A	
Site 3	Operations Manager	N/A	
Site 3	Health & Safety Officer	N/A	
Site 3	Consultant Engineer	N/A	
Site 4	Project Manager	N/A	
Site 4	Site Manager	N/A	
Site 4	SHE Officer	N/A	
Site 5	Site Technician (Consult Engineer)	**Contractor us responsible for H&S**, Our H&S Officer is there to oversee that everything is up to date	1
Site 5	Contracts Manager	N/A	
Site 5	SHE Officer	N/A	
Site 5	Student Technician	**Not that I can recall**, not always on site. 60 - 70% on site	
Site 6	Foreman (Managed the site)	N/A	
Site 6	Traffic Safety Officer	N/A	
Site 6	Senior civil technician (consultant)	N/A	
Site 6	SHE Officer	N/A	
Site 7	Transport Manager	N/A	
Site 7	Technician	N/A	
Site 8	Site Manager	N/A	
Site 8	H&S officer	N/A	

Site 8	Site Engineer	N/A	
Site 9	Safety Manager/Consultant	N/A	
Site 9	Safety Officer	N/A	
Site 9	Safety Officer	N/A	
Site 10	Safety Manager/Consultant	N/A	
Site 10	H&S Officer	N/A	
Site 10	Site Supervisor	N/A	
Site 11	Safety Manager/Consultant	N/A	
Site 11	Manager	N/A	
Site 12	Safety Officer	N/A	
Site 12	Senior Site Supervisor	N/A	
Site 12	Assistant Project Manager	N/A	
		TOTAL	1
		PERCENTAGE	**100**

		8. What method/s do you use to identify hazards associated with plant and equipment?	Tool Box talks	Risk Assessment	machine inspection	Hazardous substances (lime, diesel, stabelizers)	competent operator	other
Site 1	Site Manager	**Daily Toolbox Talks, Risk Assessment** prior to starting the operation	1	1	1			
Site 1	Health & Safety Officer	Speeding, Machine Overload, Operating machine not in a good condition			1			

Site 1	Construction site supervisor	**Daily Risk Assessment , Tool box talks**	1	1				
Site 1	Assistant Resident Engineer	Contractors Issues ->before they use them they make sure they are in the right state			1			1
Site 1	Site Administrator	**H&S will bring into attention to our attention**. Notified to supplier. We ensure that suppliers. Onsite = Agent. Plant coming from groups						1
Site 1	Site Clerk	I **don't go on onsite,** work is mainly at the office.						
Site 2	Operations Manager	Hazardous substances, lime, stabelizers, diesel, petrol (for generator) awareness. **Risk is known and prevented**		1		1		
Site 2	Health & Safety Officer	**It depends on the task to be done.** Ensure that **competent operator** is operating machine					1	
Site 2	Health & Safety Officer	Risk Assessment is conducted		1				
Site 2	Resident Engineer	Risk Assessment, Method statements, External/internal		1	1			

		audits, Checklists						
Site 3	Operations Manager	We identify the nature of **work, area (check machine)**			1			
Site 3	Health & Safety Officer	**Risk activities** and plant. Junior /mechanic service all the vehicles if under warranty. (They also service other companies)		1				
Site 4	Project Manager	A plant must meet some **requirements before it gets to site.** Eg. Good tyres, no leakages, reverse bell functional, rotating light functional. If one of the plants do not have one of the mentioned items, it must be fi1ed			1			
Site 4	Site Manager	Machinery working, recycler working. There should be no non-authorised persons working			1			
Site 4	SHE Officer	Plant Check List, Daily Site Diary			1			
Site 5	Site Technician (Consult Engineer)	N/A						

Site 5	Contracts Manager	N/A						
Site 5	SHE Officer	**Plant Check List, Daily Site Diary**			1			
Site 5	Student Technician	**Never really done anything of that nature.** But when there is a rain gauge we can check if we are able to do construction. If layers are too wet, depreciation on plant and equipment						
Site 6	Foreman (Managed the site)	**Check Machines** every morning, engine water			1			
Site 6	Traffic Safety Officer	**Check leaks, on machine, spillages, noise** (loudy noise). Onsite mechanic who checks things on site			1			
Site 6	Senior civil technician	There is safety file which includes all the check list that needs to be done						1
Site 6	SHE Officer	Plant Check List, Daily Site Diary			1			
Site 7	Transport Manager	Trial and error, basic H&S **risks assessments**		1				
Site 7	Technician	Tool box talks						
Site 8	Site Manager	All plant on site has a check sheet and is inspected or **checks visually** every morning before			1			

		work. Weekly inspections are done by the Safety officer and the management team on site						
Site 8	H&S officer	**Risk Assessments**		1				
Site 8	SITE Engineer	**Plant Checklist/** Check sheets. **Risk Assessments**		1	1			
Site 9	Safety Manager/Consultant	Risk Methology Calculations (**Risk Assessment**)		1				
Site 9	Safety Officer	If machine is, working properly, lights hooters. Competency of operator, Under the influence of alcohol, Risk losing control. Safety on site must happen involve PM			1		1	1
Site 9	Safety Officer	Perform our **check list** on every machine, mostly daily and weekly to see if in good order			1			
Site 10	Safety Manager/Consultant	Risk Methology Calculations, **Risk Assessments,** Prior Incidents		1				
Site 10	H&S Officer	Operators Risk, Pedestrians Risk more than operator risk. Walking around,						1

		machinery high) Demarked areas						
Site 10	Site Supervisor	Daily **Check List** - oil, tires, gauges, gas, pressure, operator is competent			1			
Site 11	Safety Manager/Consultant	Risk Methology Calculations (**Risk Assessments**)		1				
Site 11	Manager	Can get electrocuted or burnt from pumps. Can get knocked out by Kalmar's						
Site 12	Safety Officer	Inspections on vehicles + recorded, Spot **checks** on vehicles daily						
Site 12	Senior Site Supervisor	There is safety file which includes all the **check list** that needs to be done		1				
Site 12	Assistant Project Manager	Not aware of any. H&S audits - submitted to contractors site officers - H&S						1
		TOTAL	2	13	17	1	2	6
		PERCENTAGE	5	33	44	3	5	15

		9. What hazards are associated with plant and equipment on your site?	Chemical/Diesel Spillage	Dust	Falling material	Mechanical failure	Cement

Site 1	Site Manager	**Diesel spillage**, **Dust, Accidents** with other plant or personnel	1	1			
Site 1	Health & Safety Officer	Big boulders (rocks), Soft material (**Falling material**)			1		
Site 1	Construction site supervisor	**Falling material** such as rocks, materials, working at heights, hazards associated with plant and equipment			1	1	
Site 1	Assistant Resident Engineer	Falling rocks, Terrain where the Plant are working **(Falling material)**			1		
Site 1	Site Administrator	People, Locals not aware of P&E, school nearby					
Site 1	Site Clerk	Falling of rocks **(Falling material)**			1		
Site 2	Operations Manager	**Petrol, diesel, cement, bitumen, mechanical** if transmission pipes damaged. Smoking near bitumen	1				1
Site 2	Health & Safety Officer	Trench can collapse if an excavator is swinging. **Petrol, diesel, cement, mechanical, pipes damaged, drip trays and smoking near fuel**	1			1	1
Site 2	Health & Safety Officer	**Diesel spillages and fume**s when they rave- risky for the environment. Truck can **hit** anyone and cause injury	1				

Site 2	Resident Engineer	Brakes, Overloading, Operation (Human Error), Traffic Accommodation, Hydraulics. **(Machine Failure)**				1	
Site 3	Operations Manager	The machine itself is damaging existing services e.g. Telkom or water. Risk to people terms of working close to machine and also to properties and surrounding area					
Site 3	Health & Safety Officer	Steep slopes, condition of vehicles. Can be a hazard that’s why. Employees walking in close proximity to the plant. Qualified Operator, medically fit certificate. Appointed in writing, contracts manager will appoint				1	
Site 4	Project Manager	Run over by Machine, Car accident with machine, **machine capsizing**, machine burning, machine runaway because it is out breaks, Labour getting burnt				1	
Site 4	Site Manager	Machinery working, never working no unauthorised person working				1	
Site 4	SHE Officer	Spillage of chemical, Theft of diesel, Fire Prevention, **Mechanical Failure**	1			1	
Site 5	Site Technician	N/A	nil	nil	nil	nil	nil
Site 5	Contracts Manager	Chemical**, Mechanical Failure** Breakdowns, **Fire, Vehicular Accidents, Mishandling**	1			1	
Site 5	SHE Officer	**Spillage of Chemical,** Theft of Diesel, Fire Prevention, **Mechanical Failure**	1			1	
Site 5	Student Technician	**Traffic** not obeying their road procedures. They always hold to go in construction lane - danger to anyone/people on site. Seen accidents happens simply because of not obeying					

Site 6	Foreman (Managed the site)	Sometimes **the drives don’t obey traffic signs,** risk people being knocked drives don’t obey traffic signs. Major accident can happen involve plant. We speak to operators often					
Site 6	Traffic Safety Officer	People going above speed limit. **Traffic (motorist) is not behaving. The drivers don't obey traffic signs.** Because working at sugar fields which are burning. Smoke - visibility is not good, plant do not operate. However traffic continues, nothing happens despite that sign boards are out. So if anything happens, not liable (advanced warning sign boards covers contractors)					
Site 6	Senior civil technician (consultant)	Fire extinguisher **signs**, speed limit signs					
Site 6	SHE Officer	Spillage of Chemical, Theft of diesel, Fire prevention, **Mechanical Failure**	1			1	
Site 7	Transport Manager	Overload, Super-elevation of road (**larger trucks cannot offload on bends)** Therefore we use hard rubber basis.					
Site 7	Technician	**Plant can reverse when person not aware. E.g. paver sounds**					
Site 8	Site Manager	**mechanical failure** - **Oil and hydraulic spills – drip trays in place, Noise from the breaker** – Ear plugs/defenders, Run over employees/Crushing – Flagmen in place, Vehicle or plant accident – flagmen & qualified operators, Property damage – flagmen and qualified operators	1			1	
Site 8	H&S officer	**Mobile Plant - Collision, mechanical failure, Reverse onto People, Equipment Injury**					
Site 8	Site Engineer	Uncertified operators/drives, Oil leaks, Hydraulic/**Mechanical Failure** during operation				1	

Site 9	Safety Manager/Consultant	**Falling, Accidents of People/Plant/Property.**, **Mechanical Failure , Uncertified worker/operator**					
Site 9	Safety Officer	Leaking of floors on site- ass plant and equipment, Smoke in the air, **Risk assessment** - risks are Identified. Check list of equipment				1	
Site 9	Safety Officer	Fork Lift **do not have safety belts** (non), Morning and afternoon - cannot see light, Leakages, tire damaged **(Mechanical Failure)**				1	
Site 10	Safety Manager/Consultant	Unqualified Staff, Traffic Movement, Machinery Break-down **(Mechanical Failure)**				1	
Site 10	H&S Officer	**Risk Assessment** and analysis. Environment Risk Assessment, what do they do analyse					
Site 10	Site Supervisor	**Workers getting hurt by plant, Damage** to **Property**					
Site 11	Safety Manager/Consultant	Loose *camlocks* that are attached to the pumps and also loose bolts and nuts **(Mechanical Failure)**				1	
Site 11	Manager	Movement of Machinery, **Traffic,** Visitors and Public getting hurt				1	
Site 12	Safety Officer	Employers walking around. Operator many not see the when working. **Incompetent operator** to operator must be trained and medically fit					
Site 12	Senior Site Supervisor	Working from that telliboom, use double lane yard hook line, clean the surface to be short cleated and **lose rock falling** push the material and then pull.			1		

Site 12	Assistant Project Manager	**Open Man holes. Existing Services - open - dangerous**			1		
		TOTAL	9	1	6	17	2
		PERCENTAGE	**23**	**3**	**15**	**44**	**5**

		10.1 If yes, please give details of the incident/s:	Accident Involving Truck / Tipper	Mobile Crane	Excavator	Grader
Site 1	Site Manager	Rocks fell from higher up the Rock face onto **Excavator**			1	
Site 1	Health & Safety Officer	**Excavator** was working on a high cut, while it was grabbing material; the rock hit/ do fell and knocked the door and side mirror. The operator was unharmed but had scratch, First Aid Treatment was conducted. **ADT Truck** fell down rock fell because the bin was jammed. The load was too heavy, the operator was unharmed. **12 Tonne Truck** offloading anchors, picked up load using a **crane truck,** used the wrong gear lever and out **riggers collapsed**. The **truck was damaged** (mirror on right side), the operator was fine.	1	1	1	
Site 1	Construction site supervisor	Minor injuries, one worker had a figure that was cut badly but not broken. First Aid Kid was sufficient	n/a	n/a	n/a	n/a

Site 1	Assistant Resident Engineer	Not major - **there was a rock that fell on the truck. Excavator** slipped from the top of the mount. It was hanging from something. What happens is that it uses the bucket to prevent it from falling, it doesn't usually happen.			1	
Site 1	Site Administrator	N/A	n/a	n/a	n/a	n/a
Site 1	Site Clerk	Heard of one - rock fell and hit the wind screen of an **excavator**. Didn't hurt the operator. The windscreen was smash and gab			1	
Site 2	Operations Manager	Minor accidents all in the H&S file.	n/a	n/a	n/a	n/a
Site 2	Health & Safety Officer	N/A				
Site 2	Health & Safety Officer	**Grader**: Reverse on the private car. No one injured only the car was damaged				1
Site 2	Resident Engineer	N/A	n/a	n/a	n/a	n/a
Site 3	Operations Manager	Incident - **Public vehicle entering the site even though there was signage.** Damaged (slightly by one of the construction vehicles. Which one, **Excavation**. People are ignorant. They happen in every site. All we can do is keep informing the **community and keep on communicating with the public/Consumer**. **Ignorance and stupidity, just ignorance.**			1	
Site 3	Health & Safety Officer	N/A She is very strict and firm because there must	n/a	n/a	n/a	n/a

		be no shortfalls with regard to H&S				
Site 4	Project Manager	N/A	n/a	n/a	n/a	n/a
Site 4	Site Manager	N/A	n/a	n/a	n/a	n/a
Site 4	SHE Officer	N/A	n/a	n/a	n/a	n/a
Site 5	Site Technician	N/A	n/a	n/a	n/a	n/a
Site 5	Contracts Manager	N/A	n/a	n/a	n/a	n/a
Site 5	SHE Officer	N/A	n/a	n/a	n/a	n/a
Site 5	Student Technician	People know what happens and what to do. The safety officer makes sure people on site are informed.	n/a	n/a	n/a	n/a
Site 6	Foreman (Managed the site)	The more experienced the operator the better with the safety	n/a	n/a	n/a	n/a
Site 6	Traffic Safety Officer	N/A **Near miss.** People not stopping at the stop/go, they say they didn't see the board				
Site 6	Site Technician	N/A	n/a	n/a	n/a	n/a
Site 6	SHE Officer	N/A	n/a	n/a	n/a	n/a
Site 7	Transport Manager	N/A	n/a	n/a	n/a	n/a
Site 7	Technician	N/A	n/a	n/a	n/a	n/a
Site 8	Site Manager	N/A	n/a	n/a	n/a	n/a
Site 8	H&S officer	N/A	n/a	n/a	n/a	n/a
Site 8	Site Engineer	N/A	n/a	n/a	n/a	n/a
Site 9	Safety Man/Consultants	N/A	n/a	n/a	n/a	n/a
Site 9	Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 9	Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 10	Safety Manager/Consultant	Property damage. **Machine** gets too close to property, wall damage				
Site 10	H&S Officer	N/A	n/a	n/a	n/a	n/a

Site 10	Site Supervisor	The guy **operating the waker (compactor) put his knee against it.** It cut him open. **Rushed to the hospital, incident report.** Report to the department of labour. Forms fill IOD forms. Two weeks off work with compensation.				
Site 11	Safety Manager/Consultant	**Container damaged** - bashing one container and another collided				
Site 11	Manager	Some staff did get burned on their limbs from **hot bitumen** which is transferred through the pumps				
Site 12	Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 12	Senior Site Supervisor	N/A	n/a	n/a	n/a	n/a
Site 12	Assistant Project Manager	N/A	n/a	n/a	n/a	n/a
		TOTAL	1	1	5	1
		PERCENTAGE	3	3	13	3

		10.1 If yes, please give details of the incident/s:	Compressor	Private Vehicle	Property Damage	Mobile Pump
Site 1	Site Manager	Rocks fell from higher up the Rock face onto **Excavator**				

Site 1	Health & Safety Officer	**Excavator** was working on a high cut, while it was grabbing material; the rock hit/ do fell and knocked the door and side mirror. The operator was unharmed but had scratch, First Aid Treatment was conducted. **ADT Truck** fell down rock fell because the bin was jammed. The load was too heavy, the operator was unharmed. **12 Tonne Truck** offloading anchors, picked up load using a **crane truck,** used the wrong gear lever and out **riggers collapsed**. The **truck was damaged** (mirror on right side), the operator was fine.				
Site 1	Construction site supervisor	Minor injuries, one worker had a figure that was cut badly but not broken. First Aid Kid was sufficient	n/a	n/a	n/a	n/a
Site 1	Assistant Resident Engineer	Not major - **there was a rock that fell on the truck. Excavator** slipped from the top of the mount. It was hanging from something. What happens is that it uses the bucket to prevent it from falling, it doesn't usually happen.				
Site 1	Site Administrator	N/A	n/a	n/a	n/a	n/a
Site 1	Site Clerk	Heard of one - rock fell and hit the wind screen of an **excavator**. Didn't hurt the operator. The windscreen was smash and gab				
Site 2	Operations Manager	Minor accidents all in the H&S file.	n/a	n/a	n/a	n/a
Site 2	Health & Safety Officer	N/A				
Site 2	Health & Safety Officer	**Grader**: Reverse on the private car. No one injured only the car was damaged				
Site 2	Resident Engineer	N/A	n/a	n/a	n/a	n/a

Site 3	Operations Manager	Incident - **Public vehicle entering the site even though there was signage.** Damaged (slightly by one of the construction vehicles. Which one, **Excavation**. People are ignorant. They happen in every site. All we can do is keep informing the **community and keep on communicating with the public/Consumer**. **Ignorance and stupidity, just ignorance.**		1		
Site 3	Health & Safety Officer	N/A She is very strict and firm because there must be no shortfalls with regard to H&S	n/a	n/a	n/a	n/a
Site 4	Project Manager	N/A	n/a	n/a	n/a	n/a
Site 4	Site Manager	N/A	n/a	n/a	n/a	n/a
Site 4	SHE Officer	N/A	n/a	n/a	n/a	n/a
Site 5	Site Technician (Consult Engineer)	N/A	n/a	n/a	n/a	n/a
Site 5	Contracts Manager	N/A	n/a	n/a	n/a	n/a
Site 5	SHE Officer	N/A	n/a	n/a	n/a	n/a
Site 5	Student Technician	People know what happens and what to do. The safety officer makes sure people on site are informed.	n/a	n/a	n/a	n/a
Site 6	Foreman (Managed the site)	The more experienced the operator the better with the safety	n/a	n/a	n/a	n/a
Site 6	Traffic Safety Officer	N/A **Near miss.** People not stopping at the stop/go, they say they didn't see the board		1		
Site 6	Site Technician (Consult Engineer)	N/A	n/a	n/a	n/a	n/a
Site 6	SHE Officer	N/A	n/a	n/a	n/a	n/a
Site 7	Transport Manager	N/A	n/a	n/a	n/a	n/a
Site 7	Technician	N/A	n/a	n/a	n/a	n/a

Site 8	Site Manager	N/A	n/a	n/a	n/a	n/a
Site 8	H&S officer	N/A	n/a	n/a	n/a	n/a
Site 8	Site Engineer	N/A	n/a	n/a	n/a	n/a
Site 9	Safety Man/Consultants	N/A	n/a	n/a	n/a	n/a
Site 9	Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 9	Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 10	Safety Manager/Consultant	Property damage. **Machine** gets too close to property, wall damage			1	
Site 10	H&S Officer	N/A	n/a	n/a	n/a	n/a
Site 10	Site Supervisor	The guy **operating the walker (compactor) put his knee against it.** It cut him open. **Rushed to the hospital, incident report.** Report to the department of labour. Forms fill IOD forms. Two weeks off work with compensation.	1			
Site 11	Safety Manager/Consultant	**Container damaged** - bashing one container and another collided			1	
Site 11	Manager	Some staff did get burned on their limbs from **hot bitumen** which is transferred through the pumps				1
Site 12	Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 12	Senior Site Supervisor	N/A	n/a	n/a	n/a	n/a
Site 12	Assistant Project Manager	N/A	n/a	n/a	n/a	n/a
		TOTAL	1	2	2	1
		PERCENTAGE	3	5	5	3

		11.1 If basic H&S construction regulations relative to proper use of plant and equipment are not followed on site, why not?	Not diligently
Site 1	Site Manager	N/A	n/a
Site 1	Health & Safety Officer	N/A	n/a
Site 1	Construction site supervisor	N/A	n/a
Site 1	Assistant Resident Engineer	N/A	n/a
Site 1	Site Administrator	YES Our Safety Officer got audited externally + internally. Master builders group - SHEQ Manager who sheds 3 monthly in between.	n/a
Site 1	Site Clerk	N/A	n/a
Site 2	Operations Manager	N/A	n/a
Site 2	Health & Safety Officer	N/A	n/a
Site 2	Health & Safety Officer	N/A	n/a
Site 2	Resident Engineer	N/A	n/a
Site 3	Operations Manager	**Not diligently**	1
Site 3	Health & Safety Officer	N/A	n/a
Site 4	Project Manager	N/A	n/a
Site 4	Site Manager	N/A	n/a
Site 5	Site Technician (Consult Engineer)	N/A	n/a
Site 5	Contracts Manager	N/A	n/a
Site 6	Foreman (Managed the site)	N/A	n/a
Site 6	Traffic Safety Officer	N/A	n/a
Site 6	Site Technician (Consult Engineer)	N/A	n/a

Site 7	Transport Manager	N/A	n/a
Site 7	Rama (Consult Engineer)	N/A	n/a
Site 8	Site Manager	N/A	n/a
Site 8	H&S officer	N/A	n/a
Site 8	Site Engineer	N/A	n/a
Site 9	Safety Man/Consultants	N/A	n/a
Site 9	Safety Officer	N/A	n/a
Site 9	Safety Officer	N/A	n/a
Site 10	Safety Manager/Consultant	N/A	n/a
Site 10	H&S Officer	N/A	n/a
Site 10	Site Supervisor	N/A	n/a
Site 11	Safety Manager/Consultant	N/A	n/a
Site 11	Manager	N/A	n/a
Site 11	Safety Officer	N/A	n/a
Site 12	Safety Officer	N/A	n/a
Site 12	Senior Site Supervisor	N/A	n/a
Site 12	Assistant Project Manager	N/A	n/a
		TOTAL	1
		PERCENTAGE	3

		11.2 What are the most frequent violations of these regulations that you have encountered on this project?	Not following DSTI, Tool Box, Daily Safety Instructions	Not wearing PPE/ Poor quality of PPE	Poor equipment/ plant, Forged certificates	Unawareness of H&S on site	Not following signage
Site 1	Site Manager	N/A					

Site 1	Health & Safety Officer	Sometimes people take chances because they want to take shortcuts, instead of following instructions. DSTI - **Tool box talks and Daily Safety task instructions** as well as PEE are important	1				
Site 1	Construction site supervisor	**Not wearing PPE**, for e.g. Keep checking the guys to ensure that they are wearing dust masks		1			
Site 1	Assistant Resident Engineer	N/A	n/a	n/a	n/a	n/a	n/a
Site 1	Site Administrator	On the safety side, nothing. If plant is not working, charge/cost attached because of strike increase 10% =, R22 per hour			1		
Site 1	Site Clerk	Not wearing hard hats/full PPE. Because of **quality of PPE** gets torn easily. Labours get twice a year. If you tear the second one you have to buy but most don't. Someone wears takkies, not allowed but it happens		1			
Site 2	Operations Manager/ director	When guys go on **lunch they do not have vests on**. Safety Leader to ensures that team has e.g. gloves, hardhats and proper PPE for particular operator		1			
Site 2	Health & Safety Officer	Safety officer ensure that all employees has proper PPE		1			
Site 2	Health & Safety Officer	No one does not follow rules. **I conduct inductions.** We are from				1	

		the same mother. You are all our eyes					
Site 2	Resident Engineer	**Failure to adhere to speed restrictions**					1
Site 3	Operations Manager	**Ensuring the workers wear their PPE**. Masks are worn. But they are usually on the neck or head. Gloves are in the pockets instead of worn on hands		1			
Site 3	Health & Safety Officer	We do get audited by the client. The H&S is on their toes. **Safety is priority in the construction** industry and they know that				1	
Site 4	Project Manager	**Labour not wearing PPE**, Excessive speed on plant		1			
Site 4	Site Manager	N/A	n/a	n/a	n/a	n/a	n/a
Site 4	H&S Officer	N/A	n/a	n/a	n/a	n/a	n/a
Site 5	Site Technician (Consult Engineer)	N/A	n/a	n/a	n/a	n/a	n/a
Site 5	Contracts Manager	N/A	n/a	n/a	n/a	n/a	n/a
Site 5	Student Technician	Not that I know of. The foreman known that they know t**o wear PPE.** Tool box talks are done. Everyone knows what is expected. Safety file is for checking that site regulations are done		1			
Site 5	H&S Officer	N/A	n/a	n/a	n/a	n/a	n/a

Site 6	Foreman (Managed the site)	Not really, everyone compliant. There are **always reminded of H&S**					
Site 6	Traffic Safety Officer	**People speeding.** Respect and good working relationships are key to helping one another					1
Site 6	Site Technician (Consult Engineer)	**Cars exceeds speed li**mit when there are driving through our site					1
Site 6	H&S Officer	N/A	n/a	n/a	n/a	n/a	n/a
Site 6	Senior civil technician	Cars exceeds limit when there are driving through our site					
Site 7	Transport Manager	Operators many **not using PPE.** No signboards		1			
Site 7	Technician	Some people do **not wear their PPE**. They only where their overalls and reflectors		1			
Site 8	Site Manager	Drip trays not put					
Site 8	H&S officer	**Not using supplied PPE**		1			
Site 8	Site Engineer	**Not using supplied PPE**		1			
Site 9	Safety Manager/ Consultant	Theft of materials or goods or equipment					
Site 9	H&S officer	Operating without certificates, or **operating under the influence, or under bad weather**. For the safety					

Site 9	Site Engineer	Yes it has been happening. **People being negligent, PPE, Induction Toolbox talks but they don’t use.** Sometimes brick layers rather use their own hands instead of appropriate PPE. PPE may not be so comfortable. Appropriate PPE needs to be given for different persons.					
Site 10	Safety Manager/ Consultant	Do get **operators don’t get medical assessment lacking or missing**					
Site 10	H&S Officer on site	Uncertified operators, **Poor equipment/plant, Forged certificates on site**			1		
Site 10	site supervisor	None. Other sites have someone wanting to take shortcuts, equipment not safe, **incompetent compactor e.g. labour using machine**			1		
Site 11	Safety Manager/ Consultant	N/A	n/a	n/a	n/a	n/a	n/a
Site 11	Manager	Staff sometimes don’t follow safety rules when operating the pumps				1	
Site 12	Safety Officer	None- **we treat Plant and equipment very seriously**. That’s why we train the guys			1		
Site 12	Senior Site Supervisor	They are quite strict with Risk Assessments. No - not that am aware of					

Site 12	Assistant Project Manager	None	n/a	n/a	n/a	n/a	n/a
		TOTAL	1	11	4	3	3
		PERCENTAGE	3	28	10	8	8

		<u>11.2 What are the most frequent violations of these regulations that you have encountered on this project?</u>	Other	Operating under the influence of alcohol	Operating in bad weather	Negligence
Site 1	Site Manager	N/A				
Site 1	Health & Safety Officer	Sometimes people take chances because they want to take shortcuts, instead of following instructions. DSTI - **Tool box talks and Daily Safety task instructions** as well as PEE are important				
Site 1	Construction site supervisor	**Not wearing PPE**, for e.g. Keep checking the guys to ensure that they are wearing dust masks				
Site 1	Assistant Resident Engineer	N/A	n/a	n/a	n/a	n/a
Site 1	Site Administrator	On the safety side, nothing. If plant is not working, charge/cost attached because of strike increase				

		10% =, R22 per hour				
Site 1	Site Clerk	Not wearing hard hats/full PPE. Because of **quality of PPE** gets torn easily. Labours get twice a year. If you tear the second one you have to buy but most don't. Someone wears takkies, not allowed but it happens				
Site 2	Operations Manager/director	When guys go on **lunch they do not have vests on**. Safety Leader to ensures that team has e.g. gloves, hardhats and proper PPE for particular operator				
Site 2	Health & Safety Officer	Safety officer ensure that all employees has proper PPE				
Site 2	Health & Safety Officer	No one does not follow rules. **I conduct inductions.** We are from the same mother. You are all our eyes				
Site 2	Resident Engineer	**Failure to adhere to speed restrictions**				
Site 3	Operations Manager	**Ensuring the workers wear their PPE**. Masks are worn. But they are usually on the neck or head. Gloves are				

		in the pockets instead of worn on hands				
Site 3	Health & Safety Officer	We do get audited by the client. The H&S is on their toes. **Safety is priority in the construction** industry and they know that				
Site 4	Project Manager	**Labour not wearing PPE**, Excessive speed on plant				
Site 4	Site Manager	N/A	n/a	n/a	n/a	n/a
Site 4	H&S Officer	N/A	n/a	n/a	n/a	n/a
Site 5	Site Technician (Consult Engineer)	N/A	n/a	n/a	n/a	n/a
Site 5	Contracts Manager	N/A	n/a	n/a	n/a	n/a
Site 5	Student Technician	Not that I know of. The foreman known that they know t**o wear PPE.** Tool box talks are done. Everyone knows what is expected. Safety file is for checking that site regulations are done				
Site 5	H&S Officer	N/A	n/a	n/a	n/a	n/a
Site 6	Foreman (Managed the site)	Not really, everyone compliant. There are **always**	1			

		reminded of H&S				
Site 6	Traffic Safety Officer	**People speeding.** Respect and good working relationships are key to helping one another				
Site 6	Site Technician (Consult Engineer)	**Cars exceeds speed li**mit when there are driving through our site				
Site 6	H&S Officer	N/A	n/a	n/a	n/a	n/a
Site 6	Senior civil technician	Cars exceeds limit when there are driving through our site				
Site 7	Transport Manager	Operators many **not using PPE.** No signboards				
Site 7	Technician	Some people do **not wear their PPE**. They only where their overalls and reflectors				
Site 8	Site Manager	Drip trays not put	1			
Site 8	H&S officer	**Not using supplied PPE**				
Site 8	Site Engineer	**Not using supplied PPE**				
Site 9	Safety Manager/Consultant	Theft of materials or goods or equipment	1			
Site 9	H&S officer	Operating without certificates, or **operating under the influence, or under bad weather**. For the safety		1	1	

Site 9	Site Engineer	Yes it has been happening. **People being negligent, PPE, Induction Toolbox talks but they don't use.** Sometimes brick layers rather use their own hands instead of appropriate PPE. PPE may not be so comfortable. Appropriate PPE needs to be given for different persons.				1
Site 10	Safety Manager/Consultant	Do get **operators don't get medical assessment lacking or missing**				
Site 10	H&S Officer on site	Uncertified operators, **Poor equipment/plant, Forged certificates on site**				
Site 10	site supervisor	None. Other sites have someone wanting to take shortcuts, equipment not safe, **incompetent compactor e.g. labour using machine**				
Site 11	Safety Manager/Consultant	N/A	n/a	n/a	n/a	n/a
Site 11	Manager	Staff sometimes don't follow safety rules when operating the pumps				

Site 12	Safety Officer	None- **we treat Plant and equipment very seriously**. That's why we train the guys				
Site 12	Senior Site Supervisor	They are quite strict with Risk Assessments. No - not that am aware of	1			
Site 12	Assistant Project Manager	None	n/a	n/a	n/a	n/a
		TOTAL	4	1	1	1
		PERCENTAGE	10	3	3	3

		11.2 What are the most frequent violations of these regulations that you have encountered on this project?	Not following Induction & Toolbox talks	Lack of medical assessments	Incompetent Operator
Site 1	Site Manager	N/A			
Site 1	Health & Safety Officer	Sometimes people take chances because they want to take shortcuts, instead of following instructions. DSTI - **Tool box talks and Daily Safety task instructions** as well as PEE are important			
Site 1	Construction site supervisor	**Not wearing PPE**, for e.g. Keep checking the guys to ensure that they are			

		wearing dust masks			
Site 1	Assistant Resident Engineer	N/A	n/a	n/a	n/a
Site 1	Site Administrator	On the safety side, nothing. If plant is not working, charge/cost attached because of strike increase 10% =, R22 per hour			
Site 1	Site Clerk	Not wearing hard hats/full PPE. Because of **quality of PPE** gets torn easily. Labours get twice a year. If you tear the second one you have to buy but most don't. Someone wears takkies, not allowed but it happens			
Site 2	Operations Manager/director	When guys go on **lunch they do not have vests on**. Safety Leader to ensures that team has e.g. gloves, hardhats and proper PPE for particular operator			
Site 2	Health & Safety Officer	Safety officer ensure that all employees has proper PPE			
Site 2	Health & Safety Officer	No one does not follow rules. **I conduct inductions.** We are from the same			

		mother. You are all our eyes			
Site 2	Resident Engineer	**Failure to adhere to speed restrictions**			
Site 3	Operations Manager	**Ensuring the workers wear their PPE**. Masks are worn. But they are usually on the neck or head. Gloves are in the pockets instead of worn on hands			
Site 3	Health & Safety Officer	We do get audited by the client. The H&S is on their toes. **Safety is priority in the construction** industry and they know that			
Site 4	Project Manager	**Labour not wearing PPE**, Excessive speed on plant			
Site 4	Site Manager	N/A	n/a	n/a	n/a
Site 4	H&S Officer	N/A	n/a	n/a	n/a
Site 5	Site Technician (Consult Engineer)	N/A	n/a	n/a	n/a
Site 5	Contracts Manager	N/A	n/a	n/a	n/a
Site 5	Student Technician	Not that I know of. The foreman known that they know t**o wear PPE.** Tool box talks are done. Everyone knows what is expected. Safety file is for checking that site			

		regulations are done			
Site 5	H&S Officer	N/A	n/a	n/a	n/a
Site 6	Foreman (Managed the site)	Not really, everyone compliant. There are **always reminded of H&S**			
Site 6	Traffic Safety Officer	**People speeding.** Respect and good working relationships are key to helping one another			
Site 6	Site Technician (Consult Engineer)	**Cars exceeds speed li**mit when there are driving through our site			
Site 6	H&S Officer	N/A	n/a	n/a	n/a
Site 6	Senior civil technician	Cars exceeds limit when there are driving through our site			
Site 7	Transport Manager	Operators many **not using PPE.** No signboards			
Site 7	Technician	Some people do **not wear their PPE**. They only where their overalls and reflectors			
Site 8	Site Manager	Drip trays not put			
Site 8	H&S officer	**Not using supplied PPE**			
Site 8	Site Engineer	**Not using supplied PPE**			

Site 9	Safety Manager/Consultant	Theft of materials or goods or equipment			
Site 9	H&S officer	Operating without certificates, or **operating under the influence, or under bad weather**. For the safety			
Site 9	Site Engineer	Yes it has been happening. **People being negligent, PPE, Induction Toolbox talks but they don't use.** Sometimes brick layers rather use their own hands instead of appropriate PPE. PPE may not be so comfortable. Appropriate PPE needs to be given for different persons.	1		
Site 10	Safety Manager/Consultant	Do get **operators don't get medical assessment lacking or missing**		1	
Site 10	H&S Officer on site	Uncertified operators, **Poor equipment/plant, Forged certificates on site**			1
Site 10	site supervisor	None. Other sites have someone wanting to take shortcuts, equipment not safe, **incompetent compactor e.g.**			1

		labour using machine			
Site 11	Safety Manager/Consultant	N/A	n/a	n/a	
Site 11	Manager	Staff sometimes don't follow safety rules when operating the pumps			
Site 12	Safety Officer	None- **we treat Plant and equipment very seriously**. That's why we train the guys			
Site 12	Senior Site Supervisor	They are quite strict with Risk Assessments. No - not that am aware of			
Site 12	Assistant Project Manager	None	n/a	n/a	
		TOTAL	1	1	2
		PERCENTAGE	3	3	5

		12.2 If YES, where do you keep records of these inspections?	H&S File	Off-site office
Site 1	Site Manager	**Site office**	1	
Site 1	Health & Safety Officer	**Site office- Safety File**	1	
Site 1	Construction site supervisor	**Site office- Safety File**	1	
Site 1	Assistant Resident Engineer	**Safety File**	1	
Site 1	Site Administrator	**Safety File**	1	

Site 1	Site Clerk	**Safety File**	1	
Site 2	Operations Manager/director	**Inspection Records** kept in Safety file	1	
Site 2	Health & Safety Officer	**Inspection Records** kept in Safety file	1	
Site 2	Health & Safety Officer	**Inspection Records** kept in Safety file	1	
Site 2	Resident Engineer	**Safety file**	1	
Site 3	Health & Safety Officer	**Safety file**	1	
Site 3	Contracts Manager	**Safety file**	1	
Site 4	Site Manager	**Safety file**	1	
Site 4	H&S Officer	**Safety file**	1	
Site 4	Site Technician	**N/A**	n/a	
Site 5	Site Technician (Consult Engineer)	**Safety file**	1	
Site 5	Contracts Manager	On **Safety File** with the Admin at the office	1	
Site 5	H&S Officer	In daily site diary and safety file	1	
Site 5	Student Technician	N/A		1
Site 6	Foreman (Managed the site)	**Safety file**	1	
Site 6	Traffic Safety Officer	**N/A**	n/a	
Site 6	Site Technician (Consult Engineer)	**In the safety file**	1	
Site 6	H&S Officer	In daily site diary and safety file		1
Site 7	Transport Manager	**Office** in Pine Town		
Site 7	Technician	**In Safety File**	1	
Site 8	Site Manager	**Safety file**	1	
Site 8	H&S officer	**On site**	1	
Site 8	Site Engineer	**Safety file**	1	

Site 9	Safety Manager/Consultant	**Safety file**	1	
Site 9	Safety Officer	**Safety file**	1	
Site 9	Safety Officer	**Safety file and SMI board**	1	
Site 10	Safety Manager/Consultant	**Safety file**	1	
Site 10	H&S Officer on site	**Safety file**	1	
Site 10	site supervisor	**Safety file**	1	
Site 11	Safety Manager/Consultant	**Safety file**	1	
Site 11	Manager	**Safety file**	1	
Site 12	Safety Officer	**Safety file** on site	1	
Site 12	Senior Site Supervisor	**Safety file** on site	1	
Site 12	Assistant Project Manager	**Safety file** on site	1	
		TOTAL	34	2
		PERCENTAGE	87	5

		13 What happens when an operator is either not certified or does not have proof of certification?	Not allowed to work on site	Not allowed to operate machine	Should be trained before operating machine
Site 1	Site Manager	He will **not allowed to work/start working without all relevant documents**	1		
Site 1	Health & Safety Officer	Does not work at all. Must be the site	1		
Site 1	Construction site supervisor	**Not allowed to operate**		1	

Site 1	Assistant Resident Engineer	He does not work at all, before he starts work, he must have all of these things	1		
Site 1	Site Administrator	**Not allowed to operate the machine**. Admin he won't get charged. He won't be working because he is a risk		1	
Site 1	Site Clerk	**Won't let him go on site**, must have everything that is required.	1		
Site 2	Operations Manager/director	**Not given the machine to operators**		1	
Site 2	Safety Officer	We stop him, he **doesn't operate the machine** without a proof until we receive the certificate		1	
Site 2	H&S Officer	We don't need that! **He does not even touch the plant.**		1	
Site 2	Resident Engineer	He/she may not operate any certification. They are to first ensure that they have it		1	
Site 3	Contracts Manager	Removed off site. Not allowed to operate any machinery until its provided	1		
Site 3	Health & Safety Officer	**Not allowed to work.** If it's due for expiry, refresher course is done. Valid for two years- operators' certificate. Medicals valid for one year	1		
Site 4	Project Manager	**He does not operate any machine!**		1	
Site 4	Site Manager	**Not allowed to operate the machine.** Have to get another operator		1	
Site 4	H&S Officer	**Should be trained before operation** of plant			1

Site 5	Site Technician (Civil Engineer)	Before the site operators speak, the safety file contains all certificates. Safety officer checks the files to make sure all is well on site	1		
Site 5	Contracts Manager	**He is not allowed on site!**	1		
Site 5	H&S Officer	**Should be trained** before operation of plant			1
Site 5	Student Technician	**Not that I have encountered something of that nature. The other site, a guy was not having certification. Not let to drive**		1	
Site 6	Foreman (Managed the site)	**He does not work**. Look for another job. The grader for example is 2.2 million, cannot give incompetent operator		1	
Site 6	Traffic Safety Officer	**He will not be allowed** to operate any machinery and depending on the circumstances, may be asked to leave site	1		
Site 6	Senior Civil Technician	We have to consult with our **mechanical technician** to speak with operator about the problem that the operator is picking up			
Site 6	H&S Officer	Should be trained before operation of plant			1
Site 7	Transport Manager	**Time is given to get it**, if can't operate plant - terminate the contract			
Site 7	Technician	I have not been in that situation before			
Site 8	Site Manager	This is a requirement to be inducted onto **our site** if the peoples pack and plant pack is not complete, the operator and plant cannot	1		

		come onto site and will not be inducted			
Site 8	H&S officer	Not allowed to operate plant/ equipment	1		
Site 8	Site Engineer	He will not be able to go through **induction**			
Site 9	Safety Manager/Consultant	He is **not hired** or used.	1		
Site 9	Safety Officer	**Not allowed operate any plant and equipment**. Will be sent to redo **his licence on his expense or the company depending if his employee** / subcontractor. Company will send him to renew every 3 years.		1	
Site 9	Safety Officer	Can't operate		1	
Site 10	Safety Manager/Consultant	He is not used		1	
Site 10	H&S Officer on site	He has to leave. Another operator, competent operator to operator. Medicals need to be checked.	1		
Site 10	Site supervisor	**Not allowed to operate**		1	
Site 11	Safety Manager/Consultant	**Not allowed to operate**		1	
Site 11	Manager	He is then trained fully before commencing with work.			1
Site 12	Safety Officer	Not allowed to operate machine NB!	1		
Site 12	Construction site supervisor	**Not allowed to operate**, they have to produce valid certificate		1	

Site 12	Assistant Project Manager	Not sure- s**top doing that work**. Not compliant with safety rules	1		
		TOTAL	15	16	4
		PERCENTAGE	38	41	10

		13 What happens when an operator is either not certified or does not have proof of certification?	Time is given to get certification	Other	Never been in this situation	He will not be able to go through induction
Site 1	Site Manager	He will **not allowed to work/start working without all relevant documents**				
Site 1	Health & Safety Officer	Does not work at all. Must be the site				
Site 1	Construction site supervisor	**Not allowed to operate**				
Site 1	Assistant Resident Engineer	He does not work at all, before he starts work, he must have all of these things				
Site 1	Site Administrator	**Not allowed to operate the machine**. Admin he won't get charged. He won't be working because he is a risk				
Site 1	Site Clerk	**Won't let him go on site**, must have everything that is required.				
Site 2	Operations Manager/director	**Not given the machine to operators**				
Site 2	Safety Officer	We stop him, he **doesn't operate the machine** without a proof until we receive the certificate				

Site 2	H&S Officer	We don't need that! **He does not even touch the plant.**				
Site 2	Resident Engineer	He/she may not operate any certification. They are to first ensure that they have it				
Site 3	Contracts Manager	Removed off site. Not allowed to operate any machinery until its provided				
Site 3	Health & Safety Officer	**Not allowed to work.** If it's due for expiry, refresher course is done. Valid for two years- operators' certificate. Medicals valid for one year				
Site 4	Project Manager	**He does not operate any machine!**				
Site 4	Site Manager	**Not allowed to operate the machine.** Have to get another operator				
Site 4	H&S Officer	**Should be trained before operation** of plant				
Site 5	Site Technician (Civil Engineer)	Before the site operators speak, the safety file contains all certificates. Safety officer checks the files to make sure all is well on site				
Site 5	Contracts Manager	**He is not allowed on site!**				
Site 5	H&S Officer	**Should be trained** before operation of plant				
Site 5	Student Technician	**Not that I have encountered something of that nature. The other site, a guy was not having**				

		certification. Not let to drive				
Site 6	Foreman (Managed the site)	**He does not work**. Look for another job. The grader for example is 2.2 million, cannot give incompetent operator				
Site 6	Traffic Safety Officer	**He will not be allowed** to operate any machinery and depending on the circumstances, may be asked to leave site				
Site 6	Senior Civil Technician	We have to consult with our **mechanical technician** to speak with operator about the problem that the operator is picking up		1		
Site 6	H&S Officer	Should be trained before operation of plant				
Site 7	Transport Manager	**Time is given to get it**, if can't operate plant - terminate the contract	1			
Site 7	Technician	I have not been in that situation before			1	
Site 8	Site Manager	This is a requirement to be inducted onto **our site** if the peoples pack and plant pack is not complete, the operator and plant cannot come onto site and will not be inducted				
Site 8	H&S officer	Not allowed to operate plant/ equipment				
Site 8	Site Engineer	He will not be able to go through **induction**				1
Site 9	Safety Manager/Consultant	He is **not hired** or used.				

Site 9	Safety Officer	**Not allowed operate any plant and equipment**. Will be sent to redo **his licence on his expense or the company depending if his employee** / subcontractor. Company will send him to renew every 3 years.	1			
Site 9	Safety Officer	Can't operate				
Site 10	Safety Manager/Consultant	He is not used				
Site 10	H&S Officer on site	He has to leave. Another operator, competent operator to operator. Medicals need to be checked.				
Site 10	Site supervisor	**Not allowed to operate**				
Site 11	Safety Manager/Consultant	**Not allowed to operate**				
Site 11	Manager	He is then trained fully before commencing with work.				
Site 12	Safety Officer	Not allowed to operate machine NB!				
Site 12	Construction site supervisor	**Not allowed to operate**, they have to produce valid certificate				
Site 12	Assistant Project Manager	Not sure- s**top doing that work**. Not compliant with safety rules				
		TOTAL	2	1	1	1
		PERCENTAGE	5	3	3	3

		14.2 If YES, where do you keep records of these inspections?	On site H&S offices	Unsure	Company plant yard
Site 1	Site Manager	H&S offices	1		
Site 1	Health & Safety Officer	H&S offices Safety File	1		
Site 1	Construction site supervisor	H&S offices Safety File	1		
Site 1	Assistant Resident Engineer	N/A unsure		1	
Site 1	Site Administrator	N/A Plant Yard			1
Site 1	Site Clerk	N/A	n/a	n/a	n/a
Site 2	Operations Manager/director	Site office/ Another file. Kept on site for inspectors by safety consultants. For audit purposes	1		
Site 2	Safety Officer	Inspection Records kept in Safety file	1		
Site 2	H&S Officer	Safety file	1		
Site 2	Resident Engineer	Safety file	1		
Site 3	Contracts Manager	safety file	1		
Site 3	Health & Safety Officer	safety file	1		
Site 4	Project Manager	safety file	1		
Site 4	Site Manager	safety file	1		
Site 4	H&S Officer	safety file	1		
Site 5	Site Technician (Civil Engineer)	safety file	1		
Site 5	Contracts Manager	safety file	1		
Site 5	H&S Officer	safety file	1		
Site 5	Student Technician	safety file	1		

Site 6	Foreman (Managed the site)	safety file	1		
Site 6	Traffic Safety Officer	safety file	1		
Site 6	Senior Civil Technician	safety file	1		
Site 6	H&S Officer	safety file	1		
Site 7	Transport Manager	safety file	1		
Site 7	Technician	On the safety file	1		
Site 8	Site Manager	Safety file	1		
Site 8	H&S officer	Safety file	1		
Site 8	Site Engineer	Safety file	1		
Site 9	Safety Manager/Consultant	safety file	1		
Site 9	Safety Officer	safety file	1		
Site 9	Safety Officer	On site	1		
Site 10	Safety Manager/Consultant	safety file	1		
Site 10	H&S Officer on site	safety file	1		
Site 10	Site supervisor	safety file	1		
Site 11	Safety Manager/Consultant	safety file	1		
Site 11	Manager	safety file	1		
Site 12	Safety Officer	safety file	1		
Site 12	Construction site supervisor	safety file	1		

Site 12	Assistant Project Manager	safety file	1		
		TOTAL	36	1	1
		PERCENTAGE	94	3	3

		15. What do you do about plant and equipment that do not have up-to-date maintenance records, certifications or licences?	Plant will not be allowed to operate	Plant not used and taken off-site	Plant sent for maintenance	Contractor's business/responsibility
Site 1	Site Manager	**Plant will not be allowed to work**	1			
Site 1	Health & Safety Officer	Plant **taken off site**		1		
Site 1	Construction site supervisor	**Notify head office** that equipment is due for maintenance			1	
Site 1	Assistant Resident Engineer	**Contractor will know - it’s not our business/responsibility**. It is something general, I won’t know the details.				1
Site 1	Site Administrator	H&S right information **will be sort and replaced**. All P&E expired.				
Site 1	Site Clerk	Don’t do reports - these guys are given a checklist every day. They ID the problems before they operate the machine. It becomes easier to ID anything wrong.				
Site 2	Operations Manager/director	Plant and equipment taken **off site** if not up to date		1		
Site 2	Safety Officer	**Check machine and induct operator**				

Site 2	H&S Officer	No, no need for that. Even people from the department come to check this. I do also check			1	
Site 2	Resident Engineer	I **would request via transmittal that the particular plant which is not conforming may not be used** on the site until given clearance after all necessary checks and certificates		1	1	
Site 3	Contracts Manager	Removed **offsite.** This happens many times especially with external plant		1		
Site 3	Health & Safety Officer	**Removed** from used and reported to **head office**		1	1	
Site 4	Project Manager	The safety auditor chases that machine **out of the project**		1		
Site 4	Site Manager	We **contact head office t**o give documents			1	
Site 4	H&S Officer	To be taken for **maintenance**			1	
Site 5	Site Technician (Civil Engineer)	**Don't allow the plant** - even if when it can come to calibration (certificate of service) in good condition	1			
Site 5	Contracts Manager	We ensure that every single piece of equipment is certified for use, or else they are sold to defray expenses				
Site 5	H&S Officer	To be taken for **maintenance**			1	

Site 5	Student Technician	For that I would tend to think the **contractor's job**. They check before they are on site. You cannot be putting a machine that is not certified. They will incur more cost				1
Site 6	Foreman (Managed the site)	Don’t hire any plant **don’t us**e these plants that do not have up to date records		1		
Site 6	Traffic Safety Officer	It will be noted and recorded **site boss's will be notified** of possible hazard this could cause, then site boss's take the matter from there forward			1	
Site 6	Site Technician (Consult Engineer)	Mechanical technicians always ensure that the machines are **maintained properly.**			1	
Site 6	H&S Officer	To be taken for **maintenance**			1	
Site 7	Transport Manager	**Send it to workshop.** Workshop manager to sort it out			1	
Site 7	Technician	Not been in this situation				
Site 8	Site Manager	The plant packs are not approved and will **not be given access permits to establish on site**		1		
Site 8	H&S officer	**Do not use,** send back to supplier		1		
Site 8	Site Engineer	**Sent off site**		1		
Site 9	Safety Manager/Consulta nt	All **sites keep driver/plant records**, it is compulsory				

Site 9	Safety Officer	**Not allowed to be used** until required documents, licenses and services are up to date (operating a hazard - not sure of equipment reliability)	1			
Site 9	Safety Officer	**Stop from operating,** send for **maintenance**	1		1	
Site 10	Safety Manager/Consultant	All **sites keep driver/plant records**, it is compulsory				
Site 10	H&S Officer on site	**Start putting things** in place asap			1	
Site 10	Site supervisor	**Not allowed to be used on site** if hired, another one is obtained, if owned it is fixed	1			
		They don't use them, we don't have that problem. They are replaced while others serviced	1			
Site 11	Safety Manager/Consultant	All **sites keep driver/plant records**, it is compulsory				
Site 11	Manager	There are two broken pumps on site which we are busy something out. They are **being repaired by electricians**			1	
Site 12	Safety Officer	**They don't use them**, we don't have that problem. They are replaced while other serviced	1			
Site 12	Construction site supervisor	**Not allowed**		1		
Site 12	Assistant Project Manager	Not sure				
		TOTAL	6	10	13	1

		PERCENTAGE	15	26	33	3

		15. What do you do about plant and equipment that do not have up-to-date maintenance records, certifications or licences?	Plant is replaced	Don't do reports	Not been in this situation	Sites keep driver/plant records
Site 1	Site Manager	**Plant will not be allowed to work**				
Site 1	Health & Safety Officer	Plant **taken off site**				
Site 1	Construction site supervisor	**Notify head office** that equipment is due for maintenance				
Site 1	Assistant Resident Engineer	**Contractor will know - it's not our business/responsibility**. It is something general, I won't know the details.				
Site 1	Site Administrator	H&S right information **will be sort and replaced**. All P&E expired.	1			
Site 1	Site Clerk	Don't do reports - these guys are given a checklist every day. They ID the problems before they operate the machine. It becomes easier to ID anything wrong.		1		
Site 2	Operations Manager/director	Plant and equipment taken **off site** if not up to date				
Site 2	Safety Officer	**Check machine and induct operator**				
Site 2	H&S Officer	No, no need for that. Even people from the department come to				

		check this. I do also check				
Site 2	Resident Engineer	I **would request via transmittal that the particular plant which is not conforming may not be used** on the site until given clearance after all necessary checks and certificates				
Site 3	Contracts Manager	Removed **offsite.** This happens many times especially with external plant				
Site 3	Health & Safety Officer	**Removed** from used and reported to **head office**				
Site 4	Project Manager	The safety auditor chases that machine **out of the project**				
Site 4	Site Manager	We **contact head office t**o give documents				
Site 4	H&S Officer	To be taken for **maintenance**				
Site 5	Site Technician (Civil Engineer)	**Don't allow the plant** - even if when it can come to calibration (certificate of service) in good condition				
Site 5	Contracts Manager	We ensure that every single piece of equipment is certified for use, or else they are sold to defray expenses		1		
Site 5	H&S Officer	To be taken for **maintenance**				
Site 5	Student Technician	For that I would tend to think the **contractor's job**. They check before they are on site. You cannot be putting a machine that is not certified. They will incur more cost				

Site 6	Foreman (Managed the site)	Don't hire any plant **don't use** these plants that do not have up to date records				
Site 6	Traffic Safety Officer	It will be noted and recorded **site boss's will be notified** of possible hazard this could cause, then site boss's take the matter from there forward				
Site 6	Site Technician (Consult Engineer)	Mechanical technicians always ensure that the machines are **maintained properly.**				
Site 6	H&S Officer	To be taken for **maintenance**				
Site 7	Transport Manager	**Send it to workshop.** Workshop manager to sort it out				
Site 7	Technician	Not been in this situation			1	
Site 8	Site Manager	The plant packs are not approved and will **not be given access permits to establish on site**				
Site 8	H&S officer	**Do not use,** send back to supplier				
Site 8	Site Engineer	**Sent off site**				
Site 9	Safety Manager/Consultant	All **sites keep driver/plant records**, it is compulsory				1
Site 9	Safety Officer	**Not allowed to be used** until required documents, licenses and services are up to date (operating a hazard - not sure of equipment reliability)				
Site 9	Safety Officer	**Stop from operating,** send for **maintenance**				
Site 10	Safety Manager/Consultant	All **sites keep driver/plant records**, it is compulsory				1

Site 10	H&S Officer on site	**Start putting things** in place asap				
Site 10	Site supervisor	**Not allowed to be used on site** if hired, another one is obtained, if owned it is fixed				
		They don’t use them, we don’t have that problem. They are replaced while others serviced				
Site 11	Safety Manager/Consultant	All **sites keep driver/plant records**, it is compulsory				1
Site 11	Manager	There are two broken pumps on site which we are busy something out. They are **being repaired by electricians**				
Site 12	Safety Officer	**They don’t use them**, we don’t have that problem. They are replaced while other serviced				
Site 12	Construction site supervisor	**Not allowed**				
Site 12	Assistant Project Manager	Not sure		1		
		TOTAL	1	3	1	3
		PERCENTAGE	3	8	3	8

		16.1 Do principal contractors and sub-contractors inspect and keep records of inspections of construction plant and equipment? If not why?	Only principal contractors keep records	All files are checked including sub-contractors
Site 1	Site Manager	N/A		
Site 1	Health & Safety Officer	N/A		

Site 1	Construction site supervisor	N/A		
Site 1	Assistant Resident Engineer	N/A		
Site 1	Site Administrator	N/A		
Site 1	Site Clerk	N/A		
Site 2	Operations Manager/director	N/A (Only principal contractors keep records, they also have daily inspections)	1	
Site 2	Safety Officer	N/A		
Site 2	H&S Officer	N/A		
Site 2	Resident Engineer	N/A		
Site 3	Operations Manager	The sub-contractor is our babies, when inspection comes all files are checked including sub-contractors.		1
Site 3	H&S Officer	N/A		
Site 4	Project Manager	N/A		
Site 4	Site Manager	N/A		
Site 4	H&S Officer	N/A		
Site 5	Site Technician (Civil Engineer)	N/A		
Site 5	Contracts Manager	N/A		
Site 5	H&S Officer	N/A		
Site 5	Student Technician	N/A		
Site 6	Foreman (Managed the site)	N/A		
Site 6	Traffic Safety Officer	N/A		
Site 6	Site Technician (Consult Engineer)	N/A		
Site 6	H&S Officer	N/A		
Site 7	Transport Manager	N/A		

Site 7	Technician	N/A		
Site 8	Site Manager	N/A		
Site 8	H&S officer	N/A		
Site 8	Site Engineer	N/A		
Site 9	Safety Manager/Consultant	N/A		
Site 9	Safety Officer	N/A		
Site 9	Safety Officer	N/A		
Site 10	Safety Manager/Consultant	N/A		
Site 10	H&S Officer on site	N/A		
Site 10	Site supervisor	N/A		
Site 11	Safety Manager/Consultant	N/A		
Site 11	Manager	N/A		
Site 12	Safety Officer	N/A		
Site 12	Construction site supervisor	N/A		
Site 12	Assistant Project Manager	N/A		
		TOTAL	1	1
		PERCENTAGE	3	3

		16.2 If YES, where do you keep copies of these inspections?	H&S site Office	Distribute records	Safety auditors book
Site 1	Site Manager	**H&S Office**	1		
Site 1	Health & Safety Officer	Check list file in **H&S Office**			
Site 1	Construction site supervisor	Main office - **safety office**			
Site 1	Assistant Resident Engineer	**File them** somewhere, I don't think we do want them at any stage			

Site 1	Site Administrator	**H&S Office** (When Audit comes - records must be checked	1		
Site 1	Site Clerk	**We give everyone - the checklist**, every subcontractor. Safety applies to everyone		1	
Site 2	Operations Manager/director	**Kept at site office**	1		
Site 2	Safety Officer	**Kept at site office**	1		
Site 2	H&S Officer	Main office - **safety office**	1		
Site 2	Resident Engineer	Kept at **site office**	1		
Site 3	Operations Manager	Not in this job, generally to be **kept at office**	1		
Site 3	Health & Safety Officer	Safety file - **site office**	1		
Site 4	Project Manager	On **safety auditors book**			1
Site 4	Site Manager	Safety file - **site office**	1		
Site 4	H&S Officer	**Inspection file of plant**			
Site 5	Site Technician (Civil Engineer)	**safety file**	1		
Site 5	Contracts Manager	All are **kept in a site master file, copies at head office**			
Site 5	H&S Officer	**Inspection file of plant**			
Site 5	Student Technician	Because if there is a subcontractor, **the main contractor keeps records.** If the subcontractor fucks up, sorry for swearing, contractor must see everyone is on par, because it's their responsibility			
Site 6	Foreman (Managed the site)	**Kept at office**			
Site 6	Traffic Safety Officer	copies sent to **head office**			
Site 6	Site Technician (Consult Engineer)	**On safety file**			

Site 6	H&S Officer	**inspection file of plant**			
Site 7	Transport Manager	They keep it themselves (**contractors)** only if problem arises, a copy is sent to me			
Site 7	Technician	Safety file			
Site 8	Site Manager	Daily inspection check sheets are kept on site in the **safety filling system** (ISO9001)	1		
Site 8	H&S officer	**On site**	1		
Site 8	Site Engineer	**On site / safety file**	1		
Site 9	Safety Manager/Consultant	**File on site office**	1		
Site 9	Safety Officer	**safety file**	1		
Site 9	Safety Officer	**safety file**	1		
Site 10	Safety Manager/Consultant	**safety file**	1		
Site 10	H&S Officer on site	Subcontractor come with own safety manager. Every day that the **safety** is done	1		
Site 10	Site supervisor	**Safety file**	1		
Site 11	Safety Manager/Consultant	**In file**, hired companies keeps their own	1		
Site 11	Manager	**In Safety File**	1		
Site 12	Safety Officer	**Safety file**	1		
Site 12	Construction site supervisor	Working out of a container- **safety file**	1		
Site 12	Assistant Project Manager	**Safety officer (on site)** ...not really involved in this area, I don't really join this	1		
		TOTAL	25	1	1
		PERCENTAGE	64	3	3

		16.2 If YES, where do you keep copies of these inspections?	Plant and Equipment Inspection File	Mater file in head office	Contractor keeps records
Site 1	Site Manager	**H&S Office**			
Site 1	Health & Safety Officer	Check list file in **H&S Office**			
Site 1	Construction site supervisor	Main office - **safety office**			
Site 1	Assistant Resident Engineer	**File them** somewhere, I don't think we do want them at any stage			
Site 1	Site Administrator	**H&S Office** (When Audit comes - records must be checked			
Site 1	Site Clerk	**We give everyone - the checklist**, every subcontractor. Safety applies to everyone			
Site 2	Operations Manager/director	**Kept at site office**			
Site 2	Safety Officer	**Kept at site office**			
Site 2	H&S Officer	Main office - **safety office**			
Site 2	Resident Engineer	Kept at **site office**			
Site 3	Operations Manager	Not in this job, generally to be **kept at office**			
Site 3	Health & Safety Officer	Safety file - **site office**			
Site 4	Project Manager	On **safety auditors book**			
Site 4	Site Manager	Safety file - **site office**			

Site 4	H&S Officer	**Inspection file of plant**	1		
Site 5	Site Technician (Civil Engineer)	**safety file**			
Site 5	Contracts Manager	All are **kept in a site master file, copies at head office**		1	
Site 5	H&S Officer	**Inspection file of plant**	1		
Site 5	Student Technician	Because if there is a subcontractor, **the main contractor keeps records.** If the subcontractor fucks up, sorry for swearing, contractor must see everyone is on par, because it's their responsibility			1
Site 6	Foreman (Managed the site)	**Kept at office**		1	
Site 6	Traffic Safety Officer	copies sent to **head office**		1	
Site 6	Site Technician (Consult Engineer)	**On safety file**		1	
Site 6	H&S Officer	**inspection file of plant**	1		
Site 7	Transport Manager	They keep it themselves (**contractors)** only if problem arises, a copy is sent to me			1
Site 7	Technician	Safety file			
Site 8	Site Manager	Daily inspection check sheets are kept on site in the **safety filling system** (ISO9001)			
Site 8	H&S officer	**On site**			
Site 8	Site Engineer	**On site / safety file**			

Site 9	Safety Manager/Consultant	**File on site office**			
Site 9	Safety Officer	**safety file**			
Site 9	Safety Officer	**safety file**			
Site 10	Safety Manager/Consultant	**safety file**			
Site 10	H&S Officer on site	Subcontractor come with own safety manager. Every day that the **safety** is done			
Site 10	Site supervisor	**Safety file**			
Site 11	Safety Manager/Consultant	**In file**, hired companies keeps their own			
Site 11	Manager	**In Safety File**			
Site 12	Safety Officer	**Safety file**			
Site 12	Construction site supervisor	Working out of a container- **safety file**			
Site 12	Assistant Project Manager	**Safety officer (on site)** ...not really involved in this area, I don't really join this			
		TOTAL	3	4	2
		PERCENTAGE	8	10	5

		18.1 If YES, please provide details of the training courses and when they were taken.(Operator)	First Aid	Tool box talks/ Safety talks	H&S training on plant operation	How to ID Hazards and Safety in the Work Place (SWP)

Site 1	Health & Safety Officer	**First Aid**	1			
Site 1	Construction site supervisor	**First Aid** once a year, **Tool box** talks everyday	1	1		
Site 1	Construction site supervisor	Normally do **H&S training at the beginning of the contract.** They won’t do during contract update certificate so that they can give new certificate to main contractor			1	
Site 1	Assistant Resident Engineer	N/A 'I won’t know'				
Site 1	Site Administrator	They do it via the **Plant yard division.** They have their own H&S Officer				
Site 1	Site Clerk	Safety **Awareness. How to ID Hazards,** Your Brother's Keeper. General Safety Issues. Safety Begins. We were supposed to have notes but there was a redo done - some of the people cannot read/write. Register was signed.				1
Site 2	Operations Manager/director	**Safety Rep courses,** certificate copies needed, scanned and emailed				
Site 2	Safety Officer	**Safety Rep courses**				
Site 2	Health and Safety Officer	**Safety talk. Training of how to operate the plant which includes H&S.** Everything goes under safety, there is nothing that goes without H&S. Where there is a human being there is H&S. 1 H&S 2 Quality 3 Production		1	1	
Site 2	Resident Engineer	I don’t have that information				
Site 3	Operations Manager	They have sent some of them for training will be at **head office**				
Site 3	Health & Safety Officer	N/A	n/a	n/a	n/a	n/a

Site 4	Project Manager	It is difficult to say. Yes/No. They are tested if they can work with plant.				
Site 4	Site Manager	N/A	n/a	n/a	n/a	n/a
Site 4	H&S Officer	**Operators (control) manufacture and training**			1	
Site 5	Site Technician (Civil Engineer)	N/A	n/a	n/a	n/a	n/a
Site 5	Contracts Manager	Operators have to get yearly medicals and **competency certificates done**			1	
Site 5	H&S Officer	**Operators (control) manufacture and training**			1	
Site 5	Student Technician	**Toolbox talks** serve as H&S training. Done daily. They don’t really go in depth in H&S	1			
Site 6	Foreman (Managed the site)	N/A	n/a	n/a	n/a	n/a
Site 6	Traffic Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 6	Site Technician (Consult Engineer)	N/A	n/a	n/a	n/a	n/a
Site 6	H&S Officer	**Operators (control) manufacture and training**			1	
Site 7	Transport Manager	N/A	n/a	n/a	n/a	n/a
Site 7	Technician	N/A	n/a	n/a	n/a	n/a
Site 8	Site Manager	All hired operators				
Site 8	H&S officer	**Inductions, fire training, tool box talks**		1		
Site 8	Site Engineer	N/A	n/a	n/a	n/a	n/a
Site 9	Safety Manager/Consultant	Through on site **OHS Training program,** twice a week they have 10 -15 minutes training sessions (**toolbox talks/ Risk assessment/SOP)**		1	1	
Site 9	Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 9	Safety Officer	When they are doing/operating being inducted we inform them. **Safety talks/SOP** are		1		1

		done while working done weekly especially **toolbox talks**				
Site 10	Safety Manager/Consultant	**Awareness training**				1
Site 10	H&S Officer on site	We do **H&S training for that plant and equipment on that particular site.**			1	
Site 10	Site supervisor	Tainting courses include: **HIV, Tool box talks, Risk assessments, SWP - Safety in Work Place**		1		1
Site 11	Safety Manager/Consultant	**Competence Training certification,** yearly			1	
Site 11	Manager	N/A	n/a	n/a	n/a	n/a
Site 12	Safety Officer	They must do the **training on the equipment** that they use			1	
Site 12	Construction site supervisor	N/A	n/a	n/a	n/a	n/a
Site 12	Assistant Project Manager	**Toolbox** meeting trained on site		1		
		TOTAL	3	7	10	4
		PERCENTAGE	8	18	26	10

		18.1 If YES, please provide details of the training courses and when they were taken.(Operator)	Safety Rep courses	I don't have that information	Training in Plant yard division	Training at Head Office
Site 1	Health & Safety Officer	**First Aid**				
Site 1	Construction site supervisor	**First Aid** once a year, **Tool box** talks everyday				
Site 1	Construction site supervisor	Normally do **H&S training at the beginning of the contract.** They won't do during contract update certificate so				

		that they can give new certificate to main contractor				
Site 1	Assistant Resident Engineer	N/A 'I won't know'		1		
Site 1	Site Administrator	They do it via the **Plant yard division.** They have their own H&S Officer			1	
Site 1	Site Clerk	Safety **Awareness. How to ID Hazards,** Your Brother's Keeper. General Safety Issues. Safety Begins. We were supposed to have notes but there was a redo done - some of the people cannot read/write. Register was signed.				
Site 2	Operations Manager/director	**Safety Rep courses,** certificate copies needed, scanned and emailed	1			
Site 2	Safety Officer	**Safety Rep courses**	1			
Site 2	Health and Safety Officer	**Safety talk. Training of how to operate the plant which includes H&S.** Everything goes under safety, there is nothing that goes without H&S. Where there is a human being there is H&S. 1 H&S 2 Quality 3 Production				
Site 2	Resident Engineer	I don't have that information		1		
Site 3	Operations Manager	They have sent some of them for training will be at **head office**				1

Site 3	Health & Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 4	Project Manager	It is difficult to say. Yes/No. They are tested if they can work with plant.		1		
Site 4	Site Manager	N/A	n/a	n/a	n/a	n/a
Site 4	H&S Officer	**Operators (control) manufacture and training**				
Site 5	Site Technician (Civil Engineer)	N/A	n/a	n/a	n/a	n/a
Site 5	Contracts Manager	Operators have to get yearly medicals and **competency certificates done**				
Site 5	H&S Officer	**Operators (control) manufacture and training**				
Site 5	Student Technician	**Toolbox talks** serve as H&S training. Done daily. They don't really go in depth in H&S				
Site 6	Foreman (Managed the site)	N/A	n/a	n/a	n/a	n/a
Site 6	Traffic Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 6	Site Technician (Consult Engineer)	N/A	n/a	n/a	n/a	n/a
Site 6	H&S Officer	**Operators (control) manufacture and training**				
Site 7	Transport Manager	N/A	n/a	n/a	n/a	n/a
Site 7	Technician	N/A	n/a	n/a	n/a	n/a
Site 8	Site Manager	All hired operators		1		
Site 8	H&S officer	**Inductions, fire training, tool box talks**				

Site 8	Site Engineer	N/A	n/a	n/a	n/a	n/a
Site 9	Safety Manager/Consultant	Through on site **OHS Training program,** twice a week they have 10 -15 minutes training sessions (**toolbox talks/ Risk assessment/SOP)**				
Site 9	Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 9	Safety Officer	When they are doing/operating being inducted we inform them. **Safety talks/SOP** are done while working done weekly especially **toolbox talks**				
Site 10	Safety Manager/Consultant	**Awareness training**				
Site 10	H&S Officer on site	We do **H&S training for that plant and equipment on that particular site.**				
Site 10	Site supervisor	Tainting courses include: **HIV, Tool box talks, Risk assessments, SWP - Safety in Work Place**				
Site 11	Safety Manager/Consultant	**Competence Training certification,** yearly				
Site 11	Manager	N/A	n/a	n/a	n/a	n/a
Site 12	Safety Officer	They must do the **training on the equipment** that they use				
Site 12	Construction site supervisor	N/A	n/a	n/a	n/a	n/a
Site 12	Assistant Project Manager	**Toolbox** meeting trained on site				
		TOTAL	2	4	1	1

		PERCENTAGE	5	10	3	3

		<u>**18.1 If YES, please provide details of the training courses and when they were taken. (Operator)**</u>	Fire Training	Risk Assessment	HIV
Site 1	Health & Safety Officer	**First Aid**			
Site 1	Construction site supervisor	**First Aid** once a year, **Tool box** talks everyday			
Site 1	Construction site supervisor	Normally do **H&S training at the beginning of the contract.** They won't do during contract update certificate so that they can give new certificate to main contractor			
Site 1	Assistant Resident Engineer	N/A 'I won't know'			
Site 1	Site Administrator	They do it via the **Plant yard division.** They have their own H&S Officer			
Site 1	Site Clerk	Safety **Awareness. How to ID Hazards,** Your Brother's Keeper. General Safety Issues. Safety Begins. We were supposed to have notes but there was a redo done - some of the people cannot read/write. Register was signed.			
Site 2	Operations Manager/director	**Safety Rep courses,** certificate copies needed, scanned and emailed			
Site 2	Safety Officer	**Safety Rep courses**			
Site 2	Health and Safety Officer	**Safety talk. Training of how to operate the plant which includes H&S.** Everything goes under safety, there is nothing that goes without H&S. Where there is a human being there is H&S. 1 H&S 2 Quality 3 Production			
Site 2	Resident Engineer	I don't have that information			

Site 3	Operations Manager	They have sent some of them for training will be at **head office**			
Site 3	Health & Safety Officer	N/A			
Site 4	Project Manager	It is difficult to say. Yes/No. They are tested if they can work with plant.			
Site 4	Site Manager	N/A	n/a		
Site 4	H&S Officer	**Operators (control) manufacture and training**			
Site 5	Site Technician (Civil Engineer)	N/A	n/a		
Site 5	Contracts Manager	Operators have to get yearly medicals and **competency certificates done**			
Site 5	H&S Officer	**Operators (control) manufacture and training**			
Site 5	Student Technician	**Toolbox talks** serve as H&S training. Done daily. They don't really go in depth in H&S			
Site 6	Foreman (Managed the site)	N/A	n/a		
Site 6	Traffic Safety Officer	N/A	n/a		
Site 6	Site Technician (Consult Engineer)	N/A	n/a		
Site 6	H&S Officer	**Operators (control) manufacture and training**			
Site 7	Transport Manager	N/A	n/a		
Site 7	Technician	N/A	n/a		
Site 8	Site Manager	All hired operators			
Site 8	H&S officer	**Inductions, fire training, tool box talks**	1		
Site 8	Site Engineer	N/A	n/a		

Site 9	Safety Manager/Consultant	Through on site **OHS Training program,** twice a week they have 10 -15 minutes training sessions (**toolbox talks/ Risk assessment/SOP)**		1	
Site 9	Safety Officer	N/A	n/a	n/a	
Site 9	Safety Officer	When they are doing/operating being inducted we inform them. **Safety talks/SOP** are done while working done weekly especially **toolbox talks**			
Site 10	Safety Manager/Consultant	**Awareness training**			
Site 10	H&S Officer on site	We do **H&S training for that plant and equipment on that particular site.**			
Site 10	Site supervisor	Tainting courses include: **HIV, Tool box talks, Risk assessments, SWP - Safety in Work Place**		1	1
Site 11	Safety Manager/Consultant	**Competence Training certification,** yearly			
Site 11	Manager	N/A	n/a	n/a	n/a
Site 12	Safety Officer	They must do the **training on the equipment** that they use			
Site 12	Construction site supervisor	N/A	n/a	n/a	n/a
Site 12	Assistant Project Manager	**Toolbox** meeting trained on site			
		TOTAL	1	2	1
		PERCENTAGE	3	5	3

		18.3 If No operator H&S training courses were taken, why not?	They have basic training on plant & equipment H&S	They have Tool Box Talks	H&S Officer is on site	Only management go for H&S training
Site 1	Site Manager	N/A	n/a	n/a	n/a	n/a
Site 1	Health & Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 1	Construction site supervisor	N/A	n/a	n/a	n/a	n/a
Site 1	Assistant Resident Engineer	N/A	n/a	n/a	n/a	n/a
Site 1	Site Administrator	N/A	n/a	n/a	n/a	n/a
Site 1	Site Clerk	N/A	n/a	n/a	n/a	n/a
Site 2	Operations Manager/director	N/A	n/a	n/a	n/a	n/a
Site 2	Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 2	Health and Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 2	Resident Engineer	N/A	n/a	n/a	n/a	n/a
Site 3	Operations Manager	N/A	n/a	n/a	n/a	n/a
Site 3	Health & Safety Officer	They just do operator **safety training as part of the operations training. They don't do a specific H&S training.** Just normal. Things should go to general H&S will make work in respect to H&S	1			
Site 4	Project Manager	N/A	n/a	n/a	n/a	n/a
Site 4	Site Manager	**Their position is operator not H&S**. If			1	

		elected to be H&S then they can go for training				
Site 4	H&S Officer	N/A	n/a	n/a	n/a	n/a
Site 5	Site Technician (Civil Engineer)	N/A	n/a	n/a	n/a	n/a
Site 5	Contracts Manager	N/A	n/a	n/a	n/a	n/a
Site 5	H&S Officer	N/A	n/a	n/a	n/a	n/a
Site 5	Student Technician	**I don't know**, even an engineer, I check if am able to do the job.				
Site 6	Traffic Safety Officer	**They don't know** because they don't leave the machine. T**hey trained in the plant they operate so they operate safely**	1			
Site 6	Site Technician (Consult Engineer)	Because they have their **basic training on plant and equipment**. **Regular tool box talk**s done to ensure safe operation	1	1		
Site 6	H&S Officer	I have applied to attend that course				
Site 6	H&S Officer	N/A	n/a	n/a	n/a	n/a
Site 7	Transport Manager	Because the **H&S officer is present in all jobs** – he does **safety talk** with them these are tool box talks			1	
Site 7	Technician	N/A	n/a	n/a	n/a	n/a
Site 8	Site Manager	N/A	n/a	n/a	n/a	n/a
Site 8	H&S officer	N/A	n/a	n/a	n/a	n/a
Site 8	Site Engineer	**Only safety reps and management and supervisor staff have gone for training**. So that they can communicate it to all		1		1

		personnel workers on site. Also communicated through **toolbox talks weekly**				
Site 9	Safety Manager/Consultant	N/A	n/a	n/a	n/a	n/a
Site 9	Safety Officer	For them it's not a necessity for scope of work. They are doing. TLB driver is not in one place all the time. **Safety officer will be telling the operator H&S** issues. So that he follows regulations			1	
Site 9	Safety Officer	N/A	n/a	n/a	n/a	n/a
Site 10	Safety Manager/Consultant	N/A	n/a	n/a	n/a	n/a
Site 10	H&S Officer on site	N/A	n/a	n/a	n/a	n/a
Site 10	Site supervisor	N/A	n/a	n/a	n/a	n/a
Site 11	Safety Manager/Consultant	N/A	n/a	n/a	n/a	n/a
Site 11	Manager	**I don't know**, my company did not pay for that				
Site 12	Safety Officer	Not a requirement, they have safety induction				
Site 12	Construction site supervisor	Not only that site easy access **trained on site** - telliporter				
Site 12	Assistant Project Manager	N/A	n/a	n/a	n/a	n/a
		TOTAL	3	2	3	1
		PERCENTAGE	8	5	8	3

		18.3 If No operator H&S training courses were taken, why not?	I don't know	Not required, H&S induction only	Ongoing training on site
Site 1	Site Manager	N/A	n/a	n/a	n/a
Site 1	Health & Safety Officer	N/A	n/a	n/a	n/a
Site 1	Construction site supervisor	N/A	n/a	n/a	n/a
Site 1	Assistant Resident Engineer	N/A	n/a	n/a	n/a
Site 1	Site Administrator	N/A	n/a	n/a	n/a
Site 1	Site Clerk	N/A	n/a	n/a	n/a
Site 2	Operations Manager/director	N/A	n/a	n/a	n/a
Site 2	Safety Officer	N/A	n/a	n/a	n/a
Site 2	Health and Safety Officer	N/A	n/a	n/a	n/a
Site 2	Resident Engineer	N/A	n/a	n/a	n/a
Site 3	Operations Manager	N/A	n/a	n/a	n/a
Site 3	Health & Safety Officer	They just do operator **safety training as part of the operations training. They don't do a specific H&S training.** Just normal. Things should go to general H&S will make work in respect to H&S			
Site 4	Project Manager	N/A	n/a	n/a	n/a
Site 4	Site Manager	**Their position is operator not H&S**. If elected to be H&S then they can go for training			
Site 4	H&S Officer	N/A	n/a	n/a	n/a
Site 5	Site Technician (Civil Engineer)	N/A	n/a	n/a	n/a
Site 5	Contracts Manager	N/A	n/a	n/a	n/a

Site 5	H&S Officer	N/A	n/a	n/a	n/a
Site 5	Student Technician	**I don't know**, even an engineer, I check if am able to do the job.	1		
Site 6	Traffic Safety Officer	**They don't know** because they don't leave the machine. T**hey trained in the plant they operate so they operate safely**	1		1
Site 6	Site Technician (Consult Engineer)	Because they have their **basic training on plant and equipment**. **Regular tool box talk**s done to ensure safe operation			
Site 6	H&S Officer	I have applied to attend that course			
Site 6	H&S Officer	N/A	n/a	n/a	n/a
Site 7	Transport Manager	Because the **H&S officer is present in all jobs** – he does **safety talk** with them these are tool box talks			
Site 7	Technician	N/A	n/a	n/a	n/a
Site 8	Site Manager	N/A	n/a	n/a	n/a
Site 8	H&S officer	N/A	n/a	n/a	n/a
Site 8	Site Engineer	**Only safety reps and management and supervisor staff have gone for training**. So that they can communicate it to all personnel workers on site. Also communicated through **toolbox talks weekly**			
Site 9	Safety Manager/Consultant	N/A	n/a	n/a	n/a
Site 9	Safety Officer	For them it's not a necessity for scope of work. They are doing. TLB driver is not in one place all the time. **Safety officer will be telling the operator H&S**			

		issues. So that he follows regulations			
Site 9	Safety Officer	N/A	n/a	n/a	n/a
Site 10	Safety Manager/Consultant	N/A	n/a	n/a	n/a
Site 10	H&S Officer on site	N/A	n/a	n/a	n/a
Site 10	Site supervisor	N/A	n/a	n/a	n/a
Site 11	Safety Manager/Consultant	N/A	n/a	n/a	n/a
Site 11	Manager	**I don't know**, my company did not pay for that	1		
Site 12	Safety Officer	Not a requirement, they have safety induction		1	
Site 12	Construction site supervisor	Not only that site easy access **trained on site** - telliporter			1
Site 12	Assistant Project Manager	N/A	n/a	n/a	n/a
		TOTAL	3	1	2
		PERCENTAGE	8	3	5

		24. What systems are in place to ensure that plant and equipment related hazards are mitigated?	Daily Safe Task discussions prior work	Risk assessment	Daily Safety Site Instruction(DSCI)	Tool Box Talks	Site shut down (Stop for safety)
Site 1	Site Manager	Daily Safe Task Discussion prior to starting work	1				
Site 1	Health & Safety Officer	Risk Assessment, Safe Work procedure,(DSCI)Daily Safety Site Instruction, Tool bo1 talks, Stop for Safety (Site shutdown)	1	1	1	1	1
Site 1	Construction site supervisor	Go through Task Risk Assessment. TRA done properly/thoroughly. Go through it on a daily basis		1			

Site 1	Assistant Resident Engineer	Routine Maintenance, Certification of Plant					
Site 1	Site Administrator	Safety Officer to check. Supplier checks - brought out of site/sorted out.					
Site 1	Site Clerk	We have a flag man - to control traffic smoothly- sign boards. Warning signs, command signs, Foreman on ground to instruct persons working on the site.					
Site 2	Operations Manager/director	Safety check on plant, competent operators, Medically fit operators					
Site 2	Safety Officer	Competent Operator with skill, Medical fitness					
Site 2	Health and Safety Officer	Risk Assessment is provided, ID root cause and hazards		1			
Site 2	Resident Engineer	Toolbox talks, Risk Assessments, Method Statements		1		1	
Site 3	Operations Manager	The guys get breaks during work. Machines are comfortable. Regular tool bo1 talks. Highlighting risks and know what they are doing "on top of their game"				1	
Site 3	Health & Safety Officer	Risk Assessment, State work method statements developed and communicated to operators, tool bo1 talks done weekly		1		1	
Site 4	Project Manager	Because of noise and motorists					
Site 4	Site Manager	Unsafe work					
Site 4	H&S Officer	No supervision of plant. Check list not completed					

Site 5	Site Technician (Consult Engineer)	Plant is checked and inspected each day before use.					
Site 5	Contracts Manager	We have a daily checklist, with the Workshop guys monitoring plant hours and servicing					
Site 5	H&S Officer	No supervision of plant. Check list not completed					
Site 5	Student Technician	People don't obey rules. I mean everyone even owes for transport. The only major hazard to be driving at 40 but driving at - 95% of the time, people drive above the speed limit					
Site 6	Traffic Safety Officer	Sign boards, amber lights, cones to separate the road that we are working on. 1 flag people to show slow down. Risk assessment - site meeting, environmental assessment		1			
Site 6	Site Technician (Consult Engineer)	Toolbox talks, Risk Assessments, Keep reminding safety hazards. Always refreshing on H&S		1		1	
Site 6	H&S Officer	There is a tollbo1 talk every day to remind everyone on site about the important of safety				1	
Site 6	H&S Officer	Checklist from foreman or plant supervisor, checklist report, mechanical repairs					
Site 7	Transport Manager	Before trucks leaves depot. H&S officer checks					
Site 7	Technician	N/A					

Site 8	Site Manager	Daily check sheets. Operator’s medicals. Operator training					
Site 8	H&S officer	Daily checklists, audits by client					
Site 8	Site Engineer	Plant not licence/certified/serviced regularly					
Site 9	Safety Manager/ Consultant	Strict maintenance and repair programme parallel to OHS programme - implement experience in H&S. Onsite soft skills are important					
Site 9	Safety Officer	Toolbox talks every day, induction training, supervision				1	
Site 9	Safety Officer	Induction taken, toolbox talks done to make sure they know the hazards. Speed to travel on site is told				1	
Site 10	Safety Manager/ Consultant	N/A					
Site 10	H&S Officer on site	Operators and plant must be checked before operation. Environmental impact survey before opening the site					
Site 10	Site supervisor	Checklist, machine in place. Train people with work place procedures competent persons, warnings given.					
Site 11	Safety Manager/ Consultant	Strict maintenance and repair programme parallel to OHS programme - implement experience in H&S. Onsite soft skills are important					

Site 11	Manager	N/A					
Site 12	Safety Officer	Incompetent operator. Not doing a visual inspection. Medical fitness operator					
Site 12	Construction site supervisor	Go through Task Risk Assessment. TRA done properly/thoroughly. Go through it on a daily basis		1			
Site 12	Assistant Project Manager	H&S meetings, Risk assessment		1			
		TOTAL	2	9	1	8	1
		PERCENTAGE	5	23	3	21	3

		24. What systems are in place to ensure that plant and equipment related hazards are mitigated?	Routine maintenance and certification of plant	Competent, skilled, medically fit operators	Daily checklist for plant hours and servicing at workshop	Operator and plant checked before operation.	H&S officer check before plant leaves depot.
Site 1	Site Manager	Daily Safe Task Discussion prior to starting work					
Site 1	Health & Safety Officer	Risk Assessment, Safe Work procedure,(DSCI)Daily Safety Site Instruction, Tool bo1 talks, Stop for Safety (Site shutdown)					
Site 1	Construction site supervisor	Go through Task Risk Assessment. TRA done properly/thoroughly. Go through it on a daily basis					

Site 1	Assistant Resident Engineer	Routine Maintenance, Certification of Plant	1				
Site 1	Site Administrator	Safety Officer to check. Supplier checks - brought out of site/sorted out.					1
Site 1	Site Clerk	We have a flag man - to control traffic smoothly- sign boards. Warning signs, command signs, Foreman on ground to instruct persons working on the site.					
Site 2	Operations Manager/director	Safety check on plant, competent operators, Medically fit operators		1		1	
Site 2	Safety Officer	Competent Operator with skill, Medical fitness		1			
Site 2	Health and Safety Officer	Risk Assessment is provided, ID root cause and hazards					
Site 2	Resident Engineer	Toolbox talks, Risk Assessments, Method Statements					
Site 3	Operations Manager	The guys get breaks during work. Machines are comfortable. Regular tool bo1 talks. Highlighting risks and know what they are doing "on top of their game"					
Site 3	Health & Safety Officer	Risk Assessment, State work method statements developed and communicated to operators, tool bo1 talks done weekly					
Site 4	Project Manager	Because of noise and motorists					

Site 4	Site Manager	Unsafe work					
Site 4	H&S Officer	No supervision of plant. Check list not completed					
Site 5	Site Technician	Plant is checked and inspected each day before use.				1	
Site 5	Contracts Manager	We have a daily checklist, with the Workshop guys monitoring plant hours and servicing			1		
Site 5	H&S Officer	No supervision of plant. Check list not completed					
Site 5	Student Technician	People don’t obey rules. I mean everyone even owes for transport. The only major hazard to be driving at 40 but driving at - 95% of the time, people drive above the speed limit					
Site 6	Traffic Safety Officer	Sign boards, amber lights, cones to separate the road that we are working on. 1 flag people to show slow down. Risk assessment - site meeting, environmental assessment					
Site 6	Site Technician (Consult Engineer)	Toolbox talks, Risk Assessments, Keep reminding safety hazards. Always refreshing on H&S					
Site 6	H&S Officer	There is a tollbo1 talk every day to remind everyone on site about the important of safety					

Site 6	H&S Officer	Checklist from foreman or plant supervisor, checklist report, mechanical repairs			1		
Site 7	Transport Manager	Before trucks leaves depot. H&S officer checks					1
Site 7	Technician	N/A					
Site 8	Site Manager	Daily check sheets. Operator's medicals. Operator training		1	1		
Site 8	H&S officer	Daily checklists, audits by client			1		
Site 8	Site Engineer	Plant not licence/certified/serviced regularly					
Site 9	Safety Manager/Consultant	Strict maintenance and repair programme parallel to OHS programme - implement experience in H&S. Onsite soft skills are important	1				
Site 9	Safety Officer	Toolbox talks every day, induction training, supervision					
Site 9	Safety Officer	Induction taken, toolbox talks done to make sure they know the hazards. Speed to travel on site is told					
Site 10	Safety Manager/Consultant	N/A					
Site 10	H&S Officer on site	Operators and plant must be checked before operation. Environmental impact survey before opening the site				1	
Site 10	Site supervisor	Checklist, machine in place. Train people with work place			1		

		procedures competent persons, warnings given.					
Site 11	Safety Manager/Consultant	Strict maintenance and repair programme parallel to OHS programme - implement experience in H&S. Onsite soft skills are important	1				
Site 11	Manager	N/A					
Site 12	Safety Officer	Incompetent operator. Not doing a visual inspection. Medical fitness operator					
Site 12	Construction site supervisor	Go through Task Risk Assessment. TRA done properly/thoroughly. Go through it on a daily basis					
Site 12	Assistant Project Manager	H&S meetings, Risk assessment					
		TOTAL	3	3	5	3	2
		PERCENTAGE	8	8	13	8	5

		24. What systems are in place to ensure that plant and equipment related hazards are mitigated?	Sign boards, amber lights, cones to separate road works.	H&S meetings	Methods statement.	induction training/operator training	Environmental impact assessment prior project
Site 1	Site Manager	Daily Safe Task Discussion prior to starting work					

Site 1	Health & Safety Officer	Risk Assessment, Safe Work procedure,(DSCI) Daily Safety Site Instruction, Tool bo1 talks, Stop for Safety (Site shutdown)					
Site 1	Construction site supervisor	Go through Task Risk Assessment. TRA done properly/thoroughly. Go through it on a daily basis					
Site 1	Assistant Resident Engineer	Routine Maintenance, Certification of Plant					
Site 1	Site Administrator	Safety Officer to check. Supplier checks - brought out of site/sorted out.					
Site 1	Site Clerk	We have a flag man - to control traffic smoothly- sign boards. Warning signs, command signs, Foreman on ground to instruct persons working on the site.	1				
Site 2	Operations Manager/director	Safety check on plant, competent operators, Medically fit operators					
Site 2	Safety Officer	Competent Operator with skill, Medical fitness					
Site 2	Health and Safety Officer	Risk Assessment is provided, ID root cause and hazards					

Site 2	Resident Engineer	Toolbox talks, Risk Assessments, Method Statements			1		
Site 3	Operations Manager	The guys get breaks during work. Machines are comfortable. Regular tool bo1 talks. Highlighting risks and know what they are doing "on top of their game"					
Site 3	Health & Safety Officer	Risk Assessment, State work method statements developed and communicated to operators, tool bo1 talks done weekly			1		
Site 4	Project Manager	Because of noise and motorists					
Site 4	Site Manager	Unsafe work					
Site 4	H&S Officer	No supervision of plant. Check list not completed					
Site 5	Site Technician (Consult Engineer)	Plant is checked and inspected each day before use.					
Site 5	Contracts Manager	We have a daily checklist, with the Workshop guys monitoring plant hours and servicing					
Site 5	H&S Officer	No supervision of plant. Check list not completed					
Site 5	Student Technician	People don't obey rules. I mean everyone even owes for transport.					

		The only major hazard to be driving at 40 but driving at - 95% of the time, people drive above the speed limit					
Site 6	Traffic Safety Officer	Sign boards, amber lights, cones to separate the road that we are working on. 1 flag people to show slow down. Risk assessment - site meeting, environmental assessment	1	1			
Site 6	Site Technician (Consult Engineer)	Toolbox talks, Risk Assessments, Keep reminding safety hazards. Always refreshing on H&S		1			
Site 6	H&S Officer	There is a tollbo1 talk every day to remind everyone on site about the important of safety					
Site 6	H&S Officer	Checklist from foreman or plant supervisor, checklist report, mechanical repairs					
Site 7	Transport Manager	Before trucks leaves depot. H&S officer checks					
Site 7	Technician	N/A					
Site 8	Site Manager	Daily check sheets. Operator's medicals. Operator training				1	
Site 8	H&S officer	Daily checklists, audits by client					

Site 8	Site Engineer	Plant not licence/certified/serviced regularly					
Site 9	Safety Manager/Consultant	Strict maintenance and repair programme parallel to OHS programme - implement experience in H&S. Onsite soft skills are important					
Site 9	Safety Officer	Toolbox talks every day, induction training, supervision				1	
Site 9	Safety Officer	Induction taken, toolbox talks done to make sure they know the hazards. Speed to travel on site is told				1	
Site 10	Safety Manager/Consultant	N/A					1
Site 10	H&S Officer on site	Operators and plant must be checked before operation. Environmental impact survey before opening the site					1
Site 10	Site supervisor	Checklist, machine in place. Train people with work place procedures competent persons, warnings given.				1	
Site 11	Safety Manager/Consultant	Strict maintenance and repair programme parallel to OHS programme - implement experience in					

		H&S. Onsite soft skills are important					
Site 11	Manager	N/A					
Site 12	Safety Officer	Incompetent operator. Not doing a visual inspection. Medical fitness operator					
Site 12	Construction site supervisor	Go through Task Risk Assessment. TRA done properly/thoroughly. Go through it on a daily basis					
Site 12	Assistant Project Manager	H&S meetings, Risk assessment		1			
		TOTAL	2	3	2	4	2
		PERCENTAGE	5	8	5	10	5

		<u>25. Describe the investigation and reporting process in the event of an accident or injury occurring on site.</u>	H&S officer notified / team leader/site manager	Investigation (including photos)	First Aid conducted	Ambulance/Hospital
Site 1	Site Manager	Investigation, Report, Action taken to prevent future accident		1		
Site 1	Health & Safety Officer	**Treat incidence**, **Management notified and client**, **Report** from document what happened, **Records kept to prevent re-occurrence**				

Site 1	Construction site supervisor	**Safety rep or office** are notified, **Full report** submitted to safety manager (head office) this is the obligation of the safety manger on site	1			
Site 1	Assistant Resident Engineer	**Safety Officer needs to know about the incident**. **First aid** done. We need to **report to the safety rep.** If necessary, they will check how severe the problem with first aider is. Safety reps on site report to H&S officer.	1	1		
Site 1	Site Administrator	**Inform H&S Officer**. Depends on seriousness. Ambulance/Police. Paperwork - explain process to prevent. More precaution example for other sites	1		1	1
Site 1	Site Clerk	Kind of difficult to explain... H&S officer will do an investigation. Every morning there is a tool box talk to follow procedures. Check breath, if not under the influence of alcohol. Tip truck device used to check speed...	1	1		

		All help to avoid accidents. The more mistakes we make they lead to permanent damage.				
Site 2	Operations Manager/director	Report by team leader to site manager, who **reports** to the safety officer, will assess situation together with the **first aider**. If minor, treated on site if major , person taken to hospital	1		1	1
Site 2	Safety Officer	**Investigation** if it's a minor accident. I treat him/her on site. If it is serious I take him/her t**o the hospital**		1	1	1
Site 2	Health and Safety Officer	Form used by **first aide**r. He said what happens on the scene. Which body affected. What the first aider does. Then goes to H&S officer. She found out if negligence. Activities related. Recommend stops to prevent if it was a truck/driver maybe he took medication - dizzy.	1		1	

Site 2	Resident Engineer	This is don't by the safety officer and ultimately **a report** is furnished in the safety file				
Site 3	Operations Manager	FEM **report (**detailed). That goes to the medical aid person. Head office keeps those accident injury reports				
Site 3	Health & Safety Officer	**Communicated to workers accidents/incident process**. NB immediately notifies safety rep -foreman- /supervisor. Paramedic on site/safety officer/**First aider** determine if ambulance required	1		1	1
Site 4	Project Manager	H&S file -what you have to fill if accident occurs. Registration car need and Identification of individual sent to **hospital**. Contractor monitors everything about the incident/injury				1
Site 4	Site Manager	**H&S file Annexure A to be filled in**. **Hospital, police,** c**ompletes investigation**. **First Aid kit** -	1		1	

		stays with safety officer				
Site 4	H&S Officer	**Inform the supervisor** of incident stop the activity. **Phone for medical response** and write out the **report** of what happened.	1			1
Site 5	Site Technician (Consult Engineer)	**Photos** are taken and cause is written down in detail		1		
Site 5	Contracts Manager	All incidents are **reported to the H&S Officer**, thereafter the RE on site is called in together with the CM. Should the issue go further, th**e local authorities** are called in	1			
Site 5	Safety Officer	**Inform the supervisor** of incident stop the activity. **Phone for medical response** and write out the **report** of what happened.	1			1
Site 6	Foreman (Managed the site)	Phone ambulance and police. Make a report. If small problem/injury - first aid box is used			1	1
Site 6	Traffic Safety Officer	Accident report. **SAPS official report**. Incidence				

		Report (nothing major)				
Site 6	Senior civil technician	N/A (not answered)	n/a	n/a	n/a	n/a
Site 6	H&S Officer	Inform the supervisor of incident stop the activity. Phone for medical response and write out the report of what happened.	1		1	1
Site 7	Transport Manager	**Reported to me**. Report to **police station**. Case number. I**nsurance company if operator is hurt, fill in an IOD form**. Compensation, **investigation conducted by company. Meeting with operator, drivers, to explai**n what could have been done to prevent that.	1	1		
Site 7	Technician	N/A (not answered)	n/a	n/a	n/a	n/a
Site 8	Site Manager	Operations stop immediately and area made safe. Safety team on site **investigates incident**. A flash report is sent out to the client. Action taken to close out incident	1	1		
Site 8	H&S officer	Follow through attached **Incident**			1	1

		Management and Reporting attached -First aid, medical treatment case, loss of time in injury/disabling injury. Fatality				
Site 8	Site Engineer	Stop all activities. **Take statement**. Inspect where accident occur. Do investigation then report on **prevention measures**		1		
Site 9	Safety Manager/Consultant	Annexure is referred for incident reporting				
Site 9	Safety Officer	H&S officer will write a report out. Operator's statement/ persons involved statement. People present at incident, witness statement	1			
Site 9	Safety Officer	Incident report filled, get the whole story, and take photos. Statement from witnesses. Taken hospital if severe injury, first aid if minor injury				
Site 10	Safety Manager/Consultant	Annexure is referred for incident reporting				
Site 10	H&S Officer on site	Forensic investigation, Barricade the area, take photos, statement of		1		

		what happened and mechanical checks, call labour department				
Site 10	Site supervisor	Evaluate how bad injury, first aid if minor, if serious taken to hospital. Forms are filled in IOD claims, incident report to department of labour. Safety officer does this				1
Site 11	Safety Manager/Consultant	Annexure is referred for incident reporting				
Site 11	Manager	Respective managers are alerted and calls an ambulance				1
Site 12	Safety Officer	Investigation is done by H&S officer. Report to department of labour if fatality	1	1		
Site 12	Construction site supervisor	**Safety rep or office are notified, Full report** submitted to safety manager (head office) this is the obligation of the safety manger on site	1			
Site 12	Assistant Project Manager	First Aid Kit is used. Safety guy informed. Report done.	1		1	
		TOTAL	18	10	10	12
		PERCENTAGE	46	26	26	31

		25. Describe the investigation and reporting process in the event of an accident or injury occurring on site.	Police and local authority involvement	Action taken to prevent future accident	Incidence Report	Meeting of involved persons and Management	Records kept to prevent future accidents	Report taken to Department of Labour
Site 1	Site Manager	Investigation, Report, Action taken to prevent future accident		1	1			
Site 1	Health & Safety Officer	**Treat incidence**, **Management notified and client**, **Report** from document what happened, **Records kept to prevent re-occurrence**				1	1	
Site 1	Construction site supervisor	**Safety rep or office** are notified, **Full report** submitted to safety manager (head office) this is the obligation of the safety manger on site			1			
Site 1	Assistant Resident Engineer	**Safety Officer needs to know about the incident**. **First aid** done. We need to **report to the safety rep.** If necessary, they will check how severe the problem with first aider is. Safety reps on site report to H&S officer.			1			

Site 1	Site Administrator	**Inform H&S Officer**. Depends on seriousness. Ambulance/Police. Paperwork - explain process to prevent. More precaution example for other sites		1				
Site 1	Site Clerk	Kind of difficult to explain... H&S officer will do an investigation. Every morning there is a tool box talk to follow procedures. Check breath, if not under the influence of alcohol. Tip truck device used to check speed... All help to avoid accidents. The more mistakes we make they lead to permanent damage.						
Site 2	Operations Manager/ director	Report by team leader to site manager, who **reports** to the safety officer, will assess situation together with the **first aider**. If minor, treated on site if major , person taken to hospital						
Site 2	Safety Officer	**Investigation** if it's a minor accident. I treat him/her on site. If it is serious I take him/her **to the hospital**						

Site 2	Health and Safety Officer	Form used by **first aide**r. He said what happens on the scene. Which body affected. What the first aider does. Then goes to H&S officer. She found out if negligence. Activities related. Recommend stops to prevent if it was a truck/driver maybe he took medication - dizzy.		1				
Site 2	Resident Engineer	This is don't by the safety officer and ultimately **a report** is furnished in the safety file			1			
Site 3	Operation s Manager	FEM **report (**detailed). That goes to the medical aid person. Head office keeps those accident injury reports			1			
Site 3	Health & Safety Officer	**Communicated to workers accidents/inciden t process**. NB immediately notifies safety rep -foreman- /supervisor. Paramedic on site/safety officer/**First aider** determine if ambulance required						
Site 4	Project Manager	H&S file -what you have to fill if accident occurs. Registration car			1			

		need and Identification of individual sent to **hospital**. Contractor monitors everything about the incident/injury						
Site 4	Site Manager	**H&S file Annexure A to be filled in**. **Hospital, police,** c**ompletes investigation**. **First Aid kit** - stays with safety officer						
Site 4	H&S Officer	**Inform the supervisor** of incident stop the activity. **Phone for medical response** and write out the **report** of what happened.			1			
Site 5	Site Technician (Consult Engineer)	**Photos** are taken and cause is written down in detail						
Site 5	Contracts Manager	All incidents are **reported to the H&S Officer**, thereafter the RE on site is called in together with the CM. Should the issue go further, th**e local authorities** are called in	1			1		
Site 5	Safety Officer	**Inform the supervisor** of incident stop the activity. **Phone for medical response** and			1			

		write out the **report** of what happened.						
Site 6	Foreman (Managed the site)	Police and local authority involvement	1		1			
Site 6	Traffic Safety Officer	Accident report. **SAPS official report**. Incidence **Report** (nothing major)	1		1			
Site 6	Senior civil technician	N/A (not answered)	n/a	n/a	n/a	n/a		
Site 6	H&S Officer	Inform the supervisor of incident stop the activity. Phone for medical response and write out the report of what happened.			1			
Site 7	Transport Manager	**Reported to me**. Report to **police station**. Case number. I**nsurance company if operator is hurt, fill in an IOD form**. Compensation, **investigation conducted by company. Meeting with operator, drivers, to explai**n what could have been done to prevent that.	1			1		
Site 7	Technician	N/A (not answered)	n/a	n/a	n/a	n/a	n/a	n/a
Site 8	Site Manager	Operations stop immediately and area made safe.		1	1			

		Safety team on site **investigates incident**. A flash report is sent out to the client. Action taken to close out incident						
Site 8	H&S officer	Follow through attached **Incident Management and Reporting attached -First aid, medical treatment case,** loss of time in injury/disabling injury. Fatality	1					
Site 8	Site Engineer	Stop all activities. **Take statement**. Inspect where accident occur. Do investigation then report on **prevention measures**			1		1	
Site 9	Safety Manager/ Consultant	Annexure is referred for incident reporting			1			
Site 9	Safety Officer	H&S officer will write a report out. Operator’s statement/ persons involved statement. People present at incident, witness statement			1		1	
Site 9	Safety Officer	Incident report filled, get the whole story, and take photos. Statement from witnesses. Taken hospital if severe injury, first aid if minor injury						

Site 10	Safety Manager/ Consultant	Annexure is referred for incident reporting			1			
Site 10	H&S Officer on site	Forensic investigation, Barricade the area, take photos, statement of what happened and mechanical checks, call labour department	1		1			1
Site 10	Site supervisor	Evaluate how bad injury, first aid if minor, if serious taken to hospital. Forms are filled in IOD claims, incident report to department of labour. Safety officer does this						1
Site 11	Safety Manager/ Consultant	Annexure is referred for incident reporting			1			
Site 11	Manager	Respective managers are alerted and calls an ambulance						
Site 12	Safety Officer	Investigation is done by H&S officer. Report to department of labour if fatality						1
Site 12	Construction site supervisor	**Safety rep or office are notified, Full report** submitted to safety manager (head office) this is the obligation of the safety manger on site			1			

Site 12	Assistant Project Manager	First Aid Kit is used. Safety guy informed. Report done.			1			
		TOTAL	6	4	20	3	3	3
		PERCENTAGE	15	10	51	8	8	8

		<u>**26.3 What follow up procedures are in place to ensure that H&S items are actioned?**</u>	Safety Officer is tasked to follow up	Hazardous are indented, preventative measures	Safety Audits	Daily site task inspection/ Check list	Report issued
Site 1	Site Manager	**Safety Officer** is tasked to resolve all issues in month and he reports on the next month's meeting	1				
Site 1	Health & Safety Officer	Hazards are indented; preventative measures are taken in place. H&S documentation must be done. Copy of Act should be followed by employees and employer		1			
Site 1	Construction site supervisor	**Safety Audit**s are done on a monthly basis by safety manager, client representative as well as the main contractor and consultant			1		
Site 1	Assistant Resident Engineer	Not sure. H&S Officer would know					
Site 1	Site Administrator	**Check List is done - Time frame. Audit Check that check list**			1		
Site 1	Site Clerk	**Daily procedures.** H&S officer make sure they action everything daily and he works with safety reps on site. Everything is made under control.	1				

		Safety rep report to him and he does the follow up					
Site 2	Operations Manager/director	If a **report is given, we ensure that it is done.** Make wrongs right. This is to be done immediately. This is given by the safety consultants, copy given to head office, site manager and safety officer. Attend to those problems, done immediately					1
Site 2	Safety Officer	We ensure that it is **done**				1	
Site 2	Health and Safety Officer	Going to each person - like a performance. Aim to check if workers know what they do				1	
Site 2	Resident Engineer	Unsure					
Site 3	Operations Manager	Actioned within 48 hours - all outstanding findings. Generally sorted out by them. Minor, admin issues/faults that are found. Normal admin issues					
Site 3	Health & Safety Officer	Meetings- there an action column which the H&S officer and chairperson of the committee follow up before the next meeting. Depending on severity of the issue. Critical issues are given time frames depending on severity.					
Site 4	Project Manager	Safety audits - safety guy comes to audit. I can do it but I don't have a list. I know a few things if in order or not			1		

Site 4	Site Manager	H&S audit done every month by consultant engineers.			1		
Site 4	H&S Officer	Safety office does daily check. Toolbox talks. Risk assessment of current work				1	
Site 5	Site Technician	A frequent check of the safety file is done				1	
Site 5	Contracts Manager	Minutes are minute and instructions issued to the relevant person in charge					
Site 5	Safety Officer	Safety office does daily check. Toolbox talks. Risk assessment of current work					
Site 5	Student Technician	Check list system is used - certain common tool box talks updated on safety.					
Site 6	Foreman (Managed the site)	Foreman on site to check and follow up H&S guy to ensure that everything is cool.					
Site 6	Traffic Safety Officer	Regular checks of PPE, plant and equipment, for example toilet facilities, checking					
Site 6	Senior civil technician	There is a safety office that is working fulltime on site who oversees all the work that is done and ensuring that we all work in a safety manner					
Site 6	H&S Officer	Safety office does daily check. Toolbox talks. Risk assessment of current work					
Site 7	Transport Manager	Toolbox talks, risk assessment daily					
Site 7	Technician	N/A	n/a	n/a	n/a	n/a	n/a

Site 8	Site Manager	If issues are identified a flash report to ensue if not issued an NCR will be issued to the H&S team. If there is a sitting on site a close out report is to be issued if not issued an NCR will be issued to the H&S team					1
Site 8	H&S officer	People are given deadline dates and it is followed up					
Site 8	Site Engineer	A date is given by which to action these items and if not actioned by date NCR is issued to them					
Site 9	Safety Manager/Consultant	Action list is made. You give them a list if not expected				1	
Site 9	Safety Officer	H&S committee holds up meetings on a monthly basis. Site meetings with contractors and management					
Site 9	Safety Officer	DSTI- Daily site task inspection to see that the things identified have been followed. Able to see that the accident used to face - reduced				1	
Site 10	Safety Manager/Consultant	Action list is made. You give them a list if not expected				1	
Site 10	H&S Officer on site	Site instruction book required onsite for H&S violations, in office on site				1	
Site 10	Site supervisor	Toolbox talks, everyone signs for it. If they don’t do it accordingly, three warnings they sent out of site. Replacement is sort					

Site 11	Safety Manager/Consultant	Action list is made. You give them a list if not expected				1	
Site 11	Manager	Meetings and discussions, walk about by management weekly					
Site 12	Safety Officer	Meetings take place with all staff present and safety talks are given by H&S officers					
Site 12	Construction site supervisor	Meetings and discussions, walk about by management weekly					
Site 12	Assistant Project Manager	Guys issued on site must check if the things have done. Check				1	
		TOTAL	2	1	4	10	2
		PERCENTAGE	5	3	10	26	5

		26.3 What follow up procedures are in place to ensure that H&S items are actioned?	Unsure/do not know	Time frame given	Chairperson of the committee follows up
Site 1	Site Manager	**Safety Officer** is tasked to resolve all issues in month and he reports on the next month's meeting			
Site 1	Health & Safety Officer	Hazards are identified; preventative measures are taken in place. H&S documentation must be done. Copy of Act should be followed by employees and employer			
Site 1	Construction site supervisor	**Safety Audit**s are done on a monthly basis by safety manager, client representative as well as the main contractor and consultant			
Site 1	Assistant Resident Engineer	Not sure. H&S Officer would know	1		

Site 1	Site Administrator	**Check List is done - Time frame. Audit Check that check list**			
Site 1	Site Clerk	**Daily procedures.** H&S officer make sure they action everything daily and he works with safety reps on site. Everything is made under control. Safety rep report to him and he does the follow up			
Site 2	Operations Manager/director	If a **report is given, we ensure that it is done.** Make wrongs right. This is to be done immediately. This is given by the safety consultants, copy given to head office, site manager and safety officer. Attend to those problems, done immediately		1	
Site 2	Safety Officer	We ensure that it is **done**			
Site 2	Health and Safety Officer	Going to each person - like a performance. Aim to check if workers know what they do			
Site 2	Resident Engineer	Unsure	1		
Site 3	Operations Manager	Actioned within 48 hours - all outstanding findings. Generally sorted out by them. Minor, admin issues/faults that are found. Normal admin issues		1	
Site 3	Health & Safety Officer	Meetings- there an action column which the H&S officer and chairperson of the committee follow up before the next meeting. Depending on severity of the issue. Critical issues are given time frames depending on severity.			1
Site 4	Project Manager	Safety audits - safety guy comes to audit. I can do it but I don’t have a list. I know a few things if in order or not			
Site 4	Site Manager	H&S audit done every month by consultant engineers.			

Site 4	H&S Officer	Safety office does daily check. Toolbox talks. Risk assessment of current work			
Site 5	Site Technician (Consult Engineer)	A frequent check of the safety file is done			
Site 5	Contracts Manager	Minutes are minuted and instructions issued to the relevant person in charge			
Site 5	Safety Officer	Safety office does daily check. Toolbox talks. Risk assessment of current work			
Site 5	Student Technician	Check list system is used - certain common tool box talks updated on safety.			
Site 6	Foreman (Managed the site)	Foreman on site to check and follow up H&S guy to ensure that everything is cool.			
Site 6	Traffic Safety Officer	Regular checks of PPE, plant and equipment, for example toilet facilities, checking			
Site 6	Senior civil technician	There is a safety office that is working fulltime on site who oversees all the work that is done and ensuring that we all work in a safety manner			
Site 6	H&S Officer	Safety office does daily check. Toolbox talks. Risk assessment of current work			
Site 7	Transport Manager	Toolbox talks, risk assessment daily			
Site 7	Technician	N/A	n/a	n/a	n/a
Site 8	Site Manager	If issues are identified a flash report to ensue if not issued an NCR will be issued to the H&S team. If there is a sitting on site a close out report is to be issued if not issued an NCR will be issued to the H&S team			
Site 8	H&S officer	People are given deadline dates and it is followed up		1	

Site 8	Site Engineer	A date is given by which to action these items and if not actioned by date NCR is issued to them		1	
Site 9	Safety Manager/Consultant	Action list is made. You give them a list if not expected			
Site 9	Safety Officer	H&S committee holds up meetings on a monthly basis. Site meetings with contractors and management			
Site 9	Safety Officer	DSTI- Daily site task inspection to see that the things identified have been followed. Able to see that the accident used to face - reduced			
Site 10	Safety Manager/Consultant	Action list is made. You give them a list if not expected			
Site 10	H&S Officer on site	Site instruction book required onsite for H&S violations, in office on site			
Site 10	Site supervisor	Toolbox talks, everyone signs for it. If they don't do it accordingly, three warnings they sent out of site. Replacement is sort			
Site 11	Safety Manager/Consultant	Action list is made. You give them a list if not expected			
Site 11	Manager	Meetings and discussions, walk about by management weekly			
Site 12	Safety Officer	Meetings take place with all staff present and safety talks are given by H&S officers			
Site 12	Construction site supervisor	Meetings and discussions, walk about by management weekly			
Site 12	Assistant Project Manager	Guys issued on site must check if the things have done. Check			
		TOTAL	2	4	1
		PERCENTAGE	5	10	3

		26.3 What follow up procedures are in place to ensure that H&S items are actioned?	Tool Box Talks	Risk Assessment	Instructions given to relevant person during meetings
Site 1	Site Manager	**Safety Officer** is tasked to resolve all issues in month and he reports on the next month's meeting			
Site 1	Health & Safety Officer	Hazards are identified; preventative measures are taken in place. H&S documentation must be done. Copy of Act should be followed by employees and employer			
Site 1	Construction site supervisor	**Safety Audit**s are done on a monthly basis by safety manager, client representative as well as the main contractor and consultant			
Site 1	Assistant Resident Engineer	Not sure. H&S Officer would know			
Site 1	Site Administrator	**Check List is done - Time frame. Audit Check that check list**			
Site 1	Site Clerk	**Daily procedures.** H&S officer make sure they action everything daily and he works with safety reps on site. Everything is made under control. Safety rep report to him and he does the follow up			
Site 2	Operations Manager/director	If a **report is given, we ensure that it is done.** Make wrongs right. This is to be done immediately. This is given by the safety consultants, copy given to head office, site manager and safety officer. Attend to those problems, done immediately			

Site 2	Safety Officer	We ensure that it is **done**			
Site 2	Health and Safety Officer	Going to each person - like a performance. Aim to check if workers know what they do			
Site 2	Resident Engineer	Unsure			
Site 3	Operations Manager	Actioned within 48 hours - all outstanding findings. Generally sorted out by them. Minor, admin issues/faults that are found. Normal admin issues			
Site 3	Health & Safety Officer	Meetings- there an action column which the H&S officer and chairperson of the committee follow up before the next meeting. Depending on severity of the issue. Critical issues are given time frames depending on severity.			
Site 4	Project Manager	Safety audits - safety guy comes to audit. I can do it but I don't have a list. I know a few things if in order or not			
Site 4	Site Manager	H&S audit done every month by consultant engineers.			
Site 4	H&S Officer	Safety office does daily check. Toolbox talks. Risk assessment of current work		1	
Site 5	Site Technician (Consult Engineer)	A frequent check of the safety file is done			
Site 5	Contracts Manager	Minutes are minuted and instructions issued to the relevant person in charge			
Site 5	Safety Officer	Safety office does daily check. Toolbox talks. Risk assessment of current work			
Site 5	Student Technician	Check list system is used - certain common tool box talks updated on safety.			

Site 6	Foreman (Managed the site)	Foreman on site to check and follow up H&S guy to ensure that everything is cool.			
Site 6	Traffic Safety Officer	Regular checks of PPE, plant and equipment, for example toilet facilities, checking			
Site 6	Senior civil technician	There is a safety office that is working fulltime on site who oversees all the work that is done and ensuring that we all work in a safety manner			
Site 6	H&S Officer	Safety office does daily check. Toolbox talks. Risk assessment of current work	1	1	
Site 7	Transport Manager	Toolbox talks, risk assessment daily	1	1	
Site 7	Technician	N/A	n/a	n/a	n/a
Site 8	Site Manager	If issues are identified a flash report to ensue if not issued an NCR will be issued to the H&S team. If there is a sitting on site a close out report is to be issued if not issued an NCR will be issued to the H&S team			
Site 8	H&S officer	People are given deadline dates and it is followed up			
Site 8	Site Engineer	A date is given by which to action these items and if not actioned by date NCR is issued to them			
Site 9	Safety Manager/Consultant	Action list is made. You give them a list if not expected			
Site 9	Safety Officer	H&S committee holds up meetings on a monthly basis. Site meetings with contractors and management			1
Site 9	Safety Officer	DSTI- Daily site task inspection to see that the things identified have been followed. Able to see that the accident used to face - reduced			

Site 10	Safety Manager/Consultant	Action list is made. You give them a list if not expected			
Site 10	H&S Officer on site	Site instruction book required onsite for H&S violations, in office on site			
Site 10	Site supervisor	Toolbox talks, everyone signs for it. If they don't do it accordingly, three warnings they sent out of site. Replacement is sort	1		
Site 11	Safety Manager/Consultant	Action list is made. You give them a list if not expected			
Site 11	Manager	Meetings and discussions, walk about by management weekly			1
Site 12	Safety Officer	Meetings take place with all staff present and safety talks are given by H&S officers			1
Site 12	Construction site supervisor	Meetings and discussions, walk about by management weekly			1
Site 12	Assistant Project Manager	Guys issued on site must check if the things have done. Check			1
		TOTAL	3	3	5
		PERCENTAGE	8	8	13

		26.3 What follow up procedures are in place to ensure that H&S items are actioned?	Tool Box Talks	Risk Assessment	Instructions given to relevant person during meetings
Site 1	Site Manager	**Safety Officer** is tasked to resolve all issues in month and he reports on the next month's meeting			
Site 1	Health & Safety Officer	Hazards are identified; preventative measures are taken in place. H&S documentation must be done. Copy of Act should be			

		followed by employees and employer			
Site 1	Construction site supervisor	**Safety Audit**s are done on a monthly basis by safety manager, client representative as well as the main contractor and consultant			
Site 1	Assistant Resident Engineer	Not sure. H&S Officer would know			
Site 1	Site Administrator	**Check List is done - Time frame. Audit Check that check list**			
Site 1	Site Clerk	**Daily procedures.** H&S officer make sure they action everything daily and he works with safety reps on site. Everything is made under control. Safety rep report to him and he does the follow up			
Site 2	Operations Manager/director	If a **report is given, we ensure that it is done.** Make wrongs right. This is to be done immediately. This is given by the safety consultants, copy given to head office, site manager and safety officer. Attend to those problems, done immediately			
Site 2	Safety Officer	We ensure that it is **done**			
Site 2	Health and Safety Officer	Going to each person - like a performance. Aim to check if workers know what they do			
Site 2	Resident Engineer	Unsure			
Site 3	Operations Manager	Actioned within 48 hours - all outstanding findings. Generally sorted out by them. Minor, admin issues/faults that are found. Normal admin issues			
Site 3	Health & Safety Officer	Meetings- there an action column which the H&S officer and chairperson of the committee follow up before the next meeting. Depending			

		on severity of the issue. Critical issues are given time frames depending on severity.			
Site 4	Project Manager	Safety audits - safety guy comes to audit. I can do it but I don't have a list. I know a few things if in order or not			
Site 4	Site Manager	H&S audit done every month by consultant engineers.			
Site 4	H&S Officer	Safety office does daily check. Toolbox talks. Risk assessment of current work		1	
Site 5	Site Technician (Consult Engineer)	A frequent check of the safety file is done			
Site 5	Contracts Manager	Minutes are minuted and instructions issued to the relevant person in charge			
Site 5	Safety Officer	Safety office does daily check. Toolbox talks. Risk assessment of current work			
Site 5	Student Technician	Check list system is used - certain common tool box talks updated on safety.			
Site 6	Foreman (Managed the site)	Foreman on site to check and follow up H&S guy to ensure that everything is cool.			
Site 6	Traffic Safety Officer	Regular checks of PPE, plant and equipment, for example toilet facilities, checking			
Site 6	Senior civil technician	There is a safety office that is working fulltime on site who oversees all the work that is done and ensuring that we all work in a safety manner			
Site 6	H&S Officer	Safety office does daily check. Toolbox talks. Risk assessment of current work	1	1	
Site 7	Transport Manager	Toolbox talks, risk assessment daily	1	1	
Site 7	Technician	N/A	n/a	n/a	n/a

Site 8	Site Manager	If issues are identified a flash report to ensue if not issued an NCR will be issued to the H&S team. If there is a sitting on site a close out report is to be issued if not issued an NCR will be issued to the H&S team			
Site 8	H&S officer	People are given deadline dates and it is followed up			
Site 8	Site Engineer	A date is given by which to action these items and if not actioned by date NCR is issued to them			
Site 9	Safety Manager/Consultant	Action list is made. You give them a list if not expected			
Site 9	Safety Officer	H&S committee holds up meetings on a monthly basis. Site meetings with contractors and management			1
Site 9	Safety Officer	DSTI- Daily site task inspection to see that the things identified have been followed. Able to see that the accident used to face - reduced			
Site 10	Safety Manager/Consultant	Action list is made. You give them a list if not expected			
Site 10	H&S Officer on site	Site instruction book required onsite for H&S violations, in office on site			
Site 10	Site supervisor	Toolbox talks, everyone signs for it. If they don't do it accordingly, three warnings they sent out of site. Replacement is sort	1		
Site 11	Safety Manager/Consultant	Action list is made. You give them a list if not expected			
Site 11	Manager	Meetings and discussions, walk about by management weekly			1
Site 12	Safety Officer	Meetings take place with all staff present and safety talks are given by H&S officers			1

Site 12	Construction site supervisor	Meetings and discussions, walk about by management weekly			1
Site 12	Assistant Project Manager	Guys issued on site must check if the things have done. Check			1
		TOTAL	3	3	5
		PERCENTAGE	8	8	13

		<u>28.3 If H&S sub-contractor H&S meetings are not held, give reasons?</u>	Team talk meeting held	Small site	Separate entity	Unsure
Site 1	Site Manager	N/A				
Site 1	Health & Safety Officer	N/A				
Site 1	Construction site supervisor	N/A				
Site 1	Assistant Resident Engineer	N/A				
Site 1	Site Administrator	N/A				
Site 1	Site Clerk	N/A				
Site 2	Operations Manager/director	Yes, team talk meeting. Minutes forwarded to principal contractor. Safety is e1plained in meetings which are signed by them. So that they don't blame management if action is taken against them	1			
Site 2	Safety Officer	Blank				
Site 2	H&S Officer	N/A				
Site 2	Resident Engineer	Unsure				1
Site 3	Operations Manager	See 27.1 small sites. Brick layering and lying time. Curbs and manholes. Sept encourages local employment therefor subcontractors are hired		1		

Site 3	Health & Safety Officer	N/A				
Site 4	Project Manager	N/A				
Site 4	Site Manager	N/A				
Site 4	H&S Officer	N/A				
Site 5	Site Technician (Consult Engineer)	N/A				
Site 5	Contracts Manager	N/A				
Site 5	Safety Officer	N/A				
Site 5	Student Technician	N/A				
Site 6	Foreman (Managed the site)	Management just talk to each other, follow the chain management	1			
Site 6	Traffic Safety Officer	Separate entity only action plan for day is discussed , check PPE				
Site 6	Senior civil technician	N/A				
Site 6	H&S Officer	N/A				
Site 7	Transport Manager	N/A				
Site 7	Technician	N/A				
Site 8	Site Manager	N/A				
Site 8	H&S officer	Less than 20 people		1		
Site 8	Site Engineer	N/A				
Site 9	Safety Manager/Consultant	They are generally held	1		1	
Site 9	Safety Officer	N/A				
Site 9	Safety Officer	N/A				
Site 10	Safety Manager/Consultant	No they - don't have meetings duplication				
Site 10	H&S Officer on site	Safety file - instructions on details protocols on plant. Medical certificate, management of plant	1			

Site 10	Site supervisor	N/A				
Site 11	Safety Manager/Consultant	N/A				
Site 11	Manager	N/A				
Site 12	Safety Officer	They form part of committee, so minutes are shared	1			
Site 12	Construction site supervisor	N/A				
Site 12	Assistant Project Manager	N/A				
		TOTAL	5	2	1	1
		PERCENTAGE	13	5	3	3

		29. What measures are in place to ensure that plant and equipment related accidents are mitigated or prevented from happening?	Daily Safety Site Instruction(DSCI)	Risk Assessment (RA)	Safety Work procedures (Check list, Method Statements)	Combined toolbox talks
Site 1	Site Manager	N/A				
Site 1	Health & Safety Officer	Daily DSTI done daily, Risk assessment, safety Work procedures, Combined toolbox talks, Inspections, Employees are to be competent, Supervision	1	1	1	1
Site 1	Construction site supervisor	All based on Task Risk Assessment. Supervisor will do the initial TRA then Safety officer will be given then the consultants are informed		1		
Site 1	Assistant Resident Engineer	Routine Maintenance, Certification of Plant				

Site 1	Site Administrator	Inspecting vehicle, maintaining of plant is important. If there is a problem with the Plant taken to yard… booking done - fixed - road test done before taken to site				
Site 1	Site Clerk	We make sure…tool box talks are strict - everyone must attend and sign and make sure they understand even done in own language daily. (7 official languages)				1
Site 2	Operations Manager/director	New ideas are always communicated, team talk done to get ideas passed on, safety officer implements				1
Site 2	Safety Officer	Ensure that he is competent operator, ensure that he is fit to work, ensure that the checklist is done				
Site 2	H&S Officer	To do services on machine and keep records. That is the key. To show that you are following up procedures				
Site 2	Resident Engineer	Checklists, Method Statements, Risk Assessments		1	1	
Site 3	Operations Manager	Ongoing training for operators and staff. P&E are in fine working order. P&E to be renewed when they reach a certain lifespan. Plant generally runs +/- 4 years before being replaced. Regular toolbo1 talks with site staff, highlighting danger and risks and e1posure. Ensuring operators work appropriate hours and are refreshed. Fatigue leads to many accidents. 2 Saturdays a month, other Saturdays rest			1	

Site 3	Health & Safety Officer	Weekly inspections on the sites are done. ID hazards are mitigated/eliminated. Foreman/Worker if they see/ID any H&S hazards they inform the safety rep on site.			1	
Site 4	Project Manager	Ensuring that machine are in good condition and operators are well trained				
Site 4	Site Manager	Toolbox talks - different topics every week, they sign to acknowledge it and outcome is known. All petty things like running around on site a machine are addressed. Don't sit on or near machine- they know that but they still do it after lunch chilling around the machine				1
Site 4	H&S Officer	Checklists, Daily task for operators , signage check list for construction work			1	
Site 5	Site Technician (Consult Engineer)	Plant should always be in a good condition				
Site 5	Contracts Manager	Strict adherence on site to all the requirements as per government legislature.			1	
Site 5	Safety Officer	Checklist, daily task for operator, signage check list for construction work			1	1
Site 5	Student Technician	Sign boards, better PPE, speed limits reduced to 10 km/h. Public awareness of what can happen on site, progress. (basically safety awareness)				
Site 6	Foreman (Managed the site)	Plant and equipment operators trained. Foreman on site. H&S officer and toolbox talks				

Site 6	Traffic Safety Officer	Checking PPE, up boards (advanced warning). Flagmen				
Site 6	Senior civil technician	There are enough safety hazards on site, The flagman are always on site, The works wear there PPE properly				
Site 6	H&S Officer	Follow procedure as per safety Act			1	
Site 7	Transport Manager	Toolbox talks, daily checklist , risk assessments		1	1	1
Site 7	Technician	N/A	n/a	n/a	n/a	n/a
Site 8	Site Manager	Method statements and Risk assessments are completed and approved for each task. The DSTI (Daily Safe Task Instruction) for each task is briefed to the team daily and the RA & MS is explained. The flagmen are in place. Access routes are agreed. Speed limits are set on site. Operators are trained with the correct certification to operate the plant. Medicals are completed for all operators. Daily plant check sheets are completed and checked. Drip trays in place. The team is wearing the correct PPE (ear plugs)	1		1	
Site 8	H&S officer	N/A				
Site 8	Site Engineer	Keep service records and daily inspection check sheets				
Site 9	Safety Manager/Consultant	Safety programmes, inspections, risk assessment , Toolbox talks		1	1	1

Site 9	Safety Officer	Tool box talks, induction training, supervision, risk assessment		1		1
Site 9	Safety Officer	Regulator maintenance. SOP for operators, Toolbox talks, Checklist on machinery - leakages, make sure machine in good condition			1	1
Site 10	Safety Manager/Consultant	Safety programmes, inspections, risk assessment , Toolbox talks		1		1
Site 10	H&S Officer on site	Safety file - instructions on details protocols on plant , medical cert , management of plant	1			
Site 10	Site supervisor	N/A	n/a	n/a	n/a	n/a
Site 11	Safety Manager/Consultant	Safety programmes, inspections, risk assessment , Toolbox talks		1		1
Site 11	Manager	Ongoing maintenance of equipment				
Site 12	Safety Officer	You try preventing hazards so that accidents don't happen. Daily safety talks with operators, risk assessment training as well				1
Site 12	Construction site supervisor	Ensure adequate lighting to prevent hazards. Less convention of plant and people required				
Site 12	Assistant Project Manager	Tool box talks, risk assessment		1		1
		TOTAL	3	9	12	13
		PERCENTAGE	81	23	31	33

		29. What measures are in place to ensure that plant and equipment	Employee		Routine Maintenance

		<u>related accidents are mitigated or prevented from happening?</u>	s are to be competent	Supervision	, Certification
Site 1	Site Manager	N/A			
Site 1	Health & Safety Officer	Daily DSTI done daily, Risk assessment, safety Work procedures, Combined toolbox talks, Inspections, Employees are to be competent, Supervision	1	1	
Site 1	Construction site supervisor	All based on Task Risk Assessment. Supervisor will do the initial TRA then Safety officer will be given then the consultants are informed		1	
Site 1	Assistant Resident Engineer	Routine Maintenance, Certification of Plant			1
Site 1	Site Administrator	Inspecting vehicle, maintaining of plant is important. If there is a problem with the Plant taken to yard… booking done - fixed - road test done before taken to site			1
Site 1	Site Clerk	We make sure…tool box talks are strict - everyone must attend and sign and make sure they understand even done in own language daily. (7 official languages)			
Site 2	Operations Manager/director	New ideas are always communicated, team talk done to get ideas			

		passed on, safety officer implements			
Site 2	Safety Officer	Ensure that he is competent operator, ensure that he is fit to work, ensure that the checklist is done	1		
Site 2	H&S Officer	To do services on machine and keep records. That is the key. To show that you are following up procedures			1
Site 2	Resident Engineer	Checklists, Method Statements, Risk Assessments			
Site 3	Operations Manager	Ongoing training for operators and staff. P&E are in fine working order. P&E to be renewed when they reach a certain lifespan. Plant generally runs +/- 4 years before being replaced. Regular toolbo1 talks with site staff, highlighting danger and risks and e1posure. Ensuring operators work appropriate hours and are refreshed. Fatigue leads to many accidents. 2 Saturdays a month, other Saturdays rest			
Site 3	Health & Safety Officer	Weekly inspections on the sites are done. ID hazards are mitigated/eliminated . Foreman/Worker if they see/ID any H&S hazards they inform the safety rep on site.			
Site 4	Project Manager	Ensuring that machine are in good			1

		condition and operators are well trained with abusers			
Site 4	Site Manager	Toolbox talks - different topics every week, they sign to acknowledge it and outcome is known. All petty things like running around on site a machine are addressed. Don't sit on or near machine- they know that but they still do it after lunch chilling around the machine			
Site 4	H&S Officer	Checklists, Daily task for operators , signage check list for construction work			
Site 5	Site Technician (Consult Engineer)	Plant should always be in a good condition			1
Site 5	Contracts Manager	Strict adherence on site to all the requirements as per government legislature.			
Site 5	Safety Officer	Checklist, daily task for operator, signage check list for construction work			
Site 5	Student Technician	Sign boards, better PPE, speed limits reduced to 10 km/h. Public awareness of what can happen on site, progress. (basically safety awareness)			
Site 6	Foreman (Managed the site)	Plant and equipment operators trained. Foreman on site. H&S officer and toolbox talks			

Site 6	Traffic Safety Officer	Checking PPE, up boards (advanced warning). Flagmen			
Site 6	Senior civil technician	There are enough safety hazards on site, The flagman are always on site, The works wear there PPE properly			
Site 6	H&S Officer	Follow procedure as per safety Act			
Site 7	Transport Manager	Toolbox talks, daily checklist , risk assessments			
Site 7	Technician	N/A	n/a	n/a	n/a
Site 8	Site Manager	Method statements and Risk assessments are completed and approved for each task. The DSTI (Daily Safe Task Instruction) for each task is briefed to the team daily and the RA & MS is explained. The flagmen are in place. Access routes are agreed. Speed limits are set on site. Operators are trained with the correct certification to operate the plant. Medicals are completed for all operators. Daily plant check sheets are completed and checked. Drip trays in place. The team is wearing the correct PPE (ear plugs)			
Site 8	H&S officer	N/A			

Site 8	Site Engineer	Keep service records and daily inspection check sheets			1
Site 9	Safety Manager/Consultant	Safety programmes, inspections, risk assessment , Toolbox talks			1
Site 9	Safety Officer	Tool box talks, induction training, supervision, risk assessment		1	
Site 9	Safety Officer	Regulator maintenance. SOP for operators, Toolbox talks, Checklist on machinery - leakages, make sure machine in good condition			1
Site 10	Safety Manager/Consultant	Safety programmes, inspections, risk assessment , Toolbox talks			1
Site 10	H&S Officer on site	Safety file - instructions on details protocols on plant , medical cert , management of plant			1
Site 10	Site supervisor	N/A	n/a	n/a	n/a
Site 11	Safety Manager/Consultant	Safety programmes, inspections, risk assessment , Toolbox talks			1
Site 11	Manager	Ongoing maintenance of equipment			1
Site 12	Safety Officer	You try preventing hazards so that accidents don't happen. Daily safety talks with operators, risk assessment training as well			

Site 12	Construction site supervisor	Ensure adequate lighting to prevent hazards. Less convention of plant and people required			
Site 12	Assistant Project Manager	Tool box talks, risk assessment			
		TOTAL	2	3	12
		PERCENTAGE	5	8	31

		29. What measures are in place to ensure that plant and equipment related accidents are mitigated or prevented from happening?	Employee training (safety programmes)	Sign boards, better PPE	Ensure adequate lighting and less congestion
Site 1	Site Manager	N/A			
Site 1	Health & Safety Officer	Daily DSTI done daily, Risk assessment, safety Work procedures, Combined toolbox talks, Inspections, Employees are to be competent, Supervision			
Site 1	Construction site supervisor	All based on Task Risk Assessment. Supervisor will do the initial TRA then Safety officer will be given then the consultants are informed			
Site 1	Assistant Resident Engineer	Routine Maintenance, Certification of Plant			
Site 1	Site Administrator	Inspecting vehicle, maintaining of plant is important. If there is a problem with the Plant taken to yard… booking done - fixed - road test done before taken to site			
Site 1	Site Clerk	We make sure…tool box talks are strict - everyone must attend and sign and make sure they understand			

		even done in own language daily. (7 official languages)			
Site 2	Operations Manager/director	New ideas are always communicated, team talk done to get ideas passed on, safety officer implements			
Site 2	Safety Officer	Ensure that he is competent operator, ensure that he is fit to work, ensure that the checklist is done			
Site 2	H&S Officer	To do services on machine and keep records. That is the key. To show that you are following up procedures			
Site 2	Resident Engineer	Checklists, Method Statements, Risk Assessments			
Site 3	Operations Manager	Ongoing training for operators and staff. P&E are in fine working order. P&E to be renewed when they reach a certain lifespan. Plant generally runs +/- 4 years before being replaced. Regular toolbo1 talks with site staff, highlighting danger and risks and e1posure. Ensuring operators work appropriate hours and are refreshed. Fatigue leads to many accidents. 2 Saturdays a month, other Saturdays rest	1		
Site 3	Health & Safety Officer	Weekly inspections on the sites are done. ID hazards are mitigated/eliminated. Foreman/Worker if they see/ID any H&S hazards they inform the safety rep on site.			
Site 4	Project Manager	Ensuring that machine are in good condition and operators are well trained	1		
Site 4	Site Manager	Toolbox talks - different topics every week, they sign to acknowledge it and outcome is known. All petty things like running around on			

		site a machine are addressed. Don’t sit on or near machine- they know that but they still do it after lunch chilling around the machine			
Site 4	H&S Officer	Checklists, Daily task for operators , signage check list for construction work			
Site 5	Site Technician	Plant should always be in a good condition			
Site 5	Contracts Manager	Strict adherence on site to all the requirements as per government legislature.			
Site 5	Safety Officer	Checklist, daily task for operator, signage check list for construction work			
Site 5	Student Technician	Sign boards, better PPE, speed limits reduced to 10 km/h. Public awareness of what can happen on site, progress. (basically safety awareness)		1	
Site 6	Foreman (Managed the site)	Plant and equipment operators trained. Foreman on site. H&S officer and toolbox talks	1		
Site 6	Traffic Safety Officer	Checking PPE, up boards (advanced warning). Flagmen		1	
Site 6	Senior civil technician	There are enough safety hazards on site. The flagmen are always on site. The works wear there PPE properly		1	
Site 6	H&S Officer	Follow procedure as per safety Act			
Site 7	Transport Manager	Toolbox talks, daily checklist , risk assessments			
Site 7	Technician	N/A	n/a	n/a	
Site 8	Site Manager	Method statements and Risk assessments are completed and approved for each task. The DSTI (Daily Safe Task Instruction) for each task is		1	

		briefed to the team daily and the RA & MS is explained. The flagmen are in place. Access routes are agreed. Speed limits are set on site. Operators are trained with the correct certification to operate the plant. Medicals are completed for all operators. Daily plant check sheets are completed and checked. Drip trays in place. The team is wearing the correct PPE (ear plugs)			
Site 8	H&S officer	N/A			
Site 8	Site Engineer	Keep service records and daily inspection check sheets			
Site 9	Safety Manager/Consultant	Safety programmes, inspections, risk assessment , Toolbox talks	1		
Site 9	Safety Officer	Tool box talks, induction training, supervision, risk assessment	1		
Site 9	Safety Officer	Regulator maintenance. SOP for operators, Toolbox talks, Checklist on machinery - leakages, make sure machine in good condition	1		
Site 10	Safety Manager/Consultant	Safety programmes, inspections, risk assessment , Toolbox talks	1		
Site 10	H&S Officer on site	Safety file - instructions on details protocols on plant , medical cert , management of plant			
Site 10	Site supervisor	N/A	n/a		
Site 11	Safety Manager/Consultant	Safety programmes, inspections, risk assessment , Toolbox talks	1		
Site 11	Manager	Ongoing maintenance of equipment			
Site 12	Safety Officer	You try preventing hazards so that accidents don't happen. Daily safety talks			

		with operators, risk assessment training as well			
Site 12	Construction site supervisor	Ensure adequate lighting to prevent hazards. Less congestion of plant and people required			1
Site 12	Assistant Project Manager	Tool box talks, risk assessment			
		TOTAL	8	4	1
		PERCENTAGE	21	10	3

		29. What measures are in place to ensure that plant and equipment related accidents are mitigated or prevented from happening?	Employee training (safety programmes)	Sign boards, better PPE	Ensure adequate lighting and less congestion
Site 1	Site Manager	N/A			
Site 1	Health & Safety Officer	Daily DSTI done daily, Risk assessment, safety Work procedures, Combined toolbox talks, Inspections, Employees are to be competent, Supervision			
Site 1	Construction site supervisor	All based on Task Risk Assessment. Supervisor will do the initial TRA then Safety officer will be given then the consultants are informed			
Site 1	Assistant Resident Engineer	Routine Maintenance, Certification of Plant			
Site 1	Site Administrator	Inspecting vehicle, maintaining of plant is important. If there is a problem with the Plant taken to yard… booking done - fixed - road test done before taken to site			
Site 1	Site Clerk	We make sure…tool box talks are strict - everyone must attend and sign and make sure they understand even done in own language daily. (7 official languages)			

Site 2	Operations Manager/director	New ideas are always communicated, team talk done to get ideas passed on, safety officer implements			
Site 2	Safety Officer	Ensure that he is a competent operator, ensure that he is fit to work, ensure that the checklist is done			
Site 2	H&S Officer	To do services on machine and keep records. That is the key. To show that you are following up procedures			
Site 2	Resident Engineer	Checklists, Method Statements, Risk Assessments			
Site 3	Operations Manager	Ongoing training for operators and staff. P&E are in fine working order. P&E to be renewed when they reach a certain lifespan. Plants generally run +/- 4 years before being replaced. Regular toolbo1 talks with site staff, highlighting danger and risks and e1posure. Ensuring operators work appropriate hours and are refreshed. Fatigue leads to many accidents. 2 Saturdays a month, other Saturdays rest	1		
Site 3	Health & Safety Officer	Weekly inspections on the sites are done. ID hazards are mitigated/eliminated. Foreman/Worker if they see/ID any \H&S hazards they inform the safety rep on site.			
Site 4	Project Manager	Ensuring that machine are in good condition and operators are well trained	1		
Site 4	Site Manager	Toolbox talks - different topics every week, they sign to acknowledge it and outcome is known. All petty things like running around on site a machine are addressed. Don't sit on or near machine- they know that but they still do it after lunch chilling around the machine			
Site 4	H&S Officer	Checklists, Daily task for operators , signage check list for construction work			

Site 5	Site Technician	Plant should always be in a good condition			
Site 5	Contracts Manager	Strict adherence on site to all the requirements as per government legislature.			
Site 5	Safety Officer	Checklist, daily task for operator, signage check list for construction work			
Site 5	Student Technician	Sign boards, better PPE, speed limits reduced to 10 km/h. Public awareness of what can happen on site, progress. (basically safety awareness)		1	
Site 6	Foreman (Managed the site)	Plant and equipment operators trained. Foreman on site. H&S officer and toolbox talks	1		
Site 6	Traffic Safety Officer	Checking PPE, up boards (advanced warning). Flagmen		1	
Site 6	Senior civil technician	There are enough safety hazards on site, The flagman are always on site, The works wear there PPE properly		1	
Site 6	H&S Officer	Follow procedure as per safety Act			
Site 7	Transport Manager	Toolbox talks, daily checklist , risk assessments			
Site 7	Technician	N/A	n/a	n/a	
Site 8	Site Manager	Method statements and Risk assessments are completed and approved for each task. The DSTI (Daily Safe Task Instruction) for each task is briefed to the team daily and the RA & MS is explained. The flagmen are in place. Access routes are agreed. Speed limits are set on site. Operators are trained with the correct certification to operate the plant. Medicals are completed for all operators. Daily plant check sheets are completed and checked. Drip trays in place. The team is wearing the correct PPE (ear plugs)		1	
Site 8	H&S officer	N/A			
Site 8	Site Engineer	Keep service records and daily inspection check sheets			

Site 9	Safety Manager/Consultant	Safety programmes, inspections, risk assessment , Toolbox talks	1		
Site 9	Safety Officer	Tool box talks, induction training, supervision, risk assessment	1		
Site 9	Safety Officer	Regulator maintenance. SOP for operators, Toolbox talks, Checklist on machinery - leakages, make sure machine in good condition	1		
Site 10	Safety Manager/Consultant	Safety programmes, inspections, risk assessment , Toolbox talks	1		
Site 10	H&S Officer on site	Safety file - instructions on details protocols on plant , medical cert , management of plant			
Site 10	Site supervisor	N/A	n/a		
Site 11	Safety Manager/Consultant	Safety programmes, inspections, risk assessment , Toolbox talks	1		
Site 11	Manager	Ongoing maintenance of equipment			
Site 12	Safety Officer	You try preventing hazards so that accidents don't happen. Daily safety talks with operators, risk assessment training as well			
Site 12	Construction site supervisor	Ensure adequate lighting to prevent hazards. Less convention of plant and people required			1
Site 12	Assistant Project Manager	Tool box talks, risk assessment			
		TOTAL	8	4	1
		PERCENTAGE	21	10	3