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THE COSTS OF CONSTRUCTION ACCIDENTS

by

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DECLARATION

I, Kersey Robin Pillay, declare that the contents of this dissertation/thesis represent my own unaided work, and that the dissertation/thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

	01st August 2014
Signed	**Date**

ABSTRACT

The construction industry contributes significantly to national economic growth and offers substantial opportunities for job creation; however the industry has continually been plagued by workplace accidents. Moreover, employers may not realize the economic magnitude of workplace injury and ill health arising from construction activities. These accidents represent a considerable economic and social burden to employers, employees and to society as a whole. Despite governments and organisations worldwide maintaining an on-going commitment towards establishing a working environment free of injury and disease, a great deal of construction accidents continues to frequent our society.

Given the high rate of construction accidents experienced, employers are not entirely mindful of the actual costs of construction accidents, especially when considering the hidden or indirect costs of accidents. Various safety research efforts have attempted to quantify the true costs of worker injuries, however localised systematic information on cost of construction accidents at work is not readily available from administrative statistical data sources, therefore this study was carried out in order to estimate the costs, like lost workdays or lost income, are clearly visible and can readily be expressed in monetary value; for a large part however, economic consequences of accidents are somewhat hidden.

Indirect costs following an accident may be disregarded, damage to the company image is difficult to quantify and pricing human suffering and health damage is subject to discussion. Nevertheless, it is possible to get an adequate insight into the costs of accidents and the potential benefits of accident prevention.

A systematic appraisal of accessible literature and statistical data was conducted in order to identify the best approaches to compartmentalising the various cost categories and then calculating each component of the construction accident costs.

The following costs were examined, namely:

a) Direct Costs
   - Medical (ambulance, doctor, medical, hospital); and
   - Wages for injured person/s

b) Indirect Costs
   - Overtime costs;
   - Time lost by injured employees and co-workers;
   - Injured employees productivity loss costs;

- Supervision and Management lost time;
- Incident investigation costs;
- Training of replacement employee;
- Additional medical costs;
- Damage to equipment, plant, tools, or other property;
- Idle plant and equipment; and
- Other (including Consumables, Legal and Funeral Costs).

The costs of construction accidents for the same sample of 100 construction analysed in this study has been estimated at a staggering R 32 981 200. Of this total, R 10 087 350 has been attributed to direct costs and R 22 893 850 has been attributed to indirect costs. These estimates are presented in Figure Appendix C. The costs of construction accidents are based on four cost components: sick pay, administrative costs, recruitment costs and compensation and insurance costs.

It should be noted that the estimates of the costs to employers presented in this study are reflective of the activities and incidents of the reviewed organisation and may not necessarily represent another organisation. The costs of construction accidents values presented in this study reveal that construction accidents present a substantial cost to employers and t to society at large, inclusive of both, the direct and indirect costs. It is therefore in the best interest of the employer to identify progressive and advanced approaches to more effectively manage construction health and safety, consequently society at large will benefit tremendously.

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DEDICATION

For Candice, Berisha, Nerissa, Tyuri, Jon-Elle and Reuel

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CHAPTER ONE

1.1 Introduction

The poor health and safety performance of the South African construction industry and associated accident costs to the industry are major cause for concern (Department of Labour, 2004). According to the Department of Labour (2012) the construction sector paid out more than R287 million (about USD34 million) on claims for injuries and illnesses that were work-related in the period ending March 2012. This large payout was for compensation of employees and medical costs associated with the injuries and illnesses. The construction injury rate was significantly higher than the rate for private industry as a whole. There were 171 fatalities and 755 injuries during the period 2007-2010 (Department of Labour, 2012).

The construction sector had gained notoriety as one of the high-risk industries that recorded excessive accident and fatality incidents almost every day (Department of Labour, 2008). The construction industry has unfortunately become stereotyped as an accident- prone sector. Records of the Compensation Board and Federated Employers' Mutual Assurance Company Ltd (FEM) report approximately 25,500 accidents per annum. The industry continued to rank third after mining and transport with respect to fatalities, with a total of 74 deaths recorded on site in 2003. Workers' unions were urged to play a more active role to reduce the high rate of workplace accidents and fatalities that were plaguing the construction industry (Department of Labour, 2008).

By their very nature accidents were undesirable events given their resultant unpleasant and damaging consequences. According to The European Agency for Safety and Health at Work (2003) accidents at work and the accompanying occupational injuries were a considerable economic burden to employers, employees and society as a whole. Since the mid-90s interest in improving construction site health and safety has been increasing for humanitarian reasons and because of the continually rising costs of worker compensation (Jaselskis, Anderson and Russell, 1996). The concurrent costs of construction related accidents and fatalities are considerable. Construction accidents in South Africa when compared with other sectors were more prevalent and the costs greater. The determination of the extent and nature of these costs motivate on both humanitarian and economic grounds for the development of preventative measures (Hinze, 2006).

Construction has been recognized by the South African government as a national asset given its potential contribution to the economic development of South Africa. The International Labour Organisation (ILO) pronounced that "rapid globalization has led to technological change and competitive pressures in the scramble for capital that often induce employers in these regions to regard occupational safety and health as an afterthought" (ILO, 2008: 2). Given the growing South African infrastructure needs and the intended spend of several trillion Rand; the escalation in construction activities could potentially escalate the incidence of construction accidents and fatalities with probable severe consequences for all concerned.

Unfortunately the construction industry continues to be one of the most hazardous industries within which to work. According to Egan (1998:15) ‘the health and safety record of construction is the second worst of any industry’ and suggested that ‘accidents [could] account for 3 to 6 percent of total project costs’.

Arguably, there is a fundamental need to examine the extent, nature and management of construction accidents and their related costs to improve overall construction health and safety management. The calculated costs of construction accidents to a large extent represent the losses incurred by a construction organisation (Tang, Ying, Chan, and Chan, 2004).

In terms of the Accelerated and Shared Growth Initiative of South Africa (ASGISA), the South African government has targeted selected interventions that include, inter alia, infrastructure delivery, sector strategies, and education and skills. Construction is expected to play a major role in achieving these outcomes. Many recent accidents involving loss of life and limb have occurred on construction sites around the country. These have created negative impressions of the industry (Haupt and Smallwood, 2005). Further, the South African government has captured the essence of the pivotal relationship between employers and their employees in the Occupational Health and Safety Act (OHSA) 85 promulgated in 1993 (Haupt, 2003).

OHSA clause 8(1) requires all employers in South Africa to provide and maintain a working environment that was safe and without risk to the health of their employees. Additionally, OHSA clause 8(2)(e) requires employers to provide such information, instructions, training and supervision as might be necessary to ensure the health and safety of their workers. The findings of a recent study in South Africa during which 252 industry stakeholders were surveyed indicated a need for the following, namely:

- Endeavors to enhance the health and safety culture of the industry;
- The realization that all accidents can be prevented; and
- The motivation for health and safety based upon the impact of the cost of accidents on the cost of construction (Smallwood and Haupt, 2005).

Construction accidents cost the construction organization, the sector and national economy a great deal annually. Such is the magnitude of the problem that a definitive cost has to date never been determined (Griffith and Howarth, 2000). Economists have usually argued for the assessment of the benefits of investments in health and safety on the basis of a cost-benefit analysis (Hjalte, Noriner, Perrson and Maraste, 2003). The cost of accidents can be characterized by the distinctive iceberg effect. While the 'tip of the iceberg' reveals visible and tangible costs, the submerged bulk of the iceberg conceals much of the hidden and often indeterminate financial implications.

1.2 Preliminary Literature Review

Several studies have produced various estimates relative to the costs of construction accidents. For example, based upon the value of construction work completed in the year 2002, namely R56, 343million the total cost of accidents in South Africa could have been between 4.3%, and 5.4% of the value of completed construction (Smallwood, 2004), an unacceptable cost to the national economy.

The Compensation for Occupational Injuries and Diseases Act, 1993 Report on the 1999 Statistics (Compensation Commissioner, 2005) established that the Accident Statistics for the year 1999 include 179,399 Accident Fund cases finalized at that date and 44,215 cases reported during 1999 for the other insurance carriers, making a total of 223,614 cases in respect of which compensation and/or medical aid was paid.

The Federated Employers' Mutual Assurance Company Limited ("FEM") registered 9,184 claims in 2006, (2005: 8,720) having increased by 5% (2005: 8%) and medical claims paid have increased by 30% (2005: 23%), with the growth in business of 39% (2005: 24%). There has been a significant increase in claims paid during 2006, given the high level of economic activity, in the construction industry (FEM, 2006).

The construction industry in the United States of America (U.S.A.) is one of the most dangerous industries. In 2004, construction employed 7.7% of all workers but suffered 22.2% of all work-related fatalities. The increase in non-fatal injuries and illnesses with days of work were 71% higher than all industry as a whole (Waehrer, Dong, Miller, Haile, and Men, 2007). However, there are few estimates of the costs associated with construction injuries. A NIOSH report on the costs of workplace fatalities estimated that construction fatalities cost about $10 billion (about R85 billion) for the 10-year period from 1992-2002 (NIOSH, 2006).

In 1981, a study was commissioned by the Business Roundtable (BR) to ascertain the true costs of accidents and injuries in the construction industry (Business Roundtable, 1982). The study found that accidents and injuries accounted for 6.5% of the total cost of industrial, commercial, and utility construction. Since the time of the original study much has changed in the construction industry. The costs of workers' compensation insurance have increased considerably. Further, there has been an escalation of third-party lawsuits as a result of accidents on construction sites. The total costs of accidents had risen to between 7.9% and 15.0% of the total costs of non-residential new construction (Howell, 1998).

The Accident Prevention Advisory Unit (APAU) of the Health and Safety Executive (HSE) undertook detailed case studies, involving organisations from various industries with the aim of developing a methodology to accurately identify the full cost of accidents (HSE,1993a). The results from these studies suggested that accidents cost

- As much as 37 percent of the annualised profits of an organization;
- The equivalent of 8.5 percent of the project tender price; and
- Approximately five percent of the annual organizational running costs.

The cost to any organisation can be considerable and in a worst case scenario may make the difference between a company continuing to exist and going out of business.

The costs associated with construction-related accidents could vary radically depending on the severity of the consequences of the accident and other influencing conditions. Severity could range from minor accidents involving little or no absence from work to fatalities. The more severe the accident the longer the time typically required for a worker to recover and return to normal occupational duties. Consequently, the associated costs could be even much higher (Levitt and Samelson (1993). Evidently, the more intensive the medical treatment required by the injured worker the higher would be the costs associated with the accident (Hinze, 2006). According to Everett and Frank (1996), in addition to a moral or humanitarian commitment, owners had an economic incentive to reduce the number of accidents that occurred on their construction sites.

The association between fatal and other accidents points in an interesting direction. As early as the 1930s Herbert William Heinrich introduced an influential iceberg model of occupational accidents (Heinrich et al., 1980). One empirical finding from Heinrichs' literature (Heinrich, 1931) which became known as Heinrich's Law contended that in a workplace, for every accident that caused a major injury, there were 29 accidents that caused minor injuries and 300 accidents that caused no injuries. According to this model material hazards, near misses, major and minor accidents and deaths at work followed each other in a logical manner. Therefore, one death at work was a likely indication of a large number of safety and production problems at the workplace, and consequently, the health and safety problems needed to be managed to prevent that one death. Heinrich's studies investigated accidents that occurred in the 1920s. Occupational health and safety has changed substantively since then. Arguably, therefore, the current value and applicability of his conclusions should be re-examined.

As far as the researcher is aware, to date no significant research has been done in South Africa to determine what the actual costs of construction accidents might well be. For material losses in which no injury occurs the accounting of loss can be easily assessed. However, where human loss was concerned, the costing becomes more difficult since life or a physical facility cannot crudely be financially evaluated, yet it has been widely recognized that monetary compensation to either the injured party or relatives in the event of fatality has to be paid.

The total cost of accidents on a construction site depended on project health and safety performance (Tang, 2002). If the health and safety performance was good, it could be expected that the accident costs would be low and vice versa. Consequently, the health and safety performance of a construction site varied with the amount of health and safety investment in the project.

In 1999, the total annual cost of work-related accidents in the EU with 15 members reached an astronomical 500 million working days (Eurostat, 2004). The Fact Sheet also highlighted that in the European Union construction was the sector most at risk of accidents, with more than 1,300 fatal construction accidents every year.

The costs of accidents could be categorised into direct and indirect costs (Hinze (1994). Several direct and indirect costs were associated with any accident. The extent of these costs varied with the severity of the consequences of an accident. Severity could range from minor accidents involving little or no absence from work to fatalities.

1.2.1 Direct Costs

Direct costs tended to be those associated with the treatment of the injury arising from the accident and any unique compensation offered to workers as a consequence of being injured (Levitt and Samelson, 1993). These expenses that could be easily-identified were the 'direct costs' of the accidents. These costs are in the main covered by workers' compensation insurance. Further, historical records could be reviewed to determine the expenditure attributed to each particular injury in the organization. Hinze (2006) confirmed that most of these costs were covered by workers' compensation insurance, such as medical expenses, lost wages, sick leave administration, temporary disability payments and hospitalization. However, the remaining costs had to be covered by the business itself. What may initially be classified as an inconsequential or minor accident could prove to be exceedingly costly in terms of the associated indirect costs.

1.2.2 Indirect Costs

Less evident expenses associated with accidents are known as indirect or hidden costs and can typically be several times greater than the value of the direct costs. Hinze (1994) describes indirect costs as the most evasive cost component associated with construction worker injuries and the elusiveness of the indirect costs of these injuries lies in the lack of a clear definition of these costs.

According to Levitt & Samelson (1993) indirect costs, inter alia, included:

- Reduction in productivity;
- Costs of clean-up after the accident;
- Costs of replacing material, plant and equipment;
- Stand-by costs of idle plant and equipment;
- cost of overtime worked to make up for the resultant delays;
- administrative costs in terms of paperwork related to claims and reports;
- orientation of the replacement worker/s;
- costs resulting from delays;
- additional supervision costs;
- costs related to rescheduling of the work to ensure timely completion;
- transportation of injured worker/s; and
- wages paid while injured worker/s was/were idle.

These indirect or hidden costs typically exceeded the direct costs. Because of their intrinsic nature indirect cost data was considerably more difficult to access than direct costs because the information was not often captured or quantified as they accrued. When estimates of indirect costs were made, it was common for the records to be either inaccurate or incomplete or both. Research conducted by the University of Washington (Hinze, 1992) determined that the indirect costs (excluding claims and material damage costs) were greater than one-and two-thirds the direct costs of accidents. Other studies conducted by Occupation Safety and Health Administration (OSHA, 1996) suggested that the ratio between direct costs and indirect costs varied widely, ranging from a high of 1:20 to a low of 1:1. Research conducted by Smallwood (2000) in South Africa determined the indirect costs to be 14.2 times the direct costs. These costs were usually several times greater than the insured or direct costs (Everett and Frank, 1996). An iceberg graphically reflects the relationship between direct and indirect costs. The costs recoverable through insurance were visible, but hidden beneath the surface were the uninsured or indirect costs. Estimated ratios of direct to indirect costs from previous studies by the South African Department of Labour; Compensation for Occupational Injuries and Diseases (COID) ranged from less than 1:1 to 1:36. The Department argued that a conservative estimate for the ratio was 1:2. Several authorities, however, preferred to use a 1:4 ratio to calculate the total costs of injuries related to accidents.

The indirect costs, which were often overlooked, had been found to be detrimental to the overall performance of a business (Hinze, 1992). Importantly that there was no definitive or absolute list of cost factors that could be employed to completely determine all indirect costs relative to accidents. Apart from the human cost of suffering due to an accident, the economic effects could be devastating. For every figure of an accident costs that an insurance company has to pay out, could cost the affected organisation several times more in indirect costs. Hinze (1992; 2006) contended that these indirect costs could range extensively, from lost production costs to legal costs.

1.3 Studies on Accident Costs

The British Robens Committee was appointed in the United Kingdom to review the provisions made for the health and safety of persons in the course of their employment (Simpson, 1973). The Committee sampled 2,100 construction accidents, with accident severity, forming the basis of the survey. The surveys established those direct costs of occupational accidents within the industry which were directly measurable in financial terms, as well as indirect costs which were measured first in labor time and subsequently translated into financial equivalents. These costs were then compared with external effects, such as insurance premiums. There was wide disparity between average insurance premiums within the industry and all combined uninsured costs associated with any one accident. The Robens committee reported in June 1972, from which report the renowned Health and Safety at Work Act 1974 came into being.

According to the European Commission Director-general for Employment and Social Affairs, Odile Quintin (2004), despite there being legislation in place, there was insufficient enforcement of regulations to prevent employers from neglecting their health and safety obligations to their construction workers. Reportedly there in excess of 800,000 construction accidents in the European Union each year, causing 1,200 deaths and costing more than €75 billion. European commissioners declared that more needed to be done to reduce this unacceptable toll.

A study by the Health and Safety Laboratory reported by Binch and Bell (2007) was done to determine the feasibility of different options for collecting the data required by the Economic Analysis Unit (EAU) to calculate the overall cost of accidents, and identify an appropriate methodology to collect this data from industry. The feasibility of collecting data on the following aspects was considered, namely

- Number of non-injury accidents;
- Costs of non-injury accidents;
- Cost of damage to equipment for accidents involving injury; and

- Ratio of number of non-injury to injury accidents –calculated from information on injury and non-injury accidents.

The feasibility study was done across a variety of sectors to discuss how information on non-injury accidents and associated costs were collected and, given that organisations might not be collecting this data, explored ways that the data could be collected. The results would be used to comment on the appropriateness and utility of various data collection methods. Participants in the study reported a number of barriers to collecting information on non-injury accidents. Time and resources were found to be the most frequently reported barriers. Further, many companies indicated that they would not consider potential costs that were less than the excess to be paid on their insurance claims. There were many possible methods to collect data on non-injury accidents and their associated costs that could be explored such as a pilot study, large-scale survey or case studies. The key criterion for data collection should be the minimisation of the administrative burden on businesses by simplifying the data collection and reporting processes. However, before any data collection could be attempted companies needed to understand what data should be collected and how to do so.

In the United States of America (USA) a daily average of 9,000 workers sustain disabling injuries on the job. Approximately 153 die due to either injury or work-related diseases with a direct cost of about $40.1 billion and indirect cost of over $200 billion a year (CDC2004, NIOSH, 2004).

Tang et al., (2004) conducted a study on the social costs of construction accidents for the period 1999 through 2001 from 119 construction projects involving 1,414 accidents and from 18 government departments in Hong Kong. They identified the safety investments made by both contractors and society based on the gathered data. They found an increasing trend in social health and safety investments and a decreasing trend in the social costs of construction accidents from 1999 to 2001. During this period, for every extra $1 of social health and safety investments made, a reduction of $2.27 of the social costs on construction accidents was achieved.

This particular study is one part of a research project investigating the causes and costs of accidents with a view to preventing them from occurring in the context of a major multi-national organization. The other study on accident causation is reported on in a different master’s degree dissertation.

1.4 Problem Statement

Given the high incidence of construction-related accidents in South Africa, the nature and overall cost implications have to date not been definitively determined as a consequence of inadequate accident recordkeeping and investigation procedures resulting in the design and implementation of preventative measures that do not reduce or eliminate the likelihood and consequences of construction accidents.

1.4.1 Hypotheses

The hypotheses to be tested are:

- **Hypothesis 1**
  Whenever a construction related accident occurs, consequent disproportionate direct and indirect costs are incurred.
- **Hypothesis 2**
  No attempt is made to quantify the associated true costs of construction accidents.
- **Hypothesis 3**
  Inadequate efforts are made during incident investigations to determine the true costs in respect of construction accidents and the ensuing economic effects.

1.5 Aim

The aim of the research is to analyse construction accident statistics within a major organisation with a large construction spend capacity in order calculate the extent of costs as well as to demonstrate the staggering effect that these accidents have on the organisation.

Despite the importance of construction safety and productivity, very little research is done to determine the costs associated with construction related accidents. To date no significant research has been done in the organisation referred to previously to determine what the actual costs of accidents might be.

This project seeks to make that contribution by analysing the records of accident reports within the utility to determine the extent of the costs of accidents.

1.6 Objectives

The objectives of the study are:

- To conduct an analysis of construction accident reports in order to establish, as far as practically reasonable, the total costs of various types of construction accidents;
- To differentiate and determine those costs that are classified as direct costs as opposed to indirect costs;
- To ascertain the individual costs correlated to the various direct and indirect categories; and
- Through the findings of the study to contribute to an increased awareness of the negative impact of accidents on overall project performance.

1.7 Methodology

In an attempt to obtain a broad-spectrum perception of the cost of construction accidents, an exploratory review of 30 randomly selected and analyzed construction related accidents was conducted within an organization which has a five-year construction volume in excess of R300 billion. The number of accidents reported during the period of 1 April 2007 to 31 March

2008 was 872. This study found that the consequences ranged from fatalities to severe lost time and major medical treatment. Analysis of the records highlighted the dominant prevalence of three categories of accidents, namely:

- accidents involving persons cut or caught in/between;
- being struck by or against; and
- falls

In order to achieve the objectives of the study, a comprehensive review of construction related accidents has been carried out using the accident databases of four Divisions within the same organisation. All construction accidents included in the review needed to meet the definition of 'an unplanned event that results in injury or ill health of people'.

The review period of 1 April 2006 to 31 March 2008 has been used, examining all construction accidents relative to lost time accidents that occurred during this period. By using systematic random sampling a sample of 100 construction-related accidents was selected and analyzed.

The research methodology involves the following, namely:

- Extensive literature review: theories; accident costing models; record keeping; subject matter expertise about the costs of construction incidents;
- Acquisition of access to actual investigation records;
- Analysis of acquired data;
- Validation of the findings from the analysed data to the literature; and
- Formulation of sustainable and effective interventions.

To achieve the objectives of the study, the research methodical approach as depicted in Figure 1.1 will be followed.

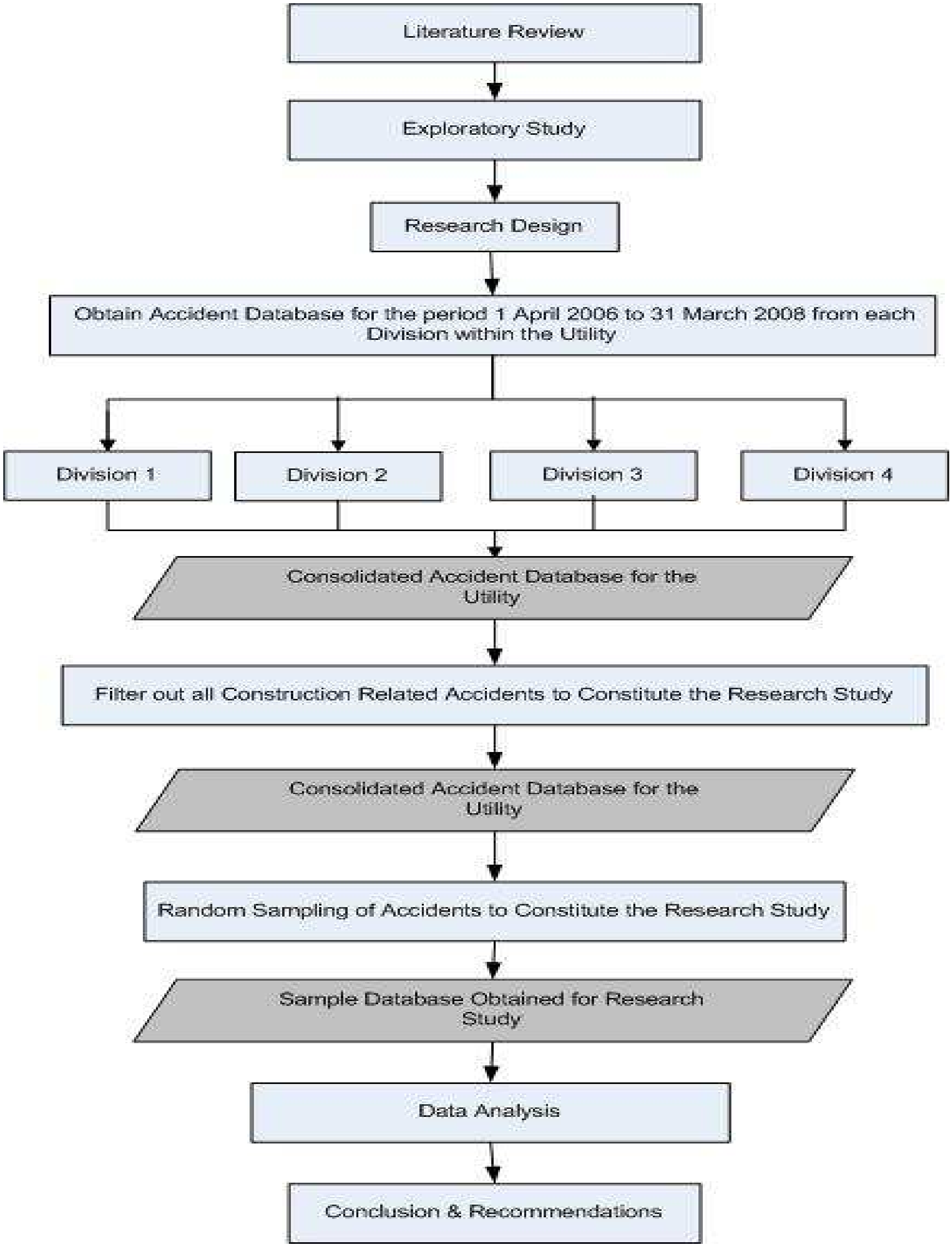

Figure 1 Research Methodology

1.8 Limitations

The study is subject to several limitations relating to the availability of requisite data as well as due to the relatively small sample that was measured. Only the construction related lost time accidents were considered for analysis, in so doing excluding near-miss, first aid and medical accidents.

Based on experience with the earlier exploratory study (Pillay and Haupt, 2008), several indirect cost categories have been omitted from the research. These are, namely:

- Loss of reputation and image;
- Loss of business and goodwill;
- Pain and suffering; Idle workers lost time;
- Remedial work/correction;
- Production loss and process delays; and
- Negative image.

However, while these costs will not be calculated, they do contribute to the overall cost of accidents. Consequently, the costs established will be understated by the costs of these items.

1.9 Sample

The study will be confined to a national organisation within which several considerable construction projects are being undertaken.

1.10 Data Access and Uniformity of Information

Incident reports are independently archived by business units and not kept in a centralized location. The reports are variable in the level of detail captured and assortments of formats are utilized. Investigation records are often fragmentary and essential cost determining data is unstipulated.

1.11 Selection of Data

The accident investigation records to be analysed will consist of construction related lost time incidents for the period of 1 April 2006 to 31 March 2008.

1.12 Approximation and Scope

There are numerous indirect and hidden costs resulting from accidents which are very difficult or virtually impossible to quantify. A substantial list of indirect costs will however be investigated. Approximate calculations will be applied to categories where precise values are unattainable. Given the complexity and impracticality of determining the cost effects of some of these, they will not be included in the study. The following indirect costs will be examined, namely:

- Overtime costs;
- Time lost by injured employee and co-workers;

- Injured employee's productivity loss costs;
- Supervision & Management lost time;
- Incident investigation costs;
- Training of replacement employee;
- Additional medical costs;
- Damage to equipment, plant, tools, or other property;
- Idle plant and equipment; and
- Other (including Consumables, Legal and Funeral Costs).

1.13 Assumptions

It is assumed that records and data acquired from the various business units will be accurate and the providers will be forthcoming with required information.

1.14 Ethical Considerations

To comply with internationally accepted ethical standards, no reference to actual names of individuals or companies will be recorded. In this way, no individual or company can be linked to a particular accident, thus assuring anonymity.

No compensation will be paid to any respondent or participant in the study. Quality assurance will be done with respect to the following aspects, namely:

- Quality of data capturing
- Accuracy in calculations.

1.15 Definition of Key Terms and Concepts

1.15.1 Accident

'An unplanned event that results in injury or ill health to people or damage or loss to property, plant, materials, or the environment, or a loss of business opportunity' (Griffith and Howarth, 2000).

Hinze (2006) articulates that an accident can be defined as an unplanned event and does not necessarily result in injury.

1.15.2 Accident Cost

The absolute expenditure with respect to an accident (Levitt and Samelson, 1993). In this study the cost may not necessarily be represented by an amount, but may well be illustrated by events and activities.

1.15.3 Direct Costs

Direct costs tend to be those associated with the treatment of the injury and any unique compensation offered to workers as a consequence of being injured and are covered by workmen's compensation insurance premiums (Hinze, 2006).

1.15.4 Incident

An accident was defined as any unplanned event that results in injury of people, damage or loss to plant materials or the environment, or loss of a business opportunity (HSE, 1999a).

1.15.5 Indirect Costs

The indirect costs are those which are hidden and for which no historical record is kept (Levitt and Samelson, 1993).

1.15.6 Lost Time Accident (LTI)

A work injury, including any occupational disease/illness or fatality, which arises out of and in the course of employment, and which renders the injured employee or contractor unable to perform his/her regular/normal work on one or more full days or shifts (other than the day or shift on which the injury occurred), including Saturdays, Sundays and public holidays (32-95, 2008).

1.16 Outline of Study

Chapter One: Introduction - Chapter one presents the Background, Problem Statement, Hypothesis, Objectives, Methodology, Limitations, Definitions, Ethical Statement and Chapter Outline.

Chapter Two: Literature Review - This chapter explores previous studies pertaining to the cost of construction accidents. The various associated costs relative to the quantified categories will be discussed.

Chapter Three: Methodology - This chapter discusses the tools and methods to be used for data gathering. Challenges faced during data collection exercise will be disclosed.

Chapter Four: Findings and Discussion - This chapter presents the analysis of data gathered from the organisation. Data analysis will focus on testing the hypothesis at the same time responding to the research problem and objectives.

Chapter Five: Conclusion and Recommendations - Conclusions and recommendations are drawn based upon data analysis, linking them to the problem statement, hypothesis and objectives of the subject under investigation.

CHAPTER 2: REVIEW OF RELATED LITERATURE

2.1. Introduction

This chapter comprehensively reviews relevant literature on costs of accidents. Several researchers and academics have researched and written about the costs of accidents. However, most literature has focused on the actual costs associated with construction accidents in first world countries and very little work within a developing country, let alone an African context.

According to Hinze (2006: 63)

"*If the true costs of injuries were well defined, management would be in a better position to make informed decisions concerning [health and] safety. Rather than addressing [health and] safety solely from an altruistic point of view, owners should also consider [health and] safety from a more purely economic perspective*".

Many researchers have echoed these sentiments. It is therefore fundamental that an understanding of the true costs of construction accidents is obtained in order to properly inform management and management policies. Various authors some years ago such as Klen (1989), Laufer (1987), Leathers and Williams (1984) and Leopold and Leonard (1987) argued that studies on the cost of accidents would motivate more dynamic efforts at accident prevention by employers.

An inherent limitation to conducting construction accident costing studies in South Africa results from inadequate costing data being available. Systematic and dependable information on the costs of accidents at work is typically not available from company administrative statistical data sources or from the South African Department of Labour.

2.2. Construction Industry Health and Safety Performance

Accidents in the construction industry represent a substantial on-going cost to employers, workers and society (Haslam, *et al.,* 2005). In the past decade, many parties in the construction have become very interested in finding ways of curbing construction related injuries and fatalities (Jaselskis, Anderson and Russell, 1996; Everett and Frank, 1996; Joyce, 2001). Most of these interests have been rooted in the escalating costs of injuries largely attributed to the rising costs of medical treatment and insurance.

Additionally, much emphasis has been placed on investigating problems related to legislation and documentation (Perry, 2003). In spite of the knowledge gained and the various acts and regulations that exist and which arguably should, if complied with, improve health and safety performance on construction sites, numerous serious accidents continue to occur. In South

Africa, to date too little has been done relative to quantifying the actual costs of construction accidents.

The construction industry has the second worst industrial record for health and safety in the world when compared with other industries (Egan, 1998; Bomel, 2001). The total financial impact of costs such as lost productivity and overtime has been estimated by the 2002 Safety Index of Liberty Mutual to be as much as $240 billion (about R2,000 billion). Direct workers compensation costs in the United States were estimated to be $48.6 billion (about R400 billion) for the most disabling workplace injuries and illnesses in 2006. By adding the indirect cost of workers' compensation claims to the $38.7 billion (about R320 billion) in direct costs, the total economic burden of workplace injuries and illness is far greater, with estimates ranging between $125 billion to $155 billion (between about R1,000 billion to R1,250 billion). According to Everett and Frank (1996), the worst-case scenario was that accidents and injuries cost in excess of 15% of construction costs.

In the United Kingdom, five studies were undertaken by the Health and Safety Executive on accident costs using a total loss approach (HSE, 1997). This approach found that eight percent of the studied accidents studied had the potential for more serious consequences, namely fatalities, multiple injuries or catastrophic losses. These accidents had the potential for being significantly more serious than they actually were. According to the Health and Safety Executive (1997) the typical cost to employers of a serious or major injury was about £17, 000 to £19, 000 (about R255, 000 to R300, 000).

While most accidents potentially could cause both property damage and personal injury, some injury accidents were unlikely to cause property damage. Even though those accidents that caused property damage did not have the potential to cause harm, they still had costs associated with them.

For decades it has been recognized by numerous authors and through an assortment of studies that the costs of accidents were considerable and expensive (Everett and Frank, 1996; Jaselskis, Anderson and Russell, 1996; Waehrer, Dong, Miller, Haile, and Men, 2007). Construction accidents were obviously costly, both in terms of human suffering and financial terms, and should be avoided (Jallon, Imbeau and de Macellis-Warin, 2011). This view is endorsed by Dorman (2000) who suggested that preventing occupational accidents made good economic sense for society as well as being good business practice. Knowing the costs of occupational accidents makes it possible for companies to derive the benefit of the corporate occupational health and safety effort in terms of costs that could be avoided if the accidents were prevented – thereby increasing the bottom line.

Losing skilled or specialist construction workers, even for a short period, could have a greater effect than direct financial costs might initially suggest. Many organisations had little mitigation against accidental losses. A serious accident might possibly have substantial cost and other implications on an organisation – even resulting in it going out of business.

2.3. Previous Studies of Accident Costs

The modern study of accident costs was pioneered by Heinrich (1959) in the United States during the 1920s when he surveyed thousands of cases and concluded that management grossly underestimated the real cost of injuries in the workplace because many of the costs were hidden from their view (Rikhardsson and Impgaard, 2004). These hidden or indirect costs could be as much as 75% of the total costs of an average occupational accident. Unfortunately, many of the claims of the studies were exaggerated, and the cost categories not very clearly defined. Recently a variety of alternative cost accounting systems have been proposed, namely controllable/uncontrollable, fixed/variable, and insured/uninsured. The classification methodology often varied widely from one study to the next.

Almost no comprehensive South African research efforts have attempted to quantify the true costs of worker injuries. Those that have been done have shown different levels of success. Rather than actually quantifying the costs in monetary terms, researchers typically compared the indirect or hidden costs to the direct costs of injuries or value of workers' compensation claims (Everett and Frank, 1996; Jaselskis, Anderson and Russell, 1996; Waehrer, Dong, Miller, Haile, and Men, 2007).

A study conducted among South African general contractors by Smallwood (1999) investigated, *inter alia*, the impact of accidents. Various categories of direct and indirect costs were recorded relative to the primary construction cost centres, namely labour, material, plant and equipment, subcontractors, and overheads. The lowest total cost of accidents was R405,000 arising from a worker stepping on a nail protruding from a piece of timber. The highest total cost of an accident was R296,000 arising from a motor vehicle-related accident. The mean total cost of accidents of the 15 accidents studied was R53,514. The mean total indirect cost of R42,840 was substantially greater than the mean total direct cost of ZA10,674. These costs of accidents contributed to the cost of construction, directly or indirectly through, *inter alia*, lower productivity, quality non-conformances and schedule disruptions. The findings of this study confirmed the findings of all preceding studies, namely that the indirect costs of accidents are greater than the direct costs of accidents.

Based upon the value of construction work completed in the year 2002, namely R56,343m (South African Reserve Bank, 2003) the total costs of accidents could have been between

4.3% (R2,401.2million/R56,343million), and 5.4% (R3,041.5million/R56,343million) of the value of completed construction (Smallwood, 2004). Research conducted in South Africa determined the indirect costs to be 14.2 times the direct costs (Smallwood, 2000).

Mthalane *et al*., (2008) conducted a study designed specifically to identify and quantify the economic and social impacts of site accidents on the South African society. Forty percent of the accidents resulted from workers falling due to their negligence or not adhering to health and safety policies and regulations. The consequent decrease in standard of living and the loss of productivity were the major economic impacts on the affected families and construction companies respectively while the unfortunate loss and/or injury of a family provider or breadwinner and the subsequent depression of fellow workers had the greatest social impact on the families and construction companies respectively.

The construction industry is an important and fundamental player in the economy of South Africa. Already, the Expanded Public Works Programme (EPWP) provides job opportunities for around 600 000 workers a year; and it aims to increase this to 1, 5million workers by 2014 (Altman, 2007). The South African Department of Public Works (2000) asserted that the construction industry contributed 35% of the total South African gross domestic fixed investment and employed approximately 230,000 employees in the formal established construction sector. The South African government is the largest construction client, making up between 40% and 50% of the total national construction spend (Department of Public Works, 2000). Despite its pivotal role in social and economic development, the construction industry is considered to be a risky sector that presents more dangers than any other industrial sector (Brace and Gibb, 2005). The main causes of accidents have typically been falls from height, falls on same level and struck against objects. All elements of society such as employees, families, employers, economy and resources had probably been affected somehow by the occurrence of a site accident. The economic impacts of site accidents were, for example, decrease in family income, decrease in the standard of living, negative effects on education and schooling expenses, increase in debts and difficulty to pay bills, insurance policies and mortgage bonds. The analysis of interviews in the U.K. by Brace and Gibb (2005) found that a drop in standard of living was the most severe economic impact of site accidents. Subsequent decrease in family income was the second major economic impact as the affected person either had to leave the job or be transferred to another place in the organisation frequently at a lower wage. Increase in debt was the third greatest economic impact. Other economic impacts on families were difficulty to pay expenses.

2.4. The Costs of Construction Accidents

The true costs of accidents can be characterized in many ways. Everett and Frank (1996) suggested three types of costs that were relevant to owners in terms of evaluating the costs of jobsite accidents, injuries and fatalities, namely:

1. direct costs of injuries and fatalities that included workers' compensation, public liability and property insurances;
2. indirect costs of injuries and fatalities that included loss of productivity, disruption of schedules, administrative time for investigations and reports, training of replacement personnel, wages paid to the injured workers and others for time not worked, clean up and repair, adverse publicity, third-party liability claims, and equipment damage; and
3. costs of health and safety programs that include salaries for health and safety, medical and clinical personnel, health and safety meetings, inspections of tools and equipment, orientation or induction sessions, site inspections, personal protective equipment, health programs, and miscellaneous supplies and equipment.

Waehrer, et al., (2007) suggested that the costs of occupational injuries and illnesses could be divided into three broad categories used in other areas, namely:

- direct costs that include the costs of hospital, physician, and allied health services, rehabilitation, nursing home care, home health care, medical equipment, burial costs, insurance administrative costs for medical claims, payments for mental health treatment, police, fire, emergency transport, coroner services and property damage;
- indirect costs that refer to victim productivity losses that include wage losses and household production losses, and administrative costs that include the cost of administering workers' compensation wage replacement programs and sick leave; and
- quality of life costs that refer to value attributed to the pain and suffering that victims and their families experience as a result of the injury, fatality or illness. According to Miller and Galbraith (1995) loss of quality of life costs were six times greater than the workplace disruption costs.

Rikhardsson, Impgaard, Mogenson and Melchiorsen (2002) developed the Systemic Accident Cost Analysis (SACA) methodology. In the SACA approach the following four cost categories were used, namely:

- Time which refers to hours spent by employees and management on activities related to the accident as well as hours for which wages were paid without getting work effort in return including standstill periods in production and employee sick pay;
- Materials and components acquired or lost due to the accident such as spare parts for machines, replacement for damaged materials and value of products not produced;
- External services bought due to the accident such as temporary replacements, consultants and legal support; and
- Other costs incurred more infrequently such as fines and rehabilitation.

Further, using these cost categories enabled three types of average 'standard' costs to be calculated, namely:

- Variable costs that varied with the number of sick days such as sick pay and supplement to full salary where the company was obliged to pay for that;
- Fixed costs from an occupational accident that are not dependent on the length of absence of the affected workers which include administrative costs and communication costs; and

- Disturbance costs that are dependent on the specific accident and the role, tasks and competencies of the injured worker/s and include production loss, overtime, lost time and possible fines (Rikhardsson and Impgaard, 2004).

However, the most typical means used in the construction industry was to express the costs by way of direct and indirect costs (Tang, Ying, Chan and Chan, 2004; Gosselin, 2004; LaBelle, 2000; Corcoran, 2002). As long ago as 1956 Simonds and Grimaldi proposed that the relationship between direct and indirect costs as well as that between insured and uninsured costs should be used.

2.4.1 Relationship between Direct and Indirect Costs

Many researchers, when studying the concepts of direct and indirect cost, express a ratio of indirect costs to direct costs. Heinrich (1979) estimated the ratio of the indirect costs of injuries to the direct costs to be approximately 4:1 using data gathered from various industrial facilities in the United States. The problem with this ratio was that it did not take into account the steep escalation of the direct costs of health care. However, this ratio has been used for many years because of its simplicity. A study by Sheriff (1980), found the ratio of indirect and direct costs to be as high as 10:1. Bird and Loftus (1976) in their work found the ratio to be even higher at 50:1. Irrespective of the variations in the ratios, in all cases the indirect costs were significant when examining the costs associated with an injury, and typically exceeded the direct costs substantially. In South Africa more than 7.3 million working days were lost during 2000 and 2001 as a result of workers taking time off because of these injuries.

The following examples of work related injuries and associated costs were cited by the Health and Safety Executive (1997), namely:

1. An employee had half a finger amputated. He was polishing a metal component when his glove became caught on a rotating machine spindle. He was away from work for two-and-a-half months. The company estimated the cost the accident at around £4,000 (R60,000). This cost estimation did not include any costs relating to the still on-going compensation claim.
2. A worker fell over a delivery ramp while walking in front of an office building. She injured her shoulder and was off work for two weeks. The company calculated the total cost of the accident to be £14,800 (R225,000).
3. A farmer was changing the attachment on the back of a tractor. During this process, his hand was crushed by it, causing severe injuries. Costs were incurred for 3 years following the accident. The net total cost to the family business was over £96,000 (R1,500,000).
4. A butcher cut his hand on a knife left in an animal carcass by another worker. He needed hospital treatment and a week off work. The costs to the company to date were £351 (R6,000) plus 2.5 hours investigating the accident. There were other on-going legal costs.

A study was conducted at Stanford University on the costs of construction worker injuries. However, given the small sample size of 49 construction injuries, no firm conclusions could be drawn from the research effort (Levitt and Samelson, 1987). The study was restricted to the short-term indirect or hidden costs that could be determined within the first few months of the occurrence of an injury. It was found that long term costs would be too difficult to quantify with accuracy given that the costs of monitoring these expenditures for several years would be prohibitive.

2.4.2 Direct Costs

The direct costs of accidents are those costs incurred due to the treatment of an injury that are normally reimbursed by workers' compensation insurance. These may include medical costs, premiums for workers, compensation insurance, liability and property losses (Kapp *et al*., 2003). According to Griffin (2006) direct costs were those costs that were directly associated and payable by the employer or the insurance carrier on the employer's behalf. These costs were typically fairly easy to establish and quantify.

2.4.3 Indirect Costs

Construction accidents were more expensive than most people realised because of the associated indirect costs also described as the hidden costs of accidents. Unless organizations systematically and accurately evaluate the true costs of accidents that occur, they most likely do not know how costly these accidents actually are.

According to Griffin (2006), indirect costs of accidents consist of uninsured losses from damage to buildings, equipment, tools and products and materials; interruption of business operations; lost productivity required overtime to make up for delays caused; inefficiency of backup employees; cost of training new employees; increased insurance premiums; and damage to a company's reputation. Indirect costs are usually non-recoverable. For example, if the direct costs of an accident total R10,000 and indirect costs are five times greater, the total cost would be in the region of R60,000. Consequently, a contractor would need to generate an additional R60,000 in profit to offset the loss.

Further, indirect costs are generally those costs attributed to the loss of productivity of the injured worker and the crew, transportation costs to the nearest medical treatment facilities and time expended to complete various forms related to the injury (Hinze & Appelgate, 1991). The indirect costs also included all other costs resulting from the injury that were not recovered through various insurance coverages. Most indirect costs could be categorized as being related to the cost of lost productivity, damaged materials and/or equipment, and added administrative effort.

Most known studies confirm that the indirect costs of accidents are greater than the direct costs of accidents. Head and Harcourt (1998 conducted a study to estimate the Direct and

Indirect Costs of Workplace Accidents in New Zealand for 1995 and subsequently concluded that the ratio of indirect to direct costs was 1:2.9. This ratio is peculiar, given the substantially lower figure than those of all the other studies reviewed. This disparity can be attributed to the fact that the direct costs of occupational accidents in New Zealand contain what are indirect costs in various other countries. They, however, acknowledge that the indirect costs could have been more because several costs were omitted due to unreliable data and conservative estimations.

Some costs, like lost workdays or lost income, are clearly visible and can readily be expressed in monetary terms. However, other costs such as, for example, administrative activities following an accident may be forgotten, damage to the company image may be hard to quantify and pricing human suffering and health damage may be subject to discussion. However, according to the European Agency for Safety and Health at Work (2003), it is possible to get an adequate insight into the costs of accidents and the potential benefits of accident prevention. Indirect costs can be associated with or consequential and due to a wide array of complexities and indefinite dynamics relative to a construction accident may not necessarily take the form of direct monetary outlays.

Insurance premiums, wages, and direct payment to physicians are examples of direct costs within an organisation. Indirect costs are just as tangible, but they must be quantified from close observation and comprehensive calculation. If an apparatus has a shorter lifespan because it was involved in an industrial accident, the accident is an economic cost. It may be one that goes unnoticed unless someone measures and allocates amounts for the damage. A list of possible indirect costs at the company level can be far-reaching and extensive, given the knock-on effect an accident could have.

There are numerous hidden costs associated with construction accidents. Many of these costs are difficult and occasionally impossible to quantify (Jallon, Imbeau and de Marcellis-Warin, 2011). A basic list of potential indirect costs as a consequence of construction accidents includes, *inter alia,* the following, namely:

- Interruption in production immediately following the accident;
- Lower morale effects on co-workers;
- Personnel allocated to investigating and writing up the accident;
- Recruitment and training costs for replacement workers;
- Damage to equipment and materials if not identified an allocated through routine accounting procedures;
- Reduction in product quality following the accident;
- Reduced productivity of injured workers on light duty;
- Product damage;
- Plant and equipment damage;
- Legal costs;

- Production delays;
- Transportation of injured person;
- Loss of efficiency of workers;
- Overtime working and the use of temporary staff;
- Recruitment of replacement staff;
- Investigation costs;
- Clerical efforts; and
- Loss of expertise and experience.

The failure to identify and take into consideration these indirect costs can have a profound impact on an organisation. Estimates of indirect costs as a proportion of direct costs have ranged from ratios that are 1:1 to more than 20:1, depending on the specific industry and methodology utilised by the researcher. If a company fails to tally the full cost it pays for poor health and safety conditions, the true costs will not be immediately realised and perhaps concealed. Without realizing it, organisations may be undermining their economic position and continued existence.

Given that indirect costs of accidents always exceed the direct costs, it makes business sense to give greater attention to the indirect costs of worker injuries. Even where indirect and direct costs are similar, indirect costs balloon exponentially when liability litigation is instituted for a worker's injury. The following example illustrates how much an injury could potentially affect the output or bottom-line of a company trying to achieve a three percent profit margin. If a company sustained a R50, 000 loss due to injury, illness or damage and still tries to make a three percent profit, the company theoretically must increase sales of services by an additional R1, 667,000 (adapted from eLCOSH, 2001).

A research study carried out in Québec found that, on average, the indirect cost of each accident was $822 (about R54, 000) (Brody, et al., 1990). OSHA in the U.S.A. uses the sliding scale shown in Table 2.1 to calculate the indirect costs of injuries and illness. OSHA claims that, statistically, the larger the amount of claim, the smaller the ratio used for the calculation (http://www.osha.gov/dcsp/smallbusiness/safetypays/background.html).

Table 2. 1 Cost Ratio

Direct Costs	**Indirect Cost Ratio**
$0 - $2,999	4.5
$3,000 - $4,999	1.6
$5,000 - $9,999	1.2
$10,000 or more	1.1

Adapted from Business Roundtable (1982)

2.5 International Cost Studies and Statistics

In estimating the uninsured costs of work-related accidents, Sun, et al., (2005) claimed that occupational injuries in the U.S.A. were a major concern across industries both from a human suffering viewpoint and a financial viewpoint. Although incidence rates had declined from 1991 to 1997, the cost of injuries had increased from $60 billion (R480 billion) to $100 billion (R800 billion) (Mital et al., 1999). Besides the personal and economic loss for employees, employers and the government, the trend highlights the complexity of calculating the full extent of the costs associated with occupational injuries. While workers' compensation provides cover for the cost of the majority of injuries, it does not account for administrative and operational losses associated with incidents at the workplace (Sun et al.,2005).

In 2004, the Spanish Trade Union Confederation of Workers' Commissions Comisiones Obreras (CC.OO), published a study examining the economic costs of industrial accidents and occupational illnesses in Spain. It established the annual total cost to be almost €12 billion (about R120 billion), equivalent to 1.72% of GDP. Sadly, Spain had the highest rate of accidents at work in the European Union, and the trend had been upward over most of the past decade. Accident prevention was clearly not an urgent priority for Spanish employers. Arguably, a major reason could be that a large part of the cost was met by the public welfare system or the victims of accidents and illnesses and not by companies (Espluga, 2004).

Eurostat (2004) estimated that in 15 European Union Member States in 2000 accidents at work cost €55 billion (R550 billion), with 5,500 work-related fatalities and 150 million working days lost. This figure corresponds to 0.64% of the GDP of about €8,500 billion (R85,500 billion) for these countries. This is a huge cost for businesses and a huge cost of human suffering for the workers and their families.

In Australia, the construction industry accounted for 6.3% in GDP in 2002-03 while employing 715,300 employees - approximately 8.0% of the Australian workforce. The workers' compensation statistics indicate that the construction industry incidence rate was 25.1 injuries per 100,000 employees in 2002-03, which was about 1.5 times greater than the all industry average of 14.2 injuries per 100,000 employees. The industry also experienced a fatality rate of 5 fatalities per 100,000 employees in 2001-02, which was more than twice the all industry average of 2.4 fatalities per 100,000 employees. Many approaches have been adopted by construction companies, but most of them are focused on improving physical working conditions and health and safety management system/procedure which have led to some limited health and safety performance improvement (Charles et al., 2007).

According to the International Labour Organisation (ILO) 337 million accidents occur at work annually, while close to 2 million people suffer from work related diseases. The resultant economic burden of poor occupational safety and health practices is staggering. The ILO suggests that approximately $1.25 trillion (about R10 trillion) is siphoned off annually by costs such as lost working time, workers' compensation, the interruption of production, and medical expenses. Beyond the economic issues, there are moral issues. The human cost of work-related accidents is unacceptable. Although work should not be a dangerous undertaking, in reality it kills more people than wars do (Al-Tuwaijri, 2008). An analysis of the statistics by the ILO illustrates that, although industrialized countries have seen steady decreases in the numbers of occupational accidents and diseases, this is not necessarily the case in countries currently experiencing rapid industrialization or those too poor to maintain effective national occupational health and safety systems, including proper enforcement of legislation. The South African Department of Labour repeatedly claims that SA construction statistics are appalling and, consequently conduct frequent blitz operations in an attempt to address the poor state of construction health and safety. In developing countries such as South Africa, standards and practices are often far below acceptable levels and the rate of accidents has been increasing rather than decreasing. The ILO argues that rapid globalization has led to technological change and competitive pressures in the scramble for capital that often induce employers in these regions to regard occupational safety and health as an after-thought. The potential must be realized for institutions with the capacity to act on a worldwide level to mobilize the forces of globalization for positive change to reverse these shocking trends (ILO, 2008).

An accident claim calculator was developed by an organization in the U.K., Accident Consult, backed by a qualified team of lawyers who are all members of the Association of Personal Injury Lawyers and who subscribe to their Code of Conduct and Consumer Charter. This claim calculator is used to assist in the calculation of the costs of various types of accident compensation claims. Examples of frequently experienced injuries with corresponding accident compensation costs utilised when compensating workers are shown in Table 2.2. The top end of the scale is for very severe cases of each accident, the lower end of the scale is for minor cases of each accident. Various problems can be experienced with such cost calculators, models or predetermined figures, given that construction accidents are quite diverse in severity, impairment, and consequences. To estimate the different costs in an organisation, the calculator would have to make various assumptions by using statistical data from previous incidents. The range in costs for each type of injury is demonstrative of this challenge but provides an indication of the potential costs that a company may incur as a result of an accident on a construction site.

Table 2. 2 Accident Claim Calculator

A simple forearm fracture	£3,800 (R57,000)	to	£11,200	(R168,000)
Loss part of a little finger	£2,300 (R34,500)	to	£3,450	(R51,750)
Severe crushed big toe	£8,150 (R122,250)	to	£11,200	(R168,000)
A simple nose fracture	£1,000 (R15,000)	to	£1,400	(R21,000)
Loss of two front teeth	£5,100 (R76,500)	to	£6,600	(R99,000)
Whiplash Injury	£750 (R11 250)	to	£2,550	(R38,250)
Back Injury	£4,575 (R68,625)	to	£58,500	(R877,500)
Brain/Head Injury	£1,300 (R19,500)	to	£165,500	(R2,482,500)
Deafness	£4,300 (R64,500)	to	£81,500	(R1,222,500)
Asbestos-related	£4,000 (R60,000)	to	£74,000	(R111,000)
Hernia injury	£2,000 (R30,000)	to	£14,000	(R210,000)
Knee injury	£8,150 (R122,250)	to	£56,000	(R840,000)
Ankle injury	£3,300 (R49,500)	to	£40,750	(R611,250)
Elbow injury	£7,375 (R110,625)	to	£32,000	(R480,000)
Leg injury	£5,350 (R80,250)	to	£79,000	(R1185,000)
Hair damage	£2,300 (R43,500)	to	£6,350	(R95,250)
Sight injury	£1,300 (R19,500)	to	£235,000	(R3,525,000)

Adapted from http://www.accidentconsult.com/ClaimCalculator/ClaimCalculator-1.html

A research team performed a comprehensive study of the economic costs of occupational injuries and illnesses at a national level in the U.S.A. (Leigh et al, 1997, NIOSH, 1992). Using a wide range of public and private data sources, and cross-checking their estimates against those of their predecessors, the research team meticulously constructed cost totals by cause of impairment or mortality, by source of cost, and by ultimate payer for the year 1992. The research team made a large number of assumptions, especially in the areas of occupational disease, the indirect costs of morbidity and mortality, and the extent to which employers are able to pass on the costs of workers' compensation premiums. Based on a conservative bias the study deliberately underestimated the cost of injury and illness, anticipating that potential criticism would come mainly from those who believed these costs to be low. Leigh et al., (1997) maintained that the costs could easily have been 25% to 50% higher. The costs were examined in terms of their estimate of the incidence and costs of fatal and non-fatal accidents and diseases in the United States, how the health and safety statistics were translated into economic costs, and the extent that they were borne by the worker or the general public rather than the employer.

To estimate the incidence of fatal and nonfatal injuries, the NIOSH team commenced with data collected by the U.S. Bureau of Labour Statistics (BLS) and other public agencies, and then adjusted the numbers for discrepancies that had previously been identified (NIOSH, 1992). More difficult was the problem of estimating the incidence of occupational disease. The team chose six disease categories which had been examined for potential occupational etiology, namely cancer, cardiovascular and cerebrovascular disease, chronic respiratory disease, pneumoconiosis, nervous system disorders, and renal disorders. The nationwide totals for each were multiplied by generally conservative estimates of the degree of occupational causation. With the exception of pneumoconiosis lung disorders suffered by miners, which were assigned 100% occupational causation, none of the others was assigned more than 10%. The overall results, including the economic burden, are summarized in Table 2.3.

Table 2. 3 The Cost of Occupational Injuries and Illnesses in the United States

Category	Severity	Number/frequency	Cost($ billions)
Injuries			**148.4**
	Fatal	6,529	3.8
	Non-fatal	13,247,000	144.6
Illnesses			**25.3**
	Fatal	60,290	19.5
	Non-fatal	862,200	5.8
Total Cost			**173.9**

Adapted from NIOSH (1992)

The cost of damage to equipment and materials in injury accidents was examined in one study of US Army Corps of Engineers construction projects (Brown, 1988). In the study conducted in 1987, the investigator estimated the average cost of damage to equipment and materials to be about $750 per accident, whether paid by the contractors or by the risk carrier of the contractor. The average was computed from the costs of 11,472 injury accidents, including 10,596 injuries for which no significant equipment or material damage had been reported. For the major damage incidents, it was assumed that only costs to the contractors were deductible amounts on their risk policies, typically set at around $2,500. On cases involving little damage, the contractors were assumed to absorb the entire cost of the damage, up to their deductible amounts. Using those conservative assumptions the investigator determined that the average out-of-pocket expenditure by the contractor for property damage was about $100 to $125 per incident.

Little else has been published about the cost of material and equipment damage. It is the injury cases that receive the most attention. There are many cases in which serious injuries occur with little equipment or material damage. There are also many cases in which significant equipment or material damage occurs with no associated worker injury.

The Health and Safety Executive (2005a) found that most organisations were concerned about potential cost implications of major incidents, but were less concerned about actual costs incurred as a result of more frequent, minor events. The majority of respondents reported that they did not know how much either accidents or work-related illnesses were costing their business. Few attempts had been made to quantify the cost of health and safety failures. Limited time and resources, perceived complexity and lack of expertise were the most commonly cited barriers to conducting accident/work-related ill health cost assessments. Further, the avoidance or reduction of accident and work-related ill health costs *per se* did not appear to be the primary motivating factor for effective health and safety management. A combination of other interlinked factors emerged as being more influential in driving the health and safety agenda in most organisations. These included:

- Avoidance or reduction of liability claims;
- Potential legal exposure;
- Concern over the cost of insurance premiums;
- External pressures from insurance companies;
- Maintenance of corporate image and reputation;
- Customer and client expectations;
- Government targets;
- Moral obligations;
- Staff morale;
- Absence, recruitment and retention; and
- Impact on productivity, efficiency and quality of service delivery.

However, it was generally acknowledged that health and safety failures might ultimately impact on the financial performance of an organisation through any of these higher level factors.

2.6 Impact on Small and Medium Enterprises

The costs of accidents are not just applicable to large organisations but also have devastating impacts on smaller firms. There has been increasing attention given to the occupational health and safety concerns of small and medium enterprises (SME’s) in recent years (Glass, 1999). In addition to recognizing that SME's have a different set of obstacles to overcome and require different policy responses, they have a tendency to externalize a higher proportion of their occupational health and safety costs since they are more highly exposed to the rise and fall of market forces. Unlike larger firms with a more stable market position and ample financial reserves, SME's are more vulnerable and rely on their performance in the marketplace. Any costs that can be delayed, such as expensive investments in improving working conditions, probably will be indefinitely delayed. Gestures to accident victims, such as supplemental income or assistance in finding new employment or redeployment, which are typical of many large corporations, are not possible at most SME's, given that they need to monitor their narrow profit margins. Small firms are unlikely to maintain their own health services. They frequently fail to provide health insurance coverage for their employees and have to assume the costs of lost income, medical care, rehabilitation, and re-entry into the labour force or the financial costs suffered by the families of injured or deceased victims. The Health and Safety Executive (2005b) found under-reporting of accidents in smaller firms - only 40% of reportable accidents are actually reported in firms employing more than 25 people and 25% in firms employing less than 25 people. It may be that greater size facilitates the development of health and safety management resources with more specialist knowledge, greater confidence and a more developed health and safety culture. There is also more likely to be a joint framework between employer and employee for consultation on, and management of, health and safety. In smaller firms there may be greater pressure to return to work earlier.

2.7 Cost Computations and Models

A substantial variety of cost calculating models and calculators have been produced by several organisations and researchers. These models and cost calculators principally utilise fixed costs determined by means of case studies and illustrate mean indicative cost values based on rigorous approximated calculations. For example Jallon, Imbeau and de Marcellis-Warin (2011) developed an indirect-cost calculation model given that indirect costs far exceeded direct costs of accidents. Tang, Yong, Chan and Chan (2004) attempted to calculate social costs of construction accidents while evaluating the impact of social health and safety investments. Rikhardsson and Impgaard (2004) used the Systematic Accident Cost Analysis (SACA) approach to evaluate the corporate cost of accidents. Everett and Frank (1996) used direct, indirect and cost of health and safety programs in their study. Waehrer, et al., (2007) used direct costs, indirect costs and quality of life costs in their analysis of the cost of occupational injuries in construction. The Health and Safety Executive Economic Analysis Unit (EAU) appraisal values are the costs to society associated with each individual case of workplace fatality, workplace injury and work-related ill health. They are most frequently used in impact assessment and appraisal of proposed measures which aim to improve occupational health and safety. The prevention of workplace accidents and work-related ill health leads to a reduction in costs to society, and the Appraisal Values are used to inform estimates of the size of such reductions in cost. The values for 2009/2010 are shown in Table 2.4.

Table 2. 4 Average Appraisal Value estimates for 2009/10 for all workers

	Non-financial human cost (rounded)	Financial cost (rounded)	Total coast (rounded)
Workplace fatal accidents	£1,004,000	£498,000	£1,502,000
Reportable injuries	£10,900	£6,500	£17,400
Minor injuries	£20	£270	£290
Ill Health	£8,100	£8,000	£16,10

(At 2009 prices)

The Health and Safety Executive developed an accident cost calculator as shown in Table 2.5. Many other less exhaustive models are however present.

When quantifying the costs in relation to construction accidents, many aspects need to be taken into consideration. These include, for example:

- the type of accident;
- the extent of the injuries suffered; and
- length of time victim suffered physically and emotionally.

All of these have significant impacts on the cost computations. Financial loss could be

- the treatment cost to injuries;
- rehabilitation;
- lost income from days off work;
- pain and suffering;
- emotional distress; and
- physical losses.

These are all important factors that must be considered in the estimation of the monetary compensation. Each case will be different and the severity of the case will certainly have an effect on the costs.

The average costs of accidents are typically determined through various costing studies for different types of accidents, to produce a representative cost for each accident type. The following costs are typically focussed on, namely:

- Time lost
  - first aid attendant to provide first aid and then fill out the documents;
  - accompany the injured worker to the hospital;
  - the injured worker who is unable to work the rest of the day after the accident;
  - the other workers who stopped work immediately after the accident;
  - the employer managing the effects of the accident; and
  - time spent erecting guardrails.

- Investigation Cost Details

  - Time for investigating the accident and filling out the required paperwork;
  - A follow-up meeting was held with the remaining workers; and
  - Property Damage Cost Details.

- Replacement Cost Details

  - Time spent locating, evaluating, and hiring a new worker; and
  - Effect of new worker working at reduced productivity as compared to the experienced worker resulting in hours of reduced productivity.

- Productivity Cost Details

  - The day after the incident the productivity of the workers will be reduced; and
  - The returned injured worker will work at lesser productivity during the first week resulting in many hours of reduced productivity.

The literature review highlighted that the costs of construction accidents represented a substantial burden to the industry at large and society.

Table 2. 5 Health and Safety Executive Accident Cost Calculator

Category	Example	Time Spent	Cost (£)
Dealing with incident (immediate action)	• First-aid treatment • Taking injured person to hospital/home • Making the area safe • Putting out fires • Immediate staff downtime • Other		
Investigation of incident	• Staff time to report and investigate incident • Meetings to discuss incident etc. • Time spent with Health and Safety Executive /local authority inspector • Consultant's fees to assist in investigation • Other		
Getting back to business	• Assessing/rescheduling work activities • Recovering work/production (including staff costs) • Cleaning up site and disposal of waste, equipment, products etc. • Bringing work up to standard (e.g. product reworking time/cost) • Repairing any damage/faults • Hiring or purchasing tools, equipment, plant, services etc. • Other		

Table 2.5. Continued

Category	Example	Time Spent	Cost (£)
Business costs	• Salary costs of injured person while off work • Salary costs of replacement workers • Lost work time (people waiting to resume work, delays, reduced productivity, effects on other people's productivity etc.) • Overtime costs • Recruitment costs for new staff • Contract penalties • Cancelled and/or lost orders • Other		
Action to safeguard future business	• Reassuring customers • Providing alternative sources of supply for customers • Other		
Sanctions and penalties	• Compensation claim payments • Solicitor's fees and legal expenses • Staff time dealing with legal cases • Fines and costs imposed due to criminal proceedings • Increase in insurance premiums • Other		
Other	• Own Examples		
Total Cost			

CHAPTER 3 RESEARCH METHODOLOGY

3.1. Introduction

This chapter presents the research approach that was followed to achieve the objectives of the study and test the study hypotheses. A research strategy may be chosen based on the nature of the research (Yin, 2003) and has its own specific approach to collect and analyse data and, therefore, has both advantages and disadvantages that have to be considered. According to Yin (2009) it is the logic that links the data to be collected and the conclusions to be drawn to the initial questions of study.

The aim of the study was to address the following objectives, namely:

- To conduct an analysis of construction accident reports in order to establish, as far as practically reasonable, the total costs of various types of construction accidents;
- To differentiate and determine those costs that are classified as direct costs as opposed to the indirect costs;
- To ascertain the individual costs correlated to the various direct and indirect categories; and
- Through the findings of the study to contribute to an increased awareness of the negative impact of accidents on overall project performance.

3.2. Research Approach

According to Welman and Kruger (2001), the design of any research study is concerned with the plan to assemble suitable data for investigating and testing the research hypotheses. Further, the methods used to gather information depend on the type of data and the problem to be researched (Leedy, 1993; Leedy and Ormrod, 2001).

3.2.1. Case Study Approach

The case study method of research is one used when a contemporary phenomenon such as accident causation is examined against very specific research questions attempting to identify a correlation between the phenomenon and the context or real-life situation in which it has occurred. To advance knowledge and understanding of a phenomenon, case studies should be placed in an appropriate literature review (Yin, 2003). Case studies are further useful as empirical research into specific scenarios where the boundaries between the phenomenon and the context are not clearly evident. According to (Shuttleworth, 2008) the case study method is used to examine a broad scope of research within a single topic available for research. In Schramm's (1971, cited in Yin 1989: pp. 22–23) words, "The essence of a case study is that it tries to illuminate a decision or set of decisions with reference to why they were taken, how they were implemented and with what result". Cases could include individuals, organizations, processes, programs and events (Yin, 2009).

There are six types of case studies that can be undertaken (Tellis, 1997), namely exploratory, *explanatory* and *descriptive*, (Yin, 2003) and *intrinsic*, *instrumental* and *collective*

(Stake, 1995). Exploratory methods involve the collection of data around a research topic, prior to the formation of any theories. The data is used to generate hypotheses and specific research questions. Explanatory methods focus on explaining a course of events typically using a substantial or mature research data pool to answer causal or progression research questions. Descriptive methods typically use a theory or hypothesis as the framework for the data collection, to answer specific research questions derived from the hypothesis. Intrinsic methods focus on drawing specific answers or criteria from a single, or multiple cases. Instrumental methods utilise case data to explain other cases or phenomena previously documented. Collective methods analyse multiple cases to draw themes or patterns from the collective pool of data.

According to these classifications, this particular study would be a combination of explanatory and collective approaches, whereby causal effects are determined, or a course of events is examined from multiple cases. The preferred form of data collection is left to the researcher to decide (Yin, 2003). When a researcher is considering “how” or “why” questions, a contemporary set of events using primary and secondary documents, over which the researcher has little or no control, the case study approach is feasible (Yin, 2009).

3.3. Validity and Reliability

A research strategy or approach needs to be tested for validity and reliability. In this sense the strategy or approach should measure what it is supposed to measure, and yield scores in the differences of which reflect the true differences of the variable being measured.

3.3.1 Assessing Validity

Validity includes testing for various aspects. Content validity ensures sampling adequacy with respect to the topics covered by the approach. Face validity is concerned with ensuring that the approach appears to be relevant. Researchers regard the face validity test as the first step in the assessment process (Gaur and Gaur, 2006). This is usually done by showing the test to experts and analysing their responses. The face validity test is however not as important as other aspects of validity such as predictive validity, content validity, criterion validity and construct validity. Predictive validity means that the measurement should be able to predict other measures of the same aspect. To establish content validity, the entire domain of the study should first be defined then the instrument should be assessed to ensure that it accurately represents the domain. Criterion validity involves validation of data with external or independent criteria being measured. Finally, construct validity is believed to be the most difficult, as it involves the determination of the degree to which an instrument successfully measures a theoretical construct (de Vos and Fouché, 2002).It is one of the most commonly used techniques and is grounded in establishing a theoretical relationship and examining empirical relationships. Construct validity tries to establish an agreement between the measuring instrument and theoretical concepts by looking for expected patterns of relationships among variables (Gaur and Gaur, 2006).

3.3.2. Assessing Reliability

Reliability is defined as the accuracy or precision of an approach or strategy; as the degree of consistency or agreement between two independently derived sets of scores, and the degree to which the same or similar results are obtained under similar conditions (de Vos and Fouché, 2002). It refers to the confidence that the measuring instrument will generate the same numeric value when repeated on the same object (Gaur and Gaur, 2006). A measuring instrument is valid when it measures what it is actually supposed to measure. If an instrument is considered to be reliable, it does not necessarily mean that it is also valid. According to Babbie and Mouton (2003) a way to ensure reliability is to use approaches that have proven their reliability in previous research. A study was recently completed in Australia using a national database that captured data relating to deaths investigated by the Australian coroner by RMIT University to analyse the causes of fatal accidents in the construction industry (Cook and Lingard, 2011). This study used the systemic incident causation model developed by Loughborough University to identify originating influences, shaping factors and immediate circumstances for each incident. Using pre-determined criteria 258 closed cases were identified. These cases were further reduced to 81 cases for study using eligibility criteria (Cook and Lingard, 2011). This study uses a similar approach but with multiple causation models.

Another way to measure reliability is by using the test-retest method which measures the same object twice and correlates the results (Gaur and Gaur, 2006). The measure is reliable if it generates the same answer in repeated attempts.

A statistical determination of the validity and reliability of the approach or strategy was not conducted. The researcher also consulted a statistician, who advised that for this study a sample size of 100 cases would contribute to the validity of the study.

3.4. Qualitative Data

Qualitative data has been described as a source of well- grounded rich description and explanation of processes in identifiable local contexts (Amaratunga *et al.,* 2002). With qualitative data one can preserve chronological flow, see precisely which events led to which consequences, and derive fruitful explanations. Qualitative data consist of detailed descriptions of events, situations and interactions between people and things providing depth and details. Such data are symbolic, contextually embedded, cryptic, and reflexive, standing for nothing so much as their readiness or stubbornness to yield to a meaningful interpretation and response. In addition, the longitudinal aspect of many qualitative studies permits data to be gathered over a period of time and allows the researcher time to develop experiential understanding of the phenomena. Qualitative data presents the opportunity to generate an explanation of phenomena, actions, processes and experiences within an holistic context. Therefore, qualitative data will describe things that really happen in context, as the researcher experiences them (Gilmore and Carson, 1996).

In qualitative studies the researcher typically seeks to develop expected as well as unanticipated patterns among many variables. This requires that the researcher develop an initial set of questions for collecting data but, once the researcher starts collecting the data, he/she plays an interpretive role, making observations, exercising subjective judgment, analyzing and synthesizing, realizing all the while his/her own consciousness. The results produced reflect the individual researcher as he/she makes more subjective claims about the meaning of data and may produce multiple realities (Harling, 2002).

3.5. Sampling

The objective of sampling is finding a practical means of enabling the data collection and processing components of research to be carried out, while ensuring that the sample provided a good representation of the population (Fellows & Liu, 2003). Sampling is concerned with drawing individuals or entities in a population in such a way as to permit generalization about the subject of interest from the sample to the population. Consequently each member of the population has an equal chance of being included in the sample and each sample of particular size has the same probability of being chosen (Welman & Kruger, 2001).Sampling can be conducted randomly or not. Random selection methods include "simple random sampling" and variations such as stratified sampling, systematic sampling and cluster sampling. Non-random selection includes methods such as judgemental or purposive sampling (Welman & Kruger 2001; Fellows& Liu, 2003).The most critical element of the sampling procedures is the choice of the sample frame which constitutes a representative subset of the population from which the sample is drawn. The sample frame adequately represents the unit of analysis.

A comprehensive review of construction related accidents was done using the accident database of one of the divisions within a large energy utility in Southern Africa, where major capital expansion was being undertaken of approximately R150 billion (about $25 billion) over the next 5 years.

The period of review was 1 April 2006 to 31 March 2008, where 872 accidents i.e. fatalities, first aid, medical and lost time incidents[1] (LTIs) were reported and recorded. A random sample was then drawn using systematic random sampling, where an accident was

[1]A work-related injury that arises out of and in the course of employment and renders the injured worker unable to perform normal duties

randomly chosen and then every 8th accident was selected in order to obtain 100 accidents for selection and analysis for this study.

Table 3. 1 Distribution of Types of Accidents including Fatalities

Nature of Accident	Fatalities	%	Accidents	%
Burn	0	0%	2	2%
Cut/Caught	0	0%	17	17%
Electrical	6	43%	18	18%
Exertion/Ergonomics	0	0%	3	3%
Fall	6	43%	35	35%
Falling Object	0	0%	2	2%
Struck	2	14%	23	23%
Total	**14**	**100%**	**100**	**100%**

Table 3.1 and Figures 3.1 and 3.2 illustrate the distribution of the various types of accidents that were included in this study.

The final 100 selected accidents for this study were analysed from both flash reports (Appendix A) and detailed corporate investigation reports[2] (Appendix B). The process of compiling these reports is outlined in the following sections.

3.6. Accident Reporting and Investigation Procedure

All incidents have initially to be reported to the Corporate Health and Safety department. All Incident information received via the initial notification report are confirmed and captured onto the data management system, namely Systems Applications and Products – Environment, Health and Safety (SAP EHS). The organization uses this management software as the electronic data management system to support the management of occupational health and safety and industrial hygiene processes. A SAP EHS system generated flash report (refer Appendix A) is sent immediately or within 24 hours after the incident as internal incident notification to internal stakeholders of the organization such as, for example, the relevant managers within the defined structure of the operating/business unit and other relevant individuals within the Eskom Service and Strategic functions.

Typically a preliminary investigation takes place and depending on the incident the Corporate Health and Safety department decides whether a corporate legal investigation should take

A work-related injury that arises out of and in the course of employment and renders the injured worker unable to perform normal duties place or not. A representative from the Corporate Health and Safety department attends significant portions of the fatal and LTI incident investigations. Initial reports are brief and limited to an outline of the known facts which include the following information, namely:

- date and time of accident;
- entry type;
- plant;
- work area;
- accident location;
- short description of accident;
- severity of injuries;
- likelihood of occurrence;
- immediate causes; and
- involved persons, etc.

The incident report that is produced following the corporate legal investigation is highly confidential and is archived by the corporate legal department of the organization.

The organization has adopted the definition of a ‘serious incident’ as defined in the OHS Act as well Mine Health and Safety Act, including a traffic incident on a public road and electrical contact incidents involving members of the public. Whenever anything becomes reportable in terms of the Act, it is regarded as serious. This includes incidents that are, or have resulted in a contravention of legislation.

In most cases selected SHE personnel have access to the SAP EHS system and are responsible to add and update information related to the incident on the SAP EHS system. The Corporate Health and Safety department conducts verification of the data regularly. In the event of any incident involving an employee, contractor or member of the public, the responsible manager must ensure that all legal aspects and the requirements are carried out, such as, for example, reporting, notification, and investigation.

For the purposes of this study, analysis of the costs were essentially based on the incident investigations participated in by the researcher as well as the investigation reports received for the others from the database. The focus was on LTI, fatalities and disregarded near-miss, first-aid, and medical accidents. Consequences of these accidents ranged from fatalities to severe lost time injuries and major medical treatment.

CHAPTER 4: DATA ANALYSIS

4.1. Introduction

This chapter presents the findings of the analysis of the sample of 100 accident reports. Copies of the actual investigation reports, because of their highly confidential nature, could not be included in the dissertation. However, the findings have been aggregated and presented in summary form. To protect the identity of persons *inured* and involved in the investigation all references to them have been removed from the accident descriptions.

Table 4.1 shows the distribution of the total number of accidents for the period 2006-2008 together with the types of accident that occurred in terms of categories/classifications used by the organization. The full description of the accident as recorded in the actual corporate accident investigation report was not reproduced but examined in detail and used to calculate the costs associated with each of the accidents.

Table 4. 1 Distribution of Accidents for 2006/08

Near Miss	First Aid	Medical	Lost Time	Fatalities	Total
380 (43.58%)	225 (25.80%)	198 (22.71%)	64 (7.34%)	5 (0.57%)	872 (100.00%)

Data for the following direct costs were extracted from accident reports, namely:

- Medical (ambulance, doctor, medication, hospital); and
- Wages for injured person/s (Refer to Appendix A).

In the case of a fatality, unless otherwise stated, a standard value of medical expenses for the deceased worker was used, namely R500 000.

The following indirect costs were analyzed, namely:

- Overtime costs;
- Time lost by injured employee and co-workers;
- Injured employee's productivity loss costs;
- Supervision & Management lost time;
- Incident investigation costs;
- Training of replacement employee;
- Additional medical costs;
- Damage to equipment, plant, tools, or other property;
- Idle plant and equipment; and
- Other (including Consumables, Legal and Funeral Costs) (Refer to Appendix B).

4.2. Calculation of Each Cost Category

The value of each cost category was arrived at for each accident in the sample as follows, namely:

- Overtime costs were derived from the records of the Human Resources department and the payroll records using the actual scales of income for each worker involved for the number of days actually lost, excluding light duty upon return of the injured worker/s.
- The costs of time lost by injured employee and co-workers were extracted directly from the respective accident investigation reports from which the list of names of workers who were off work was drawn. The costs were obtained from the records of the Human Resources department and the payroll records of each workers. fatality costs were pre-determined at R1.1m.
- The costs of Supervision & Management lost time were calculated by using the M14 to M16 salary grading scales of managers and attendance records.
- Additional medical costs were established from medical records kept by the organization in-house COID office. This office also provided prescribed costs for various medical treatments. Where external ambulance services were used these were charged out at R800.
- The costs involved with incident/accident investigation were derived from the organizational investigation process by someone from the Corporate Health and Safety department office. An investigation panel is constituted that includes both internal and external members. In the case of the latter these were typically attorneys. The costs of the internal members were calculated based on the time they spent on the investigation, together with all related costs such as travel, accommodation and subsistence. The costs of external members were extracted from the accounts submitted by attorneys.
- Costs of training of replacement employees, where required, were derived from the records of either temporary employment services or technical related labour brokers. Typically the same rates as employees of the organization were used. Where contractors were utilized their rates were used.
- The costs associated with damage to equipment, plant, tools, or other property were derived for hire fees or replacement costs, depending on type of equipment and plant, since these costs are captured by each site.
- The costs associated with idle plant and equipment are similarly derived.
- Other (including Consumables, Legal and Funeral Costs) are derived from actual records kept in the organization offices or sites themselves (Refer to Appendix B).

In the case of a fatality, unless otherwise stated other costs including consumables, legal and funeral costs were standardized to be R1,100,000 in each case.

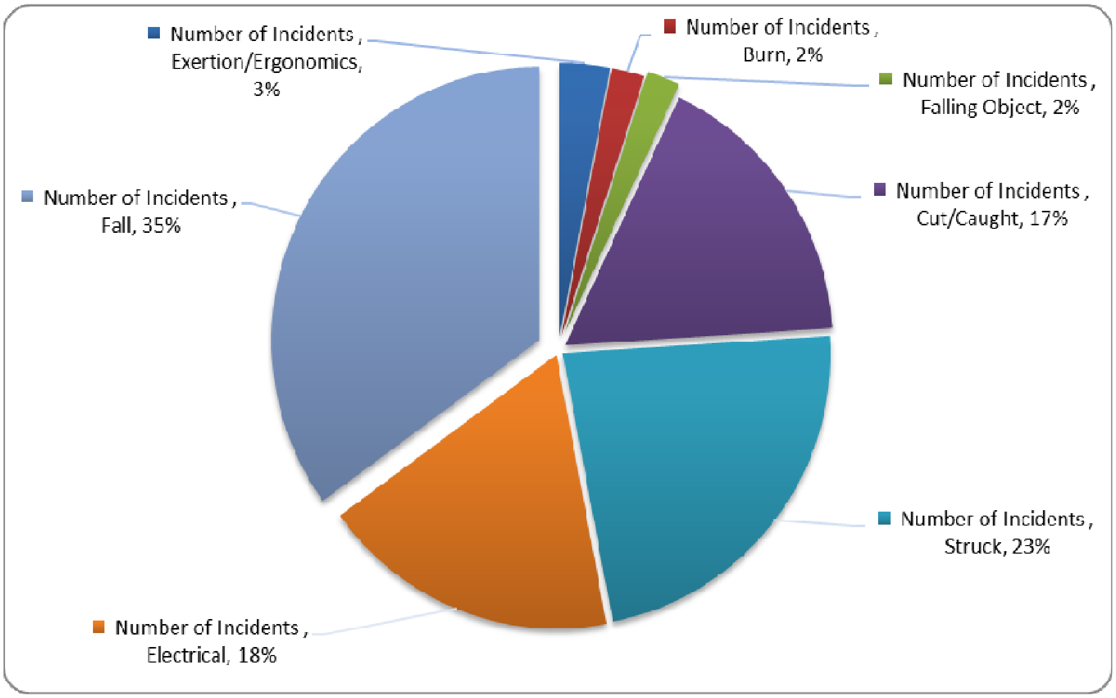

Figure 4. 1 Distribution of Sample of 100 Accidents by Nature of Accident

From Figure 4.1 it is evident that falls (35%), struck by (23%) and electrical accidents (18%) were the most frequent types of accidents in the sample of 100 accidents.

4.3. Analysis of Accident Costs including Fatalities

From Appendices A, B and C, it is evident that the breakdown of the costs of accidents including fatalities was, namely:

- Direct Costs:

Medical (ambulance, doctor, medication, hospital) – 6,96% of direct costs; and
Wages for injured person/s – 93,04% of direct costs.

Direct costs made up 30,59% of the total costs of 100 accidents.

- Indirect Costs:
    - Overtime costs – 6.40% of indirect costs;
    - Time lost by injured & co-workers – 1.4% of indirect costs;
    - Supervision & Management lost time – 2.6% of indirect costs;
    - Incident investigation costs – 10.3% of indirect costs;
    - Training of replacement worker – 0.40% of indirect costs;
    - Damage to equipment, plant, tools, or other property – 2.3% of indirect costs;
    - Idle plant and equipment – 1.3% of indirect costs; and
    - Other (incl. Additional Medical, Consumables and Funeral Costs) – 77.9% of indirect costs.

It is evident that other costs made up most of the indirect costs if fatalities are included. Indirect costs made up 69.41% of the total costs of 100 accidents that included fatalities.

Table 4.4 shows the average costs per accident based on the cause of the accident. It is evident that the accidents involving the highest average costs were electrical, falls and struck by. In almost all cases the average indirect costs were more than twice the direct costs except for falling objects.

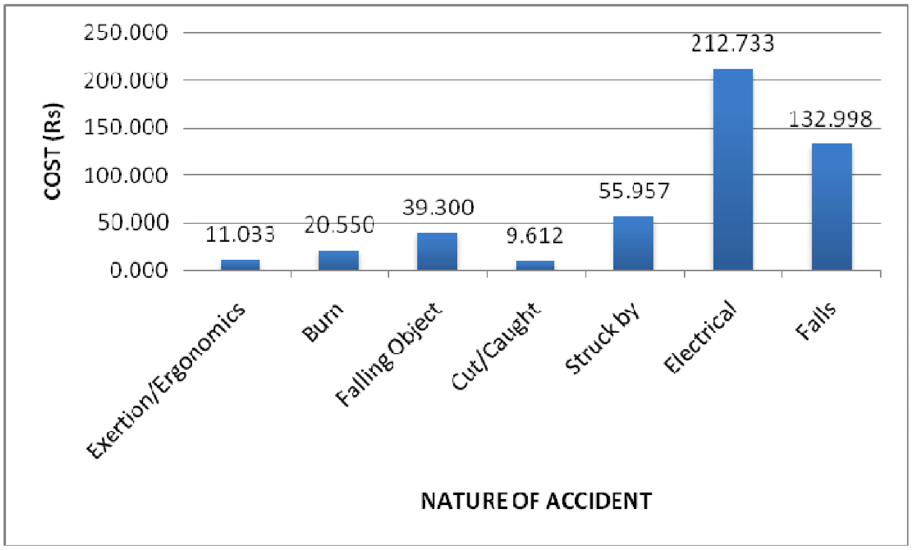

Figure 4. 2 Average Direct Costs by Nature of Accident

From Figure 4.2 it is evident that electrical accidents and accidents involving falls incurred the highest direct costs per accident.

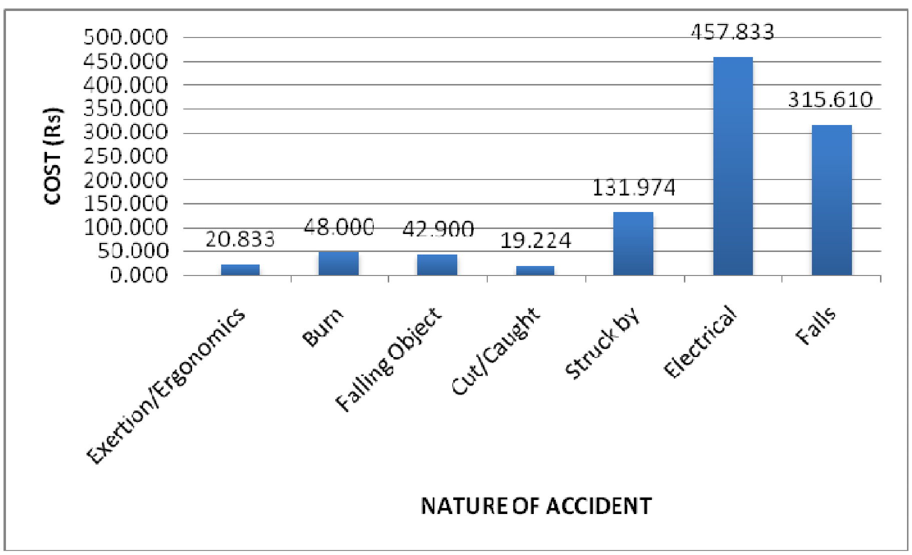

Figure 4. 3 Average Indirect Costs by Nature of Accident

It is evident from Figure 4.3 that electrical accidents and accidents involving falls also incurred the highest indirect costs per accident.

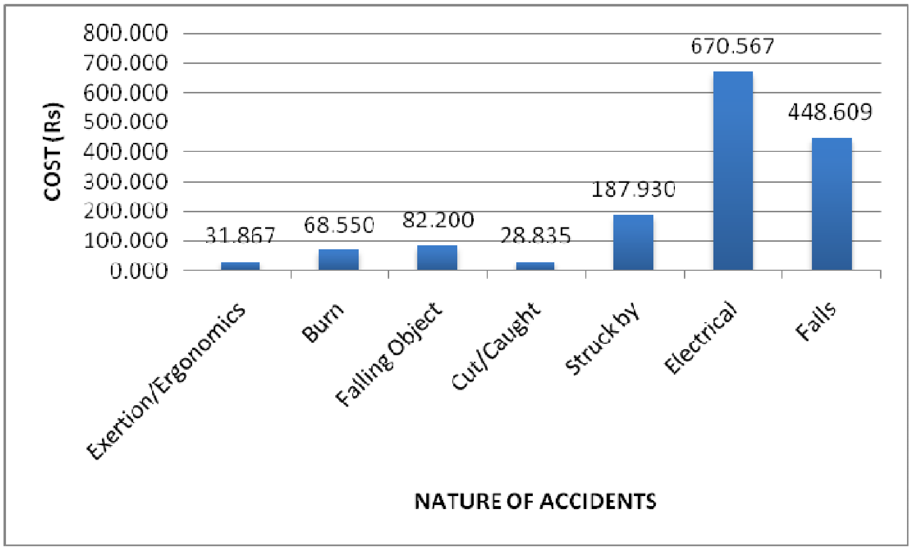

Figure 4. 4 Total Average Cost of Accidents by Nature of Accident

From Figure 4.4 it is clear that electrical accidents and those involving falls had the highest total average cost per accident.

Figure 4.5 shows that falling objects (47.81%) and exertion/ergonomics type accidents (34.62%) had the highest ratio of direct costs to indirect costs.

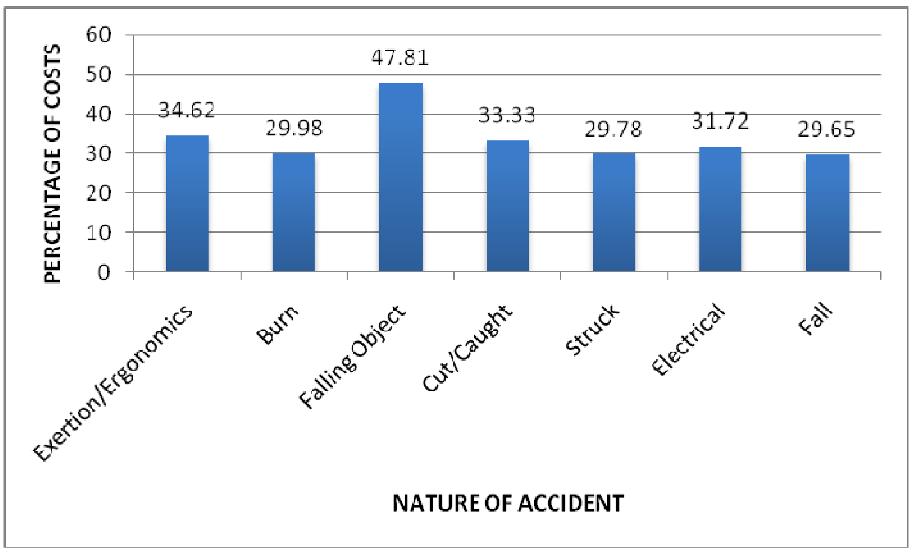

Figure 4. 5 Percentage of Direct Costs to Indirect Costs by Nature of Accident

Further, from Figure 4.6 it is evident that falls (70.35%), struck by (70.22%) and burns (70.02%) had the highest percentage ratio of indirect costs to direct costs.

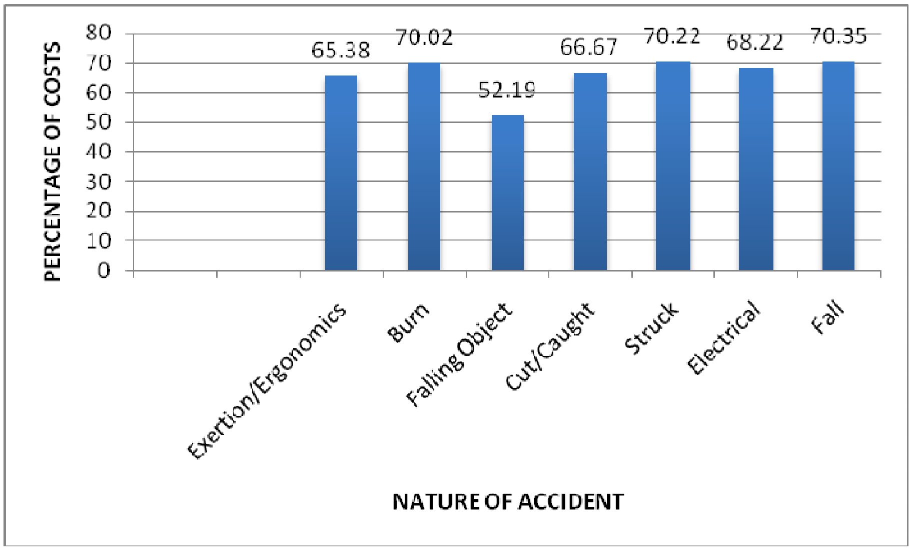

Figure 4. 6 Percentage Ratio of Indirect to Direct Costs by Accident Type

The average direct medical costs are shown in Figure 4.7. It is evident that accidents involving falling objects (R24 900) and electrical installations (R13 428) had the highest medical costs while exertion/ergonomics accidents (R1 633) had the lowest medical costs per accident.

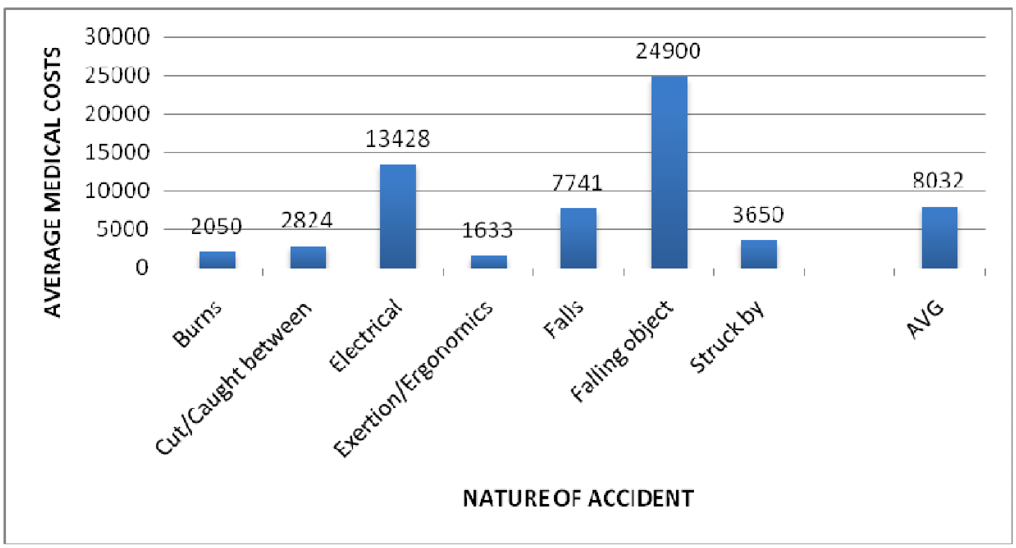

Figure 4. 7 Average Medical Costs by Accident Type

From Figure 4.8 it is evident that electrical accidents (R199 306) and those involving falls (R125,257) had the highest wage costs while exertion/ergonomics accidents (R9,400) had the lowest wage costs per accident.

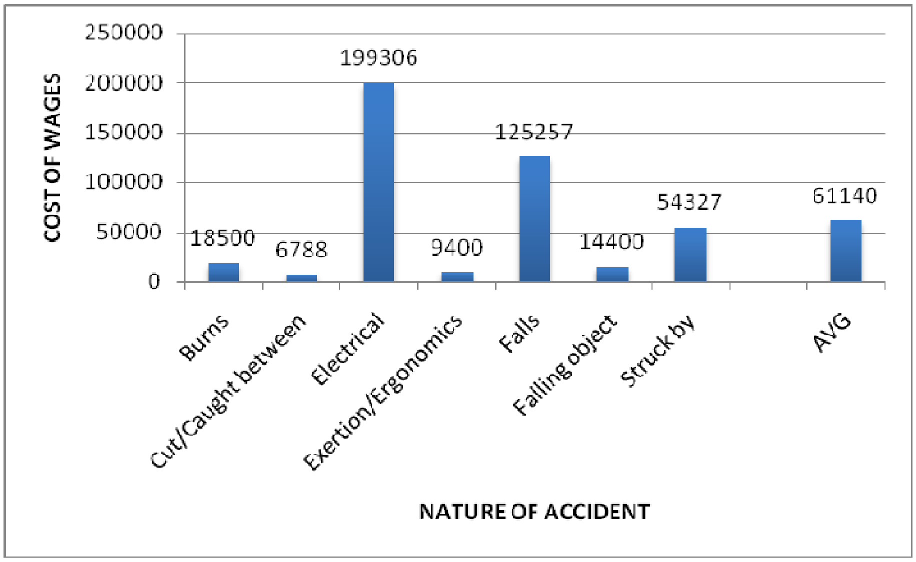

Figure 4. 8 Average Cost of Wages by Type of Accident

Figure 4.9 shows that electrical accidents (R212, 733) and those involving falls (R9 612) have the highest total average cost per accident while cut/caught between accidents the lowest total average cost.

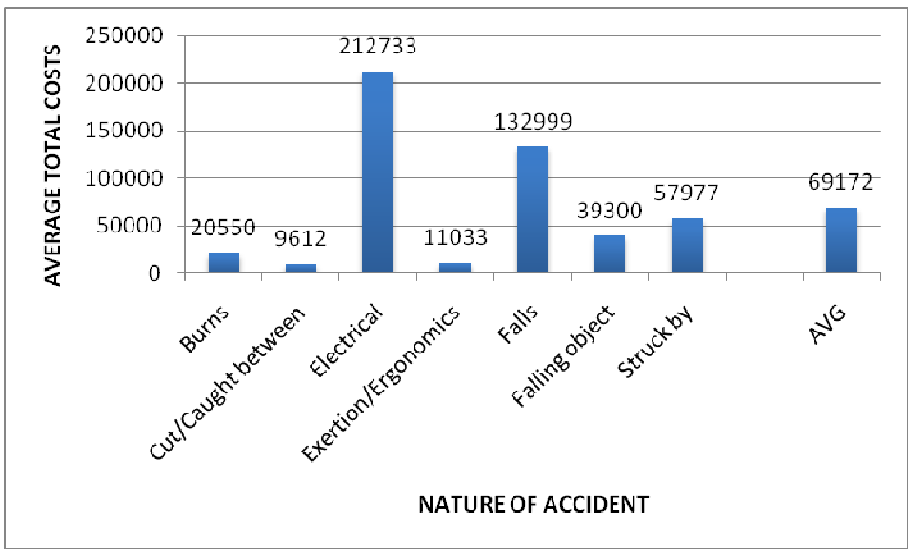

Figure 4. 9 Average Total Direct Costs per Accident Type

From Figure 4.10 it is evident that electrical accidents (R28 900), falls (R17 366) and accidents involving falling objects (R15,900) had the highest average overtime costs while cut/caught between accidents (R4,953) had the lowest per accident.

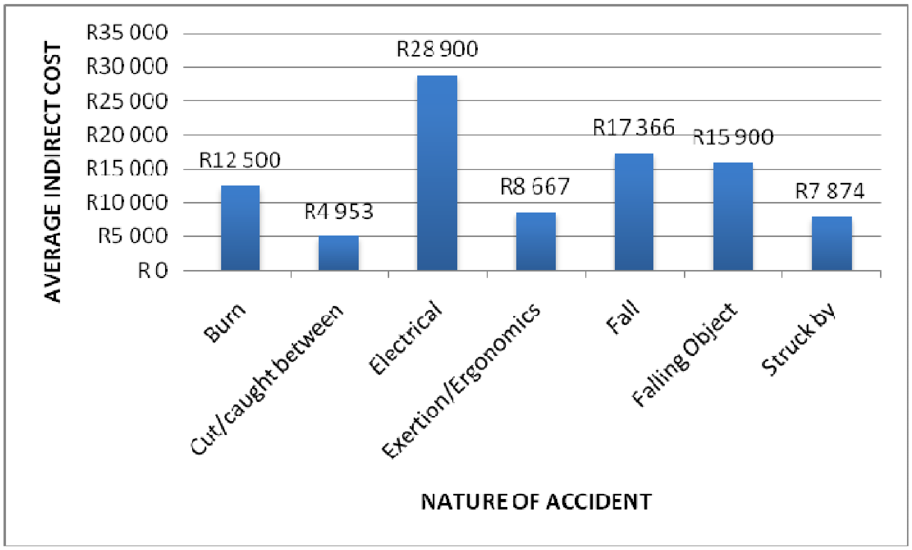

Figure 4. 10 Average Overtime Cost by Accident Type

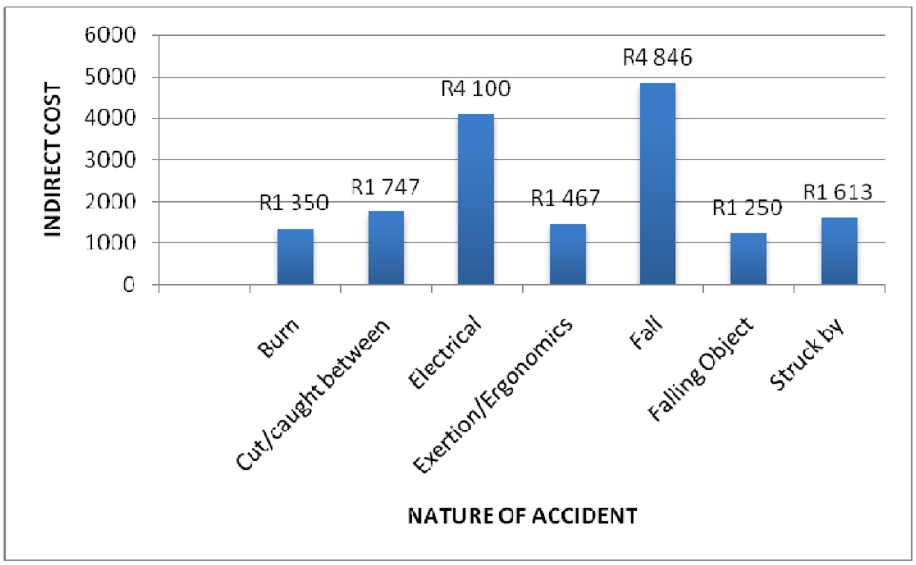

Figure 4. 11 Average Lost Time by Injured and Co-workers by Accident Type

From Table 4.11 accidents involving falls (R4,846) and electrical accidents (R4,100) incurred the highest average time lost by injured and co-workers costs while the other types of accidents incurred similar costs with those involving falling objects being the lowest (R1,250) per accident occurrence.

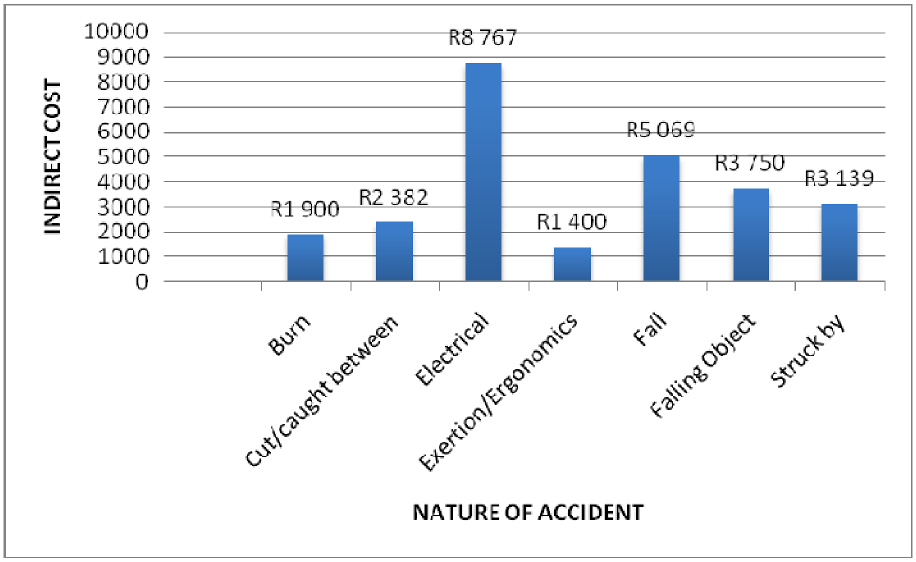

Figure 4. 12 Average Management and Supervision Costs by Accident Type

Table 4.12 indicates that electrical accidents (R8, 767) and falls (R5.069) incurred the highest average costs for time lost by management and supervision while exertion/ergonomics accidents (R1, 400) incurred the lowest average costs per accident.

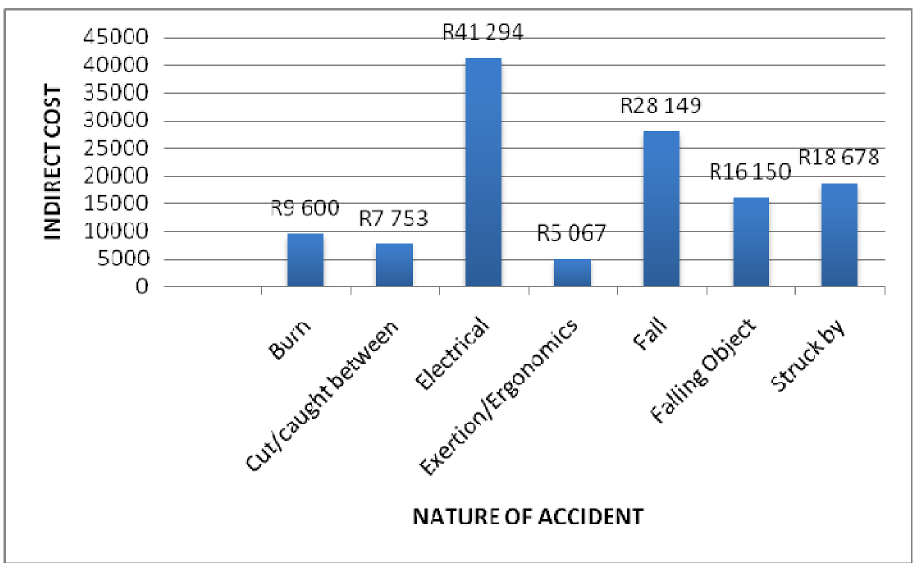

Figure 4. 13 Average Costs of Accident Investigations by Type of Accident

Figure 4.13 suggests that electrical (R41294) and falls (R28149) incurred the highest average investigation costs while exertion/ergonomics accidents (R5067) the lowest investigation cost per accident.

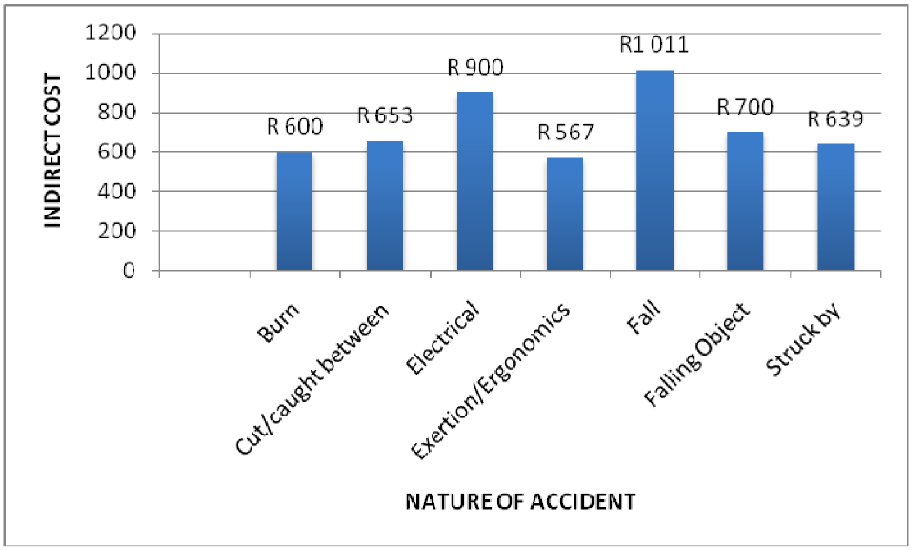

Figure 4. 14 Average Training Costs by Accident Type

From Figure 4.14 it is evident that accidents involving falls (R1 011) and electrical accidents (R900) incurred the highest average training costs while the other types of accidents incurred similar costs with exertion/ergonomics accidents incurring the lowest training costs per accident.

The indirect costs of damage to equipment, plant, tools and other property are shown in Figure 4.15. It is evident that burns (R21 500) and electrical accidents (R10 856) incurred the highest average costs while exertion/ergonomics the lowest (R500) per accident.

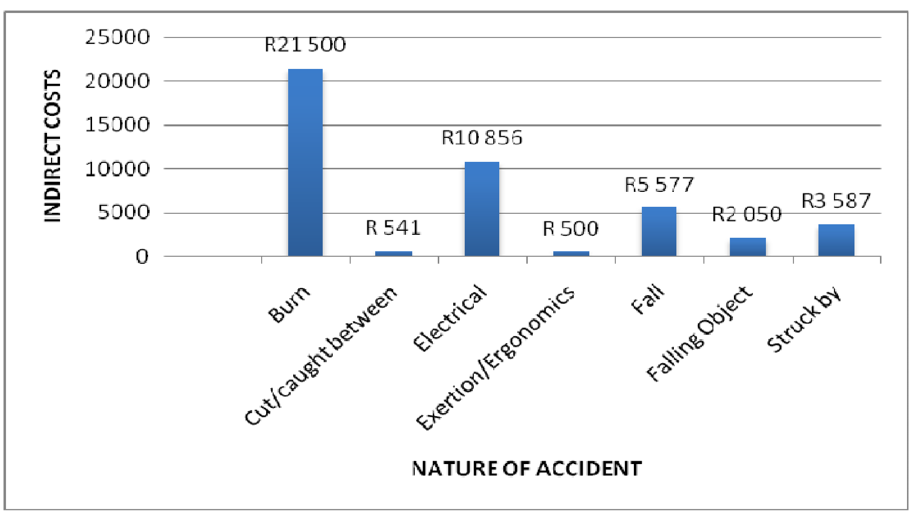

Figure 4. 15 Average Damage Costs to Equipment, Plant, Tools or other by Accident type

From Figure 4.16 it is evident that falls (R3 650) incurred the highest average costs of idle plant and equipment per accident while accidents involving falling objects (R650) the lowest.

Other indirect costs that include additional medical, consumables and funeral costs are shown in Figure 4.17. It is evident that electrical accidents (R369,078) and falls (R255,011) incurred by far the highest average costs of additional medical, consumables and funeral costs while the lowest was burns (R1,250).

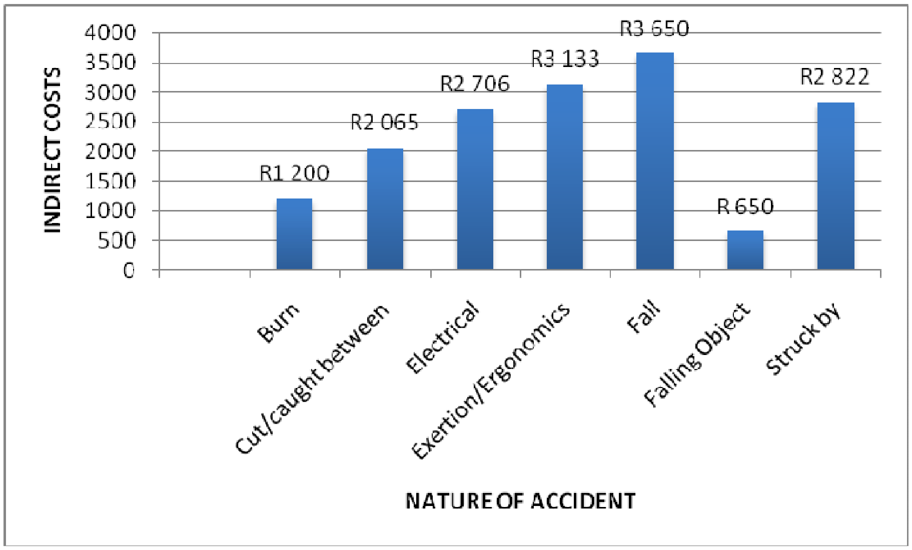

Figure 4. 16 Average Costs of Idle Plant and Equipment per Accident Type

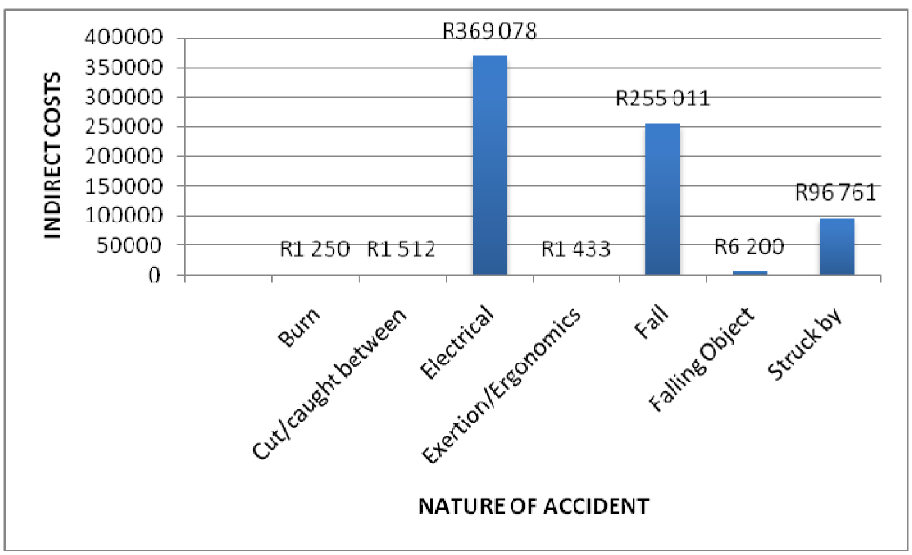

Figure 4. 17 Average other Indirect Costs by Accident Type

Figure 4.18 shows that for burns damage to equipment, plant, tools and other (R21 500) made up the highest average indirect cost for this type of accident, whereas training of replacement work (R600) made up the lowest cost. According to Figure 4.19 investigation costs (R7, 753) and overtime costs (R4 953) were the highest indirect cost categories for cuts/caught between accidents, while damage to plant, equipment and tools (R541) were the lowest.

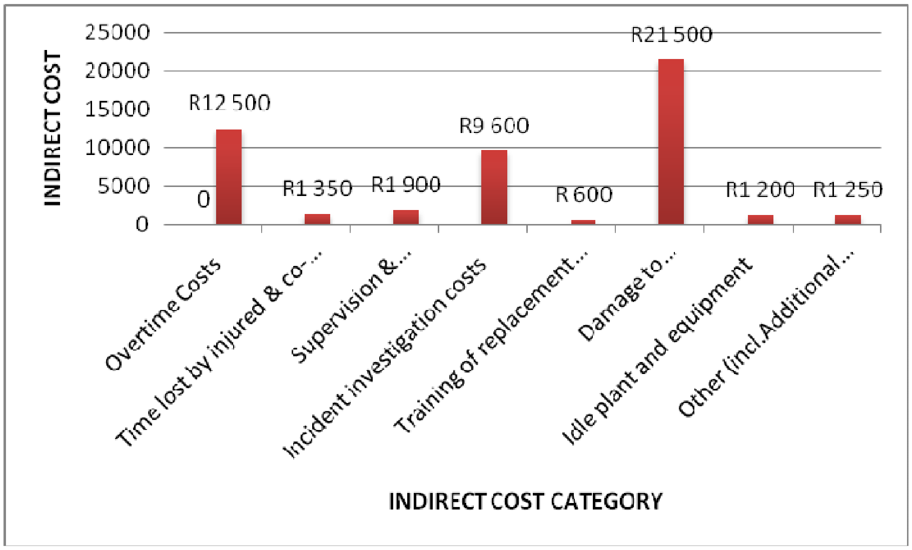

Figure 4. 18 Average Cost for Burns by Indirect Cost Category

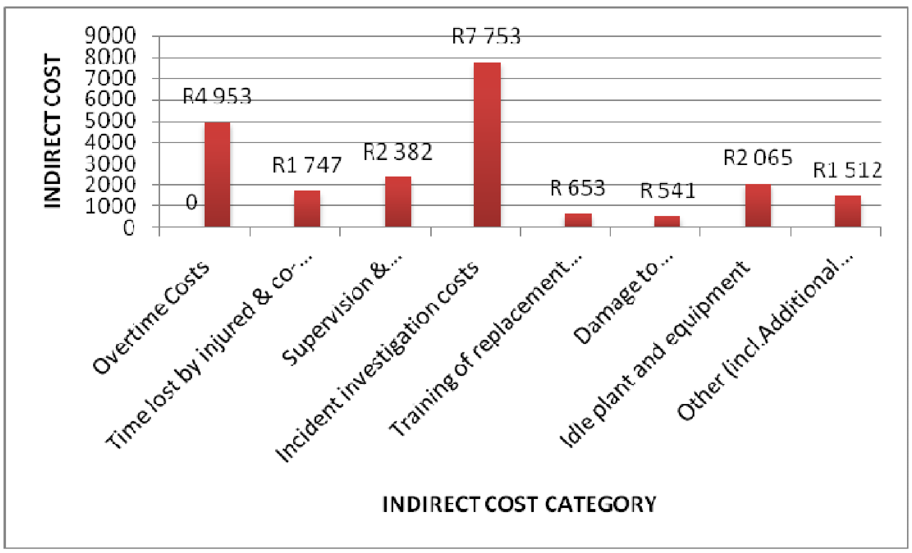

Figure 4. 19 Average Cost for Cuts/Caught between Accidents by Indirect Cost Category

For electrical accidents, other costs (R369 078) were by far the largest indirect cost followed by incident investigation costs (R41 294) as shown in Figure 4.20. Training of replacement workers (R900) was the lowest cost.

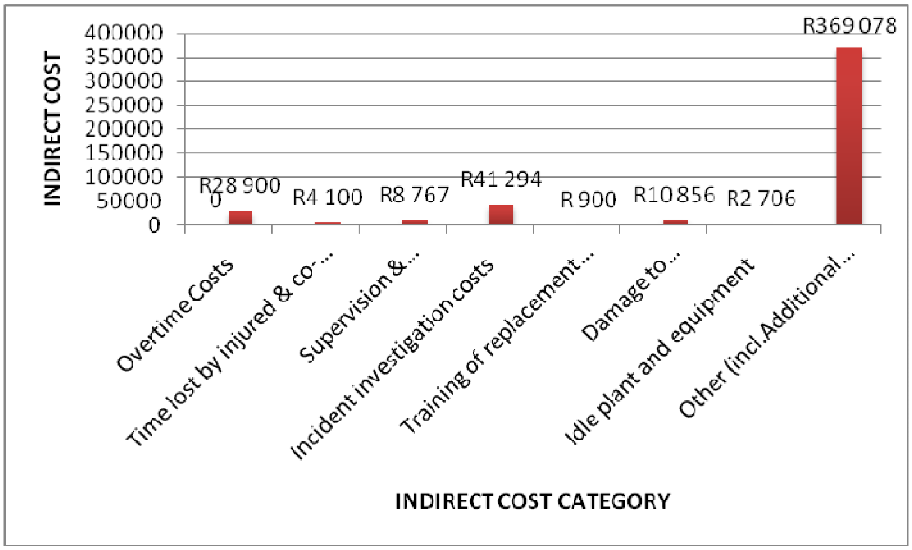

Figure 4. 20 Average Cost for Electrical Accidents by Indirect Cost Category

From Figure 4.21 it is evident that overtime costs (R8,667) and investigation costs (R5,067) were the largest indirect cost categories for exertion/ergonomics accidents, with damage to equipment (R500) being the lowest.

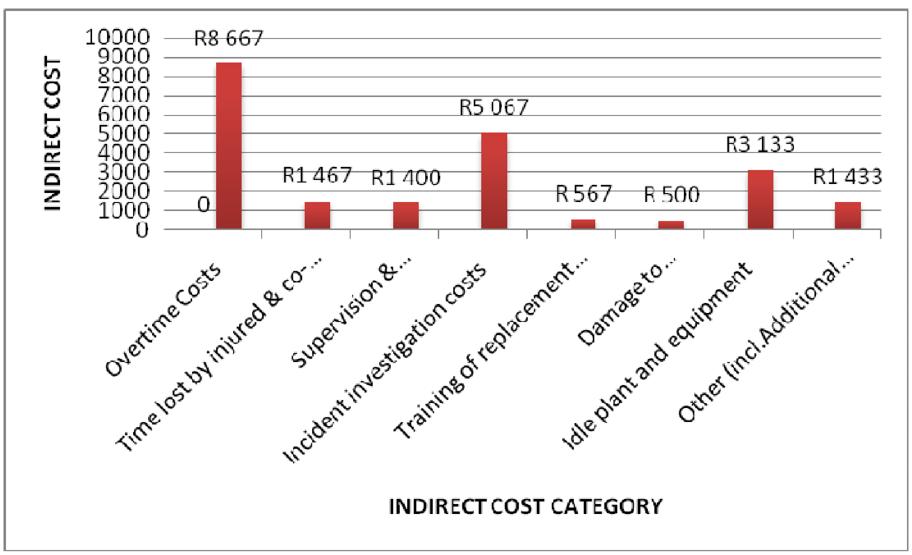

Figure 4. 21 Average Cost of Exertion/Ergonomics Accidents by Indirect Cost Category

Figure 4.22 suggests that for falls, other costs (R255, 011) were by far the largest indirect cost followed by incident investigation costs (R28 149). Training of replacement workers (R1 011) was the lowest cost for this type of accident.

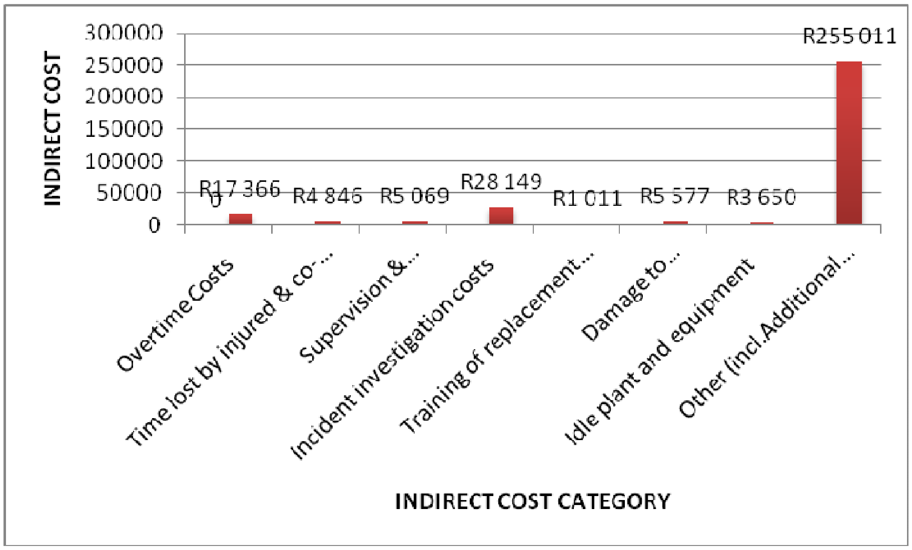

Figure 4. 22 Average Cost of Falls by Indirect Cost Category

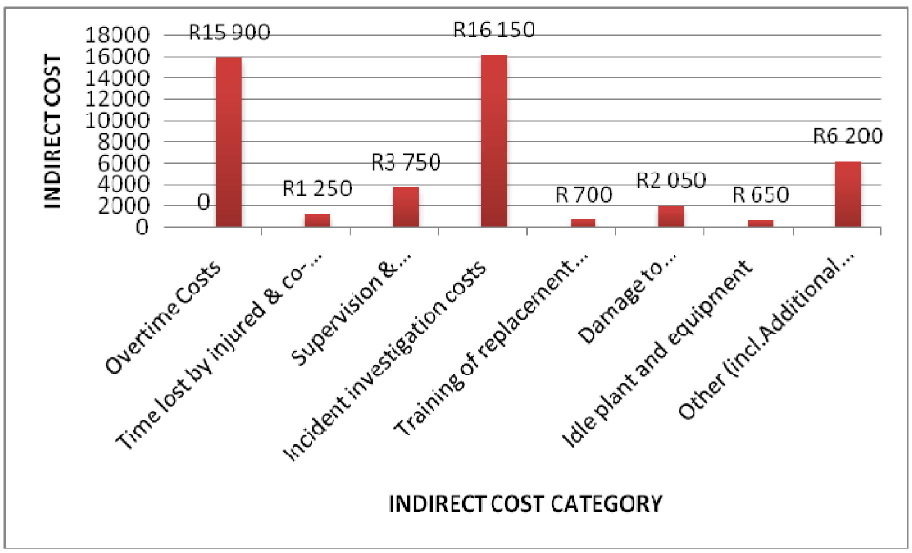

Figure 4. 23 Average Cost of Falling Objects Accidents by Indirect Cost Category

From Figure 4.23 investigation costs (R16 150) and overtime costs (R15 900) were the largest indirect cost categories, with idle plant and equipment (R650) being the lowest for accidents involving falling objects.

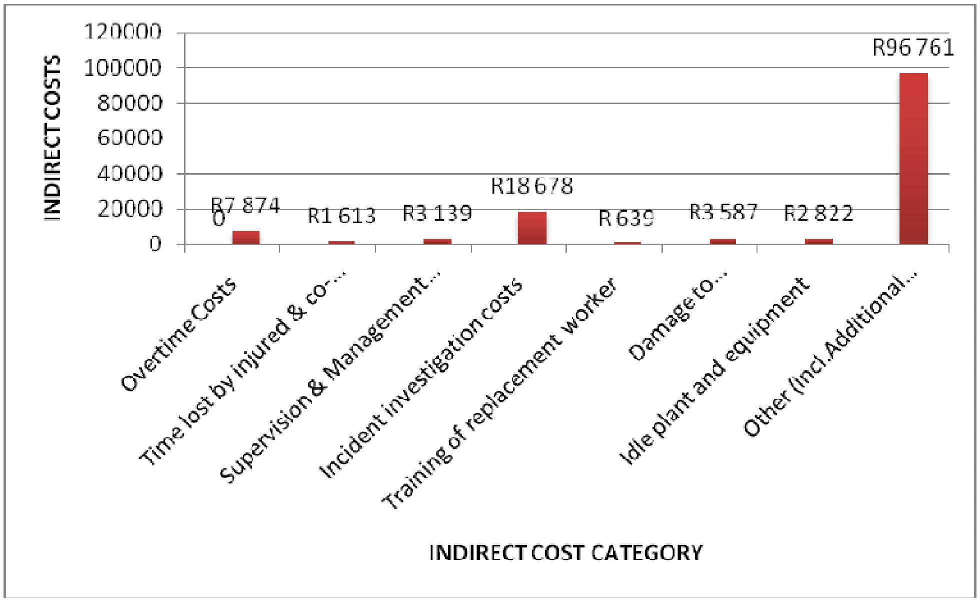

Figure 4. 24 Average Cost of Struck by Accidents by Indirect Cost Category

The largest average indirect cost categories for struck by accidents were other costs (R96 761) and investigation costs (R18,678), while the lowest was training of replacement workers (R639).

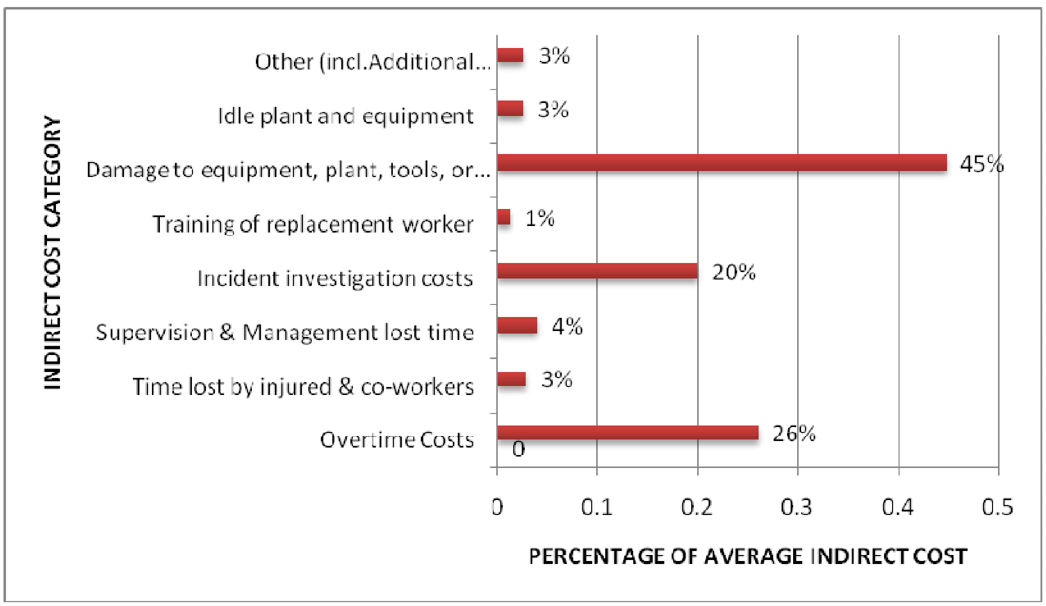

Figure 4. 25 Percentage of Average Indirect Costs by Cost Category for Burns

Figures 4.25 to 4.31 show the percentages of average indirect costs by indirect cost category for each type of accident. The key findings are, namely:

- For burns damage to equipment, plant, tools or other, makes up 45% of the indirect costs;
- For cut/caught between accidents, incident investigation costs (40%) and overtime costs (26%) made up the largest proportion of the indirect costs;

- For electrical accidents, falls and struck by accidents, other including additional medical costs, etc. accounted for most of the indirect costs (81%, 81% and 73% respectively); and
- For exertion/ergonomic accidents and those involving falling objects, the largest contributors to indirect costs were overtime costs (42% and 37% respectively) and incident investigation costs (24% and 38% respectively).

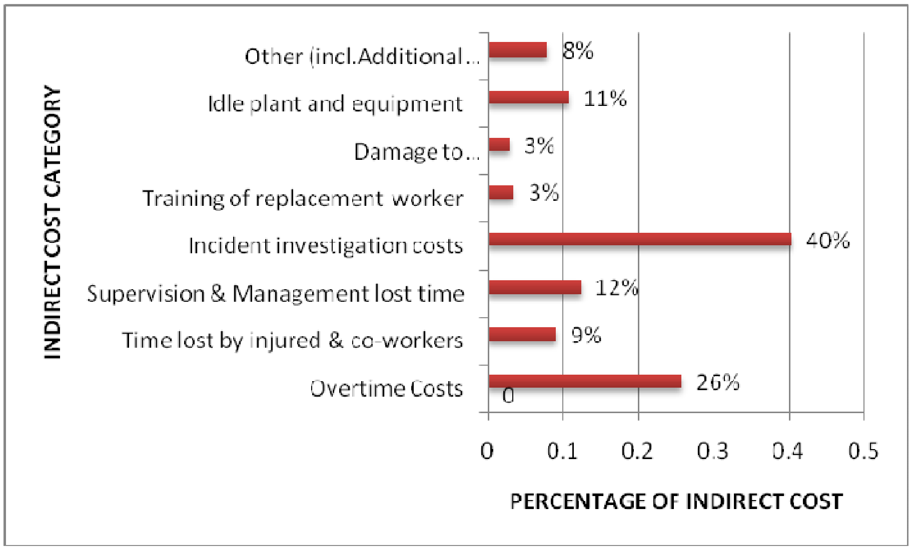

Figure 4. 26 Percentage of Average Indirect Costs by Cost Category for Cut/Caught between Accidents

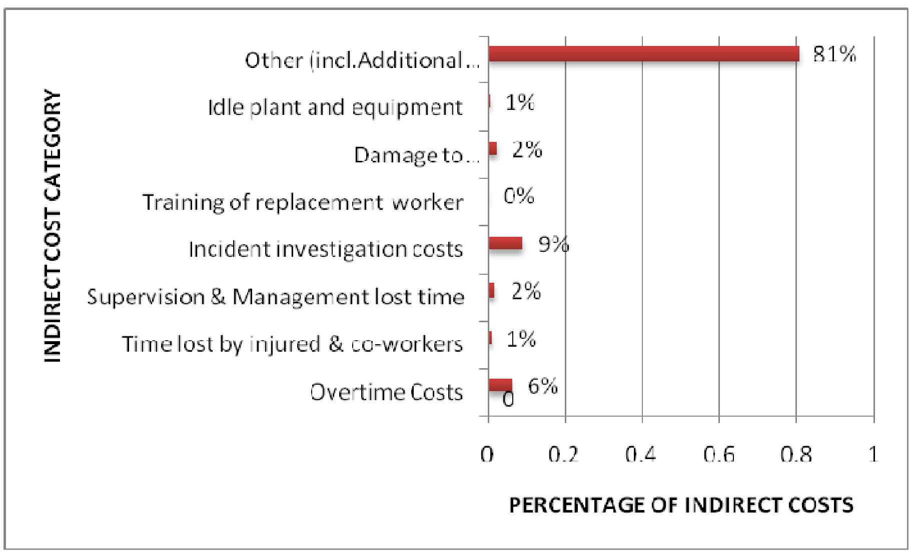

Figure 4. 27 Percentage of Average Indirect Costs by Cost Category of Electrical Accidents

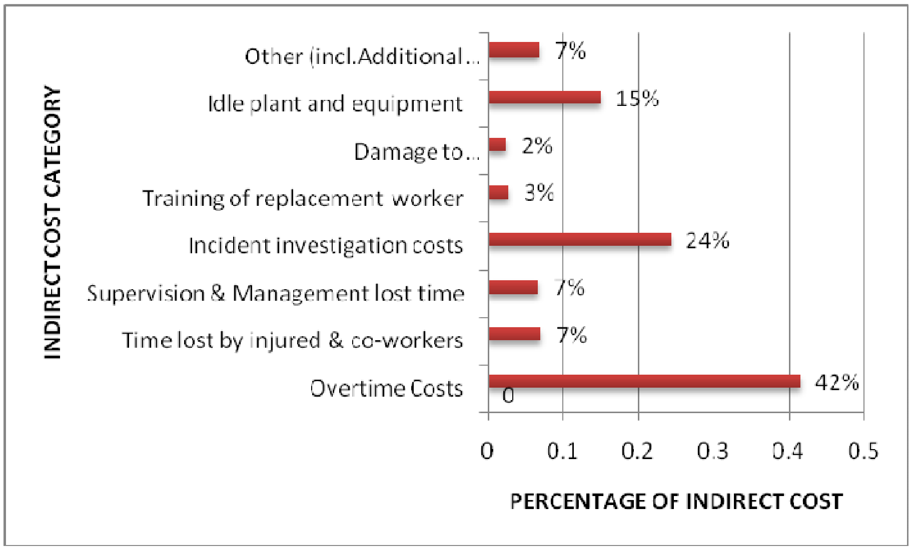

Figure 4. 28 Percentage of Indirect Costs by Cost Category of Exertion/Ergonomics Accidents

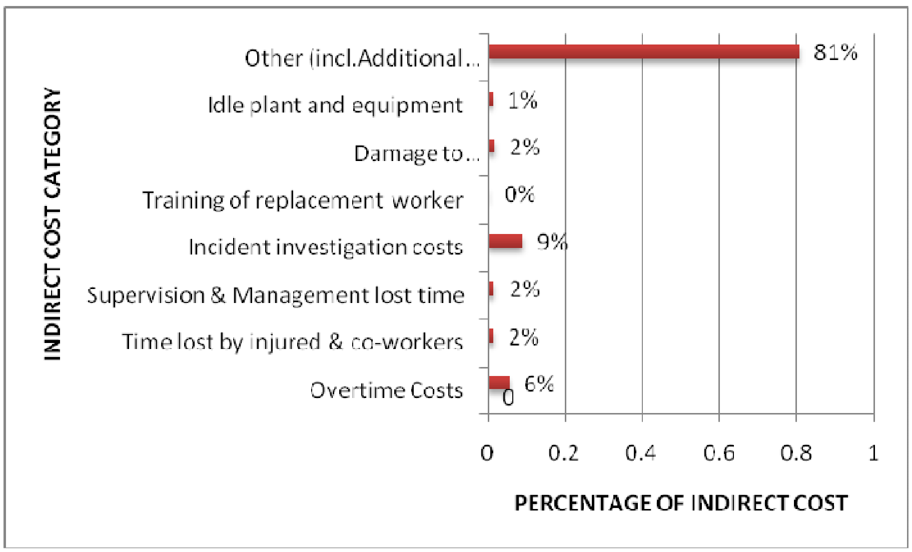

Figure 4. 29 Percentage of Indirect Costs by Cost Category of Falls

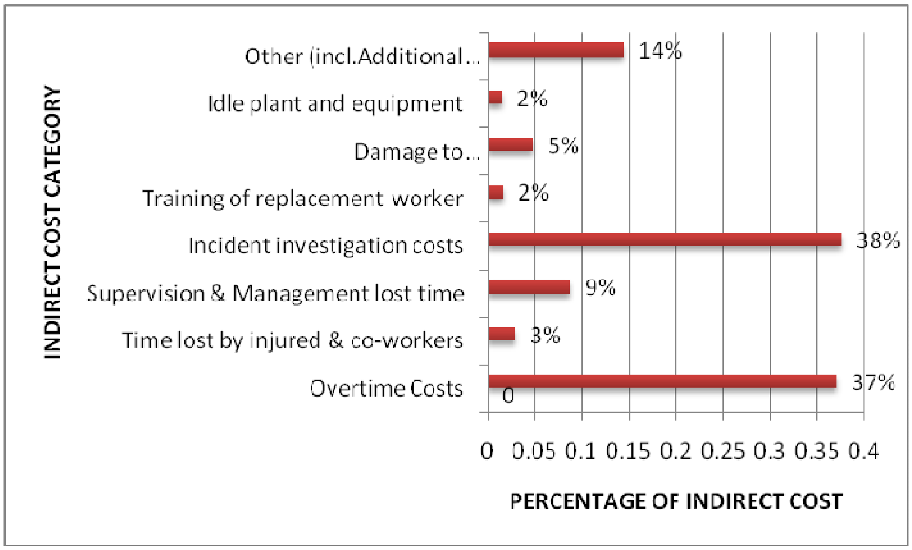

Figure 4. 30 Percentage of Indirect Cost by Cost Category of Falling Objects Accidents

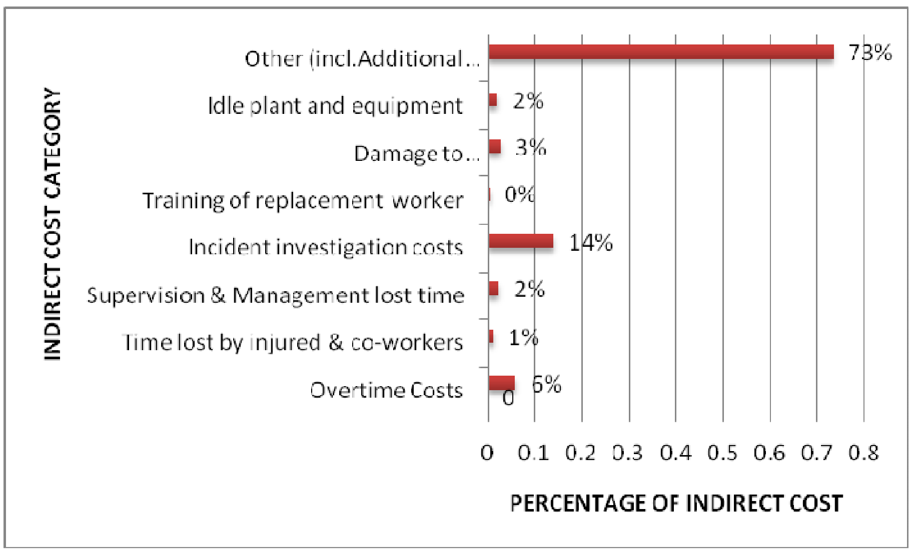

Figure 4. 31 Percentage of Indirect Cost by Cost Category of Struck by Accidents

4.4. Analysis of Accident Costs Excluding Fatalities

It is also evident that the breakdown of the costs of accidents excluding fatalities was, namely:

- Direct Costs:

  Medical (ambulance, doctor, medication, hospital) – 27, 02% of direct costs; and
  Wages for injured person/s – 72.98% of direct costs.

Direct costs made up 38.92% of the total costs of accidents that were non-fatal.

- Indirect Costs:
  - Overtime costs – 33.2% of indirect costs;
  - Time lost by injured & co-workers – 3.7% of indirect costs;
  - Supervision & Management lost time – 3.2% of indirect costs;

- Incident investigation costs – 18.2% of indirect costs;
- Training of replacement worker – 1.5% of indirect costs;
- Damage to equipment, plant, tools, or other property – 6.6% of indirect costs;
- Idle plant and equipment – 4.1% of indirect costs; and
- Other (incl. additional Medical, Consumables & Funeral Costs) – 32.7% of indirect costs.

Indirect costs made up 61.08% of the total costs of non-fatal accidents.

Table 4. 2 Average Costs by Nature of Accident

Nature of Incident	Number of Incidents	Direct Costs (R's)	% Direct	Average Direct Cost (R's)	Indirect Costs (R's)	% Indirect	Average Indirect Cost (R's)	Total Costs (R's)	Average Total Cost (R's)
Exertion/Ergonomics	3	33,100	34,62	11,033	62,500	65,38	20,833	95,600	31,867
Burn	2	41,100	29,98	20,550	96,000	70,02	48,000	137,100	68,550
Falling Object	2	78,600	47,81	39,300	85,800	52,19	42,900	164,400	82,200
Cut/Caught	17	163,400	33,33	9,612	326,800	66,67	19,224	490,200	28,835
Struck	23	1,287,000	29,78	55,957	3,035,400	70,22	131,974	4,322,400	187,930
Electrical	18	3,829,200	31,72	212,733	8,241,000	68,22	457,833	12,070,200	670,567
Fall	35	4,654,940	29,65	132,998	11,046,350	70,35	315,610	15,701,300	448,609

Table 4. 3 Breakdown of Indirect Costs by Cost Category

Accident Type	Overtime Costs	Time Lost by Injured & Co-workers	Supervision & Management Lost Time	Incident Investigation Costs	Training of Replacement Worker	Damage to Equipment, Plant, Tools, or other Property	Idle Plant and Equipment	Other (incl. additional Medical, Consumables & Funeral Costs)
Burn	R12 500	R1 350	R1 900	R9 600	R600	R21 500	R1 200	R1 250
Burn	26%	3%	4%	20%	1%	45%	3%	3%
Cut/caught between	R4 953	R1 747	R2 382	R7 753	R653	R541	R2 065	R1 512
Cut/caught between	26%	9%	12%	40%	3%	3%	11%	8%
Electrical	R28 900	R4 100	R8 767	R41 294	R900	R10 856	R2 706	R369 078
Electrical	6%	1%	2%	9%	0%	2%	1%	81%
Exertion/Ergonomics	R8 667	R1 467	R1 400	R5 067	R567	R500	R3 133	R1 433
Exertion/Ergonomics	42%	7%	7%	24%	3%	2%	15%	7%
Fall	R17 366	R4 846	R5 069	R28 149	R1 011	R5 577	R3 650	R255 011
Fall	6%	2%	2%	9%	0%	2%	1%	81%
Falling Object	R15 900	R1 250	R3 750	R16 150	R700	R2 050	R650	R6 200
Falling Object	37%	3%	9%	38%	2%	5%	2%	14%
Struck by	R7 874	R1 613	R3 139	R18 678	R639	R3 587	R2 822	R96 761
Struck by	6%	1%	2%	14%	0%	3%	2%	73%
TOTAL	R7 874	R1 613	R3 139	R18 678	R639	R3 587	R2 822	R96 761

The breakdowns of the costs of fatalities were, namely:

- Direct Costs:

Medical (ambulance, doctor, medication, hospital) – 0.8% of direct costs; and
Wages for injured person/s – 99.2% of direct costs.

Direct costs made up 28.7% of the total costs of accidents that were fatal. From Figure 4.32 it is evident that the average direct costs for fatalities resulting from falls were highest (R618, 017 per fatality).

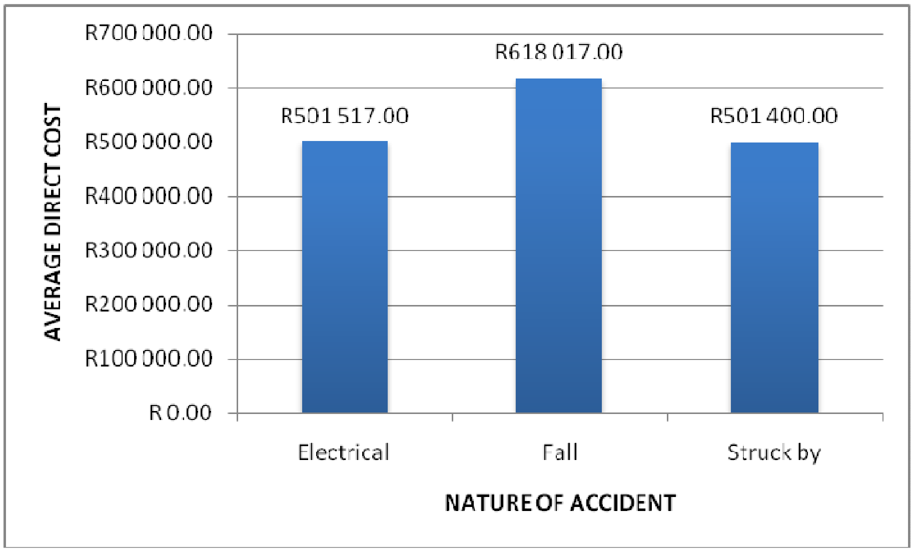

Figure 4. 32 Average Direct Costs by Nature of Accident

From Figure 4.33 it is evident that the average direct medical costs for fatalities resulting from falls were the highest (R8, 350 per fatality).

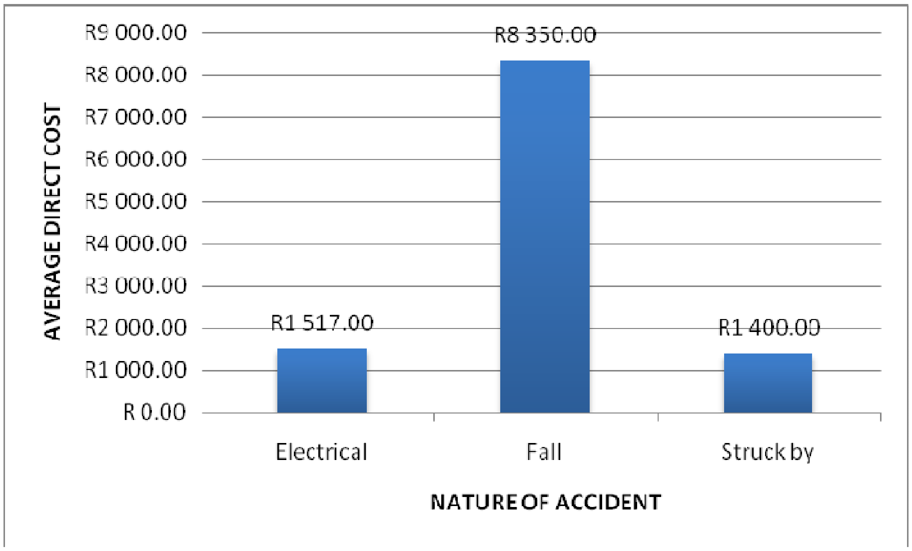

Figure 4. 33 Direct Medical Costs for Fatality by Nature of Accident

Figure 4.34 indicates that the direct cost of wages for fatalities arising from falls is highest (R609, 667 per fatality).

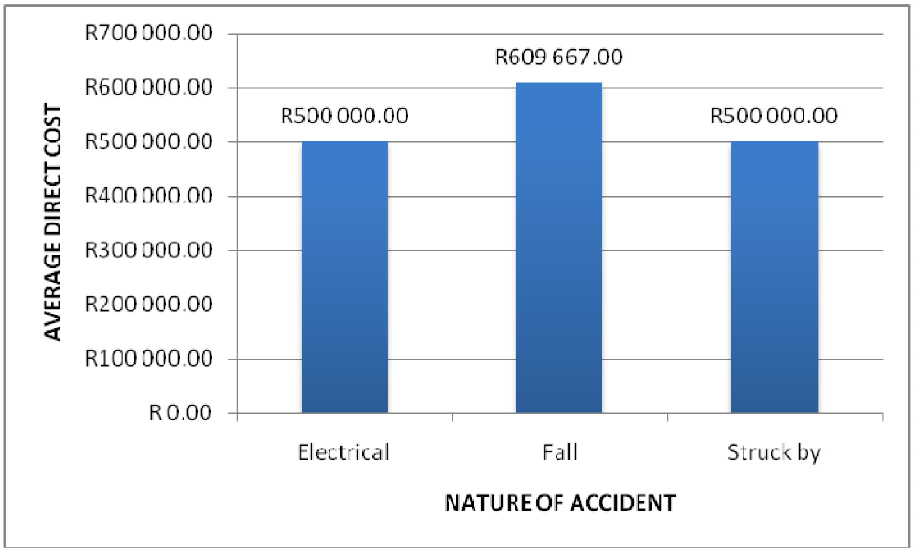

Figure 4. 34 Direct Wage Costs for Fatality by Nature of Accident

- Indirect Costs:
    - Overtime costs – 1.3% of indirect costs;
    - Time lost by injured & co-workers – 0.9% of indirect costs;
    - Supervision & Management lost time – 1.0% of indirect costs;
    - Incident investigation costs – 8.8% of indirect costs;
    - Training of replacement worker – 0.1% of indirect costs;
    - Damage to equipment, plant, tools, or other property – 1.5% of indirect costs;
    - Idle plant and equipment – 0.7% of indirect costs; and
    - Other (incl. Additional Medical, Consumables & Funeral Costs) – 86.7% of indirect costs.

Indirect costs made up 71.3% of the total costs of fatal accidents. These findings are summarized in Table 4.2.

Table 4.4 Comparison of Costs Including Fatalities and Excluding Fatalities (%)

Item	Direct Costs			Indirect Costs		
	Incl. Fatalities	Non-Fatal	Fatal	Incl. Fatalities	Non-Fatal	Fatal
Medical	6.96	27.02	0.08			
Wages	93.04	72.98	99.92			
Overtime				6.40	33.20	1.30
Time lost by injured & co-workers				1.40	3.70	0.90
Supervision & Management lost time				2.60	3.20	1.00
Incident investigation costs				10.30	18.20	8.80
Training of replacement worker				0.40	1.50	0.10
Damage to equipment, plant, tools, or other property				2.30	6.60	1.50
Idle plant and equipment				1.30	4.10	0.70
Other				77.90	32.70	86.70

From Table 4.3 it is evident that in each of the cases, indirect costs exceeded the direct costs with the largest difference occurring when accidents were fatal, namely 42.6%. The ratios of direct to indirect costs are shown in Table 4.3 with the indirect costs of fatalities being almost 2.5 times that of direct costs.

Table 4. 5 Direct costs vs. Indirect Costs Comparison (%)

	Including Fatalities	Non-Fatal	Fatalities
Direct Costs	30.59	38.92	28.70
Indirect Costs	69.41	61.08	71.30
Ratio of direct to indirect costs	1:2.27	1:1.57	1:2.48

From Figure 4.35 it appears that the average indirect cost of overtime for fatalities caused by falls is highest (R30 000 per fatality).

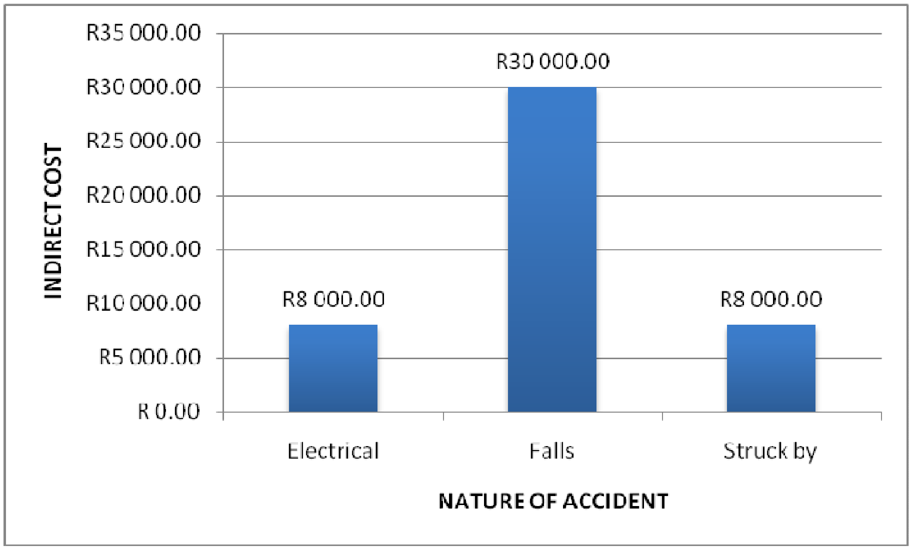

Figure 4. 35 Indirect Cost of Overtime for Fatality by Nature of Accident

Figure 4.36 indicates that the average indirect costs for time lost for a fatality due to falls is highest (R21 383 per fatality).

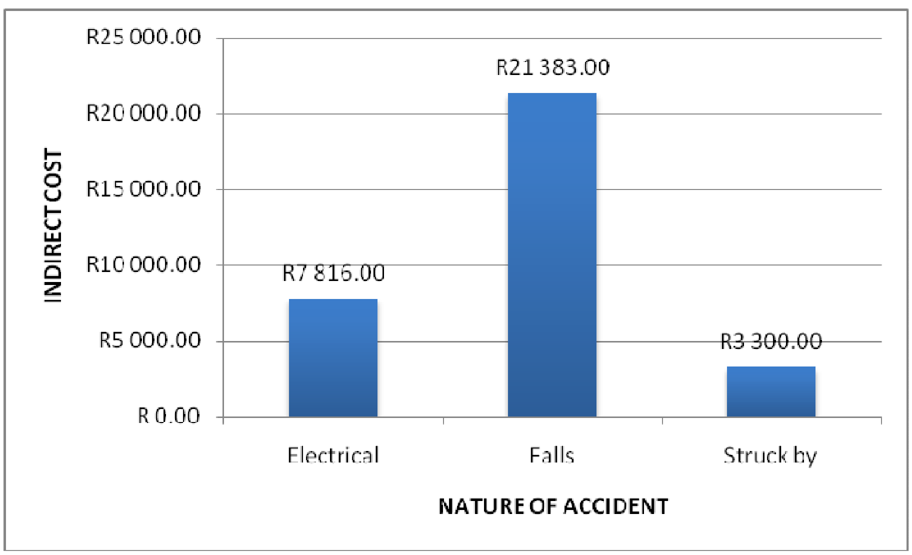

Figure 4. 36 Indirect Cost of Time Lost for Fatality by Nature of Accident

From Figure 4.37 it is evident that the average indirect costs of supervision and management time lost, as a result of a fatality, is highest for those caused by falls (R22 633 per fatality).

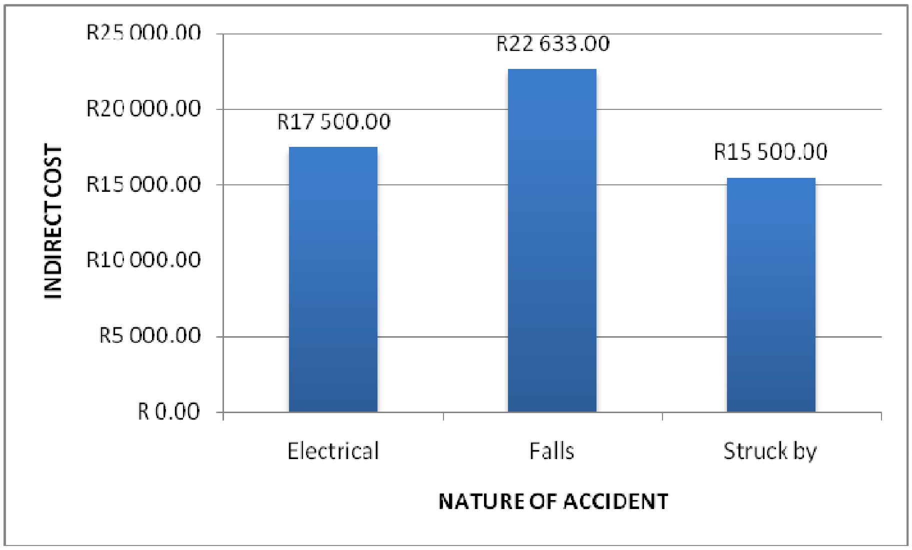

Figure 4. 37 Indirect Cost of Supervision and Management Time Lost for Fatality

Figure 4.38indicates that the average indirect cost of accident investigations in the event of a fatality is highest for those caused by being struck by (R140 500 per fatality).

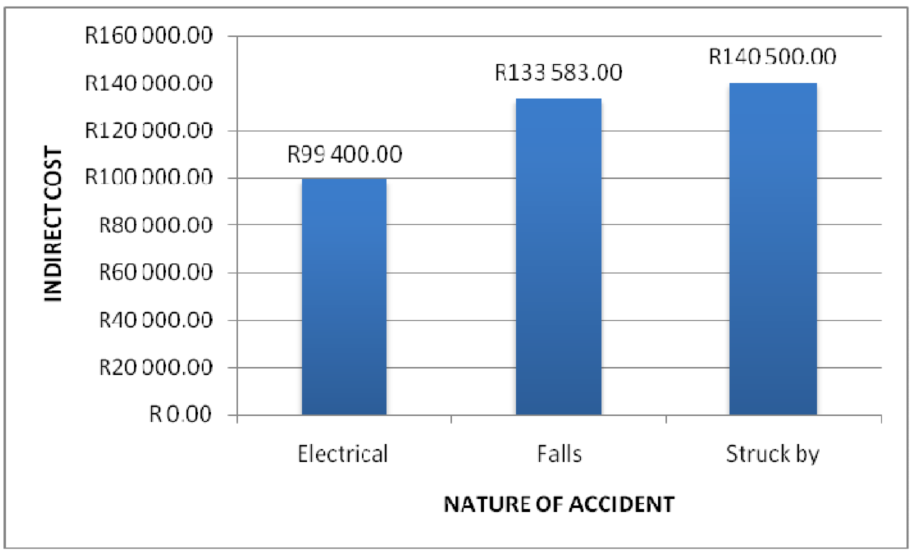

Figure 4. 38 Indirect Cost of Accident Investigation for Fatality by Nature of Accident

Figure 4.39 suggests that the average indirect cost to train a replacement worker as a result of a fatality caused by electrical contact is highest (R13 833 per fatality).

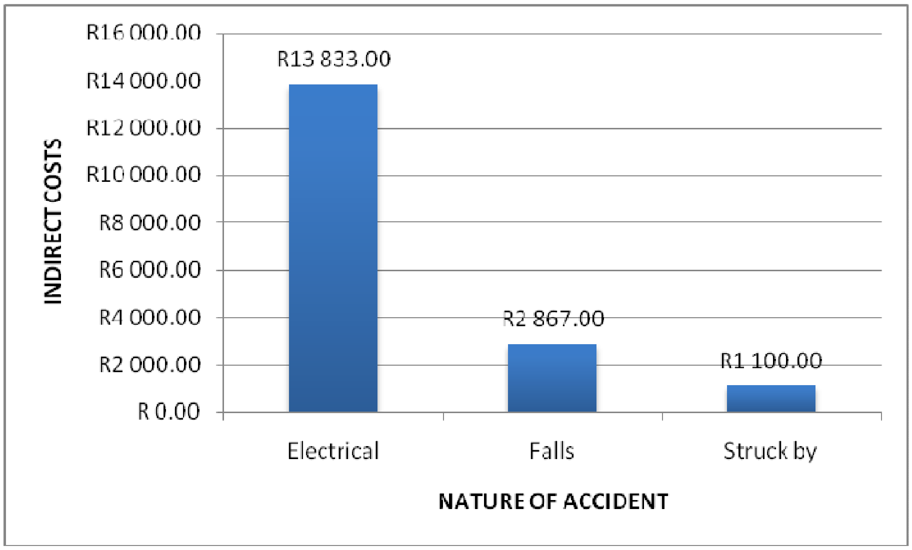

Figure 4. 39 Indirect Cost of Training a Replacement Worker after Fatality

From Figure 4.40 it is evident that the average indirect costs for damage to equipment, plant and tools due to a fatality resulting from a fall is highest (R28 467 per fatality).

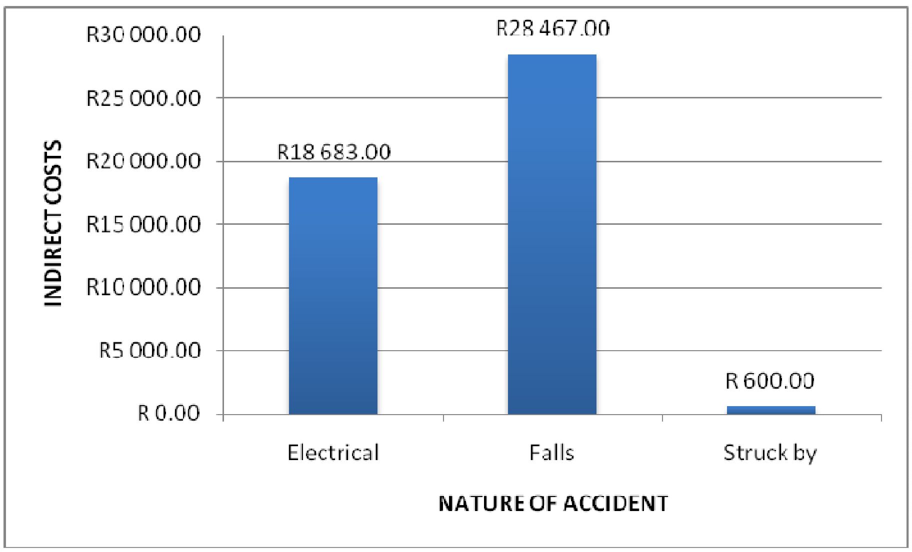

Figure 4. 40 Indirect Cost of Damage to Equipment, Plant and Tools due to Fatality

Figure 4.41 indicates that the average indirect cost of idle plant and equipment, due to a fatality arising from a fall, is highest (R17 033 per fatality).

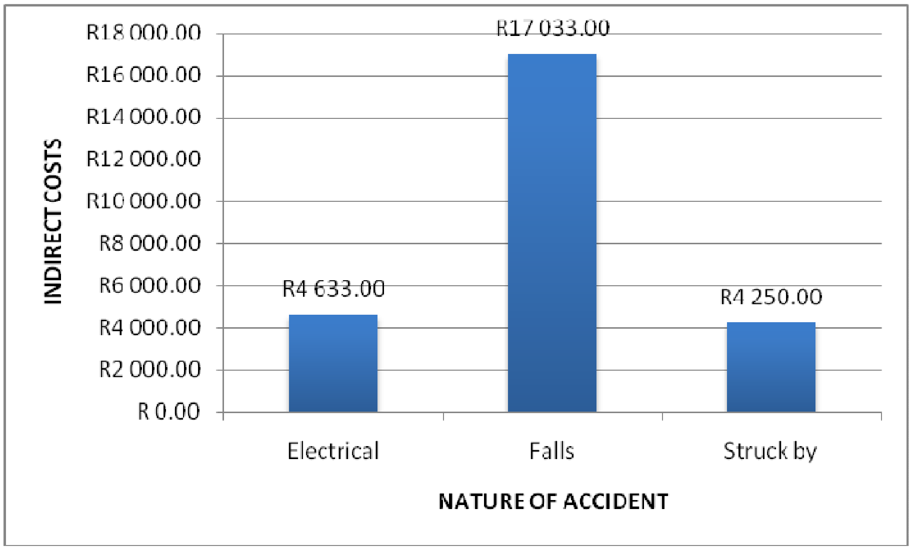

Figure 4. 41 Indirect cost of idle plant and equipment due to fatality

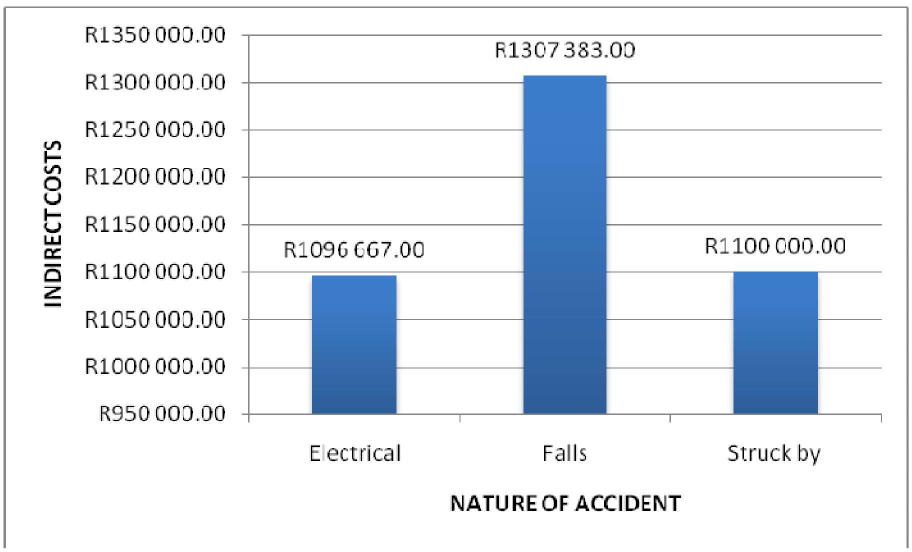

Figure 4. 42 Indirect Cost of other (incl. additional Medical, Consumables & Funeral Costs) due to Fatality

Figure 4.42 indicates that the average indirect costs of other (incl. additional Medical, Consumables & Funeral Costs) are extremely high, with those of a fatality due to a fall being highest (R1,307,383 per fatality).

From Figure 4.43 it is evident that the total average indirect costs for a fatality arising from a fall is the highest (R1, 540, 717 per fatality).

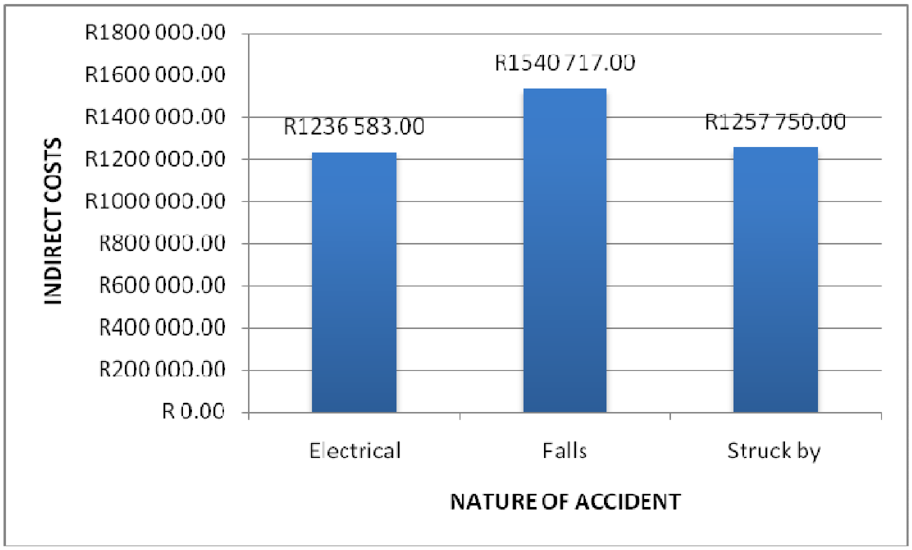

Figure 4. 43 Average Total Indirect Costs by Nature of Accident

With respect to each cause of a fatality, the highest average indirect costs per fatality were other, including additional medical, consumables and funeral costs, accident investigation costs and supervision and management time lost. The average indirect costs per cost category are shown in Table 4.4.

Table 4. 6 Average Indirect Costs for Fatalities by Cost Category

Cost Category	Electrical	Falls	Struck by
Overtime	R8 000,00	R30 000,00	R8 000,00
Time lost	R7 816,00	R21 383,00	R3 300,00
Supervision and management time lost	R17 500,00	R22 633,00	R15 500,00
Incident investigation costs	R99 400,00	R133 583,00	R140 500,00
Training of replacement worker	R13 833,00	R2 867,00	R1 100,00
Damage to equipment, plant, tools or other property	R18 683,00	R28 467,00	R600,00
Idle plant and equipment	R4 633,00	R17 033,00	R4 250,00
Other	R1 096 667,00	R1 307 383,00	R1 100 000,00
Total indirect costs	R1 236 583,00	R1 540 717,00	R1 257 750,00

Chapter 5: Summary and Conclusion

5.1. Introduction

In this chapter the findings of the study are summarized, hypotheses tested, and conclusions drawn. The aim of the study was to analyse construction accident statistics within a major organisation with a large construction spend capacity in order to calculate the extent of costs as well as to demonstrate the staggering effect that these accidents have on the organisation. The study analysed the records of accident reports within the utility to determine the extent of the costs of accidents.

The study sought to test the following hypotheses, namely:

- **Hypothesis 1**

Whenever a construction related accident occurs, consequent disproportionate direct and indirect costs are incurred.

- **Hypothesis 2**

No attempt is made to quantify the associated true costs of construction accidents.

- **Hypothesis 3**

Inadequate efforts are made during incident investigations to determine the true costs in respect of construction accidents and the ensuing economic effects.

The objectives of the study were:

- To conduct an analysis of construction accident reports in order to establish as far as practically reasonable the total costs of limited types of construction accidents;
- To differentiate and determine those costs that were classified as direct costs as opposed to the indirect costs;
- To ascertain the individual costs correlated to the various direct and indirect categories; and
- Through the findings of the study to contribute to an increased awareness of the negative impact of accidents on overall project performance.

5.2. Summary of Findings

After critically analysing the accident investigation reports of the sample of 100 accidents the following were the key findings, namely:

- Falls (35%), struck by (23%) and electrical accidents were the most frequently occurring accidents including fatalities;
- Wages for injured worker/s made up 93,04% of the direct costs of accidents including fatalities and 72,98% of accidents excluding fatalities;
- Direct costs made up 30,59% of the total costs of 100 accidents and 38,92% of the total costs of accidents excluding fatalities;
- Accident investigation costs (10,3%) and other costs including additional medical expenses, consumables and funeral costs (77,9%) were the dominant indirect costs of accidents including fatalities;

- Overtime costs (33,2%), other costs including additional medical expenses, consumables and funeral costs (32,7%) and accident investigation costs (18,2%) were the highest average total costs for accidents excluding fatalities;
- Electrical accidents, falls and struck by accidents had the highest average total cost per accident;
- Electrical accidents and falls had the highest average direct and indirect costs per accident;
- Accidents involving falling objects and exertion/ergonomics type accidents had the highest ratio of direct to indirect costs;
- Falling objects, struck by accidents and burns had the highest percentage ratio of indirect to direct costs;
- Falls and electrical accidents had the highest medical and wage costs and therefore also the highest average total cost per accident;
- Falls and electrical accidents had the highest average overtime costs, costs of time lost by injured and co-workers, costs of time lost by management and supervision, investigation costs, and training costs;
- Burns and electrical accidents had the highest average indirect costs of damage to equipment, plant, tools and other property;
- Falls caused the highest average indirect costs of idle plant and equipment;
- Investigation and overtime costs made up the highest indirect costs for cuts/caught between accidents;
- Other costs including additional medical treatment, consumables and funerals made up the highest indirect costs for electrical accidents, struck by accidents and falls;
- Overtime costs were the highest indirect costs for exertion/ergonomics type accidents;
- Investigation costs were the highest indirect costs for accidents involving falling objects;
- For burns damage to equipment, plant, tools or other make up 45% of the indirect costs;
- For cut/caught between accidents, incident investigation costs (40%) and overtime costs (26%) made up the largest proportion of the indirect costs;
- For electrical accidents, falls and struck by accidents, other including additional medicals costs, etc. accounted for most of the indirect costs (81%, 81% and 73% respectively);
- For exertion/ergonomic accidents and those involving falling objects, the largest contributors to indirect costs were overtime costs (42% and 37% respectively) and incident investigation costs (24% and 38% respectively);
- Wages made up 99,2% of the direct costs of fatalities;
- Direct costs made up 28,7% of the total average costs of fatalities;
- Fatalities due to falls had the highest average direct costs per accident, direct medical costs, wages;
- Other costs including additional medical treatment, consumables and funerals were highest indirect costs of fatalities;
- Indirect costs made up 71,3% of the total average costs per fatality;
- Indirect costs exceeded the direct costs with the indirect costs being almost 2.5 times the direct costs;
- Average cost of overtime, time lost, supervision and management were highest indirect costs for fatalities; and
- Falls had the highest total average indirect costs for fatalities.

5.3. Hypothesis Testing

> H1: Whenever a construction related accident occurs, consequent disproportionate direct and indirect costs are incurred.

The examination of the investigation reports and related documentation of the sample of 100 accidents including fatalities indicated that in every case the indirect costs exceeded the direct costs by at least 100% depending on the nature of the accident. In the case of fatalities this disproportionality is greater. These findings are well supported by previous studies (Hinze, 1997; Haslam, *et al.,* 2005; Joyce, 2001; Everett and Frank, 1996; HSE, 1997; and Waehrer, *et al.,* 2007) conducted to establish the costs of accidents and the relationship between the direct and indirect costs of accidents.

The hypothesis that whenever a construction related accident occurs consequent disproportionate direct and indirect costs are incurred cannot be rejected.

> H2: No or very little attempt is made to quantify the associated true costs of construction accidents.

In order to establish the magnitude or extent of each of the cost categories associated with each of the 100 accidents in the sample required a combination of realistically informed estimates and access to records from various sources and held in various departments such as, for example, the Human Resources department, managers and attendance records, the in-house COID office, Corporate Health and Safety department office, various temporary employment services or technical related labour brokers, and plant hire records. This information should preferably have been kept in a central location. It is evident that the organization has no way, other than through an exhaustive and time-consuming investigation, of knowing what the true costs of any accident actually are. This lack of information potentially contributes to the insensitivity of the impact of accidents on the overall performance of the organization.

The hypothesis that no or very little attempt is made to quantify the associated true costs of construction accidents cannot be rejected.

> H3: Inadequate efforts are made during incident investigations to determine the true costs in respect of construction accidents and the ensuing economic effects.

Similarly, the examination of the investigation reports and associated documents indicated that the true costs of each of the accidents in the sample of 100 accidents were not established aside from this particular study. There was no evidence in the organization of a co-ordinated effort to establish and record the true costs of accidents. Given this lack of cost data, the management of the organization are uninformed of the economic effects of the accidents that occur in the organization.

The hypothesis that inadequate efforts are made during incident investigations to determine the true costs in respect of construction accidents and the ensuing economic effects cannot be rejected.

5.4. Conclusion

This study conducted an analysis of a sample of 100 construction accident reports in order to establish, as far as practically reasonable, the total costs of limited types of construction accidents. Costs attributable to each of these accidents were classified either as direct or indirect costs. Through an exhaustive and time-consuming investigation of all available records from various sources and/or kept in various departments the individual costs were correlated to the various direct and indirect categories. The findings of the study highlighted the potential negative impact of accidents and their associated costs on overall project performance.

The overall costs of each accident in the sample were established. In every case the indirect costs were substantially more than the direct costs. In most cases the indirect costs were found to be more than 100% greater than the direct costs.

The study established that there was no concerted co-ordinated system of recording the true costs associated with construction-related accidents and that the investigation reports and documentation were deficient. Consequently the economic impact could not be established and was therefore unknown.

The study confirmed that a comprehensive analysis of the cost of every construction-related accident was necessary for any organization to completely understand the broad implications of these accidents on their overall performance. Such an analysis would enhance the prospects of an improved allocation of resources to proactive strategic health and safety interventions that would prevent accidents from occurring. However, to achieve this objective all associated costs would need to be captured and recorded and stored in a central and accessible location. For this particular organization, there was an obvious need to develop a new approach to conducting accident investigations and the recording of essential data.

Finally, the study demonstrated that the costs of accident prevention could be less than the true costs of accidents.

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APPENDICES

APPENDIX A: DIRECT COSTS OF 100 ACCIDENTS

Accident number	Accident cause from investigation report	Direct Costs					
		Medical (ambulance, doctor, medication, hospital)		Wages for injured person/s		Total Direct	
53	Burn	R 2 600	11,02	R 21 000	88,98	R 23 600	30,10
56	Burn	R 1 500	8,57	R 16 000	91,43	R 17 500	29,81
2	Cut/Caught	R 800	13,79	R 5 000	86,21	R 5 800	28,02
4	Cut/Caught	R 2 100	53,85	R 1 800	46,15	R 3 900	26,90
5	Cut/Caught	R 700	12,73	R 4 800	87,27	R 5 500	27,50
14	Cut/Caught	R 3 000	25,00	R 9 000	75,00	R 12 000	33,99
15	Cut/Caught	R 5 000	62,50	R 3 000	37,50	R 8 000	32,39
16	Cut/Caught	R 14 000	53,85	R 12 000	46,15	R 26 000	43,77
19	Cut/Caught	R 1 700	48,57	R 1 800	51,43	R 3 500	12,32
21	Cut/Caught	R 3 400	41,46	R 4 800	58,54	R 8 200	16,77
27	Cut/Caught	R 2 000	23,81	R 6 400	76,19	R 8 400	28,19
28	Cut/Caught	R 1 600	26,67	R 4 400	73,33	R 6 000	30,77
34	Cut/Caught	R 1 200	19,35	R 5 000	80,65	R 6 200	36,69
36	Cut/Caught	R 4 400	25,29	R 13 000	74,71	R 17 400	53,54
48	Cut/Caught	R 1 800	8,26	R 20 000	91,74	R 21 800	62,46
71	Cut/Caught	R 700	14,89	R 4 000	85,11	R 4 700	26,40
84	Cut/Caught	R 1 800	18,37	R 8 000	81,63	R 9 800	23,44
89	Cut/Caught	R 3 200	21,05	R 12 000	78,95	R 15 200	38,78
98	Cut/Caught	R 600	60,00	R 400	40,00	R 1 000	16,95
10	Electrical	R 2 400	61,54	R 1 500	38,46	R 3 900	17,41
37	Electrical –Fatality	R 1 800	0,36	R 500 000	99,64	R 501 800	29,79
38	Electrical	R 5 000	10,64	R 42 000	89,36	R 47 000	39,13
42	Electrical	R 9 500	34,55	R 18 000	65,45	R 27 500	33,99
43	Electrical	R 9 000	34,62	R 17 000	65,38	R 26 000	47,27
46	Electrical	R 9 500	24,05	R 30 000	75,95	R 39 500	45,77
58	Electrical –Fatality	R 1 600	0,32	R 500 000	99,68	R 501 600	29,74
60	Electrical	R 1 500	9,68	R 14 000	90,32	R 15 500	39,34
63	Electrical	R 2 300	7,35	R 29 000	92,65	R 31 300	47,50
64	Electrical	R 1 500	14,29	R 9 000	85,71	R 10 500	40,86
66	Electrical	R 3 900	11,85	R 29 000	88,15	R 32 900	33,99
73	Electrical	R 2 400	5,17	R 44 000	94,83	R 46 400	50,88
78	Electrical –Fatality	R 1 200	0,24	R 500 000	99,76	R 501 200	28,25
100	Electrical	R 1 600	10,26	R 14 000	89,74	R 15 600	42,39
31	Electrical	R 184 000	35,11	R 340 000	64,89	R 524 000	56,89
41	Electrical –Fatality	R 1 800	0,36	R 500 000	99,64	R 501 800	28,67
79	Electrical –Fatality	R 1 500	0,30	R 500 000	99,70	R 501 500	28,28
80	Electrical –Fatality	R 1 200	0,24	R 500 000	99,76	R 501 200	28,48
7	Exertion/Ergonomics	R 1 400	25,93	R 4 000	74,07	R 5 400	22,78
29	Exertion/Ergonomics	R 1 700	43,59	R 2 200	56,41	R 3 900	21,91
88	Exertion/Ergonomics	R 1 800	7,56	R 22 000	92,44	R 23 800	43,99
9	Fall	R 2 800	70,00	R 1 200	30,00	R 4 000	34,04
22	Fall	R 4 600	24,73	R 14 000	75,27	R 18 600	41,52
32	Fall	R 1 800	20,00	R 7 200	80,00	R 9 000	35,57
35	Fall	R 148 000	33,04	R 300 000	66,96	R 448 000	26,90
39	Fall	R 1 500	10,34	R 13 000	89,66	R 14 500	40,62
40	Fall	R 1 800	12,16	R 13 000	87,84	R 14 800	38,24
44	Fall	R 3 200	31,37	R 7 000	68,63	R 10 200	44,35
47	Fall	R 2 800	28,57	R 7 000	71,43	R 9 800	34,63

Accident number	Accident cause from investigation report	Direct Costs					
		Medical (ambulance, doctor, medication, hospital)		Wages for injured person/s		Total Direct	
49	Fall	R 900	11,39	R 7 000	88,61	R 7 900	38,92
50	Fall	R 2 600	9,77	R 24 000	90,23	R 26 600	47,25
51	Fall	R 7 800	13,98	R 48 000	86,02	R 55 800	54,39
52	Fall	R 9 500	12,75	R 65 000	87,25	R 74 500	59,41
54	Fall	R 11 500	24,73	R 35 000	75,27	R 46 500	53,26
57	Fall	R 850	17,53	R 4 000	82,47	R 4 850	30,22
59	Fall	R 2 600	17,22	R 12 500	82,78	R 15 100	49,19
61	Fall	R 2 800	3,74	R 72 000	96,26	R 74 800	57,06
62	Fall	R 700	21,88	R 2 500	78,13	R 3 200	30,19
67	Fall	R 2 000	22,22	R 7 000	77,78	R 9 000	32,14
69	Fall	R 1 200	12,37	R 8 500	87,63	R 9 700	37,31
72	Fall	R 700	3,95	R 17 000	96,05	R 17 700	52,21
74	Fall	R 600	14,29	R 3 600	85,71	R 4 200	30,43
76	Fall –Fatality	R 800	0,16	R 500 000	99,84	R 500 800	29,04
77	Fall –Fatality	R 1 500	0,30	R 500 000	99,70	R 501 500	28,81
83	Fall	R 1 200	11,76	R 9 000	88,24	R 10 200	39,23
86	Fall	R 1 700	8,63	R 18 000	91,37	R 19 700	43,88
87	Fall –Fatality	R 43 000	3,58	R 1 158 000	96,42	R 1 201 000	29,03
90	Fall	R 500	14,29	R 3 000	85,71	R 3 500	32,11
93	Fall	R 2 200	18,80	R 9 500	81,20	R 11 700	34,62
94	Fall	R 400	40,00	R 600	60,00	R 1 000	8,47
95	Fall	R 1 200	46,15	R 1 400	53,85	R 2 600	17,93
96	Fall	R 1 200	37,50	R 2 000	62,50	R 3 200	26,89
97	Fall	R 2 200	13,58	R 14 000	86,42	R 16 200	40,30
20	Fall –Fatality	R 1 800	0,36	R 500 000	99,64	R 501 800	26,79
65	Fall –Fatality	R 1 500	0,30	R 500 000	99,70	R 501 500	29,50
82	Fall –Fatality	R 1 500	0,30	R 500 000	99,70	R 501 500	28,23
25	Falling Object	R 48 000	66,67	R 24 000	33,33	R 72 000	56,83
26	Falling Object	R 1 800	27,27	R 4 800	72,73	R 6 600	17,51
1	Struck	R 2 000	17,39	R 9 500	82,61	R 11 500	31,08
3	Struck	R 8 400	46,93	R 9 500	53,07	R 17 900	43,66
6	Struck	R 600	37,50	R 1 000	62,50	R 1 600	10,32
8	Struck	R 4 500	39,13	R 7 000	60,87	R 11 500	43,89
11	Struck	R 4 500	36,00	R 8 000	64,00	R 12 500	24,22
12	Struck	R 1 600	44,44	R 2 000	55,56	R 3 600	15,25
13	Struck	R 1 400	14,89	R 8 000	85,11	R 9 400	30,82
17	Struck	R 1 600	26,23	R 4 500	73,77	R 6 100	34,46
18	Struck	R 1 600	53,33	R 1 400	46,67	R 3 000	12,15
23	Struck	R 4 000	21,05	R 15 000	78,95	R 19 000	37,77
24	Struck	R 3 600	10,71	R 30 000	89,29	R 33 600	21,82
30	Struck	R 7 500	18,99	R 32 000	81,01	R 39 500	50,71
33	Struck	R 26 000	41,94	R 36 000	58,06	R 62 000	61,08
85	Struck	R 1 500	23,08	R 5 000	76,92	R 6 500	21,38
99	Struck	R 1 200	75,00	R 400	25,00	R 1 600	17,58
45	Struck	R 4 600	26,14	R 13 000	73,86	R 17 600	46,93
55	Struck	R 1 800	16,67	R 9 000	83,33	R 10 800	35,18
68	Struck	R 800	47,06	R 900	52,94	R 1 700	31,48
70	Struck	R 1 200	15,58	R 6 500	84,42	R 7 700	45,03
75	Struck –Fatality	R 1 200	0,24	R 500 000	99,76	R 501 200	28,42
81	Struck –Fatality	R 1 600	0,32	R 500 000	99,68	R 501 600	28,59
91	Struck	R 600	16,67	R 3 000	83,33	R 3 600	32,73

Accident number	Accident cause from investigation report	Direct Costs					
		Medical (ambulance, doctor, medication, hospital)		Wages for injured person/s		Total Direct	
92	Struck	R 500	14,29	R 3 000	85,71	R 3 500	30,70
Totals		**R 701 750**	**6,96**	**R 9 385 600**	**93,04**	**R 10 087 350**	**30,59**

APPENDIX B: INDIRECT COSTS OF 100 ACCIDENTS

Overtime costs		Time lost by injured & co-workers		Supervision & Management lost time		Incident investigation costs		Training of replacement worker		Damage to equipment, plant, tools, or other property.		Idle plant and equipment		Other (incl.Additional Medical,Consumables & Funeral Costs)		Total Indirect	
R 13 000	23,7	R 1 400	2,6	R 2 200	4,0	R 13 200	24,1	R 500	0,9	R 24 000	43,8	R 1 200	2,2	R 1 500	2,7	R 54 800	69,90
R 12 000	29,1	R 1 300	3,2	R 1 600	2,9	R 6 000	14,6	R 700	1,7	R 19 000	46,1	R 1 200	2,9	R 1 000	2,4	R 41 200	70,19
R 4 500	30,2	R 1 400	9,4	R 4 200	7,7	R 7 000	47,0	R 800	5,4	R 0	0,0	R 300	2,0	R 900	6,0	R 14 900	71,98
R 1 800	17,0	R 1 300	12,3	R 4 200	7,7	R 5 400	50,9	R 600	5,7	R 0	0,0	R 700	6,6	R 800	7,5	R 10 600	73,10
R 4 100	28,3	R 1 500	10,3	R 3 500	6,4	R 6 800	46,9	R 800	5,5	R 0	0,0	R 400	2,8	R 900	6,2	R 14 500	72,50
R 7 000	30,0	R 1 600	6,9	R 900	1,6	R 9 500	40,8	R 700	3,0	R 0	0,0	R 1 900	8,2	R 2 600	11,2	R 23 300	66,01
R 2 500	15,0	R 1 400	8,4	R 600	1,1	R 8 900	53,3	R 800	4,8	R 0	0,0	R 600	3,6	R 2 500	15,0	R 16 700	67,61
R 10 000	29,9	R 1 900	5,7	R 800	1,5	R 7 500	22,5	R 800	2,4	R 0	0,0	R 7 700	23,1	R 5 500	16,5	R 33 400	56,23
R 1 800	7,2	R 1 600	6,4	R 4 800	8,8	R 18 700	75,1	R 600	2,4	R 400	1,6	R 1 200	4,8	R 600	2,4	R 24 900	87,68
R 4 800	11,8	R 2 700	6,6	R 4 800	8,8	R 24 300	59,7	R 700	1,7	R 1 200	2,9	R 5 200	12,8	R 1 800	4,4	R 40 700	83,23
R 5 000	23,4	R 1 200	5,6	R 1 800	3,3	R 5 200	24,3	R 700	3,3	R 1 300	6,1	R 6 400	29,9	R 1 600	7,5	R 21 400	71,81
R 3 500	25,9	R 1 300	9,6	R 1 500	2,7	R 5 500	40,7	R 600	4,4	R 600	4,4	R 500	3,7	R 1 500	11,1	R 13 500	69,23
R 4 800	44,9	R 1 300	12,1	R 3 600	6,6	R 3 200	29,9	R 500	4,7	R 0	0,0	R 200	1,9	R 700	6,5	R 10 700	63,31
R 7 000	46,4	R 1 300	8,6	R 2 800	5,1	R 5 200	34,4	R 500	3,3	R 0	0,0	R 0	0,0	R 1 100	7,3	R 15 100	46,46
R 7 000	53,4	R 1 300	9,9	R 2 500	4,6	R 3 400	26,0	R 500	3,8	R 0	0,0	R 0	0,0	R 900	6,9	R 13 100	37,54
R 3 000	22,9	R 1 400	10,7	R 1 000	1,8	R 3 500	26,7	R 500	3,8	R 0	0,0	R 4 000	30,5	R 700	5,3	R 13 100	73,60
R 6 000	18,8	R 4 500	14,1	R 1 500	2,7	R 13 000	40,6	R 700	2,2	R 4 500	14,1	R 2 000	6,3	R 1 300	4,1	R 32 000	76,56
R 11 000	45,8	R 3 500	14,6	R 1 400	2,6	R 1 800	7,5	R 800	3,3	R 1 200	5,0	R 4 000	16,7	R 1 700	7,1	R 24 000	61,22
R 400	8,2	R 500	10,2	R 600	1,1	R 2 900	59,2	R 500	10,2	R 0	0,0	R 0	0,0	R 600	12,2	R 4 900	83,05
R 1 200	6,5	R 1 400	7,6	R 1 200	2,2	R 11 800	63,8	R 800	4,3	R 600	3,2	R 1 100	5,9	R 1 600	8,6	R 18 500	82,59
R 8 000	0,7	R 2 700	0,2	R 23 000	42,0	R 59 400	5,0	R 700	0,1	R 4 600	0,4	R 7 000	0,6	R 1 100 000	93,0	R 1 182 400	70,21
R 22 000	30,1	R 3 500	4,8	R 4 000	7,3	R 16 000	21,9	R 700	1,0	R 24 000	32,8	R 2 000	2,7	R 4 900	6,7	R 73 100	60,87
R 10 000	18,7	R 1 800	3,4	R 3 600	6,6	R 8 900	16,7	R 500	0,9	R 27 000	50,6	R 3 400	6,4	R 1 800	3,4	R 53 400	66,01
R 10 000	34,5	R 1 800	6,2	R 3 600	6,6	R 8 800	30,3	R 700	2,4	R 4 000	13,8	R 2 100	7,2	R 1 600	5,5	R 29 000	52,73
R 25 000	53,4	R 1 600	3,4	R 2 800	5,1	R 11 800	25,2	R 500	1,1	R 4 500	9,6	R 1 300	2,8	R 2 100	4,5	R 46 800	54,23
R 8 000	0,7	R 2 200	0,2	R 12 000	21,9	R 63 000	5,3	R 500	0,0	R 11 000	0,9	R 600	0,1	R 1 100 000	92,8	R 1 185 300	70,26

Overtime costs		Time lost by injured & co-workers		Supervision & Management lost time		Incident investigation costs		Training of replacement worker		Damage to equipment, plant, tools, or other property.		Idle plant and equipment		Other (incl.Additional Medical,Consumabl es & Funeral Costs)		Total Indirect	
R 9 000	37,7	R 1 200	5,0	R 1 600	2,9	R 4 000	16,7	R 700	2,9	R 7 500	31,4	R 600	2,5	R 900	3,8	R 23 900	60,66
R 24 000	69,4	R 1 100	3,2	R 1 200	2,2	R 6 500	18,8	R 700	2,0	R 0	0,0	R 0	0,0	R 2 300	6,6	R 34 600	52,50
R 5 000	32,9	R 1 200	7,9	R 1 400	2,6	R 5 700	37,5	R 700	4,6	R 2 200	14,5	R 0	0,0	R 400	2,6	R 15 200	59,14
R 24 000	37,6	R 7 000	11,0	R 2 000	3,6	R 19 000	29,7	R 700	1,1	R 9 000	14,1	R 2 500	3,9	R 1 700	2,7	R 63 900	66,01
R 32 000	71,4	R 1 600	3,6	R 1 600	2,9	R 5 500	12,3	R 500	1,1	R 2 600	5,8	R 700	1,6	R 1 900	4,2	R 44 800	49,12
R 8 000	0,6	R 16 000	1,3	R 18 000	32,8	R 114 000	9,0	R 2 200	0,2	R 27 000	2,1	R 6 000	0,5	R 1 100 000	86,4	R 1 273 200	71,75
R 10 000	47,2	R 1 200	5,7	R 1 800	3,3	R 4 200	19,8	R 600	2,8	R 1 200	5,7	R 800	3,8	R 3 200	15,1	R 21 200	57,61
R 300 000	75,5	R 3 500	0,9	R 28 000	51,1	R 44 700	11,3	R 800	0,2	R 700	0,2	R 6 400	1,6	R 41 000	10,3	R 397 100	43,11
R 8 000	0,6	R 16 000	1,3	R 22 000	40,1	R 116 000	9,3	R 500	0,0	R 23 000	1,8	R 4 700	0,4	R 1 080 000	86,5	R 1 248 200	71,33
R 8 000	0,6	R 6 800	0,5	R 14 000	25,5	R 116 000	9,1	R 2 200	0,2	R 32 000	2,5	R 7 000	0,6	R 1 100 000	86,5	R 1 272 000	71,72
R 8 000	0,6	R 3 200	0,3	R 16 000	29,2	R 128 000	10,2	R 2 200	0,2	R 14 500	1,2	R 2 500	0,2	R 1 100 000	87,4	R 1 258 400	71,52
R 4 500	24,6	R 1 400	7,7	R 1 500	2,7	R 5 400	29,5	R 700	3,8	R 0	0,0	R 5 300	29,0	R 1 000	5,5	R 18 300	77,22
R 1 500	10,8	R 1 200	8,6	R 1 100	2,0	R 6 900	49,6	R 500	3,6	R 0	0,0	R 2 500	18,0	R 1 300	9,4	R 13 900	78,09
R 20 000	66,0	R 1 800	5,9	R 1 600	2,9	R 2 900	9,6	R 500	1,7	R 1 500	5,0	R 1 600	5,3	R 2 000	6,6	R 30 300	56,01
R 1 000	12,9	R 1 300	16,8	R 1 400	2,6	R 2 800	36,1	R 700	9,0	R 0	0,0	R 650	8,4	R 1 300	16,8	R 7 750	65,96
R 12 000	45,8	R 3 600	13,7	R 800	1,5	R 6 700	25,6	R 900	3,4	R 0	0,0	R 900	3,4	R 2 100	8,0	R 26 200	58,48
R 6 400	39,3	R 1 400	8,6	R 1 500	2,7	R 6 300	38,7	R 600	3,7	R 400	2,5	R 500	3,1	R 700	4,3	R 16 300	64,43
R 145 000	11,9	R 1 700	0,1	R 9 000	16,4	R 16 500	1,4	R 1 200	0,1	R 1 500	0,1	R 1 400	0,1	R 1 050 000	86,3	R 1 217 300	73,10
R 12 000	56,6	R 1 600	7,5	R 1 000	1,8	R 5 800	27,4	R 500	2,4	R 0	0,0	R 400	1,9	R 900	4,2	R 21 200	59,38
R 11 000	46,0	R 3 700	15,5	R 1 000	1,8	R 5 600	23,4	R 700	2,9	R 0	0,0	R 1 900	7,9	R 1 000	4,2	R 23 900	61,76
R 4 000	31,3	R 1 200	9,4	R 1 300	2,4	R 5 300	41,4	R 700	5,5	R 0	0,0	R 700	5,5	R 900	7,0	R 12 800	55,65
R 5 400	29,2	R 1 200	6,5	R 1 300	2,4	R 4 900	26,5	R 700	3,8	R 4 800	25,9	R 700	3,8	R 800	4,3	R 18 500	65,37
R 3 000	24,2	R 2 500	20,2	R 1 300	2,4	R 3 500	28,2	R 500	4,0	R 2 300	18,5	R 0	0,0	R 600	4,8	R 12 400	61,08
R 12 000	40,4	R 1 800	6,1	R 1 200	2,2	R 4 200	14,1	R 500	1,7	R 9 500	32,0	R 700	2,4	R 1 000	3,4	R 29 700	52,75
R 29 000	62,0	R 2 200	4,7	R 2 600	4,7	R 9 500	20,3	R 500	1,1	R 0	0,0	R 1 500	3,2	R 4 100	8,8	R 46 800	45,61
R 34 000	66,8	R 1 800	3,5	R 1 400	2,6	R 8 700	17,1	R 700	1,4	R 300	0,6	R 1 200	2,4	R 4 200	8,3	R 50 900	40,59
R 28 000	68,6	R 800	2,0	R 1 700	3,1	R 9 200	22,5	R 700	1,7	R 0	0,0	R 0	0,0	R 2 100	5,1	R 40 800	46,74
R 3 000	26,8	R 600	5,4	R 800	1,5	R 4 200	37,5	R 500	4,5	R 0	0,0	R 2 300	20,5	R 600	5,4	R 11 200	69,78

Overtime costs		Time lost by injured & co-workers		Supervision & Management lost time		Incident investigation costs		Training of replacement worker		Damage to equipment, plant, tools, or other property.		Idle plant and equipment		Other (incl.Additional Medical,Consumables & Funeral Costs)		Total Indirect	
R 10 000	64,1	R 700	4,5	R 1 000	1,8	R 3 500	22,4	R 700	4,5	R 0	0,0	R 0	0,0	R 700	4,5	R 15 600	50,81
R 45 000	79,9	R 800	1,4	R 1 600	2,9	R 3 500	6,2	R 700	1,2	R 0	0,0	R 5 500	9,8	R 800	1,4	R 56 300	42,94
R 1 500	20,3	R 900	12,2	R 1 400	2,6	R 2 800	37,8	R 700	9,5	R 1 100	14,9	R 0	0,0	R 400	5,4	R 7 400	69,81
R 5 000	26,3	R 800	4,2	R 1 200	2,2	R 11 500	60,5	R 700	3,7	R 0	0,0	R 300	1,6	R 700	3,7	R 19 000	67,86
R 7 000	42,9	R 1 200	7,4	R 900	1,6	R 1 800	11,0	R 500	3,1	R 4 500	27,6	R 600	3,7	R 700	4,3	R 16 300	62,69
R 8 000	49,4	R 2 200	13,6	R 1 100	2,0	R 4 600	28,4	R 800	4,9	R 0	0,0	R 0	0,0	R 600	3,7	R 16 200	47,79
R 2 500	26,0	R 800	8,3	R 800	1,5	R 4 500	46,9	R 500	5,2	R 0	0,0	R 600	6,3	R 700	7,3	R 9 600	69,57
R 8 000	0,7	R 3 200	0,3	R 29 000	52,9	R 106 000	8,7	R 1 500	0,1	R 1 200	0,1	R 4 000	0,3	R 1 100 000	89,9	R 1 223 900	70,96
R 8 000	0,6	R 2 800	0,2	R 25 000	45,6	R 124 000	10,0	R 1 500	0,1	R 400	0,0	R 2 800	0,2	R 1 100 000	88,7	R 1 239 500	71,19
R 7 000	44,3	R 1 300	8,2	R 700	1,3	R 4 800	30,4	R 500	3,2	R 0	0,0	R 1 300	8,2	R 900	5,7	R 15 800	60,77
R 15 000	59,5	R 1 200	4,8	R 1 300	2,4	R 6 500	25,8	R 500	2,0	R 0	0,0	R 900	3,6	R 1 100	4,4	R 25 200	56,12
R 142 000	4,8	R 57 000	1,9	R 28 000	51,1	R 158 000	5,4	R 9 500	0,3	R 146 000	5,0	R 56 000	1,9	R 2 368 000	80,6	R 2 936 500	70,97
R 2 200	29,7	R 1 300	17,6	R 700	1,3	R 3 000	40,5	R 500	6,8	R 0	0,0	R 0	0,0	R 400	5,4	R 7 400	67,89
R 8 000	36,2	R 1 200	5,4	R 1 300	2,4	R 11 500	52,0	R 500	2,3	R 0	0,0	R 0	0,0	R 900	4,1	R 22 100	65,38
R 400	3,7	R 600	5,6	R 700	1,3	R 8 200	75,9	R 500	4,6	R 0	0,0	R 700	6,5	R 400	3,7	R 10 800	91,53
R 400	3,4	R 1 000	8,4	R 700	1,3	R 8 300	69,7	R 500	4,2	R 0	0,0	R 1 000	8,4	R 700	5,9	R 11 900	82,07
R 1 000	11,5	R 1 000	11,5	R 800	1,5	R 4 500	51,7	R 500	5,7	R 0	0,0	R 1 000	11,5	R 700	8,0	R 8 700	73,11
R 9 000	37,5	R 900	3,8	R 1 100	2,0	R 11 500	47,9	R 700	2,9	R 0	0,0	R 800	3,3	R 1 100	4,6	R 24 000	59,70
R 6 000	0,4	R 60 000	4,4	R 34 600	63,1	R 198 500	14,5	R 2 800	0,2	R 600	0,0	R 27 000	2,0	R 1 076 300	78,5	R 1 371 200	73,21
R 8 000	0,7	R 1 800	0,2	R 3 200	5,8	R 87 000	7,3	R 700	0,1	R 600	0,1	R 400	0,0	R 1 100 000	91,8	R 1 198 500	70,50
R 8 000	0,6	R 3 500	0,3	R 16 000	29,2	R 128 000	10,0	R 1 200	0,1	R 22 000	1,7	R 12 000	0,9	R 1 100 000	86,3	R 1 274 700	71,77
R 27 000	49,4	R 1 400	2,6	R 700	1,3	R 9 700	17,7	R 800	1,5	R 3 500	6,4	R 800	1,5	R 11 500	21,0	R 54 700	43,17
R 4 800	15,4	R 1 100	3,5	R 6 800	12,4	R 22 600	72,7	R 600	1,9	R 600	1,9	R 500	1,6	R 900	2,9	R 31 100	82,49
R 8 000	31,4	R 1 600	6,3	R 8 500	15,5	R 13 500	52,9	R 700	2,7	R 0	0,0	R 800	3,1	R 900	3,5	R 25 500	68,92
R 10 000	43,3	R 1 400	6,1	R 9 000	16,4	R 8 000	34,6	R 800	3,5	R 0	0,0	R 500	2,2	R 2 400	10,4	R 23 100	56,34
R 600	4,3	R 1 300	9,4	R 1 800	3,3	R 6 200	44,6	R 700	5,0	R 0	0,0	R 4 500	32,4	R 600	4,3	R 13 900	89,68
R 6 500	44,2	R 1 500	10,2	R 1 200	2,2	R 3 200	21,8	R 800	5,4	R 0	0,0	R 1 000	6,8	R 1 700	11,6	R 14 700	56,11

Overtime costs		Time lost by injured & co-workers		Supervision & Management lost time		Incident investigation costs		Training of replacement worker		Damage to equipment, plant, tools, or other property.		Idle plant and equipment		Other (incl.Additional Medical,Consumables & Funeral Costs)		Total Indirect	
R 8 000	20,5	R 1 400	3,6	R 2 300	4,2	R 22 400	57,3	R 700	1,8	R 3 000	7,7	R 2 000	5,1	R 1 600	4,1	R 39 100	75,78
R 1 500	7,5	R 1 400	7,0	R 800	1,5	R 10 600	53,0	R 600	3,0	R 0	0,0	R 4 400	22,0	R 1 500	7,5	R 20 000	84,75
R 6 000	28,4	R 1 400	6,6	R 700	1,3	R 5 700	27,0	R 600	2,8	R 0	0,0	R 5 700	27,0	R 1 700	8,1	R 21 100	69,18
R 3 000	25,9	R 1 000	8,6	R 700	1,3	R 4 600	39,7	R 500	4,3	R 600	5,2	R 600	5,2	R 1 300	11,2	R 11 600	65,54
R 600	2,8	R 1 300	6,0	R 2 600	4,7	R 17 500	80,6	R 500	2,3	R 700	3,2	R 500	2,3	R 600	2,8	R 21 700	87,85
R 14 000	44,7	R 1 600	5,1	R 900	1,6	R 8 200	26,2	R 700	2,2	R 0	0,0	R 5 000	16,0	R 1 800	5,8	R 31 300	62,23
R 28 000	23,3	R 2 600	2,2	R 1 100	2,0	R 7 800	6,5	R 800	0,7	R 64 000	53,2	R 15 500	12,9	R 1 700	1,4	R 120 400	78,18
R 20 000	52,1	R 2 200	5,7	R 1 200	2,2	R 5 500	14,3	R 600	1,6	R 500	1,3	R 7 000	18,2	R 2 600	6,8	R 38 400	49,29
R 30 000	75,9	R 1 500	3,8	R 2 200	4,0	R 5 800	14,7	R 500	1,3	R 0	0,0	R 500	1,3	R 1 200	3,0	R 39 500	38,92
R 4 000	16,7	R 2 000	8,4	R 1 100	2,0	R 9 000	37,7	R 500	2,1	R 3 000	12,6	R 4 500	18,8	R 900	3,8	R 23 900	78,62
R 400	5,3	R 2 000	26,7	R 1 300	2,4	R 2 700	36,0	R 500	6,7	R 500	6,7	R 700	9,3	R 700	9,3	R 7 500	82,42
R 9 000	45,2	R 1 300	6,5	R 1 400	2,6	R 5 400	27,1	R 500	2,5	R 1 500	7,5	R 700	3,5	R 1 500	7,5	R 19 900	53,07
R 6 000	30,2	R 1 400	7,0	R 1 300	2,4	R 3 700	18,6	R 500	2,5	R 7 500	37,7	R 0	0,0	R 800	4,0	R 19 900	64,82
R 600	16,2	R 700	18,9	R 700	1,3	R 1 200	32,4	R 500	13,5	R 0	0,0	R 300	8,1	R 400	10,8	R 3 700	68,52
R 4 500	47,9	R 1 200	12,8	R 900	1,6	R 2 200	23,4	R 500	5,3	R 0	0,0	R 400	4,3	R 600	6,4	R 9 400	54,97
R 8 000	0,6	R 2 800	0,2	R 15 000	27,4	R 145 000	11,5	R 1 500	0,1	R 1 200	0,1	R 4 000	0,3	R 1 100 000	87,1	R 1 262 500	71,58
R 8 000	0,6	R 3 800	0,3	R 16 000	29,2	R 136 000	10,9	R 700	0,1	R 0	0,0	R 4 500	0,4	R 1 100 000	87,8	R 1 253 000	71,41
R 2 200	29,7	R 900	12,2	R 800	1,5	R 2 600	35,1	R 500	6,8	R 0	0,0	R 600	8,1	R 600	8,1	R 7 400	67,27
R 2 200	27,8	R 800	10,1	R 700	1,3	R 2 800	35,4	R 500	6,3	R 0	0,0	R 1 200	15,2	R 400	5,1	R 7 900	69,30
R 1 476 100	6,4	R 319 800	1,4	R 463 400	2,6	R 2 356 600	10,3	R 81 700	0,4	R 530 900	2,3	R 289 550	1,3	R 17 839 200	77,9	R 22 893 850	69,41

APPENDIX C: SUMMARY OF COSTS OF 100 ACCIDENTS

Accident number	Accident cause from investigation report	Total Cost Of Accidents	Ratio Direct/ Indirect Costs	Average Cost per Category	Average Cost of Accident
53	Burn	R 78 400	1:2	R 68 550	R 329 812
56	Burn	R 58 700	1:3		
2	Cut/Caught	R 20 700	1:4	R 28 835	
4	Cut/Caught	R 14 500	1:4		
5	Cut/Caught	R 20 000	1:4		
14	Cut/Caught	R 35 300	1:2		
15	Cut/Caught	R 24 700	1:2		
16	Cut/Caught	R 59 400	1:2		
19	Cut/Caught	R 28 400	1:9		
21	Cut/Caught	R 48 900	1:6		
27	Cut/Caught	R 29 800	1:3		
28	Cut/Caught	R 19 500	1:3		
34	Cut/Caught	R 16 900	1:2		
36	Cut/Caught	R 32 500	1:1		
48	Cut/Caught	R 34 900	1:1		
71	Cut/Caught	R 17 800	1:3		
84	Cut/Caught	R 41 800	1:4		
89	Cut/Caught	R 39 200	1:2		
98	Cut/Caught	R 5 900	1:6		
10	Electrical	R 22 400	1:5	R 452 473	
37	Electrical –Fatality	R 1 684 200	1:2		
38	Electrical	R 120 100	1:2		
42	Electrical	R 80 900	1:3		
43	Electrical	R 55 000	1:2		
46	Electrical	R 86 300	1:1		
58	Electrical –Fatality	R 1 686 900	1:2		
60	Electrical	R 39 400	1:2		
63	Electrical	R 65 900	1:1		
64	Electrical	R 25 700	1:2		
66	Electrical	R 96 800	1:3		
73	Electrical	R 91 200	1:1		

78	Electrical –Fatality	R 1 774 400	1:3		
100	Electrical	R 36 800	1:2		
31	Electrical	R 921 100	1:1		
41	Electrical –Fatality	R 1 750 000	1:3		
79	Electrical –Fatality	R 1 773 500	1:3		
80	Electrical –Fatality	R 1 759 600	1:3		
7	Exertion/Ergonomics	R 23 700	1:4		
29	Exertion/Ergonomics	R 17 800	1:4	R 31 867	
88	Exertion/Ergonomics	R 54 100	1:1		
9	Fall	R 11 750	1:2		
22	Fall	R 44 800	1:2		
32	Fall	R 25 300	1:2	R 448 609	
35	Fall	R 1 665 300	1:3		
39	Fall	R 35 700	1:2		
40	Fall	R 38 700	1:2		

Accident number	Accident cause from investigation report	Total Cost Of Accidents	Ratio Direct/ Indirect Costs	Average Cost per Category	Average Cost of Accident
44	Fall	R 23 000	1:2		
47	Fall	R 28 300	1:2		
49	Fall	R 20 300	1:2		
50	Fall	R 56 300	1:1		
51	Fall	R 102 600	1:1		
52	Fall	R 125 400	1:1		
54	Fall	R 87 300	1:1		
57	Fall	R 16 050	1:3		
59	Fall	R 30 700	1:1		
61	Fall	R 131 100	1:1		
62	Fall	R 10 600	1:3		
67	Fall	R 28 000	1:2		
69	Fall	R 26 000	1:2		
72	Fall	R 33 900	1:1		
74	Fall	R 13 800	1:3		

76	Fall –Fatality	R 1 724 700	1:3		
77	Fall –Fatality	R 1 741 000	1:3		
83	Fall	R 26 000	1:2		
86	Fall	R 44 900	1:1		
87	Fall –Fatality	R 4 137 500	1:3		
90	Fall	R 10 900	1:3		
93	Fall	R 33 800	1:2		
94	Fall	R 11 800	1:12		
95	Fall	R 14 500	1:5		
96	Fall	R 11 900	1:3		
97	Fall	R 40 200	1:2		
20	Fall –Fatality	R 1 873 000	1:3		
65	Fall –Fatality	R 1 700 000	1:2		
82	Fall –Fatality	R 1 776 200	1:3		
25	Falling Object	R 126 700	1:1	R 82 200	
26	Falling Object	R 37 700	1:6		
1	Struck	R 37 000	1:3	R 187 930	
3	Struck	R 41 000	1:2		
6	Struck	R 15 500	1:11		
8	Struck	R 26 200	1:1		
11	Struck	R 51 600	1:4		
12	Struck	R 23 600	1:6		
13	Struck	R 30 500	1:3		
17	Struck	R 17 700	1:2		
18	Struck	R 24 700	1:9		
23	Struck	R 50 300	1:2		
24	Struck	R 154 000	1:5		
30	Struck	R 77 900	1:1		
33	Struck	R 101 500	1:1		
85	Struck	R 30 400	1:4		
99	Struck	R 9 100	1:6		
45	Struck	R 37 500	1:1		
55	Struck	R 30 700	1:2		
68	Struck	R 5 400	1:3		

Accident number	Accident cause from investigation report	Total Cost Of Accidents	Ratio Direct/ Indirect Costs	Average Cost per Category	Average Cost of Accident
70	Fall	R 17 100	1:1		
75	Fall	R 1 763 700	1:3		
81	Fall	R 1 754 600	1:3		
91	Fall	R 11 000	1:3		
92	Fall	R 11 400	1:3		
Totals	Fall	**R 32 981 200**	**1:2**		

APPENDIX D: DIRECT COSTS OF FATAL ACCIDENTS

No		Direct Costs					
		Medical (ambulance, doctor, medication, hospital)		Wages for injured person/s		Total Direct	
37	Electrical - Fatality	R 1 800	0,36	R 500 000	99,64	R 501 800	29,79
58	Electrical - Fatality	R 1 600	0,32	R 500 000	99,68	R 501 600	29,74
78	Electrical - Fatality	R 1 200	0,24	R 500 000	99,76	R 501 200	28,25
41	Electrical - Fatality	R 1 800	0,36	R 500 000	99,64	R 501 800	28,67
79	Electrical - Fatality	R 1 500	0,30	R 500 000	99,70	R 501 500	28,28
80	Electrical - Fatality	R 1 200	0,24	R 500 000	99,76	R 501 200	28,48
76	Fall –Fatality	R 800	0,16	R 500 000	99,84	R 500 800	29,04
77	Fall –Fatality	R 1 500	0,30	R 500 000	99,70	R 501 500	28,81
87	Fall –Fatality	R 43 000	3,58	R 1 158 000	96,42	R 1 201 000	29,03
20	Fall -Fatality	R 1 800	0,36	R 500 000	99,64	R 501 800	26,79
65	Fall -Fatality	R 1 500	0,30	R 500 000	99,70	R 501 500	29,50
82	Fall -Fatality	R 1 500	0,30	R 500 000	99,70	R 501 500	28,23
75	Struck -Fatality	R 1 200	0,24	R 500 000	99,76	R 501 200	28,42
81	Struck -Fatality	R 1 600	0,32	R 500 000	99,68	R 501 600	28,59
Totals		R 62 000	0,80	R 7 658 000	99,20	R 7 720 000	28,70

APPENDIX E: INDIRECT COSTS OF FATAL ACCIDENTS

No	Nature of accident	Overtime costs		Time lost by injured & co-workers		Supervision & Management lost time		Incident investigation costs		Training of replacement worker		Damage to equipment, plant, tools, or other property.		Idle plant and equipment		Other		Total Indirect (R's)
37	Electrical	8 000	0,7	2 700	0,2	23 000	42,0	59 400	5,0	700	0,1	4 600	0,4	7 000	0,6	1 100 000	93,0	1 182 400
58	Electrical	8 000	0,7	2 200	0,2	12 000	21,9	63 000	5,3	500	0,0	11 000	0,9	600	0,1	1 100 000	92,8	1 185 300
78	Electrical	8 000	0,6	16 000	1,3	18 000	32,8	114 000	9,0	2 200	0,2	27 000	2,1	6 000	0,5	1 100 000	86,4	1 273 200
41	Electrical	8 000	0,6	16 000	1,3	22 000	40,1	116 000	9,3	500	0,0	23 000	1,8	4 700	0,4	1 080 000	86,5	1 248 200
79	Electrical	8 000	0,6	6 800	0,5	14 000	25,5	116 000	9,1	2 200	0,2	32 000	2,5	7 000	0,6	1 100 000	86,5	1 272 000
80	Electrical	8 000	0,6	3 200	0,3	16 000	29,2	128 000	10,2	2 200	0,2	14 500	1,2	2 500	0,2	1 100 000	87,4	1 258 400
76	Fall	8 000	0,7	3 200	0,3	29 000	52,9	106 000	8,7	1 500	0,1	1 200	0,1	4 000	0,3	1 100 000	89,9	1 223 900
77	Fall	8 000	0,6	2 800	0,2	25 000	45,6	124 000	10,0	1 500	0,1	400	0,0	2 800	0,2	1 100 000	88,7	1 239 500
87	Fall	142 000	4,8	57 000	1,9	28 000	51,1	158 000	5,4	9 500	0,3	146 000	5,0	56 000	1,9	2 368 000	80,6	2 936 500
20	Fall	6 000	0,4	60 000	4,4	34 600	63,1	198 500	14,5	2 800	0,2	600	0,0	27 000	2,0	1 076 300	78,5	1 371 200
65	Fall	8 000	0,7	1 800	0,2	3 200	5,8	87 000	7,3	700	0,1	600	0,1	400	0,0	1 100 000	91,8	1 198 500
82	Fall	8 000	0,6	3 500	0,3	16 000	29,2	128 000	10,0	1 200	0,1	22 000	1,7	12 000	0,9	1 100 000	86,3	1 274 700
75	Struck	8 000	0,6	2 800	0,2	15 000	1,3	145 000	11,5	1 500	0,1	1 200	0,1	4 000	0,3	1 100 000	87,1	1 262 500
81	Struck	8 000	0,6	3 800	0,3	16 000	1,4	136 000	10,9	700	0,1	0	0,0	4 500	0,4	1 100 000	87,8	1 253 000
	TOTAL (R'S)	244 000	1,3	181 800	0,9	271 800	1,0	1 678 900	8,8	27 700	0,1	284 100	1,5	138 500	0,7	16 624 300	86,7	19 179 300

APPENDIX F: SUMMARY OF COSTS OF FATAL ACCIDENTS

Accident Number	Nature of accident	Total Cost Of Accidents	Ratio Direct/Indirect Costs	Average Cost per Category
37	Electrical -Fatality	R 1 684 200	1:2	R 1 738 100
58	Electrical -Fatality	R 1 686 900	1:2	
78	Electrical -Fatality	R 1 774 400	1:3	
41	Electrical -Fatality	R 1 750 000	1:3	
79	Electrical -Fatality	R 1 773 500	1:3	
80	Electrical -Fatality	R 1 759 600	1:3	
76	Fall –Fatality	R 1 724 700	1:3	R 2 158 733
77	Fall –Fatality	R 1 741 000	1:3	
87	Fall –Fatality	R 4 137 500	1:3	
20	Fall –Fatality	R 1 873 000	1:3	
65	Fall –Fatality	R 1 700 000	1:2	
82	Fall –Fatality	R 1 776 200	1:3	
75	Struck by-Fatality	R 1 763 700	1:3	R 1 759 150
81	Struck by-Fatality	R 1 754 600	1:3	
Category Totals		R 26 899 300	1:2	

APPENDIX G: EXAMPLE OF FLASH REPORT

ACCIDENT / INCIDENT REGISTER NO

PART 1 – TO BE COMPLETED FOR ALL ACCIDENTS / INCIDENTS:

ESKOM		PUBLIC		CONTRACTOR	X	CASUAL/TEMP	
POOL		COMPANY CAR		SCHEME		HIRED/PRIVATE	

FIRST AID		ELECTRICAL CONTACT	
MEDICAL		EQUIPMENT DAMAGE	
FATAL x2	x	THEFT	
LOST TIME INJURY		ENVIRONMENTAL	
OCCUPATIONAL DISEASE		FIRE	
VEHICLE ACCIDENT		NEAR MISS	
STORM DAMAGE		ON DUTY	X
OTHER (Reckless Driving)		OFF DUTY	

NAME OF PERSON INVOLVED	ABC EFG
UNIQUE NUMBER OR IDENTITY NUMBER	ABC ID: 1234567 EFG ID (Passport): 1234567
NATURE OF INJURIES SUSTAINED	Smoke inhalation inside Guardroom
UNIT/SECTION/DEPARTMENT	CPD – Contractor (HVT)
DATE OF ACCIDENT/INCIDENT	05 June 2012
LOCATION OF INCIDENT/ACCIDENT	ABC C1 Substation
MANAGER/SUPERVISOR	HIJK
TELEPHONE NUMBER	123456789
FAX NUMBER	

FULL DESCRIPTION OF ACCIDENT/INCIDENT:-
Two security guards working for ABC Security company died last night due to suspected smoke (carbon monoxide) inhalation. They were discovered by the morning shift guards on the 05/06/2012. The security company is the sub-contractor to the High Voltage Technologies (HVT).

WHAT IMMEDIATE ACTION IS TAKEN TO PREVENT SIMILAR INCIDENT IN FUTURE?

The security company is suspended pending outcome of formal investigation.

SUBSTANCE ABUSE TEST DONE	Yes		No	X

PART 2 – TO BE COMPLETED FOR PUBLIC / CONTRACTOR / LIVESTOCK ACCIDENTS

LOW HANGING CONDUCTOR / CONDUCTOR ON GROUND			
IRRIGATION PIPE INTO LINE			
TELKOM LINE INTO ESKOM LINE			
EXTERNAL / SUB-CONTRACTOR			
UNLAWFUL ENTRY / VANDALISM			
CRANE INTO LINE			
TREE ON LINE			
ESKOM VEHICLE INVOLVED			

PART 3 – TO BE COMPLETED FOR ALL VEHICLE ACCIDENTS

ESKOM DRIVER & UNIQUE NUMBER	
ESKOM VEHICLE REGISTRATION NUMBER	
DAMAGES TO ESKOM VEHICLE	
THIRD PARTY REGISTRATION NUMBER	
DRIVER OF 3RD PARTY VEHICLE	
TELEPHONE NUMBER OF 3RD PARTY	
NAME OF WITNESS	
WITNESS TELEPHONE NUMBER	

PART 4 – TO BE COMPLETED FOR ALL ELECTRICAL CONTACTS

DD SHEET NUMBER	
LINE CLEARANCE	
SUB STATION AND NETWORK	
SECTION BREAKERS	
TEE LINE	
ESKOM VOLTAGE	
BEFORE THE METER	
BEYOND THE M ETER	

PART 5 – TO BE COMPLETED FOR ALL INCIDENTS / ACCIDENTS

FULL NAME OF PERSON REPORTING INCIDENT	XYZ – ABC Security Company HR Manager (Tel: 123456)
NAME OF SAFETY REP REPORTED TO	SUV - ORG CPD Programme Manager
TELEPHONE NUMBER	123456789
FAX NUMBER	n/a
DATE OF REPORTING INCIDENT / ACCIDENT	05 June 2012
TIME OF INCIDENT / ACCIDENT	06H45

PART 6 – TOBE COMPLETED FOR ALL MEDICAL AND LOST TIME INJURIES

NAME OF ATTENDING DOCTOR	
NAME HOSPITAL TAKEN TO	
TELEPHONE NUMBER OF DOCTOR / HOSPITAL	
FAX NUMBER OF DOCTOR / HOSPITAL	
DATE OF TREATMENT RECEIVED	
TIME OF TREATMENT RECEIVED	
Charcoal Pot used as a brazier	Site Container (Office)