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Title
"Health and Safety Culture on Small Residential Construction Sites: The Case of Waterfall Country Estate, Midrand."

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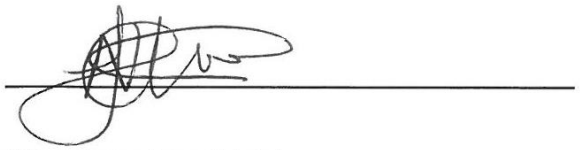
Supervisor

Dr. Maria Vosloo

A Research Report proposal submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of MSc (Building) Project Management in Construction.

DECLARATION

I declare that this Research Report is my own unaided work. It is being submitted to the Master of Science in Project Management in Construction (Building) to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.



(Signature of candidate)

27 day of October 2017 in Braamfontein

ABSTRACT

The construction industry plays an important role in our lives, more specifically the residential sector, which serves to help people access their basic human right to housing. Housing is a basic human right which most South Africans are yet to realise. The high demand for housing and other forms of infrastructure by both the private and public sectors have attracted entrepreneurs who fall under the small and medium contractor categories, to venture into the residential construction mostly as sub-contractors. The construction industry is predominantly constituted of small, micro and medium enterprises. The construction industry is also unfortunately widely known to be a hazardous and accident prone sector; whereby workers are exposed to health and safety hazards on a daily basis, some which lead to loss of life. Literature has found that small and micro enterprises (SMEs) experience more occupational health and safety problems in comparison to their medium and larger counterparts. A positive safety culture is considered as an essential contributor to improved occupational safety performance in construction. Due to the highly reported health and safety challenges faced by construction SMEs, the study seeks to determine the existing safety culture of small and micro enterprises operating in private residential construction sector. The researcher explores the safety perceptions, attitudes, and behaviour of construction workers and management safety practices on small residential construction sites and therefore determine the existing safety culture. An existing safety climate assessment questionnaire was administered to workers employed at the Waterfall Country Estate, Midrand and the findings indicated that there generally exists a good safety culture on the affluent residential construction site. Unsafe worker behaviours have been blamed as the lead cause of accidents on construction work sites, but the current health and safety status of industry calls for more accountability instead of blame shifting amongst stakeholders. Interventions and strategies that seek to address the occupational health and safety of the construction industry should not be reactive, but should rather be a proactive and anticipatory process. It is therefore crucial to begin exploring proactive approaches towards the establishment of a positive health and safety culture, whereby more commitment and accountability is shown from all key stakeholders who collectively have the means to influence and contribute towards the creation of a positive safety culture in residential construction.

Keywords:

Construction industry, construction stakeholders, small and micro enterprises, safety climate, safety culture, occupational health and safety, residential construction and accident causation theories.

DEDICATION

This research is dedicated to my mother, Nelly Sedibe, a woman of remarkable strength and courage, who constantly inspires me to reach greater heights, no matter how small the steps taken.

INSPIRATION

"Better a thousand times careful than once dead." - Proverb

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I thank God, Almighty for giving me the strength and courage to complete my research when it all seemed too great a task.

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The Waterfall Country Estate Management for granting me access and an opportunity to conduct my study on their development site. The construction workers who willingly participated in the study: may they constantly remember the importance of their own health and safety while working on site.

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TABLE OF CONTENTS

DECLARATION ..... **ii**
ABSTRACT ..... **iii**
DEDICATION ..... **iv**
INSPIRATION ..... **iv**
ACKNOWLEDGEMENTS ..... **v**
TABLE OF CONTENTS ..... **vi**
LIST OF FIGURES ..... **x**
LIST OF TABLES ..... **xii**
LIST OF ACRONYMS ..... **xiii**
CHAPTER ONE: BACKGROUND AND AIM OF THE RESEARCH STUDY **14**
1.0 Introduction 14
1.1 Background 15
1.1.1 South African Health and Safety Legislation: Construction Regulations 2014 16
1.1.2 Construction Health and Safety in an International Context. 17
1.1.3 Small and Micro Enterprises (SMEs) operating in the Residential Construction Sector. 19
1.1.4 Safety Culture in the Construction Industry 24
1.2 Research Problem 25
1.2.1 The aim of the study 26
1.2.2 Scope of study 26
1.2.3 Delineations 28
1.3 Primary research question 29
1.4 Limitations 29
1.5 Assumptions 29
1.6 Research ethics 30
1.7 The outline of the this study 30
CHAPTER TWO: LITERATURE REVIEW **31**
2.0 Introduction 31
2.1 Objectives of Literature Review 31
2.1.1 Methodology of literature review 32
2.2. Introduction to Literature Review: 36
2.2.1 Background literature to research problem: 36
2.2.2 South African Occupational Health and Safety Legislation - Construction Regulations 2014 ... 37

2.2.3 Roles of Stakeholders: Clients, Designers, Principle Contractors and Contractors 39
2.3 Construction Health and Safety issues in relation to company size: Small and Micro Enterprises (SMEs) 45
2.3.1 Factors influencing compliance of health and safety regulations 47
2.4 Residential Construction defined 48
2.4.1 Characteristics of the Residential Construction Sector 49
2.4.2 Health and Safety in the Residential Construction Sector 52
2.5 Health and Safety: Accident Causation Theories 54
2.5.1 Behavioural Theory of Accident Causation (Behaviour-based safety) 58
2.5.2 Systems Theory of Accident Causation 59
2.6 Fostering a Positive Safety Culture in the Residential Construction Industry: 61
2.6.1 What is the optimal safety culture on residential construction sites? 64
2.6.1 How safety climate and safety culture measured? 65
2.6.2 The Nordic Occupational Safety Climate Questionnaire 70
2.6.3 The Health and Safety Culture Maturity Model and the Health and Safety Climate Assessment Tool 70
2.6.4 The Safety Climate Assessment Toolkit and User Guide (LSCAT) 72
2.7 Conceptual Framework/Model: Towards the Establishing A Proactive and Positive Safety Culture 73
2.8 Conclusion 74
CHAPTER THREE: RESEARCH METHODOLOGY 75
3.0 Introduction 75
3.1 Research Objective 75
3.2 Research Philosophy 75
3.3 Research Approach 75
3.4 Research Design 77
3.5 Research Strategy and Time Horizon 78
3.6 Research Methods 78
3.7 Research Scope 78
3.8 Target Population Sampling Techniques 79
3.9 Data Collection Techniques 82
3.10 Instrument Design 82
3.11 Data Analysis and Interpretation 84
3.12 Data Validity and Data Reliability 86

3.13 Contingency 86
3.14 Ethical Considerations 87
3.15 Conclusion 88
CHAPTER FOUR: DATA ANALYSIS 89
4.0 Introduction 89
4.1 Profile of Research of Respondents 89
4.1.1 Experiential years acquired working in the construction sector 93
4.2 Response Rate of Respondents 93
4.2.1 Calculation of dimension scores 94
4.3 Organisational Context Dimension 96
4.3.1 Management Commitment - Perceptions of management's overt commitment to health and safety issues. 96
4.3.2 Communication - The nature and efficiency of health and safety communications within the organisation. 97
4.3.3 Priority of Safety - The relative status of health and safety issues within the organisation. 99
4.3.4 Safety Rules and Procedures - Views on the efficacy and necessity of rules and procedures 100
4.4 Social Environment 102
4.4.1 Supportive Environment - The nature of the social environment at work, and the support derived from it. 102
4.4.2 Involvement - The extent to which safety is a focus for everyone and all are involved. 104
4.5 Individual Appreciation 105
4.5.1 Personal Priorities and Need for Safety - The individual's view of their own health and safety management and need to feel safe. 105
4.5.2 Personal Appreciation of Risk - How individuals view the risk associated with work. 106
4.6 Work Environment 108
4.6.1 Physical Work Environment - Perceptions of the nature of the physical environment 108
4.7 Measuring the Attitudes of Workers towards Health and Safety 109
4.8 What is the current safety culture of the Waterfall Country Estate Lifestyle Estate? 110
4.9 Conclusion 111
CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS 112
5.0 Introduction 112
5.1 Summary of Findings 112
5.2 Contribution of the Study to the following: 114
5.2.1 Knowledge 114

5.2.2 Practice..... 115
5.3 Limitations of This Study..... 115
5.4 Areas of Further Study..... 115
5.5 Conclusion and Recommendation..... 116
5.5.1. The study recommends the following:..... 116
5.5.2 Concluding remarks..... 117
REFERENCES AND APPENDICES..... 118
REFERENCE LIST:..... 118
APPENDICES..... 127
1. Appendix A: Ethical Clearance..... 127
2. Appendix B: Letter to Waterfall Estate Management – requesting permission to access site. 127
3. Appendix C: Letter from Waterfall Estate Management – granting permission to access site. 127
4. Appendix D: Assistant Researcher confidentiality forms..... 127
5. Appendix E: Questionnaire administering protocol..... 127
6. Appendix F: Attendance Register (Respondent consent agreement)..... 127
7. Appendix G: Completed Safety Climate Assessment Questionnaire..... 127

LIST OF FIGURES

Figure 1. Health and Safety Statistics of the South African construction industry during the period 2004-2008 (Smallwood et al., 2009:3). 16
Figure 2. Factors and criteria of construction fatalities and nonfatal injuries, selected countries, 2008 (Center for Construction Research and Training, 2013:37). 18
Figure 3. A comparison of construction worker hazard exposure in comparison to workers from other industries ("Safe Work Australia", 2015:10). 19
Figure 4. Population growth projections for various African cities (French, 2015:7). 22
Figure 5. Graph showing residential building activity between January – July 2015 (du Toit, 2015:3). 23
Figure 6. A map of Midrand in the context of Johannesburg, Gauteng (Google, 2016). 27
Figure 7. An aerial view of Waterfall Country Estate (http://www.century.co.za). 28
Figure 8. A high level housing input chain that defines the segments of the residential construction sector that relate to residential housing ("Ministry of Business, Innovation and Employment", n.d.:5). 49
Figure 9. Residential Building Activity for January - July 2015) (du Toit, 2015:.2). 51
Figure 10. Residential Building Activity by province for January - July 2015) (du Toit, 2015:2).. 51
Figure 11. Leading causes of fatalities in construction reported in 2010 ("The Center for Construction Research and Training", 2013:43). 55
Figure 12. Distribution of fatalities from falls in construction ("The Center for Construction Research and Training", 2013:43). 55
Figure 13. Overhead power-line electrocution deaths, by construction occupation, 2008-2010 ("The Center for Construction Research and Training", 2013:45). 56
Figure 14. Systems theory model (DFW Web Presence, n.d.:40). 60
Figure 15. Gellor's Safety Triad (Che Hassan et al., 2007: 273). 63
Figure 16. Improving safety behaviour through proactive safety leadership ("Safety Leadership at Work", n.d.:.2). 65
Figure 17. Conceptual framework/model: Towards the establishing a proactive and positive safety culture. 73
Figure 18. Various sampling strategies in quantitative research (Kumar, 2011: 81). 81
Figure 19. An illustration of the dimension scores calculation ("Loughborough University", n. d.:33). 85
Figure 20.Profile of research of respondents. 90
Figure 21.Workers by occupational classification and distribution in construction, 2010 ("The Center for Construction Research and Training", 2013:40). 91
Figure 22. Respondent's experience in years of working in the construction industry. 93
Figure 23. Safety culture survey results. 95
Figure 24. Management commitment dimension score. 96
Figure 25. Communication dimension score. 97
Figure 26. Priority of safety dimension score. 99
Figure 27. Safety rules and procedures dimension score. 101
Figure 28. Supportive environment dimension score. 102
Figure 29. Involvement dimension score. 104

Figure 30. Personal priorities and need for safety dimension score. 105
Figure 31. Personal appreciation of risk dimension score 106
Figure 32. Work environment dimension score. 108

LIST OF TABLES

Table 1. Highly ranked challenges facing the implementation of health and safety requirements (Dadzie, 2013: 40)..... 17
Table 2. Definitions of small and micro enterprises ("Entrepreneurs Toolkit", 2009). 20
Table 3. Literature and empirical objectives of the study..... 32
Table 4. A literature summary of research methods used in the problem area. 35
Table 5. The Safety Level, Average Safety Score, Variance and Standard (Che Hassan et al., 2007: 275). 46
Table 6. The three stages in the development of a safety culture (Lingard et al., 2014:36). 64
Table 7. A non-exhaustive lists of existing safety climate questionnaires, with their title/name, developer, and country and sector of origin (Taylor, 2011: 23). 69
Table 8. Different perspectives on safety culture, and relating assessment methods of LSCAT (Taylor, 2011:36). 72
Table 9. The key features of Quantitative method (MacDonald & Headlam, 2009). 76
Table 10. Three types of research methods (Saunders et al., 2012: pp.162-164). 77
Table 11. Dimension score calculation. 95
Table 12. Communication on health and safety (Lingard et al., 2014: 51). 98

LIST OF ACRONYMS

ARCTM	Root Causes Tracing Model
BBS	Behaviour-based safety
BLS	Bureau of Labour Statistics
BOK	Body of Knowledge
CASS	Commercial Aviation Safety Survey
CIDB	Construction Industry Development Board
CPWR	Center for Construction Research and Training
DOL	Department of Labour
H&S	Health and Safety
HSE	Health and Safety Executive
ILO	International Labour Organization
IOSH	Institution of Safety and Health
LSCAT	Loughborough Safety Climate Assessment Toolkit
MBAWC	Master Builders Association of the Western Cape
MSC	Multilevel Safety Climate
NHBRC	National Home Building Regulation Council
NHEWS	National Hazard Exposure Worker Surveillance
NOHSC	National Occupational Health and Safety Commission
NORSCI	Norwegian Offshore Risk and Safety Climate Inventory
NOSACQ	Nordic Occupational Safety Climate Questionnaire
OHS	Occupational health and safety
OSCI	Organisational and Safety Climate Inventory
OSHA	Occupational Safety and Health Administration
OSQ	Offshore Safety Questionnaire
OSQ99	Offshore Safety Climate Questionnaire
PPE	Protective Personal Equipment
SAQ	Safety Awareness Questionnaire
SCT	Safety Climate Tool
ShoMe	Safety Health of Maintenance Engineering
SME	Small and Micro Enterprises
TCIR	Total case incident rate
UK	United Kingdom
USA	United States of America
VAT	Value Added Tax
WBV	Whole body vibration

CHAPTER ONE: BACKGROUND AND AIM OF THE RESEARCH STUDY

1.0 Introduction

An overview of Health and Safety in the South African Construction industry.

The construction industry is widely known to be a hazardous and accident prone sector. The industry is braved by a poor occupational health and safety (OHS) record due to an occurrence of unacceptably high number of accidents and work-related illnesses (ElSafty, ElSafty & Malek, 2012). The construction industry is also comprised mostly of small and micro enterprises (SMEs) (Arewa & Farrell, 2012). According to Smith-Jackson et al. (2011) small construction companies experience more occupational health and safety problems in comparison to the medium and larger counterparts. Therefore this segment presents a significant problem to occupational health and safety. Small and micro construction enterprises (SMEs) form a big component of the South African construction industry, thus playing a significant role in the growth of the economy, but also face a higher risk in experiencing more occupational health and safety challenges; as a large number of OHS accidents in the construction industry is reported to be incurred by SMEs contractors (Agumba, Pretorius & Haupt, 2013).

Occupational health and safety defined:

"Health is the protection of the bodies and minds of people from illness resulting from the materials, processes or procedures used in the workplace" (Alhajeri, 2011:18).

"Safety is the protection of people from physical injury. The borderline between health and safety is ill-defined and the two words are normally used together to indicate concern for the physical and mental well-being of the individual at the place of work" (Alhajeri, 2011:19).

Health and safety is fundamental to the success of any construction project; improving health and safety performance will aid in the reduction of construction costs and bring about efficiency of on-going operations (Che Hassan, Basha & Hanafi, 2007). More importantly improved occupational health and safety in the construction industry will mean that more lives are saved and the quality of the workers lives will be improved on work-sites. In South African, the construction industry is said to have experienced an increased rate of accidents and injuries over the past years (Othman, 2012). Although the country has sound legislation, with a more specific reference to the Construction Regulations 2014, which seek to address health and safety challenges on construction sites. However, it is not enough to solely rely on legislation to improve the status quo, but there needs to be improved and better ways of operating on construction sites. Every stakeholder needs to take more responsibility and accountability in the role they play concerning health and safety. Construction stakeholders can be listed as follows:

- Clients (or the owner)- both public and private who procure construction work
- Architects and designers
- Engineers, surveyors and others involved with the planning of construction projects
- Policy-makers
- Safety professionals and researchers
- The contractors and employers who work on construction projects
- Intermediaries such as the trade unions.

("European Agency for Safety and Health at Work", 2004:9).

Housing is a basic human right which most South Africans are yet to realise. The high demand for housing and other forms of hard infrastructure by both the private and public sectors have attracted entrepreneurs falling under the small and medium contractor categories to venture into the residential construction sector ("Gauteng Growth Development Agency", 2015). Due to the growth in residential construction and the reported health and safety challenges faced by construction SMEs, this study seeks to determine the existing safety culture of small and micro enterprises operating in private residential construction sector. A good safety culture can be characterized by three attributes namely, norms and rules for handling hazards, attitudes towards safety, and lastly reflexivity on safety practice ("Institution of Safety and Health", 2015). A positive safety culture is considered as an essential contributing factor towards improved occupational safety performance in construction (Smith-Jackson et al., 2011). Safety culture is regarded as important as it creates the context within which individual safety attitudes develop and persist and safety behaviours are promoted (Carol & Chan, 2009).

1.1 Background

The construction industry is a multi-faceted sector and can be categorized into the following sub-groups ("Gauteng Growth Development Agency", 2015):

- General building construction
- Industrial construction
- Commercial buildings construction
- Heavy civil construction

The nature and conditions of work is dynamic and labour intensive in the construction sector; thus creating a high exposure to health and safety hazards (Chuks, Okoye & Uchenna, 2013). Occupational health and safety is currently one of the most urgent issues that need to be adequately addressed in the construction industry (Fang & Wu, 2013). In South Africa, the construction industry plays a crucial role in the growth of the economy, as well as in the creation of employment opportunities. According to a Statistics South Africa report, the construction sector employed over one million people in 2011 and absorbed approximately 7,5% of the country's population into the work-force and generated an estimated R 267 billion in the year 2013 ("Gauteng Growth Development Agency", 2015). There are about six major key players that dominate South African construction market share; however the industry is generally characterized by small and micro enterprises (SMEs) and medium enterprises. The companies that are classified as small and micro enterprises are reported to form 95% of the country's construction sector ("Gauteng Growth Development Agency", 2015). Furthermore SMEs are reported to employ 41% of the work-force in the construction industry sector (Nhleko, 2012).

Despite the positive impact the South African construction industry contributes towards the country's economy, it also has a poor that come health and safety record; that comes with negative consequences such as the loss of human lives due to construction work accidents. The Department of Labour (DoL) reported in the year 2012 that the construction industry paid over R287 million in work- related claims for injuries and illnesses. The DoL also reported cases of 171 fatalities and 755 injuries in the period of 2007-2010 (Agumba et al., 2013). The statistics (which exclude motor vehicle accidents) seen in Figure 1 below are collated by the Department of Labour and are obtained from all of South Africa's provinces. Although these statistics are deemed to consist of enormous under-reporting, but they are still useful in helping form a picture

of the health and safety status of the construction industry (Smallwood, Haupt & Shakantu, 2009).

Construction H&S Statistics Excluding Motorvehicle Accidents

Department of Labour: OH&S				
	2004/05	2005/06	2006/07	2007/08
Fatal	54	81	79	162
Non-fatal	159	250	245	396
Non-casualty	11	7	10	20
Total	224	338	334	578

Source: Department of Labour

Figure 1. Health and Safety Statistics of the South African construction industry during the period 2004-2008 (Smallwood et al., 2009:3).

Globally, the construction industry generally performs poorly where occupational health and safety is concerned, however it is reported to be even worse in developing countries because of competing social, economic, and political challenges (Khan, 2013). It was found that out of 350 000 South African construction workers about 70 fatalities are suffered per year, in comparison to the United Kingdom's (UK) 2.5-million construction workers suffer only 63 deaths per year (Furter, 2011). This demonstrates that the number of accidents and fatalities are unacceptably high and desperately calls for an improvement of health and safety not only in the South African construction industry, but the construction industry as a whole.

1.1.1 South African Health and Safety Legislation: Construction Regulations 2014

The 2014 Construction Regulations (which have replaced the now repealed 2003 Construction Regulations), promises to improve occupational health and safety by to ensuring accountability through a clear stipulation of the roles and responsibilities of various stakeholders, that is, the client, the contractor, the design team, the labour force and the government, regarding health and safety in building projects (Vermeulen, 2014). Previously, this was not always the case with the repealed Construction Regulations 2003, as the roles and responsibilities of various stakeholders were not as clearly defined and led to a lack of accountability and blame shifting concerning health and safety. The current construction regulations portray health and safety as a shared responsibility amongst the various stakeholders. Furthermore it stresses the importance of a joint commitment and accountability to ensure the improvement of the status of health and safety on construction sites as it is commonly known that more can be achieved through a collective effort (Vermeulen, 2014).

Empirical evidence demonstrates that the construction industry has been and is still struggling to curb or reduce injuries and fatalities on work-sites (Agumba et al., 2013). There are various factors that pose a challenge to the effective implementation of health and safety legislative requirements of which the top 10 are presented in Table 1 below (Dadzie, 2013).

Challenges	Relative Important Index(RII)	Rank
Inadequate H& S training	0.848	1st
Poor risk assessment	0.837	2nd
Workers attitudes	0.822	3rd
Lack of Health and Safety professionals	0.819	4th
Inadequate H&S Policies	0.819	5th
Data Collection shortfalls	0.811	6th
Lack of H&S education	0.807	7th
Communication shortfalls	0.778	8th
Cost	0.759	9th
Reporting shortfalls	0.756	10th

Table 1. Highly ranked challenges facing the implementation of health and safety requirements (Dadzie, 2013: 40).

1.1.2 Construction Health and Safety in an International Context.

It has already been established in literature that the construction industry is among one of the most dangerous industries; not only in the developing countries, but also in developed first world countries. The construction industry is counted among the largest employing sectors in the United Kingdom and is also faced with its own fair share of occupational health and safety challenges (Aboagye-Nimo, Raiden &Tietze, 2011).

Health and safety statistics:

"Construction workers include those directly engaged in construction activities, such as apprentices, working foremen, craftsmen, and laborers. Other employees refer to supervisors above working foremen, office staff, executives, architects, engineers, and others engaged in non-construction activities" (The Center for Construction Research and Training, 2013:10).

The Health and Safety Executive (HSE) reported for the period 2014/2015, that the construction industry in Great Britain experienced over the last five years a total of 217 fatal injuries of labourers. There were about 69 000 reported cases of illnesses construction workers suffered due to their working conditions ("Health and Safety Executive", 2014/2015). The construction industry is estimated to represent 6% of the American work-force and also reported to cause an estimated 20% of the fatalities (ElSafty et al., 2012). A case of 721 construction employees 'deaths were reported in the year 2011 by the United States Department of Labor (Fang & Wu, 2013). According to Chong and Low (2014) the Malaysian construction industry experienced 42 775 accident cases between the years 2000-2009, 850 of those cases were fatalities, while 5985 were reported as permanent incapacitation. A total of 2634 construction workers were reported to have lost their lives in 2011 in China according to statistics reported by China State Administration of Work Safety (Fang & Wu, 2013).

The Center for Construction Research and Training (2013) reported the following construction health and safety 2008 statistics for various selected countries as indicated in Figure 2 below.

Country	Number of Deaths	Period for Qualifying Death as Work-Related	Number of Injuries	Period for Qualifying Injury as Work-Related	Includes Commuting	Includes Self-Employed	Source	Total Employment (in Thousands)	Hours Worked (per Week)
Australia	29	Within 3 years of accident	11,380	Incapacity of 5+ workdays	N	N	Insurance records	1,015	38.3
Canada	106	No maximum period	29,765	No minimum period	N	Y	Insurance records	1,320	37.1
Finland^	8	No maximum period	10,451	No minimum period	Y	N	Insurance records	183	38.5
Germany	127	No maximum period	127,384	No minimum period	Y	Y	Insurance records	2,521	39.0
Italy	189	No maximum period	74,645	Incapacity of 3+ workdays	Y	Y	Insurance records	1,970	36.6
Norway	6	No maximum period	2,051	No minimum period	N	Y	Insurance records	183	38.2
Spain	183	Within 1 year of accident	186,153	No minimum period	Y	N	Social security records	2,823	37.8
Sweden	17	No maximum period	2,936	No minimum period	Y	Y	Insurance records	306	38.8
Switzerland*	13	Within 1 year of accident	21,828	Incapacity of 3+ workdays	Y	N	Insurance records	272	41.1
United States*	975	No maximum period	120,240	Incapacity of 1+ workdays	N	Y/N**	Census / Survey	12,140	38.5

Figure 2. Factors and criteria of construction fatalities and nonfatal injuries, selected countries, 2008 (Center for Construction Research and Training, 2013:37).

It is evident that the construction industry is generally plagued with serious occupational health and safety challenges that have both direct and indirect costs which negatively affect the reputation of the industry globally. There is a pressing need to change and improve the status quo of construction industry's prevailing safety culture and work towards one of a zero-harm on work-sites. The loss of human life, reduced quality of health of workers and negative implications on the economy is calling for a proactive and collective effort from all affected stakeholders to improve the health and safety record of the industry as we know it.

Common health and safety hazards experienced in the Construction industry

There are many health and safety risks and hazards experienced construction workers on a daily basis. According to literature work-related musculoskeletal disorders are very common in the construction industry. Musculoskeletal disorders can be briefly explained as injuries of the muscles, tendons, joints, and nerves that are instigated or intensified by work where there is repeated exposures to activities such as lifting and carrying materials, sudden movements, whole body vibration (WBV), bending or twisting, repetitive and forceful hand activity, and working in a cramped space for long periods of time ("The Center for Construction Research and Training", 2013). Construction workers often use their hands to handle, control, and feel objects, tools, and controls at work on a daily basis. This particular exposure can cause hand injuries, and escalate the risk of skin conditions like dermatitis when hands are exposed to various types of chemicals or construction materials ("The Center for Construction Research and Training", 2013).

Construction jobs also often entail regular outdoor work. Therefore some workers may become exposed to sunlight and subsequently have an increased risk of skin cancer and other types of cancer. High temperatures are a serious hazard for construction workers and can lead to decreased job performance and increased risk of injury, as well as heat stroke ("The Center for

Construction Research and Training", 2013). Almost all workers in construction production occupations are frequently exposed to distracting or uncomfortable noise at construction sites from the use of heavy machinery for example, which may cause noise-induced hearing loss ("The Center for Construction Research and Training", 2013).

A National Hazard Exposure Worker Surveillance (NHEWS) survey was conducted in Australia in 2008 amongst three categories of workers: construction workers, workers in other priority industries and workers in non-priority industries with a self-reported exposure to the nine different hazards; mainly airborne hazards, vibration, noise, chemicals, biomechanical demands and sun exposure. It was found that the most exposure to such hazards was more likely to occur in the construction industry than the other priority and non-priority industries ("Safe Work Australia", 2015). The results of the survey are illustrated in the Figure 3 below.

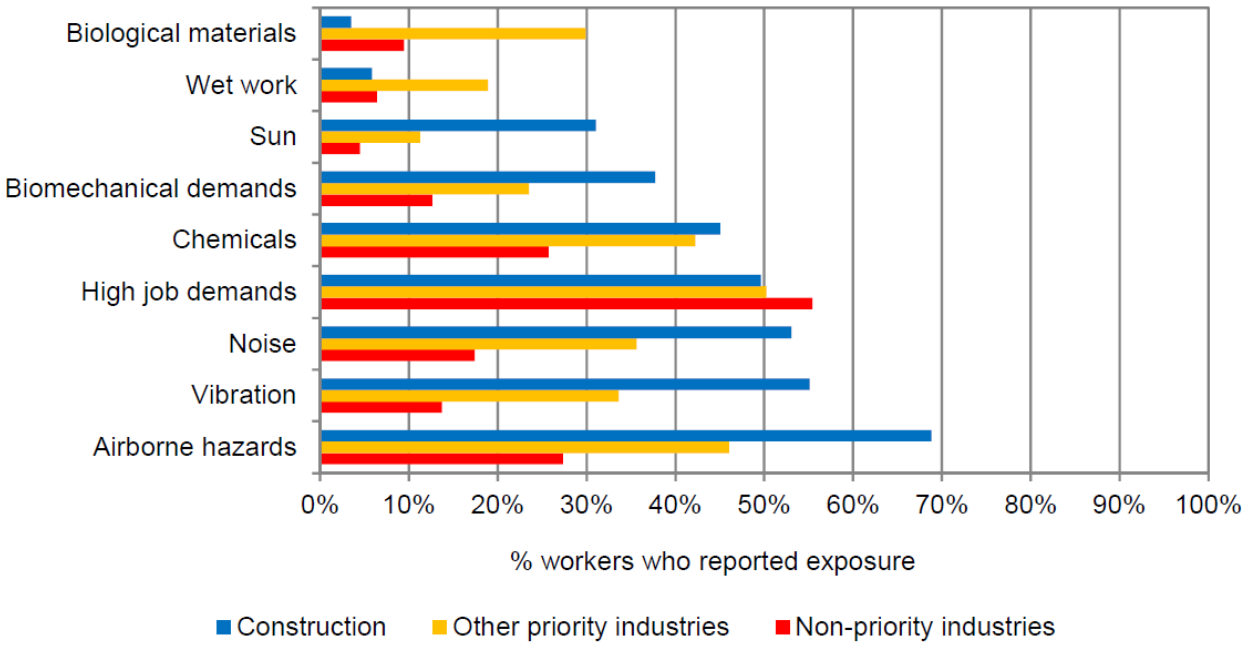


Figure 3. A comparison of construction worker hazard exposure in comparison to workers from other industries ("Safe Work Australia", 2015:10).

Empirical evidence has not only highlighted the need, but also the grave importance of improving the health and safety status of the construction sector as there is a high number of the construction work-force that is negatively affected by the current construction health and safety performance. The economy and reputation of a construction companies also become negatively impacted by the consequences of a poor occupational health and safety performance.

1.1.3 Small and Micro Enterprises (SMEs) operating in the Residential Construction Sector.

The construction industry is comprised of different sectors and businesses of varying sizes that range from a micro to macro scale. It is the small and micro as well as medium enterprises that is said to dominate the construction industry. This study seeks to determine the health and safety culture of small and micro construction enterprises that are operating in private residential sector. Table 2 below defines small and micro enterprises (SMEs) as per the South African

Small Business Act 112 of 1981 (Repealed by National Small Business Amendment Act 26 of 2003). The South African Small Business Act 112 of 1981 (Repealed by National Small Business Amendment Act 26 of 2003 categorises small and micro enterprises as follows ("Entrepreneurs Toolkit", 2009) :

Micro enterprises	Between one to five employees, usually the owner and family. Informal - no license, formal business premises, labour legislation Turnover below the Value Added Tax (VAT) registration level of R300 000 per year. Basic business skills and training Potential to make the transition to a viable formal small business.
Small enterprise	Less than 100 employees. More established than very small enterprises, formal and registered, fixed business premises. Owner managed, but more complex management structure

Table 2. Definitions of small and micro enterprises ("Entrepreneurs Toolkit", 2009).

Small and micro enterprises generally dominate the construction industry globally, and are also said to account for a high percentage of accidents and injuries. It is reported that between the periods 1992 to 2010, 5,893 construction deaths (44% of deaths among wage-and-salary workers) occurred in establishments with ten or fewer employees ("The Center for Construction Research and Training", 2013). In 2010 alone, 56.3% of construction deaths occurred in establishments with fewer than 20 employees, yet such establishments employed just 41.4% of the wage-and-salary workforce in construction. Injury rates for the largest establishments 91,000 or more employees) has been found to remain the lowest in construction ("The Center for Construction Research and Training", 2013). This particular sector of the construction industry is faced with complex and unique challenges, which is one of the contributing factors to its poor health and safety record (Arewa & Farrell, 2012). Additionally due to their size, limited resources and unique challenges such as transient workers, this particular fraction of the of the construction industry is at times exempt from certain occupational health and safety regulation, thus making it difficult to adequately monitor these enterprises (Moeti-Lysson & Boy, 2011).

Moeti-Lysson and Boy (2011) are of the view that the health and safety of employees in small and medium enterprises is overlooked in Africa. There is a high concentration of small and micro enterprises operating in the residential construction sector. In South Africa, the residential sector is experiencing growth due to a rapidly growing urban population as well as housing backlog. Residential construction has been growing significantly in South Africa. Statistics South Africa reported various growths in the different housing typologies between the periods January to July 2015 (du Toit, 2015). Figure 5 illustrates the reported the varying growth of residential construction activity in South Africa within a seven month period.

The researcher has identified a need to study further and understand the health and safety status and the challenges thereof of construction small and micro enterprises operating in the private residential construction projects and seeks to recommend strategies that will help improve the currently unacceptable health and safety record by creating better, healthier and safer ways of working in more conducive environments.

Real Estate in Africa

According to a 2015 report by PWC titled 'Real Estate – Building the future of Africa', the African continent is the world's second-largest and second-most populated with 30.2 million km² or 20.4% of the total global land area (French, 2015). Furthermore, the World Bank reported that Africa's median age was 19.7 years in 2012, and expected to rise to 25.4 years in 2050, thus making Africa the continent with the youngest population. These conjectures suggested that in 2015 the continent would have a population of 226 million aged between 15 and 24 years of age and is anticipated to double by the year 2045 (French, 2015). It is expected that such a young population will drive growth in the demand for housing - growing urban populations will demand for residential property across the African continent. The changes in demographics will have an effect the demand for real estate fundamentally as there will be a bigger need for housing supply.

Home building and improvement projects are expected to increase, alongside commercial and infrastructure projects. There will therefore be an increase in the demand for construction workers to see to the construction of such projects. One fourth of the 25 fastest growing occupations from 2010 to 2020 are related to construction ("The Aspen Institute", n.d.). Furthermore, as the construction workforce ages, more skilled construction workers will be needed. As the housing sector recovers and more workers are employed in residential construction, it is important to consider the quality of the employment created ("The Aspen Institute", n.d.). The occupational health and safety of the workers and anyone affected should be given a high priority. It is evident, based on these projections that there will be a growth in residential construction and consequently a need to ensure that there is improved occupational health and safety status in this sector. Residential construction is one of the dominant sectors in the construction industry; it also plays an important role in providing the basic right to housing for people. It contributes significantly to the growth of the economy, and while doing so it ensures equally that the workers are healthy and safe while building (French, 2015).

There are massive shortages in residential property throughout the African continent and they provide opportunities for private development on a grand scale, while a lack of local funding for infrastructure projects provides a platform for new private partnerships with the public sector. Demographic shifts and changes in consumer behaviour create demand for different real estate typologies, consequently introducing more specialist investors into the market. The fluctuating demographic trends are likely to create a huge need for new and different real estate by 2020 and beyond (French, 2015). The burgeoning middle-class urban populations in Africa will need far more housing. The need for housing raises concerns of the status of the health and safety of the residential construction and provides an opportunity to create a positive health and safety culture on such construction work sites.

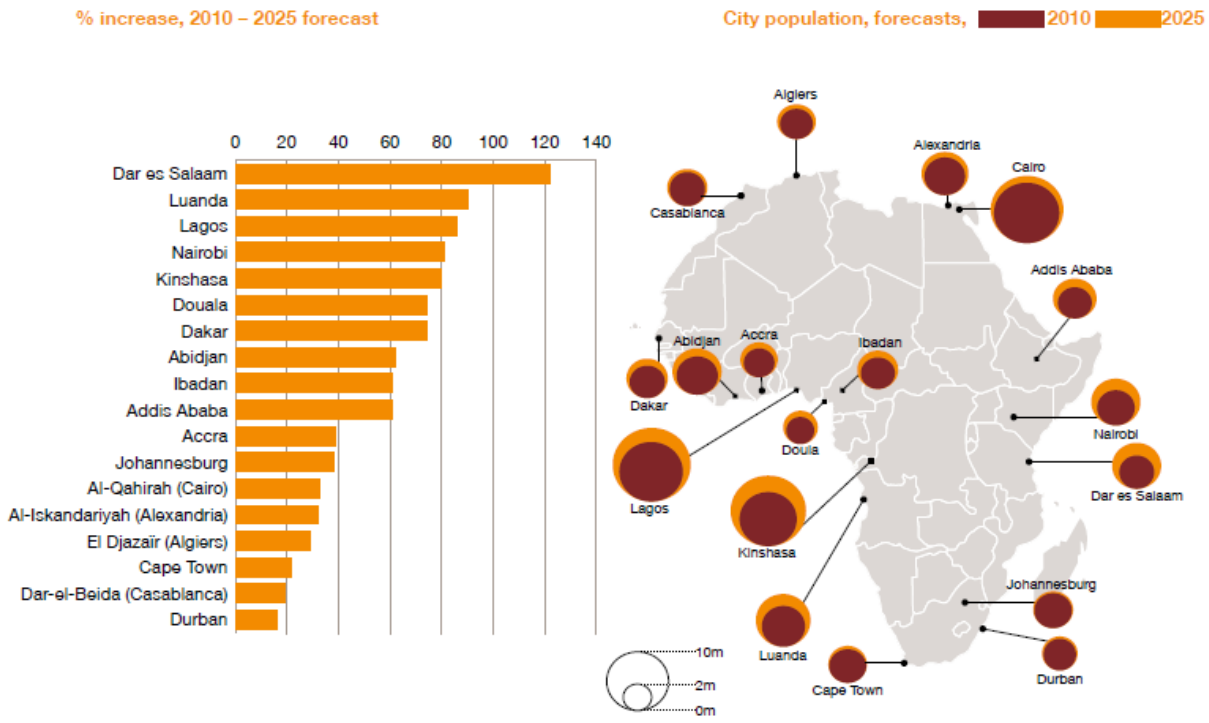


Figure 4. Population growth projections for various African cities (French, 2015:7).

Real Estate in South Africa

The United Nations World Populations Prospects report estimates that the South African population will increase to 72.9 million by 2050. Approximately 62% of the current population of approximately 53 million inhabitants reside in an urban environment. The urban population growing at a rate of 1.21% per annum and it is expected to reach 70% by 2030 due to massive urbanisation. South Africa has a housing backlog which is rising (French, 2015). In 2012, the housing backlog was estimated at 2.1 million units and the backlog stood at 2.3 million units in 2014, a figure that is estimated to grow by 178 000 units each year. Post 1994, the government has been able to provide 2.68 million units, however statistics indicate that there is a need to for more housing provision in the country given the backlog (French, 2015). This demand will bring about more increased activity with the residential construction sector. It is therefore important that while this sector grows, the health and safety of all role players, particularly the workers are given high priority.

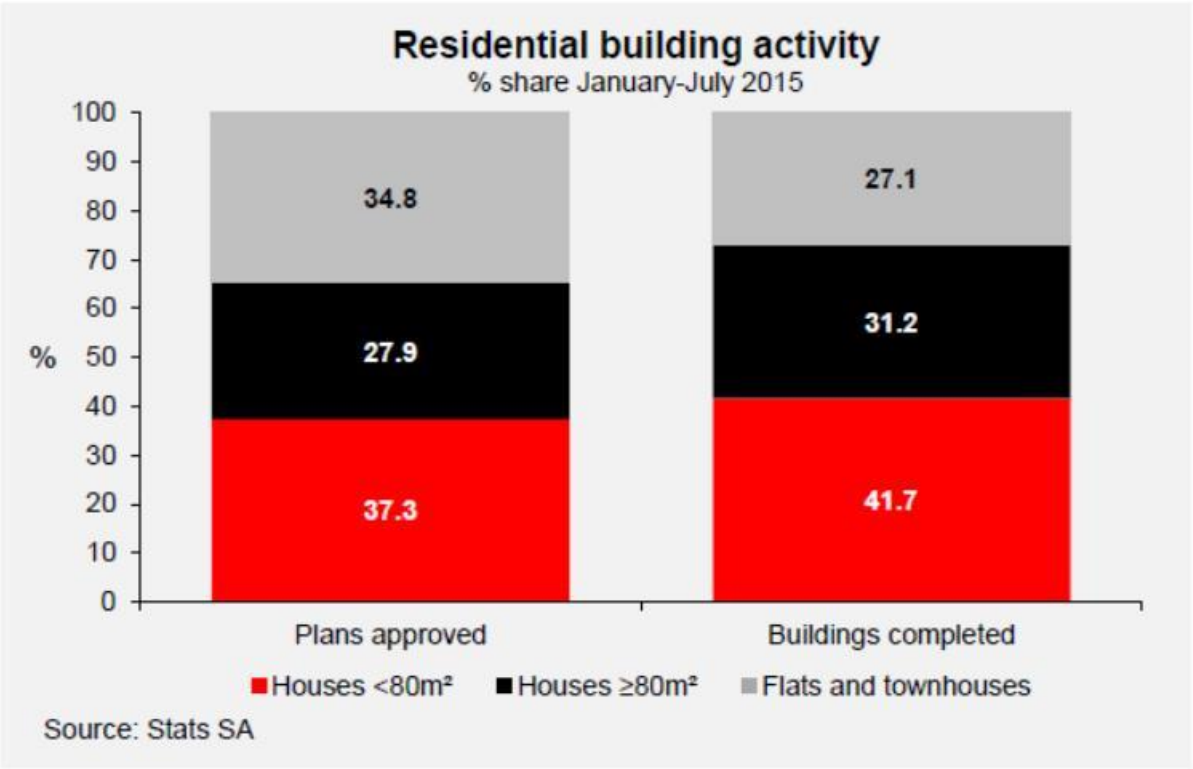


Figure 5. Graph showing residential building activity between January – July 2015 (du Toit, 2015:3).

The National Home Builders Registration Council (NHBRC)

The National Home Builders Registration Council (NHBRC) is a Section 21, non-profit organization and was established in terms of the Housing Consumers Protection Measures Act, 1998 to regulate the building industry and protect home buyers against shoddy workmanship ("The National Home Builders Registration Council", n.d.). There was at the time a scourge of fly-by-night-builders who were conning people all over South Africa and this then brought about a desperate need to regulate the home building industry and improve building standards in this part of the construction industry. As of December 1999, all home builders have been legally required to register with the NHBRC, and no financial institution is permitted to lend money against the security of a mortgage bond unless the builder is registered. As supplementary precautionary measure, conveyancers are not permitted to register bonds unless these requirements have been met ("The National Home Builders Registration Council", n.d). The NHBRC maintains a register of home builders who are members and they are in the process of establishing a classifying system so that potential clients will get an idea of the quality of work to expect. Members will be able to use this information when they advertise their services. The NHBRC also keeps a database of any previous members who have been suspended or deregistered to protect home buyers ("The National Home Builders Registration Council", n.d.). The construction contractors operating within the Waterfall Country Estate study area are registered with the NHBRC.

1.1.4 Safety Culture in the Construction Industry

According to the Unites States Department of Labour the residential construction sector is said to have less restrictive building codes in comparison to commercial construction; this leaves builders with flexibility to construct homes to the homeowner's specifications. This flexibility unfortunately comes with the disadvantage of leaving residential construction workers faced with a unique set of hazards and safety considerations ("United States Department of Labor" n.d.). Residential construction in particular is said to not be well-regulated by Occupational Safety and Health Administration (OSHA) because the projects are often small-scale and are often completed before inspectors are made aware of them (Clark, 2008). Clark (2008) considers home building is as a gateway to construction work. This then raises a concern about the number of workers that are absorbed into the labour force and are exposed to OHS hazards and risks on residential construction sites.

Although the construction industry has been subjected to a poor occupational health and safety record on a universal scale, efforts have been made to improve safety in the workplace. These particular initiatives have concentrated on legislation, engineering failure, safety awareness campaigns, safety training, and unsafe behaviour (Tam & Fung, 2012). The culture of an organisation has been identified as a causal factor in many industrial accidents (Tam & Fung, 2012). The term safety culture relates to meanings, interpretations, attitudes, values, beliefs, rules and procedures related to safety (Zhang & Gao, 2012). Stakeholders in the South African construction industry are alleged to be concerned mostly with compliance of construction regulations. However compliance and rules alone cannot improve the status of construction occupational health and safety (Smallwood et al., 2009). There's a tremendous need to focus beyond statutory compliance and consider other key initiatives in establishing a good and sustainable safety culture on every construction site. The end goal being to ultimately achieve a zero harm culture on construction project sites, whereby workers experience none or close to no occupational health and safety ills commonly suffered on work sites. Fostering a successful safety culture is said to be a company-wide effort, which requires commitment and participation from all stakeholders (Cesarini, Hall & Kupiec, 2013). An effective safety culture can help control and reduce accident and fatality rates, ongoing construction costs as well as improve operational efficiency; thus strengthening the company's reputation (Cesarini et al., 2013).

Safety culture has been defined as, "…safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies and patterns of behavior that determine the commitment to, and the style and proficiency of an organization's health and safety management" (Krywicki & Keesey, 2011:3). Lingard, Zhang, Harley, Blismas and Wakefield (2014) claim that organisations prevailing culture determines the following:

- The effectiveness of an organisation's safety management system
- The priority given to safety in the organization
- The commitment to safety of the organisation's members
- The competence in safety of the organisation's employees, and
- The organisation's ability to achieve improvement through continual reflection and learning.

(Lingard et al., 2014:6).

According to Tam and Fung (2012) years of developing safety technologies and safety management systems in the industry, numerous organizations have come to the recognition that the safety culture within the industry has to be addressed if high standards of health and safety are to be obtained and maintained. In other words, more innovations and better ways of working must be devised to improve health and safety on construction work sites - the introduction to creating a positive safety culture is acknowledged as one of the key measures that ought be explored and implemented.

1.2 Research Problem

When looking at the construction industry holistically, it is the residential sector that has been found to account for a disproportionate number of injuries every year. Residential construction has been experiencing moderate growth during the past few years which has contributed to the higher injury rates and fatalities in construction ("Michigan Occupational Safety & Health Administration", 2014). Approximately 40,000 workers are injured on residential construction sites each year. According to the Connecticut Department of Health many of the injuries in residential construction could have easily been prevented if Occupational Safety Health Act regulations were followed ("Connecticut Department of Public Health", 2009). According to Nussbaum, Shewchuk, Kim, Seol and Guo (2009) there is a high prevalence of work-related musculoskeletal disorders (WMSDs) among residential construction workers this is a result of the nature of construction work. Overall, it is estimated that more than 40% of workers in construction production occupations need to kneel, crouch, stoop, or crawl for at least half of their life, while 62% of workers in construction production occupations are required to work in cramped spaces or awkward positions at least once a month while executing their work tasks ("The Center for Construction Research and Training", 2013). It is said that unsafe work practices are common in residential construction (Kaskutas, 2013). A structure collapsed in the Meyersdal Eco residential Estate in Meyersdal, Johannesburg in 2014 injuring nine and claiming the lives of seven construction workers due to an alleged failure by the engineer to inspect the weight of an 84 ton slab (van Niekerk, 2014). This incident not only made news headlines, but it also exposed the health and safety challenges experienced in the private residential sector. Occupational health and safety challenges experienced in the construction industry can no longer be ignored. There is a desperate need to understand these challenges and address them in an adequate and sustainable manner.

The residential market in construction is characterized by many small scale contractors and it is said that small scale contractors tend to function without formal policies and procedures (Smith-Jackson et al., 2011). Small and micro enterprises (SMEs) are inclined to have more health and safety problems in comparison to their larger counter parts – these enterprises are often deemed to inherit problems which were not resolved in the earlier stages of construction planning. These SMEs are found to lack the necessary resources required to mitigate the many hazards that they encounter (Smith-Jackson et al., 2011). Residential construction is mostly a craft-based enterprise, driven by a design, but disconnected from the actual method of assembly and its impact on the human workers. These subcontractors are provided with little or no guidance on acceptable construction methods associated with the design, other than material specification and schedule expectations (Nussbaum et al., 2009). These SMEs are undoubtedly faced with unique challenges that adversely impact the status of health and safety on their work-sites. It is important to improve the performance of health and safety practices in

the South African residential construction industry. There needs to be measures developed to assist small contractors to strengthen their overall occupational health and safety management; one of the important steps is through determining their prevailing safety culture (Othman, 2012).

1.2.1 The aim of the study

This study seeks to explore the health and safety conditions, perceptions, attitudes, and behaviour of construction workers and management safety practices on small residential construction sites and therefore determine the existing safety culture. In order to assist small and micro enterprises to address their unique health and safety challenges. The following objectives were formed in an attempt to meet the aim of the study:

- *To measure the safety attitudes of workers on small residential construction sites.*
- *Determine the existing safety culture on small residential construction sites.*

1.2.2 Scope of study

The research will target residential construction activity within Midrand, Johannesburg. The area is seeing a lot of development, particularly in the residential construction sector. The Waterfall Country Estate in Midrand, is deemed as the largest property development in the country's history, estimated to have a positive economic impact valued at about R106 billion by the time it is completed in 2023 (Cokayne, 2014). There is a range of 6 000 and 8 000 residential units, which will house an estimated 35 000 to 40 000 people, which are in the process of being developed in six residential areas within the estate (Cokayne, 2014). It was also reported that there was 15 000 people working on the various construction sites across the estate (Cokayne, 2014). Therefore it is a suitable study area to explore the safety culture and safety practices of small construction contractors in the domestic residential building sector. The target population of the study small and micro enterprises (SMEs) operating specifically in the residential construction sector and registered with the National Home Builders Registration Council (NHBRC).

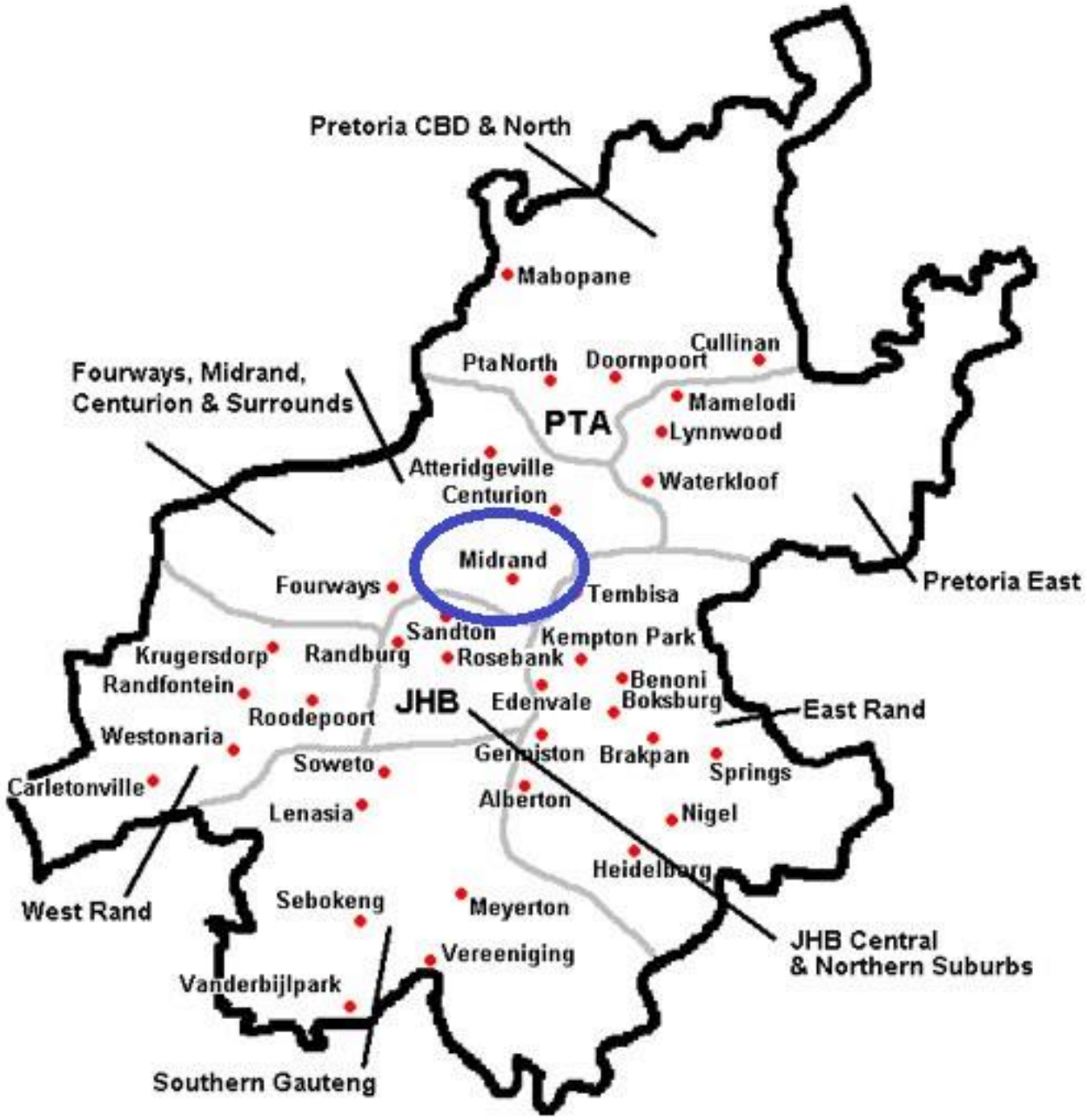


Figure 6. A map of Midrand in the context of Johannesburg, Gauteng (Google, 2016).



Figure 7. An aerial view of Waterfall Country Estate (http://www.century.co.za).

The specific study area within the Waterfall residential estate development is Waterfall Country Village.

1.2.3 Delineations

This study will not focus on the following:

- Large construction companies between grades 7 – 9 as per the Construction Industry Development Board will not be considered for this study.
- Non construction small and micro enterprises (SMEs)
- Non-residential construction activity will not be considered for the purposes of this study.
- Public sector funded residential construction development.
- Renovations and refurbishment residential projects will not form part of the study.

- Residential construction companies which are not registered with the National Home Builders Registration Council will not form part of the study.
- The study will not consider geographic locations outside of the Jurisdiction of the Johannesburg Metropolitan Municipality.
- Management (employers) will not form part of the research respondents.
- The health and safety roles of the following stakeholders - Engineers, surveyors and others involved with the planning of construction projects; policy-makers; safety professionals and researchers; Intermediaries such as the trade unions.

1.3 Primary research question

The proposed title of the study is: *"Health and safety culture on small residential construction sites through improved safety practices: A case of Waterfall Estate, Midrand".*

The primary research question and sub-questions:

- *What are the existing attitudes and perceptions of workers and supervisors concerning health and safety on residential construction sites?*

Research sub-questions:

- *Does management prioritise health and safety?*
- *What safety management practices does management employ to address health and safety challenges on construction sites?*
- *What are the workers perception of health and safety?*

1.4 Limitations

- This study will only look at one case (Waterfall Country Village) to assess safety cultures of small and micro enterprises.
- Recent work has identified trust as playing a key role in safety culture which is rarely measured by existing models.
- Only data obtained from workers, and not senior management will be used as part of the study.

1.5 Assumptions

The study will make the following assumptions:

- That the systems theory is the most applicable in analysing health and safety matters on residential construction sites.
- Study assumes that residential contractors operating at Waterfall residential construction development area are supposed to have a good existing safety culture.
- Contractors and sub-contractors registered with the National Home Builders Registration Council (NHBRC) have a better management of health and safety on their work-sites.
- There is a causal relationship between attitudes, behaviour and safety culture.

1.6 Research ethics

The study ultimately seeks to gain knowledge of the status of occupational health and safety on residential construction sites. The researcher is aware that health and safety is a sensitive topic in construction, however it is one that must be addressed urgently so, due to the pressing negative social and economic consequences. While engaging with the participants the researcher sought to respect the rights, needs, values, cultural backgrounds and desires of the participants. Furthermore the study took cognisance of the following ethical considerations concerning the research participants (Thomas, 2010):

- Participants' verbal and written consent will be requested prior to administering the questionnaires.
- Participation will be voluntary.
- The nature of the research did not place participants in any form of danger or potentially harmful situations.
- Honesty and trust – the researcher will be open and transparent with the participants.
- Privacy, confidentiality, and anonymity – anonymity of the respondents will be guaranteed.

1.7 The outline of the this study

This research study is made up of six (6) chapters, the first one being Chapter One which this introduction forms part of. Chapter one seeks to introduce the purpose of the study.

Chapter Two is a literature review that presents information gathered through research about occupational health and safety in construction in an international and South African context, the legislative roles and responsibilities of the various stakeholders concerning health and safety, accident causation theories, health and safety challenges of small to micro enterprises (SMEs) who operate in the private residential construction sector and the predominant safety culture of SMEs. The literature review will be used to provide a base for the information that will be examined in the findings and conclusion chapter.

Chapter Three forms part of the research methodology used in this study for data collection. This will outline the research method, research design instrument, sampling technique and it will describe the process used to gather the information, reliability and validity of the data.

Chapter Four will present and analyse the findings of the study. This chapter will seek to answer the objectives of the study by analysing the findings and reporting on the overall safety culture of construction SMEs operating in the domestic residential sector.

Chapter Five is the conclusions and recommendations chapter, which seeks to summarise the purpose of this study, discuss the findings and suggest recommendations to help improve and create a positive safety culture amongst SMEs operating in the private residential sector.

Chapter Six is comprised of a reference list of all the literature sources and research supporting documents in the form of annexures.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

The study has identified the need to explore the safety culture of small residential construction companies. The literature review seeks to investigate the existing occupational health and safety challenges that are experienced by small and micro scale contractors and the safety culture thereof. Small domestic residential construction companies are faced with unique health and safety challenges. This study seeks to explore and identify these problems and recommend effective solutions that can be used to assist in fostering a positive safety culture in order to adequately address the problems of managing workplace health and safety practices (Agumba et al., 2013). Stakeholder involvement is important in achieving an in improved health and safety practices. Therefore the roles and responsibilities of the various stakeholders in the terms of the health and safety legislative requirements, be it for instance the role owner/client, contractor or designer, will be discussed in order to better understand how each player's involvement contributes towards improving occupational health and safety on their work-sites and the overall construction industry. Each stakeholder has a part to play in influencing the outcome of health and safety practices on their construction site. Furthermore Huang and Hinze (2006) are of the opinion that owners can favourably impact construction safety by selecting safe contractors, encouraging designers to address safety issues in designs as well as getting involved in safety management during construction.

2.1 Objectives of Literature Review

Othman (2012) undertook a study and found that the most common accidents that occur on construction sites were found to be falls, stepping or striking against objects, mishandling of machinery, fires and explosions. Additionally it is said that the cause of these accidents are mainly due to the negligence of labourers. There exist various theories of accident causation in literature of which the study will explore and to draw understanding from; in order to find practical and suitable solutions to address the pertinent issue of improving occupational health and safety challenges faced in the residential construction sector. This study will therefore explore the attitudes of labourers towards aspects of occupational health and safety on small residential construction sites.

The literature review is to assist the researcher to do the following (Saunders, Lewis &Thornhill, 2012:74):

- Further refine the research question(s) and objectives and bring clarity and focus to the research problem.
- Highlight research possibilities that have been implicitly overlooked in research to date.
- Broaden knowledge and discover explicit recommendations for further research.
- To sample current opinions in professional and trade journals, newspapers – thus gaining insight into aspects of the research that is considered as newsworthy and relevant.
- To discover and provide insight into research approaches, strategies and techniques
- Contextualise the findings.
- Developing a theoretical framework.

- Developing a conceptual framework.

This literature and empirical objectives of this study are listed in Table 3 below:

Literature objectives	Empirical objectives
To understand the causes of occupational health and safety challenges experienced in construction.	To measure the safety attitudes of workers on small residential construction sites.
To gain better understanding of the roles of stakeholders as set in Construction Regulations 2014 and how promote accountability towards health and safety.	Determine the existing safety culture on small residential construction sites.
To find knowledge on of stakeholder contributions towards health and safety.	
To understand the components of a safety culture, determine factors that shape safety culture.	
To gain knowledge on common health and safety challenges experienced by small and micro enterprises (SMEs) operating in residential construction.	

Table 3. Literature and empirical objectives of the study.

2.1.1 Methodology of literature review

In order to review literature, a desktop analysis of various sources of information was carried out. The reviewer searched published papers, along with unpublished reports and other literature relevant to moving occupational safety and health research into practice in construction and residential construction in particular. Search terms included: *construction industry, construction stakeholders, small and micro construction enterprises, construction health and safety, construction legislation, safety climate, safety culture, occupational health and safety, residential construction, accident causation theories*, from international databases whereby expert opinions from industry were taken. Various international and local (South African) sources of information retrieved from various media platforms thus assisted in providing some insight into the research problem obtained from various research engines and website sources such as Google Scholar.

The study will draw from the authors mentioned in Table 4 below- a literature summary of research methods used in the problem area of occupational health and safety in the construction industry.

Author (s)	Date	Research topic	Methods used	Findings
Agumba and Haupt	2009	'An overview of the characteristics of health and safety culture and practices in SMEs firms in the South African construction industry'.	A descriptive survey method was adopted, which involved the use of a semi-structured and structured questionnaire in an in-depth exploration, non-probability sampling.	Commitment to health and safety (H&S), support of health and safety, goal setting and review of health and safety, creating structure and process that promote H&S and reviewing leaders' performance /self-improvement are part of health and safety culture of small and medium enterprises.
Aboagye-Nimo, Raiden and Tieze	2011	'Investigating good health and safety practices in small construction firms in the United Kingdom'.	The research methods employed include semi-structured interviews and non-participant observations.	It was found that that health and safety practices amongst workers of small construction are highly reliant on the safety culture that is developed by the workers with influence from owners/leaders. Trust was found to be crucial in building safety cultures for small construction firms.
Choi and Carlson	2014	'Occupational Safety Issues in Residential Construction Surveyed in Wisconsin, United States'.	Data was collected by means of a questionnaire.	The findings suggested that residential construction contractors needed to utilise fall protection equipment more.
Hung et al.	2011	'Use of attitude congruence to identify safety interventions for small residential builders'.	A triangulation design consisting of observation (shadowing), subjective quantitative (questionnaire) and subjective qualitative (interview) methods.	The study explored differences in safety attitudes and behaviours among construction workers, first line supervisors and project managers in small residential construction companies with respect to recommendations for safety interventions. Findings of the study showed a tendency among subcontractors to exercise risky behaviours, though generally articulated a desire to avoid injuries.
Huang and Hinze	2009	'Owners Role in Construction Safety'.	Data was collected by conducting interviews on large	The study concluded that owners can positively influence project safety performances as their commitment towards

			construction projects.	health and safety were found to lower the number of accident occurring on their project sites.
Tam and Fung	2012	'Behavior, Attitude, and Perception toward Safety Culture from Mandatory Safety Training Course'.	A questionnaire survey and structured interviews were conducted.	It was found that a good personal safety attitude, personal roles and commitment among workers, and low obstacles to safe behaviour resulted in good perception of accidents.
Wamuziri	2006	'An evaluation of safety culture in the construction industry, the overall findings of the study was that the construction industry'.	A health and safety climate assessment tool kit, recognised by the Health and Safety Executive.	Findings good health and safety management is an attribute of effective harmonization of technical and managerial systems, including human factors.
Wamuziri	2008	'Improving Safety Performance in Construction through Cultural Change'.	The methodology applied in this study consisted of extensive reviewing of relevant literature and a questionnaire of open-ended questions was administered.	It was recommended that further research is required in construction to develop a set of validated measurement methods of safety culture in the construction industry.
Wamuziri	2013	'Factors that influence safety culture in construction'.	A qualitative approach was adopted and data was collected via semi-structured interviews.	It was found factors that contribute to positive and negative safety cultures in construction could be grouped into six categories, namely, (1) organisational factors, (2) individual factors, (3) team factors, (4) project-related factors, (5) management factors and (6) supervisory factors.
Zou	2011	'Fostering a Strong Construction Safety Culture'.	The research methodology applied in the study consisted of critically reviewing literature and conducting case	It was recommended that organizations must adopt a holist strategy that focuses not only on improving the physical working environment, safety risk assessments and employees' safety knowledge, but also on shaping employees' beliefs and attitudes that

			studies.	lead to safe behaviour and ultimately to a strong safety culture.
Windapo	2013	'Relationship between Degree of Risk, Cost and Level of Compliance to Occupational Health and Safety Regulations in construction'.	A mixed method research approach, which combines both qualitative and quantitative, approached in research design and collection was adopted.	The findings of the study were that the degree of a contractor's compliance with health and safety regulatory requirements is significantly related to perceived cost savings and separated from the level of risk which the regulation is attempting to avoid.
Taylor	2011	'Occupational Safety and Health culture assessment - A review of main approaches and selected tools'.	Three assessment approaches can be distinguished in this regard: the academic, analytical and pragmatic approach to assess the safety culture in an organisation.	There exist many tools for exploring and assessing an organisation's safety culture. It is therefore useful to know what they can be used for, their potentials and limitations, and their pros and cons. No tools were found that are explicitly targeted at the assessment of corporate health culture.
Lingard, Zhang, Harley, Blismas, and Wakefield	2014	'Health and safety Culture'	A multi-level measurement approach enabling measurement of the prevailing safety climate at the organisation, project and workgroup levels.	An organisation's prevailing culture can shape the priority placed on health and safety (H&S) and ultimately determine the effectiveness and performance of the organisation's H&S system. Despite the existence of many models of H&S culture, what constitutes a good or a bad safety culture has been subject to little empirical evaluation. It is particularly important to consider the validity of an H&S culture model in the specific national and industry content in which it is to be used.

Table 4. A literature summary of research methods used in the problem area.

2.2. Introduction to Literature Review:

Occupational Health and Safety in Construction:

"Occupational safety and health (OSH) is generally defined as the science of the anticipation, recognition, evaluation and control of hazards arising in or at the workplace that could impair the health and well-being of workers, taking into account the possible impact on the surrounding communities and the general environment" (Alli, 2008:vii).

Occupational health and safety is concerned with the well-being of employees as well as the impact the environment they operate within has on them and on the broader affected communities. Occupational safety and health plays a key role in achieving sustained decent working conditions and strong preventive safety cultures. It generally advocates for a safe and healthy work environment, in addition it can be important for moral, legal and financial reasons. The cost in terms of human suffering and impact on the economy is too burdensome and thus the need for significant improvements of health and safety in the workplace (Alli, 2008).

The domain of health and safety is necessarily vast, encompassing a large number of disciplines and numerous workplace and environmental hazards. It has already been established that occupational health and safety is one of universal concern across all industries, and found to be highly problematic in the construction industry; calling for a need to improve the state of occupational health and safety in this particular sector. It is said that an organisation's attitudes and values is a significant contributing factor to its approach to work and ultimately its health and safety performance ("Institution of Safety and Health", 2014).

"The construction industry has been identified as one of the most hazardous industries as measured by work-related mortality, workers' compensation, injury and fatality rates" (Chong & Low, 2015:2).

Construction operations are inherently high-risk in nature, thus making the industry prone to health and safety risks as the construction work is carried out in a constantly changing work environment. The nature of the construction work operations, construction methods, construction materials, heavy equipment used, and physical properties of the construction project itself makes it relatively more prone to accident occurrence compared to other industries all over the world (Dadzie, 2013).

2.2.1 Background literature to research problem:

Occupational Health and safety in the South African construction industry:

It reported that people in developing countries are exposed to an estimate of more than 80% of global occupational hazards. These hazards are related to risks that are likely to cause diseases, injuries as well as fatalities (Khan, 2013). According to Chuks and Uchenna (2013), the construction industry in developing countries has performed relatively below expectations concerning the sphere of health and safety. This then further emphasises the need to improve the status of occupational health and safety management on construction sites. The construction industry plays a crucial role in the South African economy towards promoting economic growth and unemployment alleviation; providing more than one million jobs and generating annual revenue of approximately R267 billion ("Gauteng Growth Development Agency", 2015). A 2012 construction health and safety position paper, by the South African Council for the Project and Construction Management Professions (SACPCMP), reported costs of accidents (that is injuries, fatalities and death) to have totalled between R2.6 to R3.5 billion

per year. The consequences of a poor compliance and inadequate implementation of construction occupational health and safety legislation are colossal amounts of money and time spent in claims settlements. More importantly and in addition to the negative implications on the economy, is the loss of human lives of the construction workers which no financial value can be placed upon; it is their heath that suffers or lives that are lost due to failure to improve the current lacking status of health and safety on construction sites. The South African Minister of Public Works, delivered a speech, pointing out that 'an average of two construction workers are killed on a weekly basis in South Africa', this is unacceptable and calls for an improvement in the current status quo (Nxesi, 2014). There ought to be a reduction in the currently unacceptable high rates of injuries and improve occupational health and safety and eventually establish a zero harm culture on construction sites (Nxesi, 2014). When in pursuit of a zero-accidents culture, knowledge and effective implementation of health and safety legislation must become a priority for construction stakeholders (Wilkins, 2011). The onus therefore lies with all affected and involved stakeholders in the construction industry to work together to achieve this commendable goal.

There are three tiers of legislative framework that pertains to Health and Safety in South Africa, firstly being in terms of the national Constitution, secondly in terms of Acts such as the Occupational Health and Safety Act (OHSA) and lastly regulations such as Construction Regulations and their primary objective is to serve as a preventative measure of accidents and related injuries, disablement, fatality and ill-health within the work environment (Windapo, 2013).The new South African Construction Regulations 2014 has been described as 'a momentous piece of legislation for an industry that has been struggling to contain, injuries and fatalities on site' (South African Builder, 2014). The Construction Regulations 2014 seek to bring about an end to the debate regarding the ultimate responsibility of health and safety in building projects. A noticeably striking feature of the newly promulgated 2014 Construction Regulations (in comparison to the repealed Construction Regulations 2003), is the inherent recognition that health and safety on a construction site is a shared responsibility involving the design team, the client, the contractor, the labour force and government (Vermeulen, 2014). This fosters accountability from all stakeholders - as reduced or zero accidents and fatalities is ultimately dependent on everyone involved on construction sites working together, playing their individual roles to facilitate this process and ultimately moving towards creating an improved and positive safety culture in the construction industry.

2.2.2 South African Occupational Health and Safety Legislation - Construction Regulations 2014

In South Africa, the primary Acts that impact construction health and safety in South Africa are the Occupational Health and Safety Act No. 85 of 1993 (OH&S Act) and the complementary Compensation for Occupational Injuries and Diseases Act No. 130 of 1993 (COID Act) (Smallwood et al., 2009). Furthermore A range of regulations promulgated under the Occupational Health and Safety Act impact on construction health and safety (H&S) in particular the recently promulgated Construction Regulations 2014. The Occupational Health and Safety Act No. 85 of 1993 constitute the basis of occupational health and safety legislation, which regulates all organisations (Smallwood et al., 2009). The management of an organisation is therefore required by the law to enforce occupational health and safety compliance to ensure that their workers are not injured on duty.

According to Smallwood et al. (2009) the construction health and safety has long been the focus of attention of many industry stakeholders and role players in South Africa. Construction

stakeholders that play a role in the health and safety performance on the industry can be described and listed as follows ("European Agency for Safety and Health at Work", 2004:9):

- Clients (or the Owner)- both public and private who procure construction work;
- Architects and designers;
- Engineers, surveyors and others involved with the planning of construction projects;
- Policy-makers;
- Safety professionals and researchers;
- The contractors and employers who work on construction projects;

While it is acknowledged that many industry associations and professional societies, contracting organisations and others have made significant efforts to improve health and safety within the construction industry, overall occupational health and safety in construction is not improving commensurately. The construction industry continues to generate a disproportionate number of fatalities and injuries relative to other industries, furthermore there continues to be high levels of non-compliance of occupational health and safety legislation in the construction sector (Smallwood et al., 2009). It is said that robust health and safety legislation are a fundamental foundation, but must be implemented and integrated throughout an organization in order to be effective (Gillen, Goldenhar, Hecker & Schneider, 2014). It must be mentioned that the achievement of legislative objectives can only be achieved through effective, practical and accountable enforcement and compliance of all affected stakeholders (Smallwood et al., 2009).

The new Construction Regulations 2014 enforce stringent health and safety obligations on a wide range of parties who are involved in construction work, including the client (a person for whom construction work is being performed), the contractor (an employer who performs construction work), the designer (which includes an architect or engineer) and the principal contractor (an employer appointed by the client to perform construction work) (Vermeulen, 2014). This was not case in the now repealed Construction Regulations 2003, for example less health and safety obligations were placed on the designer, which is no longer the case as the new construction regulations make designers more accountable thus opening a channel that exposes them designers to criminal liability in the event of non-compliance (Vermeulen, 2014). There are various stakeholders involved in construction projects, it is important to know and understand the roles and responsibilities of these stakeholders and their contribution towards improving occupational health and safety on construction project sites.

An approximate of 160 deaths was reported to have occurred on various South African construction sites between the periods of 2007/2008. The construction industry was ranked third after mining and transportation, with 74 deaths recorded on site in 2003 (Agumba et al., 2013). A report by the South African Department of Labour (2012) indicated that, in the period 2007 to 2010, the construction industry incurred 171 fatalities and 755 injuries. The industry further paid over R287 million for occupational injuries in 2010/2011 (Agumba et al., 2013). Costs of accidents in South Africa are estimated at 5% of the value of the completed construction while the costs of implementing health and safety systems within a construction company is estimated to be between 0, 5% and 3% of the total project costs (Windapo, 2013). There are direct and indirect costs incurred when accidents occur. Direct costs are visible and include insurance compensation and medical charges. Indirect costs are hidden, and include for example lost labour time, cost of repairs and costs of replacing injured workers (Arewa & Farell, 2012). Bizzell (2008) mentioned that injuries in construction accounted for 6, 5% of the total cost for construction, but also found that the amount of money the average construction company

allocated to the safety program is roughly 2.5%. Although the cost of investing in safety is relatively high, it is can be considered to be far less a price to pay in comparison to the cost of not implementing the necessary preventative measures set out in legislation.

2.2.3 Roles of Stakeholders: Clients, Designers, Principle Contractors and Contractors

For the purposes of this study, the discussion will only look at duties and roles of the client, the designer, the principal contractor and contractor as set in provisions of Occupational Health and Safety Act, 1993 Construction Regulations, 2014. Under Section 43 of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) Construction Regulations 2014, certain regulations are stipulated to guide stakeholders (clients, designers, principal contractors and contractors) concerning various construction processes. This part of the discussion focuses on the legislative role and responsibilities of the above mentioned stakeholders as set out in the various clauses of the Construction Regulations 2014:

Duties of Client in terms of Section 43 of the Occupational Health and Safety Act, 1993 (Act 85 of 1993:10):

5. A client must-

(a) Prepare a baseline risk assessment for an intended construction work project;

(b) Prepare a suitable, sufficiently documented and coherent site specific health and safety specification for the intended construction work based on the baseline risk assessment contemplated in paragraph (a);(c) Provide the designer with the health and safety specification contemplated in paragraph (b);

(d) Ensure that the designer takes the prepared health and safety specification into consideration during the design stage;

(e) Ensure that the designer carries out all responsibilities contemplated in regulation 6;

(f) Include the health and safety specification in the tender documents;

(g) Ensure that potential principal contractors submitting tenders have made adequate provision for the cost of health and safety measures;

(h) Ensure that the principal contractor to be appointed has the necessary competencies and resources to carry out the construction work safely;

(i) Take reasonable steps to ensure co-operation between all contractors appointed by the client to enable each of those contractors to comply with these Regulations;

(j) Ensure before any work commences on a site that every principal contractor is registered and in good standing with the compensation fund or with a licensed compensation insurer as contemplated in the Compensation for Occupational Injuries and Diseases Act, 1993 (Act No. 130 of 1993);

(k) Appoint every principal contractor in writing for the project or part thereof on the construction site;

(/) Discuss and negotiate with the principal contractor the contents of the principal contractor's health and safety plan contemplated in regulation 7(1), and must thereafter finally approve that plan for implementation;

(m) Ensure that a copy of the principal contractor's health and safety plan is available on request to an employee, inspector or contractor;

(n) Take reasonable steps to ensure that each contractor's health and safety plan contemplated in regulation 7(1) (a) is implemented and maintained;

(o) Ensure that periodic health and safety audits and document verification are conducted at intervals mutually agreed upon between the principal contractor and any contractor, but at least once every 30 days;

(p) Ensure that a copy of the health and safety audit report contemplated in paragraph (o) is provided to the principal contractor within seven days after the audit;

(q) Stop any contractor from executing a construction activity which poses a threat to the health and safety of persons which is not in accordance with the client's health and safety specifications and the principal contractor's health and safety plan for the site;

(r) Where changes are brought about to the design or construction work, make sufficient health and safety information and appropriate resources available to the principal contractor to execute the work safely; and

(s) Ensure that the health and safety file contemplated in regulation 7(1) (b) is kept and maintained by the principal contractor.

The client, also referred to as the owner for the purpose of this study, is deemed to play an important role in improving health and safety; their involvement is core and considered as a key requirement for ensuring a zero accident rate in construction projects (Umeokafor & Umeadi, 2014). It is said that the leadership and concentration on the key health and safety issues must come from clients, even though they might not be necessarily familiar with the details of health and safety good practice tin comparison to principal contractors (“Institution of Occupational Safety and Health”, 2010). This then leads to the question of the owner’s role concerning health and safety in a construction project. According to Gillen et al. (2014) the following are among the owners responsibilities concerning construction projects:

- The owner sets expectations for safety
- The owner includes safety in bid specifications
- The owner provides for adequate resources and an adequate schedule to support safety
- The owner supports Prevention through Design (e.g., Design for safety)

According to a study conducted in developing countries namely Botswana, Egypt, Malawi, Nigeria, and South Africa found among a few other findings, that clients are not supportive of health and safety initiatives (Chiocha, Smallwood & Emuze, 2011). The owners of the projects are the main consumers of the construction services, the financer of the project and for most of the time the end-users of the finished product and therefore play a pivotal role in the overall

outcome of the construction project (Huang & Hinze, 2006). Private owners/clients are deemed by Gillen et al. (2014) to possess the ability to influence project safety outcome for better or worse based partly on what they are prepared to spend on; that is what value in bid decisions, the manner in which they reward and track project progress after the letting of bids as well as what they demand of contractors and workers. It is thus fundamental that clients, more especially in developing countries become more involved and supportive in health and safety initiatives; in order to improve the current status of construction occupational health and safety. Gillen et al. (2014) suggests the following owner/ client health and safety initiatives to proactively help improve health and safety management.

- Owner Controlled Insurance Program (OCIP) gives owner "skin in the game."
- Owners representative on site and be involved in orientation training
- Include safety in bid specs
- Focus on design for safety/Prevention through Design
- Use safety performance as a prequalification for bids
- Hold a pre-job meeting on safety with the GCs, subs and labor.
- Owner audits safety performance on site
- Leading metrics should be used in evaluating bids.
- Owners can solicit anonymous complaints to ensure no retaliation for raising safety issues.

(Gillen et al., 2014:29).

Duties of the designer in terms of Section 43 of the Occupational Health and Safety Act, 1993 (Act 85 of 1993:13):

6. (1) The designer of a structure must-

(a) Ensure that the applicable safety standards incorporated into these Regulations under section 44 of the Act are complied with in the design;

(b) Take into consideration the health and safety specification submitted by the client;

(c) Before the contract is put out to tender, make available in a report to the client-

(i) All relevant health and safety information about the design of the relevant structure that may affect the pricing of the construction work;

(d) Inform the client in writing of any known or anticipated dangers or hazards relating to the construction work, and make available all relevant information required for the safe execution of the work upon being designed or when the design is subsequently altered;

(e) Refrain from including anything in the design of the structure necessitating the use of dangerous procedures or materials hazardous to the health and safety of persons, which can be avoided by modifying the design or by substituting materials;

(f) Take into account the hazards relating to any subsequent maintenance of the relevant structure and must make provision in the design for that work to be performed to minimize the risk;

(g) When mandated by the client to do so, carry out the necessary inspections at appropriate stages to verify that the construction of the relevant structure is carried out in accordance with his design: Provided that if the designer is not so mandated, the client's appointed agent in this regard is responsible to carry out such inspections;

(h) When mandated as contemplated in paragraph (g), stop any contractor from executing any construction work which is not in accordance with the relevant design's health and safety aspects: Provided that if the designer is not so mandated, the client's appointed agent in that regard must stop that contractor from executing that construction work;

(i) When mandated as contemplated in paragraph (g), in his or her final inspection of the completed structure in accordance with the National Building Regulations, include the health and safety aspects of the structure as far as reasonably practicable, declare the structure safe for use, and issue a completion certificate to the client and a copy thereof to the contractor; and

(j) During the design stage, take cognisance of ergonomic design principles in order to minimize ergonomic related hazards in all phases of the life cycle of a structure.

Duties of principal contractor and contractor in terms of Section 43 of the Occupational Health and Safety Act, 1993 (Act 85 of 1993:15):

7. (1) A principal contractor must-

(a) Provide and demonstrate to the client a suitable, sufficiently documented and coherent site specific health and safety plan, based on the client's documented health and safety specifications contemplated in regulation 5(1) (b), which plan must be applied from the date of commencement of and for the duration of the construction work and which must be reviewed and updated by the principal contractor as work progresses;

(b) Open and keep on site a health and safety file, which must include all documentation required in terms of the Act and these Regulations, which must be made available on request to an inspector, the client, the client's agent or a contractor; and

(c) On appointing any other contractor, in order to ensure compliance with the provisions of the Act-

(i) Provide contractors who are tendering to perform construction work for the principal contractor, with the relevant sections of the health and safety specifications contemplated in regulation 5(1) (b) pertaining to the construction work which has to be performed;

(ii) Ensure that potential contractors submitting tenders have made sufficient provision for health and safety measures during the construction process;

(iv) Ensure prior to work commencing on the site that every contractor is registered and in good standing with the compensation fund or with a licensed compensation

insurer as contemplated in the Compensation for Occupational Injuries and Diseases Act, 1993;

(vi) Take reasonable steps to ensure that each contractor's health and safety plan contemplated in sub-regulation (2) (a) is implemented and maintained on the construction site;

(vii) Ensure that the periodic site audits and document verification are conducted at intervals mutually agreed upon between the principal contractor and any contractor, but at least once every 30 days;

(viii) Stop any contractor from executing construction work which is not in accordance with the client's health and safety specifications and the principal contractor's health and safety plan for the site or which poses a threat to the health and safety of persons;

(ix) Where changes are brought about to the design and construction, make available sufficient health and safety information and appropriate resources to the contractor to execute the work safely; and

(d) Ensure that a copy of his or her health and safety plan contemplated in paragraph (a), as well as the contractor's health and safety plan contemplated in sub-regulation (2)(a), is available on request to an employee, an inspector, a contractor, the client or the client's agent;

(e) Hand over a consolidated health and safety file to the client upon completion of the construction work and must, in addition to the documentation referred to in sub-regulation (2)(b), include a record of all drawings, designs, materials used and other similar information concerning the completed structure;

(g) Ensure that all his or her employees have a valid medical certificate of fitness specific to the construction work to be performed and issued by an occupational health practitioner in the form of Annexure 3.

(2) A contractor must prior to performing any construction work-

(a) Provide and demonstrate to the principal contractor a suitable and sufficiently documented health and safety plan, based on the relevant sections of the client's health and safety specification contemplated in regulation 5(1) (b) and provided by the principal contractor in terms of sub-regulation (1) (a), which plan must be applied from the date of commencement of and for the duration of the construction work and which must be reviewed and updated by the contractor as work progresses;

(b) Open and keep on site a health and safety file, which must include all documentation required in terms of the Act and these Regulations, and which must be made available on request to an inspector, the client, the client's agent or the principal contractor;

(e) As far as is reasonably practicable, promptly provide the principal contractor with any information which might affect the health and safety of any person at work carrying out construction work on the site, any person who might be affected by the

work of such a person at work, or which might justify a review of the health and safety plan.

(5) No contractor may allow or permit any employee or person to enter any site, unless that employee or person has undergone health and safety induction training pertaining to the hazards prevalent on the site at the time of entry.

(6) A contractor must ensure that all visitors to a construction site undergo health and safety induction pertaining to the hazards prevalent on the site and must ensure that such visitors have the necessary personal protective equipment.

(7) A contractor must at all times keep on his or her construction site records of the health and safety induction training contemplated in sub-regulation (6) and such records must be made available on request to an inspector, the client, the client's agent or the principal contractor;.

(8) A contractor must ensure that all his or her employees have a valid medical certificate of fitness specific to the construction work to be performed and issued by an occupational health practitioner in the form of Annexure 3.

Principal contractors play a significant role in managing subcontractors and maintaining a safe workplace. Principal contractors should therefore ensure that they select and appoint subcontractors who provide them with best value rather than the lowest quote (Lingard et al., 2014). Value in this context pertains to a subcontractor's ability to fulfil the principal contractor's requirements through attributes such as technical and safety competencies), including the provision of adequate and appropriate health and safety plans. Importantly, principal contractors need to allocate sufficient resources to ensure that subcontractors can perform their jobs safely (Lingard et al., 2014). A safe construction site is dependent on the planning done by principal contractors, and on their effective communication with all subcontractor groups about safety hazards and risks. Principal contractors are in the best position to foster positive interfacing between subcontractor groups through promoting and reinforcing effective communication and collaboration between affected stakeholders (Lingard et al., 2014).

Clients, project managers, architects, engineers, contractors, subcontractors, manufacturers, professional and industry associations as well as other stakeholders in construction contribute and influence health and safety in various ways ("CIDB", 2009: 24). However, empirical findings suggest that built environment professionals are not adequately using their influence to reduce the rate of incidents and fatalities in construction (Geminiani & Smallwood, 2008:226). There are prevalent problems concerning health and safety that contractors face and they include ("Institution of Occupational Safety and Health", 2010):

- an itinerant workforce
- too little skill and experience
- lack of investment in training
- Inadequate access to health and safety advice, especially for small companies.

It is said that main reasons for the appalling situation of health and safety on construction sites are due to the lack of the necessary commitment from key stakeholders that include the government (Chiocha et al. 2011). However it has been found that clients have begun to realise the importance of taking an active role in attaining construction health and safety as it makes

sound commercial and financial sense. This is based on the fact that from the on-set the client has information on risk, while the contractor's role in managing risk is vital in securing good health and safety practices on site. However, the project designer or architect often introduces risk and it always the workers who often bear the risk. All the players in the construction chain have a pivotal role to play in reducing unacceptable loss and it is significant that there is accountability from all stakeholders ("Institution of Occupational Safety and Health", 2010).

Every stakeholder, including workers, bear the responsibility of creating and maintaining safe construction workplaces, with clients holding the greatest potential leverage, which is the authority to influence the behaviour (Nxesi, 2014). The Construction Regulations 2014 are clear on the roles and responsibilities of various stakeholders and it will require committed action from all involved parties, that is, employers both large and small, employees, unions, clients, architects, designers and contractors. This action needs to be applied throughout all the phases of a construction project: from the design and planning to the construction site and to subsequent maintenance all stakeholders in the industry work together to raise occupational health and safety standards (in order to build a safer, healthier and more productive working environment for all concerned) (Chiocha et al. 2011).

"The South African construction industry needs a 'shift in mind-set' to become more health and safety conscious - and improve situations whereby at least two workers die in site accidents every week" (Smallwood et al., 2009:2). However it must be stated that the extent of the problem is and complex and cannot be simply explained by the notion of clients, contractors and designers not assuming their respective responsibilities. Safety during construction is commonly perceived as the responsibility of the contractor alone. There needs to be a collective and proactive approach when seeking to improve the current status of health and safety in residential construction and the construction industry as a whole. A continuing problem is that construction is largely driven by lowest cost rather than best value ("Institution of Occupational Safety and Health", 2010). Addressing safety should not be reactive, but should rather be a proactive and anticipatory process. It thus crucial to begin exploring proactive approaches towards establishing of health and safety culture, whereby more commitment is shown from all key stakeholders as they influence and contribute to health and safety in different forms. The uniqueness of the industry, certainly poses a challenge in terms of construction health and safety, but nevertheless provides the industry with an opportunity to find other ways of improving health and safety so as to create a sustainable health and safety cultures on construction sites (Chiocha et al. 2011).

2.3 Construction Health and Safety issues in relation to company size: Small and Micro Enterprises (SMEs)

Lingard and Rowlinson (2005) deem occupational health and safety as a strategic issue for management in all construction companies regardless of their size. However past research has found that health and safety practices tend to vary depending on the organisational structures and the size of the firm. There is a consensus in literature that small and medium enterprises tend to lack the necessary resources to implement the necessary health and safety measures. These small and micro enterprises (SMEs) are generally constitute of self-employed worker, or micro-enterprises, carrying out small scale work, often for domestic clients; small specialist firms carrying out specific construction tasks; and small construction companies who carry out work

as subcontractors for other contractors, regularly working on construction projects with multiple employers (Moeti-Lysson & Boy, 2011). Che Hassan et al. (2007) reported findings from a study comparing the safety performance of small and large construction projects shows the safety levels, average safety scores, variance and standard deviation of large and small projects in respectively. The results showed that safety level in large projects is higher than the safety level in small projects. The safety level among small projects showed wide variation with some projects showing good scores and others having a dismal performance. The large projects, however, showed a consistent level in safety (Che Hassan et al., 2007). The results indicate that health and safety performance does vary based on the scale of the project and the related size of the organisation.

Project no	Large projects		Small projects	
	Safety score	Rating	Safety score	Rating
1	84.17	very good	64.79	Fair
2	92.08	Excellent	57.50	Poor
3	75.83	Good	71.88	Good
4	81.25	very good	55.63	Poor
5	87.50	very good	62.50	Fair
Average safety score	83.46		59.97	
Variance	33.16		842.38	
Standard deviation	5.76		29.02	

Table 5. The Safety Level, Average Safety Score, Variance and Standard (Che Hassan et al., 2007: 275).

The construction sector in developing countries has a predominance of small and medium sized contractors, which primarily operate in the domestic market (Adow, 2013). Agumba et al. (2013) mentions that past studies in South Africa indicated that there are challenges of capacity and financial resource constraints experienced by small and medium construction entities. Furthermore due to limited resources and capacity, smaller contractors in the Construction Industry Development Board (CIDB) that fall between grade two (2) to four (4) were found to demonstrate both poorer health and safety practices and safety culture (Agumba et al., 2013). This then further stresses the need to find suitable solutions to address the unique challenges faced by small construction companies; as they form a fairly significant portion of the construction industry and consequently also contribute to the high number of accidents and ill-health occurring in the industry.

Health and safety is a universal subject matter that needs to be taken into consideration especially in small to medium enterprises as it is found to be fast becoming a major problem for employers worldwide. These small to medium enterprises are said to account for a significant number of the accidents and occupational ill-health in the construction industry (Smith-Jackson et al., 2011). This particular problem is said to exist on a global scale. A study based on the analysis of construction major accidents which was conducted by Lin, Cheng and Yang (2013), which used data collected between the years 2000-2010 in Taiwan, found that 85% accidents were caused by small to medium-sized construction enterprises employing fewer than 30 people. Studies have also shown that a majority of construction companies outside of the United

States of America (USA) are considered as informal, having little formal structure and organization and, the smaller companies are more likely to hire migrant workers, some of which are undocumented. In the USA, a large proportion of workers from Mexico and Central America are employed in the agriculture and in small construction companies, both of which are reported to have a disproportionate amount of fatalities compared to all other occupational sectors (Smith-Jackson et al., 2011).

In Taiwan, Filipino migrant workers, who are concentrated in small construction and agricultural companies, experience a significant number of illnesses related to exposures to toxic substances. The Australian construction industry is also reported to be dominated by small to medium sized enterprises (Smith-Jackson et al., 2011). According to the Australian Bureau of Statistics, 93.8% of construction businesses have fewer than five employees and just over two-thirds of all people working within the industry work for small to medium enterprises. These small to medium sized enterprises are also said to be responsible for poor health and safety performance due to high exposure to hazards and risks (Lingard et al., 2014).

Moeti-Lysson and Boy (2011) state that the health and safety of employees in small and medium enterprises is overlooked in Africa and resultantly there are increasing incidents of accidents occurring in small and medium enterprises. In Tanzania, migrants from surrounding countries are said to show the same pattern, as well as workers from countries such as India, Turkey, Pakistan, and Bangladesh. Unfortunately, this sector (SMEs) also represents the most difficult part of the industry to influence and improve safety and health (Moeti-Lysson & Boy, 2011). It is undeniably evident that there's an urgent need to conduct comprehensive safety and health research that targets smaller companies and devise effective and appropriate solutions (Smith-Jackson et al., 2011). Small contractors are faced with significant occupational health and safety problems. Due to their size, limited resources, and unique stressors related to work-family conflict and transient workers, this particular fraction of the construction industry is said to be difficult to monitor and, at times, exempt from certain Occupational Safety and Health Administration (OSHA) regulations (Moeti-Lysson & Boy, 2011). Furthermore, firms of relatively smaller size and projects may not in certain instances require the types of procedures and practices in place in comparison to their larger organisation counterparts, provided that the firm takes the necessary measures that will ensure safe working conditions (Aboagye-Nimo, et al., 2011).
Lingard and Rowlinson (2005) are also of the view that small construction companies bring about certain challenges to occupational health and safety due to unique factors such as the following:

- Small businesses are unlikely to have the means to employ professional occupational health and safety (OH&S) advisors.
- A lack of resources and knowledge needed to implement occupational health and safety management activities (such as training, routine inspections and audits)
- Employing external OH&S advice or services from consultants are possibly considered as unnecessary expenses.
- Cost-cutting may lead to OH&S being a least priority due to business survival.
- Poor knowledge and understanding of safe working practice.

2.3.1 Factors influencing compliance of health and safety regulations

Arewa and Farrell (2012:424) mention that the likelihood of small and micro enterprises (SMEs) complying with health and safety requirements is lessoned by economic factors. They claimed

that SMEs devote roughly six times more per employee than large firms, in order to comply with preventative health and safety requirements. Small and micro enterprises spend on average £341 per employee yearly to comply with health and safety compared to a mere £37 per employee, spent by large organisations. Arewa and Farrell (2012:424) also reported that on average it costs SMEs £598 per employee per year to remedy non-compliance with health and safety rules and regulations (Arewa & Farrell, 2012). In summary there are different factors that influence health and safety regulations by SMEs compliance of health and safety regulations, but the main aspects motivating compliance with were found to be legal obligation (67%), health and safety publicity (67%), and insurance costs (50%) (Arewa & Farrell, 2012). Other factors were identified as development of quality systems (50%), and supplier / customer / client pressure (33%). Equally so the main reasons for non-compliance with safety by small and micro enterprises were found to a lack of awareness of legislative requirements, inadequate knowledge on how to comply with safety obligations, money and poor management structures (Arewa & Farrell, 2012). Arewa and Farrell (2012:424) reported findings of statistics related to prosecutions involving health and safety fines, court sentences and other related health and safety breaches by construction firms has revealed that, on average there is a significant difference between the amount of fine (penalties) or sentences issued to SMEs when compared to large firms for similar noncompliance with health and safety. In terms of number of fines, the data reveals that, SMEs incurs more fines than large firms, in a ratio of 6:1. These statistics relating to SMES non-compliance with health and safety statutory requirements indicated that they SMEs dominate most construction work and also signals that these enterprises are in dire need of interventions that will help improve their health and safety management and performance (Arewa & Farrell, 2012).

2.4 Residential Construction defined

"Residential construction refers to new home construction and renovation of existing homes using construction materials, methods and procedures that are essentially those used for typical … single and multiple family dwellings including all walk ups that do not have a full time site superintendent (e.g. single family, duplex, triplex, 4-plex, row-house or townhouse condominium, or similar building) ("Albertas", 2014: 2)". It cannot be disputed that residential construction is an important sector which serves to help people access their basic human right to housing. Whether we rent an apartment or own a house, our homes play a vital role not only in providing us with shelter, but also in anchoring us to our community. We raise our families, invest our savings in our homes and sometimes leave them as inheritance for our loved ones ("The Aspen Institute", n.d.). Our homes are one of our most important assets.

The construction of new housing is crucial to the growth of the economy. Residential construction has a direct influence on the overall output, construction and manufacturing employment rises with housing starts, and indirectly through the multiplier effect, as new home buyers tend to purchase other consumer durables when they buy their house. Housing construction typically leads recessions and recoveries. Changes in new housing supply affect the price of existing housing units, with implications for the wealth position of homeowners and housing affordability (Mayer & Somerville 2000).

Residential construction is a diverse sector and includes everything from design (including architecture, engineering, quantity surveys and project management); construction (including

site works, building, roofing and concrete); installation (including plumbing, electrical, heating and ventilation) to completion services (including plastering, painting, glazing and fit out). In addition, the sector includes a supply chain of imports, domestic manufacture, and wholesale and retail distribution of building materials, products, and equipment ("Ministry of Business, Innovation and Employment", n.d.). The overall cost of building materials in particular appears to be relatively high. Many of these goods and services are common to the construction of residential and non-residential buildings. This study will, however, focus solely on residential construction ("Ministry of Business, Innovation and Employment", n.d.). Figure 8 below illustrates the housing input chain incorporating the various segments of the residential construction sector.

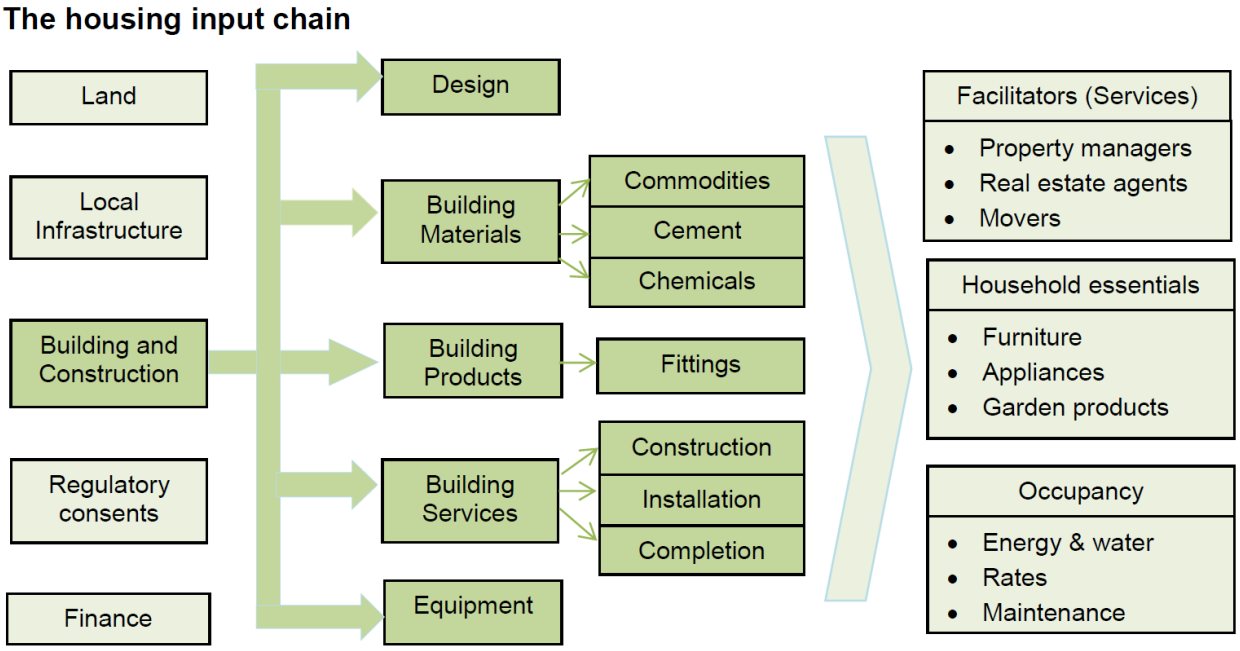


Figure 8. A high level housing input chain that defines the segments of the residential construction sector that relate to residential housing ("Ministry of Business, Innovation and Employment", n.d.:5).

2.4.1 Characteristics of the Residential Construction Sector

According to the Ministry of Business, Innovation and Employment (n.d:12.) the residential construction sector is characterised by the following factors:

- The industry is dominated by small firms that build one house at a time, are unable to generate economies of scale, and often lack management capability
- Many specialist services are required to build a house and the fragmented nature of supply presents difficulties in the management of the supply chain
- The building sector is subject to boom and bust cycles that may vary regionally
- New houses tend to be bespoke one-off designs
- Customers within the residential construction sector exist at several levels along the supply chain and have a variety of characteristics

("Ministry of Business, Innovation and Employment", n.d:12.)

There is both a high demand for housing stock as well as a back-log of housing provision in most developing countries and South Africa is no exception. As a result there will always be on-

going construction of domestic residential developments. A report (based on data published by Statistics South Africa) by du Toit (2015), a property analyst at Absa Home Loans indicated that the first seven months of 2015 reflected improved levels of building activity concerning private sector-financed housing in South Africa. These statistics showed that the number of new housing units for which building plans were approved was more than 35 000 units since January 2015, with a total of almost 22 000 units built from January to July 2015 (du Toit, 2015). Residential construction activity is also measured by building permits issued, housing starts, and housing units completed ("The Center for Construction Research and Training", 2013). These statistics are exclusive to private sector financed residential housing units and are therefore constructed by builders (contractors and sub-contractors) that are registered with the National Home Builders Registration Council (NHBRC) and are indicated in Figure 9 and 10 below:

Residential building activity (January-July)[1]

Segment	Plans approved						Buildings completed					
	Units	Units 2015		m²	Building area 2015		Units	Units 2015		m²	Building area 2015	
	2014	Number	%Δ	2014	m²	%Δ	2014	Number	%Δ	2014	m²	%Δ
Houses of <80m²	13 112	13 103	-0.1	638 669	614 190	-3.8	7 661	9 127	19.1	372 001	456 411	22.7
Houses of ≥80m²	9 798	9 816	0.2	2 568 181	2 701 880	5.2	5 745	6 824	18.8	1 436 317	1 795 288	25.0
Flats and townhouses	10 582	12 221	15.5	985 860	1 212 304	23.0	7 168	5 929	-17.3	691 927	580 165	-16.2
Total	33 492	35 140	4.9	4 192 710	4 528 374	8.0	20 574	21 880	6.3	2 500 245	2 831 864	13.3

[1]Private-sector financed
Source: Stats SA

Figure 9. Residential Building Activity for January - July 2015) (du Toit, 2015:.2).

Residential building activity by province[1]

Building plans approved

Segment	Period	Variable	WC	EC	NC	FS	KZN	NW	GAU	MPU	LIM	SA
Total new houses, flats and townhouses	Jan-Jul 14	Number	6 672	1 646	364	1 180	4 463	1 435	14 567	2 402	763	33 492
	January - July 2015	Number	9 122	2 062	117	1 944	2 126	1 995	14 785	1 928	1 061	35 140
		% change	36.7	25.3	-67.9	64.7	-52.4	39.0	1.5	-19.7	39.1	4.9
		% of SA	26.0	5.9	0.3	5.5	6.1	5.7	42.1	5.5	3.0	100.0
Alterations and additions to existing houses	Jan-Jul 14	m²	427 734	179 894	33 301	82 887	216 664	93 504	569 489	112 488	38 967	1 754 928
	January - July 2015	m²	538 878	193 456	30 197	91 926	195 291	83 618	533 794	114 886	34 311	1 816 357
		% change	26.0	7.5	-9.3	10.9	-9.9	-10.6	-6.3	2.1	-11.9	3.5
		% of SA	29.7	10.7	1.7	5.1	10.8	4.6	29.4	6.3	1.9	100.0

Buildings completed

Segment	Period	Variable	WC	EC	NC	FS	KZN	NW	GAU	MPU	LIM	SA
Total new houses, flats and townhouses	Jan-Jul 14	Number	5 243	928	100	529	1 469	1 418	8 180	2 145	562	20 574
	January - July 2015	Number	6 375	1 096	223	1 409	1 077	1 026	8 866	1 420	388	21 880
		% change	21.6	18.1	123.0	166.4	-26.7	-27.6	8.4	-33.8	-31.0	6.3
		% of SA	29.1	5.0	1.0	6.4	4.9	4.7	40.5	6.5	1.8	100.0
Alterations and additions to existing houses	Jan-Jul 14	m²	221 116	54 957	13 775	10 231	83 716	14 481	197 455	56 944	4 508	657 183
	January - July 2015	m²	265 873	56 493	15 702	21 255	79 376	55 710	102 417	69 864	1 868	668 558
		% change	20.2	2.8	14.0	107.8	-5.2	284.7	-48.1	22.7	-58.6	1.7
		% of SA	39.8	8.4	2.3	3.2	11.9	8.3	15.3	10.4	0.3	100.0

[1]Private-sector financed
Source: Stats SA

Figure 10. Residential Building Activity by province for January - July 2015) (du Toit, 2015:2)..

The National Home Builders Registration Council (NHBRC) is governed by the Housing Consumers Protection Measures Act, 1998 (Act No.95 of 1998). The Act (p.6) states that the object of the NHBRC's is to do the following ("The National Home Builders Registration Council", n.d.):

(a) Represent the interests of housing consumers by providing warranty protection against defects in new homes;

(b) Regulate the home building industry;

(c) Provide protection to housing consumers in respect of the failure of home builders to comply with their obligations in terms of this Act;

(d) Establish and to promote ethical and technical standards in the home building industry;

(e) Improve structural quality in the interests of housing consumers and the home building industry;

(f) Promote housing consumer rights and to provide housing consumer information;

(g) Communicate with and to assist home builders to register in terms of this Act;

(h) Assist home builders, through training and inspection, to achieve and to maintain satisfactory technical standards of home building.

This study seeks to exclusively focus on private sector financed residential building/construction activity for new housing developments, more specifically at the Waterfall Country Estate, Midrand region which falls under the jurisdiction of the City of Johannesburg Metropolitan Municipality. The contractors and sub-contractors employed at the Waterfall Country Estate residential development area are registered with the National Home Builders Registration Council (NHBRC). One of the assumptions that this study made was that builders who are regulated by the NHBRC have a better management of health and safety on their work-sites. There are a lot of land use developments, particularly various domestic residential developments occurring within the area, thus making the region a suitable study area. The study seeks to determine the health and safety culture of small residential construction sites, with a particular focus on worker attitudes towards occupational health and safety.

2.4.2 Health and Safety in the Residential Construction Sector

Housing plays a vital role not only in our lives, but also in the creation of employment opportunities and economic growth in our country. However we seldom know or enquire about the well –being of the workers who are responsible for building our houses. The residential market in construction is characterized by many small contractors who may have only three or four employees, and the work of building homes often involves a complicated arrangement of contracting and sub-contracting relationships. Large, brand-name, home builders often employ project management professionals to manage the overall construction process, but rarely employ the actual carpenters, plumbers, electricians, labourers, and others who do the building work ("The Aspen Institute", n.d.). Residential construction workers are said to be often misclassified as independent contractors. Workers in residential construction are usually hired by construction contractors through an informal hiring arrangement—also known as "paying

under the table" ("The Aspen Institute", n.d.). In 2011, only 14% of workers in the construction industry were registered as members of unions and in the residential market that proportion is likely far smaller, as the residential segment of the construction industry is generally not represented by organized labour, even in areas that have strong union representation in other parts of the workforce. These workers may be involved in activities such as pouring concrete, roofing, plumbing, painting, as well as electrical work on new homes, home additions/ alterations, or home repair and maintenance. Residential construction firms typically specialize in one of these tasks. Construction workers frequently encounter work situations that place them at risk of injury or death (Kaskutas et al., 2009). The lives of these workers are endangered on a daily basis while they carry out their tasks on construction sites. There is a need to focus on the health and safety challenges experienced by the small and micro enterprises operating in the private residential construction sphere and promote the creation of a positive safety culture on these work-sites.

According to Wardick (n.d.) it was found that subcontractors operating in domestic housing had a poor understanding and awareness of occupational health and safety requirements. The National Occupational Health and Safety Commission (NOHSC) concluded that the domestic housing segment was not introducing occupational health and safety as effectively as other sectors of the industry. However, there appears to be very limited research targeting occupational health and safety in the domestic housing construction industry. The remedying this situation should be considered as a matter of urgent priority (Wardick, n.d.). The researcher seeks to determine the safety culture of small and micro enterprises that work in private residential construction and consequently propose recommendations that will help assist in the improvement of the existing occupational health and safety status of the residential construction industry.

When looking at the construction industry holistically, it is the residential sector that has been found to account for a disproportionate number of injuries every year. According to the Occupational Safety and Health Administration, an approximate of 40,000 residential construction workers is injured at work job each year ("Consultation Education & Training", 2014). The construction of a house means more than each subcontractor performing their own work skilfully – it requires all trades to work together cooperatively throughout the whole life cycle of the project. The nature of the industry favours a culture of independence and individual resourcefulness at the expense of interdependence and consideration for others. Many subcontractors are often in such a hurry to finish their task assumingly due to time constraints, and they may fail to consider the safety of others while they are executing their work (Bizzell, 2008). There are hazards that change daily on the construction work-sites, thus making it difficult to control these hazards because the work environment changes frequently and the work crews are often small and dispersed in the construction industry. In addition residential construction workers are sometimes younger, inexperienced, or are immigrants. Such workers are exposed to a greater risk of injury for various reasons, including lack of familiarity with construction processes insufficient safety training, communication challenges stemming from language barriers, or lack of appropriate equipment to name a few. The situation is also worsened by on site safety professionals being a rarity in residential construction, as well as safety innovation generally lagging behind (Kaskutas et al., 2009). The residential construction sector is faced with unique health and safety problems that call for immediate, appropriate and effective interventions.

According to a Bureau of Labour Statistics (BLS) report compiled in the year 2006, approximately 90% of construction companies employ 20 or fewer workers; of these of which

30% specialized in residential construction (Smith-Jackson et al., 2011). The Bureau of Labour Statistics also estimated that almost 1, 5 million people were employed in construction occupations in residential construction in July 2012 in the United States of America. Residential construction firms typically specialize in one of the following tasks such as: pouring concrete, roofing, plumbing and painting as well as electrical work on new homes, home additions/ alterations or home repair and maintenance. ("The Aspen Institute", n.d.). Furthermore According to the U.S. Bureau of Labor Statistics, the total case incident rate (TCIR) for Michigan construction increased from two point six (2.6) injuries and illnesses per 100 full-time workers in 2011 to five (5, 0) in 2012. Over the last five years, from 2008 - 2013, over 37% of construction fatalities in Michigan have occurred in the residential industry. Homeowners, contractors and workers are among the injured every year in residential construction projects ("Consultation Education & Training", 2014).

2.5 Health and Safety: Accident Causation Theories

Background of accidents and injuries experienced by small and micro enterprises

Accidents and incidents in construction workplaces can be explained as unplanned and unwanted occurrences pertaining to movement of persons, objects or materials which may result in injury, damage or loss to property or people. There are various types of accidents prevalent in the construction industry. Many construction work activities require working in high places and climbing ladders or scaffolds on a daily basis. The people who work as elevator installers, roofers, drywall installers, power-line installers, and ironworkers are exposed to heights on the job almost every day ("The Center for Construction Research and Training", 2013). Those who work as drywall installers, roofers, painters, and insulation workers spend more time climbing ladders, scaffolds, or poles than other occupations. Almost 60% of workers in construction production occupations work at heights at least once a month, and many climb ladders or scaffolds during half of their work time. Many construction occupations require workers to keep balance while working at heights, particularly drywall installers and ironworkers ("The Center for Construction Research and Training", 2013). These exposures can lead to fall-related injuries and death, especially injuries from falls to a lower level. Construction jobs involve other hazardous work environment conditions (e.g., electricity), equipment (e.g., cranes), and tools (e.g., nail guns). Elevator installers, power-line installers, and heating and air conditioning mechanics are exposed to hazardous conditions almost daily ("The Center for Construction Research and Training", 2013). Electrocution is one of the leading causes of death in construction. From 1992 to 2010, a total of 2,432 construction workers died from electrocution at job sites, accounting for nearly half of the overall work-related electrocution deaths (5,104) in the United States ("The Center for Construction Research and Training", 2013).

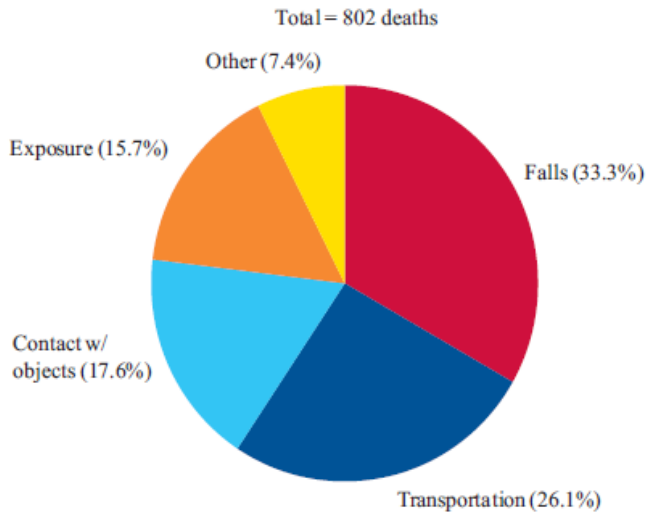


Figure 11. Leading causes of fatalities in construction reported in 2010 ("The Center for Construction Research and Training", 2013:43).

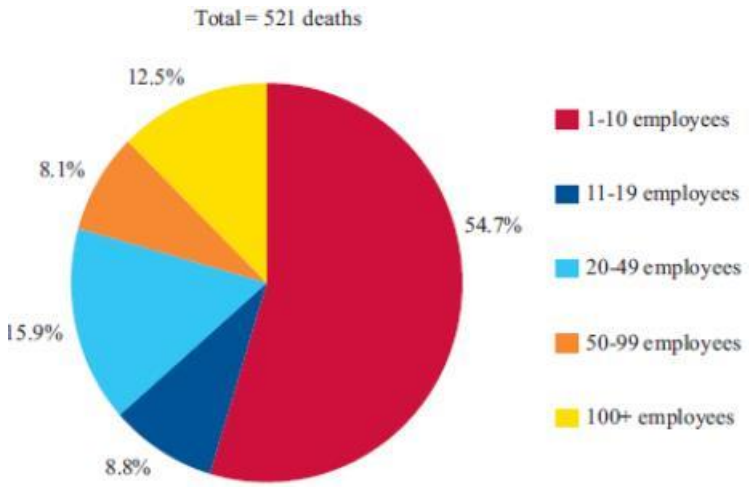


Figure 12. Distribution of fatalities from falls in construction ("The Center for Construction Research and Training", 2013:43).

It has already been established that the construction industry is predominantly comprised of small to medium enterprises; moreover the residential construction sector is also reported to be dominated by such enterprises which often employ less than ten (10) employees. Falls are reported to be one of the leading causes of fatalities in this particular sector. The Center for Construction Research and Training (2013) reported that 54% of fatalities (of 521 deaths reported in 2010) caused by falls occurred in enterprises consisting of one to ten (1-10) employees. Though the falls are not reported to have specifically occurred in the residential construction sector, they did however occur with small and micro enterprises and this further emphasises the need to pay more attention to this group and consequently aid them in the creating a positive safety culture in their work spaces.

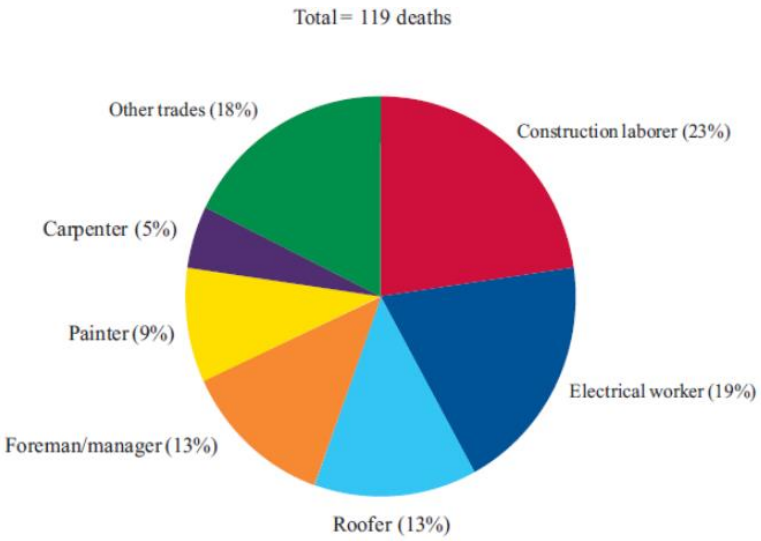


Figure 13. Overhead power-line electrocution deaths, by construction occupation, 2008-2010 ("The Center for Construction Research and Training", 2013:45).

The above statistics is a clear indication that there current occupational health and status of the construction industry requires immediate and effective intervention. The effects of poor construction health and safety performance can be seen in the immeasurable human suffering to victims and their families, major economic losses for enterprises and economies as a whole, measured in terms of health care costs, time compensated but not worked, lost productivity, reduced work capacity and lower workforce participation ("International Labour Organization", 2015). Furthermore an understanding of accident causation is central to their successful prevention.

The importance of understanding the accident causation theories is in recognizing how hazards in the construction workplaces can cause losses as well as finding and implementing proactive preventative measures in addition to legislative compliance (Hosseinian & Torghabeh, 2012). Hosseinian and Torghabeh (2012) have explained different theories of accident causation and some of which have been briefly summarised as follows:

Accident causation theories

There are various theories of accident causation in literature which have been briefly explained and summarised as the follows: (Hosseinian &Torghabeh, 2012):

Heinrich Domino theory of accident causation;

The Heinrich's domino theory is based on five standing dominos which will fall one after the other if the first domino (Ancestry and social environment) falls. The accident can be prevented only if the chain of sequence is disturbed, e.g. the unsafe act/condition can be eliminated in order to prevent the accidents and associated injuries (Hosseinian &Torghabeh, 2012).

Management-based theories, Human errors Models;

The management-based theories define management as responsible for causing accidents and the theories attempt to recognize failures within the management system (Hosseinian & Torghabeh, 2012).

The 'Swiss Cheese' Model,

The 'Swiss Cheese' accident causation model was first developed by James Reason (1970-1977) as a linear accident causation model. The theory is currently widely used since it simply suggests that the organizations try to prevent accidents by defences in order not to allow the risks and hazards become loss (Hosseinian & Torghabeh, 2012).

Accident Root Causes Tracing Model (ARCTM),

The main reason of this model is to provide an investigator with an easy model for identification of root causes of construction accidents, compared to sophisticated models of accident's investigation (Hosseinian & Torghabeh, 2012).

Hierarchy of causal influences,

The model proposes that the lack of sufficient communication between work team, workplace, equipment and materials can lead to creation of 'immediate accident circumstances' (Hosseinian & Torghabeh, 2012).

In order to better understand health and safety challenges such as the cause of accidents on construction work-sites, this study will primarily draw from two theories namely Systems Theory of Accident Causation and Behavioural Theory of Accident Causation which will be discussed in detail in this chapter.

Small contractors, with specific reference to the small residential construction sector, are said to have a tendency of operating in the absentia of formal policies and procedures. Moreover, it is said that there are a lot of accidents and injuries occurring in small residential construction sites that are said to go unreported (Che Hassan et al., 2007). It is important to take into cognisance the unique challenges that face small contractor, but equally there is need to implement a safety standard to monitor and enforce safety requirements at construction work sites (Smith-Jackson et al., 2011). More importantly, there is a bigger need to focus efforts in achieving more than the bare minimum required by statutory health and safety regulations, but to also establish a positive health and safety culture on construction sites.

Although there is adequate existing legislation to regulate construction health and safety practices in South Africa, statistics show that there are prevalent challenges experienced particularly by small contractors concerning the implementation of the requirements of occupational health and safety regulations (Smallwood, 2013). According to Agumba and Haupt (2009) the issue of a health and safety culture and health and safety climate of small and medium enterprises (SMEs) has received minimal attention in South Africa and that the workers in this sector are exposed to hazards which cannot be overlooked. It is therefore fundamentally important to determine the existing health and safety culture among SMEs in the construction industry; so as to find appropriate solutions to improve the challenges of health and safety particularly faced by this small construction companies.

Zou (2011) is among the researchers that are of the perception that most of the workplace incidents, injuries and fatalities are a consequence of unsafe work practices as opposed to unsafe working conditions and thus holds unsafe behaviour as a fundamental factor responsible for the occurrence of accidents. The existing literature on accident causation in the construction industry acknowledges that there's a similarity in the nature of the factors that influence accidents across different countries. Numerous studies have found the majority of accidents and related injuries to be more a product of unsafe work practices as opposed to unsafe working

conditions (Meekel & Hyrmark, 2012). It is said that the prevailing health and safety culture within an organisation i.e. the way it approaches health and safety issues, is a major influence on the health and safety related behaviour of people at work. Therefore developing a positive safety culture is important if high standards of health and safety are to be achieved and maintained (Gillen et al., 2014). Safety culture can be considered as a catchball term often used to reflect organisational norms and members' perceptions, attitudes and. A positive safety culture provides a platform to create greater awareness, understanding and compliance with safety rules and regulations (Wamuziri, 2006).

2.5.1 Behavioural Theory of Accident Causation (Behaviour-based safety)

"A significant number of accidents can be traced to unsafe behaviours" ("Institution of Safety and Health", 2014:2). Behavioural Based Safety is an approach to safety that focuses on workers' behaviour as the cause of most work-related injuries and illnesses. It is said that 80% to 90% of all accidents are triggered by unsafe behaviour on the part of employees; behaviours that are within the individual's control, and also within the scope of managers and superiors to effectively control (Lingard & Rowlinson, 2005). According to the International Labour Organisation (ILO), in Sri Lanka, one out of six accidents and 25 out of 40 fatalities occurring at construction sites are said to be a result of negligence or carelessness (Priyadarshani, Karunasena & Jayasuriya, 2013). Most accidents happen when employees disregard safety rules (and engage in unsafe acts) and management ignore the presence of unsafe conditions. According to findings by Bester (2013), an occupational health and safety manager for the Master Builders Association of the Western Cape (MBAWC) stated that there's anecdotal evidence that indicates that 80% of construction accidents are caused by employees acting unsafely. Therefore unsafe acts and unsafe conditions are considered as the primary causes of accidents.

Working safely is viewed by others as a cultural issue and that behaviours are said to be shaped by the existing safety culture. A definition of culture is to include not just what people do, but also why they do it and it therefore important to clarify the factors that influence behaviour. Ultimately, the purpose of behavioural safety is not simply to improve individual behaviours, but to positively impact the overall safety culture and related safety systems (Health and Safety Professionals Alliance, 2012). An effective safety culture has the potential to the desired goal of zero incidents objective in the work place.

Focusing on behaviour before an accident occurs is believed to enable managers to limit the underlying causes of accidents (Lingard & Rowlinson, 2005).The behavioural theory of accident causation and prevention is also commonly known as the behaviour-based safety (BBS). This theory is said to be founded on seven basic principles of behaviour-based safety and they are as follows:

1. Intervention that is focused on employee behaviour;
2. Identification of external factors that will help understand and improve employee behaviour (from the perspective of safety in the workplace)
3. Direct behaviour with activators or events antecedent to the desired behaviour, and motivation of the employee to behave as desired with incentives and rewards that will follow the desired behaviour
4. Focus on the positive consequences that will result from the desired behaviour as a way to motivate employees;
5. Application of the scientific method to improve attempts at behavioural interventions
6. Use of theory to integrate information rather than to limit possibilities and
7. Planned interventions with the feelings and attitudes of the individual employee in mind

("DFW Web Presence", n.d:44.)

Behaviour-based safety (BBS), which focuses on the intervention of employees' unsafe behaviours to promote behavioural support for injury prevention, has been proposed and developed. Content and methodologies of BBS have experienced wide discussion and evolution, and BBS has become a popular management tool in many industries (Fang and Wu, 2013). This theory is applicable in any situation in which certain types of human behaviours are desired while others are undesirable. According to Hosseinian & Torghabeh (2012), the BBS is the primary area to focus when deliberating safety issues in construction. Human factors have been recognised to have the ability to contribute towards the improvement of health and safety performance in the construction sector (Wamuziri, 2006). Furthermore it is explained that the main vision of the BBS is the integration of safety and health of construction workers into the planning and design stages as it is at such stages that general health and safety hazards related to different construction activities can be addressed prior to commencement of (Hosseinian & Torghabeh, 2012). Behavioural safety is easier to implement in organizations where employees see their leader's consistently promoting and paying attention to safety. The management support is identified as the single most important element for ensuring a successful behavioural safety process ("Safety Leadership at Work", n.d.). Safety leaders can exist at all levels from senior executives, middle managers to informal leaders among workers, n.d.). When safety leaders exhibit a strong commitment to safety, they get involved and inspire others to have positive safety behaviours ("Safety Leadership at Work", n.d.)

Unsafe behaviours are assumed to be the main causal factor of accidents on the domestic residential construction sites; as many studies have demonstrated that the majority of accidents and resulting injuries in the construction industry are a consequence of unsafe work practices of the construction workers rather than the unsafe working conditions (Meekel & Hyrmak, 2012). The weakness of the theory is that it only focuses on the behaviour of employees and does not take into consideration management's role in accident causation, for example when management fails to address unsafe work conditions. However the task of rectifying construction workers' unsafe behaviours is primarily the responsibility of managerial personnel; conversely safety performance is highly dependent upon the individual's attitude and responsibility towards their own safety (Hung et al., 2011).

2.5.2 Systems Theory of Accident Causation

Most incidents are found to be attributed by a combination of human factors, environmental and organisational factors (Gillen et al., 2014). This theory acknowledges that the identification of events and causal factors in an accident are not isolated but are rather dependent on the context of human needs and experience in which they occur. The principal constituents of the systems model are the person/machine/environment, information, decisions, risks, and the task to be performed ("DFW Web Presence", n.d.). At the core of the systems theory is the notion that an accident may occur in a context of a system encompassed of a person (host), machine (agency) and environment and how these components interact determines the likelihood of accident ("DFW Web Presence", n.d.). Every time a task must be performed; there is the risk that an accident may occur. Sometimes the risks are great; at other times, they are small. This is where information collection and decision making factors in ("DFW Web Presence", n.d.). However, the environment in which the machine operator is working is unusually hectic, and the pressure to complete an order that is already behind schedule is intense. These factors are stressors that can cloud the judgment of those collecting information, weighing risks, and

making the decision. When stressors are introduced between points 1 and 3 in Figure 14 below, the likelihood of an accident increases. For this reason the following five factors should be considered before beginning the process of collecting information, weighing risks, and making a decision ("DFW Web Presence", n.d.):

1. Job requirements
2. The workers' abilities and limitations
3. The gain if the task is successfully accomplished
4. The loss if the task is attempted but fails
5. The loss if the task is not attempted

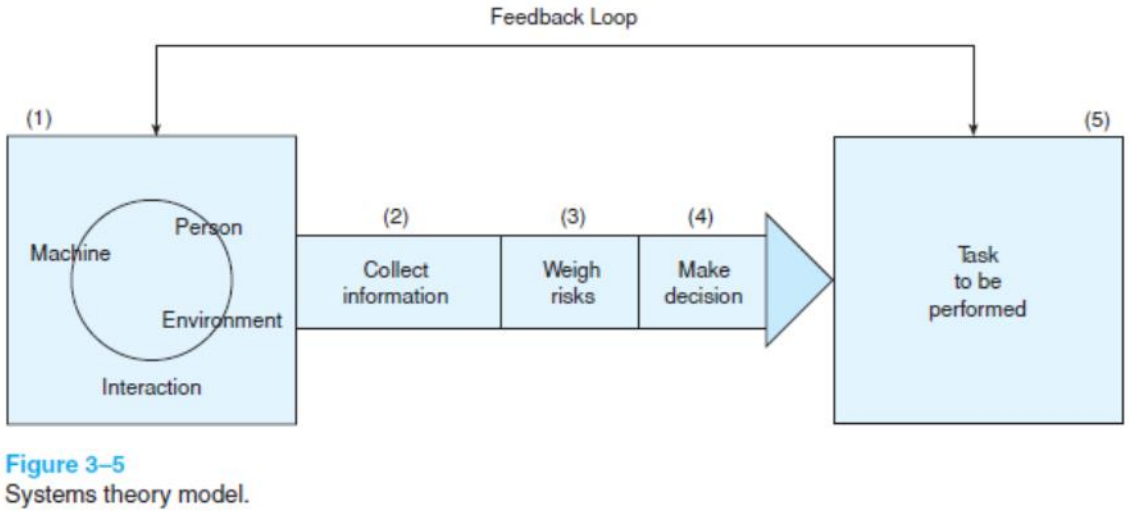


Figure 3–5
Systems theory model.

Figure 14. Systems theory model (DFW Web Presence, n.d.:40).

These factors can help a person achieve the correct perspective before performing the above-mentioned tasks. Systemic accident models which examined the idea that systems failures, rather than just human failure, were a major contributor to accidents began to address some of these issues (but not non-linear concepts) and recognised that events do not happen in isolation of the systemic environment in which they occur (Health and Safety Professionals Alliance, 2012). The theory has the potential to achieve the following:

- Create a common understanding of accident phenomena through a shared simplified representation of real-life accidents.
- Help structure and communicate risk problems.
- Give a basis for inter-subjectivity, thus preventing personal biases regarding accident causation and providing an opening for a wider range of preventive measures.
- Guide investigations regarding data collection and accident analyses.
- Help analyse interrelations between factors and conditions.
- Different accident models highlight different aspects of processes, conditions and causes.

(Health and Safety Professionals Alliance, 2012:21).

Huang and Hinze (2006) are of the opinion that construction accidents are caused by inappropriate responses to certain constraints and the environment. In this particular accident causation model, the owner (client) responses are the actions or lack of actions of the owner regarding constraints that emerge during the developments of the project scope. This could include occurrences such as the reduction of project budget, changing the project objectives, adding new project scope and accelerating the design or construction efforts of the project. These are among some of the factors are considered to be contributing elements to the causation of accidents (Huang & Hinze, 2006). Many studies have demonstrated that accidents occur as a result of unsafe individual behaviours, and/or unsafe team behaviours, and/or unsafe system behaviours. Accidents usually happen due to a combination of unsafe individual, team, and system behaviours.

Conclusion

Theories and models of accidents causation as mentioned earlier are developed with the purpose describing how accidents occur as well as to give a better understanding of how strategies can be developed to help avoid or reduce the occurrence thereof. This will ultimately aid in addressing the challenges relating to health and safety in the construction industry. However according to Hosseinian and Torghabeh (2012) the weakness of accident causation theories is the inability to offer substantial strategic guidelines for management on ways to reduce risks at construction work places. Furthermore, these theories are said to imply an inappropriate perception that accidents in workplaces can be prevented through the elimination of human errors – this fails to acknowledge that not all accidents can be prevented given that risk is something that supersedes human intervention. This researcher is of the view that the systems theory of accident causation is more a useful for the purposes of the study and will thus be adopted to gain a better perspective of the factors involved accident causation in residential construction. The study will use the theory to investigate how organisations can learn how to prevent accidents through drawing from previous accidents by gaining a better understanding their contributory factors and consequently develop efficient prevention measures. The researcher does take cognisance that not all accidents are avoidable due to certain factors such as force majeure/ ‘acts of God’ that are simply out if human control. The health and safety culture prevailing in the construction industry, particularly the residential sector dominated by small and micro enterprises had not been found to be one that can be described as good or positive. It is essential to create a positive safety culture and there is no better time to begin fostering one like the present.

2.6 Fostering a Positive Safety Culture in the Residential Construction Industry:

What does safety climate and culture mean in the construction industry?

There generally is a wide interest in developing an appropriate safety culture throughout industries. Safety culture has been defined as “‘the product of individual and group values, attitudes and beliefs, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation’s health and safety management” (“Loughborough University”, n.d.:11).

“Researchers and practitioners have identified safety culture and safety climate as key to reducing injuries, illnesses and fatalities on construction worksites. Many construction contractors are trying to improve these indicators as a way to move closer to a goal of achieving zero injury worksites” *(Gillen et al., 2014:5).*

Safety climate and safety culture has over the years gained a considerable amount of attention in literature. A good safety climate has been said to be one of the positive indicators of a safety culture, however it is important to note that though both concepts are inextricably linked, they are two separate entities. In other words they are independent complementary concepts (Chuks & Uchenna, 2013*).* "Safety culture and safety climate are difficult to assess in small organisations. The lack of knowledge about safety culture in relatively informal work systems is a major impediment to the development of prevention and control measures that target this population of workers who are over represented in the injury and fatality data" (Smith-Jackson et al., 2011: 40). This then instigates the need to explore these concepts in order to better understand the context specific challenges experienced by small construction companies and consequently find appropriate solutions to their occupational health and safety problems- with the aim of establishing a sustainable positive safety culture on construction sites. For the purpose of this study both safety culture and safety climate will be treated as two different terms with respective meaning.

Safety culture defined:

"Safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of an organization's health and safety management (Gillen et al., 2014:14)". "Safety culture is a subset of, and clearly influenced by, organizational culture. Organizations often have multiple cultures or subcultures, and this may be particularly true in construction" *(Gillen et al., 2014:7).* The culture of the construction industry in developing countries has been found to be one which fails to adequately promote or improve the status of occupational health and safety. For instance in procurement it is said that the practices of competitive tendering and awarding of most public contracts to the lowest bidder in developing countries often compels contractors to drive their prices low while cutting costs which in turn poorly affects health and safety (Muiruri & Mulinge, 2014).

An organisation's prevailing culture is considered to have the ability to shape the priority placed on health and safety (H&S) and ultimately determine the effectiveness and performance of the organisation's H&S system (Lingard et al., 2014). However, organisations are said to be increasingly recognising the significant part 'human factors' that affects the maintenance of high standards of health and safety. One of the major influences in shaping peoples safety related behaviour is the prevailing health and safety culture in the organisation in which they work (Krzywicki & Keesey, 2011).

Safety climate defined:

"Individual perceptions of the policies, procedures and practices relating to safety in the workplace" *(Lingard, Cooke & Blismas, 2011:160).* An organisations safety climate is considered to consist of employee's attitudes towards and perceptions of, health and safety behaviour. In the construction industry, workers attitudes towards safety are influenced by how they perceive risk, management, safety rules and procedures. Safety climate is believed to shape workers' behaviour through the expectations they form about how organizations value and reward safety. Safety climate is considered to be a leading performance indicator that can provide insight into safety performance before accidents have occurred (Raja Prasad & Reghunath, 2010). According to Wamuziri (2006) the organisational climate is considered as an indicator of the culture.



Figure 15. Gellor's Safety Triad (Che Hassan et al., 2007: 273).

The diagram above represents a safety triad theory; at the basis of this theory is a continuous monitoring process to three domains namely, "environment", "person" and 'behaviour" should be maintained. The "person" reflects the competency of a worker where as the "behaviour" illustrates the attitudes of workers in carrying out job safely in a "specific environment'. These three domains are dynamic and interactive; a change in either one factor will eventually influence the other one. For instance once people choose to act safety, they act themselves into safe thinking and the corresponding behaviours often result in some environmental change (Che Hassan et al., 2007). Safe behaviour is viewed to be reflected by good attitude; most accidents/incidents that occurred in the workplace especially in the building construction sites were due to inadequate adherence of workers to work procedures. Attitude is a term defined as 'enduring reactions toward people, places, or objects, based on our beliefs and emotional feelings and it is believed that individual attitudes play a role in guiding attention and efforts seeking to improve health and safety (Friend & Kohn, 2007). Workers uncontestably play an important role contributing in the accomplishment of the building construction. The awareness and perception of the workers toward safety, health and their working environment are important aspects to enhance the building construction (Che Hassan et al., 2007).

Every organisation or industry is represented by a culture of some sort which can either be labelled as positive, negative, a reporting culture, a tolerant culture or any other aspect an organisation so wishes to use to describe the culture. A positive safety culture exists when employees not only understand the importance of safety but also display positive safety behaviours. Positive safety behaviours can include, but not limited to construction workers wearing personal protective equipment (PPE) without being asked, completing risks assessments for all jobs and reporting all incidents (Wamuziri, 2006). If an organisation has a negative safety culture, safety may be seen as unnecessary and consequently create an environment whereby workers have poor safety practices such as workers not following safety rules or procedures by taking short-cuts while working. Wamuziri (2006) is of the opinion that an organisations existing culture is a variable that influences its performance. A positive safety culture affords a platform whereby increased awareness, understanding and compliance with safety rules and regulations can be established (Wamuziri, 2006). In the construction industry, cultural change is deemed as necessary to bring about improvements in set health and safety

targets and this is considered to be possible only if all involved in construction projects play their role. The characteristics of an effective safety culture are listed as follows:

- Has a safety information system that collects analyses and disseminates information from accidents, near misses and active safety monitoring systems.
- Has a reporting culture in which people feel able to report errors, mistakes, violations, and safety problems.
- Has a culture of trust in which people are encouraged to provide safety information but in which a clear line is drawn between acceptable and unacceptable behaviour.
- Is flexible and characterised by an ability to change in response to changes in a dynamic and demanding task environment.
- Is willing and able to analyse the performance of its safety system and make improvements to the system when required.

(Lingard et al., 2014:47).

These characteristics are useful for a company to benchmark against when evaluating effectiveness of their existing safety culture and also serve as a guide on how to improve their existing safety culture. Safety culture is explained to be a dynamic process which is constantly changing over time. Zou (2011) also acknowledges that the development of a safety culture for a construction project or organization does not occur overnight; it is a continuous process, and it requires a commitment from top management right down to individual employees over an extended period in order to be sustainable. The three stages, shown in the Table 6 below, reflect a progressive engagement with the human elements of the organisational safety system (Lingard et al., 2014):

Stage 1	Safety is seen as an external requirement imposed by government and regulatory agencies. Safety is not seen as something that will enhance the business or operation of the organisation. Safety is considered as a technical issue and there is little awareness of the behavioural or attitudinal aspects of safety. The focus is on complying with rules and regulations.
Stage 2	Safety is seen as an important organisational goal, irrespective of externally imposed requirements. The safety management system generally focuses on technical and procedural controls, although there is an emerging understanding of the importance of behavioural and attitudinal aspects of safety. Safety targets and goals are specified. However, it is common for the safety performance of Stage 2 organisations to improve rapidly and then to plateau.
Stage 3	The concept of continuous improvement of safety has been adopted. There is a strong emphasis on safety communication, training, managerial behaviour and improving safety system effectiveness. The impact on safety of cultural aspects of the organisation is well understood.

Table 6. The three stages in the development of a safety culture (Lingard et al., 2014:36).

2.6.1 What is the optimal safety culture on residential construction sites?

Establishing a safety culture in the work place will is important as it will play an important role of ensuring that the workforce is trained to a standard such that even though its members could

move from one job to the next, workers will carry a strong awareness of what constituted safe and correct practice. Consequently reducing the risks to themselves and others associated with the temporary structures and unstable environments which characterise their profession (Wilkins, 2011). Umeokafor and Umeadi (2014) are of the view that an organisation with positive safety culture will have a lower accident rate than one without safety culture. This further supports and stresses the need to move into ensuring the establishment of positive safety cultures on construction work site.

There are certain core beliefs that influence culture on the personal and organizational level and are listed as follows:

- All injuries are preventable
- All employees are responsible for their safety and the safety of their co-workers
- Management is ultimately responsible for the safety of all employees.
- Working safely is a condition of employment.
- All risks will be identified, addressed, and managed.
- Educating and training employees to work safely is essential.
- Preventing injuries is good business - a profit centre activity.
- Safety, production, cost, and quality depend on each other.
- Safety will never be compromised for production or convenience.
- Every employee has the obligation to shut down an unsafe operation.
- The continuing health and wellness of each employee is vital to our long-term success

(OSTN 2000-2005:8)

There will always be room for improvement for safety in construction, until every construction project is completed without any incidents (Bizzell, 2008). Safety leaders inspire others to have positive attitudes towards safety by setting a good example of safety and rewarding staff for good safety behaviours. If safety leaders are consistent they can influence the safety climate and over time have an impact on the safety culture. If safety leaders exhibit a strong commitment to safety, motivate staff and provide a positive example of safety, this will improve the safety climate Safety Leadership at Work, n.d.). Figure 16 demonstrates the process of improving employee safety behaviour through safety leadership (Safety Leadership at Work, n.d.).

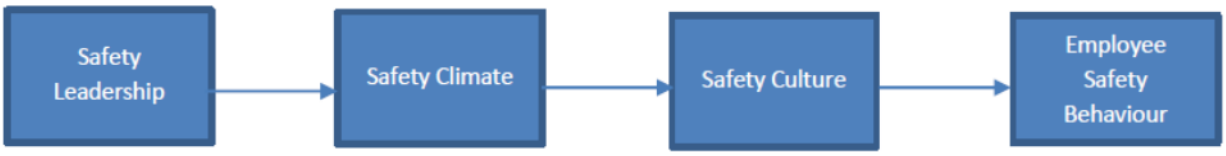


Figure 16. Improving safety behaviour through proactive safety leadership ("Safety Leadership at Work", n.d.:.2).

2.6.1 How safety climate and safety culture measured?

Despite acknowledging the important role the safety culture of plays in improving occupational safety performance of construction companies, unfortunately neither the industry nor the scientific literature have reached a consensus on how to define these concepts, how they should be measured, or which interventions designed to improve them are likely to succeed (Gillen et al., 2014). According to Wamuziri (2006) if we are to ever understand the degree to

which safety culture and safety climate contribute to improving safety outcomes, we need to 1) agree on what safety culture and safety climate mean, 2) develop reliable and valid ways to measure them so we can identify and target sites needing improvement, and 3) design, implement, and evaluate interventions that, based on the research metrics, actually improve them specified the need to better understand safety culture in construction and how it impacts construction safety and health.

An existing question in the safety culture debate is whether safety climate or culture in an organisation can be deemed as an important indicator of safety performance in construction. Safety culture is inherent to the organization; safety climate is an expression of safety culture on a jobsite (Gillen et al., 2014).The development of a positive safety culture is said to have the potential to be an effective tool for improving safety however the measurement of safety performance is said to remain problematic. This is due to the fact that indicators such as accident rates or compensation costs are lagging indicators and have the ability to measure system failure rather than its success (Wamuziri, 2008).

Taylor (2011) states that Zohar (1980) developed one of the first safety climate scales and further mentions that since then numerous safety climate scales have been developed, tested and applied worldwide across an extensive range of sectors and occupations. As the research field has grown, researchers have adopted a variety of methods in order to develop a quantitative measure of safety climate. A number of research publications have collected, examined and compared existing safety climate questionnaires in order to analyse their underlying definitions, theories, factors (dimensions), their predictive validity and so forth. Although a large amount of research has focused on what safety measures should be included in the make-up of a questionnaire, it is said that there is still confusion over the number and type of safety climate measures that should be included (Taylor, 2011). It has been reported that there approximate of 50 construction-specific studies of safety culture or climate has been published in English. A majority were conducted by academics outside the United States including Hong Kong, Taiwan, United Kingdom, Scandinavia, and Australia (Gillen et al., 2014). Most of the measurement tools were not construction specific or were adapted from instruments designed for general industry application. The most rigorously tested and well known tools are ("The Health Foundation", 2011):

- Safety Attitudes Questionnaire
- Patient Safety Culture in Healthcare Organisations
- Hospital Survey on Patient Safety Culture
- Safety Climate Survey Manchester Patient Safety Assessment

There are plentiful safety climate surveys that have been used in construction and while neither researchers nor practitioners have coalesced around any one standard survey tool, existing surveys have many similarities (Gillen et al., 2014). Taylor (2011) assembled a non-exhaustive list of existing safety climate questionnaires, with their title/name, developer, and country and sector of origin non-exhaustive in this instance refers to the simplicity of the questionnaire whereby it is normally a page long. A review was conducted in which 16 safety climate questionnaires were examined, identified the following five core dimensions of the safety climate:

- Management commitment to safety

- Supervisor safety support
- Co-worker safety support
- Employee participation in safety-related decision making and activities
- Competence level of employees with regard to safety.

(Taylor, 2011:22).

The literature review, and related search for the assessment methods and tools, was carried out by experts from the following institutes: Prevent (Institute for Occupational Safety and Health, Belgium), TNO Quality of Working Life (The Netherlands), Health and Safety Laboratory (UK), and KOOP (Kooperationsstelle, Germany) (Taylor, 2011). An iterative literature search and Internet search was used to amass a broad range of occupational health and safety tools in Germany, Belgium, The Netherlands, the Nordic Countries, Spain, France, the UK, and abroad (mainly USA and Australia). The mentioned safety climate questionnaires are summarised in the Table 7 below:

Title/Name (Acronym)	Developer/Author	Country of origin	Sector of origin	Characteristics*
Loughborough Safety Climate Assessment Toolkit (LSCAT)	Loughborough University, Health & Safety Executive (HSE), and a number of offshore organisations (Cox & Cheyne, 2000)	UK	Offshore oil and gas installations (but adaptable for broader use)	T
Safety Health of Maintenance Engineering (ShoMe) Tool	UK Civil Aviation Authority (CAA) (Developed by Health and Safety Engineering Consultants (HSEC) Ltd.)	UK	Aviation maintenance	(T)
Safety Culture Toolbox	Eurocontrol (Developed with the help of Aberdeen University)	EU	Air Navigation Services Providers (ANSP)	T,M
HRMI Safety Culture Inspection Toolkit	Her Majesty's Railway Inspectorate (HMRI) (Developed by Human Engineering Ltd. (HSE, 2005a/b))	UK	Railway	T,M,R
RSSB Safety Culture Improvement Toolkit	Rail Safety and Standards Board (RSSB)	UK	Railway	T,M
Multilevel Safety Climate (MSC) Scale (Organisational and Group-level Safety Climate)	Zohar (1980), Zohar and Luria (2005)	Israel	Manufacturing	R
Offshore Safety Questionnaire (OSQ) Offshore Safety Climate Questionnaire (OSQ99)	Robert Gordon University / Aberdeen University (Mearns et al., 1998, 2003)	UK	Offshore oil and gas installations	C?, R
Commercial Aviation Safety Survey (CASS)	Federal Aviation Administration (FAA)	US	Commercial aviation, aviation maintenance	M

	(Developed by University of Illnois) (Wiegmann , 2003, 2004)			
Norwegian Offshore Risk and Safety Climate Inventory (NORSCI)	International Research Institute of Stavanger (IRIS) (Tharaldsen et al., 2008)	Norway	Offshore	C
Nordic Occupational Safety Climate Questionnaire (NOSACQ)	Consortium of Scandinavian organisations (Kines et al., in press)	Nordic countries	Construction (now in high-risk industries)	
HSL Safety Climate Tool (SCT)	Health & Safety Laboratory (HSL)	UK		C
Safety Awareness Questionnaire (SAQ) (Arbeitstätigkeit und UmgangmitSicherheit)	ETH Zürich and Swiss Re (Grote & Künzler, 2000; Grote, 2008)	Switzerland	Petrochemical (now in all high-risk industries)	C?, R
Organisational and Safety Climate Inventory (OSCI)	Centro de Investigacao e Intervencao Social (CIS) (Silva et al., 2004)	Portugal		R

Table 7. A non-exhaustive lists of existing safety climate questionnaires, with their title/name, developer, and country and sector of origin (Taylor, 2011: 23).

** C = commercial, not free of charge at the point of use; M = only for members; T = toolbox/toolkit, containing amongst others a questionnaire; R = mentioned in research article(s).*

The researcher seeks to explore the safety perceptions, attitudes, and behaviour of construction workers and management safety practices on small residential construction sites and therefore determine the existing safety culture - with the aim of assisting small and micro enterprises to address their unique health and safety challenges. Three instruments were investigated and selected based on their suitability for the purpose of the study and they are namely; The Nordic Occupational Safety Climate Questionnaire, The Health and Safety (H&S) Culture Maturity Model and the Health and Safety Climate Assessment Tool and The Safety Climate Assessment Toolkit and User Guide (LSCAT), and the latter was selected as the most appropriate tool to adopt and utilise to gather data.

2.6.2 The Nordic Occupational Safety Climate Questionnaire

The Nordic Occupational Safety Climate Questionnaire (NOSACQ-50) was developed by a team of Nordic occupational safety researchers from respectively Denmark (NRCWE), Finland (FIOH), Iceland (Administration for Occupational Safety and Health), Norway (University of Stavanger) and Sweden (University of Gothenburg). The instrument is grounded on organisational and safety climate theory, psychological theory, previous empirical research, and empirical results acquired through international studies and a continuous development process. It has been pilot tested in various industries in all the Nordic countries, and the results confirm the reliability and validity of the questionnaire (Taylor, 2011). It is available in numerous languages including: Chinese (simple), Czech, Dutch (Belgium and Netherlands), Danish, English, Finnish, French (Belgium), German, Hungarian, Icelandic, Italian, Norwegian, Persian, Polish, Russian, Slovene, Spanish and Swedish, and other language versions are being prepared. This makes it beneficial for studies conducted in companies with a multilingual and/or multinational workforce. Results from around the world are currently being collected in an international database in order to allow for benchmarking and further development of the Tool (Taylor, 2011). The questionnaire has already been applied in several high injury risk sectors, such as construction, manufacturing, health care, transport, etc. NOSACQ-50 consists of 50 items across seven dimensions, i.e. shared perceptions of safety:

- Management safety priority, commitment, and competence
- Management safety empowerment
- Management safety justice
- Workers' safety commitment
- Workers' safety priority and risk non-acceptance
- Safety communication, learning, and trust in co-workers' safety competence, and
- Workers' trust in the efficacy of safety systems. -can be used to collect many different kinds of information
- Quick and low cost as compared to observation and experimental method.

(Taylor, 2011:38).

Although the Nordic Occupational Safety Climate Questionnaire has been used specifically in the construction sector and other similar high injury risk sectors, the instrument is not the most suitable for researchers proposed study. When undertaking and delivering a project the following three factors are of grave importance, the cost of the project, the quality of the project and the time frame set for project completion. The researcher intends to focus on the attitudes of worker's only, and thus has to be mindful of the time that will consumed when completing the questionnaire and the goal is to ensure that as minimal time (at least 10-15 minutes) as possible is spent willingly participating in the study.

2.6.3 The Health and Safety Culture Maturity Model and the Health and Safety Climate Assessment Tool

The construction industry due to its relatively poor health and safety performance has been identified as a priority industry for action in the Australian Work Health and Safety Strategy 2012-2022. It is said that The Australian construction industry is characterised by the following factors (which are said to contribute to a cultural context that is challenging for health and safety) (Lingard et al., 2014):

- A predominantly male workforce

- A multi-level system of contracting and subcontracting with associated economic pressures
- Long work hours, and
- Poor work-life balance.

Australian Constructors Association requested that a report be compiled as part of a project that aimed to do the following:

1. Conduct a comprehensive literature review to discuss the definition of culture and the operation of culture at the national, industry and organisational levels, and to discuss the impact on health and safety performance of Australian national culture, the construction industry culture, and organisational culture.
2. Develop a Safety Culture Framework which specifies the attributes of a 'good' safety culture at the organisational, project and work group levels.
3. Develop a Safety Culture Assessment Tool, which will include a safety climate assessment instrument and a safety culture maturity model.

(Lingard et al., 2014:4)

The Centre for Construction Work Health and Safety Research thus developed a Health and Safety Culture Framework as mandated. It comprises of the following nine commonly components of a culture for safety Lingard et al., 2014:94):

- Leadership
- Communication
- Organisational goals and values
- Supportive environment
- Responsibility
- Learning
- Trust in people and systems
- Resilience, and
- Engagement

The above mentioned nine culture components are described using a five point organisational culture maturity spectrum ranging from 'pathological' to 'generative'. Based on this analysis, the Centre developed for this project the Health and Safety Culture Maturity Model. For each of the nine components, the Model describes the progressive development of an organisational culture for safety. The Health and Safety Culture Framework developed by the Centre for this project also includes the Health and Safety Climate Assessment Tool. The Tool implements a multi-level measurement approach enabling measurement of the prevailing safety climate at the organisation, project and workgroup levels. The nine identified components of safety culture are the basis of the H&S Climate Assessment Tool and will become an instrument for measuring the safety climate within construction organisations (Lingard et al., 2014). The Health and Safety Culture Maturity Model and the H&S Climate Assessment Tool were devised following a widespread review of the research literature. However, neither the Model nor the Tool has yet been validated in the Australian construction context. The Centre recommends that a robust validation of both the Model and the Tool is undertaken. Validation of the Health and Safety Culture Maturity Model would involve a panel of industry experts. Although the Health and Safety Culture Maturity Model and the Health and Safety Climate Assessment Tool are designed specifically for the construction industry (in an Australian context), however it is not

ideal to be used for the purpose of this study as it is yet to be validated as a reliable instrument (Lingard et al., 2014).

2.6.4 The Safety Climate Assessment Toolkit and User Guide (LSCAT)

The Loughborough Safety Climate Assessment Toolkit and User Guide (LSCAT), developed by Loughborough University, Health & Safety Executive (HSE), and a number of offshore organisations. The instrument is developed for the use of offshore and gas industries; which is a high injury risk sector similar to the construction sector. The LSCAT designed to help organisations measure safety culture using a combination of quantitative and qualitative methodologies. The Toolkit employs the principle of triangulation, combining data from a survey questionnaire with following additional sources of data (Taylor, 2011):

- in-depth, informal discussions with individuals
- focus groups
- document analysis
- examination of records and databases.

The triangulation approach enables users to exploit a multi-methods approach to data collection that lends a greater 'robustness' to the assessment of safety climate. Utilising a multi-method approach to assessing safety culture allows different aspects of safety culture to be assessed represented in the Table 8 below.

Safety culture viewed as	Assessment methods
Objective organisational attribute	Observation, audit
Perceptions of the organisation	Interviews, questionnaires, etc.
Individual perceptions	Questionnaires, observation, etc.

Table 8. Different perspectives on safety culture, and relating assessment methods of LSCAT (Taylor, 2011:36).

The survey questionnaire comprises 47 items that examine the following organisational factors:

- organisational content
- social environment
- individual appreciation
- work environment
- organisation specific factors.

Although the questionnaire comprises of 47 items, it exists in short form assessment version which useful if one has limited time to complete an assessment. The survey questionnaire is described as potentially the most useful component of the Toolkit for assessing Occupational Safety and Health compared to the qualitative aspects of the LSCAT. The study will make use of the compressed version of the toolkit as it meets the objective of gathering data in a timeous manner and will only make use of the quantitative aspect of the Toolkit. The instrument is suitable for this study because it also views safety culture from the individual (employee)

perceptions using an assessment method in the form of an attitude survey which looks at management practice (in safety issues) from the workers' point of view, workers' own approach and perceptions towards safety (Taylor, 2011). The short form assessment matrix contains two of items which best characterise each dimension of the questionnaire, sometimes in an alternative form from the full survey. When using the assessment matrix one is advised to question as many individuals as deemed necessary to gain a full picture, the assessment matrix makes provision for 17 responses but more or less individuals may be used, depending on the target sample. This tool is the most appropriate and will be adopted, however is it mentioned that the suitability of the Toolkit for use in very small (i.e. micro organisations of less than five employees) is questionable. The research will be focusing on small and micro enterprises as they dominate the domestic residential construction sites and also represent unique occupational health and safety challenges in the construction industry.

2.7 Conceptual Framework/Model: Towards the Establishing A Proactive and Positive Safety Culture

The researcher through literature reviewing formulated a conceptual framework that interlinks the factors that are important to establish continuous and sustainable positive health and safety culture on construction work-sites.

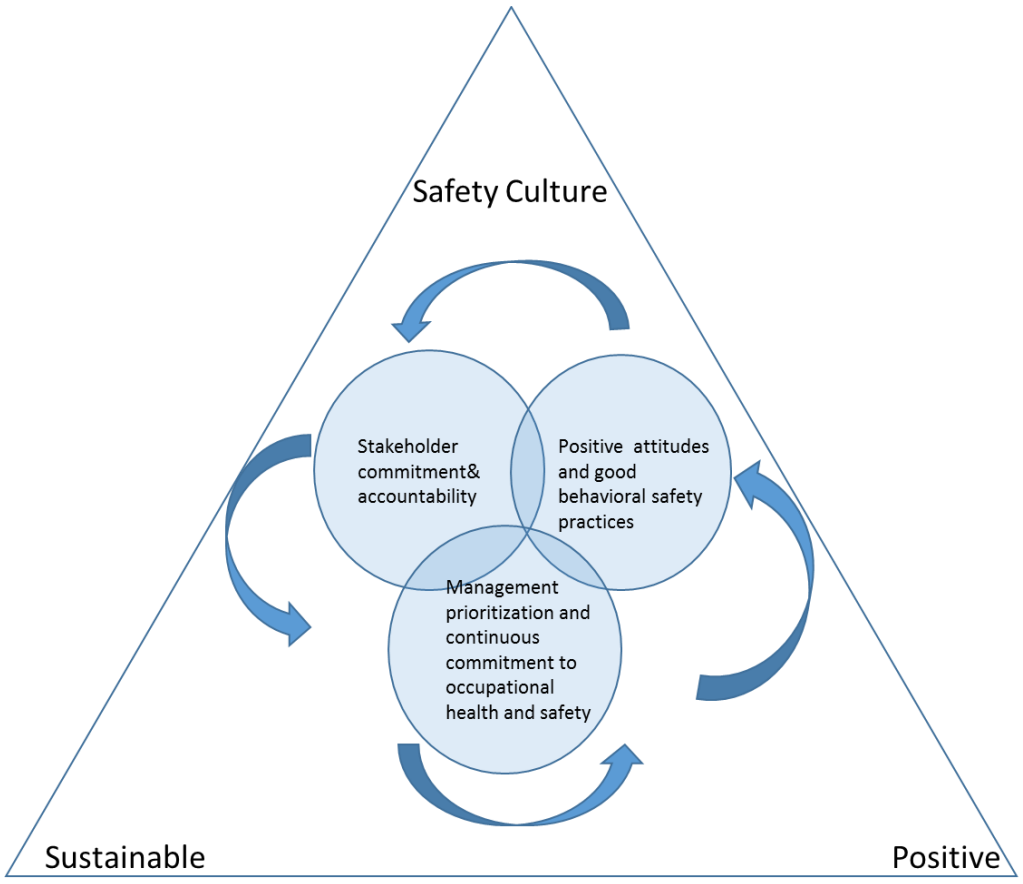


Figure 17. Conceptual framework/model: Towards the establishing a proactive and positive safety culture.

2.8 Conclusion

The construction industry operates in a uniquely project-specific and complex environment, combining different investors, clients, contractual arrangements and consulting professions. It impacts directly on communities and the South African public at large, and its improved efficiency and effectiveness will enhance quality, productivity, health, safety, environmental outcomes and value for money (Marx, 2014). Establishing a sustainable positive safety culture will help save lives, retain workers, reduce claims and delays and increase the efficiency of on-going operations in the long-tern as well strengthen a company's reputation and longevity. In the event where a construction company succeeds in building a strong culture of health and safety, it becomes a core value for every employee. A strong safety culture burnishes the company's reputation, which is one of the most valuable assets for any business, and plays an essential role in its long-term success. A safer company has been found to experiences fewer losses, enjoys lower costs, becomes a more competitive bidder and makes it more attractive to potential clients and insurers. But safety is a job that never ends, it is a continuous endeavour.

The construction industry is always adopting new methods, new equipment and new machinery. Safety has to continually adapt to the new ways that workers are performing their jobs. Small residential construction companies are faced with the risk of high workplace accidents and injuries and face unique challenges concerning adequate implementation of legislation. It is said that these companies often adhere to the bare minimum compliance and nothing further. Ultimately, every company wants every worker to go home safe at night. The ultimate goal should thus be zero injuries and all efforts ought to be focused on ensuring that this goal is achieved until it becomes the status quo concerning occupational health and safety in the construction industry. There is thus a need to ensure that measures are put in place to foster the creation of a positive safety culture to ensure that there are eventually zero harm/accidents experienced in the construction work places that they dynamically operate in. There needs to be a shift towards proactive approaches that will improve occupational health and safety practices as well as change behaviour from all affected stakeholders in a way that improves attitudes, culture and systems.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

The study is descriptive and analytical in nature as it is intended to create an understanding of the health and safety culture on construction sites by determining worker attitudes towards health and safety. The research has relied on both primary and secondary sources of data. The data collected was analysed by using the quantitative processes.

3.1 Research Objective

The study involves investigating health and safety culture of small and micro enterprises operating primarily on domestic residential construction sites – through determining the worker's attitudes towards occupational health and safety matters. The aim of the research methodology seeks to obtain answers to that will solve the research problem and sub-questions.

3.2 Research Philosophy

A positivist philosophy involves objectively uncovering truth and presenting it empirically. It is said that positivism esteems human behaviour as passive, controlled and determined by the external environment (Thomas, 2010). The study adopted quantitative methods to quantify the knowledge obtained from stakeholders, particularly construction workers concerning their views on issues of occupational health and safety. Safety culture within the construction industry must be addressed in order to reach as well as maintain acceptable health and safety practices and standards (Tam & Fung, 2012).

The study seeks to determine the safety cultures of small and micro-enterprises operating in private residential construction sites at the Waterfall Country Village. Therefore a positivist paradigm will be adopted to conduct this study. Residential construction is said to present construction workers with a unique number of challenges and safety considerations as there is more flexibility to construct homes to the homeowners' specifications ("United States Department of Labor", no date). The environment in which residential construction workers operate in is undeniably hazardous and has direct impact on the workers behaviour on health and safety risks. The safety practices or behaviour of workers has a direct impact on the organisations safety culture; for instance good safety behaviour results in the creation of a positive safety culture.

Literature critics believe the positivist paradigm to be flawed in its lack of subjectivity in construing social reality and claim that it is almost impossible to be objective when seeking to acquire knowledge (Thomas, 2010). The researcher acknowledges the advantages and limitations of this philosophy, but will strive to maintain optimum objectivity while searching for knowledge.

3.3 Research Approach

A descriptive study is said to be one that seeks to describe systematically a situation, problem, phenomenon, service or programme, or provides information for instance about the living conditions of a community, or describes attitudes towards an issue (Kumar, 2011). This

research study is descriptive in nature and the main purpose of descriptive research is to describe the state of current affairs as it presently exists. Typically in this research approach the researcher has no control over the variables, but can only report on what has happened or is happening (Kumar, 2011). This study seeks to determine worker attitudes towards issues of occupational health and safety and ultimately determine the safety culture on domestic residential construction work sites. An improved and positive safety culture is desirable and should be sought to be obtained as the benefits outweigh the repercussions of a poor occupational health and safety

The research approach adopted in this study is a quantitative one; which will involve generating data in a quantitative form which is to be subjected to rigorous quantitative analysis in a rigid and formal fashion (Kothari, 2004). The quantitative research method is deductive and objective in nature, and is characterized by tangible data such as counts, weight, mass, and other physical measures (Phoya, 2012). Quantitative research is generally based on two research methods namely survey and experimentation. A survey encompasses either interviewing or administering questionnaires to a sample of research respondents. In experimentation, observations of the phenomenon of interest occur under intentionally controlled conditions produced by the researcher. The advantage of the quantitative approach is that it measures the reactions of a great many people to a limited set of questions, thus facilitating comparisons and statistical aggregation of the data, and so the generalisation of the results (Phoya, 2012). Key feature of the quantitative approach are summarised in the Table 9 below (MacDonald & Headlam, 2009:

Aim	**The aim is to count things in an attempt to explain what is observed.**
Purpose	Generalisability, prediction, causal explanations
Tools	Researcher uses tools, such as surveys, to collect numerical data.
Data collection	Structured
Output	Data is in the form of numbers and statistics.
Sample	Usually a large number of cases representing the population of interest. Randomly selected respondents
Objective/ Subjective	Objective – seeks precise measurement & analysis
Researcher role	Researcher tends to remain objectively separated from the subject matter.
Analysis	Statistical

Table 9. The key features of Quantitative method (MacDonald & Headlam, 2009).

An existing questionnaire survey, The Safety Climate Assessment Toolkit and User Guide (LSCAT) - short form assessment matrix, was adopted and used to determine the safety culture of small and micro enterprises due to the occupational health and safety challenges that they face and consequently the challenges that these Small and micro enterprises (SMEs) contribute to the overall health and safety of the South African construction industry. The study will only consider participants (both employers and employees) that fall under the definition of small and micro enterprises, registered with the National Home Builders Registration Council (NHBRC), involved in the construction of privately financed domestic housing projects within the jurisdiction of the City of Johannesburg Metropolitan Municipality. Questionnaire surveys were administered to employees in different levels of the workforce from various residential

construction SMEs operating at Waterfall Country Estate, Midrand; in order to gain data to draw better understanding of the existing safety culture through investigating worker and other stakeholder perceptions.

3.4 Research Design

The research design is described as the general plan of how one will go about answering the research question(s) and is determined by considering how to link the research questions with data collection and analysis of the results (Saunders et al., 2012).

The study's primary research question:

What are the existing attitudes and perceptions of workers concerning health and safety on residential construction sites?

The objectives of the study are as follows:

- *To measure the safety attitudes of workers on small residential construction sites.*
- *To determine the existing safety culture on small residential construction sites.*

There are three types of research methods, being qualitative, quantitative and multiple methods research design which be briefly summarised and explained in the Table 10 below (Saunders et al., 2012):

	Quantitative design	**Qualitative design**	**Multiple method design**
Research philosophy	Positivism (objective)	Interpretive (subjective)	Realism and pragmatism
Research approach	Deductive – data is used to test theory.	Inductive- naturalistic and emergent design is used to develop a theoretical perspective	Deductive or Inductive research approach or a combination of both.
Characteristics	Examines relationships between variables, measures numerically and analysed via a range of statistical techniques.	Studies participant's meanings and relationships between them via various data collection techniques and analytical procedures.	Mono method- either qualitative or quantitative Multiple methods – using more than one data collection technique and analytical procedure
Research strategies	Experimental and survey strategies	Action research, case study research, ethnography, Grounded Theory and narrative research	Concurrent triangulation design, concurrent embedded design, sequential explanatory design, and sequential , multiphase design

Table 10. Three types of research methods (Saunders et al., 2012: pp.162-164).

3.5 Research Strategy and Time Horizon

The research used a survey strategy. An existing questionnaire survey, called the Loughborough Safety Climate Assessment Toolkit and User Guide (LSCAT). This research was a cross sectional study as it sought to determine and understand the attitudes of workers and the overall safety culture on residential construction sites.

3.6 Research Methods

A quantitative design was utilised for the purposes of the study. Quantitative research studies relationships between variables, measures them numerically and uses a range of statistical techniques to analyses these relationships (Saunders et al., 2012). Quantitative research also uses a deductive research approach whereby the focus is on using data to test theory (Saunders et al., 2012). Safety culture components such as 'management commitment, stakeholder involvement and safety competence' are some of the crucial elements of the human factor in health and safety. This study will focus on the systems theory which briefly explained concerns human, machine (equipment) and the environment and the role these factors play in accident causation. It is commonly known and reported that the construction sector has poor health and safety record as many accidents and fatalities occur on construction work sites on a daily basis across continents. It is important to understand the factors that cause or contribute to these accidents and consequently find ways to prevent and reduce occurrence of such tragedies.

3.7 Research Scope

The research is primarily focused on residential construction activity within Midrand, Johannesburg. The area has and is seeing a lot of development, particularly in the residential construction sector. The Waterfall Estate in Midrand, is currently deemed as the largest property development in the country's history, estimated to have a positive economic impact valued at about R106 billion by the time it is completed in 2023 (Cokayne, 2014).There is a range of 6 000 and 8 000 residential units, which will house an estimated 35 000 to 40 000 people, which are in the process of being developed in six residential areas within the entire estate (Cokayne, 2014). It was also reported that there was 15 000 people working on the various construction sites across the estate (Cokayne, 2014).Therefore it is a suitable study area to explore the safety culture and safety practices of small construction contractors in the domestic residential building sector based on the land development activity.

The specific study area will be Waterfall Country Village. There is an estimated work-force of 1000 labourers currently working at the study area. The target population of the study will be small and micro enterprises (SMEs) operating specifically in the residential construction sector and registered with the National Home Builders Registration Council (NHBRC). The construction sector is dominated predominantly by a lot of SMEs. Based on the growth in residential construction and the reported challenges faced by construction SMEs, the study seeks to determine the existing safety culture of small and micro enterprises operating in domestic residential sites.

3.8 Target Population Sampling Techniques

A sample is explained to be a smaller (but hopefully representative) collection of units from a population used to determine truths about that population. A population can be described as including all people or items with the characteristic one wish to understand. Typically sampling means that data is collected on a smaller scale that is researchers gather data from a portion or sample of the population (Kumar, 2011). Determining sample size is a very important aspect because samples that are too large may waste time, resources and money, while samples that are too small may lead to inaccurate results ("iSix Sigma", n.d.).

Confidence level

In survey sampling, different samples can be randomly selected from the same population and each sample can often produce a different confidence interval. A confidence level refers to the percentage of all possible samples that can be expected to include the true population parameter ("Stat Trek.", n.d.). The confidence level used in the study was 95%.

Margin of Error

The margin of error expresses the maximum expected difference between the true population parameter and a sample estimate of that parameter ("Stat Trek.", n.d.). The margin of error for the study is 7.81%.

Sampling Frame: The Waterfall Country Estate Builders profile:

There are mainly ten (10) Building companies and their respective sub-contractors currently working at the Waterfall Country Estate residential construction development. This is the sampling frame from which willing research participants will be sought. There is a population of approximately 1000 workers employed in over 120 various residential construction sites.

Sampling population

Century Property Developments is the company overseeing the residential construction component of the Waterfall Country Estate Development and will contacted in order to obtain a registrar of contractors employed on the site. Only employees (labourers) of the contractor's and or sub-contractors operating on the residential construction component of the development will be selected. A sample of 136 skilled and unskilled construction workers will form part of the research participants. The study will inquire the following factors concerning the research participants:

- Experiential years in construction
- Period employed by current employer
- Job Function

The personnel at the Waterfall Country Estate residential construction site development typically include owners or managers of company, project managers, project engineers and site general foremen, casual workers. The researcher will mostly target casual workers (skilled and unskilled) as research participants since they are the ones who are mostly employed to execute the ground work.

Types of Sampling

There are various sampling strategies in quantitative research and can be categorised into mainly into three types namely (Kumar, 2011):

1. Random/Probability sampling
2. Non-random/Probability sampling

3. Mixed sampling

These studies will use random sampling to obtain a research sample; Figure 18 illustrates the different types of sampling methods that exists in literature.

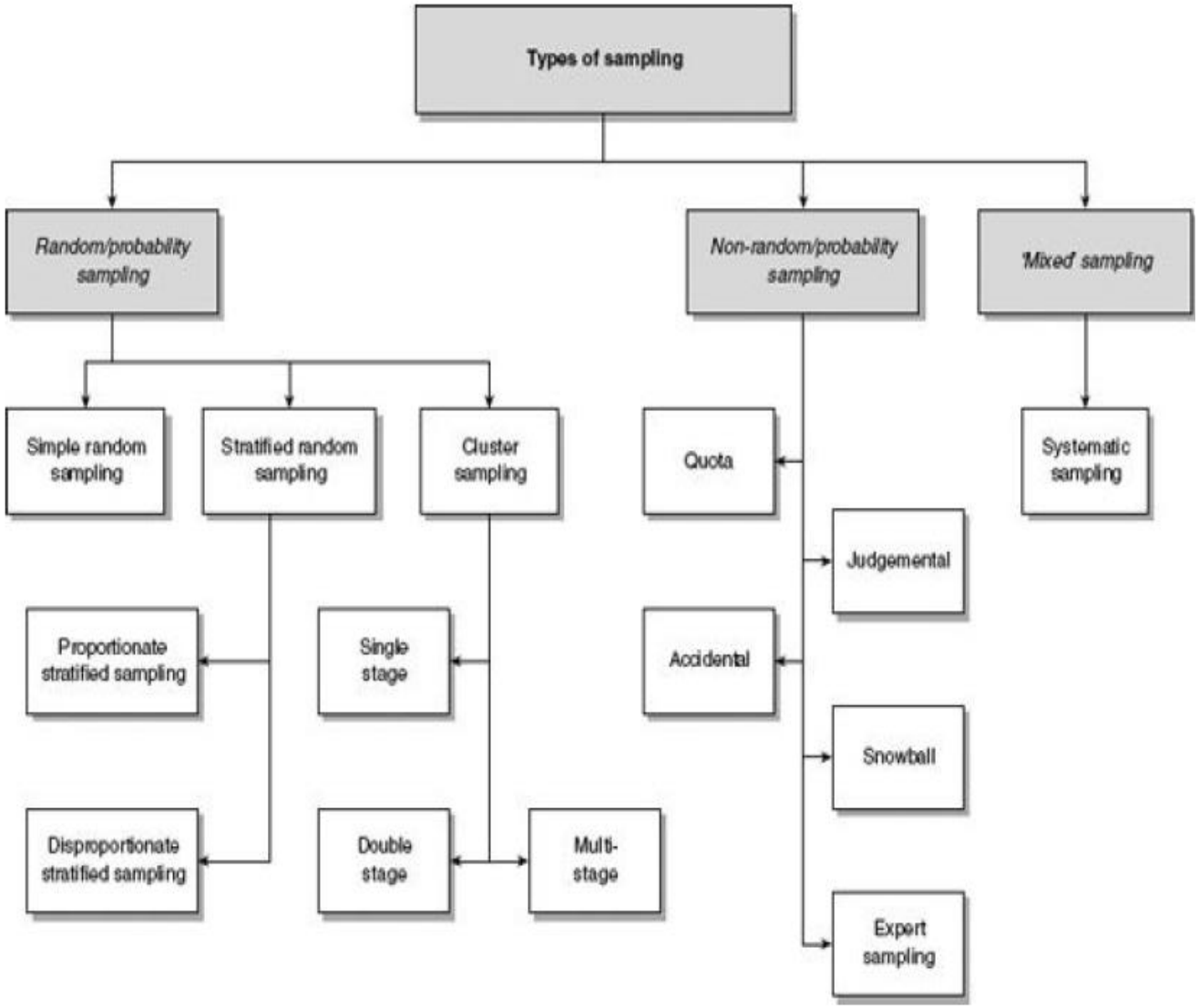


Figure 18. Various sampling strategies in quantitative research (Kumar, 2011: 81).

This study will make use of purposive sampling: it is the one in which the person who is selecting the sample is who tries to make the sample representative, depending on his opinion or purpose (Barreiro & Albandoz, 2001). The primary consideration in purposive sampling is the researchers opinion on who can provide the best information to achieve the objectives of the study – thus the researcher will seek to interview willing participants who are deemed to possess such information and therefore be able to develop a deeper understanding of occupational health and safety issues faced by casual workers (Kumar, 2011).

3.9 Data Collection Techniques

Data was collected by means of reviewing literature and a questionnaire survey. A questionnaire is typically a compiled list of questions, of which answers are obtained from relevant respondents (Kumar, 2011). The questionnaires will be used to collect primary sources of data from residential construction workers. Questionnaires will be administered mostly during lunch breaks on construction sites to willing participants. The researcher will secure appointments telephonically with management – who will then grant the researcher(s) access to these interview respondents. The questionnaires were self-administered whereby they were hand delivered to the respondents to complete the questionnaires themselves, however researchers who are fluent in a minimum of 3 official South African languages will be present to assist workers should they require any interpretations or further explanations from possible language barriers.

According to Statistics Canada data capturing refers to any process that converts the information provided by a respondent into electronic format, data concerning the safety culture of residential construction sites will be collected by mean of questionnaires surveys and structured interviews. Furthermore the researcher will undertake the following measures during the data capturing process (“Statistics Canada”, 2015):

- Designing the data capture process in order to reduce capturing costs and to maximise timeliness and data accuracy.
- Make use of standard collection tools and process so as to ease interviewer work and limit the risk of introducing a capture error.
- Ensure that they have appropriate training and necessary tools for the data capturing procedures.
- Manual data capture from paper questionnaires or scanned images is subject to keying error therefore solutions such as the use of online edits (i.e. edits that will identify keying errors) for error conditions that the data capture operator can correct
- For automated data capture, the researcher will safeguard that the questionnaire is designed to ease the scanning and the intelligent character recognition (enhances accuracy of data).

3.10 Instrument Design

The Health and Safety Executive (HSE) in collaboration with the Offshore Safety Division of the HSE, Chevron UK, Chevron Gulf of Mexico (Ship Shoal/Eugene Island), Mobil North Sea and Oryx UK undertook a joint industry project. The mandate of the project was to meet the following objectives (“Loughborough University”, n.d.):

- An examination of current techniques used in the assessment of safety climate and culture;

- Generate assessment technique which provides both a practical tool for the assessment of safety climate and aids the promotion of a positive safety culture in the offshore environment;
- Produce appropriate tools for assessment; and
- Produce process guidelines for the use of such a technique.

As per the mandate of the joint industry project an assessment technique, based on the use of multiple methods, was developed. This technique was based on information derived from the relevant literature on organisational culture and climate, as well as previous studies in the offshore sector. The term offshore can also be used in reference to companies with offshore oil and gas operations. The technique comprises of three methods for assessing safety climate offshore and seeks to build on current industry initiatives, such as the cross industry leadership initiative ("Loughborough University", n.d.). The user guide and toolkit have been developed, in collaboration with oil industry personnel, specifically for use in offshore environments. They built on cultural concepts and frameworks from existing offshore organisations and allied industries. The Toolkit was developed initially for use in the offshore oil and gas industry, but (with some further development) has been successfully 'transported' for use in the UK health sector by the Royal College of nursing ("Loughborough University", n.d.).

The 'Safety Climate Assessment Toolkit survey questionnaire is comprised of 47 items that examine the following organisational factors:

- organisational content
- social environment
- individual appreciation
- work environment
- organisation specific factors.

The questionnaire also exists in a short form version referred to as 'the short form assessment matrix' which contains two of items which best characterise each dimension of the of the full questionnaire survey. It is a closed-ended questionnaire consisting of a set of eighteen (18) questions, which will administered to a willing participants working on the Waterfall Country Estate residential construction site. It is expected that the feedback which will be obtained from the questionnaire or the chosen answers to each question will indicate a numerical value where the researcher can argue about it and make evidence to support a certain issue or number of issues. The questionnaires and interviews for this research will also aim to obtain results that will add value to the research.

These are typically some of the factors that are typically taken into consideration when formulating a questionnaire (Thomas, 2010):

- Objectively constructed questions; thus not giving the participants any indication of a preferred answer.
- Questions are arranged from general to specific allowing for adequate order of the questions to the participants.
- Clear and complete instructions are given at the beginning of all questionnaires so as to avoid any misunderstandings.
- The questionnaires are, as much as possible, set free from ambiguous and embarrassing questions.

- Caution is taken to avoid grammatical issues such as poorly phrased questions, misspelled words and typing mistakes.
- An acceptable length of the questionnaires was realised, leading to restrict it only to essential information needed by the research - questions are short and closed with a set of answers for participants to choose from.

3.11 Data Analysis and Interpretation

According to the Safety Climate Assessment Toolkit the following must be considered when analysing the data:

- Each item should be scored by giving a value of 5 to the 'strongly agree' category, 4 to the 'agree' response, 3 to the 'neither agree nor disagree' category, 2 to the 'disagree' response, and 1 to the 'strongly disagree' category.

- Certain items in the questionnaire are negatively worded and users of the toolkit are advised to be mindful of reversing the scoring for negative items in the questionnaire when coding the item responses (this is ordinarily achieved by subtracting the item score from 6 to reverse the scoring. For example, a score of 2 on a negatively worded item would be reversed to a score of 4).

- Scores should be averaged for each item, across the whole group(s).

- These average item scores can now be used to calculate dimension scores.

- Dimensions in the current questionnaire have different numbers of items and, therefore, scores need to be standardised before plotting and comparing these dimensions. Converting the scores to a 1 to 10 scale can be achieved by dividing the actual score by the total possible score and then multiplying by 10.

- The responses for each item on the short form questionnaire should be averaged and the two averages added together to give each dimension a score. You should note that two of the dimensions (Safety Rules and Procedures, and Personal Appreciation of Risk) include only negative items and you should subtract the totals of these two dimensions from 12 to obtain a positive dimension score. For example, if the averages for the two items on Safety Rules and Procedures were 2.2 and 1.8, you would add them (equalling 4) and then subtract this from 12, giving a dimension score of 8.

- If the survey sample is small calculations can be done by hand. However, in the event of a larger the sample data analysis is time consuming. In that case, data from the survey may be best analysed using a simple spreadsheet computer software package (e.g. Microsoft Excel), with the formula for each calculation pre-set.

("Loughborough University", n.d.: 32).

Calculating dimension scores

Dimension	Add	Divide by	Multiply by	Score
Management Commitment	Item 9 + (6 - Item 16) +(6 - Item 19) + Item 26 + Item 33 + Item 38 + Item 42	35	10	
Communication	Item 1 + Item 10 + (6 - Item 25) + (6 - Item 28) + Item 31	25	10	
Priority of Safety	Item 4 + Item 5 + (6 - item 20) + Item 40	20	10	
Safety Rules and Procedures	(6 - Item 17) + (6 - Item 21) + (6 - Item 35	15	10	
Supportive Environment	Item 3 + Item 15 + (6 - Item 22) + Item 29 + (6 - Item 32) + Item 41	30	10	
Involvement	Item 8 + Item 13 + (6 - Item 39)	15	10	
Personal Priorities and Need for Safety	Item 2 + Item 11 + Item 12 + (6 - Item 23) + Item 36	25	10	
Personal Appreciation of Risk	(6 - Item 6) + Item 18 + (6 - Item 24) + Item 34	20	10	
Work Environment	(6 - Item 7) + Item 14 + (6 - Item27) + (6 - Item 30) + Item 37 + (6 - Item 43)	30	10	

Figure 19. An illustration of the dimension scores calculation ("Loughborough University", n. d.:33).

Although the questionnaire comprises of 47 items, it exists in short form assessment version which useful if one has limited time to complete an assessment. The data was collected by means of the short form assessment. The short form assessment matrix contains two of items which best characterise each dimension of the questionnaire, sometimes in an alternative form from the full survey. When using the assessment matrix one is advised to question as many individuals as deemed necessary to gain a full picture, the assessment matrix makes provision for 17 responses but more or less individuals may be used, depending on the target sample. The responses for each item on the short form questionnaire were averaged and the two averages added together to give each dimension a score ("Loughborough University", n.d.).

3.12 Data Validity and Data Reliability

Validity means that correct procedures have been applied to find answers to a question. Reliability refers to the quality of a measurement procedure that provides repeatability and accuracy. The term reliability applied on a measurement tool used to obtain the same result if used repeatedly by other researcher at the same time. In contrast, the term validity applied to say that a measurement tool measures what it plans to measure (Thomas, 2010). If the indicator contains small error percentage, then the indicator is a valid measure of the concept. To obtain reliability, the questions aim to collect data relevant to the subject matter (Thomas, 2010).

The instrument design has three methods for assessing safety climate offshore and seeks to build on current industry initiatives, such as the cross industry leadership initiative. These methods underwent a series of tests and refinements before the production of the 'Safety Climate Assessment Process and Toolkit User Guide' and the 'Safety Climate Assessment Toolkit'. The tests and refinements were undertaken with the intention of collecting data in a manner that will ensure maximum validity and reliability ("Loughborough University", n.d.). This tool was analysed and was found to be appropriate and was therefore adopted, however is it mentioned that the suitability of the Toolkit for use in very small (i.e. micro organisations of less than five employees) is questionable. The researcher ensured that the randomly selected sites had more than five employees that volunteered to form part of the research respondents.

It is important that the findings of the research are of quality, that is the evidence and conclusions drawn should be able to hold water under the closets scrutiny (Saunders et al., 2012). The researcher is going to make use of an existing and tested data collection instrument which has been implemented and adopted in various organisations and is therefore confident of the research quality will be guaranteed. Furthermore the researcher will consider quality measures such as response rates, processing error rates, follow-up rates and rates of nonresponse by reason. It is said that when these measures are available throughout all levels at which estimates are produced and at various stages of the process, they can serve both as performance measures and measures of data quality ("Statistics Canada", 2015).

3.13 Contingency

The researcher ensured that the following contingency measures were implemented in an attempt to ensure the successful execution of this research study project ("Statistics Canada", 2015):

- The survey concepts and subject matter of occupational health and safety were kept in simple and comprehendible terms so as to ensure accurate answers to questions from respondents.
- The researcher recruited three (3) research assistants, who were also students at the School of Construction, Economics and Management to assist in the data collection process. The assistants were required to be fluent in a minimum of 3 official South African languages to ensure that there are no communication barriers or misunderstandings as such during the administration of the survey question.
- The researcher was aware that not every identified participant will be willing to participate, but will most will capture data from those who are willing to participate. The

researcher allocated sufficient time and recruited research assistants to assist in the data collection to ensure that the set population sample of 136 was met.

- Optimum effort was taken to ensure the confidentiality of the data. The names of the workers and their employers were not requested nor revealed in survey responses.
- The research instrument (questionnaire) was worded in English. Measures were taken to counteract possible language barriers (although assuming that most people use or understand the English language a medium of communication), as the researcher (s) are fluent in English, Swati, Zulu, Sotho, Setswana and Tsonga. The researcher and the research assistants were able to translate to workers who were not fluent nor understood English.
- The study was conducted under limited time frames, and permission to access the site was granted to the researcher(s) for duration of 3 days allowing the researcher sufficient time to administer questionnaires to willing participants.
- In the event where response rate to the survey is not deemed as sufficient, demographic data would be employed to analyse whether the data collected can be seen as representative of the population. However the implications are that there would not be any statistical generalization and the data collected can be deemed as representative of the population.

3.14 Ethical Considerations

The study ultimately seeks to gain knowledge of the status of occupational health and safety on residential construction sites. The researcher is aware that health and safety is a sensitive topic in construction, however it is one that must be addressed urgently so, due to the pressing negative social and economic consequences. The researcher obtained ethical clearance from the School of Construction Economic and Management Ethics Committee, protocol number CEM/16/12/MSC (please see Annexure A). While engaging with the participants the researcher sought to respect the rights, needs, values, cultural backgrounds and desires of the participants. Furthermore the study took cognisance of the following ethical considerations concerning the research participants (Thomas, 2010):

- The purpose of the study was explained to participants and their Informed consent was sought and obtained this was done to ensure that participation is voluntary. An attendance register which acted as consent form was completed by the participants and the researcher(s).
- Participants' verbal and written consent will be requested prior to administering the questionnaires. Participants were permitted to stop completing the questionnaire when they desired to do.
- The nature of the research did not place participants in any form of danger or potentially harmful situations.
- Participants were informed that their identity will be anonymous and their identity was not revealed nor requested in the questionnaire.
- Honesty and trust – the researcher will be open and transparent with the participants.

- Privacy, confidentiality, and anonymity – anonymity of the respondents will be guaranteed. Participants will be assured that their responses are confidential and sorely to be used for the findings of the research report.
- Undergraduate students enrolled for the course Construction Management were recruited from the School of Construction, Economics and Management, to assist in the administration of the questionnaires to research respondents. The researcher financially compensated the students at an hourly rate obtained from the university's Fees Office and transportation to and from the site was provided by the researcher.

Kumar (2011) cautions researchers to consider the following ethical matters in their respective studies:

- Avoiding bias – attempting to deliberately hide findings or report findings in an untruthfully from reality.
- Using inappropriate research methodology – using a method and procedure that is inappropriate.
- Incorrect reporting – changing results to suit the researchers interest.
- Inappropriate use of the information – using the findings in a manner that will in/directly affect the respondents in adverse manner.

3.15 Conclusion

The research design is positivist in nature and an existing research instrument known as the Loughborough Safety Climate Assessment Toolkit and User Guide (LSCAT) was adopted for the purpose of the study). The researcher sought and obtained permission from the Waterfall Country Village manager to gain access to collect data by administering questionnaires to willing respondents at the subject site. Questionnaires were administered by the researcher as well three research assistants over a time frame of two working days to a sample size of 136 residential construction labourers in an attempt to gauge the status of health and safety culture on the various construction sites within the estate. The results of the survey were computed and calculated on Microsoft Excel. The analysis of the data obtained from the questionnaires responses will be discussed in detail in the next chapter of this research.

CHAPTER FOUR: DATA ANALYSIS

4.0 Introduction

This chapter seeks to present, discuss and analyse the findings that were obtained from the safety culture survey administered at the Waterfall Country Estate- Gate 4 site. A safety culture was survey was conducted by means of a questionnaire which was administered to construction workers on various construction sites at the Waterfall Country Village. The researcher seeks to explore the safety perceptions, attitudes, and behaviour of construction workers and management safety practices on small residential construction sites and therefore determine the existing safety culture - with the aim of assisting small and micro enterprises to address their unique health and safety challenges.

The following objectives were formed in an attempt to meet the aim of the study:

- *To measure the safety attitudes of workers on small residential construction sites.*
- *To determine the existing safety culture on small residential construction sites.*

The Safety culture survey aimed to provide a baseline measure of work health and safety attitudes, beliefs and behaviours of construction workers as well as the management of safety practices in order to determine the existing safety culture. The survey targeted construction workers (employees). The questionnaire was specific to the types of selected respondents and covered themes and questions related to health and safety culture. This report presents findings from the worker and employer surveys. A sample size of 136 out of a population of 1000 labourers' construction workers, working on various residential construction sites within the estate participated in the survey. The safety culture questionnaire was administered in English to construction workers throughout various sites on the estate, but was also verbally translated in several of the 11 official South African languages for workers who were not fluent in English. Workers over the age of 18 years employed in the construction site study area were eligible to participate in the survey. The workers had varying years of experience in construction work. Completed surveys were obtained from 136 workers across 25 sites out of a 120 construction sites.

4.1 Profile of Research of Respondents

In residential construction the typical specialty trades include framing, finish carpentry, painting and wall covering, roofing, masonry, drywall and insulation, poured concrete foundation and structure, plumbing, heat and air conditioning, electrical and site preparation ('The Center for Construction Research and Training", 2013).

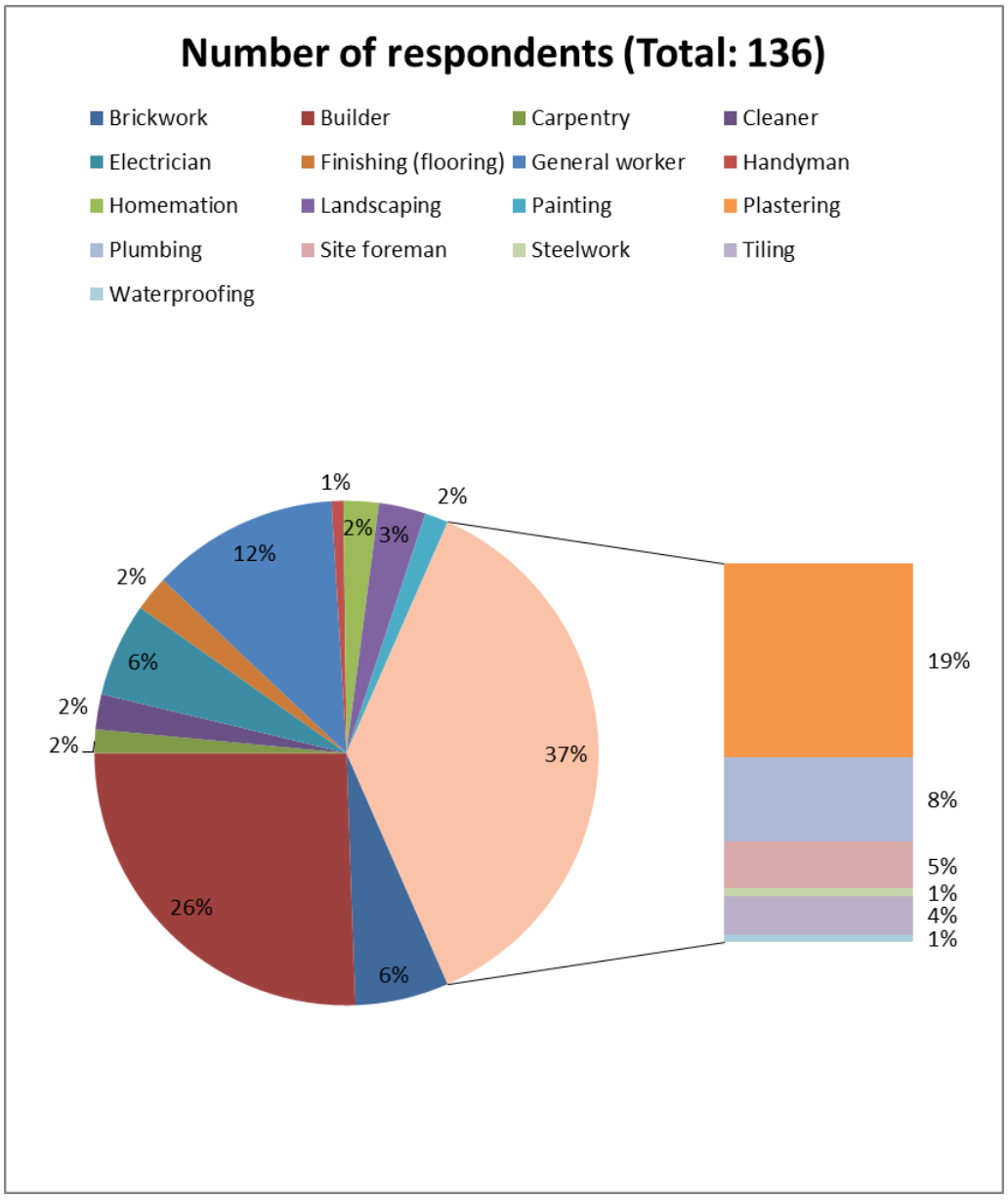


Figure 20.Profile of research of respondents.

There were a total of 136 research respondents who volunteered to participate in the study. Their job functions included a variation of the following: Brickwork, building, carpentry, cleaning, electrician, finishing (flooring), general worker, handyman, homemation, landscaping, painting, plastering, plumbing, site foreman, steelwork, tiling and waterproofing. These job functions are consistent and similar to the trades mentioned as typical of residential construction. Construction workers can be classified into various occupational groups and distribution. Figure 20 below displays the various occupational groups within in the construction sector and information is based on a study conducted in various parts of the United States of America.

Label	Code	Description	Number (thousands)	Percent
Laborer	6260	Construction laborer	1,221	13.4%
Carpenter	6230	Carpenter	1,080	11.9%
Construction manager	0220	Construction manager	1,062	11.7%
Foreman	6200	First-line supervisor/manager of construction trade	565	6.2%
Painter	6420, 6430	Painter and paperhanger	529	5.8%
Admin support	5000-5930	Administrative support	482	5.3%
Electrician	6350	Electrician	444	4.9%
Manager	0010-0430 (except 0220)	Manager (except construction manager)	414	4.6%
Plumber	6440	Pipelayer, plumber, pipefitter, and steamfitter	366	4.0%
Professional	0500-3650	Professional	353	3.9%
Repairer	7000-8960 (except 7310, 7410, 8140)	Installation, maintenance, and repair worker	296	3.3%
Operating engineer	6320	Operating engineer and other construction equipment operator	273	3.0%
Heat A/C mech	7310	Heating, air conditioning, and refrigeration mechanic	263	2.9%
Roofer	6510	Roofer	196	2.2%
Carpet and tile	6240	Carpet, floor, and tile installer and finisher	187	2.1%
Drywall	6330	Drywall installer, and ceiling tile installer	171	1.9%
Truck driver	9130	Driver/sales worker and truck driver	144	1.6%
Brickmason	6220	Brickmason, blockmason, and stonemason	142	1.6%
Service	3700-4980	Service/sales	133	1.5%
Highway maint	6730	Highway maintenance worker	90	1.0%
Concrete	6250	Cement mason, concrete finisher, and terrazzo worker	84	0.9%
Welder	8140	Welding, soldering, and brazing worker	75	0.8%
Helper	6600	Construction helper	55	0.6%
Plasterer	6460	Plasterer and stucco mason	44	0.5%
Sheet metal	6520	Sheet metal worker	43	0.5%
Material moving	9000-9750 (except 9130, 9520)	Transportation and material moving	42	0.5%
Fence erector	6710	Fence erector	40	0.4%
Ironworker	6530	Structural iron and steel worker	38	0.4%
Dredge	9520	Dredge, excavating, and loading machine operator	35	0.4%
Misc worker	6760	Miscellaneous construction and related worker	35	0.4%
Inspector	6660	Construction and building inspector	33	0.4%
Insulation	6400	Insulation worker	27*	0.3%
Glazier	6360	Glazier	27*	0.3%
Elevator	6700	Elevator installer and repairer	22*	0.2%
Paving	6300	Paving, surfacing, and tamping equipment operator	19*	0.2%
Power-line installer	7410	Electrical power-line installer and repairer	19*	0.2%
Driller	6820	Earth driller, except oil and gas	18*	0.2%
Boilermaker	6210	Boilermaker	6*	0.1%
Other	--	Iron reinforcement, farming/fishing/forestry, hazardous material removal, etc.	21*	0.2%
TOTAL			**9,093**	**100%**

Figure 21.Workers by occupational classification and distribution in construction, 2010 ("The Center for Construction Research and Training", 2013:40).

Job function	Number of respondents (Total: 136)
Brickwork	8 (6%)
Builder	34 (25%)
Carpentry	2 (1%)
Cleaner	3 (2%)
Electrician	8 (5%)
Finishing (flooring)	3 (2%)
General worker	16 (12%)
Handyman	1 (1%)
Homemation	3 (2%)
Landscaping	4 (3%)
Painting	2 (1%)
Plastering	25 (18%)
Plumbing	11 (8%)
Site foreman	6 (4%)
Steelwork	1 (1%)
Tiling	5 (4%)
Waterproofing	1 (1%)

Table 11. A summary of the respondents' job function and distribution

Table 11 below illustrates a summary of the job function and distribution of workers at the study area. When comparing the various job activities such as electrician a similarity of 4, 9% is seen on Figure 21 and 5% is seen on Table 11. Labour is at 13.4% and general work (labour) is at 12%. Site foreman is at 6.2% and 4% in comparison to Table 11. Though there are similarities in the distribution there are also vast differences in the distribution of certain trades for instance plastering is rated 18% in Table 11 and 0.5% in Figure 21; however the occupational classification is generally the same. It is therefore asserted that the demographic profile workforce that participated in the questionnaire survey is typical of a construction workforce, more specifically of a residential construction workforce.

4.1.1 Experiential years acquired working in the construction sector

The workers who formed part of the study were required to be 18 years of age and older to ensure that they were of a legal working age. These workers had a vast and varying number of years' experience in construction ranging from less than a year to a maximum of 30 years.

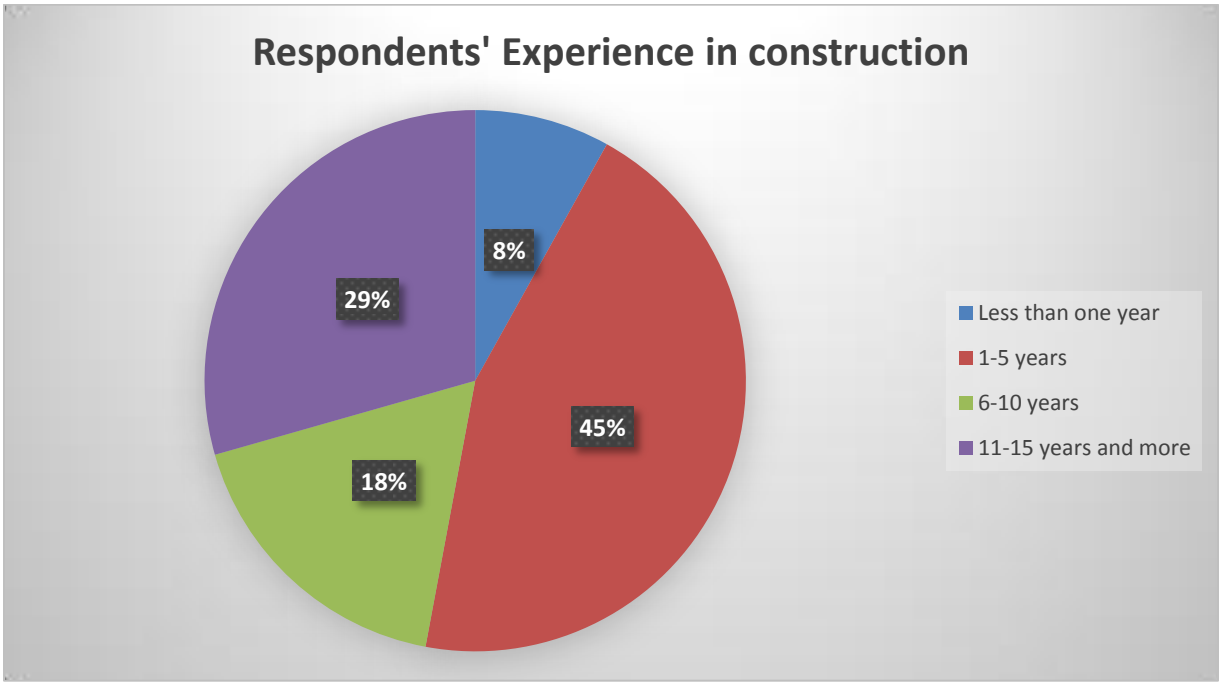


Figure 22. Respondent's experience in years of working in the construction industry.

The majority of the workers, employed by small and micro enterprises (SMEs) in the residential construction sites, were males, with the exception of 3 female cleaners. Out of a total of 136 research participants, 10 of the participants (carpentry, cleaning, plastering, painting, plumbing and general work) had less than a years' experience working in the construction industry. The majority of the workers 45% of the respondents had a 1 year to 5 years' experience, 8% of the workers had less than a years' experience, and 18% had had experience of 6 to 10 years' experience and lastly 29% had 11 years and more years (to a maximum of 30 years) experience. Overall the majority of the workers had worked in the construction industry and had gained sufficient experience and was considered as suitable candidates to partake in the study.

4.2 Response Rate of Respondents

A total of 136 construction workers were targeted and participated in the safety culture survey over a period of two working days at the Waterfall Country Village, Midrand. The study area consisted of over a 100 residential sites that were under construction and willing respondents were randomly selected to participate. The short-form matrix questionnaire was administered to only 25 of the 100 potential under residential construction sites. The short-form matrix questionnaire consisted of 18 questions which required 17 respondents. A total of eight (8) questionnaires were administered by the researcher and the three research assistants at a ratio of two questionnaires per researcher. In total each researcher administered the questionnaire to 34 construction worker participants. The questionnaire survey is an attitude measure based on the general attitude dimensions, and seeks to gather data from individuals regarding their views

on, and feelings about, safety where they work. A brief description of each dimension ("Loughborough University", n.d.):

Organisational Context:

1. Management Commitment - Perceptions of management's overt commitment to health and safety issues.
2. Communication - The nature and efficiency of health and safety communications within the organisation.
3. Priority of Safety - The relative status of health and safety issues within the organisation.
4. Safety Rules and Procedures - Views on the efficacy and necessity of rules and procedures

Social Environment:

5. Supportive Environment - The nature of the social environment at work, and the support derived from it.
6. Involvement - The extent to which safety is a focus for everyone and all are involved

Individual Appreciation:

7. Personal Priorities and Need for Safety - The individual's view of their own health and safety management and need to feel safe.
8. Personal Appreciation of Risk - How individuals view the risk associated with work.

Work Environment:

9. Physical Work Environment - Perceptions of the nature of the physical environment

4.2.1 Calculation of dimension scores

The completed surveys, the responses from the construction companies were compiled in a Microsoft Excel spreadsheet. In order to score the questionnaire responses each item should be scored by giving a value of 5 to the 'strongly agree' category, 4 to the 'agree' response, 3 to the 'neither agree nor disagree' category, 2 to the 'disagree' response, and 1 to the 'strongly disagree' category. Scores then had to be averaged for each item, across the whole group (or groups). The scores then had to be converted to a 1 to 10 scale which was achieved by dividing the actual score by the total possible score and then multiplying by 10. The score had a potential range of 0 to 100 whereby 0-59% as poor, 60-69% as fair, 70-79% as good, 80-89% as very good, 90-100% as excellent. The Loughborough Safety Climate Assessment Toolkit and User Guide (LSCAT) states that the higher the score the better the safety climate and culture and same true for the reverse. Ultimately the organization should seek to obtain the highest score possible in order to have a positive safety culture. The general trends of safety climate surveys has shown that higher scores tend to be associated with lower accident injury rates and indicate the existence of a positive safety culture in an organisation ("Loughborough University", n.d.).

The total scores for each of the nine key dimensions were computed and calculated using Microsoft Excel software. The results obtained from the safety climate survey are summarized and illustrated on both a Table 11 and Figure 23 below:

Calclulating dimension score				
Item	**Dimension**	**Number of respondents per item**	**Average Score**	**%**
1	Management commitment	136	7.28	72.79
2	Communication	136	7.32	73.16
3	Priority of Safety	136	7.13	71.25
4	Safety Rules and Procedures	136	5.64	56.40
5	Supportive Environment	136	7.65	76.47
6	Involvement	136	7.81	78.09
7	Personal Priorities and Need for Safety	136	8.40	84.04
8	Personal Appreciation of Risk	136	5.52	55.22
9	Work evironment	136	6.66	66.62

Table 11. Dimension score calculation.

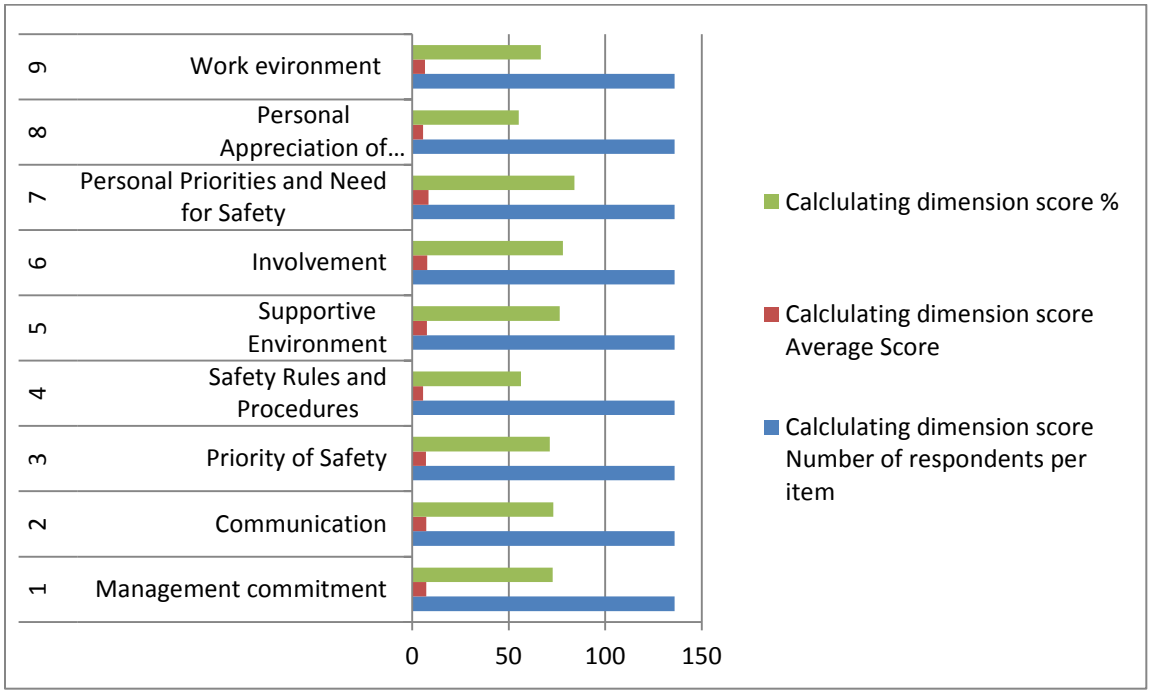


Figure 23. Safety culture survey results.

The nine dimension total scores are listed below in a descending order on the highest to the lowest scores.

1. Personal Priorities and Need for Safety scored the highest at 84.04%
2. Involvement scored 78.09%
3. Supportive Environment scored 76.47%
4. Communication scored 73.16%
5. Management commitment scored 72.79%
6. Priority of Safety scored 71.25%

7. Work environment scored 66.62%
8. Safety Rules and Procedures scored 56.40% and
9. Personal Appreciation of Risk scored the lowest at 55.22%

4.3 Organisational Context Dimension

4.3.1 Management Commitment - Perceptions of management's overt commitment to health and safety issues.

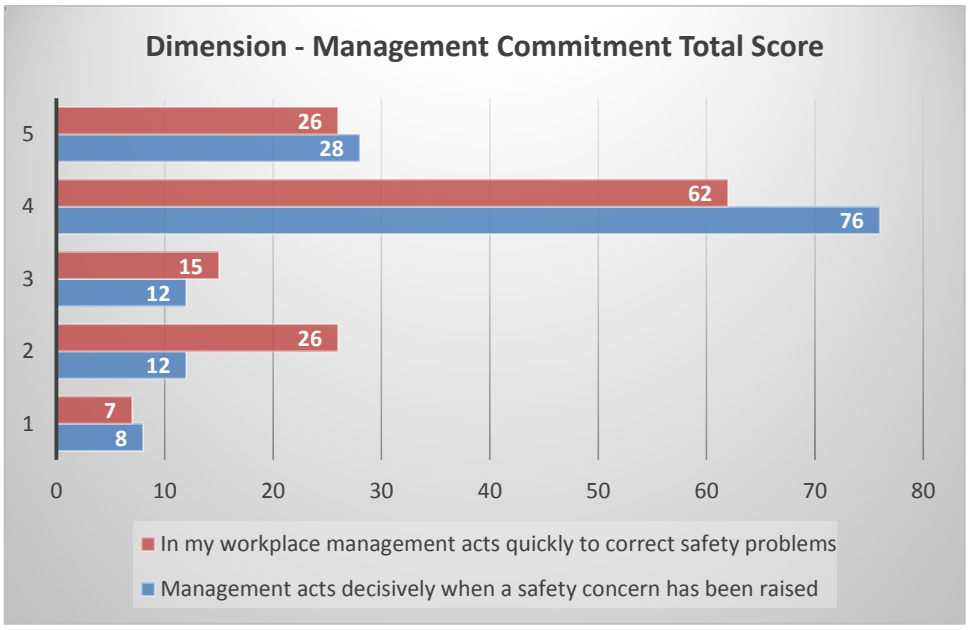


Figure 24. Management commitment dimension score.

Every construction company is said to have its own unique view on safety, and the importance of it. Management plays an important role in leading employees to a safety standard of excellence (Krzywicki & Keesey, 2011). Strong leadership is considered by Krzywicki and Keesey, (2011) to be one of the important factors necessary to improve an organisations safety culture. Management needs to be visible and demonstrate commitment to health and safety of its employees through placing an emphasis on the importance of work-place safety on a consistent and continuous basis. Management commitment to health and safety involves actively promoting safety across all levels within the organisation (Lingard et al., 2014). Everyone involved on construction work sites has a role and responsibility to play towards improving health and safety performance.

The results of the survey indicated that 6% of the workers strongly disagreed, 9% disagreed, 9% were neutral, 56% agreed and 21% strongly agreed when asked if management acted decisively when a safety concern has been raised. When asked if management acted quickly to correct safety problems 5% strongly disagreed, 29% disagreed, 11% were neutral, 46% agreed while 19% strongly agreed. It can be deduced that a majority of the workers were in agreement that management was committed to their safety and well-being; however there were workers who found management to be lacking in their commitment to effectively address their concerns in a timeous manner. A total of 15% of the workers generally disagreed that management acted

decisively when safety concerns were raised, additionally 34% of the workers also generally disagreed when asked if management acted quickly to correct safety problems. The systems theory of accident causation advocates most incidents are found to be attributed by a combination of human factors, environmental and organisational factors (Gillen et al., 2014). Management failing to act decisively and timeously is an organisational flaw that needs to be addressed effectively as literature and practice proves how pivotal it is to creating a positive culture. Overall management commitment dimension scored 72%, ranking 5th place. The Loughborough Safety Climate Assessment Toolkit and User Guide (LSCAT) states that the higher the score the better the safety climate and culture. Though the management commitment scored 72% which is above average and indicates that management is actively involved in the organisation should seek to attain the highest score of 100%, which then translates into the desired goal of achieving zero-harm on construction work sites and as well as the creation of a positive safety culture.

In order to the improve health and safety culture at the work place, management ought to ensure that there are sound, meaningful policies and principles that seek to address health and safety (Krzywicki & Keesey, 2011). These policies and principles can be implemented through the setting of goals, objectives and strategies which seek to attain, improve and maintain a high standard for health and safety. Furthermore, management must make available adequate provision resources to support the implementation of safety activities. Management can also demonstrate commitment by establishing high standards of safety performance and procedures (Krzywicki & Keesey, 2011). This can be achieved when management prioritises safety over production at all times, even in unfavourable situations such at time constraints (Lingard et al., 2014*). "*Poorly designed equipment or operations, poor working conditions can all encourage unsafe behaviours" ("Institution of Safety and Health", 2014:2).

4.3.2 Communication - The nature and efficiency of health and safety communications within the organisation.

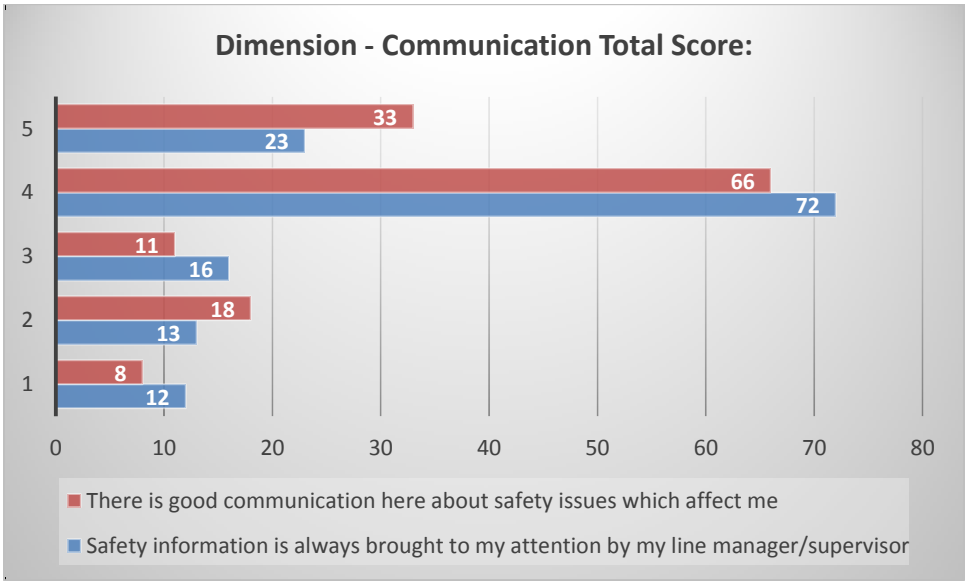


Figure 25. Communication dimension score.

Communication in health and safety is considered to be an important component of forming a positive health and safety culture. Lingard et al. (2014) stress that communication must be open and frequent and further categorises communication into three different classifications in the Table 12 below as the follows:

Ongoing engagement/communication mechanisms	*Management should ensure effective two way communication so that are raised and shared, allowing for appropriate measures to be identified.*
Standardised communication mechanisms	Management should develop various formal communication mechanisms for safety related decision making.
Daily communication mechanisms	Management should also develop daily communication mechanisms to ensure communication occurs between workers and supervisors on an ongoing basis, e.g. toolbox talks, and daily activity briefs.

Table 12. Communication on health and safety (Lingard et al., 2014: 51).

Communication pertaining to occupational health and safety serves to inform workers about health and safety hazards, risks and ways of working (Lingard et al., 2014).Workers are exposed to health and safety hazards and risks on a daily basis while they work, it important that they are educated and made aware of the potential dangers and consequently educated on how to avoid or minimise the hazards and risks. Elicit important information about workers' experiences and concerns (Lingard et al., 2014). It is important that management demonstrates their commitment to the health and safety concerns of workers by being made aware of the workers encounters and concerns and subsequently acting on those concerns immediately. Elicit suggestions for ways to improve health and safety (Lingard et al., 2014). Improving health and safety in the construction sector is a collective effort and is even enforced in legislation which stipulates the respective roles and responsibilities. There must be continuous discourse between the workers and management on finding new way to work better and safer and improving the work environment into a conducive and productive one.

The communication dimension was scored a total of 73% by the workers and ranked at 4th place. When the workers were asked if safety information is always brought to their attention by their line manager/supervisor and responded as follows: 9% strongly disagreed, 10% disagreed, 12% were neutral, 53% agreed and 17% strongly agreed. When the workers were asked if there was good communication at their work place about safety issues that affect them their response was 6% strongly disagreed, 13% disagreed, 8% were neutral, 49% agreed and 24% strongly agreed. Overall the majority of the workers agreed that management communicated matters of health and safety. Based on the score, it is evident that there is room for management to improve communication of health and safety matters, especially because there a 19% fraction of workers who generally disagreed that there was good communication form management about health and safety issues. It must be emphasised that communication on health and safety should be a daily and on-going occurrence as workers face occupational hazards and risks on a daily bases. Wamuziri (2008) undertook a study to determine the safety culture of a small construction enterprise with 35 site based employees. The study collected data via a safety climate questionnaire which was administered to a group of employees in a particular organisation with the support of senior management. The findings reported 97% of the

workforce to agree or strongly agree that health and safety concerns are effectively communicated within the organisation and when asked if their supervisor was willing to listen and discuss safety issues, 93% agreed or strongly agreed. The findings suggest that there is a healthy system in operation for communication of health and safety matters. When comparing the findings of this study of a communication score of 73% to Wamuziri (2008) findings of 93% it becomes evident that there is a need to improve the communication channels of the SMEs operating at the various construction sites at Waterfall estate, though there currently exists good communication.

Bizzell (2008) reports that factors such as the international labour market, local availability of skilled labour and the global economy have brought about a rise in number of foreign workers are engaged in the construction sector. Management is required to train construction workers on health and safety matters, this can be done formally and informally in the form of toolbox meetings. It must be mentioned that communication can be made ineffective by language barriers; an example would be when a toolbox meeting is conducted by an English speaking worker while not all the workers are fluent in English (Bizzell, 2008). In such an instance not all the employees will receive beneficial information from the meeting and effectiveness of toolbox meetings would therefore be limited because of language barrier. Strategies should be developed to support communication with migrant workers. In attempt to curb communication barriers some contractors obligate the subcontractors provide a bilingual worker to be on their crew who also mandated to attend the toolbox talks (Bizzell, 2008). Lingard, Zhang, Harley, Blismas and Wakefield (2014:62) suggest four basic measures to improve health and safety communication with migrant workers:

1. Provide professional interpreters to translate information
2. Convey information using pictures where possible
3. Organise work to minimise language barriers, and
4. Provide English language development opportunities.

4.3.3 Priority of Safety - The relative status of health and safety issues within the organisation.

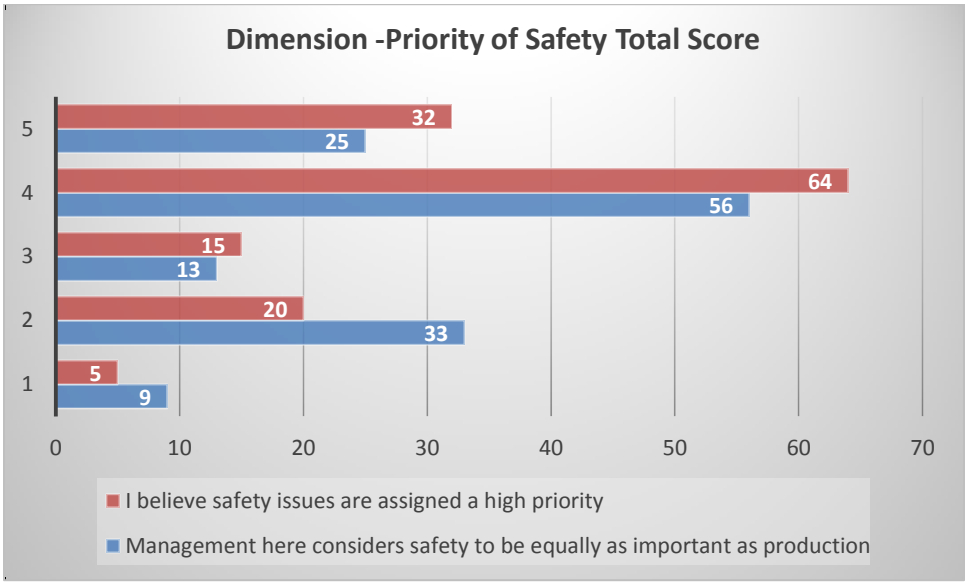


Figure 26. Priority of safety dimension score.

The health and safety record of the construction has been described as poor (ElSafty et al., 2012). When looking at the construction industry holistically, it is the residential sector that has been found to account for a disproportionate number of injuries every year ("Consultation Education and Training", 2014). The construction sector in developing countries has a predominance of small and medium sized contractors, which primarily operate in the domestic market (Adow, 2013). Agumba et al. (2013) mentions that past studies in South Africa indicated that there are challenges of capacity and financial resource constraints experienced by small and medium construction entities. Costs of accidents in South Africa are estimated at 5% of the value of the completed construction while the costs of implementing health and safety systems within a construction company is estimated to be between 0.5% and 3% of the total project costs (Windapo, 2013). The statistics indicate that it is cheaper in the long run to adhere to health and safety requirements compared to the consequences of not doing so; therefore management needs to prioritise health and safety when executing construction activities.

Priority of Safety scored a total 71.25% and ranked 6th place. When the workers where asked if management considers safety to be equally as important as production, their responses were as follows: 7% strongly disagreed, 24% disagreed, 10% were neutral, 41% agreed and 18% strongly agreed. When workers asked the question 'I believe safety issues are assigned a high priority'; 4% strongly disagreed, 15% disagreed, 11% were neutral, 47% agreed and 24% strongly agreed.
Most of the workforce generally agreed that management prioritised work place safety, compared to some who did not agree. It is important for management to take measures to ensure that workers understand the benefits of positive health and safety behaviours, but this cannot be done adequately if workers do not consider management to be prioritising issues of health and safety. Management must enforce a culture of assigning safety as a high priority in daily activities. This will ensure that the workers feel based on the knowledge that their company has their best interest in mind by trying to protect them from hazards on the jobsites (Bizzell, 2008). It is important for organisations to allocate substantial effort as well as invest considerable resources in health, safety and welfare. This will ensure that workers have the necessary equipment and knowledge to follow health and safety procedures at all times and there are always additional staff resources to complete work safely. Companies also ensure that any worker allocated to a task has the necessary skills and training to complete it competently and safely (Healey & Sugden, 2012).
Instead of opposed putting workers under pressure to complete tasks and therefore compromising their safety in attempt to save costs through increased productivity.

Prioritising safety construction work sites also means that there exists a reporting culture whereby workers feel comfortable to raise health and safety concerns or stopping work on health and safety grounds without fear of being blamed or punished (Healey & Sugden, 2012). When management prioritises health and safety, it might have a positive on the individual workers' confidence by enabling them to raise and discuss health and safety issues with anyone on site. It could also prompt workers to propose new ways of working to other colleagues whereby an individual workers might feel encouraged to not only take responsibility for themselves but also for one another regarding health and safety. For example, if workers noticed anything unsafe on site; then can immediately inform others of the situation and avoid any possible harm from occurring (Healey & Sugden, 2012).

4.3.4 Safety Rules and Procedures - Views on the efficacy and necessity of rules and procedures

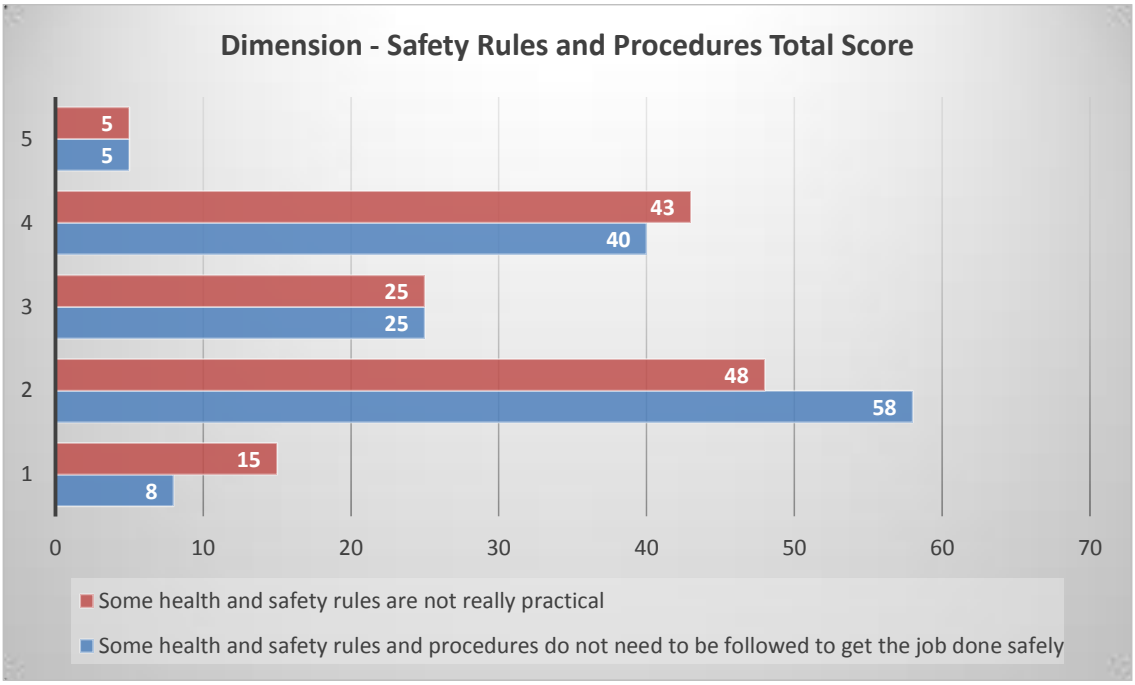


Figure 27. Safety rules and procedures dimension score.

Wamuziri (2006) is of the opinion that an organisations existing culture is a variable that influences its performance. A positive safety culture affords a platform whereby increased awareness, understanding and compliance with safety rules and regulations can be established (Wamuzi, 2006). Compliance with health and safety rules and procedures is a legal requirement and it is requires adherence from both the employers and employees amongst other stakeholders. A study was conducted and it was found that there are different elements that affects small and micro enterprises (SMEs) compliance of health and safety regulations, but the main reasons for health and safety compliance were reported as: legal obligation (67%), health and safety publicity (67%), and insurance costs (50%) (Arewa & Farrell, 2012). While other reported causes were: development of quality systems (50%), and supplier / customer / client pressure 33%. Equally so the main reasons for non-compliance with safety by SMEs were identified as: a lack of awareness of legislative requirements, inadequate knowledge on how to comply with safety obligations, money and poor management structures (Arewa and Farrell, 2012).

Complex or poorly developed procedures can be a reason for people not following recommended actions or instructions. Technically accurate procedures need to be well written, understandable to the employees involved, and periodically revised to ensure that they reflect current operations (Tam & Fung, 2012). An organisation's health and safety procedures should be clear, practical documents that are easy to use (Healey & Sugden, 2012). The respondents were asked if some health and safety rules and procedures do not need to be followed to get the job done safely. Overall the safety rules and procedures dimension scored 56%, ranking at 8th place. The results also showed that 6% strongly disagreed, 43% disagreed, 18% were neutral, 29% agreed and 4% strongly agreed. Secondly the workers were asked the question some health and safety rules are not really practical: 11% strongly disagreed, 35% disagreed, 18% were neutral, 32% agreed and 4% strongly agreed. A large fraction (43%) of the participants deemed it important that they comply with the health and safety rules and procedures, and workers (35%) disagreed that some health and safety rules are not really

practical. Most of the workers comprehended the importance of abiding by safety rules and procedures, while a significant fraction did not uphold the same view. It is commonly agreed in literature that the majority of workplace incidents, injuries, and fatalities are attributed to unsafe work practices of employees rather than unsafe working conditions (Zou, 2011). Studies have found unsafe practices from workers such as not taking protective measures or ignorance of warning as well as workers not using personal protective equipment (PPE) correctly when working as some of the causes of accidents on sites (Lin, Chen & Yang, 2013). Many accidents/incidents that occurred in the workplace especially in the building construction sites were due to inadequate adherence of workers to work procedures (Hassan et al., 2007). Poor attitudes toward safety as well as a lack of interest in safety issues as contributing factors to high accident rates on-site (Zou, 2011). Attitudes need to be changed before behaviour is changed. To improve safety performance, it is important to shape a sound organizational culture regarding construction safety.

4.4 Social Environment

4.4.1 Supportive Environment - The nature of the social environment at work, and the support derived from it.

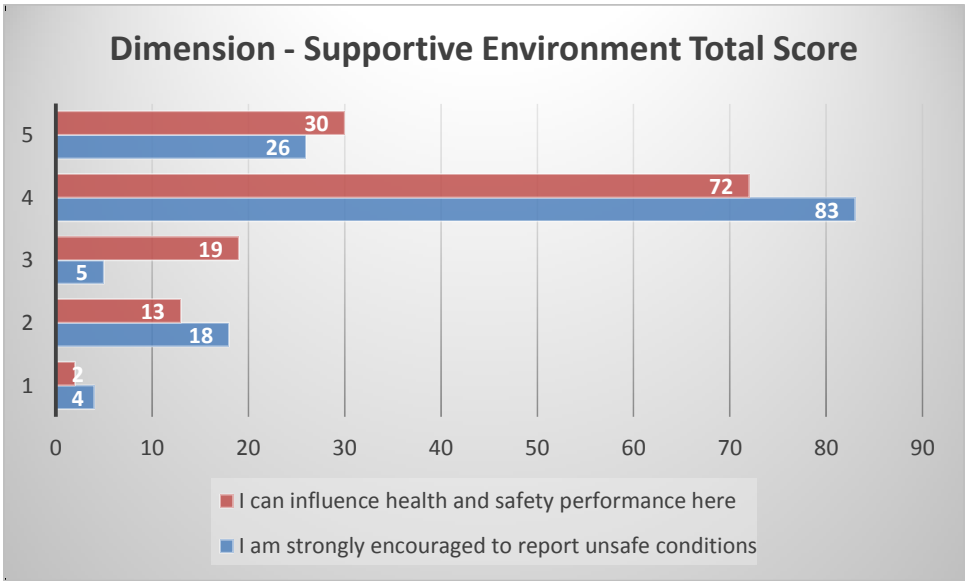


Figure 28. Supportive environment dimension score.

The Supportive Environment dimension scored 76.47%, ranking 3rd place. A supportive work environment has been identified in literature as an important aspect of a health and safety culture. Research confirms that features of the physical and psychosocial work environment influence health and safely related behaviour and performance. It is claimed that the workers' adoption of safe working practices is positively predicted by workers' perceptions that their employing organisation provides a work environment that is supportive of good supervision, training adequacy, job security and communication quality (Lingard et al., 2014). Having a supportive work environment is believed to impact health and safety in a constructive manner.

The workers were asked the question 'I am strongly encouraged to report unsafe conditions' and their responses were as follows: 3% strongly disagreed, 13% disagreed, 4% were neutral, 61% agreed and 19% strong agreed. The majority of the workers (61%) agreed Workers were also asked the question 'I can influence health and safety performance here' their responses were as follows: 1% strongly disagreed, 10% disagreed, 14% were neutral, 55% agreed and 22% strongly agreed. Overall, the majority of the workers responded positively and confirmed that their work environment was supportive and they could influence health and safety performance only 1% strongly disagreed that they could impact the health and safety performance of their organisation. The workers confirmed their involvement in influencing health and safety performance. Improving the status of health and safety on construction sites is a collective effort endeavour.
A supportive work environment is said to constitute the elements listed below as follows:

- The physical condition of the workplace (and amenities) reflects a commitment to excellence in H&S
- Jobs are designed to ensure high standards of health, safety and wellbeing for all personnel
- All personnel feel competent and capable to perform their work in a way that promotes health, safety and wellbeing
- Managers, workers and contractors experience good working conditions with regard to time pressures, workloads and stress
- All personnel can maintain a positive work-life balance

(Lingard et al., 2014: 85).

It has been reported that perceptions of social support and of the level of safety of the physical work environment were both linked to safety related behaviour and involvement in accidents. Worker training on construction health and safety is one way of ensuring that worker complete their tasks in a safe manner. Specifically the more social support workers receive, the safer their behaviour and the less likely they are to be involved in accidents, and the more risky the physical work environment is perceived to be, the less involved workers will be in organisational health and safety activities and the more likely they are to be involved in workplace accidents (Lingard et al., 2014). A positive safety culture can be identified by low accident rates and the residential construction ought to inspire to reduce the disproportionate amount of accidents currently experienced.

4.4.2 Involvement - The extent to which safety is a focus for everyone and all are involved.

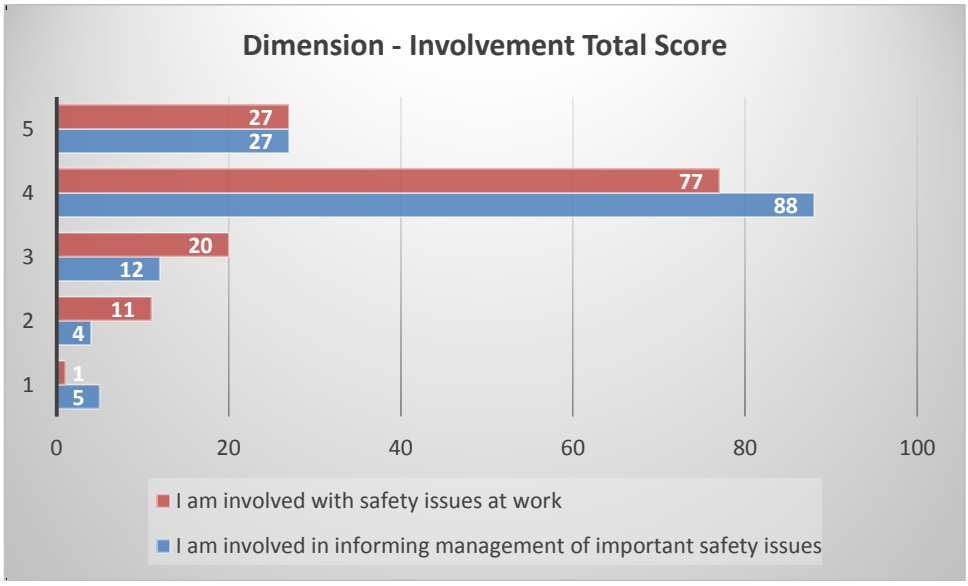


Figure 29. Involvement dimension score.

Involvement of all stakeholders in the health and safety system, including senior management, supervisors and employees is key attaining improved health and safety performance in the residential construction sector. Participative management is stated to be important in fostering a positive safety culture. Effective leaders are said to facilitate Workforce involvement through actively involving workers in work planning and decision making (Gillen et al., 2014). The involvement of people at all levels within the organisation can lead to shared solutions which in turn can help promote a safe working environment.

The overall results for the Involvement dimension scored 78% and ranked 2nd place. When the participants were asked the question 'I am involved in informing management of important safety issues' and 4% strongly disagreed, 3% disagreed, 9% were neutral, 65% agreed and 20% strongly agreed. Subsequently the workers were also asked the question 'I am involved with safety issues at work 1% strongly disagreed, 8% disagreed, 15% were neutral, 57% agreed while 20% strongly agreed. Most of the workers proved to be involved with safety issues at their work place as well as updating management of safety issues. It is therefore assumed that management promotes an environment in which hazards and incidents can be reported without fear of reprisal. However there were some workers 34% who disagreed that management acted decisively and timeously to address their safety concerns. It is therefore emphasised that it is important that management effectively addresses the concerns of their employees when issues are raised, this help promote more worker involvement.

Gillen et al. (2014) conducted a study on factors that were believed to most influence construction safety climate and the findings were such that employee involvement and management commitment – were considered by one of the participating groups to be the top influences on safety climate. Employee involvement received a vote of 26% in comparison to other safety climate dimensions. Tam and Fung (2012) have reported that a successful health and safety culture requires that everyone recognize the importance of health and safety and

actively support health and safety efforts. All employees should be informed of their role, duties, and amount of authority they have concerning matter of occupational health and safety and be proactively involved such matters.

4.5 Individual Appreciation

4.5.1 Personal Priorities and Need for Safety - The individual's view of their own health and safety management and need to feel safe.



Figure 30. Personal priorities and need for safety dimension score.

The theory of Behavioural Based Safety is an approach to safety that focuses on workers' behaviour as the cause of most work-related injuries and illnesses. Behaviours are said to be shaped by the existing safety culture. Ultimately, the purpose of behavioural safety is not simply to improve individual behaviours, but to positively impact the overall safety culture and related safety systems (Pryor & Capra, 2012). Healey and Sugden (2012) undertook a safety culture study of the construction of a stadium and found that health and safety oriented behaviours are embedded in the working practices and daily activities of workers and do have an impact on the extent to which people work in a safe and healthy manner. This requires a shared understanding of the importance of health and safety at work e.g. safety procedures are strictly adhered to, and individuals do not take risks at work. Overall, there is a strong climate of safety where individuals are aware of the negative consequences of risk-taking behaviour and work safely even in the absence of supervision (Healey & Sugden, 2012). A worker can lose their life or suffer detrimental injuries (e.g. loss of mobility) than can leave them unable to work when they do not keep safety on their mind nor behave safely when working in a hazardous environment such as the construction industry.

Personal Priorities and Need for Safety scored the highest at 84.04% at 1st place. Workers were asked if 'safety is the number one priority in my mind when completing a job'; 1% strongly disagreed, 4% disagreed, 6% were neutral, 43% agreed and 45% strongly agreed. The respondents were also asked whether it is important that there is a continuing emphasis on

safety; 0% strongly disagreed, 1% disagreed, 10% were neutral, while 62% agreed and 27% strongly agreed. Of the 9 safety culture dimensions, the Personal Priorities and Need for Safety ranked 1st place and therefore assumed to be the most important aspect for the workers. There was a 0-1% of respondents who strongly disagreed and a total of 5% that disagreed about the overall importance of and need for safety as a personal priority.

It is said that eighty (80) to ninety (90) per cent of all accidents are triggered by unsafe behaviour on the part of employees - behaviours that are within the individual's control, and also within the scope of managers and superiors to effectively control (Lingard & Rowlinson, 2005). Good health and safety behaviours that are embedded in daily working practices and activities encourage workers to work in a safe and healthy manner, even in the absence of supervision (Healey & Sugden, 2012). Over 80% of the workforce viewed it important to keep safety constantly on their mind while working. There is shared and good understanding of the importance of health and safety at work, and its relevance to workers' personal lives (Healey & Sugden, 2012).

4.5.2 Personal Appreciation of Risk - How individuals view the risk associated with work.

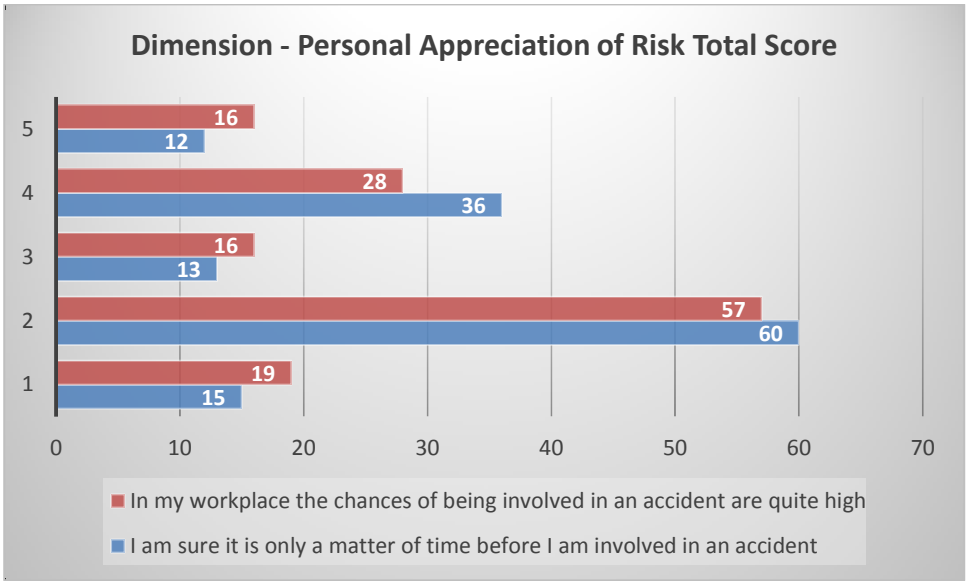


Figure 31. Personal appreciation of risk dimension score

"Poorly designed equipment or operations, poor working conditions can all encourage unsafe behaviours (Institution of Safety and Health, 2015:2)". Risk has been described as a probability of occurrence (likelihood) of an event and the magnitude of its consequence. Risk is described as related to hazard whereby risk becomes the hazard level (hazard severity) combined with the likelihood of the hazard leading to hazard consequence (Phoya, 2012). The construction industry is widely known to be a hazardous and accident prone sector. The industry is braved by a poor occupational health and safety (OHS) record due to an occurrence of unacceptably high number of accidents and work-related illnesses (ElSafty et al., 2012). Personal Appreciation of Risk scored the lowest at 55.22% and ranked 9th place. When workers were asked the question 'I am sure it is only a matter of time before I am involved in an accident'; 11% strongly

disagreed, 44% disagreed, 10% were neutral, 26% agreed and 9% strongly agreed. The workers were also asked the question 'in my workplace the chances of being involved in an accident are quite high of which 14% strongly disagreed, 42% disagreed, 12% were neutral, 21% agreed and 12% strongly agreed.

Although Personal Priorities and Need for Safety scored the highest at 84.04% at 1st place, Personal appreciation of risk ranked on the contrary scored last place. Most of the workers informed the researcher that based on their experience of working at the affluent residential development of Waterfall Country Village, the chances of an accident occurring were very low and they therefore did not strongly perceive or fear their materialisation. All the contractors and subcontractors working at the Waterfall Residential Estate are registered with the National Home Building Registration Council (NHBRC). This study made an assumption that contractors and sub-contractors registered with the National Home Building Registration Council (NHBRC) have a better management of health and safety on their work-sites as they are held accountable by the NHBRC to uphold certain values, principles and standards of which there exist negative consequences for non-compliance.

Construction workers frequently encounter work situations that place them at risk of injury or death (Kaskutas et al., 2009). The lives of these workers are endangered on a daily basis while they carry out their tasks on construction sites. Some of the respondents did agree that there were risks involved and did perceive it to be a matter of time before experiencing an accident at work. It is important that organisations by fostering an environment where workers felt cared for and that allowed workers to perform at the optimum level. Healey and Sugden (2012) suggest that this can be achieved through interventions such as following:

- Raising awareness of worker health as well as safety, through health campaigns and activities
- Undertaking tailor workshops and campaigns to make them relevant and appropriate to workers (i.e. based on trends in recent incidents/injuries on site)
- Encourage workers to consider the impact of injuries sustained at work to themselves, their colleagues and their families
- Balance serious messages with interesting activities to engage workers in campaigns and workshops
- Invest in workers to provide opportunities for them to reflect on how they can transfer good safety practices to their home lives
- Use credible champions and guest speakers to help deliver campaigns and training messages
- Use incentives to encourage positive behaviours on site (e.g. donating money to charity for observations submitted)
- Involve workers as well as management in observing behaviours on site, and recording observations

(Healey and Sugden, 2012:29).

4.6 Work Environment

4.6.1 Physical Work Environment - Perceptions of the nature of the physical environment

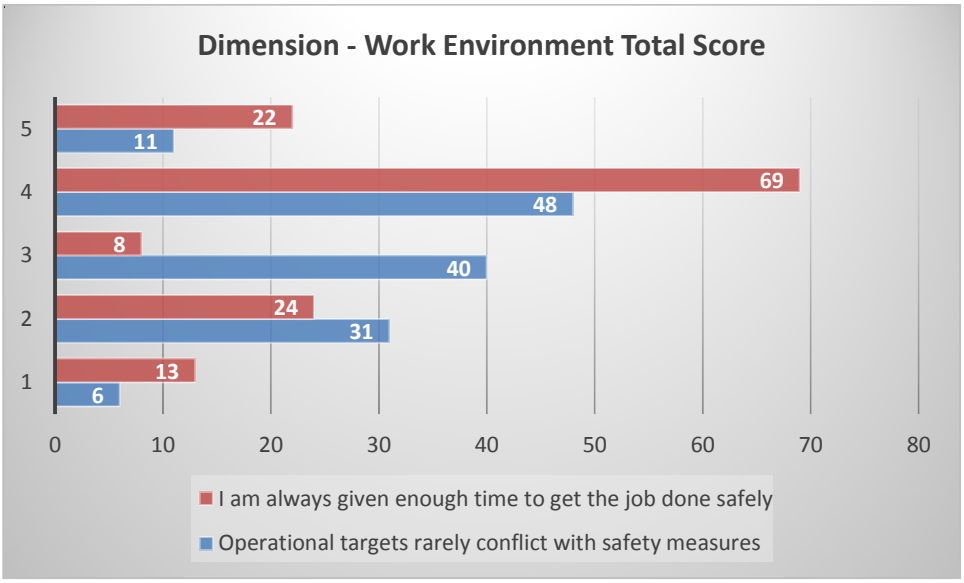


Figure 32. Work environment dimension score.

Bizzell (2008) asserts that for a construction company to be successful there has to be three factors present on every project. The project must be completed on time, within budget, and with no serious worker injuries. If any one of these three factors is missing, the construction company performing the work could lose money or its reputation, which in turn could compromise business opportunities. A majority of construction enterprises put forth a strong effort in the estimating and scheduling of projects, but safety concerns on project do not seem to get the same time and effort as the other two factors (Bizzell, 2008). For instance on site safety professionals are said to be a rarity in residential construction, and safety innovation has lagged behind compared to sectors such commercial construction (Kaskutas et al., 2009). Literature has found matters of health and safety to be overlooked in small and micro enterprises. Moeti-Lysson and Boy (2011) are of the view that the health and safety of employees in small and medium enterprises is overlooked in Africa. This study has already established that there is a high concentration of small and micro enterprises operating in the residential construction sector.

Work environment dimension scored 66.62% ranking at 7th place. When workers were asked if operational targets rarely conflict with safety measures; 4% strongly disagreed, 23% disagreed, 29% were neutral, 35% agreed while 8% strongly agreed. Workers were asked the question 'I am always given enough time to get the job done safely 10% strongly disagreed, 18% disagreed, 6% were neutral, 51% agreed and 16% strongly agreed. There were more workers who generally agreed than not that operational targets did not conflict with safety measures and that they were given sufficient time to execute tasks in a safe manner. A sizable amount of respondents (29%) were neutral in their response to the question operational targets rarely conflict with safety measures. Wamuziri (2008) conducted a study aiming to assess the safety

climate of organisation and some of his findings were that 67% of the workforce actually agrees that their management does not sacrifice safety for productivity whilst 100% of the management believe this to be the case. This study did not look at senior management, but focused on the employee, it is however interesting to see the results of a similar study and the contrasting perceptions of the employer and employee.

It is important that companies consistently recognise the value and importance of workers, whereby with management considers it their responsibility to refrain workers from pressures to 'get the job done' faster or continue working where there were health or safety concerns (Healey & Sugden, 2012). Companies ought to invest sufficient time and resources to provide workers with the relevant equipment, human resource and training as and when it was needed. When management takes such steps it then sends a message that confirms that companies are committed to the health and safety of their employees and considers it their top priority (Healey & Sugden, 2012). Furthermore can invest in health and safety through ensuring that following is in place at their residential construction work sites:

- Work is restructured so far as possible to support health and work-life balance
- Functional teams work hard at sharing and cooperating to improve H&S
- Physical workplace and equipment provided reflect good industry practice
- Design job and work conditions that positively promote health and work life balance
- Effective cross functional cooperation and team work
- All people feel they have the knowledge, skills, and ability to work in a healthy and safe way
- Willing to invest in innovative ways to provide a safe and healthy workplace

(Lingard et al., 2014:85).

4.7 Measuring the Attitudes of Workers towards Health and Safety

The design instrument adopted to collect data was a questionnaire which views safety culture from the individual (employee) perceptions using an assessment method in the form of an attitude survey which looks at management practice (in safety issues) from the workers' point of view, workers' own approach and perceptions towards safety (Taylor, 2011). The questionnaire survey is an attitude measure based on the general attitude dimensions, and seeks to gather data from individuals regarding their views on, and feelings about, safety where they work. The score had a potential range of 0 to 100 whereby 0-59% as poor, 60-69% as fair, 70-79% as good, 80-89% as very good, 90-100% as excellent.

The total scores per dimension obtained from the results of the survey is listed in a descending order below

1. Personal Priorities and Need for Safety scored the highest at 84.04%
2. Involvement scored 78.09%
3. Supportive Environment scored 76.47%
4. Communication scored 73.16%
5. Management commitment scored 72.79%
6. Priority of Safety scored 71.25%
7. Work environment scored 66.62%
8. Safety Rules and Procedures scored 56.40% and
9. Personal Appreciation of Risk scored the lowest at 55.22%

The scores ranged from ratings of very good, good, fair and poor. There was no dimension that was rated as excellent. Just over half of the dimensions were rated as good. Overall Individual appreciation scored the highest (84%) and the lowest (55%). Workers thought it important to manage their own health and safety and the need to feel safe. However most of the workers did not perceive there to be a high degree of risk associated with their work. Most of the workers were of the view that there was a low possibility of risk because of the affluent nature of the residential development. They explained that based on their experience of working on the site they were yet to encounter any negative health and safety experiences such as fatal injuries on duty. Organisational context was generally rated good; except for one expect of safety rules and procedures rated poor at 56%. Workers did not view it necessary to follow certain rules and procedures that concern health and safety. Arewa and Farrell (2012) have reported the main reasons for non-compliance with safety by small and micro enterprises to be attributed by a lack of awareness of legislative requirements, inadequate knowledge on how to comply with safety obligations, money and poor management structures.

Overall the attitudes of the workers was deemed to be mostly positive, however there is a lot of room for improvement at the ultimate goal should be of excellency. Safety attitudes are concerned with individual and collective beliefs about hazards and the importance of safety, and the motivation to act on those beliefs. Such attitudes require that both employees and the organisation are concerned for the outcome of dealing with risks and care about the effect of their activities on people. The study revealed that workers had a poor perception and attitude towards a personal appreciation of risk and therefore workers might not be able to effectively deal with risk or know how to minimise it. Health and safety risks increase the chances of an accidents happening and it is important that workers understand this even if their work environment is supportive and has a positive health and safety record. Safety attitudes reflect individually and collectively held rules and norms relating to how to handle workplace hazards. The current attitude towards the workers personal appreciation of risk is not positive or desirable in a high-risk industry like construction. However the average score of the 9 safety culture dimensions is 70%, thus indicating a rating deemed as ‘good’. There needs to be a development of positive attitudes toward all aspects of worker safety across all levels of an organisation. This will aid in improving the safety culture from a rating of good to better and to best overtime in pursuit of a zero-harm goal on residential construction sites.

4.8 What is the current safety culture of the Waterfall Country Estate Lifestyle Estate?

It is important to note that there is always some form of culture that exists in an organisation or industry. It is said that culture could be described as either positive, negative, a reporting culture, a tolerant culture or any other aspect an organisation so wishes to use to describe the culture (“Safety Leadership at Work”, n.d.). According to organisational culture exists on a scale and that organisations can either have a good or poor health and safety culture. A positive safety culture exists when employees understand the importance of safety and exhibit positive safety behaviours. An illustration of positive safety behaviours includes workers wearing personal protective equipment without being asked to do so, completing risks assessments for all jobs and reporting all incidents when they occur. The awareness and perception of the workers toward safety, health and their working environment are important aspects to enhance the building construction to the better condition to the workers themselves (Hassan et al., 2007). It is known in literature that small and micro enterprises (SMEs) operating in the residential construction account for a high number of occupational health and safety accidents and injuries. The small and micro enterprises employed to build houses at Waterfall residential estate were

required to be registered with the National Home Builders Registration Council (NHBRC) and it was assumed that such contractors and sub-contractors would have a better management of health and safety on their work-sites as they are accountable to this particular body. Small and micro enterprises are considered to generally have a poor safety culture; however the overall findings of the study indicated there is a good safety culture on the various construction sites at the Waterfall Country Estate. Although this is the case, the study suggests that there should never be any complacency where health and safety is concerned and that the construction industry stakeholders should continuously seek new and improved ways of doing things that will aid in obtaining an excellent safety culture on construction work sites.

4.9 Conclusion

A good safety culture often translates into improved discipline in other areas of operations, beyond just fewer on the job injuries and less lost time. Beyond just the obvious safety improvements, companies benefit from increased productivity and overall operating efficiency through improvements that include things not readily visible, such as improved quality, low equipment damage and elimination of litigation issues, production delays, fines and the like. Reduction of these indirect costs also increases profitability (Khan, 2013). The change in safety culture starts with management commitment and continues throughout the organization. Organizations with a positive safety culture are characterized by communication founded on mutual trust, by shared perceptions of the importance of safety and by confidence in the efficacy of preventive measures. Through undertaking the safety culture assessment of the various small and micro enterprises operating on different residential construction sites, the study was able to achieve the following:

- determine and measure the safety culture
- Obtain positive and negative aspects of health and safety in the workplace
- Identify areas for improving health and safety management systems
- Identify perception gaps (in respect to health and safety) of employees
- Understand through employee perceptions the effectiveness of management's health and safety effort.

A zero-incidents safety culture is a concept whose time has come. It is both a challenge and an opportunity.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

A positive safety culture is considered as an essential contributor to the improvement of occupational health and safety performance in construction. Due to the growth in residential construction and the reported health and safety challenges faced by construction small and micro enterprises (SMEs), the study seeks to determine the existing safety culture of small and micro enterprises operating in private residential construction sector. The thus researcher explored the safety perceptions, attitudes, and behaviour of construction workers and management safety practices on small residential construction sites and therefore determine the existing safety culture - with the aim of assisting small and micro enterprises to address their unique health and safety challenges.

5.1 Summary of Findings

The aim of this research was to find out the existing health and safety culture on residential construction sites. A safety climate survey was conducted at the Waterfall Country Village by means of an administered questionnaire. The study formulated two empirical objectives which will be discussed below.

- ***To measure the safety attitudes of workers on small residential construction sites.***

This research sought to measure the attitudes of the workers towards matters of occupational health and safety. The findings of the study implied that there was a positive safety attitude among the work-force.

- ***To determine the existing safety culture on small residential construction sites.***

A good safety climate has been said to be one of the positive indicators of a safety culture. The total scores per dimension obtained from the results of the survey is listed in a descending order below

1. Personal Priorities and Need for Safety scored the highest at 84.04%
2. Involvement scored 78.09%
3. Supportive Environment scored 76.47%
4. Communication scored 73.16%
5. Management commitment scored 72.79%
6. Priority of Safety scored 71.25%
7. Work environment scored 66.62%
8. Safety Rules and Procedures scored 56.40%
9. Personal Appreciation of Risk scored the lowest at 55.22%

The findings of the study suggested there is an existing good safety culture on the various residential construction sites within Waterfall Country Village. The results showed a variation with some dimensions showing good scores and others having a dismal performance which implied that there were certain aspects of a positive safety culture that needed to be improved, such as workers compliance with safety rules and procedures. The development of a positive safety culture is said to have the potential to be an effective tool for improving safety however the measurement of safety performance is said to remain problematic. This is due to the fact

that indicators such as accident rates or compensation costs are lagging indicators and have the ability to measure system failure rather than its success.

The primary research question:

- *What are the existing attitudes and perceptions of workers concerning health and safety on residential construction sites?*

Safety attitudes are concerned with individual and collective beliefs about risks, hazards and the importance of safety, and the motivation to act on those beliefs. Such attitudes require that both employees and the organisation as a whole are concerned for the outcome of dealing with risks and care about the effect of their activities on people. The workers had a good attitude towards health and safety at their respective work sites. According to literature, safe working behaviours are linked to low accident rates. Most of the workers did not perceive their work place to be a high risk environment for accidents and injuries mostly because there were minimal occurrences of such incidents at the Waterfall Country Estate construction sites. The contractors and subcontractors employed at the site have varying and vast experience in the construction industry and are also accountable to various stakeholders, including but not limited to the National Home Builders Registration Council (NHBRC). Their work sites were assumed to have minimal work injuries due to better health and safety management and practices.

Research sub-questions one:

- *Does management prioritise health and safety?*

The results of the survey indicated that management demonstrated commitment to health and safety. The workers also asserted that management assigned safety and productivity equal priority; some workers agreed that their safety was not compromised over getting the job done on time. However some of research respondents disagreed, or were neutral in their view that management prioritized health and safety. The workers attitude towards management commitment to their health and safety was generally positive; however there is a lot of room for management to improve their efforts.

Research sub-questions two:

- *What safety management practices does management employ to address health and safety challenges on construction sites?*

The results of the survey indicated that management demonstrated commitment to the workers' health and safety. Some of the workers agreed that management acted decisively and quickly to address or correct safety problems. Management was also reported to communicate with workers about safety matters by bringing them to the attention of the workers. The results of the study also showed that management ensured that they create a supportive environment for the workers that allows and strongly encourages workers to report unsafe conditions. It is important that workers feel and know that management is committed to their well-being while equally to work productivity. Workers in turn become encouraged to constantly demonstrate safe working behaviour and practices.

Research sub-questions three:

- *What are the workers perception of health and safety?*

Over 80% of the workforce viewed it important to keep safety constantly on their mind while working. There is shared and good understanding of the importance of health and safety at work, and its relevance to workers' personal lives

Findings of study assumptions:

- The systems theory is the most applicable in analysing health and safety matters on residential construction sites The findings of the study indicated that there various factors that affect the safety culture of an organisation such as management commitment, physical work environment and personal appreciation of risk. These dimensions are consistent with the systems theory of accident causation; "environment", "person" and 'behaviour" should be maintained as they all affect one another. These factors were demonstrated to all affect one another positively at the construction sites at Waterfall Country Estate and therefore helped establish a positive safety culture on site.

- Study assumes that residential contractors operating at Waterfall residential construction development have a good existing safety culture. The results of the finding indicated that there exists a good safety culture based on an average score of 70% (70% being rated as good on a scale of 0-100%).

- Contractors and sub-contractors registered with the National Home Builders Registration Council (NHBRC) have a better management of health and safety on their work-sites. The workers reported that there were barely an injuries or accidents experienced on construction sites at the Waterfall Mature Lifestyle residential estate. Most of the workers therefore did not perceive their work to be associated with a lot of risk.

The aim of the research:

This study seeks to explore the safety perceptions, attitudes, and behaviour of construction workers and management safety practices on small residential construction sites and therefore determine the existing safety culture. In order to assist small and micro enterprises to address their unique health and safety challenges. The data analysis found that there workers generally exuded a positive attitude towards health and safety and it was deduced based on the findings that the currently exists a good safety culture on the various construction sites at the Waterfall Country Village. A positive safety culture is also said to be identified by a low rate of accidents. Most of the workers mentioned that they did not perceive their work at that particular residential development to be associated with a lot of risk as they were yet to experience accidents or injuries at work.

5.2 Contribution of the Study to the following:

5.2.1 Knowledge

There is a lot of existing literature on construction health and safety in the body of knowledge (BoK). It commonly known that Small and micro enterprises (SMEs) dominate the construction

industry and contribute significantly to poor construction health and safety performance. There is however limited on the safety culture of SMEs that work in private residential developments in developing countries such as South Africa. This study explored the safety perceptions, attitudes, and behaviour of construction workers and management safety practices on small residential construction sites in order to determine the existing safety culture. The study determined the safety attitudes of workers and existing safety culture of SMEs on private residential construction sites and found that there is an existing a positive safety culture. Workers were particularly found to have an excellent attitude concerning the dimension Individual appreciation: Personal Priorities and Need for Safety - the individual's view of their own health and safety management and need to feel safe. On the contrary workers were also found to have a poor attitude on Personal Appreciation of risk; that is how individuals view the risk associated with work. The workers generally agreed that their personal safety was a priority, yet they did not perceive their work-sites to be high-risk concerning health and safety hazards.

5.2.2 Practice

A positive safety culture is considered as an essential contributor to improved occupational safety performance in construction. There is a pressing need to change the status quo of construction industry's prevailing safety culture and work towards one of a zero-harm on work-sites. The loss of human life, reduced quality of health of workers and negative implications on the economy is calling for a proactive and collective effort from all affected stakeholders to improve the health and safety record of the industry as we know it. The study seeks to determine the safety culture of small and micro enterprises and consequently propose initiatives to help raise health and safety standards, with particular focus on employee attitudes and perceptions.

5.3 Limitations of This Study

This study only looked at one case (Waterfall Country Village – Gate 4) to assess safety cultures of small and micro enterprises. There needs to be a study that focuses on all the residential sites under construction within the greater Waterfall Residential Estate Development. Only data obtained from workers, and not senior management was used as part of the study. Safety culture was therefore measured from the employees' perspective. Recent work has identified trust as playing a key role in safety culture which is rarely measured by existing models. This study was therefore unable to include or assess trust as component of a safety culture.

5.4 Areas of Further Study

The health and safety of workers employed by small and micro enterprises (SMEs) is overlooked in Africa and other developing countries. There is limited research on the safety culture of SMEs who operate in the private residential construction sector. This study identified some existing gaps in literature which include yet not limited to the following:

- A full scale study of the safety culture of SMEs operating on private residential projects using the full survey and triangulation approach which includes attitude assessment and questionnaires, interviews and focus groups and behavioural and observational assessment.

- The safety culture of larger enterprises that specialise in residential construction to gain better insight of the health and safety challenges experienced by the different organisations. Literature has established the issues of health and safety vary based on the size of the construction company.

- The safety culture of public (government) funded residential developments. Housing is a basic human right which most South Africans are yet to realise. The high demand for housing by public sectors has attracted entrepreneurs falling under the small and medium contractor categories to venture into the residential construction sector.

- The contractors and sub-contractors building the houses at the estate had to be registered with the National Home Builders Registration Council (NHBRC) and abide by certain standards and criteria. Further studies should be undertaken to determine the health and safety performance management of small and micro enterprises that are registered with the NHBRC and those that are not.

- Safety culture is comprised of different dimensions such as organisational context – safety rules and procedures and individual appreciation – personal appreciation of risk. The findings of this study showed that these components of safety culture scored poorly in the survey. A further study can be undertaken to gain a deeper understanding of how workers perceive the efficiency and necessity of rules and procedures. Additionally, the study should seek to gain a deeper understanding of how individuals perceive the risk associated with work.

5.5 Conclusion and Recommendation

The construction industry plays an important role in our lives, more specifically the residential sector; from the built environment that we live in, the economy we participate in and the overall social well-being of our communities. The construction industry is also unfortunately widely known to be a hazardous and accident prone sector. The construction industry is predominantly constituted of small, micro and medium enterprises. Literature has established that small construction companies experience more occupational health and safety problems in comparison to the medium and larger counterparts.

5.5.1. The study recommends the following:

- A positive safety culture is said to have the potential to be an effective tool for improving safety performance. However the measurement of safety performance is said to remain problematic. This is due to the fact that indicators such as accident rates or compensation costs are lagging indicators and have the ability to measure system failure rather than its success. This study recommends that literature develops a consensus on how to measure safety culture including but not limited to indicators such as accident rates or compensation cost.

- The interpretation of results of the safety climate assessment require an action plan to be developed, with milestones established, that may be linked to the organisation's business plan, vision or mission. These milestones should be realistic and understandable. The study proposes that the action plan focus strongly on the following dimensions: Work environment scored, Safety Rules and Procedures and Personal Appreciation of Risk.

- Construction workers employed by small and micro enterprises demonstrated a poor personal appreciation of risk. The possibility of being injured on duty and the frequency there of was not perceived as a high risk. Although the health and safety management of the SMEs operating at the Waterfall Country Estate is considered to exceptional (due to minimal injuries), the construction residential sector is prone to high health and safety hazards and risks. It is important that workers do not become complacent and believe to be immune to injury on duty, even if they are highly experienced or have never been involved in an incident. It is recommended that training on personal appreciation of risk is provided for workers employed by SMEs that operate in the private residential sector.

5.5.2 Concluding remarks

Small and micro enterprises (SMEs) dominate the construction industry and general operate in the residential sector. These enterprises contribute significantly to the overall health and safety problems of the construction industry. These SMEs are faced with unique challenges that cause them to have a poor health and safety performance. Unsafe behaviours and poor worker attitudes have been blamed as the lead cause of accidents on construction work sites. The current health and safety status of industry calls for more accountability instead of blame shifting amongst stakeholders. Interventions and strategies that seek to address the occupational health and safety of the construction industry should not be reactive, but should rather be a proactive and anticipatory process. It is therefore crucial to begin exploring proactive approaches towards the establishment of a positive health and safety culture, whereby more commitment and accountability is shown from all key stakeholders who collectively have the means to influence and contribute towards the creation of a positive safety culture in residential construction. A positive safety culture leads toward the desired goal of zero safety incidents in the work place. The time is has come for the residential construction and the construction industry as a whole to aggressively work towards a zero-harm culture where excellent health and safety management and practices epitomise the industry.

REFERENCES AND APPENDICES

REFERENCE LIST:

Books, Conference papers, proceedings and journals:

Aboagye-Nimo, E., Raiden, A., & Tietze, S. (Eds.). (2011). *Investigating good health and safety practices in small construction firms in the United Kingdom. Proceedings of the 27th Annual ARCOM Conference*. Bristol: ARCOM.

Adow, O. (2013). The Management of Health and Safety of Construction Sites in Accra. *Civil and Environmental Research, 3(12), 127-131.*

Agumba, J. N., & Haupt, T. (2009). *Construction Health and Safety Culture in South African Small and Medium Enterprises. Proceedings 4th Built Environment Conference*. Livingstone – Zambia.

Agumba, J., Pretorius, J.H., & Haupt, T. (2013). Health and safety management practices in small and medium enterprises in the South African construction industry. *ActaStructilia, 20(1), 66-88*.

Alli, B.O (2008). *Fundamental Principles of Occupational Health and Safety* (2nd ed.). Geneva: International Labour Office.

Arewa A.O., & Farrell, P. (2012). A review of compliance with health and safety regulations and economic performance in small and medium construction enterprises *In*: S.D. Smith (Eds.), *Proceedings of 28th Annual* Association of Researchers in Construction Management (pp. 423-432}. Edinburgh, UK: *ARCOM.*

Chan, E. (2013). A Safety culture in construction business. *Journal of Research in International Business and Management*, 2(13), 335-340.

Che Hassan, C.R., Basha, O.J., & Wan Hanafi, W.H. (2007). Perception of Building Construction Workers towards Safety, Health and Environment. *Journal of Engineering Science and Technology, 2, (3),* 271- 279.

Chiocha, C., Smallwood, J., & Emuze, F. (2011). Health and safety in the Malawian construction industry. *ActaStructilia*, 18(1), 69-80.

Choi, S.D., & Carlson, K. (2014). Occupational Safety Issues in Residential Construction Surveyed in Wisconsin, United States. *Industrial Health*, (52), 541-547.

Chong, H.Y., & Low, T.S. (2014). Accidents in Malaysian Construction Industry: Statistical Data and Court Cases. *International Journal of Occupational Safety and Ergonomics (JOSE),* 20 (3), 503–513.

Chuks, O.K., & Uchenna, O.P. (2013). Appraising the influence of cultural determinants of construction workers safety perception and behaviour in Nigeria. *International Journal of Engineering and Medical Science Research*, (1), 11-24.

Dadzie, J. (2013). Perspectives of Consultants on Health and Safety Provisions in the Labour Act: A Study into Theory and Practicals. *Engineering Management Research*, 2(1), 34-42.

Diaz-Cabrera, D., & Hernandez-Fernand, E. (2007). An evaluation of a new instrument to measure organisational safety culture values and practices. *Accident Analysis and Prevention, (*39), 1202-1211.

ElSafty, A., ElSafty. A., & Malek, M. (2012). Construction Safety and Occupational Health Education in Egypt, the EU, and US Firms. *Open Journal of Civil Engineering*, (2), 174-182.

Fang, D., & Wu, H. (2013). Behavior-based Safety for Construction. In R.M Choudhry, S. Azhar, J.W. Hinze and Zia-ud-Din (Eds), *Proceedings of the International Conference on Safety, Construction Engineering and Project Management (pp.1-8).* Islamabad, Pakistan: *CSCEPM*.

Friend. M.A., & Kohn, J.P. (2007). *Fundamentals of Safety and Health*. United States of America: Government Institutes.

Geminiani, F. & Smallwood, J. (2008). A critical review of the effectiveness of the Department of Labour (DoL) Occupational Health and Safety (OH&S) Inspectorate in relation to the construction industry in South Africa, *ActaStructilia*, 15 (2), 6-28.

Gillen, M., Goldenhar, L.M., Hecker, S. & Schneider, S. (2014). *Safety Culture and Climate in Construction: Bridging the Gap between Research and Practice*. Washington, DC: The Center for Construction Research and Training.

Huang, X., & Hinze, J. (2006). Owner's Role in Construction Safety. *Journal of Construction Engineering and Management*, 132(2), 164-173.

Hon, C.K.H., & Chan, A. (2009). Safety climate: recent developments and future implications. In Lingard, Helen, Cooke, Tracy, & Turner, Michelle (Eds.) *Proceedings of the W099 Conference: Working Together: Planning, Designing and Building a Healthy and Safe Construction Industry*, (pp. 45-54). RMIT University, Melbourne. VIC.

Hosseinian, S.S., & Torghabeh, J.Z. (2012). Major Theories of Construction Accident Causation Models: A Literature Review. *International Journal of Advances in Engineering and Technology*, 4(2), 53-66.

Hung, Y-H., Smith-Jackson, T., & Winchester, W. (2011). Use of attitude congruence to identify safety interventions for small residential builders. *Construction Management and Economics*, (29), 113-130.

Jacobs, S.A., & Furgerson, S.P. (2012). Writing Interview Protocols and Conducting Interviews: Tips for Students New to the Field of Qualitative Research. *The Qualitative Report,* (17), 1-10.

Kaskutas, V., Dale, A.M., Nolan, J., Patterson, D., Lipscomb, H.J., & Evanoff, B. (2013). Fall prevention and safety communication training for foremen: Report of a pilot project designed to improve residential construction safety. *Safety Res*, (44), 111–118.

Khan, M.I. (2013). Developing a Safety Culture in Developing Countries. In R.M Choudhry, S.Azhar, J.W. Hinze & Zia-ud-Din (Eds), *Proceedings of the International Conference on Safety, Construction Engineering and Project Management* (pp.26-31). Islamabad, Pakistan: CSCEPM.

Krzywicki, R.S., & Keesey, M.B. (2011). *Using the Safety Perception Survey to Assess Your Organization's Safety Culture*. London: Du Point Sustainable Solutions.

Kumar, R. (2011). *Research Methodology- A step-by-step guide for beginners* (3rd ed). New Dheli, India, Sage Publications. Retrieved from: http://www.sociology.kpi.ua/wp-content/uploads/2014/06/Ranjit_Kumar-Research_Methodology_A_Step-by-Step_G.pdf

Lingard, H., Cooke, T., & Blismas, N. (2011). Co-workers' response to occupational health and safety. An overlooked dimension of group-level safety climate in the construction industry? *Engineering, Construction and Architectural Management*, 18 (2), 159-175.

Lingard, H. & Rowlinson, S. (2005). Occupational Health and Safety in Construction Project Management. New York*:* Spon Press Publishers.

Mayer, C. J., & Somerville, C.T. (2000). Residential Construction: Using the Urban Growth Model to Estimate Housing Supply. *Journal of Urban Economics*, (48), 85-109.

Meekel, S., & Hyrmak, V. (2012). Has Construction Site Safety Changed in Ireland; and is Company Size the Key to Safety Performance Success? Proceedings of the ASC 48th International Conference. Birmingham: ARCOM.

Moeti-Lysson, J., & Boy, R.L. (2011). A study of health and safety practices in small and medium sized enterprises: -A case of Botswana. *E3 Journal of Business Management and Economics*, 2(3), 125-131.

Muhammad I. K. (2013). Developing a Safety Culture in Developing Countries. In R.M. Choudhry, S. Azhar, J.W. Hinze and Zia-ud-Din (Eds.). *Proceedings of the International Conference on Safety, Construction Engineering, and Project Management Issues, Challenges and Opportunities in Developing Countries* (pp.26-31}. Islamabad: (ICSCEPM).

Nussbaum, M.A., Shewchuk, J.P., Kim, S., Seol, H. & Guo, C. (2009). Development of a decision support system for residential construction using panellised walls: Approach and preliminary results. *Ergonomics*, 52 (1), 87–103.

Othman, A.A. (2012). A study of the causes and effects of contractors' non-compliance with the health and safety regulations in the South African construction industry. *Architectural Engineering and Design Management*, (8)3, pp.180-191.

Priyadarshani, K., Karunasena, G., & Jayasuriya, S. (2013). Construction Safety Assessment Framework for Developing Countries: A Case Study of Sri Lanka. *Journal of Construction in Developing Countries,* 18(1), 33-51.

Raja Prasad, S.V.S., & Reghunath, K.P. (2010). Empirical Analysis of Construction Safety Climate – A Study. *International Journal of Engineering Science and Technology*, 2(6), 1699-1707.

Saunders, M, Lewis, P., &Thornhill, A. (2012). *Research Methods for Business Students* (6th ed.). United Kingdom, Pearson Education Limited.

Smallwood, J., Haupt, T., & Shakantu, W. (2009*). Construction Health and Safety in South Africa: Status and Recommendations*. Pretoria: Construction Research Education and Training Enterprises Report-Construction Industry Development Board (CIDB).

Smith-Jackson, T., Artis, S., Hung, H-Y., Kim, N.H., Hughes, C., Kleiner, B., & Nolden, A. (2011). Safety Critical Incidents among Small Construction Contractors: A Prospective Case Study. *The Open Occupational Health & Safety Journal*, (3), 39-47.

Tam, V. W. Y., & Fung, I.W. H. (2012). Behavior, Attitude, and Perception toward Safety Culture from Mandatory Safety Training Course. *Journal of Professional Issues in Engineering Education & Practice*, (138), 207-213.

Umeokafor, N., & Umeadi, B. (2014). *Compliance With Occupational Safety And Health Regulations: A Review of Nigeria's Construction Industry*. *Proceedings of the 3rd International Conference on Infrastructure Development in Africa*. Abeokuta, Nigeria, 17th-19th March, 2014.

Wamuziri, S. (2006). Safety culture in the construction industry. *Municipal Engineer*, 159 (3), 167-174.

Wamuziri, S. (2008) Improving safety performance in construction through cultural change. In: A. Dainty (Eds.) *Proceedings of the 24th Annual Association of Researchers in Construction Management Conference* (pp.1103-1111}. UK: ARCOM.

Wamuziri, S. (2013). Factors that influence safety culture in construction. *Management, Procurement and Law*, 166 (5), 219-231.

Wilkins, J.R. (2011). Construction workers' perceptions of health and safety training programmes. *Construction Management and Economics*, 29(10), 1017-1026.

Windapo, A. (2013). Relationship between Degree of Risk, Cost and Level of Compliance to Occupational Health Safety Regulations in Construction. *Australasian Journal of Construction Economics and Building*, 13(2), 67-82.

Zhang, L., & Gao, Y. (2012).Safety Culture Model and Influencing Factors Analysis in Construction Enterprises of China. *Research Journal of Applied Sciences, Engineering and Technology*, 4(18), 3297-3312.

Ordinary website:

Barreiro, P.L., & Albandoz, J.P. (2001). Population and sample. Sampling techniques. Management Mathematics for European Schools, the University of Seville, Spain. Retrieved from: https://pdfs.semanticscholar.org/6d37/62e85a877163c7f02306d169f5b7ebd4632d.pdf.

Bester, D. (2013).*The construction road-safety drive escalates: Construction industry road accidents a serious concern*. Master Builders South Africa. Retrieved from: www.mbsa.org.za/35-sab-august-2013/file.html.

Bizzell, S.G. (2008). Safety Practices of Small to Medium-Sized Construction Firms. University of Florida, Florida. Retrieved from: http://ufdc.ufl.edu/UFE0022192/00001

Century Property Developments. (n.d.). Waterfall – Country Lifestyle Estate and Village brochure. Retrieved from: http://www.century.co.za/email/270wce.pdf.

Clark, S. (2008). Residential Construction Presents Many Hazards. Laborers' Health & Safety Fund of North America. Retrieved from: http://www.lhsfna.org/index.cfm/lifelines/may-2008/residential-construction-presents-many-hazards/.

Cokayne, R. (2014). Waterfall Estate project to transform face of Midrand. Retrieved from: http://www.iol.co.za/business/news/waterfall-estate-project-to-transform-face-of-midrand-1.1674400.

Connecticut Department of Public Health (2009). Top 5 OSHA Violations in Residential Construction. Retrieved from: http://www.ct.gov/dph/occupationalhealth.

Consultation Education & Training (CET) Division (2014). Safety in Residential Construction. Presented By: Michigan Occupational Safety & Health Administration (MIOSHA) Michigan Department of Licensing & Regulatory Affairs (LARA). Retrieved from: www.michigan.gov/miosharesidential.

DFW Web Presence. (n.d.).Theories of Accident Causation. Retrieved from: http://dfwwebpresence.com/files/FlashDrives/New%20Drive/Classes/occupational%20safety%20and%20health/To%20Upload/OSH_CH3.pdf.

du Toit, J. (2015). Residential building statistics. ABSA Home loans. Retrieved from: http://propertywheel.co.za/wp-content/uploads/2015/09/ABSA-Building-stats-Jul-2015.pdf

Entrepreneur's Toolkit for social and environmental entrepreneurs (2009). Small, micro and medium enterprises in South Africa. Retrieved from: http://www.entrepreneurstoolkit.org/index.php?title=Small,_micro_and_medium_enterprises_in_South_Africa.

European Agency for Safety and Health at Work (2004). Achieving better safety and health in construction Information report. Retrieved from: file:///F:/TE5904136ENC_-_Achieving_better_safety_and_health_in_construction.pdf.

French, I. (2015). Real Estate Building the future of Africa. Retrieved from: https://www.pwc.co.za/en/assets/pdf/real-building-the-future-of-africa-brochure-2-mar-2015.pdf.

Furter, E. (2011). Construction Health and Safety accidents 'halved in five years'. Retrieved from: http://sheqafrica.com/construction-compensation/.

Gauteng Growth Development Agency (2015). Construction Sector Fact Sheet. Retrieved from: http://www.lemmasijura.co.za/ggdasite/index.php/knowledge-centre/category/28-sector-reports.

Google Maps: Map of Midrand, Gauteng (2016). Retrieved from: https://www.google.co.za/search?q=map+of+midrand+area&biw=1920&bih=943&source=lnms&tbm=isch&sa=X&ved=0CAYQ_AUoAWoVChMI-MiYg_n9yAIVyWsUCh3ZsQQ4&dpr=1#imgrc=40zbRJh6JOaFlM%3A.

Hay. D. (n.d). Safety Culture Assessment Tool – An overview. Work Place Press. Retrieved from: http://www.workplacepress.co.nz/assessment_tool.pdf.

Healey, N., & Sugden, C. (2012). Safety culture on the Olympic Park. Retrieved from http://www.hse.gov.uk/research/rrpdf/rr942.pdf

Health and Safety Execute (2015). Health and Safety in Construction sector Great Britain, 2014/15. Retrieved from: www.hse.gov.**uk**/statistics/industry/construction/construction.pdf.

Health and Safety Executive. (n.d.). Common topic 4: Safety culture. Retrieved from: (http://www.hse.gov.uk/foi/internalops/fod/inspect/mast/safetychecklist.pdf.

Home Design Expo (2014). Century Property Developments. Retrieved from: http://www.homedesignexpo.co.za/architectsbuilderswce.html.

Institution of Safety and Health (Iosh) (2015).Promoting a positive safety culture – a guide to health and safety culture. Retrieved from: www.iosh.co.uk/freeguides.

International Labour Organization. (2014). Creating Safe and Healthy Workplaces for All International Labor Organization Report prepared for the G20 Labor and Employment Ministerial Meeting Melbourne, Australia, 10-11 September 2014 Retrieved from: http://www.ranepa.ru/images/media/g20/2014brisbane/ILO-safe_and_healthy_workplaces.pdf.

iSix Sigma. (n.d). How to Determine Sample Size, Determining Sample Size. Retrieved: https://www.isixsigma.com/tools-templates/sampling-data/how-determine-sample-size-determining-sample-size.

Lingard, H., Zhang, R., Harley, J., Blismas, N., & Wakefield, R. (2014). Health and Safety Culture. Centre for Construction Work Health and Safety. Retrieved from: http://www.rmit.edu.au/research/health-safety-research.

Loughborough University. (n.d).Offshore Safety Climate Assessment. Retrieved from http://www.lboro.ac.uk/media/wwwlboroacuk/content/sbe/downloads/Offshore%20Safety%20Climate%20Assessment.pdf.

MacDonald, S., & Headlam, N. (2009). Research Methods Handbook Introductory guide to research methods for social research. Retrieved from: www.cles.org.uk/wp-content/uploads/2011/01/Research-Methods-Handbook.pdf.

Marx, H.J. (2014). Results of the 2014 CIDB Construction Industry Indicators. Retrieved from: http://www.cidb.org.za/publications/Documents/Construction%20Industry%20Indicators%20-%202014%20Survey%20Results%20-%20Full%20Report.pdf.

Ministry of Business, Innovation and Employment (n.d.). Residential Construction Sector Market Study Issues Paper. Retrieved from: http://www.mbie.govt.nz/info-services/building-construction/documents-and-images-library/residential-construction-sector-market-study/Residential%20Construction%20Sector%20Study%20-%20Issues%20Paper.pdf.

Mothiba, G. (2012). DG Speech Construction Accord launch. Retrieved from: http://www.labour.gov.za/DOL/media-desk/speeches/2012/dg-speech-construction-accord-launch-24-august-2012.

National Home Builders Registration Council – NHBRC (n.d). The NHBRC gives protection against shoddy workmanship. Retrieved from: http://sans10400.co.za/national-home-builders-registration-council/.

National Home Builders Registration Council (n.d). The Act. Retrieved from http://www.nhbrc.org.za/the-act/.

Nxesi, T. (2014). Construction Regulations Launch (Address by the Minister of Public works). Retrieved from: http://www.publicworks.gov.za/PDFs/Speeches/Minister/sacpcmp_construction_regulations_10022014.pdf.

OSTN. (2000-2005). Introduction to Practical Behavior-Based Safety. Retrieved from http://www.oshatrain.org/pdf/otn717w.pdf.

HaSPA (Health and Safety Professionals Alliance). (2012). The Core Body of Knowledge for Generalist OHS Professionals. Tullamarine, VIC. Safety Institute of Australia. Retrieved from: http://www.ohsbok.org.au/wp-content/uploads/2013/12/32-Models-of-causation-Safety.pdf.

Profiles of the Residential Construction Workforce and the Workers Defense Project. (n.d.). Retrieved from: http://www.aspenwsi.org/wordpress/wp-content/uploads/Profiles-of-the-Residential-Construction-Workforce-and-the-Workers-Defense-Project.pdf.

Research Methodology. (n.d).retried from: http://www.ihmgwalior.net/pdf/research_methodology.pdf

Safe Work Australia (2015). Work Health and Safety Perceptions: Construction Industry Retrieved from: http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/905/whs-perceptions-construction-industry.pdf.

Safety Attitudes, Safety Climate, and Employee Health among Older and Younger Workers Working at Height in Construction Industry: A Facet Approach. (n.d.). Retrieved from: http://www.bre.polyu.edu.hk/research/ConstrSafetyAtHeight/archive/Fall_from_Height_Sol_%20HK/HKReport/OSHC_Employee.pdf.

Safety Leadership at work (n.d). Safety culture, climate and leadership. Retrieved from https://www.worksafe.qld.gov.au/__data/assets/pdf_file/0010/116848/safety-culture-climate-leadership.pdf.

Sampling techniques. (n.d.). Retrieved from: http://optimierung.mathematik.uni-kl.de/mamaeusch/veroeffentlichungen/ver_texte/sampling_en.pdf.

Stat Trek. (n.d). Statistics and Probability. Retrieved from: stattrek.com.

Shodhganga INFLIBNET Centre. (n.d.). Chapter - ii review of literature. Retrieved from: http://shodhganga.inflibnet.ac.in/bitstream/10603/8661/10/10_chapter%202.pdf.

Statistics Canada, (2015). Statistics Canada Quality Guidelines. Retrieved from: http://www.statcan.gc.ca/pub/12-539-x/12-539-x2009001-eng.htm.

Taylor, T.N. (2011). Occupational Safety and Health culture assessment -A review of main approaches and selected tools. A report commissioned by the European Agency for Safety and Health at Work (EU-OSHA), Luxembourg: Publications Office of the European Union. Retrieved from: https://osha.europa.eu/.../culture_assessment_soar_TEWE11005ENN.

The Aspen Institute (n.d.). Overview of Workers in Residential Construction. Retrieved from: http://www.aspenwsi.org/wordpress/wpcontent/uploads/ConstructionOverveiw.pdf.

The Health Foundation (2011). Measuring Safety Culture. Retrieved from: http://www.health.org.uk/publication/measuring-safety-culture.

The South African Council for the Project and Construction Management Professions (SACPCMP) (2012). Construction health and safety position paper. Retrieved from:http://www.masterbuilders.co.za/resources/docs/News-Articles-2012-PDFs/SACPCMP_CHS_Position_Paper_v_8_Registrar_21_August_2012.pdf.

Thomas, P.Y. (2010). Research Methodology and Design. Retrieved from: http://uir.unisa.ac.za/bitstream/handle/10500/4245/05Chap%204_Research%20methodology%20and%20design.pdf

United States Department of Labour (no date). Residential construction industry – Hazards and solutions. Retrieved from: https://www.osha.gov/SLTC/residential/hazards.html.

van Niekerk, S. (2014). Nine die in Meyersdal building collapse - Supporting structures and columns collapsed on a two storey building in Meyersdal Eco Estate, taking the lives of nine construction workers. Retrieved from http://comarochronicle.co.za/56432/death-toll-rises-to-nine-2/.

Vermuelen, A. (2014). Changes to Construction Regulations of the Occupational Health and Safety Act (OHASA) as of 7 February, 2014. Retrieved from: https://www.ensafrica.com/Uploads/Images/news/Pieter_Colyn_Engineering_News_Article.pdf.

Wadick, P. (n.d). Safety Culture among Subcontractors in the Domestic Housing Construction Industry. (Unpublished master's thesis) Monash University, Johannesburg. Retrieved from: http://www.irbnet.de/daten/iconda/CIB20327.pdf.

Government gazette, online:

The South African Department of Labour 2004 (2014).Amended Occupational Health and Safety Act. Retrieved from: http://www.labour.gov.za/DOL/downloads/legislation/acts/occupational-health-and-safety/amendments/Amended%20Act%20-%20Occupational%20Health%20and%20Safety.pdf.

Pre-publication from an institutional repository:

Alhajeri, M. (2011). Health and safety in the construction industry: challenges and solutions in the UAE. Manuscript submitted for publication. Retrieved from Coventry University Repository: https://curve.coventry.ac.uk/open/file/8ef107a7-8740-4cb5-ad55-07449f57cad4/1/Al%20Hajeri%202011.pdf.

Muiruri, G., & Mulinge, C. (2014, June). Health and Safety Management on Construction Projects Sites in Kenya A Case Study of Construction Projects in Nairobi County. Paper presented at the FIG Congress, Kuala Lumpur, Malaysia. Retrieved from: http://www.fig.net/resources/proceedings/fig_proceedings/fig2014/papers/ts07k/TS07K_muiruri_mulinge_6847.pdf.

Phoya, S. (2012). Health and Safety Risk Management in Building Construction Sites in Tanzania: The Practice of Risk Assessment, Communication and Control (Unpublished master's research report, Chalmers University of Technology Gothenburg, Sweden).

APPENDICES

1. Appendix A: Ethical Clearance.
2. Appendix B: Letter to Waterfall Estate Management – requesting permission to access site.
3. Appendix C: Letter from Waterfall Estate Management – granting permission to access site.
4. Appendix D: Assistant Researcher confidentiality forms.
5. Appendix E: Questionnaire administering protocol.
6. Appendix F: Attendance Register (Respondent consent agreement).
7. Appendix G: Completed Safety Climate Assessment Questionnaire.

1. Appendix A: Ethical Clearance.

School of Construction Economics & Management

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SCHOOL OF CONSTRUCTION ECONOMICS AND MANAGEMENT RESEARCH ETHICS COMMITTEE

CLEARANCE CERTIFICATE **PROTOCOL NUMBER** CEM/16/12/NI2/MSC

PROJECT TITLE: Health and safety culture on small residential construction sites: A case of Waterfall Estates, Midrand.

INVESTIGATOR Nthumi Indira Shabangu 0610186p

SCHOOL/DEPARTMENT **SCHOOL OF CONSTRUCTION ECONOMICS AND MANAGEMENT**

DATE CONSIDERED 22/12/2016

DECISION OF THE COMMITTEE Approved conditionally with respect to the declaration.

EXPIRY DATE 30th December 2017

DATE 22 December 2016

CHAIRPERSON
Dr. Kola Ijasan

cc: Supervisor: Dr. Ria Vosloo

DECLARATION OF INVESTIGATOR (S)

To be completed in duplicate and **ONE COPY** returned to the Secretary Mrs. M. Sithole at the CEM reception desk.

I fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

Signature **Date** 22 / 12 / 2016

2. Appendix B: Letter to Waterfall Estate Management – requesting permission to access site.

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5th January 2017

To whom it may concern

PROJECT TITLE: HEALTH AND SAFETY CULTURE ON SMALL RESIDENTIAL CONSTRUCTION SITES: A CASE OF WATERFALL ESTATE, MIDRAND.

Dear Mr. Grant Poole - Estate Manager

Residential construction has been growing significantly in South Africa. There is a high concentration of small and micro enterprises (SMEs) operating in the residential construction sector. The nature and conditions of work are dynamic and labour intensive in the construction sector; thus creating a high exposure to health and safety hazards. This study seeks to explore the safety perceptions, attitudes, and behaviour of construction workers and management safety practices on small residential construction sites and therefore determine the existing safety culture. The term safety culture relates to meanings, interpretations, attitudes, values, beliefs, rules and procedures related to safety.

The researcher(s) seek to collect data from willing participants working in residential estate through an administered questionnaire. The questionnaire that will be used is the Safety Climate Assessment Toolkit and it used by organisations to measure safety culture. The questionnaire will take approximately 10-15 minutes to complete. The researcher will position herself and her assistants where they will be able to contact construction workers that are not on the particular sites where they are working in order to ensure that the specific contracting firms will stay anonymous.

Participants will not be eligible to answer the questionnaire if they do not currently work specifically in the residential construction component of the estate. The questionnaire seeks to address questions of occupational health and safety, workers might be at the risk of sharing sensitive information concerning health and safety practices. This information will be treated with highly strict confidentiality to avoid the any negative consequences from participating in this study. The researcher and her assistants will assist consenting construction workers to complete the survey after they have signed the consent register. No identifying information will be recorded on the survey. No information regarding the specific project or site that they work on will be collected.

The researcher seeks consent to use the name of the study area, however, if permission is not granted the name of the estate will not be mentioned.

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The execution of this research study project has number of benefits for the following stakeholders:

Construction industry: small and micro enterprises

- This research will be able to assist contractors in small residential projects to address their health and safety challenges by providing them with a better understanding of what may be needed to improve the health and safety performance at their construction sites.

Research participant:

- Gain knowledge on the status of safety culture of residential construction projects.

The institution and society in general:

- Add to the body of knowledge

Respondent participation is entirely voluntary and anonymous. All information obtained from the questionnaire is strictly confidential. Access to the data will be limited to the researcher, the supervisors and the designated examiners (appointed by the University of the Witwatersrand). The questionnaire data will be captured without any identifying information and will not be linked to the participant's name or to the contracting firm that they work for. The responses and personal information kept and stored in a confidential format that will be accessible to the researcher only and destroyed after 5 years. Participants have the right to withdraw at any stage without any penalty or future disadvantage whatsoever.

The School of Construction Economic and Management (SCEM) Ethics Committee of the University of the Witwatersrand have approved the formal study proposal. The ethics clearance number is Ref# CEM/16/12/N12/MMSC. Every aspect of the study will be conducted according to internationally accepted ethical principles.

The primary investigator wishes to declare that she has no conflict of interest where this study is concerned. This study is solely for the purpose of fulfilling the University's requirements for the completion of the course.

Your participation in the study will be greatly appreciated.

The school appreciates your assistance.

Yours Faithfully

Prof David Root
Head of School

UNIVERSITY OF WITWATERSRAND
05 JAN 2017
P.O. Box 20
WITS 2050
School of Construction Economics & Management

3. Appendix C: Letter from Waterfall Estate Management – granting permission to access site.

Waterfall
· COUNTRY LIFESTYLE ESTATE ·

trafalgar

Dear Contractors,

Please be advised that the University of WITS will be performing research surveys on the construction sites, interviewing the labourers.

Estate Management has approved the research project from the 12th of January 2016 till the 16th of January 2016.

Kindly allow access to your respective sites for the following individuals:

- Indira Shabangu
- Dema Sive;
- Menzi Mkhombo;
- Siphelele Nqobile Mvelase.

Kind regards,

Estate Management

Grant Poole, Shawn Benningfield and Johan Barnard

4. Appendix D: Assistant Researcher confidentiality forms.

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FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

SCHOOL OF CONSTRUCTION, ECONOMICS AND MANAGEMENT

FIELDWORKER AND/OR RESEARCH ASSISTANT CONFIDENTIALITY AGREEMENT

I, SIPHELELE NQOBILE MVELASE, **hereby agree to:**

1. Abide by the confidentiality requirements of this study, as approved by the Research Ethics Committee of the University of The Witwatersrand, by ensuring that the identities and information of the participants are not revealed during and after the course of the study;
2. Keep all the research information shared with me confidential by not discussing or sharing the research information in any form or format with anyone other than the Principal Investigator;
3. Keep all research information in any form or format securely stored while it is in my possession;
4. Return all research information in any form or format to the Principal Investigator when I have completed the research tasks;
5. There is no compensation for your participation in this study.
6. After consulting with the Principal Investigator, erase or destroy all research information in any form or format regarding this research project that is not returnable to the Principal Investigator (e.g. information sorted on computer hard driver).

If you have any questions or concerns about this study, please contact: Ms. N.I Shabangu at Tel (011) 407 6873 or her cellular phone 0720160942. Complaints about this research may be presented to Dr. K. Ijasan, SCEM Ethics Committee Chair phone: 011 717 7681.
E-mail: cem@wits.ac.za;
This study has been reviewed and approved by the Research Ethics Committee at the University of The Witwatersrand.

Research Assistant or Fieldworker:

NQOBILE MVELASE	S.N. MVELASE	09/01/2017
Print name	Signature	Date

Principal Investigator:

INDIRA SHABANGU		09/01/2017
Print name	Signature	Date

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JOHANNESBURG

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SCHOOL OF CONSTRUCTION, ECONOMICS AND MANAGEMENT

FIELDWORKER AND/OR RESEARCH ASSISTANT CONFIDENTIALITY AGREEMENT

I, MENZI MKHOMBO, **hereby agree to:**

1. Abide by the confidentiality requirements of this study, as approved by the Research Ethics Committee of the University of The Witwatersrand, by ensuring that the identities and information of the participants are not revealed during and after the course of the study;
2. Keep all the research information shared with me confidential by not discussing or sharing the research information in any form or format with anyone other than the Principal Investigator;
3. Keep all research information in any form or format securely stored while it is in my possession;
4. Return all research information in any form or format to the Principal Investigator when I have completed the research tasks;
5. There is no compensation for your participation in this study.
6. After consulting with the Principal Investigator, erase or destroy all research information in any form or format regarding this research project that is not returnable to the Principal Investigator (e.g. information sorted on computer hard driver).

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E-mail: cem@wits.ac.za;
This study has been reviewed and approved by the Research Ethics Committee at the University of The Witwatersrand.

Research Assistant or Fieldworker:

MENZI		09/01/2017
Print name	Signature	Date

Principal Investigator:

INDIRA SHABANGU		9/01/2017
Print name	Signature	Date

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FIELDWORKER AND/OR RESEARCH ASSISTANT CONFIDENTIALITY AGREEMENT

I, SIVE DEMA **, hereby agree to:**

1. Abide by the confidentiality requirements of this study, as approved by the Research Ethics Committee of the University of The Witwatersrand, by ensuring that the identities and information of the participants are not revealed during and after the course of the study;

2. Keep all the research information shared with me confidential by not discussing or sharing the research information in any form or format with anyone other than the Principal Investigator;

3. Keep all research information in any form or format securely stored while it is in my possession;

4. Return all research information in any form or format to the Principal Investigator when I have completed the research tasks;

5. There is no compensation for your participation in this study.

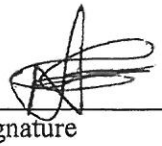
6. After consulting with the Principal Investigator, erase or destroy all research information in any form or format regarding this research project that is not returnable to the Principal Investigator (e.g. information sorted on computer hard driver).

If you have any questions or concerns about this study, please contact: Ms. N.I Shabangu at Tel (011) 407 6873 or her cellular phone 0720160942. Complaints about this research may be presented to Dr. K. Ijasan, SCEM Ethics Committee Chair phone: 011 717 7681.
E-mail: cem@wits.ac.za;
This study has been reviewed and approved by the Research Ethics Committee at the University of The Witwatersrand.

Research Assistant or Fieldworker:

SIVE DEMA		09/01/17
Print name	Signature	Date

Principal Investigator:

INDIRA SHABANGU		09/01/2017
Print name	Signature	Date

5. Appendix E: Questionnaire administering protocol.

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FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

SCHOOL OF CONSTRUCTION, ECONOMICS AND MANAGEMENT

INTERVIEW PROTOCOL

1. The participants will be randomly selected based on their voluntary willingness to participate in the study. The questionnaires will be distributed to the worker's during lunch breaks and after working hours. The researcher will make the following introductory statement and opening remarks prior to the commencement of the questionnaire administration:

2. Announcement for your participation today:

- My name is Nthumi Indira Shabangu and I am a student at the University of the Witwatersrand conducting my research study for the degree of Master of Science in Building – Project Management in Construction.

- The title of my study is titled "Health and safety culture on small residential construction sites: A case of Waterfall Estate, Midrand."

- The purpose of this study is to increase our understanding of the health and safety culture and how it can improved to the advantage of all concerned stakeholders.

- I am the responsible primary researcher and I have with me undergraduate students, Dema Sive, Menzi Mkhombo and Siphelele Nqobile Mvelase from the School of Construction, Economics and Management, the University of Witwatersrand, who will be helping me to hand the questionnaires.

- Thank you for voluntary participation the surveys, which will take about 10 -15 minutes of your time. There are 18 questions regarding your experiences on issues of occupational health and safety and will assist the researcher in assessment of the health and safety culture within your organisation.

PARTICIPANT INFORMATION SHEET

- You will be presented with a series of statements on the following pages about health and safety. You should indicate your response by ticking the appropriate box. For example, if you agreed with the following statement you would tick under the 'I agree' category, thus:

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1. Health & Safety issues are very important.		✓			

- All of your answers are confidential. Your responses will remain confidential and will be used to develop a better understanding of how you and your peers view issues of have and safety and what might influence it.

- The researcher (s) are fluent in English, Zulu, Pedi, Sotho, Xhosa, Setswana and Swazi and will be able to translate to you in any of these languages should you need any help.

- I have an attendance register I would like you to complete. The reason for this attendance register is serve as both proof to the University that the researchers did administer the questionnaires on this construction site as well as your written consent to participate in the study. Your names and information will not be used in the research report.

- At this time I would like to remind you of your written consent (in the form of the register) to participate in this study. You and I have both signed and dated each copy, stating that we agree to continue this questionnaire.

- Your participation in this questionnaire is completely voluntary, meaning you are not forced or obligated to participate. If at any time you need to stop, take a break, or return a page, please let me know. You may also withdraw your participation at any time without consequence.

- The researcher will use the data from the questionnaires in her final report, but will not refer to your names or company names in her findings. The reporting will be very confidential.

- Do you have any questions or concerns before we begin?

- If the participants agree and sign the attendance register, the questionnaire will be administered.

- Should you wish to follow up on the findings or require any concerns related to the study here my details, here is a card with my contact details?

Thank you!

6. Appendix F: Attendance Register (Respondent consent agreement).

Attendance Register

Researcher/ assistant: Nthumi Indira Shabangu

Participant No.	Date of survey	Experiantial years in construction	Period employed by current employer	Designation of participant within the construction	Job Fuction	Are you over 18 years (Y/N)	Are you willing to partcipate? (Y/N)
1	12/01/2017	4 years	8 months	[illegible] - Gate 4	General worker	Yes	Yes
2	12/01/2017	12 days	12 days	Mikiya - Gate 4	Carpentry	Yes	Yes
3	12/01/2017	1 years	1 years	[illegible] - Gate 4	General worker	Yes	Yes
4	12/01/2017	13 years	3 years	[illegible] - Gate 4	Builder	Yes	Yes
5	12/01/2017	4 years	3 years	[illegible] - Gate 4	Site manager	Yes	Yes
6	12/01/2017	21 years	2 years	Petros - Gate 4	electrician	Yes	Yes
7	12/01/2017	5 years	4 years	X - Gate 4	Plumbing	Yes	Yes
8	12/01/2017	3 years	2 years	Sibusiso - Gate 4	General	Yes	Yes
9	12/01/2017	7 years	5 years	[illegible] - Gate 4	Site manager	Yes	Yes
10	12/01/2017	3 months	3 months	[illegible] - Gate 4	cleaner	Yes	Yes
11	12/01/2017	2 years	2 years	[illegible] - Gate 4	Brick worker	Yes	Yes
12	12/01/2017	3 years	9 months	[illegible] - Gate 4	Builder	Yes	Yes
13	12/01/2017	6 years	2 years	[illegible] - Gate 4	Plumbing	Yes	Yes
14	12/01/2017	2 years	2 years	[illegible] - Gate 4	Builder	Yes	Yes
15	12/01/2017	4 years	3 years	[illegible] - Gate 4	Plastering	Yes	Yes
16	12/01/2017	12 years	1 year	[illegible] - Gate 4	Builder	Yes	Yes
17	12/01/2017	3 years	4 months	[illegible] - Gate 4	Tiling	Yes	Yes

Attendance Register

(Researcher) assistant: Nthumi Indira Shabangu

Participant No.	Date of survey	Experiantial years in construction	Period employed by current employer	Designation of participant within the construction	Job Fuction	Are you over 18 years (Y/N)	Are you willing to partcipate? (Y/N)
1	13/01/2017	3 years	1 year	- Gate 4	electrical installation	Yes	Yes
2	13/01/2017	8 years	4 years	- Gate 4	handyman	Yes	Yes
3	13/01/2017	8 years	3 months	- Gate 4	Plastering	Yes	Yes
4	13/01/2017	9 months	9 months	- Gate 4	Plastering	Yes	Yes
5	13/01/2017	2 years	1 year	- Gate 4	landscaping	Yes	Yes
6	13/01/2017	4 years	1 year	- Gate 4	landscaping	Yes	Yes
7	13/01/2017	7 years	6 years	- Gate 4	General	Yes	Yes
8	13/01/2017	15 years	2 years	- Gate 4	Tiling	Yes	Yes
9	13/01/2017	5 years	5 years	- Gate 4	Supervisor	Yes	Yes
10	13/01/2017	2 years	1 month	- Gate 4	plumber	Yes	Yes
11	13/01/2017	6 years	5 years	- Gate 4	Builder	Yes	Yes
12	13/01/2017	2 years	9 months	- Gate 4	Builder	Yes	Yes
13	13/01/2017	12 years	5 days	- Gate. 4	Builder	Yes	Yes
14	13/01/2017	7 years	5 day's	- Gate 4	Builder	Yes	Yes
15	13/01/2017	10 years	5 years	- Gate4	Brick work	Yes	Yes
16	13/01/2017	4 years	3 years	- Gate 4	Builder	Yes	Yes
17	13/01/2017	3 years	3 years	- Gate 4	Builder	Yes	Yes

Attendance Register

Researcher/assistant: SIPHELELE NQOBILE MVELASE

Participant No.	Date of survey	Experiantial years in construction	Period employed by current employer	Designation of participant within the construction	Job Fuction	Are you over 18 years (Y/N)	Are you willing to partcipate? (Y/N)
1	12/01/17	1yr 2months	1yr 2months	[illegible] - Gate 4	labour	Y	Y
2	12/01/17	14 yrs	3 yrs	[illegible] - Gate 4	builder	Y	Y
3	12/01/17	2 yrs	1 day	stopped, not comportable	plastering	Y	N
4	12/01/17	7 months	5 months	[illegible] - Gate 4	plastering	Y	Y
5	12/01/17	1 year	5 months	[illegible] - Gate 4	plastering	Y	Y
6	12/01/17	2 years	2 years	T.D - Gate 4	plastering	Y	Y
7	12/01/17	20 years	1 day	[illegible] - Gate 4	electrician	Y	Y
8	12/01/17	6 years	2 months	[illegible] - Gate 4	Gaurdian	Y	Y
9	12/01/17	2nd day	2nd day	[illegible] - Gate 4	painting	Y	Y
10	12/01/17	30 years	1 year	[illegible] - Gate 4	electrician	Y	Y
11	12/01/17	2 months	1 week	M.I - Gate 4	Cleaning	Y	Y
12	12/01/17	1 year	1 week	[illegible] - Gate 4	general	Y	Y
13	12/01/17	6 years	1 week	[illegible] - Gate 4	general	Y	Y
14	12/01/17	5 months	1 day	[illegible] - Gate 4	plumbing	Y	Y
15	12/01/17	11 years	2 years	[illegible] - Gate 4	plumber	Y	Y
16	12/01/17	10 years	5 years	[illegible] - Gate 4	brick layer	Y	Y
17	12/01/17	15 years	10 years	[illegible] - Gate 4	brick Payer	Y	Y
	12/01/17	15 years	1 year	[illegible] - Gate 4	plastering	Y	Y

Attendance Register

Researcher/~~assistant:~~ SIPHELELE NQOBILE MUELASE

Participant No.	Date of survey	Experiantial years in construction	Period employed by current employer	Designation of participant within the construction	Job Fuction	Are you over 18 years (Y/N)	Are you willing to partcipate? (Y/N)
1	13/01/17	3 years	3 years	[illegible] – Gate 4	Home Automations	y	y
2	13/01/17	10 years	1 year	[illegible] – Gate 4	installation	y	y
3	13/01/17	24 years	4 years	[illegible] "	supervisor	y	y
4	13/01/17	4 years	2 years	[illegible] "	plastering	y	y
5	13/01/17	4 years	2 years	[illegible] "	plaster	y	y
6	13/01/17	4 years	2 years	[illegible] "	labour	y	y
7	13/01/17	17 years	2 years	[illegible] "	driving and tiling	y	y
8	13/01/17	13 years	2 months	[illegible] "	land Stapping	y	y
9	13/01/17	13 years	1 year	[illegible] "	painting	y	y
10	13/01/17	12 days	12 days	[illegible] "	cleaning	y	y
11	13/01/17	4 years	2 days	[illegible] "	slap	y	y
12	101/17	2 years	2 years	[illegible] "	Building	y	y
13	101/17	4 years	4 days	[illegible] "	builder	y	y
14	101/17	4 years	5 days	[illegible] "	Foundation	y	y
15	101/17	4 years	3 days	[illegible] "	Foundation	y	y
16	101/17	1 week	1 week	[illegible] "	labourer	y	y
17	101/17	20 years	1 month	[illegible] "	Brick layer	y	y

Attendance Register

Researcher/Assistant: MENZI MKHOMBO

Participant No.	Date of survey	Experiantial years in construction	Period employed by current employer	Designation of participant within the construction	Job Fuction	Are you over 18 years (Y/N)	Are you willing to partcipate? (Y/N)
1	12-01-17	13 years	1 Year	GATE 4	Builder	Yes	Yes
2	12-01-17	3 YEARS	1 YEAR	Gate 4	BRICKLAYER	Yes	Yes
3	12-01-17	2 YEARS	1 YEARS	Gate 4	Builder	Yes	Yes
4	12-01-17	2.5 years	9 years	Gate 4	Electrician	Yes	Yes
5	12-01-17	3 YEARS	2 YEARS	Gate 4	Electrian	Yes	Yes
6	12-01-17	6 YEARS	6 YEARS	Gate 4	Electrician	Yes	Yes
7	12-01-17	8 YEARS	8 YEARS	GATE 4	Plumbing	Yes	Yes
8	12-01-17	2months	2days	Gate 4	General worker	Yes	Yes
9	12-01-17	3YEARS	2days	Gate 4	General worker	Yes	Yes
10	12-01-17	6YEARS	5 YEARS	Gate 4	STEELWORK	Yes	Yes
11	12-01-17	4 YEARS	4 YEARS	Gate 4	Steelwork	Yes	Yes
12	12-01-17	2years	2years	Gate 4	Plumbing	Yes	Yes
13	12-01-17	5 years	1 Year	Gate 4	Labour	Yes	Yes
14	12-01-17	5years	5 years	Gate 4	Plastering	Yes	Yes
15	12-01-17	24 years	1 Years	Gate 4	Building	Yes	Yes
16	12-01-17	5 Years	1 Years	Gate 4	plastery	Yes	Yes
17	13-01-17	9 years	1 Year	Gate 4	HOMEMATION	Yes	Yes

Attendance Register

Researcher/assistant: MENZI MKHOMBO

Participant No.	Date of survey	Experiantial years in construction	Period employed by current employer	Designation of participant within the construction	Job Fuction	Are you over 18 years (Y/N)	Are you willing to partcipate? (Y/N)
1	13-01-17	20 YEARS	2 days	Gate 4	Waterproofing	Yes	Yes
2	13	20 YEARS	4 months	Gate 4	Tiling	Yes	Yes
3	13-01-17	1 YEAR	2 days	Gate 4	Tiling	Yes	Yes
4	13-01-17	27 years	4 years	Gate 4	Plumbing	Yes	Yes
5	13-01-17	24 years	3 years	Gate 4	Plastering	Yes	Yes
6	13-01-17	2 years	1 year	Gate 4	plastering	yes	Yes
7	13-01-17	4 years	1 year	Gate 4	Plaster	Yes	Yes
8	13-01-17	5 years	1 year	Gate 4 MATLENIANE	Plaster	Yes	Yes
9	13-01-17	19 years	2 years	Gate 4	Electrician	yes	Yes
10	13-01-17	10 years	6 years	Gate 4	Brickwork	Yes	Yes
11	13-01-17	30 years	1 year	Gate 4	Site foreman	Yes	Yes
12	13-01-17	6 years	6 years	Gate 4	Builder	Yes	Yes
13	13-01-17	1 years	1 year	Gate 4	Brickwork	Yes	Yes
14	13-01-17	5 years	3 years	Gate 4	Builder	Yes	Yes
15	13-01-17	4 years	3 Years	Gate 4	Builder	Yes	Yes
16	13-01-17	4 years	3 years	Gate 4	Builder	Yes	Yes
17	13-01-17	11 years	1 month	Gate 4	Plaster	Yes	Yes

Attendance Register

Researcher/assistant: SIVE DEMA 1508687

Participant No.	Date of survey	Experiantial years in construction	Period employed by current employer	Designation of participant within the construction	Job Fuction	Are you over 18 years (Y/N)	Are you willing to partcipate? (Y/N)
1	12/01/17	11 YERS	1 YEAR	GATE 4	FLOORING	Y	Y
2	12/01/17	4 YEARS	2 YEARS	GATE 4	CAPENTRY	Y	Y
3	12/01/17	17 YEARS	1 YEAR	GATE 4	PLASTERING	Y	Y
4	12/01/17	8 YEARS	2 days	GATE 4	BUILDER	Y	Y
5	12/01/17	3 YEARS	1 MONTH	GATE 4	BUILDER	Y	Y
6	12/01/17	15 YEARS	1 MONTH	GATE 4	WIRING	Y	Y
7	12/01/17	5 YEARS	1 YEAR	GATE 4	BUILDER	Y	Y
8	12/01/17	1 YEAR	3 Month	GATE 4	BUILDER	Y	Y
9	12/01/17	3 YEARS	1 MONTH	GATE 4	BUILDER	Y	Y
10	12/01/17	10 YEARS	6 MONTH	GATE 4	PLANNER	Y	Y
11	12/01/17	6 YEARS	3 MONTH	GATE 4	BUILDER	Y	Y
12	12/01/17	1½ YEARS	1 MONTH	GATE 4	PLUMBING	Y	Y
13	12/01/17	3 YEARS	1 WEEK	GATE 4	PLUMBING	Y	Y
14	12/01/17	12 YEARS	1 YEAR	GATE 4	BUILDER	Y	Y
15	12/01/17	17 YEARS	1 MONTH	GATE 4	BUILDER	Y	Y
16	12/01/17	4 YEARS	1 MONTH	GATE 4	PLASTER	Y	Y
17	12/01/17	3 YEARS	2 YEARS	GATE 4	BUILDER	Y	Y

Attendance Register

Researcher/ ~~assistant:~~ SIVE DEMA 1506087

Participant No.	Date of survey	Experiantial years in construction	Period employed by current employer	Designation of participant within the construction	Job Fuction	Are you over 18 years (Y/N)	Are you willing to partcipate? (Y/N)
1	12/01/17	2 YEARS	1 YEAR	GATE 4	GENERAL WORKER	Y	Y
2	13/01/17	17 YEARS	3 YEARS	GATE 4	BUILDER	Y	Y
3	13/01/17	5 YEARS	5 MONTH	GATE 4	FINISHING	Y	Y
4	13/01/17	17 YEARS	1 YEAR	GATE 4	PLASTER	Y	Y
5	13/01/17	16 YEARS	1 YEAR	"	PLASTER	Y	Y
6	13/01/17	15 YEARS	1 YEAR	"	LANDSCAPING	Y	Y
7	13/01/17	10 YEARS	1 YEAR	"	PLUMBING	Y	Y
8	13/01/17	1 YEAR	1 YEAR	"	PLASTERING	Y	Y
9	13/01/17	11 YEAR	1 YEAR	"	BUILDER	Y	Y
10	13/01/17	7 YEARS	1½ YEAR	"	FLOOR FINISHING	Y	Y
11	13/01/17	20 YEARS	2 YEARS	"	SUPERVISOR	Y	Y
12	13/01/17	15 YEARS	3 WEEKS	"	BUILDER	Y	Y
13	13/01/17	14 YEARS	1 WEEK	"	BUILDER	Y	Y
14	13/01/17	11 YEARS	1 WEEK	"	BUILDER	Y	Y
15	13/01/17	20 YEARS	1 YEAR	"	PLASTER	Y	Y
16	13/01/17	21 YEARS	2 WEEKS	"	PLASTER	Y	Y
17	13/01/17	2 YEARS	1 YEAR	"	PLASTER	Y	Y

7. Appendix G: Completed Safety Climate Assessment Questionnaire.

Safety Climate Measurement Toolkit - Safety survey
SHORT-FORM QUESTIONNAIRE

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

Questions	Individuals' Scores	Average
Management acts decisively when a safety concern has been raised	4 5 5 5 5 5 5 5 5 5 5 5 5 5 7 4 4 4	
In my workplace management acts quickly to correct safety problems	4 4 5 5 5 5 5 5 5 5 5 5 4 5 2 2 2 3	
		Dimension -Management Commitment Total Score:
Safety information is always brought to my attention by my line manager/supervisor	4 5 5 3 4 4 4 4 5 5 5 4 5 5 5 5 3	
There is good communication here about safety issues which affect me	5 5 5 4 5 5 4 4 5 5 5 4 2 5 5 5 5	
		Dimension -Communication Total Score:
Management here considers safety to be equally as important as production	4 4 5 4 5 5 5 5 5 5 5 4 2 2 2 2 3	
I believe safety issues are assigned a high priority	5 5 5 5 4 4 4 4 5 5 5 5 4 4 4 4 5	
		Dimension -Priority of Safety Total Score:
Some health and safety rules and procedures do not need to be followed to get the job done safely	4 5 5 5 4 4 4 4 1 5 2 4 2 2 2 2 5	
Some health and safety rules are not really practical	4 2 1 4 2 2 2 2 1 2 4 2 4 4 4 4 2	
		Dimension - Safety Rules and Procedures Total Score (Reversed (the total subtracted from 12)):
I am strongly encouraged to report unsafe conditions	5 4 5 5 4 4 2 2 5 4 5 4 4 5 5 5 4	
I can influence health and safety performance here	5 4 5 4 5 5 4 4 4 5 5 4 4 4 5 5 4	
		Dimension - Supportive Environment Total Score:
I am involved in informing management of important safety issues	5 4 4 5 4 4 2 2 5 4 5 5 4 4 4 4 5	
I am involved with safety issues at work	4 5 5 5 5 5 4 4 5 2 5 5 5 4 4 4 5	
		Dimension - Involvement Total Score:
Safety is the number one priority in my mind when completing a job	5 4 5 5 5 5 4 4 5 5 5 5 5 4 5 4 5	
It is important that there is a continuing emphasis on safety	5 5 5 4 4 4 4 4 5 5 5 5 5 4 5 4 4	
		Dimension - Personal Priorities and Need for Safety Total Score:
I am sure it is only a matter of time before I am involved in an accident	1 2 2 2 4 4 4 4 1 3 5 4 2 2 2 2 4	
In my workplace the chances of being involved in an accident are quite high	1 1 1 1 4 4 4 4 1 3 1 2 4 1 1 1 2	
		Dimension - Personal Appreciation of Risk Total Score (Reversed (the total subtracted from 12)):
Operational targets rarely conflict with safety measures	4 2 2 4 2 2 5 5 2 4 2 2 4 4 5 5 2	
I am always given enough time to get the job done safely	2 5 5 4 2 2 4 4 5 2 5 4 5 4 4 4 4	
		Dimension - Work Environment Total Score:

Safety Climate Measurement Toolkit - Safety survey
SHORT-FORM QUESTIONNAIRE

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

Questions	Individuals' Scores	Average
Management acts decisively when a safety concern has been raised	5 4 1 5 5 2 4 4 5 4 4 4 1 4 5 3 4	
In my workplace management acts quickly to correct safety problems	5 4 1 1 4 2 5 2 4 5 5 3 2 4 4 4 2	
	Dimension -Management Commitment Total Score:	
Safety information is always brought to my attention by my line manager/supervisor	4 5 4 5 4 4 1 4 2 4 4 4 1 1 1 1 4	
There is good communication here about safety issues which affect me	5 4 4 5 5 4 4 4 2 5 5 2 5 5 5 5 5	
	Dimension -Communication Total Score:	
Management here considers safety to be equally as important as production	5 4 5 2 4 1 1 5 2 2 2 1 1 2 4 4 1	
I believe safety issues are assigned a high priority	5 3 4 2 2 2 1 2 4 5 5 2 1 4 4 4 5	
	Dimension -Priority of Safety Total Score:	
Some health and safety rules and procedures do not need to be followed to get the job done safely	2 4 2 4 4 4 3 4 4 1 1 2 4 4 4 4 4	
Some health and safety rules are not really practical	1 2 5 4 5 4 4 4 4 2 2 3 5 4 4 3 4	
	Dimension - Safety Rules and Procedures Total Score (Reversed (the total subtracted from 12)):	
I am strongly encouraged to report unsafe conditions	5 4 4 4 5 4 5 4 4 5 5 1 5 2 4 5 5	
I can influence health and safety performance here	5 4 4 5 5 5 5 5 4 5 5 1 5 5 3 2 5	
	Dimension - Supportive Environment Total Score:	
I am involved in informing management of important safety issues	5 4 4 5 4 4 5 5 4 1 1 1 5 1 4 5 2	
I am involved with safety issues at work	5 5 4 5 5 4 5 2 4 5 5 3 4 5 4 4 4	
	Dimension - Involvement Total Score:	
Safety is the number one priority in my mind when completing a job	5 5 4 5 4 4 5 5 2 1 1 4 5 5 4 5 5	
It is important that there is a continuing emphasis on safety	5 4 3 4 4 5 5 4 4 4 5 4 5 4 4 4 5	
	Dimension - Personal Priorities and Need for Safety Total Score:	
I am sure it is only a matter of time before I am involved in an accident	5 4 5 1 4 4 2 2 4 4 4 4 1 2 4 4 2	
In my workplace the chances of being involved in an accident are quite high	4 3 2 1 4 5 5 4 4 4 5 5 1 1 4 4 1	
	Dimension - Personal Appreciation of Risk Total Score (Reversed (the total subtracted from 12)):	
Operational targets rarely conflict with safety measures	4 5 4 1 1 5 2 2 3 4 5 1 1 5 3 3 2	
I am always given enough time to get the job done safely	5 4 4 5 5 4 1 2 2 5 5 2 5 1 4 5 4	
	Dimension - Work Environment Total Score:	

Safety Climate Measurement Toolkit - Safety survey
SHORT-FORM QUESTIONNAIRE

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

Questions	Individuals' Scores	Average
Management acts decisively when a safety concern has been raised	4 2 1 4 4 4 4 2 4 2 1 1 4 4 4 4 4	6
In my workplace management acts quickly to correct safety problems	4 2 1 4 4 4 4 2 4 2 2 2 4 5 4 4 4	8
	Dimension -Management Commitment Total Score:	
Safety information is always brought to my attention by my line manager/supervisor	2 4 2 2 4 4 4 4 4 4 1 2 4 2 3 4 4	8
There is good communication here about safety issues which affect me	2 4 2 2 4 4 4 2 4 4 1 2 5 4 4 4 2	
	Dimension -Communication Total Score:	
Management here considers safety to be equally as important as production	2 1 1 2 4 4 4 2 4 4 1 2 4 2 3 4 4	
I believe safety issues are assigned a high priority	2 4 4 4 2 4 4 1 4 2 1 2 4 2 2 4 4	
	Dimension -Priority of Safety Total Score:	
Some health and safety rules and procedures do not need to be followed to get the job done safely	4 3 2 2 2 4 2 2 2 2 2 2 2 4 4 2 4	
Some health and safety rules are not really practical	4 1 2 2 4 4 4 4 4 4 4 2 3 4 2 4 3	
	Dimension - Safety Rules and Procedures Total Score (Reversed (the total subtracted from 12)):	
I am strongly encouraged to report unsafe conditions	4 2 4 4 4 4 4 4 2 4 1 2 5 4 5 2 4	
I can influence health and safety performance here	2 3 4 4 2 4 2 3 4 3 2 2 5 4 4 4 4	
	Dimension - Supportive Environment Total Score:	
I am involved in informing management of important safety issues	4 5 4 4 4 4 4 4 4 4 5 4 4 4 4 4 5	
I am involved with safety issues at work	2 4 4 4 3 4 3 3 4 4 2 2 4 2 2 4 4	
	Dimension - Involvement Total Score:	
Safety is the number one priority in my mind when completing a job	5 4 4 5 4 5 4 5 5 5 5 5 5 5 5 5 5	
It is important that there is a continuing emphasis on safety	4 5 4 4 4 4 4 4 4 4 5 5 4 4 4 5 4	
	Dimension - Personal Priorities and Need for Safety Total Score:	
I am sure it is only a matter of time before I am involved in an accident	2 3 5 5 3 2 3 4 1 1 4 4 1 2 2 2 4	
In my workplace the chances of being involved in an accident are quite high	4 4 4 5 4 2 2 4 2 2 4 3 2 2 2 2 4	
	Dimension - Personal Appreciation of Risk Total Score (Reversed (the total subtracted from 12)):	
Operational targets rarely conflict with safety measures	4 1 2 2 2 4 2 2 3 3 2 2 4 2 2 2 4	
I am always given enough time to get the job done safely	4 1 4 4 2 4 1 1 4 5 1 1 5 2 2 2 4	
	Dimension - Work Environment Total Score:	

Safety Climate Measurement Toolkit - Safety survey
SHORT-FORM QUESTIONNAIRE

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

Questions	Individuals' Scores	Average
Management acts decisively when a safety concern has been raised	4 4 4 4 4 4 2 2 4 4 2 2 4 4 4 1 2	
In my workplace management acts quickly to correct safety problems	2 4 5 5 4 4 2 2 4 4 2 2 1 4 4 3 4	
	Dimension -Management Commitment Total Score:	
Safety information is always brought to my attention by my line manager/supervisor	4 3 4 3 4 4 3 3 4 4 2 4 4 4 3 3 4	
There is good communication here about safety issues which affect me	4 3 4 4 4 4 2 2 4 4 4 3 4 5 4 4 4	
	Dimension -Communication Total Score:	
Management here considers safety to be equally as important as production	4 3 4 4 4 4 2 1 4 4 4 4 2 4 4 3 4	
I believe safety issues are assigned a high priority	4 2 4 4 4 4 5 4 4 4 4 4 4 4 4 4 5	
	Dimension -Priority of Safety Total Score:	
Some health and safety rules and procedures do not need to be followed to get the job done safely	2 4 4 2 4 4 2 2 2 2 3 4 3 2 2 3 4	
Some health and safety rules are not really practical	2 4 2 2 4 4 2 2 2 2 2 3 3 3 2 2 3	
	Dimension - Safety Rules and Procedures Total Score (Reversed (the total subtracted from 12)):	
I am strongly encouraged to report unsafe conditions	4 2 4 4 4 4 5 4 4 4 4 4 4 4 4 4 4	
I can influence health and safety performance here	4 2 4 4 4 5 4 4 4 4 3 3 4 4 3 4 4	
	Dimension - Supportive Environment Total Score:	
I am involved in informing management of important safety issues	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	
I am involved with safety issues at work	4 2 4 4 3 4 4 2 4 4 4 3 4 4 4 3 4	
	Dimension - Involvement Total Score:	
Safety is the number one priority in my mind when completing a job	5 2 5 5 4 4 5 4 4 4 5 4 5 5 4 3 2	
It is important that there is a continuing emphasis on safety	4 2 4 4 4 4 4 4 4 4 5 4 4 4 4 4 4	
	Dimension - Personal Priorities and Need for Safety Total Score:	
I am sure it is only a matter of time before I am involved in an accident	4 2 2 4 2 2 5 4 2 2 4 4 4 4 4 3 4	
In my workplace the chances of being involved in an accident are quite high	4 2 2 4 4 4 4 5 4 2 5 4 4 3 4 3 5	
	Dimension - Personal Appreciation of Risk Total Score (Reversed (the total subtracted from 12)):	
Operational targets rarely conflict with safety measures	4 4 4 4 4 4 4 4 4 4 3 3 3 3 4 4 4	
I am always given enough time to get the job done safely	4 3 5 4 4 5 4 4 4 2 4 4 4 4 4 4 4	
	Dimension - Work Environment Total Score:	

Safety Climate Measurement Toolkit - Safety survey
SHORT-FORM QUESTIONNAIRE

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

Questions	Individuals' Scores	Average
Management acts decisively when a safety concern has been raised	4 4 4 4 2 3 4 3 2 4 5 3 4 5 3 2 1	
In my workplace management acts quickly to correct safety problems	4 4 4 4 3 3 4 3 2 4 4 3 4 5 3 3 3	
	Dimension -Management Commitment Total Score:	
Safety information is always brought to my attention by my line manager/supervisor	4 5 4 4 2 2 1 1 1 4 4 4 4 4 1 2 3	
There is good communication here about safety issues which affect me	4 4 3 4 2 2 1 2 1 4 4 4 4 5 1 1 1	
	Dimension -Communication Total Score:	
Management here considers safety to be equally as important as production	4 4 3 4 2 3 2 3 2 4 4 4 4 4 2 3 3	
I believe safety issues are assigned a high priority	4 4 3 5 3 3 2 2 2 5 4 4 4 4 3 5 3	
	Dimension -Priority of Safety Total Score:	
Some health and safety rules and procedures do not need to be followed to get the job done safely	5 4 4 4 3 3 4 4 4 3 3 3 2 3 4 4 4	
Some health and safety rules are not really practical	5 4 4 4 2 2 3 3 3 3 2 3 2 3 5 4 5	
	Dimension - Safety Rules and Procedures Total Score (Reversed (the total subtracted from 12)):	
I am strongly encouraged to report unsafe conditions	5 4 4 4 2 2 2 1 2 4 4 2 4 4 4 3 4	
I can influence health and safety performance here	4 4 4 4 3 3 2 1 3 4 4 2 4 4 5 4 3	
	Dimension - Supportive Environment Total Score:	
I am involved in informing management of important safety issues	4 4 4 4 3 3 1 1 1 3 4 4 4 5 4 4 4	
I am involved with safety issues at work	4 4 4 3 3 3 1 2 3 3 4 4 5 4 4 4 4	
	Dimension - Involvement Total Score:	
Safety is the number one priority in my mind when completing a job	4 4 4 3 4 4 4 4 4 4 5 4 4 4 4 4 4	
It is important that there is a continuing emphasis on safety	4 4 4 5 5 5 4 4 4 4 5 4 4 4 4 4 4	
	Dimension - Personal Priorities and Need for Safety Total Score:	
I am sure it is only a matter of time before I am involved in an accident	4 4 4 4 5 3 4 5 4 4 4 4 5 4 3 3 3	
In my workplace the chances of being involved in an accident are quite high	4 4 4 4 5 3 5 5 5 4 4 4 5 4 1 4 5	
	Dimension - Personal Appreciation of Risk Total Score (Reversed (the total subtracted from 12)):	
Operational targets rarely conflict with safety measures	4 3 4 4 3 3 3 3 3 3 4 4 4 4 3 4 3	
I am always given enough time to get the job done safely	2 4 4 4 1 2 1 1 1 4 4 1 4 4 4 4 5	
	Dimension - Work Environment Total Score:	

Safety Climate Measurement Toolkit - Safety survey
SHORT-FORM QUESTIONNAIRE

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

Questions	Individuals' Scores	Average
Management acts decisively when a safety concern has been raised	4 3 4 4 4 4 3 1 4 4 3 3 4 4 3 4 4	
In my workplace management acts quickly to correct safety problems	4 4 2 4 3 4 2 2 4 5 3 3 3 4 2 4 4	
	Dimension -Management Commitment Total Score:	
Safety information is always brought to my attention by my line manager/supervisor	4 3 4 3 4 4 1 4 1 4 5 4 4 4 3 5 4	
There is good communication here about safety issues which affect me	4 4 4 4 4 4 1 2 3 3 2 2 4 4 2 4 4	
	Dimension -Communication Total Score:	
Management here considers safety to be equally as important as production	4 5 4 4 4 5 2 3 4 4 3 2 4 4 2 4 3	
I believe safety issues are assigned a high priority	3 5 4 4 3 5 4 3 4 5 4 4 4 4 4 4 4	
	Dimension -Priority of Safety Total Score:	
Some health and safety rules and procedures do not need to be followed to get the job done safely	4 3 4 4 4 3 3 3 3 4 2 4 4 2 3 2 3	
Some health and safety rules are not really practical	5 3 4 4 4 3 3 3 3 3 2 4 4 2 3 2 3	
	Dimension - Safety Rules and Procedures Total Score (Reversed (the total subtracted from 12)):	
I am strongly encouraged to report unsafe conditions	4 4 3 4 3 4 2 4 3 5 2 2 4 4 2 4 4	
I can influence health and safety performance here	2 4 3 4 3 4 3 4 4 4 4 3 4 3 2 3 4	
	Dimension - Supportive Environment Total Score:	
I am involved in informing management of important safety issues	4 4 3 3 3 4 3 4 4 5 4 4 3 4 4 4 4	
I am involved with safety issues at work	4 4 3 3 3 4 3 4 4 4 3 5 4 2 4 4 3	
	Dimension - Involvement Total Score:	
Safety is the number one priority in my mind when completing a job	4 5 5 4 4 4 4 3 4 4 3 5 4 3 4 4 3	
It is important that there is a continuing emphasis on safety	4 4 4 4 4 4 4 4 3 3 5 4 4 4 4 4 4	
	Dimension - Personal Priorities and Need for Safety Total Score:	
I am sure it is only a matter of time before I am involved in an accident	4 4 4 4 4 5 4 4 4 4 4 4 4 4 3 3 4	
In my workplace the chances of being involved in an accident are quite high	2 3 5 4 2 4 4 2 2 3 4 4 2 4 4 2 4	
	Dimension - Personal Appreciation of Risk Total Score (Reversed (the total subtracted from 12)):	
Operational targets rarely conflict with safety measures	3 4 4 4 3 4 3 3 3 3 4 3 3 5 4 3 4	
I am always given enough time to get the job done safely	3 4 4 4 4 4 2 2 3 5 3 2 3 4 2 4 4	
	Dimension - Work Environment Total Score:	

Safety Climate Measurement Toolkit - Safety survey
SHORT-FORM QUESTIONNAIRE

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

Questions	Individuals' Scores	Average
Management acts decisively when a safety concern has been raised	1 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	
In my workplace management acts quickly to correct safety problems	1 2 4 4 4 4 4 5 4 4 4 4 4 4 3 4 4	
		Dimension -Management Commitment Total Score:
Safety information is always brought to my attention by my line manager/supervisor	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 3 3	
There is good communication here about safety issues which affect me	3 4 4 4 4 4 3 4 3 4 4 4 4 4 4 3 3	
		Dimension -Communication Total Score:
Management here considers safety to be equally as important as production	2 2 4 2 4 4 4 5 4 2 4 4 3 4 2 2 2	
I believe safety issues are assigned a high priority	2 5 4 4 4 4 5 3 3 3 4 4 3 3 2 2 2	
		Dimension -Priority of Safety Total Score:
Some health and safety rules and procedures do not need to be followed to get the job done safely	2 4 2 4 4 3 3 4 4 3 2 4 4 4 2 4 3 3	
Some health and safety rules are not really practical	4 4 2 2 4 4 4 5 4 2 2 2 4 2 2 2 3	
		Dimension - Safety Rules and Procedures Total Score (Reversed (the total subtracted from 12)):
I am strongly encouraged to report unsafe conditions	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	
I can influence health and safety performance here	4 4 4 4 4 4 4 4 3 4 4 4 4 4 2 2 2	
		Dimension - Supportive Environment Total Score:
I am involved in informing management of important safety issues	4 5 4 3 5 5 4 4 4 4 3 4 4 4 4 4 4	
I am involved with safety issues at work	4 5 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	
		Dimension - Involvement Total Score:
Safety is the number one priority in my mind when completing a job	5 4 4 4 2 2 5 5 4 2 5 5 4 5 4 4 4	
It is important that there is a continuing emphasis on safety	3 4 4 3 3 3 5 5 3 4 4 4 4 4 4 3 3	
		Dimension - Personal Priorities and Need for Safety Total Score:
I am sure it is only a matter of time before I am involved in an accident	4 4 2 2 2 2 4 2 2 4 4 4 4 2 4 2 2	
In my workplace the chances of being involved in an accident are quite high	4 2 2 2 4 4 5 4 4 2 4 4 5 2 4 3 3	
		Dimension - Personal Appreciation of Risk Total Score (Reversed (the total subtracted from 12)):
Operational targets rarely conflict with safety measures	3 4 3 3 4 4 3 3 3 3 2 2 3 3 3 2 3	
I am always given enough time to get the job done safely	3 3 4 4 4 4 3 4 2 4 2 2 4 4 2 4 4	
		Dimension - Work Environment Total Score:

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1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

Questions	Individuals' Scores	Average
Management acts decisively when a safety concern has been raised	3 5 4 4 4 4 4 4 4 5 3 5 5 5 5 5 5	
In my workplace management acts quickly to correct safety problems	1 5 4 4 4 4 4 5 2 5 1 2 3 5 5 5 4	
	Dimension -Management Commitment Total Score:	
Safety information is always brought to my attention by my line manager/supervisor	2 5 5 5 2 4 5 5 4 5 3 3 4 4 5 5 5	
There is good communication here about safety issues which affect me	1 3 5 5 4 4 4 4 5 5 4 4 5 4 5 5 5	
	Dimension -Communication Total Score:	
Management here considers safety to be equally as important as production	2 5 4 4 5 5 5 5 5 5 5 2 4 5 2 5 5	
I believe safety issues are assigned a high priority	1 5 5 4 4 5 5 5 5 4 5 2 4 5 4 5 5	
	Dimension -Priority of Safety Total Score:	
Some health and safety rules and procedures do not need to be followed to get the job done safely	2 3 5 4 3 2 4 3 4 3 3 1 4 5 4 3 3	
Some health and safety rules are not really practical	3 3 4 4 5 4 5 2 1 5 4 5 2 5 5 4 5	
	Dimension - Safety Rules and Procedures Total Score (Reversed (the total subtracted from 12)):	
I am strongly encouraged to report unsafe conditions	5 5 4 4 4 4 3 4 4 2 4 1 4 5 5 5 5	
I can influence health and safety performance here	4 5 4 4 5 4 5 4 5 5 4 5 4 4 5 5 5	
	Dimension - Supportive Environment Total Score:	
I am involved in informing management of important safety issues	3 5 4 4 4 3 5 5 5 4 5 4 4 4 5 4 4	
I am involved with safety issues at work	4 5 4 4 5 4 4 4 4 4 3 5 3 4 5 5 6	
	Dimension - Involvement Total Score:	
Safety is the number one priority in my mind when completing a job	4 5 5 5 5 5 3 3 4 4 4 5 5 5 5 4 5	
It is important that there is a continuing emphasis on safety	4 5 4 4 5 4 4 3 2 5 5 5 4 5 4 5 5	
	Dimension - Personal Priorities and Need for Safety Total Score:	
I am sure it is only a matter of time before I am involved in an accident	1 1 1 5 2 2 3 3 5 1 2 5 5 1 5 2 1	
In my workplace the chances of being involved in an accident are quite high	3 4 3 2 2 5 4 1 2 3 3 4 4 3 5 1 3	
	Dimension - Personal Appreciation of Risk Total Score (Reversed (the total subtracted from 12)):	
Operational targets rarely conflict with safety measures	4 4 5 5 2 2 4 1 2 4 3 2 2 2 4 2 3	
I am always given enough time to get the job done safely	4 4 2 4 4 4 2 4 4 5 4 1 5 5 4 4 5	
	Dimension - Work Environment Total Score:	