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CURRENT RISK MANAGEMENT STRATEGIES THAT ARE BEING USED BY CONSTRUCTION COMPANIES IN SOUTH AFRICA

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A research report submitted in partial fulfilment of the requirements for the Degree of Master of Science in Building in the field of Construction Project Management to School of Construction Economics and Management of Faculty of Engineering and the Built Environment University of Witwatersrand Johannesburg

24th August 2021

DECLARATION

I, **Stevie Mickwell Munthali**, declare that this research report

"CURRENT RISK MANAGEMENT STRATEGIES THAT ARE BEING USED BY CONSTRUCTION COMPANIES IN SOUTH AFRICA"

is my own unaided work, sources from the internet, books and journal articles have been referenced and acknowledged. This research report is submitted in partial fulfilment of Master of Science in Building Degree in the field of Construction Project Management at the University of the Witwatersrand, Johannesburg.

It has not been submitted before for any degree or examination in any other university.



Signature:……Date: 24rd August 2021

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ABSTRACT

Construction companies in South Africa experience a lot of risks. The majority of construction risks in South Africa emanate from insufficient scope definition, poor quality management plan, poor health and safety plan and poor environmental management plan. These risks consequently result in schedule overruns, cost overruns, poor quality of construction product and loss of lives. Construction contractors put control measures or risk management strategies to manage construction risks. Risk management strategies are plan of action which are implemented by construction companies specifically to manage risks that cause deviations or undesirable effects on the construction project. Risk management strategies are long term plan of actions for management of construction risks. On the other hand, risk response strategies are short term responses to construction risks. Risk response strategies are a subset of risk management strategies. For example, construction companies implement risk management strategy by employing competent employees to manage the risk of poor contract administration. Insurances and bonds are risk responses strategies. From the findings the current risk management strategies that are being used in Gauteng Province (South Africa) construction industry are employing of competent professionals especially those registered with Engineering Council of South Africa (ECSA) or South African Council for Project and Construction Management Professions (SACPCMP), training of employees on the job to make sure that there is succession plan in case one of their key employees leaves or dies, preparation of quality management plan which outlines the process that are involved in construction quality management and quality control measures, preparation of a detailed programme of works, preparation of health and safety plan, choice of the suitable form of construction contract, careful selection of a contract procurement strategy and preparation of environmental management plan, compliance with statutory and regulatory requirements, use of insurance and bonds to protect their work from weather related risks and other risks associated with construction work, contract price adjustment which is used on projects that take longer than one year to finish and the type of project delivery method that is being used by both the client and the contractor to deliver a project.

Keywords:

Risk management, risk analysis, risk response, risk management strategies, risk register, cost overruns, schedule overruns, quality management, health, and safety

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ACRONYMS AND ABBREVIATIONS

SA	South Africa/South African
PMBOK	Project Management Body of Knowledge
CIDB	Construction Industry Development Board
ECSA	Engineering Council of South Africa
JBCC	Joint Building Contracts Committee
NQF	National Qualification Framework
SACPCMP	South African Council for Project and Construction Management Professions
BOQ	Bill of quantities
GCC	General Condition of Contract
FIDIC	International Federation of Consulting Engineers
NEC	New Engineering Contract 3-Engineering and Construction Contract
PPP	Private Public Partnerships
SMMEs	Small Medium and Micro-Enterprises
COVID 19	Coronavirus Disease of 2019
SABS	South African Bureau of Standards
SWOT	Strength Weaknesses Opportunities and Threats

CHAPTER 1 INTRODUCTION

1. Introduction

Risk management strategies are plans that are implemented by construction companies to manage construction risks. Construction risk management strategies must be applied proactively rather than reactively. Some of the risk management strategies that are used by construction companies when managing construction risks revolve around four strategies that are used to respond to risks. The four risk response strategies are a subset of risk management strategies. The four risk response strategies are elimination by either using a different construction method or by not doing the project at all, transferring of the risk to the party that is very good at managing that particular kind of risk, mitigation of the risks on the project deliverables and acceptance of the risk with a contingent plan (Flanagan & Norman, 1993).

This research is investigating the risk management strategies that are being used by contractors in South African construction industry when managing construction risks. Literature has been reviewed on the risk and uncertainty definitions. The process that are used in risk identification have been presented such as reviewing of documentation, data collection, checklist, assumption analysis, diagramming systems, Swot analysis and expert judgement. After risks have been identified there is need to do a risk assessment, risk assessment can be performed through either qualitative risk or quantitative risk assessment. Examples of quantitative risk assessment are sensitivity; scenario; probability and decision trees assessment. Qualitative analysis for risk assessment is based on descriptions, and the description can describe more on the likelihood and impact of a risk. Qualitative methods are favourable when there is scarcity of numerical data. Risks are categorised based on their likelihood and impacts (Szymanski, 2017). The research uses qualitative approach, in this research structured interviews were used to generate data for the research.

There are challenges during implementation of risk management in developing countries (Bahamid & Doh, 2017). There is need to find ways of making sure that risk management processes are implemented in construction projects. For instance, only checklist, interview with experts, brainstorming and past experiences are the only commonly used techniques in risk management in developing countries (Bahamid & Doh, 2017). Another evidence of challenges in risk management implementation is that contracting firms should provide training programs for their workers to properly apply management principles. This implies that the workers are

not familiar with procedures that are used in managing risks. According to Serpell *et al.*, 2015 the problem with risk management is not lack of information pertaining to interpretation and application of risk management, but lack of knowledge to interpret and apply measures to manage risk during construction projects. Risk management measures in the industry of construction are being implemented as an emergency instead of managing them proactively. Current risk management practice is more of reactive than proactive (Serpell *et al.*, 2015). According to Landage, 2016 the track record of coping with risks in construction industry is not impressive. Construction companies fail with respect to completion time, cost overruns, scope changes and poor work. A lot of risks in construction industry occur during the construction stage, and one of the prominent or major risk during construction stage is financial risks.

The research logic was inductive, which aimed at generating a theory on how construction companies in SA manage construction risks. There was sampling bias in a way that only companies that accepted the author's appointments were visited. The research experienced convenient sampling in a way that the author interviewed the practitioners from companies that were accessible to the author. The research method that was used for this research comprised of structured questions, internet and library search. The structured questions that were used during interviews were valid. Validity was achieved because the questions were able to capture the information that they were supposed to capture during the interview (Saunders et al., 2016). The structured questions were reliable, in a way that the same questions were used to ask different construction practitioners who gave stable and consistent responses (Saunders et al., 2016).

1.1. Background to the study

This study is based on the problems that are faced by construction companies in SA. According to the study that was carried by Baloyi and Bekker in 2011, after South Africa hosted the 2010 World Cup. It was established that SA construction companies experienced cost overruns, schedule overruns and scope changes. The study identified the factors which contributed to the cost overruns, schedule overruns and scope changes into three categories:

- Those that were caused by the clients.
- Those which were caused by the contractors and their suppliers and
- Those that emanated from external factors.

Despite the stadia being completed in 2010 some of the stadia were not completed and ready for confederation cup, which is a curtain raiser event for the world cup. The confederation cup was competed for in 2009 while other stadia were still under construction stage. The factors that contributed to late completion of the stadia were incomplete drawings, changes in designs, late decision making from the clients, late delay in issuing of instructions, insufficient skilled labour, poor planning and scheduling, scarcity of manpower, poor dissemination of information, frequent change orders from clients during construction and delay in approval of work by the clients. The factors that contributed to cost overruns were increase in cost of materials, poor material estimates, insufficient skilled labour, late appointment of contractors, complexity of the projects, a sharp rise in labour cost, poor quantity take off, discrepancies between selected bid and estimate of the consultants, frequent change orders by the client during construction and lastly the shortage of manpower (Baloyi & Bekker, 2011).

The external factors that affect timely completion of construction projects are changes in government acts and or legislation in construction industry. Adverse weather conditions which affected the duration of the construction projects and cost of the project on the contractors' side. Inflation and fluctuations in the exchanges rates affect the construction contractors when tendering for construction projects. There are also incidents of disputes between the construction companies and the client organisation regarding the problems stated above (Flanagan & Norman, 1993).

The theoretical framework which is forms the basis of this study is as shown in the figure 1 below.

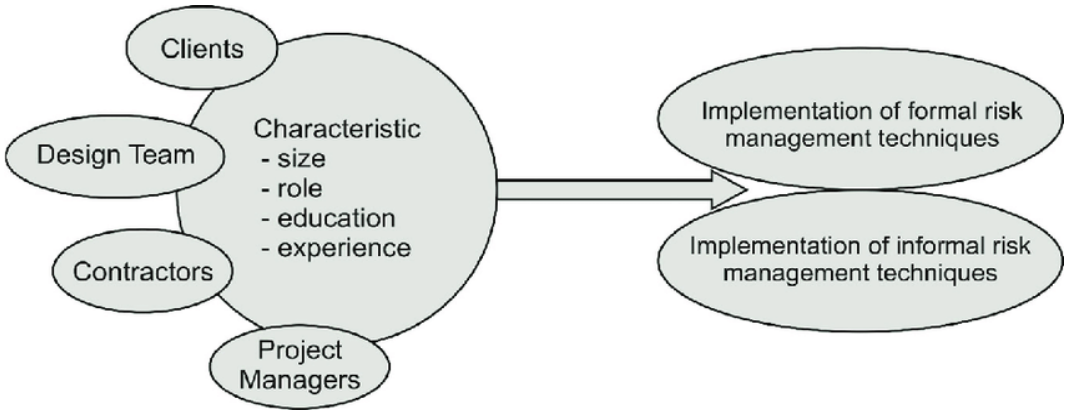


Figure 1: Theoretical framework for construction risk management (source: Jin *et al*., 2017)

1.2. Substantiation of the Problem

There are many factors that affect risk management in construction companies in SA. This research report focusses on the risks that affect successful completion of construction work with regard to cost, duration, quality, and scope of construction project. These deviations in cost, scope, quality, and time results in low rate of return on part of the client and low profit margin on part of the construction contractor (Serpell et al, 2015). For example, construction projects in Sweden experience cost overruns, schedule overruns and poor quality. Consequently, construction companies in Sweden are not willing to try new and innovative methods and procedures (Abderisak & Lindahl, 2015). Delays in construction projects have detrimental effects on the parties involved in the construction project. Stakeholders on construction project are affected differently, for instance the clients and construction contractors experience cost overruns when the completion date is exceeded, whereas the consulting engineers are least affected. Project completion delay is the world phenomenon, and it varies from country to country, from one construction project to another (Sullivan & Haris, 1986). From the findings it was established that delays in completion of construction projects in Egypt were caused by challenges faced by the construction project owners in financing the construction projects, frequent breakdown of the contractor's equipment or machines and lastly the availability and the fluctuations in the prices of the construction materials (Aziz & Abdel-Hakam, 2016).

Different stakeholders in construction projects contribute to the risks that are associated with construction projects. Some of the risks in construction industry emanate from decision makers, technological factors involved in construction industry, organisation structure of a construction company and even the environment where construction is taking place. Construction companies manage risks through reactive processes rather than proactive processes. In this research project there will be an evaluation of the company's performances that apply risk management strategies and those that do not (Aziz & Abdel-Hakam, 2016).

Literature survey has shown that there are a number of factors that contribute to construction risks. According to the study conducted by Berenger *et al*., 2016, it was revealed that supplies of faulty materials, poor communication and financial failures were significant risks experienced by construction contractors. In developing countries there is very little evidence on successful implementation of risk management strategies, this is because there is minimal attention paid to risk management (Bahamid & Doh, 2017). On the projects where the author

worked, the author experienced a lot of risks that were managed reactively instead of strategically. Some of the risks that were experienced by the author were design risks, financial risks, political risk, and environmental risk. The author experienced design risk on the construction of Dwarsloop Wastewater Treatment Works, the design of the Wastewater Treatment plant was contracted to unqualified designers. The author experienced financial risk while working on Blantyre to Zomba Road Construction in Malawi. The country (Malawi) experienced high rise in the inflation rates that resulted in the reduction of the profit margin for the construction company (Mota-Engil Engenharia). The author experienced political risks on construction of Dwarsloop Wastewater Treatment Works, when the contractor who was working on the project dumped the cleanings of the anaerobic ponds in the fields without approval of the department of environmental affairs. The author experienced weather-related risk when the progress of work was affected by heavy rains that lasted for a period of three weeks while the author was working on Blantyre-Zomba Road project in Malawi.

1.3. Problem Statement

South African construction industry experience schedule overruns, cost overruns, bad quality of construction products and frequent scope changes, which emanate from bad risk management strategies. During the FIFA World Cup 2010 SA construction companies experienced cost overruns, schedule overruns and scope changes. The causes of cost overruns, schedule overruns and scope changes were the client's late decisions, the capacity of the contractors, the material suppliers, and lastly external factors (Baloyi & Bekker, 2011).

1.4. Primary Research Question

What are the impacts of the current risk management strategies that are being used by construction companies in South Africa when managing construction risks?

1.5. Secondary Research Questions

Based on the primary question the secondary questions are identified below;

- What are the frequently used current risk management strategies in South African construction Industry?
- What are the gaps in the risk management strategies that are currently being used in SA Construction Industry?

- What are the differences in the performance of projects where risk management strategies are applied and the projects where risk management strategies are not applied?

1.6. The aim of investigation study

To investigate how construction companies are practically applying the current risk management strategies to manage the risks of cost overruns, schedule overruns, bad quality of construction product, safety, and frequent scope changes.

1.7. Research objective

The research objectives for this investigation study are:

- To investigate the frequently used construction risk management strategies in South Africa based on the four risk response mechanisms of avoidance, transfer, mitigation, and acceptance.
- To identify gaps in the risk management strategies that are used in SA Construction Industry.
- To evaluate the performance of the projects where risk management strategies were applied and the projects where risk management strategies were not applied.

1.8. Limitations

The following limitations were identified in this study:

- Some companies were not able disclose a lot of information on the strategies that they use when managing risks for competition's sake.
- Some managers were not allowed to disclose company's strategies to strangers based on their company policies.
- Distances between construction companies were longer in such a way that in one day only two or one company were interviewed.
- Some projects managers and safety officers were not willing to participant in the research study. One of the managers had to stop the interview because he did not have enough time to participate in the interview.
- Some of the construction companies were not operational due to COVID 19 pandemic.

1.9. Assumptions

The following are the research assumptions in this study:

- The research participants answered truthfully and straightforward.
- The sampled population of construction practitioners had all the experience required in answering the structured questions.
- The research participants were interested in the study and gave as much information as they can.
- The sampled population of construction practitioners had all the experience required in answering the structured questions.
- All construction companies were operational, none of them had shut down due to lack of tenders from the government.

CHAPTER 2 LITERATURE REVIEW

2. Literature Review

2.1. Literature review objectives

The main objectives of literature review were to find out what has already been written on the risk management strategies that are being used in South African construction industry and other countries around the world. To substantiate the importance of carrying out the research in risk management strategies and to use literature as a point of departure in carrying out this research

2.2. Literature review-Introduction

Construction companies around the globe experience a lot of construction risks (Schieg, 2006). Studies conducted by various researchers around the world have highlighted different risks associated with construction in different countries. What is considered as a risk in one country may not be a risk in another country. The following studies that were conducted in Tanzania, European Union countries, Australia, Nigeria, Lithuania, Pakistan, Malaysia, Kuwait, Egypt, and South Africa highlights some of the risks associated with construction project in these countries.

2.2.1. Tanzania

According to the study that was conducted by Chileshe and Kikwasi, (2013) construction companies in Tanzania experience a lot of construction risks that causes cost overruns and delays on completion of projects. The following are some of the risks associated with construction industry in Tanzania:

- Lack of trained professionals
- Competition from foreign construction companies who employee competent employees. Despite being small in number these foreign construction companies have a big market share.
- Poor resource management which emanates from lack of awareness of risk management processes.
- There is shortage of skills and training in construction management

2.2.2. European Union Countries

Studies that were conducted in European Union countries by Schieg in the year 2006 identified the following risks that are associated with construction:

- Risks that cause quality issues on construction projects which emanates from defects interim results on material tests, project methodologies not being followed and too few tests and controls on the construction materials.
- Human resource risks which are caused by lack of skills and coordination among team members on construction projects.
- Cost overruns which are caused by changes in planning, complex project conditions and delayed payment or sometimes the clients do not pay at all.
- Lack of strategy in decision making which emanates from failure to recognize opportunities and lack of ability to consistently use opportunities.
- External risks which are caused by natural occurrences or acts of God, regime change, shift in market or availability of new markets, new developments in legislations and technological changes.

2.2.3. Australia

The construction industry in Australia is one of the challenging, dynamic, and risky businesses. Major construction projects fail to meet the deadlines and cost targets this is attributed to poor reputation in management of construction related risks (Antony, 2001). Some of the construction risks that affect Australian construction industry are:

- Increment weather
- Poor production which is attributed to poor management of labour and plant
- Quality of construction materials
- Industrial disputes
- Delayed decisions from the clients
- Adverse physical conditions encountered on construction sites
- Health and safety related injuries
- Third party delays such as suppliers of construction materials
- Defective designs from the client and their consultants
- Fluctuations in the price of construction materials

2.2.4. Nigeria

Nigerian construction industry is one of the industries that is heavily affected by construction risks. Construction projects in Nigeria go beyond the project deadlines and the target budgets for the projects are exceeded. Risks associated with construction in Nigeria are grouped into

internal risks and external risks. The internal risks are risks that are experienced within the construction companies and the external risks are risks that are beyond the management of the construction companies (Ekung *et al*., 2015). Listed below are some of the internal and external risk factors that are experienced by Nigerian construction industry.

- Internal risks factors which are propagated by ineffective communication among construction team members, lack of skills among construction team, lack of project leadership, contractor financial difficulties, sub contractor's slow mobilization, equipment breakdown, suppliers of materials, late delivery of ordered materials, price escalation, sub-contractors' financial difficulties, planning, and scheduling problems.
- External risk factors which emanate from political interference, new technology in management of construction projects, economic factors such as inflation and organizational culture.

Table 1 below shows the risk categories that are were experienced in the construction of Nigeria's East-West Coastal Highway together with the mitigation measures.

Ref	Category	Heading	Mitigation Strategies	PR	IM	PF
P1	Political	Government lack of Political will	Government to show adequate commitment to project	H	H	CL
P2		Change in government	Backed project with legislation	H	H	CL
P5		Political indecision	Adhere to implementation milestone	H	H	CL
F1	Financial	Low budgeting	Prioritized funding & seek joint funding other tiers of government	H	H	CL
F8		Corruption & fraud	Engage reputable private fund manager	H	H	CL
Tp1	Technical-Project	Funding shortfall to acquire right-of-way	Prioritize key acquisition to enable expedient demolition	H	H	CL
TD1	Technical-design	Insufficient design details	Design consultants to submit full and detailed as applicable	H	H	CL
TD3		Incompetent design team	Engage best in class consultant	H	H	CL
TD10		Ground condition	Site investigation should be thorough	H	H	CL
TD22		Design error	Peer review design	H	H	CL
E1	Economic	Market condition	Improve estimate to allow for varying market condition	H	H	CL
Ev1	Environmental	Flood/coastal surge	Design for sea revetment and sea wall as appropriate	H	H	CL
Ev2		Surface run-off	Provide mitigation measures	H	H	CL
Ev7		Exceptionally adverse weather	Program to fit float where possible	H	H	CL
Ev8		Coastal erosion	EIA should address this problem	H	H	CL
Ev14		Beaches fluctuations	Adopt wait-and-see method with contingency for mitigation	H	H	CL
S3	Social	Stakeholder management	Prioritize and engage extensively before construction	H	H	CL
S4		Militant insurgence	Monitor and provide for security	H	H	CL
CM1	Cost Management	Inaccurate cost plan	Benchmark base estimates	H	H	CL
CM4		Uncertainty of project budget	Investigate and current tools for cost estimates	H	H	CL
C3	Construction Risk	Poor labourers training	Provide adequate training for employees	H	H	CR
C5		Lack of professionals	Contractor to explore local content	H	H	CR
C6		Force majeure	Appropriate remedies in contract	H	H	CL
C10		Political instability	Study closely to understand political climate	H	H	CR
C12		Construction tolerance	Design consultant to recognize what is achievable rather than what is desirous	H	H	CL
C21		Accessibility	Extensive pre-construction surveys	H	H	CLR
C27		Dredging & disposal	EIA should identify mitigation measure	H	H	CLR
TP6	Technical Project	Difficulty in serving vesting notices	Undertake advance consultation	M	M	CL
TE4	Technical Early works	Miscellaneous delay issues	Improve identification of miscellaneous causes	M	M	CR
TD7	Technical Design	Inaccurate design data	Engage competent consultant and modern equipment	M	M	CL
TD13		Existing structures	Preliminary survey should be thorough	M	M	CL
TD18		Dilapidation to existing infrastructures	Detour traffic as much as possible	M	M	CR
C1	Construction Risk	Delay in supply of offshore components	Fund should be release in advance of construction	M	M	CL
P3	political	Inadequate government consultation	Ensure all tiers of government are well consulted	L	L	CL
P6		Political opposition	Seek opposition support based on economic benefit	L	L	CL
TP6	Technical Project	Failure to vacate right of way	Pre-construction planning should be done in advance	L	L	CL
TDe8	Technical demolition	Additional security for demolition	Property owners should be mandated to vacate after payment	L	L	CL
TDe		Difficulty in demolition	Review schedule of property to be demolish	L	L	CL

9						
TDe 10		Insufficient working space for demolition	Contractor to consider careful phased approach	L	L	CR
TD5	Technical Design	Changes in design standards	Prioritization of the project is work as planned	L	L	CL
TD9		Multiple approval problem	Approval body should be harmonized	L	L	CL
Td11		Unexpected utility crossing	Site investigation should be thorough	L	L	CL
T1	Technological	Technology obsolesce	Prioritized the project as planned	L	L	CL
S6	Social	Public objection	Ensure sufficient engagement	L	L	CL

Table 1: Principal Risk Factors in Nigeria's East-West Coastal Highway. (source: Ekung et al.,2015)

2.2.5. Lithuania

Construction projects in Lithuania are exposed to uncertain environments due to poor project planning, defective designs, complexity of construction projects and presence of various interest groups ranging from the clients, consultants, contractors, suppliers, and various stakeholders. Construction projects are unpredictable and management of risk in construction project was identified in Lithuania as a very important process to achieve projects objectives. Projects should be delivered on time, within budget, within project specification and injuries should be avoided (Banaiteiene & Banatis, 2012). Table 2 below shows the controllable risks that were identified in the study. The risks are further divided into seven sub-categories: design, environmental, organization, right of way, project management and construction related risks.

	Categories	Likelihood 1 (rare)-5 (very frequent)	Impact 1 (very low)-5 (very high)
	Design risks		
D1	Design errors and omissions	4	5
D2	Design process takes longer than anticipated	3	4
D3	Stakeholders request late changes	3	3
D4	Failure to carry out the works in accordance with the contract	3	3
	External risks		
Ex1	New stakeholders emerge and request changes	2	4
Ex2	Public objections	1	3
Ex3	Laws and local standards change	1	3
Ex4	Tax change	1	4
	Environmental risks		
En1	Environmental analysis incomplete	2	4
En2	New alternatives required to avoid, mitigate or minimize environmental impact	2	4
	Organizational risks		
O1	Inexperienced workforce and staff turnover	3	3
O2	Delayed deliveries	3	3
O3	Lack of protection on a construction site	2	4
	Project management risks		
PM1	Failure to comply with contractual quality requirements	3	4
PM2	Scheduling errors, contractor delays	4	4
PM3	Project team conflicts	3	3
	Right of way risks		
R1	Expired temporary construction permits	1	4
R2	Contradictions in the construction documents	2	3
	Construction risks		
C1	Construction cost overruns	4	4
C2	Technology changes	2	4

Table 2: Risk categories in Lithunia (source: Banaiteiene & Banatis, 2012)

2.2.6. Pakistan

Construction project in Pakistan go beyond the planned completion dates, budget, scope, and quality. This emanated from poor risk management in Pakistan construction industry. According to the study conducted by Iqbal *et al*., 2014 which aimed at highlighting the main risks that construction companies are facing in Pakistan and the associated risk management that the Pakistan construction companies are using to manage the risks. In the list below are some of the significance risks that are encountered by construction companies in Pakistan:

- Delayed payment of contractors invoices from the clients.
- Contractors cash flow problems
- Accidents on construction sites
- Defective designs from the clients
- Inaccurate estimation of the project durations
- In experienced subcontractors
- Fluctuations in exchange rates and inflation
- In adequate scope definition
- Poor quality of equipment and construction materials
- Shortage of construction materials

2.2.6. Malaysia

Malaysia is one of the countries in the world that has experienced rapid economic growth. Construction boom in Malaysia commenced as early as in 1990's. Construction companies in Malaysia are more vulnerable to many risks when compared to other industries. These risks are connected to important project players such as consulting engineers, clients and contractors involved in construction works (Goh & Abdul-Rahman, 2015). The management of construction risk in Malaysia is still immature with only a few construction companies utilizing appropriate tools in construction risk management (Riazi et al., 2011). There are numerous uncertainties connected with construction businesses which make it one of the most paying, dynamic, and risky establishments. Risks associated with construction industries do not only affect the construction industry alone they also affect the economic growth of the country (Goh & Abdul-Rahman, 2015)The following are the risks that affected completion dates, budget, quality, scope, and safety in Malaysian construction industry:

- Delays in delivering materials to construction sites.
- Lack of proper estimates when ordering materials which results into surplus materials at the site after project completion.
- Late payment of contractors' invoices from the client
- Escalation in material costs
- Technical risks
- Increment weather
- Human resource risk

- Political risk
- Unstable construction regulations

From the study it was established that risks experienced by construction companies in Malaysia were interrelated. The occurrence of one risk generated the occurrence of other risks. For instance, material wastage was caused by poor workmanship. Poor workmanship emanated from bad practices when handling construction materials, setting out error, ordering materials that do not conform to specifications, improper storage, and misdemeanor. Low productivity during construction projects was caused by low technology usage, inadequate site administration, use of unskilled labour, poor duration estimation, shortage of manpower, non-conducive and accident-prone environments. The tables 3 to 6 show the risks associated with Malaysian construction industry, allocation of risks among project participants and the obtained scores from the survey that was conducted in Malaysia. The scores represent the results of the survey in which the respondents were asked to identify the project participant that is in a better position to manage the risk mentioned in the risk type column. Table 6 shows the risks that were not allocated to any contracting party.

No	Risks type		Obtained score			Age responsibility, AS (%)		
			Client	Contractor	Shared	Client	Contractor	Shared
1	Risk of defective design	R_1	68	3	15	79	3	17
2	Risk of funding problems for project	R_2	77	2	7	90	2	8
3	Delays in obtaining permits	R_3	50	16	20	58	19	23
4	Delay in availability of drawings	R_4	75	4	7	87	5	8
5	Risk of change in codes and regulations	R_5	50	5	31	58	6	36
6	Risk of Changes in scope of work	R_6	61	6	19	71	7	22
7	Improper scope of work definition in contract	R_7	50	4	32	58	5	37
8	Payment delays	R_8	67	5	14	78	6	16

Table 3: Client's responsibility (source: Iqbal et al., 2014)

No	Risks type		Obtained score			Age responsibility, AS (%)		
			Client	Contractor	Shared	Client	Contractor	Shared
1	Accidents/safety during construction	R_9	6	55	25	7	64	29
2	Risk of bad quality material/equipment	R_{10}	3	75	8	3	87	9
3	Inaccurate execution plan/schedule	R_{11}	4	73	9	5	85	10
4	Risk of insufficient technology	R_{12}	6	62	18	7	72	21
5	Theft/robbery of material at site	R_{13}	2	77	7	2	90	8
6	Third party delays	R_{14}	8	49	29	9	57	34
7	Risk of labor, materials and equipment availability	R_{15}	2	80	4	2	93	5
8	Risk of labor disputes and strikes	R_{16}	0	80	6	0	93	7
9	Poor performance of subcontractor	R_{17}	2	80	4	2	93	5
10	Poor coordination with subcontractor	R_{18}	4	77	5	5	90	6
11	Risk of defective material from supplier	R_{19}	2	77	7	2	90	8
12	Shortage of plant and equipment	R_{20}	3	78	5	3	91	6
13	Poor productivity of plant and equipment	R_{21}	2	83	1	2	97	1
14	Shortage/delay of material supply	R_{22}	2	79	5	2	92	6
15	Lack of qualified staff	R_{23}	0	45	41	0	52	48
16	Poor competence and productivity of labor	R_{24}	1	82	3	1	95	3

Table 4: Client's responsibility. (source: Iqbal et al., 2014)

S/No	Risks type		Obtained score			Age responsibility, AS (%)		
			Client	Contractor	Shared	Client	Contractor	Shared
1	Risk of natural disasters	R_{25}	30	4	52	35	5	60
2	Delays due to disputes with contractor	R_{26}	15	9	62	17	10	72
3	Inappropriate risk allocation in contract	R_{27}	27	9	50	31	10	58
4	Risk of exchange rate fluctuation and inflation	R_{28}	30	11	45	35	13	52
5	Terrorism/war threats	R_{29}	25	2	59	29	2	69
6	Adverse weather conditions	R_{30}	22	4	60	26	5	70
7	Political instability	R_{31}	23	5	58	27	6	67
8	Corruption including bribery at sites	R_{32}	5	17	64	6	20	74

Table 5: Shared responsibility (source: Iqbal et al., 2014)

S/No	Risks type		Obtained score			Age responsibility, AS (%)		
			Client	Contractor	Shared	Client	Contractor	Shared
1	Risk of unforeseen site conditions	R_{33}	29	16	41	34	19	48
2	Risk of differing site conditions	R_{34}	37	14	35	43	16	41
3	Inaccurate estimation of quantities of work	R_{35}	28	38	20	33	44	23
4	Inadequacy of insurance	R_{36}	17	30	39	20	35	45
5	Delays due to lack of availability of utilities	R_{37}	39	19	28	45	22	33

Table 6: Undecided responsibility. (source: Iqbal et al., 2014)

2.2.7. Kuwait

Risk affects the profitability of construction companies in Kuwait. Risk management practices are not well documented in Kuwait this is due to Kuwait's heavy reliance on oil reserves and the construction industry represents a small percentage of the gross domestic products GDP.

According to the study by Kartam and Kartam (2000) construction companies in Kuwait accept and share most of the risks which were identified. In the survey it was established that the client shared only 15% of the risks and the remainder (85%) of the risks are taken care by the construction companies. The following are some of the risks factors that cause delay in project delivery, over budget, unsatisfactory product quality and unsafe working environment in Kuwait:

- Differing site conditions
- Increment weather
- Sub-contractors' technical qualifications, reliability and financial stability
- Defective designs

2.2.8. Egypt

According to El karim *et al.,* (2017) the main causes of disputes in Egyptian construction industries emanate from delays and failure to complete the work in specified cost and time frame. The consequence of schedule overruns and cost overruns do not only impact the construction industry but the overall economy of Egypt. The following are some of the risks which were identified in Egyptian construction industry categorized into site conditions, resources, project parties and project feature related factors:

- Site conditions comprises of the following:
    i. Environmental factors
    ii. Sub-surface
    iii. Site location
- Resource related risks include the following:
    i. Labour
    ii. Equipment
    iii. Material
- Project parties related risks are caused by the following parties:
    i. Project owner
    ii. Engineering and design team
    iii. Contract and project management team
- Project feature risks include:
    i. Financial

ii. Political

iii. Schedule

2.2.9. South Africa

Even though the stadia were ready for 2010 FIFA World Cup some of the stadia were not ready for Confederation Cup which is the curtain raiser event for the World Cup. The following risk factors contributed to cost overruns during the construction of the stadia (Baloyi & Bekker, 2011):

- Price increase in the cost of construction materials
- Poor estimates of construction material quantities
- Scarcity of skilled labour
- Late award of construction tenders by the clients
- Degree of complexity of the designs of the stadia
- Escalation in the cost of labour
- Poor quantity take-off
- Variation orders by the clients during construction stage
- Scarcity of manpower

After the risks were ranked, it was established that the most significant risk factor was "price increase in the cost of construction materials". Whereas "poor estimates of construction material quantities" was the second significant risk factor which contributed to cost overruns (Baloyi & Bekker, 2011).

According to the same study that was conducted by Baloyi and Bekker in 2011, the risk factor which contributed to delays in completion of stadia projects were:

- Incomplete designs
- Scope changes
- Client's indecisive
- Late instruction from the clients

- Scarcity of skilled labour
- Bad planning and scheduling of construction work
- Strikes and labour disputes
- Scarcity of manpower
- Bad dissemination of information by the client
- Delay in approving work by the client

From the findings it was established that the highest ranked risk factors that contributed to project delay emanated from the client actions such as “incomplete designs’, “scope changes”, “clients’ indecisive”, “late instruction from the clients”.

Chihuri and Pretorius, 2010 identified the following risks during the construction of stadia, Gautrain, and associated infrastructures during the run up to the FIFA World Cup:

- Escalating cost of infrastructure

The cost of stadia during the preparation to hosting of 2010 FIFA World Cup escalated due to the rise in the cost of construction materials. The roof structures and lights for the stadia were imported from other countries. The fluctuation of the South African Rand against the major currencies also contributed to the escalation in cost of the stadia. The cost of constructing Gautrain rapid-rail link project was estimated to cost R7 billion in the year 2002 and when the project started it was established that Gautrain Project would cost over R25 million. The construction cost of the stadia was affected during the inception of stadia project in 2005 the estimated cost was R6 Million and during implementation the cost rose to over R10 billion (Chihuri & Pretorius, 2010).

- Power shortages

The stadia, Gautrain and all the projects which were being constructed in preparation to hosting of the FIFA World Cup in 2010 were threatened by Eskom’s unstable power supply in 2007 and early 2008.This unreliable power supply from Eskom smothered and clipped much needed economic growth in SA (Chihuri & Pretorius, 2010).

- Skill shortages

The construction industry experienced critical skills in construction and engineering fields during the run up to the hosting of the World Cup. In other projects skills were sourced from foreign countries and this resulted in an increase in cost of construction projects (Chihuri & Pretorius, 2010).

2.3. Risks and Uncertainty

Risks are detrimental occurrences on construction projects that have undesirable impact on the deliverables for instance cost, time, scope, quality, and safety. With risks there is knowledge that there is a probability of their occurrence. Not all risks are negative some risks create opportunities for the project. Uncertainty is unknown risk; it also has negative or positive impact on the project. It is very difficult to manage uncertainty than to manage risks during construction projects. Risk is uncertainty that can be estimated whereas uncertainty is risk that cannot be estimated (Serpell *et al.*, 2015).

Construction industry faces the following types of risks; financial, time, technical, market, natural, external, and internal risks (Szymanski, 2017). In construction projects risks can manifest themselves in five main stages; preliminary design, tender, detailed design, construction works and during financing stage. Risk that are encountered by construction companies during implementation are risk of protest, risk of poor soil investigation, poor work schedule, equipment failure, employee's absenteeism, incompetent employees, delays in material procurement, poor quality, scope changes and poor work organization (Szymanski, 2017).

2.4. Risk Management

Risk management process consists of planning, identification, analysis, response strategies and control of risks. Risk analysis is comprised of two processes qualitative and quantitative risk analysis. Qualitative analysis of risks comprises of arranging risks according to their degree of impact on the project. Quantitative analysis of risks is based on probability of occurrence and associated monetary losses due to the occurrence of the risks (Keshk *et al*., 2017). Risk responses comprises of avoidance, transfer, mitigation, and risk acceptance. Risk management does not eliminate risks from construction projects but mitigate the impacts of risks on the project. Figure 2 below from PMBOK 5th edition shows an overview of risk management process.

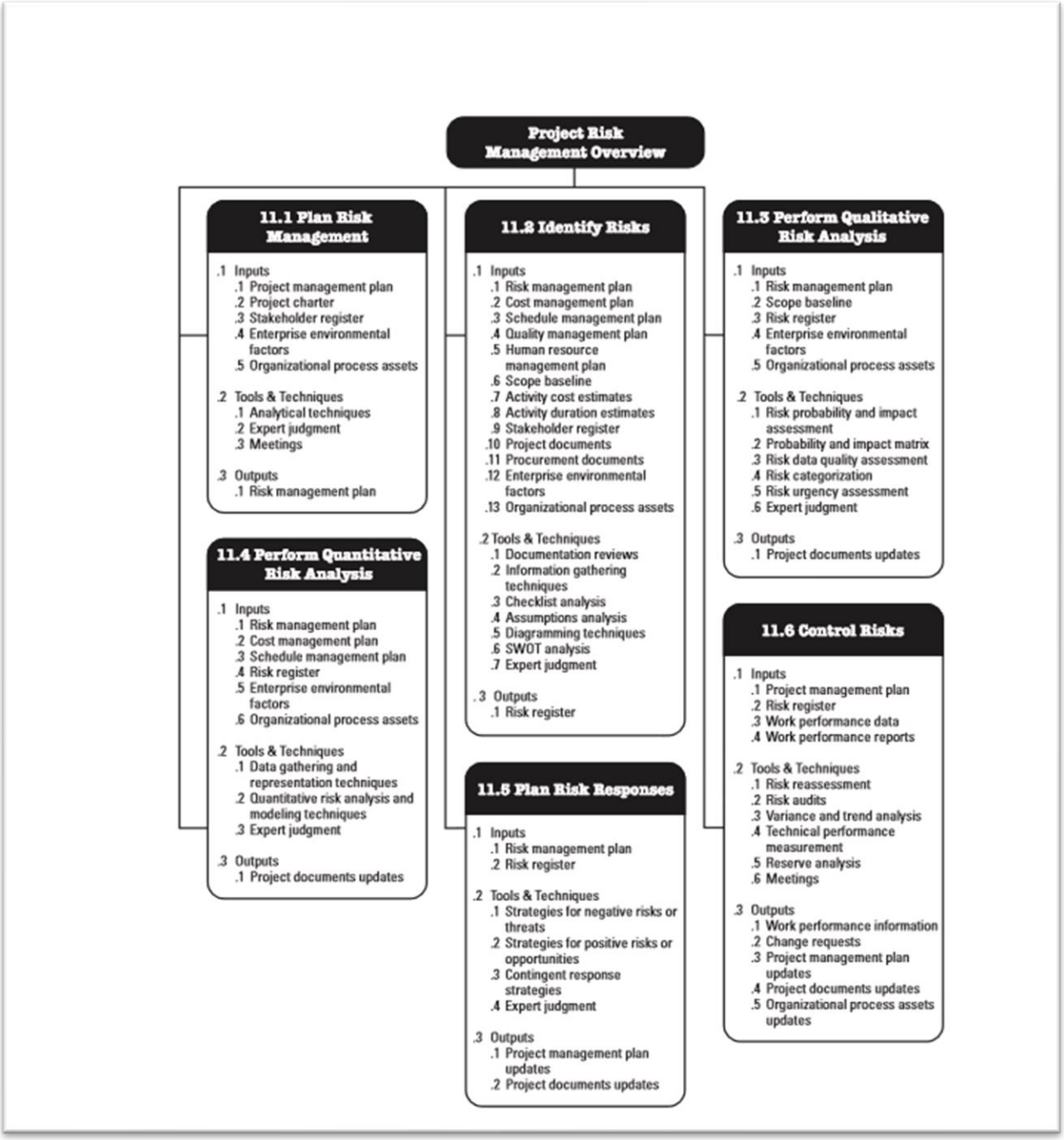


Figure 2: Project Management Overview (Source: PMBOK 5th edition)

2.5. Processes involved in risk identification

According to PMBOK 5th edition risk can be identified through review of documentation, gathering of information, checklists, assumptions, diagramming methods, swot analysis and expert judgement. Reviewing of documentation comprises of critical review of plans, assumptions, and previous project files. Information gathering is a procedure of capturing project risks and is conducted through Delphi technique, interviewing, brainstorming and identification of the root causes of risks. Brainstorming is conducted through meetings in which

members are allowed to contribute without being criticised. Risks are identified after brainstorming and they are characterized by type of risk and their descriptions are refined. In Delphi method one facilitator solicits risks from the respondents through a structured questionnaire. The identity of the correspondent is kept confidential. With regard to Delphi technique there is less bias as compared to brainstorming. In interviewing, the facilitator interviews experienced participants, subject matter experts and relevant stakeholders to identify risks associated with the construction project. In root cause analysis there is identification of problems and their associated causes and finding ways of preventing the problems from happening. Checklist is another tool used in identification of risks, a check list is reviewed from time to time to remove unnecessary risks on the list, a checklist records all the historical risks that have been experienced by similar construction project. Assumption analysis is a risks identification process where risks to the project are identified grounded on a set of hypotheses, scenarios, or assumptions. Risks are identified based on the inaccuracies, instabilities, and inconsistencies of the assumptions. Diagramming techniques of risk identification comprises of cause-and-effect diagrams, popularly identified as fish bone diagrams, procedure flow charts which highlights how systems interrelate and lastly influence diagrams which shows how the variables in projects influence one another. SWOT analysis with regard to risk identification is a procedure that identifies any opportunities that come about due to the strength of an organisation and any risks that come about due to organisation weaknesses. In expert judgement practitioners with relevant experience in construction project are asked to come up with the possible risks that are associated with the construction project (Flanagan & Norman, 1993).

After all the risks have been identified there is need to come up with a register of risks where all risks are stated and described. The causes of the risks are identified, consequences, probability of occurrence, impact of risks, risk score, risk ranking, risk control strategy and risk owners should also be identified (PMI, 2013).

The study investigated how the construction companies generate a risk register and documented all the risks associated with a particular project. The main final product of risk identification is a risk register. Figure 3 below shows the processes that are involved in risk identification (PMI, 2013).

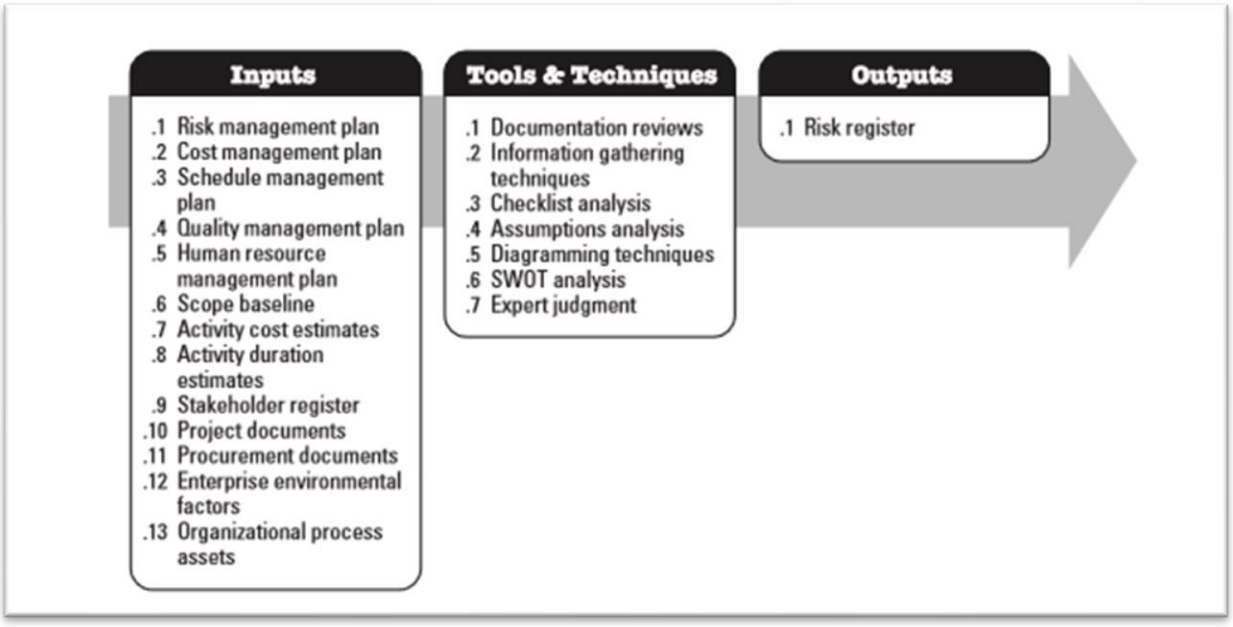


Figure 3: Risk identification processes (source: PMBOK 5th edition).

2.6. Risk analysis

After risk identification there is need to conduct a risk assessment. Assessment of risks is carried out using either qualitative or quantitative methods. Examples of quantitative risk assessment are sensitivity analysis, scenario analysis, probability analysis and decision trees. Qualitative analysis for risk assessment is based on descriptions, and the description can describe more on the likelihood and impact of a risk. Qualitative methods are favourable when there is scarcity of numerical data. Risks are classified based on their likelihood and impacts (Szymanski, 2017). The research topic focussed on qualitative approach to management of risks, in this research structured interviews using structured questions were used to generate data for the research.

2.7. Qualitative Risk Analysis

PMBOK 5th edition states that qualitative risk analysis is the process of looking at risks by combining the impact with probability for further analysis. This helps to rank risks from high impact risks to low impact risks. Managers on construction project using qualitative risk analysis are able to concentrate their resources on high priority risks. Figure 4 below shows the probability and impact matrix. The probability of occurrence of the risk is multiplied by the impact to get the risk rating.

Probability and Impact Matrix

Probability	Threats					Opportunities				
0.90	0.05	0.09	0.18	0.36	0.72	0.72	0.36	0.18	0.09	0.05
0.70	0.04	0.07	0.14	0.28	0.56	0.56	0.28	0.14	0.07	0.04
0.50	0.03	0.05	0.10	0.20	0.40	0.40	0.20	0.10	0.05	0.03
0.30	0.02	0.03	0.06	0.12	0.24	0.24	0.12	0.06	0.03	0.02
0.10	0.01	0.01	0.02	0.04	0.08	0.08	0.04	0.02	0.01	0.01
	0.05/ Very Low	0.10/ Low	0.20/ Moderate	0.40/ High	0.80/ Very High	0.80/ Very High	0.40/ High	0.20/ Moderate	0.10/ Low	0.05/ Very Low

Impact (numerical scale) on an objective (e.g., cost, time, scope or quality)

Each risk is rated on its probability of occurring and impact on an objective if it does occur. The organization's thresholds for low, moderate or high risks are shown in the matrix and determine whether the risk is scored as high, moderate or low for that objective.

Figure 4: Risk matrix (Source: PMBOK 5th edition)

Qualitative methods used in risk assessment are likelihood and impact assessment of risks. Risk rating matrices are generated from probability and impact assessment of risks (Mhetre *et al*., 2016). The figure 5 below shows the input, tools and techniques and outputs in qualitative risk analysis.

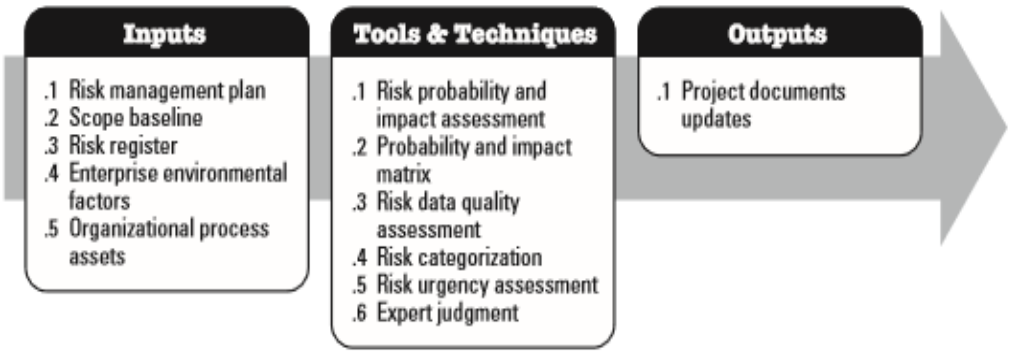


Figure 5: Qualitative risk assessment (source: PMBOK 5th edition)

2.8. Quantitative Analysis of risks

PMBOK 5th edition states that quantitative analysis of risks is the process of calculating numerical impact of the risks on the deliverables of construction projects. The impact can

contribute to increased cost of the project or schedule overruns. The tools that are used in quantitative risk management are risk plan for risk management, schedule management plan, cost management plan, registry for all risks, enterprise environmental factors and organizational processes. Figure 6 below shows the processes and tools that are used when analysing risks quantitatively.

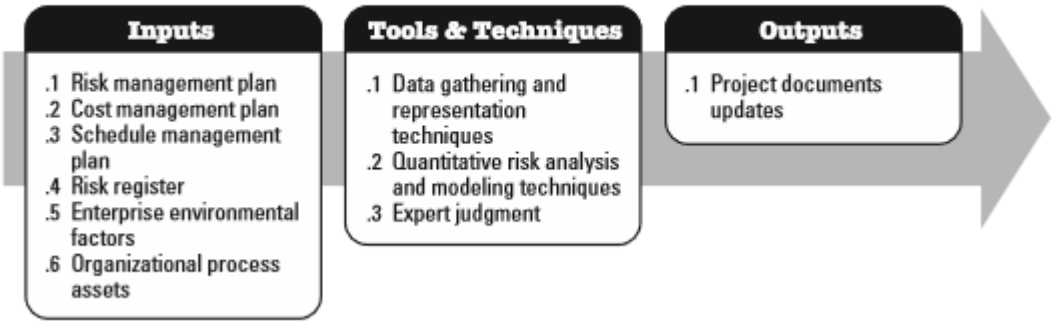


Figure 6: Qualitative risk assessment (source: PMBOK 5th edition).

2.9. Risk responses

Risk responses which are employed to respond to risks are avoidance, transfer, mitigation, or reduction of risk. While responses to opportunities are exploitation, sharing, enhancement and acceptance of an opportunity (Mhetre *et al*, 2016). Figure 7 shows the processes involved in risk responses.

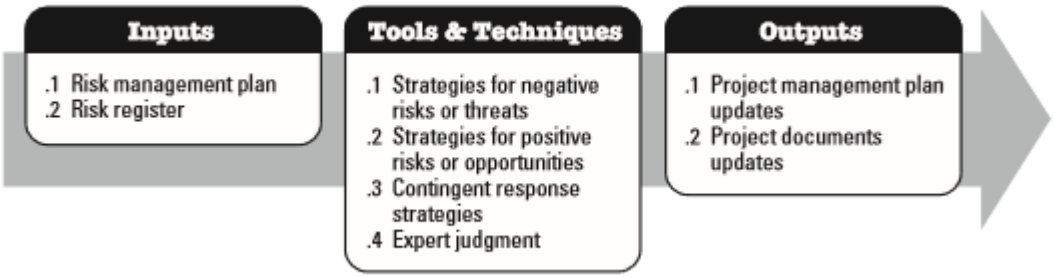


Figure 7: Risk response process (source: PMBOK 5th edition).

2.10. Risk control

Final step in risk management is risk control that comprises of implementation of risk response mechanisms, tracking the effects of the risks on the project deliverables, documentation of potential risks and assessment of risk management effectiveness throughout the project. Control and monitoring are the methods that are employed when evaluating risk management strategies that are currently being used by construction companies (PMI, 2013). Figure 8 below shows the process that are involved in risk control.



Figure 8: The process of risk control (source: PMBOK 5th edition).

2.11. Methodology used in review of literature

The methodology used in reviewing of literature involved searching on the recently published journal articles on risk management in construction industry. PMBOK 5th edition, google scholar and science direct were some of the sources that were used by the author.

The following key words were used when searching for literature on the internet. The key words in the search were risk management in construction industry, identification of risks, risk assessment, risk response strategy in construction industry, monitoring of risks and review in construction industry, delays projects completion dates, cost overruns in projects, Sources of poor-quality work in construction industry, Current challenges experienced by construction companies in SA.

2.12. Topic Area 1

The first topic area is on risk management with regard to management of risks of cost overruns, schedule overruns, quality (Smith & Merrit, 2002) and safety related risks on construction projects.

2.13. Topic Area 2

The second topic is on risk management strategies that are used in South African construction Industry (Baloyi & Bekker, 2011).

2.14. Literature Review Key Findings

The main findings from literature reveals that construction industry experience risks that causes schedule overruns, cost overruns, scope changes and poor quality of construction products. Companies manage risks reactively rather than proactively (Baloyi & Bekker, 2011).

The other finding is that qualitative methods are favourable when there is scarcity of numerical data. Risks are classified based on their likelihood and impacts (Szymanski, 2017).

2.15. Literature Review Conclusion

Risk is defined as anything that can affect successive completion of construction project with respect to time, cost, quality, scope, and safety. Risk affects construction projects positively and sometimes negatively. Risks which affect construction projects positively are called opportunities and those that affect projects negatively are called risks. The responsive mechanisms for positive risks are exploit, enhance and sharing of the opportunities with other stakeholders on the project. Risks response mechanisms for negative risks are avoidance, acceptance, mitigation, and transfer (Kerzner, 2017).

Risk management comprises of the following processes: planning for risk, identification of risks, analysis of risks (quantitatively or qualitatively), responding to risks and controlling of the risks. Risk management strategies are the response and control mechanism that are used by construction companies (Serpell *et al.,* 2015).

From various studies that were conducted across the globe some of the commonest risks on construction projects are shortage of skilled personnel, delayed payment of construction companies' invoices, increment weather, adverse physical conditions, defective or incomplete designs, frequent breakdown of construction machinery, inflation and price fluctuations of construction materials, inaccurate estimation of the project duration, inexperienced sub-contractors, inadequate scope definitions, political risks, lack of skill in ordering of construction materials etc.

Risk management in South Africa is being carried out using intuition and gut feeling, there is no structured risk management in place to manage risk in construction. Construction risk management in South Africa is still at an infant stage even though some construction

companies have adopted the principles of project risk management, they still do not apply risk management principles throughout their project life cycle. The lack of appreciation of the benefits associated with structured project risk management was one of the reasons that contributed to the general lack of appreciation of structured risk management. The other two reasons were lack of knowledge in project risk management and the perception that risk management is costly to construction companies (Chihuri & Pretorius, 2010).

CHAPTER 3 RESEARCH DESIGN

3. Research Design

The research assumption in this research is epistemology, which gives a wider choice of methods to be used. The author went to construction contractors and investigated the risk management strategies that are being applied in management of construction risks. This study focussed on the risk management strategies that are applied at construction stage. The reason being that the construction companies' involvement in construction project cycle is concentrated at tender, construction and close out stage. Much of the construction companies' effort are spent on the construction stage. During the construction stage construction companies experience a lot of risks which contribute to cost overruns, schedule overruns, poor quality of construction product and scope changes. The author asked structured questions and verified how companies manage risks through use of company records. The following sub-headings under research designs explains the research design in detail.

3.1. Research philosophy and approach

Research philosophy for this study is a hybrid of interpretivism and pragmatism. The reason the researcher is using interpretivism is that this study created new, richer understandings and interpretations of methods that are being used by construction companies in management of risks in their business environments. Interpretivism emphasises that humans are different from physical phenomena because they create meanings (Saunders et al., 2016). Construction project managers and safety officers from different organisations answered questions differently from each other because they have different experience in risk management. Risk management in construction projects has a bearing on the interaction of construction project managers in the organisation. Interpretivism recognises that their interpretation of research materials and data and thus their own values and beliefs, played an important role in the research process. The researcher used pragmatism philosophy because this study starts with a problem statement and is aimed at finding practical solutions to risk management in construction companies that will inform future practice. In this study the important determinant of the research design and strategy is the research problem. This study is addressing the research problem and research question. The explanation above explains why the hybrid of interpretivism, and pragmatism philosophies were used in this study (Saunders *et al.,* 2016).

The research logic is inductive approach in a way that the research study starts with collecting of data. Generalisations is made on the strategies that are being used by construction companies

in SA when managing construction risks at both construction and tendering stage. The data collected from companies is analysed qualitatively. Theory regarding the risks management strategies that are used by construction companies will emerge from the data that will be collected through interviews (Saunders *et al.,* 2016).

The methodological choice of the study is mono method qualitative. The research is based on qualitative analysis of data that was captured using structured interviews. The interview participants were interviewed using structured question.

The research strategy that the researcher used in this research is narrative inquiry. Qualitative data was collected using structured interviews to gather data from the research participants. It is called narrative inquiry because its focus is to explain the outcome of the interview in qualitative research (Saunders et al., 2016). The researcher listened to the experiences of the research participants regarding risk management strategies that are applied by construction project managers and health & safety officers, when dealing with risks in construction. Through narrative inquiry the research participants were able to shed more light on their personal experiences regarding the management of risks in their organizations (Saunders *et al.,* 2016).

The time horizon for the research interviews was cross-sectional because the research sought to establish the risk management response strategies that are currently being used by contractors in South Africa to manage construction risks (Saunders *et al.,* 2016). The research is based on interviews that were conducted over a short period and qualitative methods of data analysis was used.

The final stage in the research onion is the collection and analysis of the data that was captured during the structured interviews. The author identified important themes and patterns from the data that was collected using structured interviews.

3.2. Methodology

The interviews with the research participants were timed in a way that there was sufficient time after one interview to analyse the interview results before proceeding to the next interview. Appointments were made with the construction project managers and safety officers before the interview and the participants were informed about the purpose of the interview. The structured interviews were conducted in Gauteng Province in the cities of Johannesburg and Pretoria. These two cities were used as laboratories for this study because Johannesburg is the commercial city in SA and Pretoria is the Capital City of SA and most big construction

companies in SA have their headquarters in these two cities. Placing of construction companies' headquarters in either of the two cities facilitates smooth running of construction projects across all the nine provinces of SA. Johannesburg and Pretoria are geographically located at the centre of SA.

3.3. Research methods

The philosophy that is used in this study is a combination of interpretivism and pragmatism. The research methods that were used in this research were structured interviews, recording of the interviews using phone, research notebooks and reflective diary or journal.

3.4. Population and Sampling

The research experienced sampling bias in a way that only companies that accepted the researcher's booking for interviews were visited and those that did not accept the booking were not visited. The sampling method that was used was convenient, only the construction companies in Gauteng province were interviewed. The population for this objective comprised of construction project managers and health and safety officers from different construction companies in Gauteng Province (Pretoria and Johannesburg). Sampling was conducted through non-probability sampling. The group that was interviewed comprised of volunteers. Access to the volunteers was through snowballing and self-selection by the researcher. Appointments with the construction project managers were arranged through visits to the construction company's premises, through telephonic appointments and email communications. Seventeen managers from different construction companies were interviewed. Responses from interviews were captured on separate sheet of paper and recorded on recording device. To maintain confidentiality names of companies and individuals who participated in the interviews were not disclosed. The researcher did not interview contractors in CIDB grade range of 1 to 6, because a lot of contractors in this category do not have capacity to carry out big construction projects. The interviewer did not interview foremen because most of them are not involved in strategic decision making. The interviewer did not interview companies outside Gauteng because a lot of big construction companies have their headquarters in Gauteng.

3.5. Development of the Research Instrument(s)

The research instrument that was used was structured interview. The structure interviews managed to capture the risk management strategies that are being used by construction companies when managing construction risks. The structured questions were prepared in alignment with the literature review from journals, books, and internet search. The interviews

started with introductions, the researcher introduced himself to the research participant and the researcher asked the participant to introduce themselves. After introduction the researcher stated the purpose of the interview. The researcher told the participant that the purpose of the interview was for academic purposes only. The researcher told the participant that the interview takes less than 30 minutes. The researcher told the participants that he was investigating the risk management strategies that are being used by construction companies when managing construction risks. The researcher informed the participants that the interviews were strictly confidential and participation in the interview was voluntary. At any time, the participant felt uninterested in the interview were free to stop or withdrew from the research interview. The table 1 below is a list of the questions that were asked during the structured interviews.

Number	Question	Reference
1.	What is your position in this construction company?	General introductory question.
2.	What qualifications are required for someone to occupy your position in this company?	General introductory question.
3.	Do you have a risk management plan in your organisation?	Risk management definition from literature.
4.	What do you know about risk management in construction?	Risk management (literature review)
5.	Which tools or methods do you use when identifying risks?	PMBOK 5th edition
6.	What are the common risks that your company experience on construction projects?	Literature from academic journals
7.	What measures do you implement to manage the common risks on construction projects?	Literature from academic journals
8.	Who is responsible for management of risks in your organisation?	General enquiry question.
9.	How do you plan risk management in your organisation	PMBOK 5th Edition
10.	Do you have a risk register in your organisation that you use on construction projects?	Literature from academic journals
11.	How do you prioritise risks in your organisation?	Literature from academic journals
12.	Which risk analysis do you frequently use between quantitative and qualitative risk analysis?	Literature from academic journals
13.	Which risk management response strategies do you use in your company?	Literature from academic journals
14.	How do you control and monitor the risk management strategies in your company?	Literature from academic journals

Table 7: Research questions.

3.6. Ethical Risks and Mitigation Strategy

The following are some of the procedures that were followed to ensure that research ethics was adhered to.

- The research participants were informed on the objective of the research, nothing was hidden from the research participants.
- The research participants were treated with respect.
- The identities of the research participants were kept anonymous.
- The research participants participated voluntarily; they were not forced to participate in this research.
- The participants had the right not to answer some of the questions that were asked by the researcher.
- Anonymity and confidentiality of the research participant were maintained during analysis and reporting of research findings.
- The research interviews were conducted in a safe environment for both the researcher and the research participants.
- The participants were asked for permission before recording of the interview.
- The true purpose of the research was not concealed from the research participants.
- The confidentiality of the research participants was always protected.
- The participants of the research were not influenced by the researcher on their views regarding risk management in SA Construction Industry.

3.7. Validity and Reliability

The instruments (structured interviews) that were used during the face-to-face interviews were valid. Validity was achieved because most of the questions were drawn from prior journal articles. Measures were taken to provide the participants with relevant information and question themes before the interview. This gave the participant ample time to consider the information that was being requested and time to assemble relevant documentation for the interview. These efforts promoted validity and reliability of the research instruments reference (Petrovic, 2017). According to Bryman *et al.*, (2011) and Saunders *et al.*, (2009 reliability implies the degree to

which data collection and analysis generates consistent results while validity involves the actual precision of the research instruments. The research questions were understood by the participants as intended by the researcher and the responses were understood by the researcher as intended by the participants. Valid research questions facilitated collection of precise and reliable data. According to Saunders et al., (2009) four stages must happen before research questions can be considered valid and reliable. Figure 9 below shows the stages that must occur for validity and reliability to be satisfied.

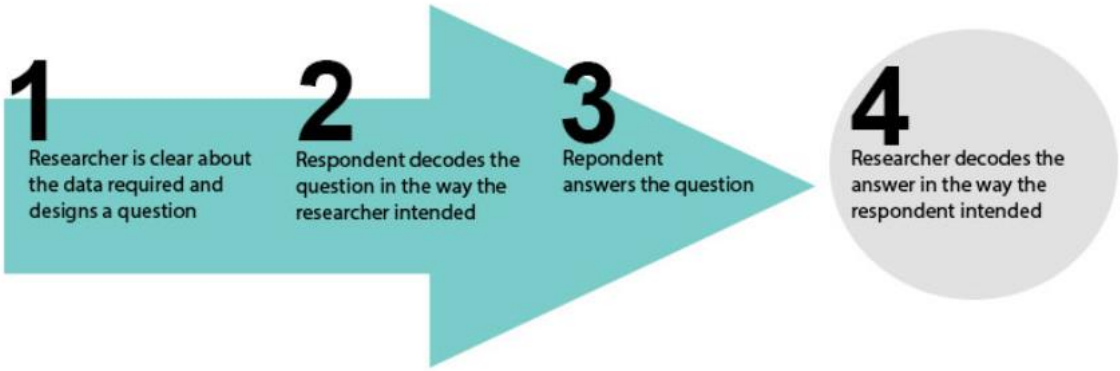


Figure 9: Four stages that must occur before research questions can be considered valid and reliable (source: Saunders et al., 2009)

3.8. Data Analysis

Data analysis in this research is thematic analysis. In thematic analysis data is analysed to check if there are patterns or themes within the qualitative data (Saunders *et al.*, 2016). Thematic analysis searches for themes and patterns that are common to the research data set. This analysis is associated with the coding of the data to identify themes and patterns for detailed analysis regarding the research question.

CHAPTER 4. ANALYSIS AND RESEARCH FINDINGS

4. Analyses and research findings

This chapter presents and analyses the research findings on the risk management strategies that are being used by construction companies in Gauteng province (Pretoria and Johannesburg), when managing construction risks. Seventeen research participants' responses to the interview questions are presented and analysed. The responses to the 14 interviews questions by the 17 interview participants are as detailed in the following sections:

4.1. Positions of research participants in their organisations

- **What is your position in this construction company**?

The responses to this question from the 17-respondent showed that the participants to the research interview were 13 construction project managers, 1 assistant construction project manager and 3 were health & safety officers. The targeted population of the study were skewed towards construction project managers because they are the ones who are involved in all the stages of construction projects. Table 2 summarizes the above data in tabular format.

Position in the company	**Number interviewed**
Construction project manager	13
Health & safety officers	3
Assistant construction project manager	1
Total interviewed	**17**

Table 8: Number of research participants and their positions

According to SACPCMP guidelines construction project managers are involved in all the stages of construction project delivery. The following are the stages in which the construction project managers are involved:

- Stage 1-project initiation and briefing
- Stage 2-concept and feasibility
- Stage 3- design development
- Stage 4-tender documentation and procurement
- Stage 5-construction documentation and management

- Stage 6-project close out

Based on the construction project managers involvement and their knowledge the results of this study can be generalized even though this study is focussing only on tender and construction stage and close out stages of project delivery.

5.2. Qualifications of research participants

- **What qualifications are required for someone to occupy your position in this company?**

Responses to this question from the 17 respondents showed that a lot of them possessed construction related qualifications. This is evidence that shows that one way of managing risks on construction projects is to appoint personnel with the suitable qualifications for the job. Appointment of suitable candidates on construction projects is one of the risk management strategies that are being used by construction companies in Gauteng province when managing construction risks. Total quality management states that customer satisfaction is achieved through proper coordination of the processes that are involved in production and that the people executing the works should be well trained to do the work. The personnel on construction projects should focus their energies in meeting the requirements of the construction project (Nel, 2006) . Some of the safety officers were highly skilled in safety management. Big construction companies are careful when it comes to employment of personnel considering the numerous risks associated with construction of capital projects. The projects demand good knowledge of the risks associated with the construction of the projects. Personnel with professional registration and years of experience are more knowledgeable of the risks associated with the construction project than inexperienced professional who just join the construction industry straight from university or college. The figure 9 below shows the seventeen research participants who were selected from the construction company in CIDB range of 7 to 9. Four of the participants had Bachelor of Technology in civil engineering plus registration with ECSA. Two had Bachelor of Science in Construction studies, one had Bachelor's Degree in Quantity Surveying, one had Bachelor's Degree in Management, two had Bachelor of Civil Engineering, one had Bachelor of Technology in Transportation, one had only experience in earthworks and no academic qualification, one had project management degree and the other had a Diploma in Building. One of the three safety officers in addition to having Diploma in Safety Management and Samtrack is professionally registered with SACPCMP as a professional construction Safety Officer. The qualifications attained by the

respondent assisted the respondent in acquiring knowledge of the processes that are undertaken during construction projects. This knowledge enabled them to plan for risks, identify risks, analyse risk, and come up with response mechanism to manage risk associated with construction projects. Even though the qualification of the respondents did not cover enough scope on risk management in construction, their qualifications coupled with the numbers of years of experience assisted the interviewees to manage risks associated with construction proactively. The respondents demonstrated that they were aware of the underlying factors which cause cost overruns, schedule overruns, injuries, poor quality work and scope changes on construction projects. The participants with qualifications and experience were using gut feeling and intuition to proactively manage risks despite not having formal risk management qualifications.

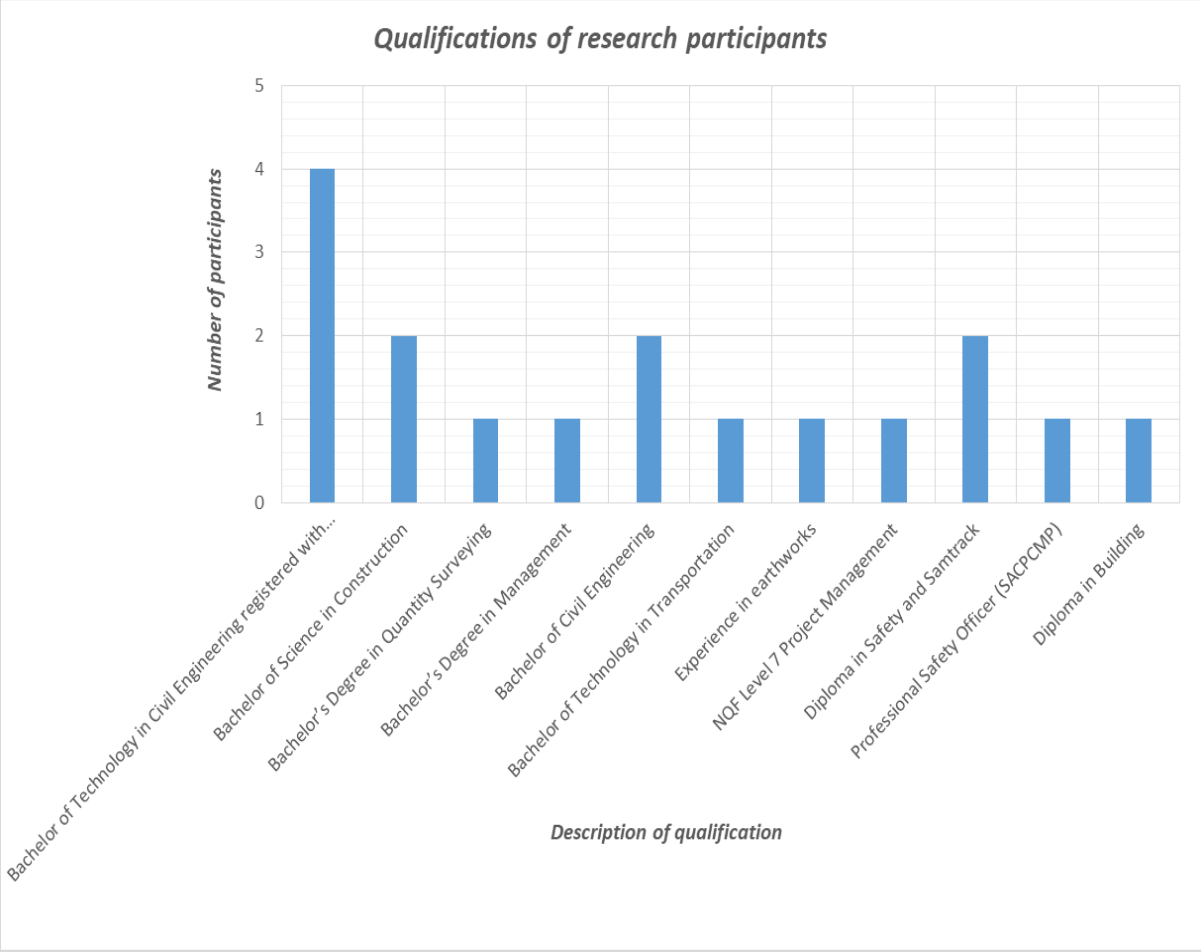


Figure 10: Qualifications of the research participants.

5.3. Risk management planning in organisations

- **Do you have a risk management plan in your organisation?**

When asked if they have a risk management plan in their organisation 12 of the respondent said that they had risk management plan in their organisation and 5 of them said that they did not have any risk management plan. One of the reasons 5 of the respondent had no risk management in place was due to lack of commitment from top management regarding risk management in their organisations. Some of the respondent who stated that they do not have risk management plan they said that their companies do not pre-plan for risk management they just resolve the risks as they happen on the projects. Some of them said that they use experience from other projects and prepared a programme of works that they use when dealing with some of the risks such as procurement risks and quality management risks. All the respondents with safety management qualifications said that they have risk management plan on their construction sites. Even some project managers who were not aware of risk management they were able to agree that they have risk management plan in place, and they referred the author to their safety officers. Out of the 12 research participants who responded that they have risk management plan 3 of them were safety officers. Table 3 below shows how they responded to question number 3.

State	**Number**
Have risk management plan	12
Do not have risk management plan	5

Table 9: Number of companies that have risk management plan versus those without.

According to the study which was carried out by Chihuri and Pretorius, 2010 the findings revealed that project risk management practices are still not commonly used in construction and engineering environment in SA. Even Though many construction companies adopt the principles of project risk management, they still do not apply the principles throughout the entire life of construction project. From the author's findings 5 of the correspondent had no risk management plan whilst 12 of the correspondents had risk management plan. Lack of risk management plan in the 5 construction companies could be attributed to some of the factors that contributed to overall lack of use of project risk management in the study that was carried

out by Chihuri and Pretorius, 2010. The following factors contributed to the overall lack of use of project risk management practices in the run up to 2010 FIFA World Cup:

- Lack of understanding of the advantages of a well-defined project risk management approach. Most respondents were still not sure about the scope to which project risk management would add knowledge to the overall success of projects in SA.
- Speed to complete the projects on time
- Shortage in project risk management proficiency. As a result of general lack of full awareness of the risk management procedures, it can be concluded that construction company employees on construction projects should be trained to close the gap.
- The perception among construction companies in SA that project risk management is expensive.

5.4. Research participants knowledge in risk management

- **What do you know about risk management in construction?**

Only one project manager did not have any knowledge in risk management out of the seventeen respondents. Seven of the respondents managed to define risk management as the process of planning, identifying, analysing, responding to risks, and finally monitoring and controlling the responses to risks ensuring that the undesirable situation is not experienced on a construction project, all the seven respondent who defined risk management properly are employed in construction companies that are executing big construction projects in the country. Three of the safety officers defined risk management in line with safety management, in which they stated that risk management is the identification of risks associated with the project scope of work. The safety officers highlighted that before coming up with a risk management plan they check what the scope of work will comprise of. Then they identify the risks associated with that type of construction project. After identification of the risks then they plan for risk responses. One of the safety officers went on to say that risks change with time what was considered a risk in the past is no longer a risk. He cited the coronavirus as a new risk to the construction industry and he stated that coronavirus also changed risk management regarding safety. One of the foremen with experience in earthworks who doubled as a contract's manager had no knowledge in risk management. One site agent defined risk management partially after the author explained to him what was involved in risk management. Three of the managers that were interviewed also did not have any knowledge in risk management and they just said that risk management is managed by their safety officers. One project manager withdrew from the

interview. Table 4 below presents the total number of persons with risk management knowledge, those without any knowledge in risk management and the one that withdrew, and it was not established if he had risk management knowledge.

State	**Number**
Have knowledge in risk management	10
Do not have knowledge in risk management	6
Not established	1

Table 10: Managers who had risk management knowledge versus those without.

Some correspondents did not have knowledge in risk management because risk management is not being practised proactively. The other reason being that some practitioners have risk management knowledge but they fail to interpret and apply the risk management principles. In the previous studies the main challenges that were found had to do with the implementation of risk management tools and techniques on the construction projects. Widespread adoption of risk management in SA had been impeded by lack of knowledge and skills in the implementation of risk management practices on construction projects (Chihuri & Pretorius, 2010). According to Serpell *et al.,* 2015 the challenge with risk management is not unavailability of information relating to interpretation and application of risk management, but lack of knowledge to interpret and utilize procedures to cope with risk on construction projects. Risk management in SA is managed using intuition and gut feeling, there is no structured risk management in place to manage risk in construction. Risk management in SA is still at an infant stage. Even though some construction companies have adopted the principles of project risk management, they still do not apply risk management principles throughout the construction project. The lack of appreciation of the benefits associated with structured project risk management was one of the reasons that contributed to the general lack of application of structured risk management. The other two reasons were lack of knowledge in project risk management and perception that risk management is expensive to a construction company (Chihuri & Pretorius, 2010).

The only time risk management will be prioritized by construction companies and managed using formal risk management processes will be the time when there will be increased pressure

from stakeholders, tighter regulatory requirements, external environment threats, global competition, and increased operational complexity (KPMG, 2006). The current practice in the industry does influence the senior management of construction company to support formal risk management practices in their organizations.

5.5. Tools used when identifying risks

- **Which tools or methods do you use when identifying risks?**

Some of the respondent mentioned the tools that they were using when identifying the risks and the motivation behind the use of the tools, while the others just mentioned the tools and the author did not ask the reason, they were using those tools. The first respondent (construction project manager) said that the tool that they frequently use is the risk register. They said they use a risk register because all the risks that they encountered on previous projects are already captured on their company risk register. They said they used risk registers because it simplified the process of risk identification on construction projects. Whenever they start new projects, they just pick risks that are associated with the new projects and list them on a new risk register and update the register with risks that have been identified on the new project. The second respondent (construction project manager) said that they use a JBCC contract to manage construction risk on a construction project. They used JBCC contract to identify risks on construction projects because JBCC contract allocate risks to parties on construction projects therefore it was easy for them to isolate their risks in the project. The third respondent (construction project manager) said that they have templates that are issued to them from the consulting engineers on which they record all the tests results, and they wait for the consulting engineers to verify if the results comply with the design specifications before executing the next activity on the programme of works. They said they used templates provided by consultants rather than their own templates to avoid duplication of work. The fourth respondent (construction project manager) said that they use a checklist of similar previous projects that were executed by their company. The fifth respondent (construction project manager) said that they use a risk matrix to identify risks on the project. The sixth respondent (Construction project manager) said that they use a detailed risk assessment which is prepared jointly between the construction project manager and the safety officer. The seventh respondent (construction project manager) said that he just plans for the work that will be executed and he updates the programme of works if there are changes that affect the programme on the project. The eighth respondent (construction project manager) said that every risk on their project is identified by

the safety officer. The ninth respondent (construction project manager) did not answer this question he withdrew from the interview. The tenth respondent (construction project manager) said that he did not have any knowledge on tools that are used, and he referred the author to the safety officer. The eleventh respondent (health and safety officer) said that they use the scope of work to identify the risks that are associated with the construction project. The twelfth respondent (health and Safety officer) said that they use a risk profile. The thirteenth respondent (construction project manager) said that when identifying risks, they use gut feeling and checklist of the risks that were experienced in the previous projects. The fourteenth respondent (health and safety officer) said that they use the scope of work to identify the risks associate with that type of construction. The fifteenth respondent (construction project manager) said that they use checklist, physical and visual surveys to predict risks associated with the project and advise the site personnel to come up with mitigation measures. The sixteenth respondent (construction project managers) said that they use a basket of risks, where all the risks associated with construction of roads, bridges and buildings are documented. The seventeenth respondent (assistant construction project manager) said that they use expert judgement and brainstorming.

Identification of risk is the first and possibly the most critical stage in the risk management. It is at this stage where risks are identified with their associated sources. It comprises the appreciation of potential risks in the construction project and the assignment of roles and responsibilities to project participants (Wang & Chou, 2003). Identification of risk is done using brainstorming, Delphi technique, interviewing experts in the field of construction, using experience, and using checklists (Mhetre et al., 2016).

5.6. Common Construction risks

- **What are the common risks that your company experience on construction projects?**

The first respondent (construction project manager) said that they experience community unrest, poor workmanship which emanate from employment of local community sub-contractors. The second respondent (construction project manager) said that they experience health and safety related injuries, cash flow problems, schedule overruns, increment weather, theft of construction materials, poor workmanship from sub-contractors and sometimes the sub-contractors go bankrupt in the middle of the project due to mismanagement of funds. The third respondent (construction project manager) said that they experience delays that emanate

from disapproved quality of construction materials. The fourth respondent (construction Project manager) said that they experience late payment of their invoices from their client, late delivery of construction materials, design risks which emanate from incomplete designs and poor workmanship from the sub-contractors. The fifth respondent (construction project manager) said that they encounter time related risks, financial risks, and quality related risks. The sixth respondent (construction project manager) said that they experience collapse of trenches, fall from heights and hazardous chemicals. The seventh respondent (construction project manager) said that they experience risk of losing some of the project team members through death or resignation. Eighth respondent (construction project manager) said that all risks that are experienced on the construction sites are known by safety officer only. Ninth respondent (construction project manager) withdrew from the interview. The tenth respondent (construction project manager) said that risk management is the job of the safety officer, and he is not involved. The eleventh respondent (health and safety officer) mentioned injuries to persons on site. The twelfth respondent (health and safety officer) said that experience fall from heights when people work on heights. The thirteenth respondent (construction project manager) said that they experience safety related risks, community unrest, failure to procure construction materials on time and inflation. The fourteenth respondent (health and safety officer) said that they experience injuries on construction site. The fifteenth respondent (construction project manager) said that they experience safety related risks, plant, and equipment risks, working on heights and trench excavation work. The sixteenth respondent (construction project manager) said that there are a lot of risks that are experienced by their company ranging from bad pricing of the work, financial risks, work related risk and some of the risks are difficult to plan for. The seventeenth respondent (assistant construction project manager) said that they experience safety related risks, theft of construction materials diesel and changes in rental market.

In summary the 17 respondents stated that they experience the following construction related risks: community demand to be involved in the project and sometimes they stop the projects unnecessarily, poor quality work from the local subcontractors, health and safety related injuries, cash flow problems which emanate from delayed payment of the contractors' invoices from their clients, increment weather which contributes to schedule overruns, theft of construction materials, sometimes subcontractors go bankrupt, loss of key project personnel through death and resignations, failure to procure construction materials on time, inflation and change in exchange rates, frequent breakdown of construction equipment, bad pricing of construction work and last but not least changes in rental market.

In the run up to the 2010 FIFA World Cup the SA construction companies experienced escalating costs which was caused by fluctuation of the South African Rand against the major currencies and the rise in price of construction materials. Power shortage which was caused by Eskom's unstable power supply (Chihuri & Pretorius, 2010).

5.7. Measures used to manage common risks on construction projects

- **What measures do you implement to manage the common risks on construction projects?**

The first respondent (construction project manager) said that they address issues of community unrest through negotiations with the political leaders such as councillors of the area and sometimes they go to court and seek court interdicts to prevent the community from delaying their project. The second respondent (construction project manager) said that they write security report regarding movement of materials on the construction site, they prepare cost reports to compare them with the initial budgets and they make sure that the sub-contractors sign contracts before starting to work on the construction project. The third respondent (construction project manager) said that they have a checking mechanism in place to avoid the materials from being rejected and consequently delay the completion of construction project. The fourth respondent (construction project manager) said that on late payment of invoices from their clients they prepare a bigger claim at the beginning of the project, to avoid late delivery of materials they prepare a procurement schedule that is in line with the engineer's approved program of works, regarding design risk their company study the scope of work that is on the construction drawing and highlight the missing information on the drawings and they present the details of the missing information to the consulting engineers. They also make sure that the design engineer from the consulting engineers' side is registered with Engineering Council of South Africa (ECSA). At their construction company they make sure that all the drawings that have been delivered to the sites are all signed by the design engineer. On poor workmanship from the local sub-contractors their company checks if there are funds on the project contingency, and if there are enough funds, they ask the engineer to release part of the contingency sums so that it can be used to up skill the local sub-contractors. Sometimes they also look for an experienced person from the local community who can guide his team to perform quality work. The fifth respondent (construction project manager) said that they come up with an organogram which clearly outlines the roles and responsibilities of the personnel in the company and monitoring of the operations on a daily, weekly, monthly, and quarterly

depending on the level of risk. On the organogram the company clearly define the job description and the required qualification for the posts. The sixth respondent (construction project manager) said that they have qualified health and safety officer who manage the health and safety related risks. The seventh respondent (construction project manager) said regarding demanding of sub-contracts they accommodate the local sub-contractors by awarding contracts on brick laying and drainage. They also train some of the sub-contractor's labourers in bricklaying and health and safety. On theft of construction materials, they have a stores clerk and the guard who check each one when they are knocking off from the site on daily basis. Regarding the quality of work from the sub-contractors the site agent drafts contracts that are signed between the main contractor and the sub-contractor in which the main contractor stipulates that 10% of the contract amount will be retained till the sub-contractor performs quality work and if the sub-contractor does not perform quality work the main contractor will hire a different sub-contractor to do the works and get paid instead of the initial sub-contractor. On the risk of losing project team members through death or resignation they have a succession plan. In this plan they train employees on the job so that when the other leaves they do not have difficulties in replacing them. The eighth respondent (construction project manager) said that all risks are managed by the safety officer. The ninth respondent (construction project manager) withdrew from the interview. The tenth respondent (construction project manager) said that risk was not his area of specialisation and in their company, risk is managed by the safety officer. The eleventh respondent (health and safety officer) said that they conduct daily safety task analysis, each foreman with his team identifies the risks and manage them proactively. They also conduct toolbox talks and they also conduct pre-start checking of risks and checking of the construction vehicle conditions. The twelfth respondent (health and safety officer) said that they manage the risk of falling from height by training the workers and they also induct the workers before commencing work on site. The thirteenth respondent (construction project manager) said that regarding safety they engage with the safety consultants on construction sites, procurement they make sure that they order construction on time before they are actually needed on the construction site, and they also acquire the services of the sub-contractors on time. On risk of inflation when tendering they make sure that they have sufficient contingencies and allowances for contract price adjustments. The fourteenth respondent (health and safety officer) said that daily safety task analysis, where each foreman with his team plan on the work that they are going to execute, they also conduct toolbox talks and they also conduct pre-start checking of the risks and they check the conditions of the construction vehicles before starting

to work on site. The fifteenth respondent (construction project manager) said that after identification of the risks they implement possible mitigation measures, and they appoint individuals to manage the risks. The sixteenth respondent (construction project manager) said that they identify the risks, then control procedures and evaluate the impact and level of exposure and rating of the risks, when they find that the risk is significant or not significant, they come up with an appropriate measure. He also said that quality is also a risk in construction project and they provide quality management plan to manage quality related risks on the project. The seventeenth respondent (assistant construction project manager) said that they appoint competent employees such as safety consultants, Safety representatives and safety officers and avoiding the risk by properly identifying it in the planning phase.

In summary the 17 respondents presented the following measures that they used to manage construction risks: negotiations with the community members and politicians regarding subcontracts, seeking court interdicts if negotiation with community members fails, preparation of construction material control sheets and registers to curb theft of construction materials, submission of a bigger invoice with projected work to the clients to manage cash flow problems on a project, signing of contracts with local subcontractors and including clauses for retention and defects liability period to ensure that the subcontractors are held accountable for poor workmanship, preparation of procurement schedule which is in alignment with the engineers approved program of works and specifications, checking designs before commencement of construction work to ensure that the designs have sufficient information, making sure that the engineers designs are signed by engineers who are professionally registered with ECSA, training of the local subcontractor to manage the risk of poor quality work by the subcontractors, preparation of company organogram to ensure that the roles and responsibilities are assigned to the suitable personnel, conducting of safety audits and toolbox talks on construction site.

The following measures that were used to respond to risk were identified in the survey that was conducted by Keshk *et al*., 2017: assigning roles and responsibilities to project participants, estimating budgets for all the risks associated with the construction project and allowance for contingencies, detailed scheduling of the program of works and planning for risks associated with the program of works, categorizing the risks into categories for easy management of the risks. According to Wang and Chou, 2003 contractors use risk transfer through employment of sub-contractors, signing insurance contracts with insurance companies and buying of insurance

bonds from bondsmen. The other measures used by construction companies when managing project is preventive risk management technique in which the risks are managed at the onset of the project. This assist in eliminating the risks before they could even appear in the project by taking a different course of action Keshk *et al.,* 2017.

5.8. Responsibility for management of risks

- **Who is responsible for management of risks in your organisation?**

The first respondent (construction project manager) said that that every construction project manager is responsible for construction risks on their project and they report all those risks to their head office. The second respondent (construction project manager) said risk management is the responsibility of the contract's manager of their company. The third respondent (Construction project manager) said that it is the responsibility of the construction project manager and the safety officer. The fourth respondent (construction project manager) said that it is the risk manager. The fifth respondent (construction project manager) said that it is the responsibility of the contract's manager. The sixth respondent said that it is the responsibility of the health and safety officer and himself as the head of department. The seventh respondent (Construction project manager) said that he was responsible for risk management in their company. The eighth respondent (construction project manager) did not have any answer to this question and the interview ended there. The ninth respondent (construction project manager) withdrew from the interview. The tenth respondent (construction project manager) said that it is the responsibility of the safety officer. The eleventh respondent (health and safety officer) he mentioned the safety officer, safety manager and site manager. The twelfth respondent said that it is the duty of the safety officer. The thirteenth respondent (construction project manager) said that everyone in their company is responsible for risk management. The fourteenth respondent (health and safety officer) said that it is the responsibility of the safety officer. The fifteenth respondent (construction project manager) said that it is the responsibility of the safety officer. The sixteenth respondent (construction project manager) said that each construction site is responsible for risk management, and they report all the risks that they identified to the managing director who comes up with a final decision regarding the risk. The seventeenth respondent (assistant construction project manager) said that it is a joint responsibility of senior safety officer, project manager, construction manager, Safety health and environmental officers. Sub-contractor is also responsible for their own risk.

From the findings it shows that the responsibility of risk management in construction companies lies in the hands of the construction project managers and safety officers. One the respondent mentioned that risk management is the responsibility of a risk manager. There was another respondent who said that risk management is the responsibility of everyone in an organization. Top management of construction companies should promote a culture of proactive risk management in their organisation. Top management should identify the personnel that are in better position to manage certain risks based on the positions and responsibilities within the company. Risk management for certain activities should be assigned to individuals who have relevant education and experience to manage the risks. It is insane to assign a risk to a party or an individual who cannot manage the risk efficiently and effectively. In some standard forms of contracts, the allocation of risks among contractors, clients and consultants is done in such a way that a contracting party that is in better position to manage the risk is allocated the risk in the contract. For instance risk of bad designs is taken care by the consulting engineers, risk of poor quality work is managed by the contractor and risks lack of project funding is managed by the client (Flanagan & Norman, 1993).

5.9. Risk management planning procedures

- **How do you plan risk management in your organisation?**

The first respondent (construction project manager) said that they use the construction programme of works and identify the critical areas of the programme. The second respondent (construction project manager) said that they plan risk management using a programme of works, the standard contract for the project JBCC and the Bill of Quantities (BOQ). The third respondent (construction project manager) said that they plan risk management through having proper quality control documents on construction sites. The fourth respondent (construction project manager) said that it depends on the project, the project team identify the risks using a template and highlight the prevention measures. The fifth respondent (construction project manager) said that they plan risk by having proper defined job description, responsibility matrix, and assigned jobs to personnel with proper qualifications and ongoing monitoring and training of personnel. The sixth respondent (construction project manager) said that each site has a safety file which acts as a guide on the planning of risk management for construction related injuries. The seventh respondent (Construction project manager) said that there is no pre-project planning for risk management in their company. The eighth respondent (construction project manager) said that risk management is planned by their safety officer.

The ninth respondent (construction project manager) withdrew from the interview. The tenth respondent (construction project manager) said that risk management is planned by their safety officer. The eleventh respondent (health and safety officer) said that that they use a risk register and the scope of work. Considering that he already stated that they have a risk register in their organisation when answering question number three. The twelfth respondent (health and safety officer) said that they jointly conduct safety management as a team, the team is comprised of safety consultants, site managers and safety officers. The thirteen-respondent said that the planning for risk management is done during weekly meetings where all stakeholders, community consultant are informed of the community unrest. The stakeholders come up with intervention measures. The fourteenth respondent (health and safety officer) said that that they use the risk register and scope of work. The fifteenth respondent (construction project manager) said that there is no pre-planning regarding risk management in their company, but it becomes the responsibility of the project manager and safety manager on the project. The sixteenth respondent (construction project manager) said that they use a risk basket where all the construction related risks are documented. The seventeenth and last respondent (assistant construction project manager) said that use a risk basket where all the construction related risks are documented.

From the results it shows that the construction project managers and safety officers plan for risk management using the following: construction program of works, JBCC standard form of contract, bill of quantities, quality management plan, risk identification, proper assignment of roles and responsibilities in their companies, using safety files, using scope of work, using risk registers, through weekly meetings and others use risk baskets. In the risks basket they list all the risks associated with construction projects.

Risk management planning in organization comprises of identification of risks that can affect the project, analysing the probability of their occurrence and impact they will have on the project deliverables and taking necessary steps to prevent the occurrence of the risks and minimizing the ones that cannot be prevented (Parker & Mobey, 2004). During risk management planning all the risk are identified and listed down in the risk register. The potential causes of the risks are listed in the column adjacent to the identified risks. The consequences of the risks are also listed in another column. The probability, impact and risk score are also evaluated, and the risks are ranked according to the magnitude of the risks score. The responses to the risks and the risk owners are also listed in their separate column. A risk

register is one of the convenient tools when planning for risk management (Dziadosz & Rejment, 2015).

5.10. Use of risk registers in construction companies

- **Do you have a risk register in your organisation that you use on construction projects?**

Out of the 17 participants who participated in the structured interviews 12 of the respondent said that they have a risk register in their organisation where all the risks associated with their projects are documented. Three of the respondents said that they do not have a risk register and one withdrew from the interview and the other one just said that risk management is the responsibility of the safety officer. Table 5 below is a summary of the findings.

State	**Number**
Have risk register	12
Do not have risk register	3
Not sure	2

Table 11: Number of companies with risk register versus those without.

Companies that had no risk register or risk baskets had challenges when managing risks because a risk register assist companies to come up with a comprehensive risk management plan. The risk register outlines the risks associated with construction projects, describes the risks, describes the consequence of the risk on the construction project and scores the risks. Risk scoring using risk register assisted companies in risk prioritization (Dziadosz & Rejment, 2015).

5.11. Risk prioritisation in construction companies

- **How do you prioritise risks in your organisation?**

The first respondent (construction project manager) said that monthly they assess the progress regarding the programme of works and observe how the risks are impacting on the project progress, the risks that are having a huge impact on the progress of works are prioritised and response strategies are applied to the risks. The second respondent (construction project manager) said that the main tool that they use in prioritising risk is the approved programme

of works. The third respondent (construction project manager) said that using structured documents. The fourth respondent (construction project manager) said that they weigh the impact or consequences the risks will have on the projects and prioritise the ones which have higher impacts on the project with respect to cost and delay in completion time. The fifth respondent (construction project manager) said that they use a risk matrix to identify risks that have huge financial, and time impacts on the projects. The sixth respondent (construction project manager) said that they start by looking at the magnitude of the risks, the ones with a huge magnitude or impact is considered first. The seventh respondent (construction project manager) said that they do not prioritise risks in their organisation. The eighth respondent (construction project manager) said that it is the responsibility of the safety officer. The ninth respondent (construction project manager) withdrew from the interview. The tenth respondent (construction project manager) said that it is the responsibility of the safety officer. The eleventh respondent (health and safety officer) said that risk prioritisation depends on the scope of work for instance if the scope of work involves blasting, excavation and supports for excavation. Risk prioritisation will also be based on the magnitude of the risks associated with these activities. The twelfth respondent (health and safety officer) said that they target the riskiest task, deal with it and finish with the lowest risk. The thirteenth respondent (Construction project manager) said they identify the risk items and prioritise depending on safety, procurement and they make sure that the sub-contractors sign off the scaffolding because he (sub-contractor) is a specialist in scaffoldings. The fourteenth respondent (health and safety officer) said that they look at the scope of work and determines the priorities of risks. Works such as blasting, excavation, depth of excavations and support for excavations all determines the risks that need to be prioritised. The fifteenth respondent (construction project manager) said that they prioritise risks according to work activities, and he went on to say that priority is given to the risks as they appear. The sixteenth respondent (construction project managers) said that they look at the impact and categorise the risks based on their impact on the project. They also look at the level of exposure to the risks. The seventeenth and last respondent (assistant construction project manager) said that they prioritise the risks by evaluating the impact it will have on the project in terms of cost, duration, and general safety.

From the findings risk is prioritized using the following: scope of works, structured documents, risk matrix, program of works, and identification of risks that have huge impact on the project. They prioritize risks using the risk matrix to figure out risks which have huge financial, and

time impacts on the project deliverables. They identify the riskiest task and deal with it first before dealing with the lowest risk.

Risk assessment maps assists construction project managers to prioritize risk according to their rate of occurrence and the consequence they have on the construction project if they occur. In risk assessment maps risks are mapped into four quadrants. Each risk in the risk map has the impact and frequency of occurrence. The impact is plotted on the horizontal axis of the risk assessment map and the frequency on the vertical axis. When at least top 10 of the risks that have been identified on the construction project and plotted. The next step is to identify the quadrant where the risks are in the risk assessment map. The positions of the risks in the risk assessment maps (quadrants) assist the construction project managers in prioritizing of the risks. The position of the risks further shows the level of concern and attention which should be directed to the risks and the project managers should come up with measures to mitigate the potential impact of the risk on the project (Sharma & Swain, 2011). Figure 11 show the risk map.

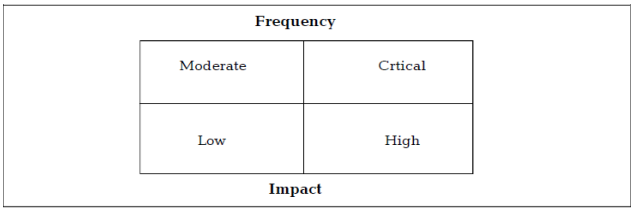


Figure 11: Risk Assessment map (source: Sharma & Swain, 2011)

Risks that are in the “critical quadrant” of the risk assessment map should be avoided or reduced. If there is an alternative course of action to be taken these risks should be eliminated from the project. Risks in the critical quadrant have potential huge impact on the project deliverables and should be subjected to continuous testing and evaluation. Risks in the “high quadrant” have low frequency of occurrence but huge impact on the project. These Risks in this quadrant are checked on rotational basis. Risks in “high quadrant” are ranked second to the critical risks. Risks in the “moderate quadrant” are less important but have high frequency of occurrence. They are monitored on regular basis to ensure proactive management of these risks. Risks in the “low quadrant” have both low frequency of occurrence and less impact on the project deliverables (Sharma & Swain, 2011).

5.12. Frequently used risk analysis technique

- **Which risk analysis do you frequently use between quantitative and qualitative risk analysis?**

The first respondent (construction project manager) said that both forms of risk analysis are used interchangeably when they are analysing project risks. The second respondent (construction project manager) said that they neither use qualitative nor quantitative risks analysis. The third respondent (construction project manager) said that both qualitative and quantitative are used when analysing risks. The fourth respondent (construction project manager) said they use both risk analysis. The thirteenth respondent (construction project manager) said that they look at the activities at hand and chose the right analysis that they can use. For the three of the respondents, it was difficult to know which analysis they frequently used because one of them withdrew from the interview, the other two said that it was not within their responsibility. The table 6 below summarises the finding on the frequently used risk analysis.

Risk analysis	**Number**
Use Qualitative risk analysis	2
Use Quantitative risk analysis	2
Use both qualitative and quantitative risk analysis	9
Does not use any of the risk analysis	1
Not known	3

Table 12: Companies that uses either qualitative or quantitative risks analysis.

In risk analysis there are methods of analysing risks namely quantitative and qualitative. When the identified risks can be placed on a scale from high to low, then qualitative analysis of risk becomes a suitable risk analysis method. To determine the impact and probability of the identified risks the project managers use quantitative risk analysis. Quantitative risk analysis is based on numeric estimations (Winch, 2002). Qualitative risk analysis is easy to use because it does not involve a lot of numeric data. It is more convenient to describe the risks than to quantify the risks. From the research findings the risk analysis method which was commonly

used is semi-quantitative which a hybrid of qualitative and quantitative risks analyses (Cooper *et al.*, 2005) the number of respondents who stated that they use both quantitative and quantitative risk analyses were 9 out of the 17 respondents.

5.13. Risk management response strategies

- **Which risk management response strategies do you use in your company?**

The first respondent (construction project manager) said that they do not have any specific risk response strategy. It depends on the risk that they are dealing with at that time. The second respondent (construction project manager) said that they use insurances or make money somewhere and pay for the risk that has occurred on the project. The third respondent (construction project manager) said that they use mitigation measures to control the impacts of poor-quality work on construction projects. The fourth respondent (construction project manager) said that they use mitigation. The fifth respondent (construction project manager) said mitigation measures just to reduce the impact of the risk event. The sixth respondent (construction project manager) said that they use all the four risk response strategies of avoidance, acceptance, mitigation and risk transfer to manage construction related risks. The seventh respondent (construction project manager) said that they use mitigation. The eighth respondent (construction project manager) said that it is the responsibility of the safety officer. The ninth respondent (construction project manager) withdrew from the interview. The tenth respondent (construction project manager) said that it is the responsibility of the safety officer. The eleventh respondent (health and safety officer) said that they respond to risks through planning and mitigation. The twelfth respondent (health and safety officer) said that they use all the risk response strategies of avoidance, acceptance, mitigation, and risk transfer. The thirteenth respondent (construction project manager) said the response strategy that they use for shortage of construction materials on site is to pay for construction materials upfront. With regard to procurement, they purchase the materials on time and make them available on construction site. He also said that they make sure that everybody is accountable for risk on a construction project. The fourteenth respondent (health and safety officer) mentioned planning and mitigation of risks as the responses that they use at their company. The fifteen respondents (construction project manager) said that they use elimination of risks and mitigation of risks. The sixteenth respondent (construction project manager) said that regarding quality they use mitigation which comprises of tests on the construction materials and sometimes they accept the risk with a contingency and sometimes they deal with the risks. The seventeen respondents

(assistant construction manager) said that they avoid the risk, reduce the risk to an acceptable level and lastly, they transfer the structural design risks to the structural engineer.

From the findings the following were risk response strategies that were used by the construction companies: insurances and finding alternative source of money to finance the construction projects, quality management plan to mitigate the impact of poor-quality work, planning and mitigation, the use of the hybrid of avoidance, acceptance, mitigation and risk transfer, up front purchase of construction materials, transferring of the structural designs to the structural engineers.

After risks have been identified the next step is to take action towards the identified risks. Response strategies should be tailored to manage the risks identified. Each identified risks will have its own response strategy and this depends on the competence of the construction manager and the availability of contingent course of action in the project. It is of at most importance to allocate a supervisor to each risk that has been identified on the project (Winch, 2002). Supervisors should be provided with sufficient information regarding the risks associated with their project. It is difficult to take action towards a risks based on little information, supervisors should wait till they have gathered enough information before apply any risk response strategies. This method of handling risk is applicable only in some situations, especially when handling critical risks on the project (Winch, 2002).

Risk which have lower impact on the project are easier to manage than those which have higher impact on the project. There are four risk response strategies namely: avoidance, reduction, transfer and retention (Potts, 2008).

Avoidance of risk is possible by looking at alternatives in the project, or changing the scope of work. Application of known and well known ways of working on the project instead of new ones can assist to eliminate risks on the project (Darnall & Preston, 2010). According to Cooper *et al*. (2005) the following are some of the activities that can assist to eliminate potential risk on the project:

- Detailed program of works
- Alternative methodologies
- Safety and protection systems
- Reviewing operations from time to time
- Inspections and documentation of the inspections on regular basis

- Employees training and skills enrichment

Reduction or mitigation of risk is the process in which the level of the risk is reduced to desirable levels. It is a response strategy that is employed to minimize the likelihood and impact of the potential risk (Thomas, 2009). According to Darnall and Preston, (2010) one of the methods used to mitigate risks is to add expenditures that can deliver profit in the long term. Some construction companies procure guarantees or hire the services of experts to take care of the high risk tasks on the project. Cooper *et al*. (2005) identified the following risk reduction strategies:

- Allocation of contingencies in the plan
- Quality control and assurance
- Proper allocation of activities and resources
- Drafting of suitable contract terms and conditions
- Proper management of risks and disaster recovery plans

Risk transfer is a response strategy in which the risk is reduced by sharing the risk with other parties who have appropriate resources and experience regarding the management of the risk (PMI, 2004). Standard construction contract such as JBCC, FIDIC, NEC and GCC allocates risks to different parties on the project based on their level of influence and expertise on the project. On a construction contract risks are allocated to the client, contractor, subcontractor, designer etc., based on the nature of the risk (Flanagan & Norman, 1993). Standard construction contracts are drafted with the objective of transferring or allocating risks to the party that knows how to manage them. It must be pointed out that when risk has been transferred to another party the risk is not eliminated, the risk has just been assigned to a party that is competent enough to manage it (PMI, 2004).

The last risk response strategy is retention, in which a risk is accepted as part and parcel of the project. The only remedy in retention is controlling the risk in order to minimize the consequence of its occurrence. When other options of risk response strategies are not economical retention of risk can be the best option (Potts, 2008)

5.14 Control and monitoring of risk management strategies in construction companies

- **How do you control and monitor the risk management strategies in your company?**

The first respondent (construction project manager) said that control and monitoring of risk management is done through contracts review meetings which are conducted on a monthly basis on each construction site. The second respondent (construction project manager) said that the most important element in risk control and monitoring is the programme of works once it is being updated and monitored risk is also being controlled and monitored. The third respondent (construction project manager) said that she documents every test result that is conducted on site and all corrective actions that are instructed by their construction project manager. The fourth respondent (construction project manager) said that there is a risk manager who checks the baseline risk management plan against the actual preventative measures that they have been put in place to mitigate the impact of the risks. The fifth respondent (construction project manager) said that they control and monitor the risk management strategies through development of communication channels that incorporates bottom-up and top-down. They also use the templates for capturing new risks and updating of the risk registers. The sixth respondent (construction project manager) said that they control and monitor risk by looking at the risk management plan baseline by engaging with the safety officer and all the personnel who are working at a particular construction project. The seventh respondent (construction project manager) said that they control and monitor risk management strategies through conduction daily checks on site. The eighth respondent (Construction project manager) said that risk management is the responsibility of the safety officer in their company. The ninth respondent (construction project manager) withdrew from the interview. The tenth respondent (construction project manager) said that it is the responsibility of the safety officer to monitor the risk management strategies in the company. The eleventh respondent (health and safety officer) said that they control and monitor risk management strategies through inspection of the site and regular inspections from the client's safety consultants. If they find that there are gaps in the risk management strategies, they revise the risk management plan and propose new ways of doing things. The twelfth respondent (health and safety officer) said that they control and monitor risk management strategies using risk management plan. In the risk management plan, they evaluate and review the risk strategy to see if it is working or not working. The thirteenth respondent (construction project manager) said that they control and monitor risk management strategies in their company using the risk register. The risk register acts as the

baseline plan for example installation of escalators, arrange delivery after hours, breakdown the access and check with the engineer if whatever you are doing is controlling the risks and measure the effectiveness of the control measures. The fourteenth respondent (health and safety officer) said that they inspect the construction site, the client also has a safety consultant who monitors the safety related risk on construction sites. If they find that there are changes on the risks that they anticipated they revise the documents and propose new ways of doing things. The fifteenth respondent (construction project manager) said that they control and monitor the risk management strategies in their company through the appointment of personnel responsible for the risks. The sixteenth respondent (construction project manager) said that they check and update the risk register and closing some of the risks encountered. They check in the basket of risks to see which risks are open then they start mitigating the impact of the risks to reduce the exposure to risks. The seventeenth and last respondent (assistant construction project manager) said that they control and monitor risk management strategies through implementation of a risk response plan and evaluating the risk on a regular basis.

From the findings the following are used in controlling and monitoring of the risk management strategies: contract review meetings, using the program of works and updating it on regular basis, documenting all tests and executing all corrective actions, checking the baseline risk management plan against the actual preventative measures, through communication channels both top-down and bottom-up, creation of templates for capturing new risks and updating the risk register, safety officer who monitor every risk that was identified on the project, regular inspection from the client safety consultants, using risk management plan, using risk register, revision to the original program of works and use of risk plan and evaluation of the risk on a regular basis.

Monitoring and control of risks is the final stage in risk management process. Once all information about the risk and the response strategies have been established it is easy to monitor and control the risk associated with the project (Winch, 2002). The continuous monitoring and control over the risk management strategies helps to identify new risks, keep track of identified risks and eliminating of past risks that have been resolved from the risk assessment and project. The whole purpose of risk monitoring and control is to supervise the status of the risks and effect remedial actions where necessary (PMI, 2004). According to PMI, (2004) the following are the tools and techniques that are used to monitor and control risks on construction projects:

- Conducting risk reassessment to identify new risks to the project and this process should be continuously throughout the project life.
- Overall monitoring of the project status to establish if there are any changes in the project that can effect and cause new risks to the project.
- Status meetings in which various stakeholders discuss risks with risk owners, share knowledges and help each other to respond to the new risks.
- Updating of risk register with new risks.

CHAPTER 6 DISCUSSIONS AND FINDINGS

6.1. Gaps in Risk management strategies in Gauteng Province

This section highlights the gap that exist in risk management in Gauteng Province (Pretoria and Johannesburg). Risk management in these areas is not being carried out in a proactive manner. There is no structured risk management process, only a few companies in CIDB grade 8 and 9 have a structured risk management.

6.1.1. Risk management planning

Twelve out of the seventeen construction companies that were interviewed showed that they had risk management plan. Five of them had no pre-planned risk management, because they did not have sufficient knowledge in construction risk management and their projects were not as demanding as those of the twelve construction companies. The five companies were managing risks reactively rather than proactively. The companies that had risk management plan in place were the construction companies that were executing big construction contracts which were quite demanding. It was imperative for construction companies that were managing big projects to manage risk proactively. In appendix B is the risk register that was being used by one of the construction companies. Some of the risks that were on the risk register ranged from those that were owned by the contractor and those that were owned by the client through their contract agent (principal consultant or engineer). The risks that were owned by the contractor were identified and responses were identified and documented. For those construction companies that had risk register in place, used the risk register as point of departure regarding risk management plan on projects. The companies were able to select the risks that were going to be experienced on their projects and they identified the response mechanisms for those risks. One of the construction project managers said that they use standard form of contracts such as JBCC, GCC, FIDIC and NEC in planning for risk management on their projects. In these standard forms of contracts the risks on construction projects are properly allocated to the parties on the construction projects. Parties (engineers, clients and contractors) have different roles to play on construction projects. The standard forms of contract define the expected roles and responsibilities from different parties on the construction project. Use of the risk register by the construction companies jointly with the standard form of contract on the project assisted the construction project managers in identification of the risks associated with the construction projects and coming up with the response mechanisms on the identified risks. Figure 10 below shows the number of companies with risk management plan and those without any risk management plan.

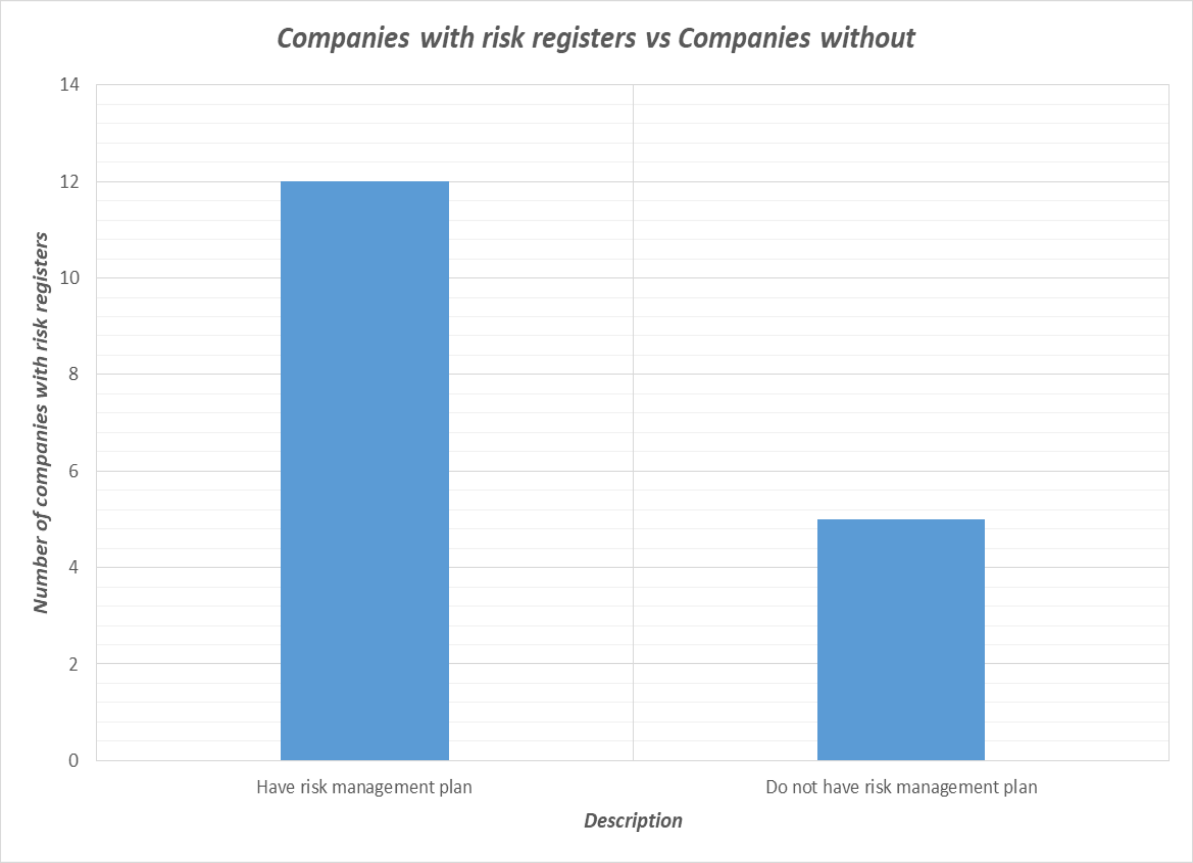


Figure 12: Companies with risk management plan versus companies without risk management.

6.1.2. Risk management knowledge

From the findings it is evidenced that personnel that are employed on construction project do not have formal training in risk management. Out of the seventeen research participants only five said that they have risk management knowledge and eleven of them said that they did not know anything regarding risk management. It was difficult to establish whether one of the respondents who pulled out of the interview had risk management. The objective of the question was to assess the individual's knowledge in risk management and not the company. Despite showing lack of technical knowledge in risk management a lot of them showed that they knew how to plan and respond to undesirable circumstances that could lead to various risks on construction projects such as cost overruns, poor quality work, schedule overruns etc. The response to undesirable circumstances was done reactively. Figure 11 below shows the number of research participants who had risk management knowledge, those that had no risk management knowledge and the one that pulled out of the interview.

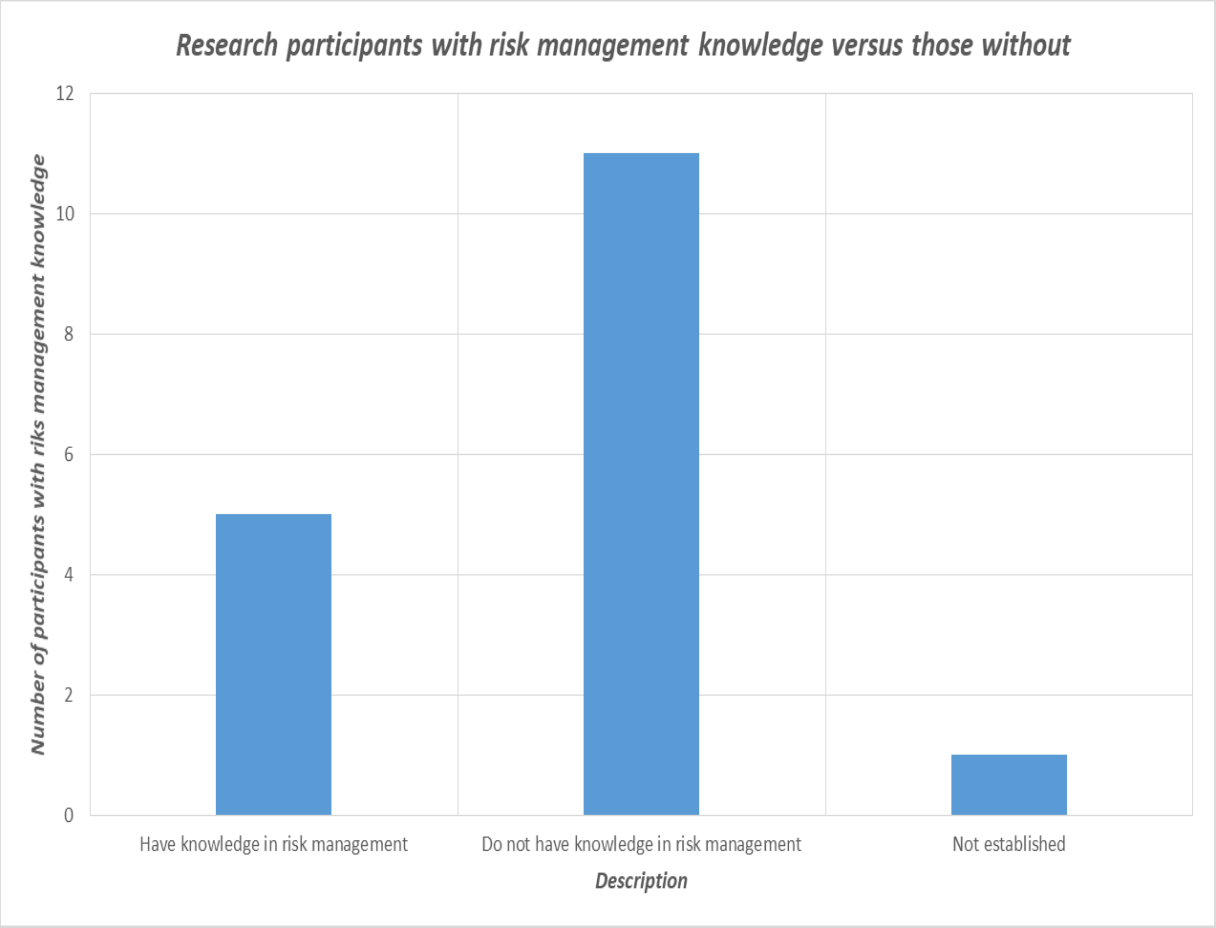


Figure 13: Number of participants with risk management knowledge.

6.1.3. Risk identification tools and methods

The main objective of risk identification is to find out where things on a construction project could go wrong and affect the project deliverables. Information on risk identification can be accessed on the information from previous projects and experience of the personnel (Chahrour, 2017). The following sub-section will present some of the tools and methods that are being used by construction companies when identifying construction risks.

One of the research participants said that they use a risk register when identifying risks that are associated with construction projects. They use the risk register from previous projects to assist them with the identification of the risks in current projects. When projects are similar but executed in different locality, they just select the risks that are going to be experienced in the new construction project and the additional risks are identified through involvement of different stakeholders in brain storming sessions. The risk register used by the construction companies is in a form of a spreadsheet in excel file. In the risk register there is the description

of the risk, the risk owner or the one responsible for managing the risk, the risk event driver, consequences of the risk, the probability of the risk, the impact of the risk on the construction project deliverables, the ranking of the risk, the risk control strategy (Smith & Merrit, 2002).In appendices section there is a risk register that one construction company shared with the researcher to show the risk associated with construction projects.

The other research participants said that they use a JBCC to identify risks on construction projects. In JBCC contract the roles and responsibility of the client, principal consultants and the contractors are clearly defined, and this helps to manage expectations from the parties involved on construction projects. The risks associated with execution of the works rests with the contractor. The risk of design errors or omissions is managed by the design engineer and the risk of cost overruns due to unforeseen circumstance is managed by the client. One of the research participants also highlighted that the type of alternative procurement strategy that is selected by the client also distribute risks on the construction project differently. For example, if the client chooses to use traditional procurement strategy, the client is responsible for the design of the project and advertise for tendering and finally appoints the contractor whose main job is to construct the infrastructure. In this type of procurement strategy, the client is responsible for design errors and omissions. The contractor is responsible for all the risks associated with workmanship and quality related risks. In traditional procurement strategy the client is represented by the consulting engineer or principal consultant. The other procurement strategy is the design and build contract, in this type of procurement strategy the contractor is responsible for the design and construction of the project. All risks associated with designs and construction are borne by the contractor. The client only risk is that he may end up paying more for the works than necessary. The risk of cost overruns in this kind of procurement is borne by the contractor. There are several procurement strategies that are used in procuring construction work, the two mentioned above are just some of them (procurement strategies).

The other respondent said that they use quality management plan to identify the risks on construction projects. Quality management plan uses input from the programme of work. They develop templates that specify the stages of quality control. Using that information, they are able to identify the quality related risks that are associated with different types of work on construction project. At the appendix C there is a list of some of the quality management forms that are used to manage quality related risks. The contractors make sure that they have a documentary evidence of contract agreement, contract drawings, project quality plan,

inspection and test plan, method statements and corporate procedures. All drawings issued by the consulting engineers are signed by their design engineer who is professionally registered with ECSA. This protects the contractor from any risk of design errors or omissions on the drawings. All the tests that are conducted on sites are approved and signed by the engineer before proceeding to the next stage of construction, this covers the contractors from the risks of reworking and extra spending on the works.

The other research participants said that they use checklist and experience from the previous projects when identifying risks on construction projects. In the appendix A there is a sample of a checklist that is being used by one of the construction companies. The companies employ people who have experience on certain projects to make sure that risks associated with those projects are managed through gut feeling.

The other respondent said that they use the programme of works, scope of work to identify the risks that are associated with the type of construction project. The scope of work for the project are properly detailed. The risk assess checks the risks associated with execution of that project by looking at the links in the programme of works. Safety officers were the ones who mentioned scope of work as one of the tools that are used to identify risks on construction projects. Safety officers use the programme of works or scope of work to establish the safest way of doing the works by identifying the risks and implement measures to prevent the risks associated with that type of construction. One safety officer said that they use a risk matrix or a risk profile when identifying risks. These two are products of risk identification, risk profile is the level of threat that the construction company is exposed to whereas risk matrix is a stage in risk analysis. The safety officers did not have sufficient knowledge regarding risk matrix and risk profile but they demonstrated that they have partial knowledge in risk identification. Both risk matrix and risk profile from previous projects can be used to identify risks associated with new construction project especially if the two construction projects are very similar in nature.

The other participants said that they use physical, visual surveys and basket of risk to identify the risks on construction projects. The physical and visual surveys comprise of visiting the sites where construction is taking place and identify the risks that could be experienced on those projects and plan the mitigation measures. The basket of risk is not different from the checklist. In the basket of risks the company just list all the risks that are experienced on construction

projects and if there are new risk the basket of risks is also updated. The basket of risks serves the same purpose as the checklist.

6.1.4. Use of risk register

From the data that was collected the majority of the participants said that they had risk registers. From the survey 12 out of the 17 research participants said that they had risk registers in their companies. Only three research participants said that they had no risk registers in their companies. One of the participants stopped the interview and the other one did not have any knowledge of risks register. It was established that the risk registers that these companies were talking about were not the formal risk registers that are used in risk management as described in literature review. Appendix B show copy of the risk register that was used by one of the construction companies. On the risk register what was displayed were the risks that are frequently experienced on construction sites and the numbering of the risks. The contractors basically were using the checklist as risk registers rather than the risk registers. In the risks register there are columns that number the risk, describe the risks, the cause of the risk, the impact of the risk, probability of the risk, ranking of the risk, the personnel responsible for the management of risk and status of the risks. The status of the risks refers to whether the risks is still open or closed. This information is shown on risk register that was used by one of the construction company that is registered in CIDB grade 9 in appendix B.

6.1.5. Risk prioritisation

There are gaps in the way construction companies are prioritising risks in South African construction industry. This is due to the fact that the only risk that the construction industry knows most is safety related risk. Risk on construction project must be prioritised by the client of the construction project. Most of the construction project managers who were interviewed demonstrated lack of understanding with regard to risk prioritisation. If the project client put much emphasis on safety and quality definitely the contractor will also prioritise the risks associated with safety. If the client states that the construction project should not exceed a certain contract value, the contractor will try as much as possible not to exceed that amount and all the risks that are associated with cost overruns are prioritised. If the client emphasises that the project should not extend the contract period the contractor will also make sure that all the risks that could contribute to schedule overruns are managed proactively. Some clients also require the contractors execute only the work that are on the scope of work for the project and if the work is not on the scope the contractor should not execute such work.

Safety related risks are the risks that are highly prioritised on construction projects and are managed proactively. This is evidenced from what the research participants were saying regarding risk. Whenever a research participant is asked about risk what always came into their minds even if they do not know about other risk was safety. Some of the research participants were even saying that risk management is the responsibility of the safety officer because the government has put a lot of emphasis on construction safety. The government promulgated construction regulations to manage safety on construction projects. There are two documents that are used on construction projects. The first one is occupational health and safety act No 85 of 1993 and construction regulations of 2014. Occupational health and safety tell the contractors what to do and the construction regulation tells the contractors how to do it. There are 35 construction regulations in total. The intention of the construction regulation is to manage construction risks.

6.1.6. Risk analysis

Risk analysis is process of estimating the degree of impact the risk will have on the project deliverables. It comprises of estimating of the probability of occurrence and consequences associated with the risk (Kerzner, 2017). Risk analysis can be conducted using qualitative or quantitative analysis.

Nine out of the research participants said that they use both qualitative and quantitative risks analysis. To be in a better position to analyse the risk there is need to use both quantitative and qualitative risks analysis. The quantitative analysis helps in quantifying the magnitude of the risks in terms of money that can be lost in a project as result of a risk. The qualitative risks analysis helps in explaining the degree of the consequences of the risks on the project. The research participants who chose only one of analysis showed that their risk management processes were not complex and that they were not dealing with complex risks. The other did not even have an idea with regard to the two types of risk analysis. This is evidence that their organisation was practising reactive risk management. If their companies were practising proactive risk management everyone in the company should have been aware of the two types of risk analysis associated with construction projects. This is evidence that there are gaps in the way construction companies are analysing construction risks.

6.1.7. Responsibility of risk management

There are gaps on the responsibility of risk management in construction companies. Generally, risk management is the responsibility of each and every employee in a construction company. From the findings it shows that the some of the construction project managers do not understand that risk management is their responsibility. Some construction project managers were mentioning the safety officers because they were not understanding the concept of risk management. Some of the participants have only heard of risk management when it is being referred to construction safety and environmental management. The project managers from construction companies that were involved in capital projects said that risk management was a collective effort in their companies. These managers who said that everyone was responsible for risks management had exposure in dealing with different interfaces on projects. In one of the companies that had structured risk management there were clear definitions and roles of managers who were responsible for risk management decision making. The company identified the individuals who owned the risks and responded to those risks. The company was also organising training for its personnel on risk management processes. The company made sure that everyone was responsible for risk identification. The company had well-structured risk analysis processes. The company had detailed risk plans and necessary resources were allocated for implementation of the risk management process. The company had structured procedures of collecting data on risks. The appendices show some of the documents that were used by some companies to track risks on their project. From the findings it shows that some company's risks management was well structured and every construction project manager at project level was responsible for risk management. The construction project manager at project level was able to involve his personnel on that project in risk management and report all the risks to their head office. At their head office the managing director was the one who receives the risks from various sites and in turn assist the respective sites in responding to the risks by committing resources to the projects.

6.1.8. Planning of risk management

Risk management plan is prepared through use of inputs from scope of work, programme of works, budgets, quality management plan, human resources plan, plant and equipment schedule and risk registers from similar previous project. Figure 12 below shows the risk management process.

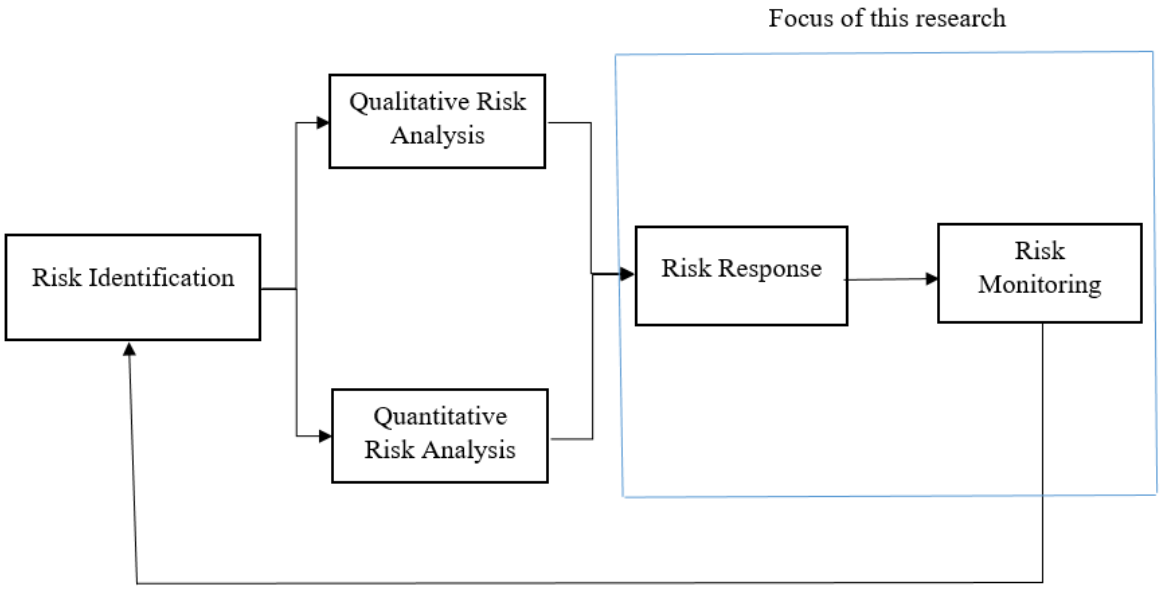


Figure 14: Risk management planning in construction companies.

From the scope of work the contractors are able to come up with a detailed work breakdown structure. They break down the scope of work into finer details that highlight the critical stages in the construction process. After the detailed work breakdown structure, the contractor prepares a programme of work. In the programme of works the contractor produces the critical path which highlights the critical activities that should be executed on the project. The duration of the activities is summed up and aligned with the completion date of the project as per the clients' requirement. From the programme of works the contractor prepares contractors internal budgets for the execution of the work. Using the scope of work the contractor prepares a quality management plan for the project. In the quality management plan the contract details all the tests that will be conducted on the construction materials and the documents for recording of the tests, communications, and rainfall. The contractors also use the standard form of contracts to plan for the risks that are within their control on a construction project. The appendix C show some of the documents that are being used by some of the contractors to document quality management on construction sites. From the programme of works the labour requirements for the project can also be estimated. The plant and equipment that are required on construction sites are also estimated from the programme of works. Risk registers from past projects are also used to plan for risks on new projects. From what has been explained above the contractors are in a position to identify all the risks associated with the project, analyse the risks, and classify the risks and start dealing with risks that have huge impacts on the project. They deal

with risks through any of the four risks response measures of acceptance, elimination, mitigation and risk transfer.

From the findings some companies do not have pre-planned risk management some of them do not even execute risk management planning. Risk management in those companies is managed reactively rather than proactively. They respond to risks as they experience them on construction sites. Some companies they employ competent projects managers who have vast experience in construction. According to Kerzner 2017 a person who uses a certain road frequently the existence of pot-holes on that road does not pose a hazard to him but to the person who is using the road for the first time. On this basis the contractors who employ construction project managers who have lots of experience manage risks through gut feeling and they do not even use detailed risk management. These experienced project managers use only a simple risk checklist to manage all the risks associated with construction of certain projects.

6.1.9. Risk control and monitoring

Monitoring and control assist in evaluation of the effectiveness of the risk response strategies. Risk monitoring does not aim at solving problems, but its intention is to source objective data on the effectiveness of the risk management strategies in reducing risks on the project. Risk management is an iterative process and the result from monitoring and control process is fed to the initial stage of risk management plan. Monitoring and control also assist in identification of new risks on the project, and this should add to the number of already identified risks on the project (Kerzner, 2017). Figure 13 below show the risk management process from risk identification to risk monitoring and control:

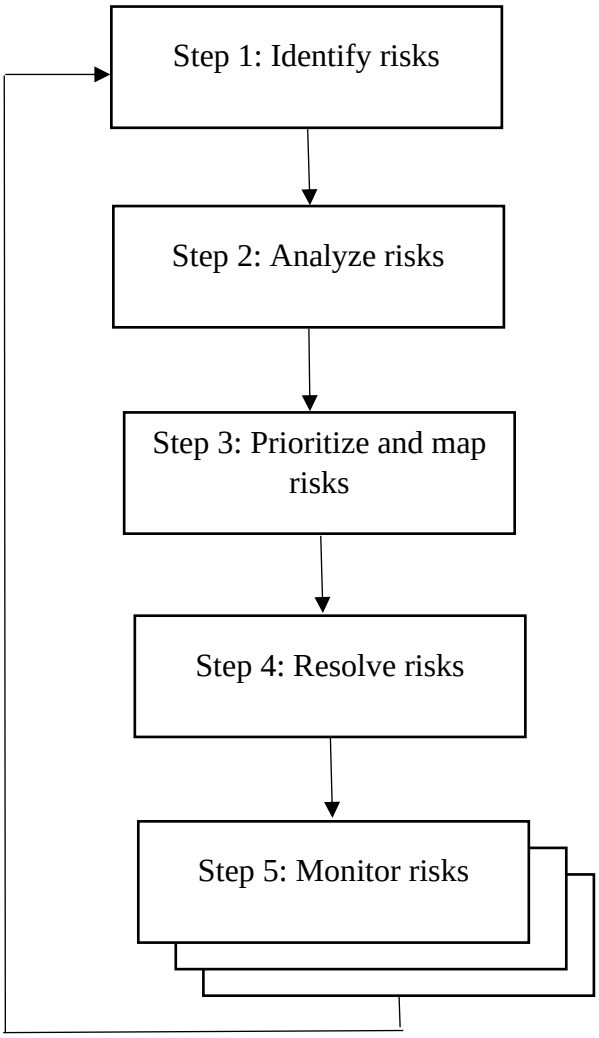


Figure 15: Risk management process (source: Smith & Merrit, 2002).

One of the research participants said that they control and monitor the effectiveness of the risk's response strategies through contract review meetings. The contract review meetings are conducted on monthly basis. During these meetings the team is able to identify the risks that are affecting the successful completion of the project. They revise the response strategies that they implemented initially to manage those risks if it is found that they are not effective. If they identify new risks on the project, they go back to the risk register and update the register to accommodate the new risks. Then they plan the responses to the newly identified risks. The other research participant said that they monitor and control the effectiveness of the risk response strategies through the use of the baseline programme of works. From the baseline programme of works they are able to produce the baseline budget for the project, quality management plan, safety management plan, cash flow projections for project revenue, human resources, and equipment schedule for the project. The contractor manages the project

expectations versus what was planned and if they are deviations, he updates the programme of works and resolve the causes of the deviations from the planned course of action. The other respondent who worked as a construction project manager said that they use the quality management plan to control and monitor the risk response strategies. In the quality management plan, they outlined all the tests that were to be conducted on the construction materials. The expected results of the test should conform to the designer's specifications. If there are deviations from the designer's specification, they rework the sections that produced the poor results and update the quality management plan with corrective action documents. The corrective action documents are used as evidence that there was a rework despite failure at the first attempt. The other participant said that to control and monitor risk management strategies on construction projects they encouraged communication among project team members. There was both bottom-up and top-down communication on the project. Some project managers said that they use risk registers to monitor and control the effectiveness of the risk management strategies on construction projects. As the project was progressing the team leader was checking which risk response strategies were not effective at reducing risks and he was also identifying new risks. Then used this information to update the risk register and propose alternative risks response strategies on the ones that were not effective in reducing the risks. From the participants it showed that risks were changing as the projects were progressing what were considered as risks at the beginning of the project were not considered as risks during the execution of the project. The other response from one of the participants was that they were monitoring and controlling risks through daily checks. This response came from the safety officer, the safety officer was always checking the effectiveness of response strategies on daily basis because safety was given priority on their projects. The other research participants who said that risk management was the responsibility of the safety officer were not able to respond to this question. They did not understand the concept of risk management on construction projects. The reason being that whenever they hear of the word "risk" on construction project what comes to their mind is safety related injuries on construction site. They were not aware that apart from safety related risks there are other risks on construction site that causes cost overruns, schedule overruns, scope changes and poor quality. The other reason could be attributed to lack of knowledge in construction risk management.

One safety officer said that they control and monitor the effectiveness of risk response strategies through site inspections. He further said that even the client had their own safety consultant who used to inspect the construction site once in a month. The gaps in safety

management on sites were addressed through corrective action and updating of the safety management plan. On their risks register they were updating the risks that they identified and alternative response to the risks on those that were not effective were proposed and implemented.

6.2. Performance of projects where risk management strategies were applied

This section focuses on the performance of construction companies that applied risk management strategies when dealing with construction risks and those that did not apply the risk management strategies. The follow up subsections highlights the difference between the performance of construction projects where risk management strategies were applied and those in which risk management strategies were not applied.

6.2.1. Common risks experienced by construction companies

As an introduction to this section 6.2 there is need to highlight the common risks that are being experienced by construction contractors. There are many risks that are associated with construction projects. This section discusses some of the common risks that were experienced by the seventeen research participants. Different projects that are constructed in different geographical locations experience different risks.

Different construction project managers who participated in the study viewed risks differently from those of safety officers. Safety officers said that the common risks on construction projects were collapse of trenches, fall from height, hazardous chemicals, and injuries resulting from operation of plant and equipment and project managers said that common risks experienced on construction sites were community unrest, schedule overruns, cost overruns and poor quality and safety related risks. This shows that the construction project managers look at a holistic picture when managing risks. The safety officers are confined to risks that emanate from safety during the execution of works. The risks that emanate from safety can cause cost overruns, for example when the machines or equipment are involved in accidents. The managers should replace the equipment and also compensation for the operators who were operating the equipment. This cost could contribute to extra cost on the project and consequently contribute to schedule overruns and cost overruns. If the employees are not safe at work they cannot perform at their best and this consequently contribute to poor quality of work.

The community unrest that is mostly caused by the local sub-contractors who demand 30% of the contract value to be sub-contracted to locals. This was brought about by the preferential

procurement regulations of the year 2000. In which it is stated that before awarding contracts to main contractors the main contractors should show that they have previously promoted South African owned enterprises, they have promoted small medium and micro-enterprises (SMMEs) and that they previously created jobs through labour intensive (National Treasury South Africa, 2000). It is on this regard that there are misunderstandings between the main contractors and the SMMEs. Resolving the issues of community unrest is time consuming and consequently the construction project completion time is extended beyond the planned duration of the project.

Extreme weather is another risk that is experienced by construction companies when managing construction projects. In South Africa extreme weather emanate from heavy rainfalls that cause disruptions on construction projects and consequently impacts on the project cost, time and quality. Extreme weather causes waste of construction materials which results in reworking. Reworking results in extra spending on the works and this results in cost overruns. Reworking also consumes time which results in schedule overruns. The quality of work is compromised through rework because some construction materials need to be constructed properly at the beginning and they do not mix properly with the reworked portion of the work. For example, concrete casting should not be interrupted once started there is need to finish casting the portion. The risk associated with stopping concrete works is that concrete dries, so if left in the concrete mixing truck unattended the concrete mixer truck bucket has to be disposed.

Some of the research participants said that they experience design risks. There are omissions or errors from some of the designs that are issued by the consulting engineers. The consulting engineers hired design engineers who were not competent enough to provide detailed information on the designs. This consequently affected the contractor's procurement schedule for construction materials. One research participant who was working on a wastewater treatment project said that the designs that were issued by the consulting engineer omitted the number of steels that were required on the concrete structures. When the contractor was ordering steel from one of his suppliers it was established that the steel that was being order was not enough to cover the whole area of reinforcement required on the concrete structures. These omissions in designs contribute to cost overruns and also delay in completion of the works.

Cash flow related risks are caused by many factors, from what was discovered from the seventeen research participants' cash flow risks are caused by theft of construction materials,

late payment of the contractor's invoices and sub-contractor's mismanagement of funds. On some of the projects the contractors said that some of their labourers and operators steal diesel, cements, steels and other materials that are used when executing the construction works. This affects the contractor's budget because they spend most of their profits on procuring extra materials and diesel on the project. The contractors also experience late payment of invoices from their clients. This makes the contractors to fail to honour some of their obligations on construction sites such as paying their labourers, buying of construction materials etc. This consequently affects the completion date for the project. Sometimes the sub-contractors of the main contractors lack the skills in financial management and once paid by the main contractor they mismanage their funds and this consequently affects the financing of their day to day operations on site.

Quality related risks on construction projects emanate from poor workmanship from sub-contractors. The sub-contractors who are employed on most of the construction sites do not have technical skills to do the job. For the local sub-contractors to perform they require a lot of training from the main contractor. This makes the main contractor to spend considerable time on training of the local labourers which consequently contribute to schedule overruns. The unskilled sub-contractor does not do proper job and there is a lot of rework on the work that are done by the local sub-contractors. The main focus of the local sub-contractor is to get paid, once paid they do not help the main contractor in fixing some of the works that were not done properly.

6.2.2. Control measures for common risks

Construction contractors with proper risk management strategies implement various measures on construction projects to manage risks that adversely impact on their performance on construction contract. The following paragraphs discuss the measures that are taken to manage the common risks.

Some of the participants said that they addressed issues of community unrest through negotiations with political leaders and sometimes the court cases interdiction is used to stop the community from delaying the construction project. Construction companies that did not manage communities by negotiating with them and using court interdicts experienced delays in completion dates. One of the project management knowledge areas is stakeholder management. During inception of the project there is need to involve the different stakeholders on the project. The list of the project stakeholders should include politicians of the areas were

development projects are taking place. Through these stakeholder involvements all the parties involved should be consulted their needs and expectations from the project should be clear. There is community unrest on the projects because the community needs and expectations from the projects are not addressed. At the start of the construction project the construction managers should engage with the local community and have all their needs and expectations identified. There should be an agreement on the works that will be sub-contracted to the community, the equipment that will be hired from the community and all this information should be properly documented. The documents containing information of sub-contracts should be made available to the community members through their councillor and Community Liaison Officer (CLO). The local community should be informed of the number of labourers that will be hired on the projects from the start of the project up to the end of the project. The community should also be told that some of the sub-contracts will be awarded when substantial work has been done on the project. It is the responsibility of the main contractor to make sure that critical components of the project are executed by the main contractor so that they (main contractor) can reduce risks of having poor quality work.

Health and safety related injuries on one of the construction projects were prevented through the use of safety consultant who conducted weekly and monthly safety audits on construction projects. The safety audits comprised of having a safety file with templates that were used to manage various aspect of safety. The construction project had a safety file and all the documents required in the safety were properly filed. Construction regulation of South Africa stipulates that the safety file should have the following documents (Roux & Colyn, 2014):

- Appointment letter for the contractor
- Acceptance letter from the contractor
- Notification of construction work
- Letter of good standing
- Construction programme of works
- Health and safety management plan
- Health and safety policy
- Risk assessment

- Baseline Risk Assessment
- Safe work Procedures
- Fall protection plan
- Medical certificate certified by occupational practioner
- Health and safety organogram
- Appointments (including sub-contractors)
- Induction information
- Emergency numbers and emergency plan
- Sample of registers
- Incident/accident management control
- Traffic management
- Environmental management
- Hazardous chemical substance list and masculo skeleton disorder (MSD)
- Occupational health and safety act
- Construction Regulation 2014

All of these documents act as a baseline plan for health and safety. The contractor who implemented the health and safety plan managed their projects successfully and prevented a lot of delays and associated costs that would have impacted negatively on their projects. The appendix D shows some of the documents that are used in safety management.

Measures that were implemented on one of the construction projects comprised the use of a detailed quality management plan and employment of competent personnel. The list of competent employees was highlighted in the safety file in the section “appointments”. One of the contractors made sure that the site is having an organogram. The roles and responsibility of the persons appointed on the project were clearly defined, to make sure that expectations from their work was properly managed. On one of the project quality related risks were managed through the use of quality management plan. In the quality management policy, the

contractor's managing director stated that their company was committed to providing their customers with quality construction products. The company complied with the requirements of ISO 9001:2015 when carrying out construction work. The quality management plan for the project comprised of the standard form of contract (GCC 2015), the quality control sheets for concrete, earthworks, steel fixing, shuttering, scattering, scaffolding, excavation, pipe works and compaction of the backfill gravel materials. On the project the designer of the project specified that all pipes should be South African Bureau of Standards (SABS) approved. The pipes that were not meeting the requirement were being removed from the construction site. To guarantee the quality of work from their sub-contractor one of the main contractors drafted bespoke contracts that stipulated that 10% of the contract amount will be retained on payment certificates. The contractor was complying with the requirements of the safety management plan and reduce the time that he spent on rework and defective work. This contributed to completion of the project on time and within the construction budget.

Measures that were put in place to manage cash flow on one of the projects comprised of preparation of a big claim at the commencing of the project. One of the standard forms of contract (FIDIC) allowed the contractor to ask for an advance payment at the beginning of the construction project to minimise the cash flow related problems. The advance payment is an interest free loan that is issued to the contractor and is paid back to the client through deductions on each and every payment certificate to the contractor until the advance is paid back in full (FIDIC Redbook, 2017).On theft of construction materials such as cement, steel and asphalt one of the contractors implemented a materials control register which was being checked every time the contractor was preparing a certificate of payment. The contractor made sure that cement, steel and asphalt that were delivered to construction sites were fully claimed in the payment certificates. On late payment of invoices one of the contractors was putting in a claim earlier so that they do not experience cash flow problems. The other measure that they use for late payment of invoice is that when there is a delay in payment, they claim the interest that is compounded on monthly basis. The interest charges are calculated based on the annual rate of 3% above (FIDIC Redbook, 2017). On one of the projects the contractor insured the works and the materials that are delivered on site to manage the risk of theft of construction materials. Sometimes the contractor under-prices the works especially the ones that involves ground excavations. With the application of the clause on construction projects that covers the contractors from such situations the contractors were able to claim for unforeseen ground conditions. On the risk of bad financial management from their sub-contractors. There is need

for subcontractors to provide detail cash flow statements that should be updated on monthly basis to make the contractors aware of the need to invest the funds in the project. One main contractor was also providing assistance with training the site agents of the sub-contractor in financial management and budgeting. Some of the government funded projects stipulate that one of the requirements to award contracts to the main contract that they (main contractors) show that in their previous projects they trained the local community in various skills (National Treasury South Africa, 2000).

Design risk on of the construction project was managed through proper document control. All the designs that were received on one of the projects were properly checked to makes sure that they were signed by the design engineer who is professionally registered with ECSA. This was the only way the contractor managed to transfer all the risks associated with omissions and defective designs back to the design engineer. All revisions on the documents were properly marked and the drawings that were revised were marked obsolete to make sure that they were not used on construction site. Evidence from one construction companies that employed an engineer as construction project manager on the project was able to track the mismatches between what was on the design drawings versus what was in the bill of quantities. The contracts manager highlighted the differences and presented them to the design engineers for correction. The contractor also said that they also verified on ECSA data base if the engineers who were assigned to the project were professionally registered with ECSA. Professional registration with ECSA is a guarantee that the work that is done by these professionals will be of high standards.

6.3 Frequently used current risk management strategies in South Africa

There are four risk response strategies namely avoidance, acceptance, transfer and lastly mitigation. Risk response strategies are means of reacting to risks on construction projects. Risk response strategies are subsets of risk management strategies. From the research findings it shows that the construction managers used a hybrid of risk response strategies to manage construction risks. Some of the construction project manager said that they used insurance to cover the work that they executed in case of weather damage, others used contingency sums to cover unforeseen circumstances. Other said they respond to risk through proper documentation of the process that are involved in construction. All the measures stated above are risk response strategies.

There is a difference between risk response strategies and risk management strategies. A strategy is a plan that has an intention of bringing a certain achievement whereas a response is a reaction to something that has occurred (Oxford Dictionary, 1948). Risk management strategies involves detailed planning in order to manage risks associated with construction projects. The following are risk management strategies that are being used by construction companies to manage diverse risks that are associated with construction projects:

- Employment of competent and experienced professionals who are registered with either ECSA or SACPCMP.
- Training of employees on the job to ensure that there is succession plan in case one of their employees leave the company or dies.
- Quality management plans which details all the documentations associated with management of quality on the project. Quality audits are scheduled from time to time to make sure that there is conformance with the specifications.
- Safety management plan which assists the contractors in the management of safety related risks on the construction projects.
- Programme of works which shows the sequence of the activities that will take place on the project and their duration. Programme of works assist the construction companies in management of time related risks.
- Standard form of contracts (FIDIC, JBCC, GCC and NEC) which assist the contractors to differentiate the risks that are within their control and those that are within the control of the employer.
- The type of project delivery that is being used on the projects such as design and build, private public partnerships etc.
- Environmental management plan which assists in the management of environmental related risks. Environmental management plan enforces compliance with environmental regulations.
- Insurance and bonds which comprises of insurance for the works and materials
- Contract price adjustment/ escalation to cater for escalating prices of construction materials.

- Compliance with statutory and regulatory requirements. ISO 9001: requirements demands that organisation comply with the law and regulation of the country where the organisation is conducting their business.

CHAPTER 7 CONCLUSIONS AND RECOMMENDATIONS

7. Conclusions and recommendations

7.1. Common construction related risks

From the study conducted on 17 construction companies it shows that the common risks that are experienced by construction companies in Gauteng Province in South Africa are:

- Incompetent construction project managers
- Poor workmanship from the local subcontractors
- Increment weather
- Theft of construction materials
- Death or resignation of key personnel on construction projects.
- Delay in procurement of construction materials caused by low production of construction materials from the supplier
- Community unrest demanding 30% of the construction project cost
- Health and safety related injuries on construction sites
- Contractor cash-flow problems exacerbated by delayed payment of certificates (contractors' invoices)
- Bad pricings of construction tenders
- Inflation

7.2. Gaps in construction risks management

From the findings there is sufficient evidence that risk management in construction is carried out reactively rather than proactively. The study has exposed gaps in the management of risks in South African construction industry. There is no formal qualification in risk management in construction industry. This results in lack of proper risk management planning in construction companies. There is no proper identification of the responsible person for management of some of the construction risks. When appointing construction project managers some of the company do not look into requirements of South African Council for Project and Construction Management professions requirement (SACPCMP) or Engineering Council of South Africa

(ECSA). This results in appointment of personnel with insufficient construction project management skills. The appreciation of construction risk management is poorer in construction companies in grade 7 CIDB category than those in grade 8 and 9 category. Construction companies in grade 8 and 9 showed that they had better appreciation of risk management through the way they responded to the interview questions. One of the construction company in grade 9 CIDB had a proper risk register that they use to identify risks and plan for risks. The other contractor did not show any evidence that they know how to use a risk register in their companies.

7.3. The Current risk management strategies

The current risks management strategies that are being used by construction companies in Gauteng Province in South Africa comprises of employing registered professions with SACPCMP and ECSA to work on construction projects as construction project managers, on job training for their internal labour force and on-site training for their sub-contractors and their labourers. Preparation of organograms which highlights the job description of the key employees of the construction company, use of quality management plans and safety management plans on construction site, environmental management plans, contract price adjustments, programme of works, standard form of contracts, the type of project delivery, insurances and bonds and lastly compliance with statutory and regulatory requirements. ISO 9001: requirements demands that organisation comply with the law and regulation of the country where the organisation is conducting their business.

7.4. Hypothetical findings

7.4.1. Common risks in SA

South African construction industry experience schedule overruns, cost overruns, bad quality of construction products and frequent scope changes, which emanate from bad risk management practices. From the interviews which were conducted in Pretoria and Johannesburg in Gauteng Province, the following were the common risks that contributed to schedule overruns, cost overruns, bad quality of construction product and frequent scope changes: community unrest, frequent stoppage of construction work by the community members, poor quality work from local sub-contractors, health and safety related injuries on construction sites, delays in payment of contractors ‘invoices, increment weather, theft of construction materials, mismanagement of project funds, rework due to poor quality work, late delivery of construction materials, defective designs, collapse of trenches, fall from height,

hazardous chemicals, loss of project team members through death and resignation, inflation and rise in cost of construction materials and equipment, bad pricing of construction work and changes in rental market.

In preparation for the hosting of 2010 FIFA World Cup SA construction companies experienced a lot of delays and cost overruns. Even though the stadia were ready for use during the 2010 FIFA World Cup some of the stadia were not completed during the hosting of the Confederation Cup. The delays affected the Confederation Cup which occurred in 2009. The Confederation Cup is a curtain raiser for FIFA World Cup. By the time the confederation Cup was taking place some of the ten stadia which were supposed to host the tournament were not completed (Baloyi & Bekker, 2011). The causes of cost overruns, schedule overruns and scope changes during the run up to the 2010 FIFA World Cup were late decisions by the clients, increase in cost of construction materials (stadia roofs), frequent changes in designs of stadia, late payment of contractors' invoices, lack of capacity and skill to construct stadia, and external factors which were beyond the control of project parties (Baloyi & Bekker, 2011). From literature review there is enough evidence that there are risk management challenges in SA construction industry. In the run up to the 2010 FIFA World Cup the SA construction companies experienced escalating costs which were caused by fluctuation of the South African Rand against the major currencies and the rise in price of construction materials. Power shortage which was caused by Eskom's unstable power supply (Chihuri & Pretorius, 2010).

7.4.2. Strategies that are used to manage risks in SA

From the research interviews (findings) the current risk management strategies are as stated below:

- Court interdiction to prevent communities from stopping the projects
- Negotiating with community members and political leaders such as councillors whenever there is a problem concerning the labourers and community participation goals
- Documentation of the movement of construction materials within construction site and also when delivered to site
- Preparation of comprehensive sub-contracts between the main contractors and subcontractors
- Preparation of bigger claim at the beginning of the project to manage cash flow for the project.

- Before commencing with construction work the designs are studied to check if there are no missing information on the drawings and ensuring that designs are signed by professional engineers
- Training of local subcontractors
- Proper allocation of roles and responsibility on the project
- Withholding retention money on the local subcontracts
- Succession planning in case one of their key employee leaves of dies
- Toolbox talks before carrying out works on construction sites
- Provision of contract price adjustment and contingencies in the tendered amounts
- Provision of performance guarantees
- Hiring of competent employees especially those who are professionally registered with ECSA or SACPCMP

From literature review (findings) construction companies in SA have strategies in place that they use in management of construction risks. To manage the public liability risk on construction project construction companies, buy all risk insurance to cover themselves against risk emanating from damage to persons and property. To manage the risk of rise in the prices of construction materials, labour and plant the construction companies use contract price adjustments (CPA) (Baloyi & Bekker, 2011). The contractors are allowed to state the base month of the time they submitted the tender to the client. The base month indices published monthly by Stat SA are used to check the impact the rise in prices is having on the cost of the construction project. If the effect of the rise in the price of construction materials, labour and plant is high a factor is applied to each monthly invoice that is submitted by the contractors to the clients. To manage the effect associated with project delay and increase in scope of work the construction companies use the standard form of contract to claim for liquidated damages and associated cost (Ekung et al., 2015). To manage the risk of community unrest, the contractors work closely with the ward councillors of the wards where the construction project is taking place. The construction companies manage the risk of poor workmanship from local subcontractors through training of the local sub-contractors and labourers. To manage political risks construction companies, create relationships with powerful political groups of the area where construction is taking place. They also create good working relationships with local businesses, and they also try as much as possible to employ capable local partners. The strategies stated above are some of the risk managements used by construction companies in

SA. Some risk management strategies are not used in South Africa are making higher tender offers. This strategy is also a risk to contractors in South Africa because they may end up not winning the tender. Charging interest on the late payments is also not practised by contractors in SA because construction companies are afraid of losing future business with their clients. The other strategy of managing construction risk is choice of suitable projects. Construction companies in SA do not have the luxury of choosing suitable projects because there is stiff competition for tenders in the industry (Chang et al., 2018).

7.5. Recommendations

The following are the recommendation regarding the risk management processes on construction projects:

- Risk management should be the responsibility of each and every one on the construction project.
- Construction companies should proactively prepare risk management plans and document all the risks associated with the project. All the risks that affect time, cost, quality and safety should be documented in the risk register. The description of the risk, the cause of the risk, the impact of the risk, the probability of the risk, the ranking of the risk, the owner of the risk, response plan and the status of the risk should be captured in the project risk register. From time to time the risk register should be updated.
- Project leaders should be encouraged to attend continuing professional development in risk management so that they can gain insights in the management of risks on construction project.
- The personnel employed on construction projects should be registered with professional bodies such as ECSA or SACPCMP.
- The construction sites should have clear organogram. The roles and responsibilities of the personnel on the project should be well defined.
- The construction contract that binds the parties to the construction project should always be on construction site. The project leaders should read and appreciate the risk allocation on the projects.
- Government should enforce the formal risk management in construction companies. Tenders submitted without a detailed risk management plan should be rejected.

7.6. Contribution to Body of knowledge

There is need for construction companies in South Africa to employee competent construction project managers registered with South African Council for Project and Construction Management Professionals (SACPCMP) or professionals registered with Engineering Council of South African (ECSA) when carrying out construction work. The construction project managers who are registered with these professional bodies demonstrated that despite not having formal qualifications in risk management they had knowledge in the processes that are followed when carrying out construction work. Therefore, one of the important risk management strategy is employment of construction professional registered with the relevant built environment professional bodies when carrying out construction work. The absence of these professional has resulted in projects being completed late, numerous scope changes, cost overruns and design risks. In conclusion some of the companies which experienced numerous constructions related risks was a result of projects being designed and managed by incompetent people.

7.7. How the research can be improved

This research can be improved further by increasing the number of participants to be interviewed. Apart from interviewing the construction project managers and safety officers, the participation can be extended to the accountants of construction companies, contracts managers, risk managers (if the company has one), construction company owners and the site foremen. This will enable capturing of data that covers a wider view with regard to construction related risks. The construction project managers and the safety officers who were interviewed only focussed on the construction related risks, but if the company owners and the accountants are included many of the impacts caused by construction related risks can be appreciated and resolved. Construction foremen can also assist in highlighting some of the risks associated with construction which are sometimes overlooked by the construction project managers and the safety officers.

7.8. Further studies

There is need for more and deeper investigation into the current risk management strategies that are currently being used by construction companies in South Africa. This will assist the construction fraternity to develop a uniform risk management strategy that can even assist new entrants in the construction industry.

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APPENDICES

9. Appendices

9.1. Appendix A

- **Ethics clearance**

School of Construction Economics & Management

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SCHOOL OF CONSTRUCTION ECONOMICS AND MANAGEMENT RESEARCH ETHICS COMMITTEE

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER CEM/20/1/SMM**
PROJECT TITLE	Current risk management strategies that are used by construction companies in south Africa.
INVESTIGATOR	Stevie Mickwell Munthali 1059055
SCHOOL/DEPARTMENT	**SCHOOL OF CONSTRUCTION ECONOMICS AND MANAGEMENT**
DATE CONSIDERED	01/03/2020
DECISION OF THE COMMITTEE	Approved conditionally with respect to the declaration
EXPIRY DATE	31st March 2021
DATE 1/3/2020	**CHAIRPERSON** Dr. Kola Ijasan

Supervisor: Lungi Maseko

DECLARATION OF INVESTIGATOR

To be completed in duplicate and **ONE COPY** returned to the Secretary Mrs. M. Kirsten 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** 3/ 03 / 2020

9.2. Appendix B

- Risk register

PROJECT MANAGEMENT DOCS
Free Project Management Templates

Project Risk Register
<Project Name>

Risk Identification		Qualitative Rating				Risk Response		
Risk	Risk Category	Probability	Impact	Risk Score	Risk Ranking	Risk Response	Trigger	Risk Owner
				0	1			
				0	2			
				0	3			
				0	4			
				0	5			
				0	6			
				0	7			
				0	8			
				0	9			
				0	10			
				0	11			
				0	12			
				0	13			
				0	14			
				0	15			
				0	16			
				0	17			
				0	18			
				0	19			
				0	20	Timeout Alert		
				0	21			
				0	22			
				0	23			
				0	24			
				0	25			
				0	26			
				0	27			
				0	28			
				0	29			
				0	30			

Key Terms
Risk: The risk stated in a complete sentence which states the cause of the risk, the risk, and the effect that the risk causes to the project.
Risk Category: Categorization of risks by area of project affected, source of risk or other useful category.
Probability: The likelihood that a risk or opportunity will occur (on a scale from 0 to 10 with 10 being the highest).
Impact: The impact of the risk on the project if the risk occurs (scale from 0 to 10 with 10 being the highest).

PROJECT MANAGEMENT DOCS
Free Project Management Templates

Project Risk Register
<Project Name>

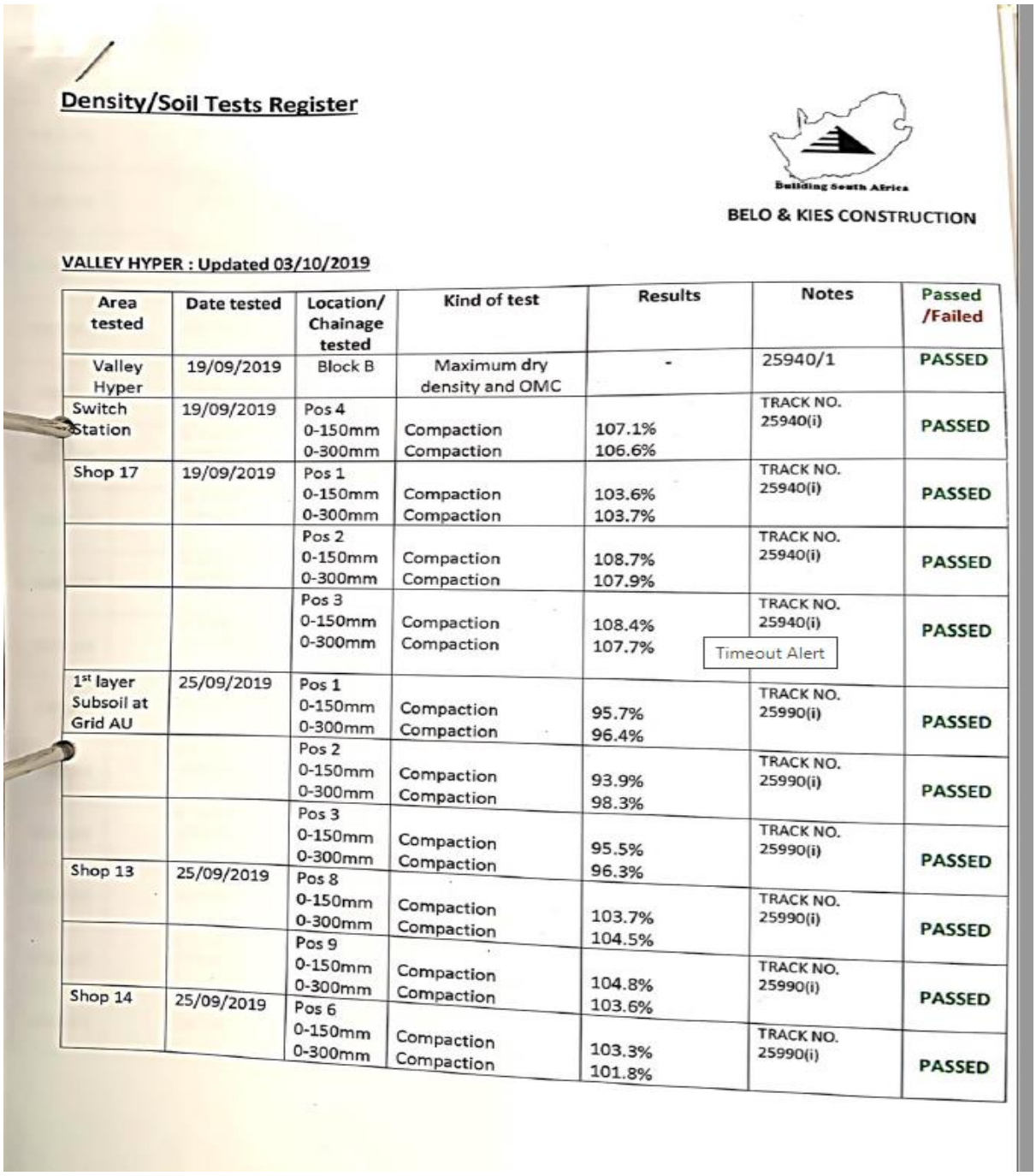
Risk Identification		Qualitative Rating				Risk Response		
Risk	Risk Category	Probability	Impact	Risk Score	Risk Ranking	Risk Response	Trigger	Risk Owner

Risk Score: Determined by multiplying probability and impact (scale from 0 to 100).
Risk Ranking: A priority list which is determined by the relative ranking of the risks (by their scores) within the project with the number one being the highest risk score.
Risk Response: The action which is to be taken if this risk occurs.
Trigger: Something which indicates that a risk is about to occur or has already occured.
Risk Owner: The person who the project manager assigns to watch for triggers, and manage the risk response if the risk occurs.
This Risk Register Template is brought to you by www.projectmanagementdocs.com

Timeout Alert

9.3. Appendix C

- **Quality management Control Documents**
  - ***i.*** **Density/soil test register**



Density/Soil Tests Register

Building South Africa

BELO & KIES CONSTRUCTION

VALLEY HYPER : Updated 03/10/2019

Area tested	Date tested	Location/ Chainage tested	Kind of test	Results	Notes	Passed /Failed
Valley Hyper	19/09/2019	Block B	Maximum dry density and OMC	-	25940/1	PASSED
Switch Station	19/09/2019	Pos 4 0-150mm 0-300mm	Compaction Compaction	107.1% 106.6%	TRACK NO. 25940(i)	PASSED
Shop 17	19/09/2019	Pos 1 0-150mm 0-300mm	Compaction Compaction	103.6% 103.7%	TRACK NO. 25940(i)	PASSED
		Pos 2 0-150mm 0-300mm	Compaction Compaction	108.7% 107.9%	TRACK NO. 25940(i)	PASSED
		Pos 3 0-150mm 0-300mm	Compaction Compaction	108.4% 107.7%	TRACK NO. 25940(i)	PASSED
1st layer Subsoil at Grid AU	25/09/2019	Pos 1 0-150mm 0-300mm	Compaction Compaction	95.7% 96.4%	TRACK NO. 25990(i)	PASSED
		Pos 2 0-150mm 0-300mm	Compaction Compaction	93.9% 98.3%	TRACK NO. 25990(i)	PASSED
		Pos 3 0-150mm 0-300mm	Compaction Compaction	95.5% 96.3%	TRACK NO. 25990(i)	PASSED
Shop 13	25/09/2019	Pos 8 0-150mm 0-300mm	Compaction Compaction	103.7% 104.5%	TRACK NO. 25990(i)	PASSED
		Pos 9 0-150mm 0-300mm	Compaction Compaction	104.8% 103.6%	TRACK NO. 25990(i)	PASSED
Shop 14	25/09/2019	Pos 6 0-150mm 0-300mm	Compaction Compaction	103.3% 101.8%	TRACK NO. 25990(i)	PASSED

Timeout Alert

Density/Soil Tests Register

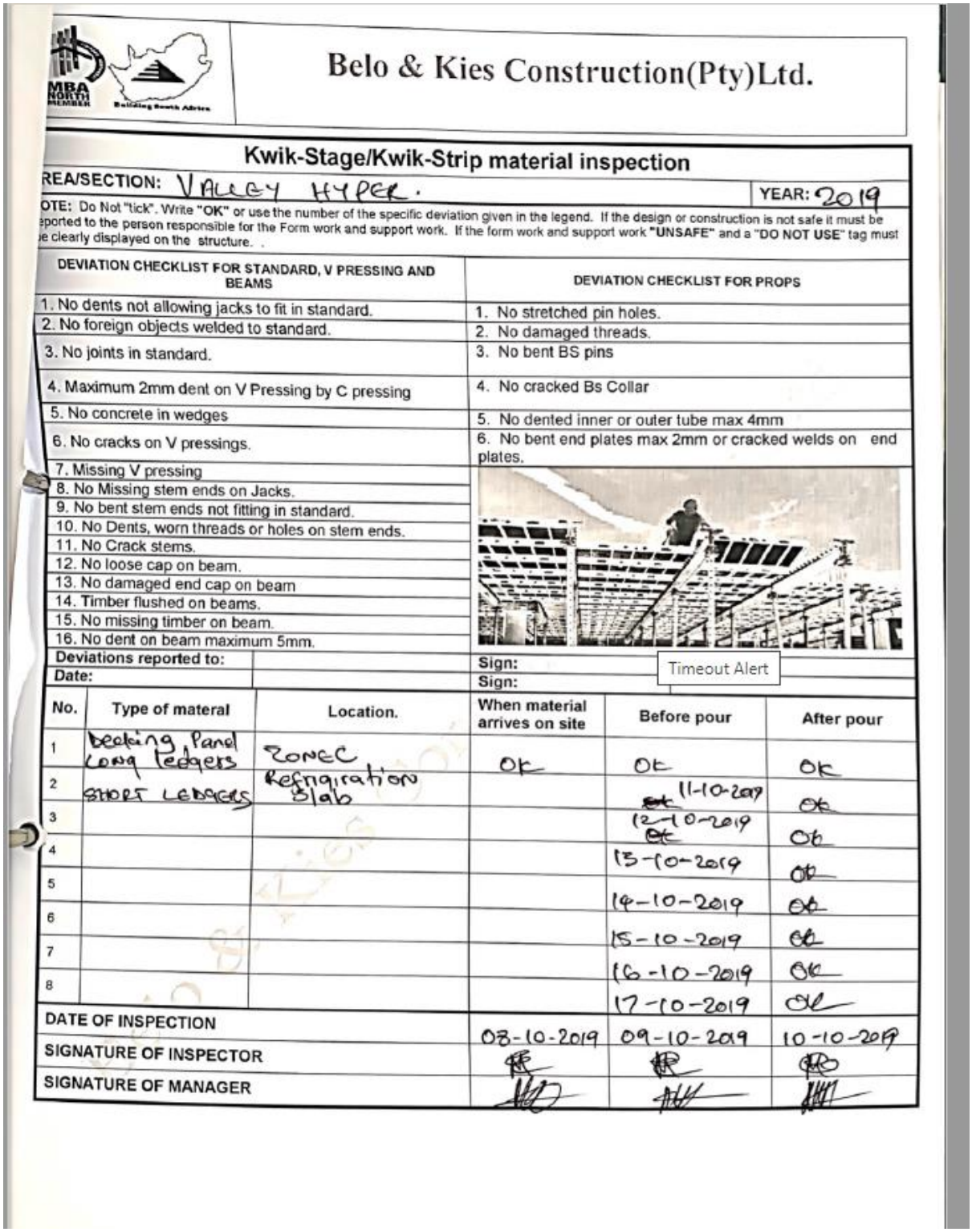
Building South Africa

BELO & KIES CONSTRUCTION

VALLEY HYPER : Updated 03/10/2019

Area tested	Date tested	Location/ Chainage tested	Kind of test	Results	Notes	Passed /Failed
Valley Hyper	19/09/2019	Block B	Maximum dry density and OMC	-	25940/1	PASSED
Switch Station	19/09/2019	Pos 4 0-150mm 0-300mm	 Compaction Compaction	 107.1% 106.6%	TRACK NO. 25940(i)	PASSED
Shop 17	19/09/2019	Pos 1 0-150mm 0-300mm	 Compaction Compaction	 103.6% 103.7%	TRACK NO. 25940(i)	PASSED
		Pos 2 0-150mm 0-300mm	 Compaction Compaction	 108.7% 107.9%	TRACK NO. 25940(i)	PASSED
		Pos 3 0-150mm 0-300mm	 Compaction Compaction	 108.4% 107.7%	TRACK NO. 25940(i) Timeout Alert	PASSED
1st layer Subsoil at Grid AU	25/09/2019	Pos 1 0-150mm 0-300mm	 Compaction Compaction	 95.7% 96.4%	TRACK NO. 25990(i)	PASSED
		Pos 2 0-150mm 0-300mm	 Compaction Compaction	 93.9% 98.3%	TRACK NO. 25990(i)	PASSED
		Pos 3 0-150mm 0-300mm	 Compaction Compaction	 95.5% 96.3%	TRACK NO. 25990(i)	PASSED
Shop 13	25/09/2019	Pos 8 0-150mm 0-300mm	 Compaction Compaction	 103.7% 104.5%	TRACK NO. 25990(i)	PASSED
		Pos 9 0-150mm 0-300mm	 Compaction Compaction	 104.8% 103.6%	TRACK NO. 25990(i)	PASSED
Shop 14	25/09/2019	Pos 6 0-150mm 0-300mm	 Compaction Compaction	 103.3% 101.8%	TRACK NO. 25990(i)	PASSED

ii. Kwik-stage/kwik strip material inspection



Belo & Kies Construction(Pty)Ltd.

Kwik-Stage/Kwik-Strip material inspection

AREA/SECTION: VALLEY HYPER. YEAR: 2019

NOTE: Do Not "tick". Write "OK" or use the number of the specific deviation given in the legend. If the design or construction is not safe it must be reported to the person responsible for the Form work and support work. If the form work and support work "UNSAFE" and a "DO NOT USE" tag must be clearly displayed on the structure. .

DEVIATION CHECKLIST FOR STANDARD, V PRESSING AND BEAMS	DEVIATION CHECKLIST FOR PROPS
1. No dents not allowing jacks to fit in standard.	1. No stretched pin holes.
2. No foreign objects welded to standard.	2. No damaged threads.
3. No joints in standard.	3. No bent BS pins
4. Maximum 2mm dent on V Pressing by C pressing	4. No cracked Bs Collar
5. No concrete in wedges	5. No dented inner or outer tube max 4mm
6. No cracks on V pressings.	6. No bent end plates max 2mm or cracked welds on end plates.
7. Missing V pressing	
8. No Missing stem ends on Jacks.	
9. No bent stem ends not fitting in standard.	
10. No Dents, worn threads or holes on stem ends.	
11. No Crack stems.	
12. No loose cap on beam.	
13. No damaged end cap on beam	
14. Timber flushed on beams.	
15. No missing timber on beam.	
16. No dent on beam maximum 5mm.	
Deviations reported to:	Sign:
Date:	Sign:

Timeout Alert

No.	Type of materal	Location.	When material arrives on site	Before pour	After pour
1	Decking Panel Long ledgers	ZONE C Refrigiration Slab	OK	OK	OK
2	SHORT LEDGERS			~~OK~~ 11-10-2019	OK
3				12-10-2019 OK	OK
4				13-10-2019	OK
5				14-10-2019	OK
6				15-10-2019	OK
7				16-10-2019	OK
8				17-10-2019	OK
DATE OF INSPECTION			03-10-2019	09-10-2019	10-10-2019
SIGNATURE OF INSPECTOR					
SIGNATURE OF MANAGER					

iii. Formwork inspection form

MBA NORTH MEMBER — Building South Africa

Belo & Kies Construction(Pty)Ltd.

FORMWORK INSPECTION REGISTER

AREA/SECTION: VALLEY HYPER. YEAR: 2019

NOTE: Do Not "tick". Write **"OK"** or use the number of the specific deviation given in the legend. If the design or construction is not safe it must be reported to the person responsible for the Form work and support work. If the form work and support work **"UNSAFE"** and a **"DO NOT USE"** tag must be clearly displayed on the structure. .

DEVIATION CHECKLIST	CORRECTIVE ACTION TO BE DONE IMMEDIATELY IF NOT SAFE
1. Line and Alignment of Shutters.	a. Safe
2. Verticality of Shutters.	b. Not Safe
3. Shutter oiled and cleaned.	Site manager to sign:
4. Cambers allowed for.	Section Foreman to sign:
5. Bracing to edges and stop ends.	QA Officer:
6. Built-in items correct, clean and properly fixed in correct position.	
7. Adequate support under-side of formwork.	
8. Jacks adequate and secure and soil boards under jacks	
9. Joints sealed.	
10. Adequate cross-bracing of support work.	
11. Support work bears on suitable bearings members.	
12. Formwork stays are tight.	
13. Survey checks have been done.	
14. Filler plates secured.	
15. Safe access and edge protection all the way around	
16. Removal of support-work.	
16.1 Instruction given to: Name: Petrus	Sign: Date: 13-10-2019
16.2 Instruction given by: Name: MAMSI	Sign: 10-2019



Timeout Alert

No.	Area.	Location.	Before pour (Do not start pour if any deviation is noted from legend	During pour	After pour
1	ZONE C	REFRIGIRATION SLAB.	Ok	Ok	Ok
2				11-10-2019	Ok
3				12-10-2019	Ok
4				13-10-2019	Ok
5				14-10-2019	Ok
6				15-10-2019	Ok
7				16-10-2019	Ok
8				17-10-2019	Ok
DATE OF INSPECTION			08-10-2019	09-10-19	10-10-2019
SIGNATURE OF INSPECTOR					
SIGNATURE OF MANAGER					

iv. Request for inspection form

SN: 028

ENGINEERING UBUNTU (PTY) LTD CONSULTANTS

ENG-F604

Effective Date: 20 April 2017 | Revision: Rev 0

REQUEST FOR INSPECTION FORM

PROJECT NAME : VALLEY HYPE

CLIENT : RUSSET

PROJECT NUMBER : N/1448

CONTRACT NUMBER : BLS3.

CONTRACTOR : BELO & TIES. CONSTRUCTION

FILE REF : N####/CA/O/CS

Request No	Work Description	Time Ready	Requested By	Remarks	Time Inspected	Inspected By
	ZONE C. SLAB	07H30.	NICHOLAS	CHECK COVER.	09/10/19	
	REFRIGIRATION	08/10/2019			09H50	
	AW/AT A3/A6.					

Timeout Alert

v. Reinforcement check

Belo & Kies CONSTRUCTION
Building South Africa

Belo & Kies Construction (Pty) Ltd.
Reg. No:2000/002363/07 | Vat No:4040188262
Postal Address:PO Box 978 GLENVISTA 2058
Tel:(071) 607-5578 | Fax: (086) 660-5195
Email:info@beloandkies.co.za | Website:www.beloandkies.co.za

7. REINFORCING CHECK

CONTRACT NAME: VALLEY HYPER CONTRACT NO: BK 57

Location: ZONE C.. Reflighting Date: 07/10/2019
SLAB.

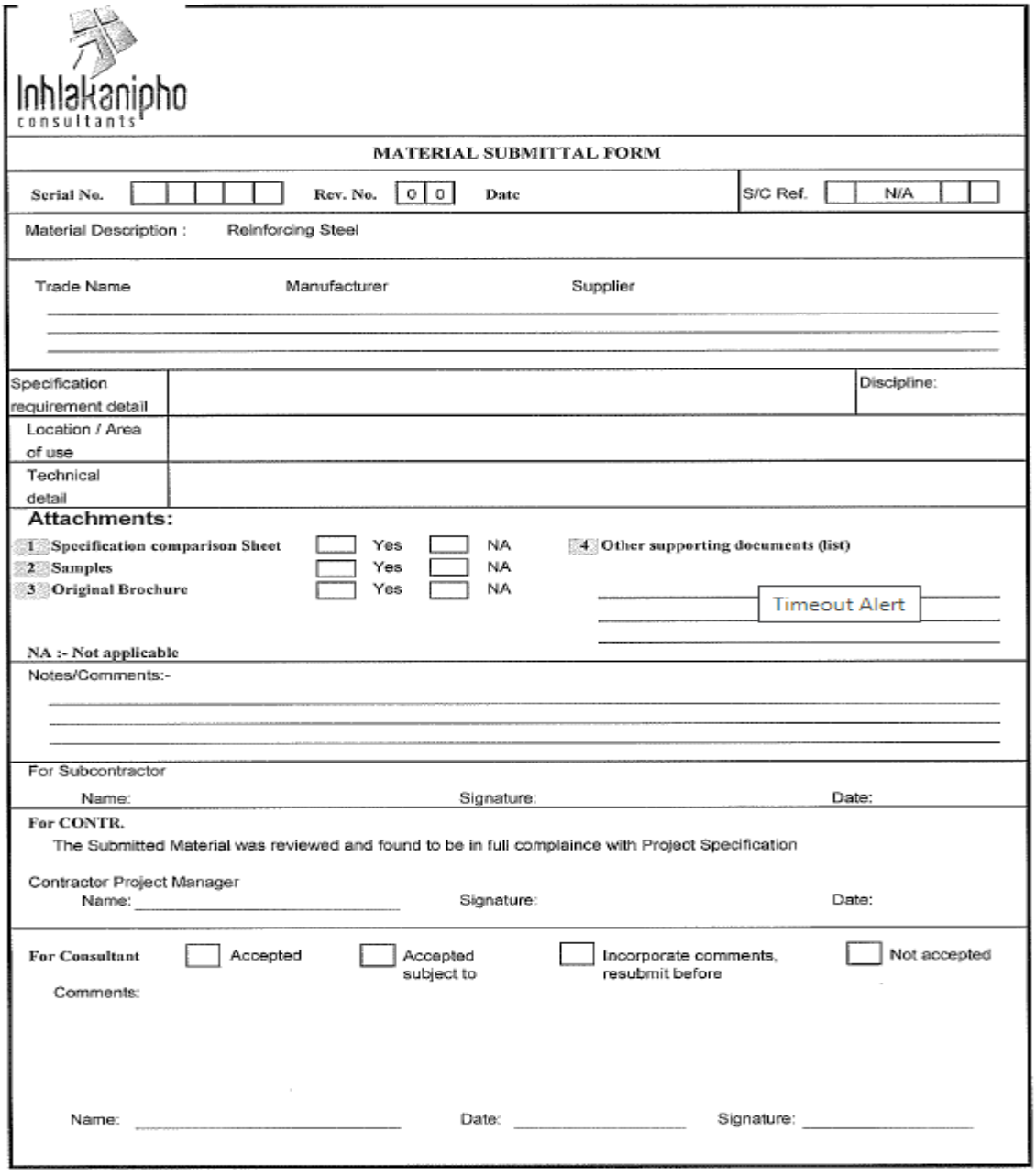
Check	Satisfactory	Not Satisfactory	Remarks
1. All reinforcing as per latest drawing number	✓		
2. Reinforcing clean	✓		
3. Spacer blocks sufficient and good quality	✓		
4. Cover to steel satisfactory	✓		Check
5. Correct level and position of reinforcing	✓		
6. Starter bars secure and in correct position	✓		
7. Reinforcing protected from deformation and damage by traffic	✓		
8. Laps are correct 50x diameter	✓		
9. Reinforcing properly fixed	✓		

Timeout Alert

QA OFFICER | SECTION FOREMAN | SITE MANAGER

REBAR = ATTACH PHOTO EVIDENCE AND ENGINEER'S APPROVAL

vi. Material submittal forms



Inhlakanipho consultants

MATERIAL SUBMITTAL FORM

Serial No.		**Rev. No.** 0 0 **Date**	S/C Ref. N/A

Material Description : Reinforcing Steel

Trade Name Manufacturer Supplier

Specification requirement detail		Discipline:
Location / Area of use		
Technical detail		

Attachments:

1	**Specification comparison Sheet**	Yes	NA	4	**Other supporting documents (list)**
2	**Samples**	Yes	NA		
3	**Original Brochure**	Yes	NA		

Timeout Alert

NA :- Not applicable

Notes/Comments:-

For Subcontractor

Name: Signature: Date:

For CONTR.

The Submitted Material was reviewed and found to be in full complaince with Project Specification

Contractor Project Manager

Name: Signature: Date:

For Consultant Accepted Accepted subject to Incorporate comments, resubmit before Not accepted

Comments:

Name: Date: Signature:

vii. Drawing /document transmittal form

Inhlakanipho consultants

DRAWING / DOCUMENT TRANSMITTAL FORM

Transmittal No.:	Date:	Resp. By:
From:	To:	Attn.:

☐ Document Class ☑ First Submission ☐ Second Submission ☐ Further Submission

Previous Submittal Ref : Date: Category: S/C Ref: Date:

Sr. No.	Drawing / Document No.	Description	Rev.	Copies	Approval Category

CONTRACTOR REVIEW CHECK LIST

☐ Architectural ☑ Structural ☐ Mechanical ☐ Electrical ☐ Plumbing ☐ Others

THIS SUBMITTAL INTENDED FOR

☑ APPROVAL / COMMENTS
☐ AS PER YOUR REQUEST
☐ YOUR INFORMATION / RECORDS
☐ YOUR NECESSARY ACTION

Timeout Alert

For : Contractor

Mr.....	Projects Manager		
Name	Designation	Signature	Date

viii. Inspection Test Request Log

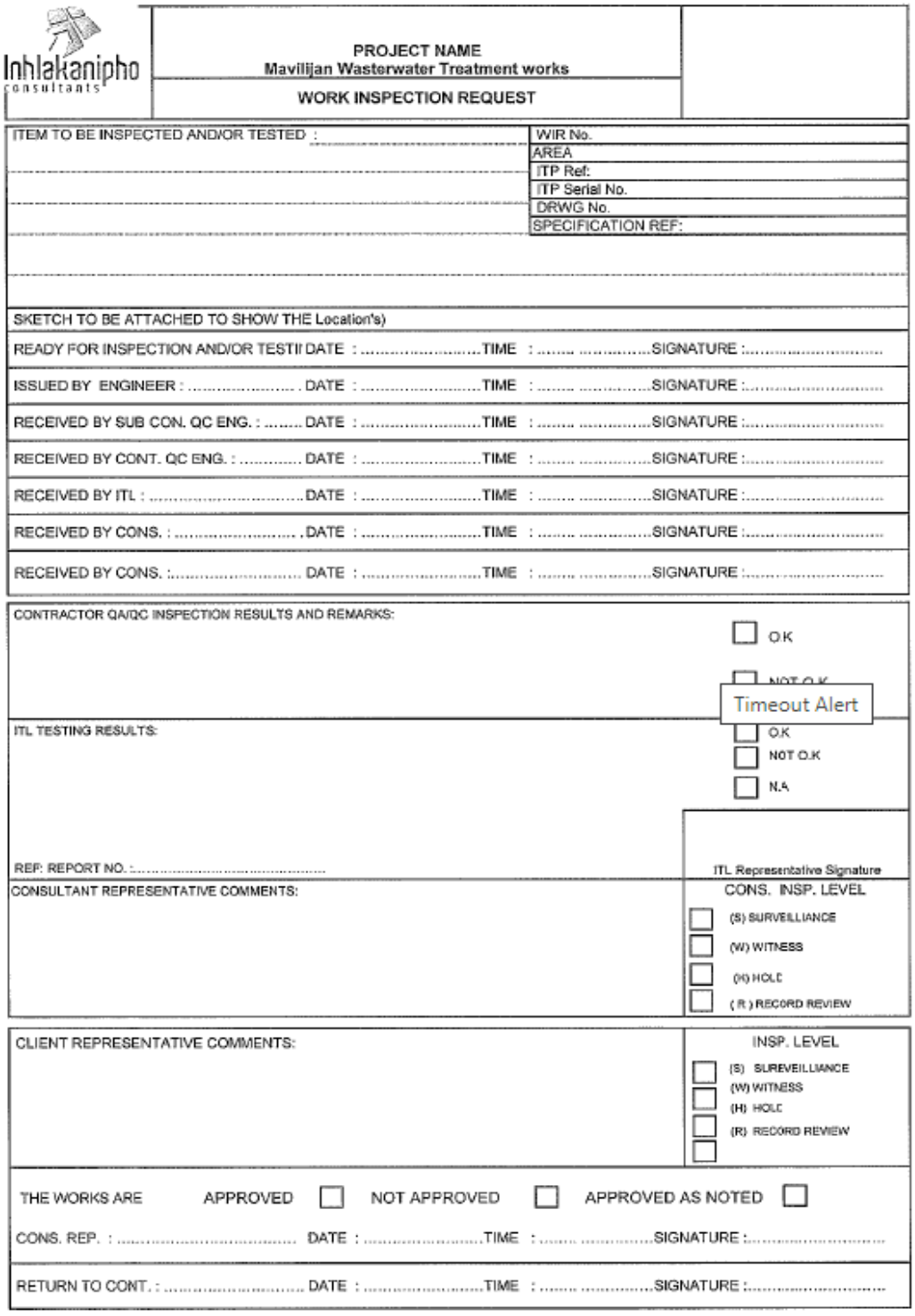
PROJECT NAME

Inspection Test Request Log

S. No	Request No	Date of Request	Inspection Date	Description & Location	Date Returned	Status
				Timeout Alert		

A = Approved
B = Approved as noted
C = Approved Subjected to
D = Rejected

ix. Work Inspection Request



Inhlakanipho consultants

PROJECT NAME
Mavilijan Wasterwater Treatment works

WORK INSPECTION REQUEST

ITEM TO BE INSPECTED AND/OR TESTED :

WIR No.
AREA
ITP Ref:
ITP Serial No.
DRWG No.
SPECIFICATION REF:

SKETCH TO BE ATTACHED TO SHOW THE Location's)

READY FOR INSPECTION AND/OR TESTI/ DATE : .....TIME : ....SIGNATURE :.....

ISSUED BY ENGINEER : ..... DATE : .....TIME : ....SIGNATURE :.....

RECEIVED BY SUB CON. QC ENG. : ..... DATE : .....TIME : ....SIGNATURE :.....

RECEIVED BY CONT. QC ENG. : ..... DATE : .....TIME : ....SIGNATURE :.....

RECEIVED BY ITL : .....DATE : .....TIME : ....SIGNATURE :.....

RECEIVED BY CONS. : ..... .DATE : .....TIME : ....SIGNATURE :.....

RECEIVED BY CONS. :..... DATE : .....TIME : ....SIGNATURE :.....

CONTRACTOR QA/QC INSPECTION RESULTS AND REMARKS:

☐ O.K
☐ NOT O.K

Timeout Alert

ITL TESTING RESULTS:

☐ O.K
☐ NOT O.K
☐ N.A

REF: REPORT NO. :.....

ITL Representative Signature

CONSULTANT REPRESENTATIVE COMMENTS:

CONS. INSP. LEVEL
☐ (S) SURVEILLIANCE
☐ (W) WITNESS
☐ (H) HOLD
☐ (R) RECORD REVIEW

CLIENT REPRESENTATIVE COMMENTS:

INSP. LEVEL
☐ (S) SURVEILLIANCE
☐ (W) WITNESS
☐ (H) HOLD
☐ (R) RECORD REVIEW
☐

THE WORKS ARE APPROVED ☐ NOT APPROVED ☐ APPROVED AS NOTED ☐

CONS. REP. : ..... DATE : .....TIME : ....SIGNATURE :.....

RETURN TO CONT. : ..... DATE : .....TIME : ....SIGNATURE :.....

x. Change request

Inhlakanipho consultants	CHANGE REQUEST (CR)	CR NO: REV.	

PROJECT : Maviljan Wastewater Treatment Works AGREEMENT NO. :

PROJECT NO. : DATE :

CHANGE REQUESTED BY:			CONTRACTOR	☒

BRIEF DESCRIPTION OF PROPOSED CHANGE:

JUSTIFICATION (USE ATTACHMENTS AS NECESSARY):

ESTIMATED COST/SCHEDULE IMPACT:

SIGNED BY:
[CONTRACTOR NAME]

PROJECT MANAGER DATE:

PMC COMMENTS ☐ APPROVED ☐ REJECTED

SIGNED: DATE:

ENDORSEMENT:

SR. QUANTITY SURVEYOR	SR. PLANNING ENGINEER	Timeout Alert S ENGINEER
SIGNED/DATE:	SIGNED/DATE:	SIGNED/DATE:

ENDORSED BY:
CONS. PROJECT MANAGER ☐ APPROVED ☐ REJECTED

SIGNED DATE:

APPROVED BY:
CIVIL PROJECTS DIVISION MANAGER

SIGNED: DATE:

IMPLEMENTATION VERIFIED BY:
[CONTRACTOR NAME]

SIGNED: DATE:

xi. Request for information

nhlakanipho consultants

PROJECT NAME
Maviljan Wastewater Treatment Works

REF: RFI -

REQUEST FOR INFORMATION (RFI)

PROJECT TITLE :

PROJECT NO. :

CONTRACTOR :

REQUEST:

ATTACHMENTS :

Timeout Alert

NAME :

RESPONSE REQUIRED BY TITLE : PROJECT MANAGER

DATE : DATE :

RESPONSE :

ATTACHMENTS :

NAME :

TITLE : PROJECT MANAGER

DATE :

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xii. Confirmation of verbal instruction

Inhlakanipho consultants	Maviljan Wastewater Treatment Works	

CONFIRMATION OF VERBAL INSTRUCTION

This is to confirm your *VERBAL INSTRUCTION* Issued to Contractor Site Management as detailed below

Issued By: **Name:** **Date:**	C.V.I Ref No: CVI-0001 Date:

This Confirmation made by:	C.V.I SR Ref No:
Name:	Date:

Details of Verbal Instruction:

Impact	Timeout Alert
Design Change: Yes - No	Affected Drawing / Specification No:
Programme: Yes - No	Time Period Required :
Additional Resources: Yes - No	Total Man / hours:

Details of Work to be Carried – out.	Start date:	Finish date:

This is an additional cost to the Contract:	☐
This is Not an additional cost to the Contract:	☐

For Contractor – Project Manager Name:	Signature:	Date:

For use by Consultant
We Confirm and Agree with the above detailed Verbal Instruction.

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xiii. Trend Inspection sheet

Inhlakanipho consultants	**Maviljan Wastewater Treatment Works**	

Project Title:	CTN No. / Rev: Date: CTN Type:

Originator: Contractor – General Contracting

Trend Request Description:
Referenced Documents:

Description of Change / Request to Depart From Drawings and Specification & Or Procedu Timeout Alert
Deviations / Proposed Rectification / Justification for Change (As Applicable)

Summary Of Cost Impact Total Omission / Addition	Amount Proposed As Attached

Effect on Milestone / and / or Project Completion Date:

Status				
Approved	Rejected	Cancelled	Withdraw	Others (Specify)
Explanation:				

For Contractor	For Consultant
Name: Signature: Title: Date:	Name: Signature: Title: Date:

xiv. Contractual trend notice register

Mavilijan Wastewater Treatment Works

Inhlakanipho Consultants

CONTRACT TREND NOTICE (CTN) REGISTER

CTN No	Rev N	Issue No	CTN Type	Description	Request By ACC		CTN Status	COMPANY Position		C.O NO. @	Remarks
					Cost Impact	SCH Impact (Weeks)	A/C/P/R/W	Cost Impact	SCH. Impact (Weeks)		
1	2	3	4	5	6	7	8	9	10	11	12

For CTN Type:- DD = Design Deviation CR = Cession Request GR = General Request

For CTN Status A = Approved C = Cancelled R = Rejected W = Withdraw

@ Indicate, where applicable the Change Orde which covers the approved CTN with Cost / Schedule Impact

Note: Contractor shall provide the CTN reports sor Column 4 and / or 8 as requested by Consultant.

Contractor shall maintain separate register fo sultant initiated trends (CTN - A - 001 series) and CONTRACTOR initiated trends

Timeout Alert

xv. Non-conformance report

Inhlakanipho consultants

NON CONFORMANCE REPORT

CONTRACTOR	:	Mfumelelo Business Enterprise	Agreement	:	
Department / Discipline	:		NCR No.	:	
Function Audited	:		Audit Date	:	
Consultant Representative	:				

Non-Conformance Requirements: According to:

Deficiency:

Signature Signature Date:
Initiator: Civil Site Inspection Engineer CONTRACTOR:

Corrective Action Recommendation

Signature Implementation Planned Consultant Comments:
(Contractor's Representative) Date: Acce Timeout Alert

Preventive Action Recommendation

Signature Implementation Planned Date:
(Contractor's Representative)

Follow-Up & Close-Out BY Consultant

Closed- Out By Signature Date :
(NAME)

xvi. Corrective Action Request

Inhlakanipho consultants

Corrective Action Request

Part 1 – Classification

1- Product Nonconformity		2-Customer Complaint		3- System Audit		4- Data Analysis	

Issued To:	Department:	CAR #:
CC:	Subcontractor:	Audit Ref No:

Part 2

Details of Nonconformity	Category Major - Minor	Document & Clause Ref

Root Cause of the Non-Conformity

1- Deficiency in System Implementation		4- Deficiency in Communication		7- Deficiency in Tools / Equipment	
2- Deficiency in Documentation		5- Deficiency in Required Competency		8- Deficiency in Operating Environment	
3- Deficiency in Required Human Resource		6- Deficiency in Materials		9- Deficiency in Training & Motivation	

Issued by QA Manager	Auditee	Re-assessment Required
Name & Signature:	Name & Signature:	Yes - No
Date:	Date:	Date:

Timeout Alert

Part 3

Proposed Remedial Action (*Attach separate sheet if required)*	Action By	Target Date	Status
Corrective Measures (*Attach separate sheet if required)*			

Note: Once the Corrective & Preventive Actions Are Completed, Initial the Status Column & Notify the QA Department for Re-Assessment

Part 4 Proposed Corrective / Preventative Action Accepted: Yes - No

Department Manager	Suppliers / Subcontractors	QA Manager
Name & Signature	Name & Signature	Name & Signature
Date	Date	Date:

Part 5 Corrective actions Verified as Completed & Accepted: Yes - No

QA Manager -	Name:	CAR Closed, Yes - No
	Signature	Date:

Note: 1- This Form can only be used during Internal Audit

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xvii. Project monthly quality report

Inhlakanipho consultants

Maviljan Wastewater Treatment Works

PROJECT MONTHLY QUALITY REPORT

1- QA / QC Perosnnel on Site:

Report #:

QA / QC Engineer: _____

Date:

2- Quality System Documentation Submittal Status:

Title	Date Submitted	Rev	Status

3- Site Audits: {If any} attach Audit Report

4- Status of Corrective & Preventive Actions (CAR)

	Issued Last Month	Issued This Month	Cumulative Issued	Resolved This Month	Outstanding
contractor			0		0
Subcontractors			0		0

Timeout Alert

5- Status of Site Non-conformance Reports

	Issued Last Month	Issued This Month	Cumulative Issued	Resolved This Month	Outstanding
Contractor			0		0
Subcontractors			0		0

6- Site Instructions issued by consultnat

	Issued Last Month	Issued This Month	Cumulative Issued	Resolved This Month	Outstanding
contractor			0		0
Subcontractors			0		0

7- Inspection & Test Request Status

Request for Inspection

xviii. Request for concrete supply

Inhlakanipho consultants

Request for Concrete Supply

To:			**Date Submitted:**
Address:			**Date Required by:**
Tel:	**Fax:**		

This is to Request Supply of Concrete to:

Project Title:		**RCS SR Ref No:**
Project Ref No:		
Project Address:	**Tel # :**	**Fax # :**

Details of Concrete

Class / Grade	Spec Ref	Qty	Delivery Interval	Delivery Time	Remarks

Timeout Alert

Yours truly,

Project Manager

Name:	**Signature:**

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xix. Document Distribution sheet

Inhlakanipho consultants

Document Distribution Sheet

Project Title: -	
Issued To:	**DTS Ref. #:**
	Date:

We are forwarding herewith, the documents listed below

Document Details

No	Document Ref Number	Rev	Document Title	Type	Issued for	Copy
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						

Timeout Alert

Remarks

Copy To:	Document & Data Controller	Date:

Received By:

Name: Signature: Date:

Issued For:				*Type:*			
A	Action as noted	D	As requested	D	Drawing	SS	HSE System
B	Comment	E	General issue	S	Submittal	P	Program & Progress
C	Information	F	Preliminary	Q	Quality	O	Other

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xx. Material/Product inspection report

Inhlakanipho consultants	**Material / Product Inspection Report**	

Project Title: **Client:**	**Consultant:**

1- Description of Material / Product:	Date:
2- Area of Use:	MIR SR Ref No

3- Supplier:	Tel:
Address:	Fax:
	Delivery No:
Manufacturer:	L.P.O No:

Inspection Status

4- Details	Indicate Quantity	
	1- Exact	
	2- Damaged	
	age	
	ss	

Timeout Alert

5- Inspection / Test Records Provided as Requested Yes - No. If Yes List below. (***Attach Test Certificates to This Report***)
Further Tests are Required Yes – No, If yes Specify & State No of Samples Taken.

1-	3-
2-	4-

6- Inspection Status: Indicate as Applicable		
1- Accepted & Released		State Reason (s) for Rejection:
2- Rejected		NCR No:
3- Released While Awaiting Test Results		Date Results Received:
4- On Hold Awaiting Test Results		Date Results Received Test Results Conform YES / No

7- Non – conformance Report Issued Yes - No
If Yes: NCR Ref No:

8- Remarks / Comments:

xxi. Material Inspection Record (MIR)

nhlakanipho onsultants	CONSULTANT: Inhlakanipho Consultants	CONTRACTOR: - Mfumelelo
	Project Title: Maviljan Wastewater Treatment Works	Project No:

Material Inspection Record (MIR)

(Material Procured By CONTRACTOR)

IIR Ref. No.:		Date:	
		Time:	
Material Description: Cement Plaster Render- DP210/1	**Supplier:**	Discipline	
		Material Approval No.	
Manufacturer: Dubai Plaster Dry Mix Co		Origin:	

Attached Documentation with delivery: -	**Yes / No**	**Document Identification No.**
Approval of MAR (Material Approval Request)		
Sub-Contractor / LPO / LC (Priceless)		
Delivery Note / Store Issue Voucher		
Site Receipt		
Manufacturer's Test Certificates		
Certificate of Origin incase of Foreign Materials		
Any other Document		

Receiving Inspection/Verification of Compliance By Storekeeper / Discipline Engineer

Received materials are in good condition and quantity as per attached delivery note.

NAME: SIGNATURE: Timeout Alert

Inspection / Verification (By CONTRACTOR QA/QC)

Conforming / Accepted ☐ Accepted

Material has been inspected and as per approved material submittal

Non-Conforming / Rejected ☐

Inspection / Verification (By MANAGER) For Major Items

Conforming / Accepted ☐

Non-Conforming / Rejected ☐

Comments (If any):

SIGN AS ACCEPTED ☐/ REJECTED ☐

	SUB-CONTRACTOR	CONTRACTOR QA/QC	CONSULTANT (For Major Items)	
Name:	-------			
Signature:	-------			
Date:	-------			

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xxii. Annual internal audit

Inhlakanipho consultants	Inhlakanipho Consultants	Form No.	
	Ref. : PQP Clause 8.2.2 Internal Audit	Revision	0
	Annual Internal Audit Plan	Date:	

FOR THE YEAR 2014

Audit Subject	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Document and records Control												
Project Planning: - Baseline Schedule Compliance - Look ahead and progress reports - *Technical Submittals:* - *Shop Drawings* - *Material submittals* - *Method statements* - *Inspection and test plan*												
Contractual Requirements: - Status of variations - Design records and approvals - Design Change Records - Contractual Deliverables												
Project Management: - Inspection - Testing - Calibration												
Purchasing: Material Verification records												
Corrective preventive action and NCRs												

Timeout Alert

Note: Audit Programme shall be prepared accordingly and records shall be kept for internal reference only.

xxiii. Trend report

Inhlakanipho consultants

Maviljan Wastewater Treatment Works

	Issued Last Month	Issued This Month	Cumulative Issued
Structural			0
Furnishings			0
Electrical			0
Plumbing			0
Mechanical			0
Materials			0

8- Key Issues / Trends that Have Impact on Product Quality

1-
2-
3-
4-
5-

9- List of Major Complaints by consultnat with Respect to Inspection & Testing

1-
2-
3-
4-
5-

10- Status of Materials Receiving Inspection

	Type of Material	Test Status
1-		
2-		
3-		
4-		
5-		
6-		

Timeout Alert

11- Details of Any Test Failure

1-
2-
3-
4-
5-

12- Quality Management System Implementation - Key Areas of Concern

1-
2-
3-
4-
5-

Inhlakanipho consultants

Maviljan Wastewater Treatment Works

13- Subcontractors Performance - Areas of Concern

1-
2-
3-
4-
5-

15- Quality Meeting Summary - Outstanding Issues

1-
2-
3-
4-
5-

Timeout Alert

16- Attachments

1- Status of RFIs	☐	3- Cube Crushing Register	☐
2- Audit Report (If Any)	☐	4- Instruments Calibration Register	☐

Prepared by

Project QA / QC Engineer

Name: Signature: Date:

xxiv. Excavation and backfill for structures

nhlakanipho consultants

Maviljan Wastewater Treatment Works

Check Sheet For:	**Excavation & Backfill For Structure**	**Form No:**
Contractor -		**Rev No:** 0
Subcontractor		**Date:**
		Page: 1 of 1

Section of Work: **Location:**

Level:

Stage	Item	Checked by S / C		Checked by	Date
Setting Out – Lines & Levels	Lines & Levels are within the Specified Tolerances.				
Dewatering System	Area is free from water				
Excavation For Structure	Nature ground lines & levels are recorded & agreed				
	Elevation & Dimension as shown on the Latest Approved Drawings.				
	Bottom of excavation is not disturbed.				
	Underground services protected (If any)				
Backfill Materials	Verify Tested & Approved				
Placement & Compaction	200 mm layers for compaction by heavy equipment				
	100 mm layers for compaction by hand – operated equipment				
	Compaction Test carried out &Results are Satisfactory				
Note: Check Drawings for Waterproofing	***Prior To Backfill for Structure, Check Waterproofing is Installed and Approved.***				

Timeout Alert

For S/C QA / QC Date:	For Contractor - - QA / QC Date:	For Consultant Rep : Date:
Name:	Name:	Name:
Sign:	Sign:	Sign:

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xxv. Cast in place concrete

nhlakanipho consultants

Maviljan Wastewater Treatment Works

Check Sheet For:	**Cast - In - Place Concrete**	**Form No:**
Contractor -		**Rev No:** 0
Subcontractor		**Date:**
		Page: 1 of 1

Section of Work: **Location:**

Level:

Stage	Item	Checked by S / C		Checked by	Date
Setting Out – Lines & Levels	Check against App Drawing				
	Check for Tolerances				
Formwork	Check the following				
	Number & Spacing of Struts and braces – ensure rigid & uniform.				
	Lock joints between from sections free form play or movement.				
	Shape, strength, rigidity, water tightness and surface smoothness of re used				
	Forms maintained in good condition				
	Metal ties are so constructed as to permit their removal.				
	Form surface treated with oil.				
	Checked prior to concrete for plump and tightness - Tolerances				
Reinforcement	Check the following:				
	Dimension, Shape, & Size as per App Design Drawing.				
	Accurately Placed in position Firmly fixed and held during concreting.				
	Cover is maintained.				
	Splices as per approved Drawing.				
	Clean, no loose mill scale, excessive rust, etc				
Embedded Items	Check the following				
	Size, type, location as per App Drgs				
Water Stop	Check the following				
	Size, type, location as per App Drgs				
Construction Joints / Expansion Joints	Check the following				
	Type is App - Location as Per App Drgs				
Transport and Place Concrete	Check the following				
	Receiving Inspection.				
	Slump Test / Cubes				
	Temp not to exceed 30 Deg C				
	Vibration as requirements of the specification				

For S/C QA / QC	For Contractor - Cont - QA / QC	For Consultant Rep :
Date:	Date:	Date:
Name:	Name:	Name:
Sign:	Sign:	Sign:

Timeout Alert

xxvi. Concrete pour card

Inhlakanipho consultants

Concrete Pour Card

Pour Element

Foundation / Pile Caps ☐ Columns ☐ Walls ☐ Slab ☐ Others ☐

Location: Casting Level: Ref No :

Date:

Type of Concrete:

Supplier: Specified Slump mm:

Mixer No	Delivery No.	Batch Time Hrs	Arrival Time Hrs	Start Pour Hrs	Finish Pour Hrs	Quantity M3	Cumulative Quantity M3	Temp D C	Slump MM	Cube Ref No 7 Days A	Cube Ref No 28 Days B

xxvii. Daily inspection/testing schedule

Inhlakanipho consultants	PROJECT NAME & LOGOS	

DAILY INSPECTION / TESTING SCHEDULE

Date:

Time	WIR Ref No	Activity	Location	Re – Schedule Date & Time

Timeout Alert

xxviii. Work Inspection and acceptance sheet

Inhlakanipho consultants

INSPECTION & TEST PLAN
REF. No. :
REV. No. :
DATE: :
PAGE :

ACTIVITY:
AREA :
LEVEL :

ITEM	ACTIVITY DESCRIPTION	SPECIFICATION / CRITERIA	INSPECTION & ACCEPTANCE			REMARKS/ REPORT NO.
			ITL	CONT.	Consultant	

Timeout Alert

Legend: H – HOLD FOR INSPECTION W – WITNESS INSPECTION S – SURVEILLANCE INSPECTION R - REVIEW

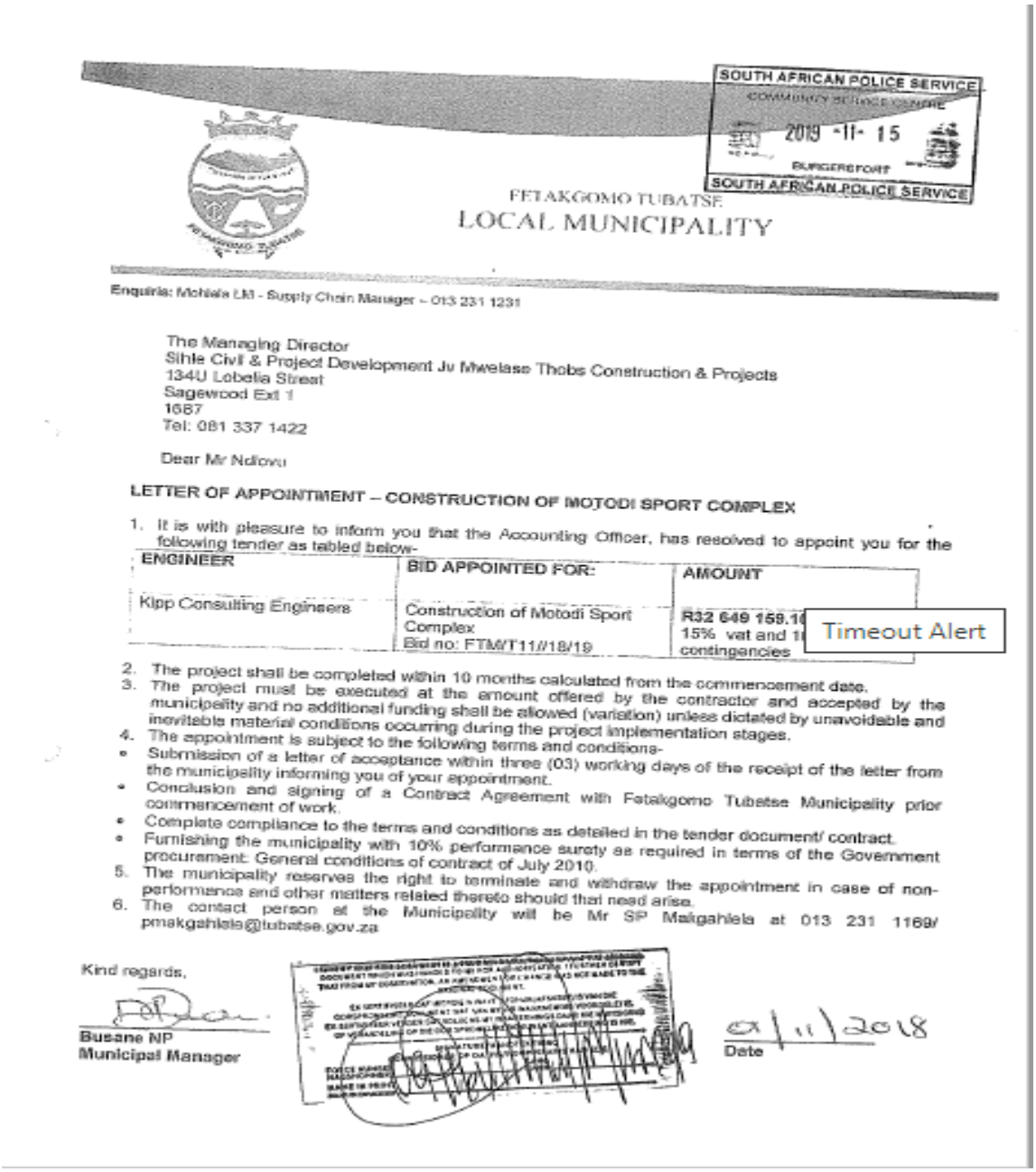
MAIN CONTRACTOR	M	CONTRACTOR APPROVAL	CONSULTANT APPROVAL
	NAME:	NAME:	
	SIGNATURE:	SIGNATURE:	
	DATE:	DATE:	

5999 - FM - ITP

9.4. Appendix D

a) Safety management control documents

i. Appointment letter



SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2019 -11- 15
SOUTH AFRICAN POLICE SERVICE

FETAKGOMO TUBATSE
LOCAL MUNICIPALITY

Enquiries: Mohlala LM - Supply Chain Manager – 013 231 1231

The Managing Director
Sihle Civil & Project Development Jv Mwelase Thobs Construction & Projects
134U Lobelia Street
Sagewood Ext 1
1687
Tel: 081 337 1422

Dear Mr Ndlovu

LETTER OF APPOINTMENT – CONSTRUCTION OF MOTODI SPORT COMPLEX

1. It is with pleasure to inform you that the Accounting Officer, has resolved to appoint you for the following tender as tabled below-

ENGINEER	BID APPOINTED FOR:	AMOUNT
Klpp Consulting Engineers	Construction of Motodi Sport Complex Bid no: FTM/T11//18/19	R32 649 159.1[illegible] 15% vat and 1[illegible] contingencies

Timeout Alert

2. The project shall be completed within 10 months calculated from the commencement date.
3. The project must be executed at the amount offered by the contractor and accepted by the municipality and no additional funding shall be allowed (variation) unless dictated by unavoidable and inevitable material conditions occurring during the project implementation stages.
4. The appointment is subject to the following terms and conditions-
   - Submission of a letter of acceptance within three (03) working days of the receipt of the letter from the municipality informing you of your appointment.
   - Conclusion and signing of a Contract Agreement with Fetakgomo Tubatse Municipality prior commencement of work.
   - Complete compliance to the terms and conditions as detailed in the tender document/ contract.
   - Furnishing the municipality with 10% performance surety as required in terms of the Government procurement: General conditions of contract of July 2010.
5. The municipality reserves the right to terminate and withdraw the appointment in case of non-performance and other matters related thereto should that need arise.
6. The contact person at the Municipality will be Mr SP Malgahlela at 013 231 1169/ pmakgahlela@tubatse.gov.za

Kind regards,

Busane NP
Municipal Manager

01/11/2018
Date

ii. Acceptance letter

Sihle Civil & Project Development

VAT NO. 4810282778
INCOME TAX REF NO. 9993440154
CITY OF TSHWANE VENDOR NO. 219059

NO. 50
Midlink Building, First Floor
Tenetol Street
1685
Tel/Fax No. 011 312 5888
Cell No. 079 227 0843/ 081 337 1422
Email:sihle@sihlecivil.co.za
www.sihlecivil.co.za

FETAKGOMO LOCAL MUNICIPALITY
1 Kastania street
P.O Box 206
Burgersford
1150

Our ref: TTL/001

Attention: N P Busano

02 November 2018

CONSTRUCTION OF MOTODI SPORT COMPLEX: ACCEPTACE LETTER

You appointment letter dated 01 November 2018 and attached to this letter has reference.

We hereby accept the appointment as a contractor for the above mentioned project as per conditions set out in the Letter of Appointment and the contract document.

The contact person and contact details for this contract is Mr Thabiso Chaane.

Name and Surname	Thabiso Chaane
Cellphone number	083 533 3750
Fax Number	086 628 2999
Email	thnbisoc@baapo.co.za

Timeout Alert

Furthermore we would like you to inform us of the date of the site handover meeting. H
find the above in order

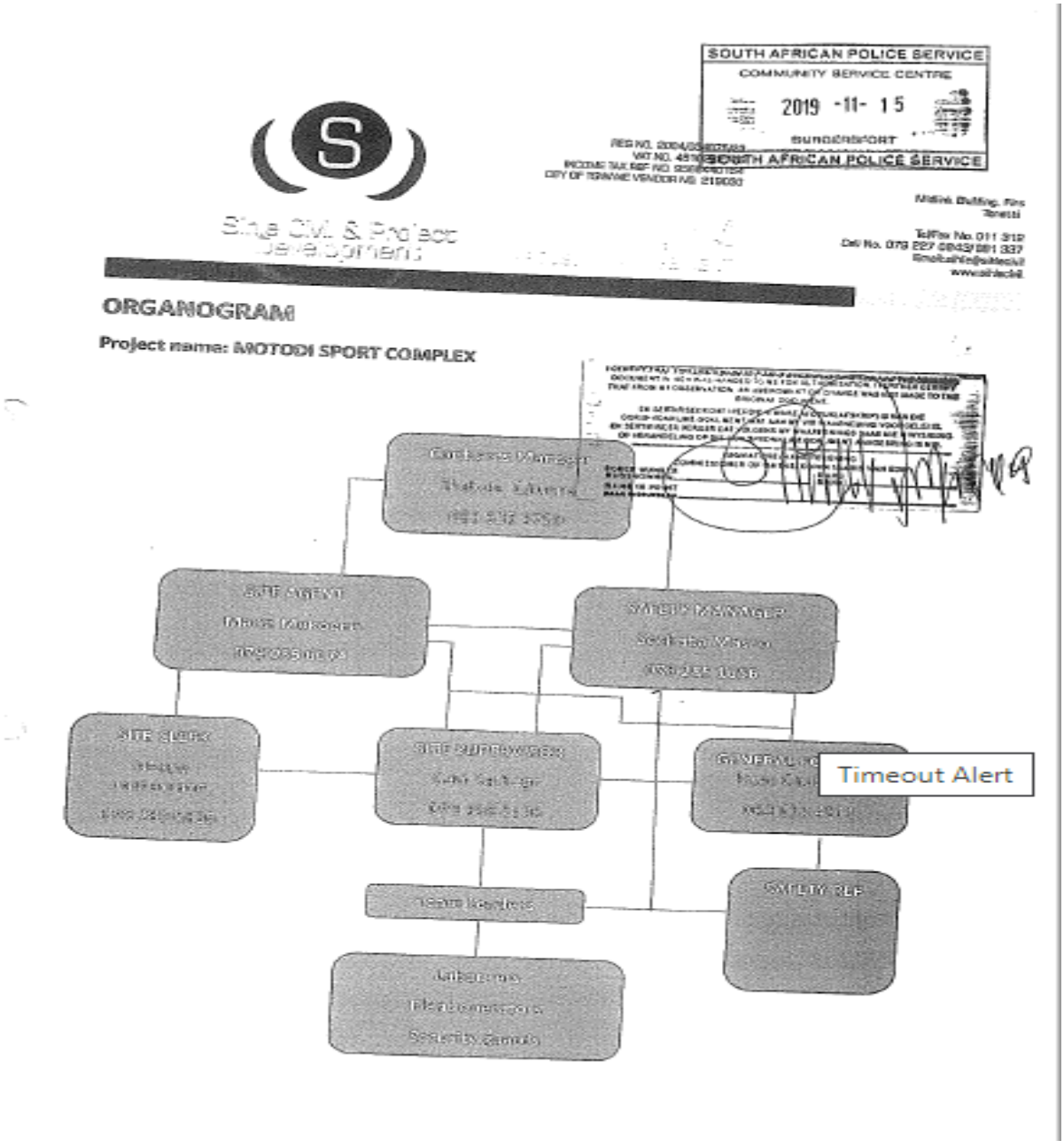
Regards.

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2019 -11- 15
BURGERSFORT
SOUTH AFRICAN POLICE SERVICE

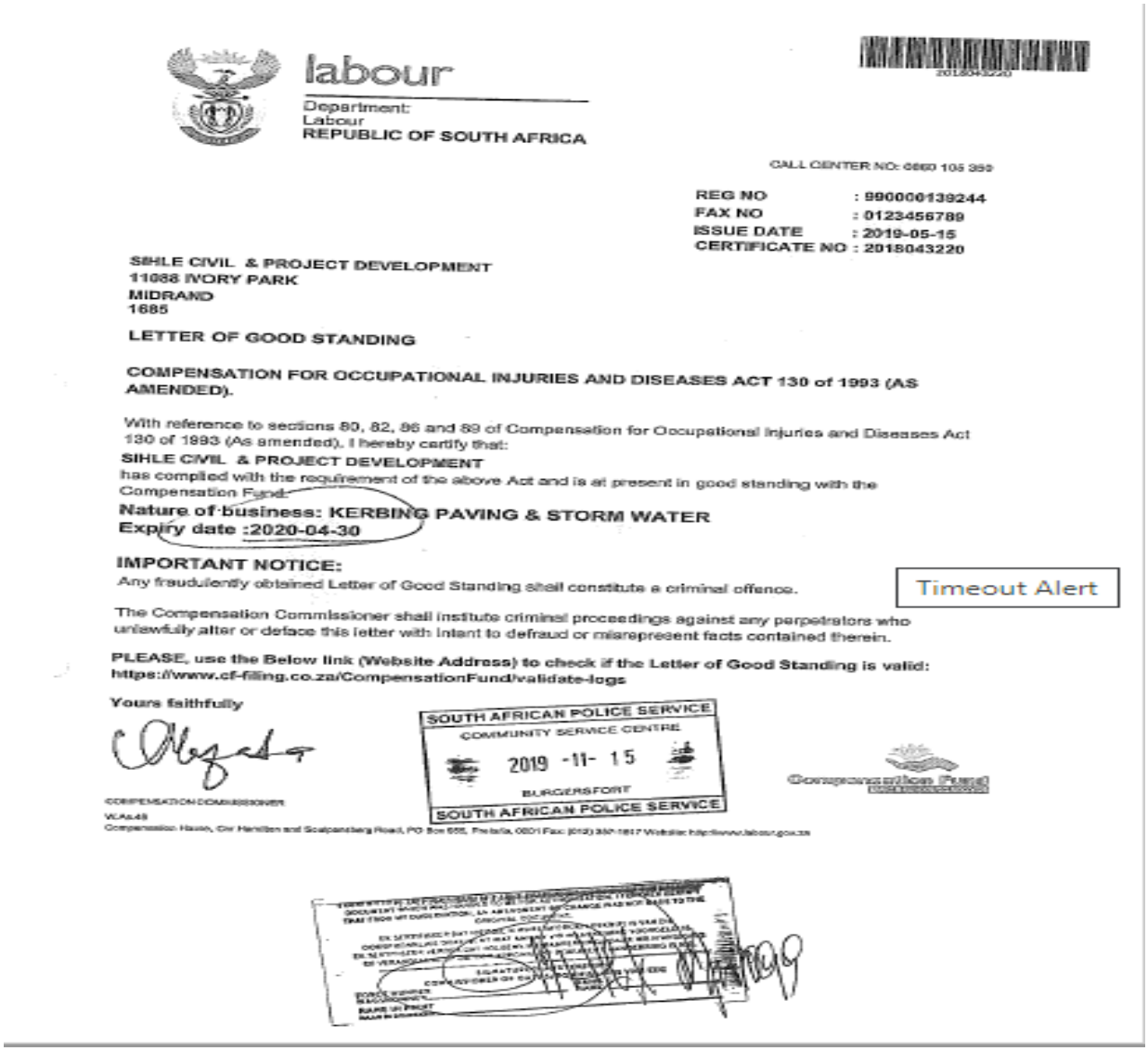
Thabiso Chaane, B.Eng **(Civil)** Contracts Manager,
Sihle Civil Development Project

By Email: pmakgahlole@tubatse.gov
mlolsoelo@tubatse.gov.za

iii. Organogram



iv. Letter of good standing



labour

Department:
Labour
REPUBLIC OF SOUTH AFRICA

2018043220

CALL CENTER NO: 0860 105 393

REG NO : 990000139244
FAX NO : 0123456789
ISSUE DATE : 2019-05-15
CERTIFICATE NO : 2018043220

SIHLE CIVIL & PROJECT DEVELOPMENT
11068 IVORY PARK
MIDRAND
1685

LETTER OF GOOD STANDING

COMPENSATION FOR OCCUPATIONAL INJURIES AND DISEASES ACT 130 of 1993 (AS AMENDED).

With reference to sections 80, 82, 86 and 89 of Compensation for Occupational Injuries and Diseases Act 130 of 1993 (As amended), I hereby certify that:
SIHLE CIVIL & PROJECT DEVELOPMENT
has complied with the requirement of the above Act and is at present in good standing with the Compensation Fund.
Nature of business: KERBING PAVING & STORM WATER
Expiry date :2020-04-30

IMPORTANT NOTICE:
Any fraudulently obtained Letter of Good Standing shall constitute a criminal offence.

Timeout Alert

The Compensation Commissioner shall institute criminal proceedings against any perpetrators who unlawfully alter or deface this letter with intent to defraud or misrepresent facts contained therein.

PLEASE, use the Below link (Website Address) to check if the Letter of Good Standing is valid:
https://www.cf-filling.co.za/CompensationFund/validate-logs

Yours faithfully

COMPENSATION COMMISSIONER

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2019 -11- 15
BURGERSFORT
SOUTH AFRICAN POLICE SERVICE

Compensation Fund

VCAct 49
Compensation House, Cnr Hamilton and Scalpensberg Road, PO Box 955, Pretoria, 0001 Fax: (012) 337-1817 Website: http://www.labour.gov.za

v. Application for construction permit

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2019 -11- 15
BURGERSFORT
SOUTH AFRICAN POLICE SERVICE

labour
Department:
Labour
REPUBLIC OF SOUTH AFRICA

R.850 of 2018

(G.G. 41839 of 17/08/2018)

DEPARTMENT OF LABOUR

NOTICE REGARDING APPLICATION FOR CONSTRUCTION WORK
PERMIT OF CONSTRUCTION WORK IN TERMS OF THE CONSTRUCTION REGULATIONS 2014

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993 CONSTRUCTION REGULATIONS, 2014

Under section 40(3)(b) of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), I, Tibor Szana, appointed as chief inspector in terms of section 27(1) of the said Act, and by virtue of the powers delegated to me by the Minister of Labour, in terms of section 42(1) of the said Act, hereby grant the following temporary exemption of Construction Regulations 3(1) in terms of section 40 of the said Act:

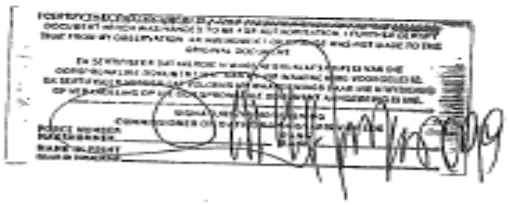
A client who intends to have construction work carried out, must at least 30 days before that work is to be carried out apply to the provincial director in writing for a construction work permit to perform construction work if the intended construction work starts from the 7th August 2018 and will

1. Exceed 365 days and will involve more than 3600 person days of construction work; or
2. The tender value limit is grade 7, 8 or 9 of the Construction Industry Development Board (CIDB) grading

Government Notice 641 of 24 July 2015 is hereby repealed.

Tibor Szana
Chief Inspector

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vi. Application for permit

ANNEXURE 1

ANNEXURE 1

APPLICATION FOR A PERMIT TO DO CONSTRUCTION WORK

[In terms of Regulation 3(2) of Construction Regulations, 2014]

This application must be submitted with the following documents:
1. Health and Safety specification.
2. Health and Safety plan.
3. Baseline risk assessment.

1. Name, postal address and telephone numbers of the client:
_____
_____

2. Details of the Agent.
   a. Title, Surname and Initials._____
   b. Identity number/ Passport Number _____
   c. Registration number with SACPCMP_____
   d. Office Tel. number and/or Mobile number _____
   e. Postal address. _____
   _____

3. Name, postal address and telephone numbers of the appointed principal c Timeout Alert
_____
_____

4. Name, postal address and telephone numbers of designer of the project:
_____
_____

5. Name, postal address and telephone numbers of the following persons:

   a. Construction Manager:
   _____

   b. Construction Health and Safety Manager:
   _____

c. Construction Health and Safety Officer:

_____

6. Exact physical address of the construction and site office:

_____

_____

7. Nature of construction work:

_____

_____

_____

8. Expected commencement date:

_____

9. Expected completion date:

_____

10. Estimated maximum number of persons on the construction site:

_____

11. Planned number of contractors on site accountable to principal contractor:

_____

12. Name(s) of contractors appointed:

_____

_____

_____

_____

_____

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13. _____
Signature of Client/Client's Agent

14. _____
Signature of the Principal Contractor

Annexure A
Notification of Construction Work

Regulation 3 of the Construction Regulations, 2003

NOTIFICATION OF CONSTRUCTION WORK

1)

a) Name and postal address of principal contractor: Mwelase Thabo Sihle Civil & Project Development Construction & Projects JV
NO. 50 Midlink Building, 1st Floor Tonetti Street 1685

b) Name and tel. no of principal contractor's contact person:
Sihle Civil & Project Development
081 337 1422 (Sihle)

2) Principal contractor's compensation registration number:
191 0000 139244

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3)

a) Name and postal address of client:
Feta Kgomo Tubatse municipality P.O. BOX

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b) Name and tel. no of client's contact person or agent:
Lesley Thobejane - 013 231 1000

4)

a) Name and postal address of designer(s) or the project:
KIPP Consulting Engineers
1344 Loberia street, Sagewood ext 1 1687

b) Name and tel. no of designer(s) contact person:
P. Metene - 082 572 1179

5) Name and telephone number of principal contractor's construction supervisor or site appointed in terms of regulation 6(1).

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JANE FURSE REGIONAL OFFICE
2019 -01- 30
JANE FURSE 1085
PRIVATE BAG / PRIVAATSAAK 435
KGORO YA BAŠOMI

Senzo Masinga – 076 950 9381

6) Name(s) of principal contractor's sub-ordinate supervisors on site appointed in terms of regulation 6(2).

Thomas Mamobolo

7) Exact physical address of the construction site or site office:

Matodi village, Moshate section

8. Nature of the construction work:

Civil & Building works

9) Expected commencement date:
21 November 2018

10) Expected completion date:
30 March 2019

11) Estimated maximum number of persons on the construction site.

60

12) Planned number of contractors on the construction site accountable to principal contractor:

N/A

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13) Name(s) of contractors already chosen.

N/A

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JANE FURSE 1085
PRIVATE BAG / PRIVAATSAK 433
KGORO YA BASOMI

30-01-2019

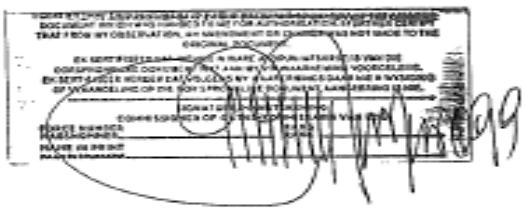
Principal Contractor Date

Client Date 30/01/2019

☐ THIS DOCUMENT IS TO BE FORWARDED TO THE OFFICE OF THE DEPARTMENT OF LABOUR PRIOR TO COMMENCEMENT OF WORK ON SITE.

☐ ALL PRINCIPAL CONTRACTORS THAT QUALIFY TO NOTIFY MUST DO SO EVEN IF ANOTHER PRINCIPAL CONTRACTOR ON THE SAME SITE HAD DONE SO PRIOR TO THE COMMENCEMENT OF WORK.

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ANNEXURE 2

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993
(Regulation 4 of the Construction Regulations, 2014)

NOTIFICATION OF CONSTRUCTION WORK

1.(a) Name and postal address of principal contractor:

_____

(b) Name and tel. no of principal contractor's contact person:

_____

2. Principal contractor's compensation registration number:

_____

3.(a) Name and postal address of client:

_____

(b) Name and tel. no of client's contact person or agent:

_____

4.(a) Name and postal address of designer(s) for the project:

_____

(b) Name and tel. no of designer(s) contact person:

_____

5. Name and telephone number of principal contractor's construction supervisor on site appointed in terms of regulation 8(1).

_____

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6. Name/s of principal contractor's sub-ordinate supervisors on site appointed in terms of regulation 8(2).

_____

7. Exact physical address of the construction site or site office:

_____

8. Nature of the construction work:

_____

_____

_____

9. Expected commencement date: _____

10. Expected completion date: _____

11. Estimated maximum number of persons on the construction site.

Total: _____ Male:_____Female:_____

12. Planned number of contractors on the construction site accountable to principal contractor: _____

13. Name(s) of contractors already selected.

_____

_____

_____

_____ _____

Principal Contractor Date

_____ _____

Client's Agent (where applicable) Date

_____ _____

Client Date

- THIS DOCUMENT IS TO BE FORWARDED TO THE OFFICE OF THE DEPARTMENT OF LABOUR **PRIOR TO COMMENCEMENT** OF WORK ON SITE.

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vii. Medical certificate

Annexure 3

OCCUPATIONAL HEALTH AND SAFETY ACT, 85 OF 1993 Construction Regulations, 2014

Medical Certificate of Fitness

Name of Employee _____ ID Number _____ Co. Number _____

	*Possible Exposures e.g. Noise, Heat, Fall Risk, confined spaces etc.	*Job Specific Requirements e.g. Operate Mobile Crane, Digging Trenches, Erecting Formwork & Support work etc.	*Protective Equipment e.g. Dust Respirator (Right Duty), Welding gloves etc.
*Occupation e.g. General Worker, Welder, Bricklayer, Steel Fixer, Mobile Crane Operator, etc.			

*The Employer to complete the information in the spaces marked with a * before sending the Employee for a medical Examination.

Declaration by Medical Examiner:

I certify that I have, by examining and testing, using above criteria specified by the employer, satisfied myself that the abovementioned employee is fit to perform the duties as described by the employer in the matrix above.

Occupational Medicine Practitioner/ tional Health Nursing Practitioner: (Please Print Name) _____

Signature: _____ Practice Number: _____ Date: _____

Address: _____

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GENERAL PRACTITIONER

DR.KATLEGO NTOAMPE

MP 0715379

PR. NO.0662216

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ress PLOT 09,CORNER PRAKTISEER AND PENGE

KTISEER

GERSFORT

)

417 8669

GENCY ONLY:0768654770



MEDICAL CERTIFICATE

e undersigned hereby certify that LAWRENCE NKUANA

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itity number 910203 5952 087 was examined by me

15/02/19 According to my knowledge he/she is clinically fit/unfit to perform normal/light duties

ure of illness/operation/injury if any

.....

.....

atures

Dr. KATLEGO NTOAMPE
MB ChB Limpopo
Pr. No. 0611223 MP No. 0715379
Cell: 076 605 4779
E-mail: drntoampe@gmail.com

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viii. Guide to a health and safety plan

Guide to a Health and Safety Plan

- By law, Principal Contractors and contractors (sub) must draw up a Health and Safety Plan. Don't have your construction project stopped by the Department of Labour. Make sure you have a Health and Safety Plan on site. This chapter outlines exactly what your Principal Contractor and contractor's duties are when it comes to the Health and Safety Plan.
- Once, the client, have drawn up the Health and Safety Specification, the Principal Contractor draws up a Health and Safety Plan based on your Specification document. This plan ensures that everyone deals with any health and safety matters in the correct way from start to finish on any construction project.
- The Principal Contractor must prepare it before starting any construction work. You must also keep it on site at all times (*Construction Regulation 7 (1) (a)*).

Here are some of the items a Principal Contractor could include in the plan:

(**NB:** *You should base your Health and Safety Plan on the client's Health and Safety Specification (Construction Regulation 7(1) (a)).*

1. Scope of work.
2. Health and Safety induction for the staff.
3. Site rules.
4. Personal Protective Equipment (*General Safety Regulation 2*) issue, maintenance and what PPE you may need;
5. Method statements of the tasks to be done;
6. Risk assessments procedures (*Construction Regulation 9*);
7. Health and Safety training for your staff (*Section 8 of the OHS Act*). F example, which toolbox talks you'll do and how often you'll do this training. This includes the formal health and safety training;
8. Safe work procedures (*Section 13 of the OHS Act*);
9. Steps to do accident/incident investigations (*Section 24 of the OHS Act*);
10. Public and environmental issues;
11. Fall protection procedure and plan(*Construction Regulations 10*)
12. Legal appointments
13. Monitoring, review and updates of health and safety plan

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Project Safety file guidelines:

The following data must be reflected on your safety file:

A) Your Company data:

1) Copy of registration of company.
2) Copy of COID registration. (Workman's comp.). - Valid Letter of Good standing.
3) Public liability insurance. (For the amount required by client).
4) Copy of Notification of construction work (To be obtained by principal contractor from DoL)

B) Project data:

1) Scope of work awarded.
2) Program/plan of work.
3) Appointment letter as Principle contractor.
4) OHS Act 37(2) agreement with principle contractor.
5) Baseline Risk assessment provided by client to principle contractor (with signatures).
6) Health and Safety specifications provided by client to principle contractor to comply with during project work.
7) Health and Safety plan based on Client's Health and Safety specifications provided by Principal Contractor

C) Project information:

1) Project organogram.
2) Contact details of relevant project supervision. (Fax, Cell phones and/or land line telephone numbers).
3) Construction Manager(s), Supervisor(s) appointment letters in terms of the awarded project work.
4) Other relevant appointments. (Scaffold erector & inspector, first aider, ladder inspector, Risk assessor etc.)
5) Competency verification. (CV's, Copies of training certificates/diplomas, experience in this type of work)
6) Hazard identification & risk assessments for specific project work awarded.
7) Fall protection plan. (Where applicable) for fall risks identified.
8) Emergency procedure and plan as well as proof of training with relevant workforce. (In line with that of the site)
9) SWP's (Safe Work Procedures) and associated training as per risk assessments conducted.

D) Project management:

1) Proof of site safety induction training by client.
2) Proof of contractor company's safety induction
3) Equipment inspection checklist / registers. (First aid box, fire extinguishers, PPE, scaffolding, portable electrical equipment, hand tools, ladders etc.)
4) Toolbox talks attendance registers (reflecting topic, employee signatures and date of toolbox talk).
5) DSTI's (Daily Safe Task Instructions) or Mini risk assessment before work start
6) MSDS's (Material Safety Data Sheets) for all hazardous chemicals to be used during your project w
7) Proof of training on risk assessments and safe work procedures with relevant workforce.
8) Employee annual medicals. Certificate of medical fitness to conduct project work. (In the Annexure 3 format)

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