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ASSESSMENT OF THE PERFORMANCE OF ROADS INFRASTRUCTURE IN THE
GAUTENG PROVINCE OF SOUTH AFRICA - STAKEHOLDERS’ PERSPECTIVE

A dissertation presented

by

SHONISANI WINNIE MUSHATU

to

THE FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

in fulfiment of the requirements for the degree of

MASTER OF TECHNOLOGY

in the subject of

CONSTRUCTION MANAGEMENT

UNIVERSITY OF JOHANNESBURG, SOUTH AFRICA

SUPERVISOR: MS. N. MASHWAMA

CO-SUPERVISOR: PROF. C.O. AIGBAVBOA

2019
ASSESSMENT OF THE PERFORMANCE OF ROADS INFRASTRUCTURE IN THE GAUTENG PROVINCE OF SOUTH AFRICA - STAKEHOLDERS’ PERSPECTIVE

by

Shonisani Winnie Mushatu

A dissertation submitted in partial fulfilment of the requirements for the award of a Magister Technologiae degree in Construction Management in the Department of Construction Management and Quantity Surveying, Faculty of Engineering and the Built Environment, University of Johannesburg, Republic of South Africa.

JOHANNESBURG, 2019
DECLARATION

I, Shonisani Winnie Mushatu, declare that “Assessment of the performance of road infrastructure projects in the Gauteng Province, South Africa – Stakeholders’ perspective” is the result of my own investigation and research, except to the extent indicated in the references and by comments included in the body of the report, and that it has never been presented anywhere else for a similar purpose. It is submitted to the University of Johannesburg (Department of Construction Management) as a requirement to obtain a Master’s degree in Construction Management in the Department of Construction Management and Quantity Surveying, Faculty of Engineering and Built Environment, University of Johannesburg, Republic of South Africa.

__________________________________________
Shonisani Winnie Mushatu

__________________________________________
Date

University of Johannesburg
Doornfontein campus
ACKNOWLEDGEMENTS

I would like to give glory to God and thank Him for His lifetime favour and mercy to have brought me this far. Without Him, I wouldn’t have been able to achieve anything. “Ndi tshilidzi na tshilidzi – It is Glory and glory”.

I would also like to thank my supervisor, Ms. Nokulunga Mashwama, and my co supervisor, Prof. C.O. Aigbavboa, for their support and guidance throughout this journey.

I also thank the Gauteng Department of Roads and Transport (GDRT) for supporting me financially and for giving me all time and information I needed to study.

I would like to thank my father, Mr. Thinavhuyo Samson Masindi, and my late mother, Mrs. Nthambeleni Francinah Masindi, who are always in my heart. They stood by their responsibilities to raise me and gave me the education of my choice with the little that they had. Their guiding words shaped me to be who I am today.

Finally, I would like to thank the questionnaire respondents. I am very fortunate to have had respondents who are in the construction industry, who are professionals in this field, who support research efforts and who were willing to provide quality and honest information which they did.

Finally, I thank the Department of Construction Management and Quantity Surveying, University of Johannesburg, South Africa for giving me another chance to accomplish my studies after such a long break.

Mushatu S.W.

September 2019
DEDICATION
I dedicate this study to my late son, my only son, Rotondwa, who passed on in 2016 due to a taxi ‘hit and run’ accident while I was attending one of my BTech class modules; and to my late mother, Mrs. Francinah Masindi, who passed on, (10/10/2010) which is the same month of submitting the research study; and to the rest of my family whose love, support and prayers made things possible.

My special dedication is to all HIV and Aids victims. May they keep reaching for the next level and walk tall with their heads held high. With God, everything is possible. May they stay blessed.
ABSTRACT

This thesis is based on the assessment of project performance in roads infrastructure projects in the Gauteng, South Africa. Many research studies identified performance as poor performance; however, there is good performance to be found as well. Furthermore, the study focused on the completed road projects performance, the recent and the future road projects. The data used were derived from primary and secondary resources. Structured questionnaire were distributed to construction professionals such as Project Managers, QS, Resident Engineers among others from various construction companies within Gauteng Province. Out of 100 distributed questionnaires, 76 were returned as completed by respondents and the 24 distributed questionnaires were not returned back to the researcher. Overall, 76% of the questionnaires were valid and usable. The secondary source data was derived from a review of the literature. Research findings were revealed as per related categories which are stated in chapter 8. Among other categories are client, contractor, consultant, design and human related categories. The findings revealed that on those related categories, factors such as payment delays, late reviewing of design tender document, financial difficulties, cash flow, community unrest, poor communication, worker absenteeism, cost overrun and time overrun were having the high impact in the performance of road infrastructure projects.

Mitigations to the revealed findings highlighted. Skills transfer; education and training, and effective communication were among other mitigation stated. The study continued to indicate the measures used to assess the performance of road infrastructure projects, the quality factor, the cost factor and time factor were one of the top measures used to assess the performance.

The treatise recommends that project stakeholders should work as a team to run the project in professional manner. It is recommended that poor performance should always and effective communication is the success of any project.

Originality

The study contributes to the body of knowledge on the assessment of the performance of road projects in Gauteng Province, South Africa.

Key words: Performance, Assessment, CIDB, Construction industry, Roads, Infrastructure, Projects
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<th>Full Form</th>
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<tr>
<td>ANC</td>
<td>African National Congress</td>
</tr>
<tr>
<td>ASCE</td>
<td>American Society of Civil Engineering</td>
</tr>
<tr>
<td>AIDS</td>
<td>Acquired immune deficiency syndrome</td>
</tr>
<tr>
<td>BAI</td>
<td>Builders Association of India</td>
</tr>
<tr>
<td>BEE</td>
<td>Black Economic Empowerment</td>
</tr>
<tr>
<td>BIS</td>
<td>Bureau of Indian Standards</td>
</tr>
<tr>
<td>BNQP</td>
<td>Baldrige National Quality Programme</td>
</tr>
<tr>
<td>BOQ</td>
<td>Bill of quantities</td>
</tr>
<tr>
<td>BOT</td>
<td>Build-Operate-Transfer</td>
</tr>
<tr>
<td>BOO</td>
<td>Build-Operate-Own</td>
</tr>
<tr>
<td>BOOT</td>
<td>Build-Own-Operate and Transfer</td>
</tr>
<tr>
<td>B-BBBEE</td>
<td>Black-Based Black Economic Empowerment</td>
</tr>
<tr>
<td>CII</td>
<td>Construction Industry Indicators</td>
</tr>
<tr>
<td>CIC</td>
<td>Construction Industry Council</td>
</tr>
<tr>
<td>COJ</td>
<td>City of Johannesburg</td>
</tr>
<tr>
<td>CIDA</td>
<td>Construction Industry Development Authority</td>
</tr>
<tr>
<td>CIDB</td>
<td>Construction Industry Development Board</td>
</tr>
<tr>
<td>CIDC</td>
<td>Construction Industry Development Council</td>
</tr>
<tr>
<td>CSIR</td>
<td>Council of Scientific and Industrial Research</td>
</tr>
<tr>
<td>CSFs</td>
<td>Critical success factors</td>
</tr>
<tr>
<td>CIPAA</td>
<td>Construction Industry Payment and Adjudication Act</td>
</tr>
</tbody>
</table>
Ci3 : Construction Industry Improvement Initiative India

CPWO : Central Public Works Department

DAR : Delhi Analysis of Rates

DTI : Department of Trade and Industry

DC : District Councils

DDF : District Development Fund

DFROT : Design-finance-refurbish-operate-transfer

DFBOT : Design-finance-build-operate-transfer

ECSA : Engineering Council of South Africa

ERF : European Union Road Federation

FDI : Foreign direct investment

FIDIC : Federat Internationale Des Ingenieurs Conseils

GCC : General conditions of contract for construction work

GDARD : Gauteng Department of Agricultural and Rural Development

GDP : Gross domestic product

GIE : Ghana Institute of Engineers

GIA : Ghana Institute of Architects
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>GIOC</td>
<td>Ghana Institute of Construction</td>
</tr>
<tr>
<td>GDRT</td>
<td>Gauteng Department of Roads and Transport</td>
</tr>
<tr>
<td>GP</td>
<td>Gauteng Province</td>
</tr>
<tr>
<td>HIV</td>
<td>Human immunodeficiency virus</td>
</tr>
<tr>
<td>I-PRSAP</td>
<td>The Interim Poverty Reduction Strategy Paper</td>
</tr>
<tr>
<td>ICE</td>
<td>Institution of Civil Engineers</td>
</tr>
<tr>
<td>IIT</td>
<td>Indian Institute of Technology</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standards Organization</td>
</tr>
<tr>
<td>JBCC</td>
<td>Joint Building Contracts Committee</td>
</tr>
<tr>
<td>JRA</td>
<td>Johannesburg Roads Agency</td>
</tr>
<tr>
<td>JV</td>
<td>Joint venture</td>
</tr>
<tr>
<td>KPIs</td>
<td>Key performance indicators</td>
</tr>
<tr>
<td>M &amp; R</td>
<td>Murray &amp; Roberts</td>
</tr>
<tr>
<td>MBAM</td>
<td>Master Builders Association Malaysia</td>
</tr>
<tr>
<td>MIS</td>
<td>Mean item score</td>
</tr>
<tr>
<td>MCIMP</td>
<td>Malaysian Construction Industry Master Plan</td>
</tr>
<tr>
<td>MCI</td>
<td>Malaysia construction industry</td>
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</table>
MOSPI : Ministry of Statistic and Programme Implementation
MOWWA : Ministry of Water Resources, Works and Housing
MMDA : Metropolitan Municipalities District Assemblies
MOT : Ministry of Transportation
MOF : Ministry of Finance
NBCC : National Building Construction Corporation of India
NHDP : National Highways Development Project
NEC : New Engineering Contract
NMT : Non-motorised transport
PERT : Programme evaluation and review techniques
PRASA : Passenger Rail Agency of South Africa
PMBOK : Project Management Body of Knowledge
PMI : Project Management Institute
PMS : Performance measurement system
PPPFA : Preferential Procurement Policy Framework Act
PFMA : Public Finance Management Act
PWD : Public Works Department
<table>
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<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>PPP</td>
<td>Public-private partnership</td>
</tr>
<tr>
<td>PPI</td>
<td>Private participation infrastructure</td>
</tr>
<tr>
<td>RAMS</td>
<td>Roads Assets Management System</td>
</tr>
<tr>
<td>PWC</td>
<td>PricewaterhouseCoopers</td>
</tr>
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<td>RCAM</td>
<td>South African Road Classification and Access Management</td>
</tr>
<tr>
<td>RISFSA</td>
<td>The Road Infrastructure Strategic Framework for South Africa</td>
</tr>
<tr>
<td>ROTI</td>
<td>Road transport investment</td>
</tr>
<tr>
<td>RSA</td>
<td>Republic of South Africa</td>
</tr>
<tr>
<td>RTI</td>
<td>Road transport injuries</td>
</tr>
<tr>
<td>SA</td>
<td>South Africa</td>
</tr>
<tr>
<td>SAA</td>
<td>South African Airways</td>
</tr>
<tr>
<td>SADC</td>
<td>South African Development Community</td>
</tr>
<tr>
<td>SAICE</td>
<td>South Africa Institute of Civil Engineering</td>
</tr>
<tr>
<td>SANRAL</td>
<td>South Africa National Roads Agency Limited</td>
</tr>
<tr>
<td>SATCC</td>
<td>Southern Africa Transport and Communications Commission</td>
</tr>
<tr>
<td>SARS</td>
<td>South Africa Revenue Services</td>
</tr>
<tr>
<td>SAQSP</td>
<td>South African Council for Quantity Surveying Profession</td>
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<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>SACPCMP</td>
<td>South African Council for Project and Construction Management Professions</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for the Social Science</td>
</tr>
<tr>
<td>SCM</td>
<td>Supply chain management</td>
</tr>
<tr>
<td>SCC</td>
<td>State Construction Corporation</td>
</tr>
<tr>
<td>SETA</td>
<td>Sectors of Education and Training Authorities</td>
</tr>
<tr>
<td>SD</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>SMME</td>
<td>Small, medium and micro-enterprises</td>
</tr>
<tr>
<td>SME’s</td>
<td>Small and medium enterprises</td>
</tr>
<tr>
<td>QSE</td>
<td>Qualifying small enterprises</td>
</tr>
<tr>
<td>TRH</td>
<td>Technical Recommendations for Highways</td>
</tr>
<tr>
<td>VCI</td>
<td>Visual Condition Index</td>
</tr>
<tr>
<td>VOC</td>
<td>Vehicle operating cost</td>
</tr>
<tr>
<td>ZANU-PF</td>
<td>Zimbabwe National Road Administration</td>
</tr>
<tr>
<td>ZANU-PF</td>
<td>Zimbabwe African National Union - Patriotic Front</td>
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LIST OF ARTICLES PUBLISHED

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- The effects of performance on roads infrastructure projects in Gauteng Province of South Africa - in Review
- The impact of external stakeholders in the roads infrastructure projects - in Review
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CHAPTER ONE

1.1 INTRODUCTION
This chapter initiates the research and outlines the purpose of study, the research problem, the research questions, the research objectives, the significance of the research study, the value of research study, the research methodology and the outline of the chapters to be provided. The intention of this research study is to assess the performance of road projects in the Gauteng Province, South Africa.

1.2 BACKGROUND OF THE RESEARCH
Construction projects have been reported as complex in nature as all projects are never the same even if they are similar (Aljohani, Ahiaga & Moore, 2017). The construction industry provides vital components such as business, high rate of recruitment of people and developing entrepreneurs for economy development (Mahamid et al., 2012).

Roads make our life easier in many ways as they link provinces and connect us to neighbouring countries of South Africa. Road infrastructure boost the economy of the country in transportation of goods, mineral resources in mining, agricultural goods, and improving the access to various facilities such as schools, hospitals, shopping centres, work places and recreation centres. If roads are in a good condition, they also reduce travel times, save on fuel for vehicles, and reduce production costs for the ever-growing number of goods shipments. In general, roads boost the country’s economy and simplify people’s lives; therefore it is vital to take roads’ challenges into consideration for modernizing quality roads in South Africa (Levinson, 2004).

Despite roads making our lives easier, there are many challenges that are encountered during road construction projects. The challenges on road construction are experienced in infrastructure which includes existing roads and the new infrastructure that is mushrooming and which needs to take traffic into consideration (Technical Recommendations for Highways [TRH 26], 2012). Road and rail transport are the most powerful methods of conveying goods and people inside the South African Development Community (SADC). They handle the bulk of imports and exports in the respective countries, thus providing a vital transport link for the countries’ diverse import and export commodities (Mutambara, 2008).

Road construction challenges re-examined as one of the most repeatedly occurring problems in the construction industry in South Africa. Most of the road construction challenges are continuous and
recently new added challenges have surfaced in the industry due to new technology and other influences. There is a need to resolve these challenges within the industry (TRH 26, 2012).

The study highlighted the need to resolve some of the challenges in different stages such as the planning, design, construction and maintenance of the road constructions. Various road jurisdictions in South Africa have the responsibility to plan, design, construct and maintain the road network for the public to ensure that the transportation system functions well and to actively encourage traffic safety on the road network (TRH 26, 2012).

The study concentrated on the Gauteng provincial government roads network where most of the road construction projects are taking place. The study examined the South Africa construction industry and compared it with other countries such as Malaysia, India, Zimbabwe and Ghana. This study will hopefully elicit how different governments operate in terms of awarding tenders, procurement, selection criteria of contractors and consultants, alternative choices in terms of construction for roads priority, proclamation of properties along the planned roads and other related issues.

1.3 PROBLEM STATEMENT
Performance measures are not effective or efficient to overcome the poor performance by the service providers such as contractors and consultants in the roads infrastructure projects. Performance can be good or bad; however, most of the researchers focus on the poor performance by the contractor caused by various circumstances such as poor administration of funds, amenities management, and political interferences amongst other factors. The South African construction industry faces many roads infrastructure challenges which hinder the completion of construction projects. Some of these challenges are new technologies in the industry, time constraints, procurement systems, and infrastructure that is mushrooming therefore, this study identified the research gap by outlining the causes of different performance in the road projects, stakeholders that implicate the success of the roads projects, the mitigation to the causes and the recommended mitigation. The study also explored the factors that influence the poor performance of the road infrastructure projects, the effects and stakeholders’ impacts on roads infrastructure projects. The aim of the research was to assess the performance of roads infrastructure projects in Gauteng Province, South Africa.

1.4 RESEARCH QUESTIONS
Thus, the research questions which will collectively seek to assess the performance for roads infrastructure in the Gauteng Province of South Africa are as follows:
1. What are the factors influencing the poor performance of road infrastructure in the Gauteng Province of South Africa?
2. What are effects of poor performance of road infrastructure on the stakeholders of the delivery of projects in the Gauteng Province of South Africa?
3. What are the impacts of stakeholders on the road infrastructure projects in the Gauteng Province of South Africa?
4. How can the poor performance of the roads infrastructures in the Gauteng Province of South Africa be mitigated?
5. What are measures used to assess the performance of road infrastructure in the Gauteng Province of South Africa?

1.5 RESEARCH OBJECTIVES
According to the research questions above, the research objectives will collectively seek:

1. To determine the factors influencing the poor performance of road infrastructure in the Gauteng Province of South Africa;
2. To investigate the effects of poor performance of road infrastructure on the stakeholders of the delivery of projects in the Gauteng Province of South Africa;
3. To determine the impacts of stakeholders on the road infrastructure projects in the Gauteng Province of South Africa;
4. To suggest ways to mitigate the poor performance of the road infrastructure in the Gauteng Province of South Africa; and
5. To identify measures used to assess the performance of road infrastructure in the Gauteng Province of South Africa.

1.6 PURPOSE OF THE STUDY
Many construction projects often suffer from poor performance influenced by the different stakeholders such as contractors, clients and consultants. Performance can be good or bad; therefore, the performance measurement systems need to be improved so that they can be effective and efficient to overcome the poor performance by the stakeholders mentioned above. Therefore, the purpose of the study was to assess the performance of road infrastructure projects regarding the factors that influence the performance, the effects of performance, stakeholders’ impacts on the road infrastructure projects in the Gauteng Province of South Africa, ways to mitigate the performance problems and the performance measures that may be used to assess the performance.
1.7 SIGNIFICANCE OF STUDY
The current research provided knowledge on factors that influence the poor performance of road infrastructure in the Gauteng Province of South Africa. The research investigated the effects of stakeholders on road infrastructure; It also suggested the methods to mitigate the factors influencing the poor performance of road infrastructure and examined performance measures used to improve the performance of road infrastructure in the Gauteng Province of South Africa.

1.8 RESEARCH METHODOLOGY
The study has been conducted using primary and secondary sources. The secondary sources include a literature review of journal articles and case studies and the primary source includes a structured questionnaire. The study started with the literature review followed by identification of the survey participants. The research methodology indicated how the approach fits the overall research design. These included the method of data collection and how the results were to be analyzed and interpreted. It included the rationale and addressed the limitations.

1.8.1 Research approach and design
The research questions and objectives dictated a quantitative method or approach. The quantitative approach in the data collection processes is where questions are answered from defined research questions. A descriptive survey was chosen for the research because it assigns a correct account of features such as behaviour, opinions, abilities, beliefs and knowledge of an individual, situation or group. This system was selected to achieve the objectives of this study, specifically to determine the factors influencing the poor performance of road infrastructure, investigate factors influencing poor performance of road infrastructures, and the effects of road infrastructure on the economy and stakeholders. In addition, it aimed to suggest ways to mitigate those factors that influence poor performance of road infrastructure and to identify the performance measures used to assess the performance of road infrastructure in the Gauteng Province of South Africa. To this end, a structured questionnaire was prepared and distributed to the applicable respondents to meet the research objectives.

1.8.2 Quantitative research
According to Creswell (2009), survey research provides a quantitative or numeric description of trends, attitudes or opinions of a population by studying a sample of that population. Quantitative research includes questionnaires and structured interviews. A questionnaire is more suitable than structured interviews as the structured interviews are costlier and more time consuming.
1.8.3 Area of research and targeted respondents

The study was conducted in Gauteng Province of South Africa. Targeted respondents or the study participants (population) comprised a construction team, namely engineers, contractors’ team, consultants’ team, registered professionals and candidates from ECSA and SACPCMP database. Most of the professionals working within this built environment are very knowledgeable about the construction industry, particularly those who are constructing Gauteng roads under the Gauteng Province Department of Roads and Transport (GDRT). Most of the engineers, consultants and contractors have been supervising roads works and have been involved in the actual road construction for more than decade.

1.8.4 Sample and data collection

Questionnaires were used as the data collection tool. Questionnaires were designed and distributed to the above-mentioned respondents by the researcher. Data analysis and identification of challenges facing roads construction were from primary and secondary sources. The research was conducted regarding existing literature, from online journals, conferences proceedings, and articles such as ASCE, ICE virtual, and Emerald. The random sampling method was preferred and adopted in this study using multiple probability techniques. Random sampling was adopted because it gave all the participants an equal chance to be selected and all the participants were selected according to the same criteria, which was that the participants had to be a construction professional practising in South Africa (Burns & Grove, 1993).

1.8.5 Data analysis

The quantitative data collected was analysed using the mean item score (MIS) and the Statistical Package for the Social Sciences (SPSS), which is a computer programme. Furthermore, factor analysis was used to determine the sample size, the strength of the suitability or validity of data for analysis.

1.9 DELIMITATIONS

The study was conducted in South Africa, Johannesburg in roads construction industry. The reason is that the construction industry is very broad: different construction structures are identified.
However, the research study adhered to road construction only. The study focused on the construction teams that are contractors registered on the CIDB database, consulting engineers, who are professionals registered and specializing in the construction of roads. The study also included the employer or client.

1.10 RESEARCH LIMITATIONS
The study focused on the main contractors, consultants and clients within Gauteng Province, in the Johannesburg area. This is the area in which the Gauteng Department of Roads and Transport together with City of Johannesburg constructs, rehabilitates, resurfaces and maintains provincial roads on a daily basis. The study focused on the factors influencing the performance of road infrastructure projects, the effects of performance on the road infrastructure projects, the impact of stakeholders on the road infrastructure projects, the ways to resolve performance problems on road infrastructure projects and the performance measures that may be used to assess the performance regarding road infrastructure projects in the effective delivery of road construction in Gauteng Province, South Africa.

1.11 ENVISAGED FINDINGS
Road infrastructure projects experience various factors that influence performance which are ongoing. There are additional factors occurring in the construction industry from time to time due to new technology and other influences. Therefore there is a need to resolve the performance problems within construction industry. The aim of study was to identify those factors that influence the performance, and to identify the effects of performance. Also, it aims to highlight the impact of stakeholders on the road infrastructure projects, to suggest ways to mitigate those performance problems and to suggest performance measures to assess the performance in the Gauteng Province of South Africa.

1.12 ETHICAL CONSIDERATION
The focus of study was within disciplines of the study standards and conduct to analyze values that are mandatory to merge work such as trust, accountability, mutual respect and fairness. Based on this research study, the challenges facing roads construction are increasing on a daily basis in addition to the existing projects and the mushrooming developments which hinder the production of the road construction industry in South Africa. The main aim of the study was to identify the factors that influence the performance in the road infrastructure projects in the Gauteng Province, South Africa while finding ways to mitigate the performance problems using the relevant
performance measures to assess the performance for the effective delivery of road construction in Gauteng Province, South Africa.

1.13 OVERVIEW OF CHAPTERS

CHAPTER 1
Introduction
Chapter one outlines the research problem, states the background of the study, the research questions, research objectives, the value and significance of the study, the delimitation, limitations, research methodology, envisaged findings and ethical considerations. The problem statement identified the need for the study of which specific problems will be addressed. The chapter also outlined the research questions that need to be assessed.

CHAPTER 2
Literature review - The performance of road infrastructure
The chapter reviews the literature from existing journal articles, scholarly books and proceedings of conferences from various countries. The chapter highlights factors that influence the poor performance for different countries, the overall performance measures system used in those countries and the most common effects of road infrastructure that affect the economy and stakeholders in particular.

CHAPTER 3
International perceptions - Literature review
The chapter main aim is to highlight the Malaysian and Indian historical backgrounds in their construction industries. In addition, it examines the possibility of similarities from different countries with the same chosen topic of study in South Africa with reference to past studies on the performance of road infrastructure in Malaysia and India.

CHAPTER 4
African countries - Literature review
This chapter highlights the historical background of Zimbabwe and Ghana together with the past studies in this research topic by other researchers. The reviews highlights some of the performance of road infrastructure, standard sustainable practices, measuring tools, factors influencing poor performance in road infrastructure and stakeholders impacts in Zimbabwe and Ghana as the way of determining the direction in which the research is heading and what is happening in Zimbabwe and Ghana which also applies to South Africa.

CHAPTER 5
South African literature review
The chapter reviews existing literature and journal articles, books and proceedings of South African construction industry conferences with the aim of identifying the problem statement and objectives of the study. The literature review surveys scholarly articles, books and other sources such as the Internet, and dissertations appropriate to the researcher’s choice of study to provide information from international (Malaysia and India) and African countries such as Zimbabwe and Ghana.

CHAPTER 6

Research methodology
The chapter gives an idea of the geographical area where the research will be conducted, the research approach and also the targeted respondents. The chapter also outlines the method used to resolve the problem statement and the method used when communicating with participants.

CHAPTER 7

Findings, Analysis, Recommendations and Conclusions
Data analysis and identification was done using a quantitative method by means of questionnaires as the study’s data collection tool. The research finalizes conclusions and recommendations from the researcher’s findings.

CHAPTER 8

Discussions of findings
This chapter discusses the research findings that were previously analyzed and compares them to the literature review. This determines whether the research objectives were met and whether the research questions were answered. Findings reveal the performance on road infrastructure projects in Gauteng Province, South Africa.

CHAPTER 9

Conclusion and Recommendations
The chapter outlines the solutions that were identified by the researcher to the research questions provided and ensures that the research objectives met. The chapter further provides recommendations on the findings of the research. The chapter reveals the various sub-headings of the study.

1.14 CONCLUSION
The chapter outlines different sub-headings of the study. From the problem statement to the investigating of the factors influencing poor performance of road infrastructure in Gauteng, South Africa. The study covers the summary of research questions that are included in the study, the research objectives, research approach and design.
CHAPTER TWO
LITERATURE REVIEW: PERFORMANCE OF ROAD INFRASTRUCTURE

2.1 INTRODUCTION
Chapter two examines the key literature on current performance in the construction industry. The performance in construction, bad or good, is the main factor that contributes to challenges and delays encountered in the construction industry, cost increases in project, extension of time on project and other factors. Furthermore, performance is the main factor that controls the success or failure of a project by its components that influence poor performance, effects of roads infrastructure on a country’s economy and stakeholders, and performance measure methods used to assess performance. This chapter reviews the performance of the road infrastructure projects regarding the participants of delivery of the project.

2.2 GENERAL CONSTRUCTION INDUSTRY
Construction is the Latin word (from ‘com’, meaning ‘together’ and strewer ‘to pile up’) means the art and science of forming material, systems and organizations to build some structures (Shukla et al., 2016). Construction in general is an operation in which material, equipment and plant are used in infrastructure such as roads, railways, harbours and other civil engineering work including dams, irrigation projects, and power plant (Wells, 1984). The construction industry is very important for the development for any nation. Many countries’ economic growth is strengthened by the development of their infrastructure such as buildings, roads and bridges. The degree of positive results in achieving construction projects development activities is determined by the quality of the administrative, financial, technical and company’s performance of the particular participants taking into account risk management, environment matters, economic and political firmness (Takim & Akintoyee, 2002).

The construction industry is important as it contributes to national socio-economic development and it is nations’ economic backbone that attracts foreign investment. The construction industry also contributes to the gross domestic product (GDP) of the country. Furthermore, the industry contributes to labour by creating employment (Ofori, 2012). The valuation of a successful construction project is achieved when project is carried out on time, within the budget, according to technical specification and meeting client satisfaction. The performance of project stakeholders also included, their contributions and understanding their expectations (Takim & Akintoyee, 2002).

The construction industry experiences challenges or factors influencing poor performance such as personnel on site, safety, time constraints, changing of scope of the work, quality of work, environmental issues, legal issues and many more. In many instances, the government is the client
of public sector construction projects and the community are the beneficiaries of those specific projects. Client, consultant and the contractor are the most important stakeholders of a construction projects (Ngacho, 2013).

Road infrastructures are a useful catalyst for development of the business and residential areas. It eases the strength of people and their goals, provides the link to the external world and specifically access to markets and public services such as ambulances and police services. Road construction creates jobs where labour intensive methods are used which assists poverty alleviation and unemployment (Local Government Budget and Review SA, 2011).

2.3 CONSTRUCTION INDUSTRY PERFORMANCE

In general, the performance of road construction projects can be good or poor. Poor performance in construction projects is a world-wide phenomenon in construction projects, including roads construction. Construction factors influencing the performance depend on the different projects, different duration of the projects, and different countries; however, there is no specific factor that causes poor performance. Delay is the usual factor that influences poor performance. It causes expensive, complicated and dangerous problems in construction projects in unusual ways (Aziz & Abdel-Hakam, 2016).

Traditionally, the construction industry concentrates on project performance where performance and contractors are assessed based on clients’ objectives such as time, cost and the quality of the projects. The normal assessment of construction projects’ success are delivery on time, within allocated budget, to technical specifications, meeting client satisfaction, stakeholders’ participation and their expectations (Gyandu-Asiedu et al., 2013). The construction projects vary in size, project duration, complexity, different challenges and client requirements. The quality of public construction seriously affects the everyday life of the public (Chang, 2016). The construction industry has observed the failure of many contractors due to various reasons such as financial problems, poor performance or accidents arising from the lack of adequate safety inspections of worksite (Singh et al., 2006). The assessment of the performance in a construction project should cover every stage of the whole lifecycle of the project which includes planning, design, supervision, project management, construction operation and maintenance (Chang, 2015).

The performance in construction industry has been a subject of concern in many countries. Underperforming is a problem that is affecting many construction projects. In South Africa, construction industry indicators (CIIs) have been identified by the Department of Public Works and the CIDB with the help of the Council for Scientific and Industrial Research (CSIR) to play a role
in developing a sustainable industry and to be adopted as a tool to improve performance in South Africa. Cost, time and quality are three basic and most important performance indicators in construction projects followed by safety, functionality and satisfaction. The CIDBCIIIs are measures of the performance of the industry focusing on the client, client’s agent/consultant and contractor’s perceptions (CIDB, 2014).

2.3.1 PERFORMANCE DEFINED

The Construction Industry Institute (CII) defines performance as a systematic procedure of measuring one’s performance amongst outcomes from established leaders for the reason of determining best practices that lead to high ranking performance when modified and executed (Hudson, 1997). Performance measurement in the construction industry use a methodical way of examining project performance by assessing the inputs, outputs and the final project outcomes (Agbenyega, 2014). Performance is the result of a process or an activity and performance assessed and analysed with two major performance measures, namely effectiveness “doing the right thing” and efficiency “doing the things right” (Turban & Aronson, 2001).

2.3.2 INFRASTRUCTURE DEFINED

Infrastructure is regarded as vital for social and economic development. Quality infrastructure helps to elevate productivity and lower general costs. Therefore road projects are important infrastructures in a country amongst other infrastructure (Garurel, 2014). Road infrastructure supports both families and geographical fundamentals; it is a constructive catalyst for spatial development and the development of business and residential areas. Infrastructure is also defined as a set of facilities through which goods and services are provided for the public. It is the commodities of primary facilities and capital equipment needed for the functioning of a country or area. The term ‘infrastructure’ refers collectively to the roads, bridges, railway lines and similar public works that are required for an industrial economy or a section of it (Wanjiku, 2014). Infrastructure is referred to as a basic public infrastructure by other researchers, which forms the starting point for society and the economy. It plays a vital role in the industrial and general economy.

There is economic infrastructure that encourages economic activities such as roads, highways, rail roads, airports, and telecommunications and there are social infrastructures that encourage the health, education and cultural standards of the population; activities that have both direct and indirect impact on the welfare of the people such as good schools, hospitals, courts, libraries, playgrounds and many more (Snieska & Simkunaite, 2009). Infrastructure to all countries means
roads, bridges, tunnels, rails, airport, telephone lines, cell phone towers, dams and reservoirs, canals, fire stations, hospitals, clinics, schools, post offices, schools, public parks and others.

Infrastructure is generally defined a set of interconnected structural elements, utilities and services – such sectors of economy and society as transport, water and sanitation, power and electricity, telecommunications, irrigation, health care, education and other basic services – that provide the framework for supporting people’s daily life operations. Furthermore, infrastructure is divided into economic infrastructure, also referred to as public utilities, and physical infrastructure, that is the actual set of interconnected, structural elements that provide the framework for supporting the entire structure of basic services and public utilities essential to the commodity-producing sectors of an economy. Physical infrastructure includes the transport networks that are used, as well as the nodes or terminals (Keskinen, 2007).

Road infrastructure provides connections to the external world and specifically access to markets and public services such as ambulances and police services, amongst others. Road construction creates jobs, especially labour-intensive methods used which helps alleviate poverty and unemployment (Local Government Budget and Expenditure Review, 2011).

2.3.3 QUALITY VERSUS PERFORMANCE

Construction industry quality is the potential of materials and procedures to perform the established requirements. Quality is effective concern throughout the whole project process as it influences performance of every phase of the project. Quality of construction project is determined during the design and construction phases of the project. The success of construction projects depends on the quality performance. Quality is regarded as one of critical factors in the success of construction projects. Quality and construction project cannot succeed without each other (Chinchu & Ambili, 2017).

2.4 FACTORS INFLUENCING THE PERFORMANCE OF ROAD INFRASTRUCTURE

The performance of the construction industry depends on factors such as time, cost, quality, client satisfaction, productivity and safety. Project management and project performance are related in construction industry (Njenga, 2014). The construction industry is complicated as it comprises large numbers of parties such as the owners (clients), consultants, stakeholders and regulators. Regardless of its difficulties, the industry plays a significant role in the development and achievement of society’s goals (Enshassi et al., 2009). Globally, numerous road contractors have failed in performance as their measurement systems are not effective or efficient to overcome poor
performance problems. Many road projects fail according to different types of performance such as factors indicated on the table below (Njenga, 2014).

Table 2.1 summarises the factors influencing performance in construction projects which were identified by various scholars from different countries. It can be noticed that sources of factors influencing performance are anticipated such as weather conditions, payment delays, late decision making by the client, quality of works by contractors, and the unavailability of resources amongst others.

**Table 2.1: Factors influencing performance on road infrastructure projects**

<table>
<thead>
<tr>
<th>Researchers</th>
<th>Context</th>
<th>Factors influencing poor roads performance in construction industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ofori et al., (2014)</td>
<td>Ghana</td>
<td>(1) Access to credit, (2) lack of capacity to compete with foreign contractors, (3) low level of technology, (4) weather condition, (5) community unrest and (6) contracts awarded based on political considerations have the greatest effects on performance.</td>
</tr>
<tr>
<td>Muguiyu (2012)</td>
<td>Kenya</td>
<td>(1) Design quality, (2) changed conditions, (3) human resources conditions, (4) disruption.</td>
</tr>
<tr>
<td>Rida (2015)</td>
<td>Sudan</td>
<td>(1) Poor site management, (2) unforeseen ground condition, (3) low speed of decision making (4) unavailability of resources, (5) design delays, (6) weather delays, (7) consistency of drawings, (8) good communication between parties and (9) diligent inspection of quality on the construction sites.</td>
</tr>
<tr>
<td>Enhassi, Mohamed and Abushaban, (2009)</td>
<td>Gaza Strip</td>
<td>(1) Cost factors such as liquidation of the company, project design cost, reworks cost, waste of material, escalation of material price, (2) time factors such as unavailability of resources, claims approval delays, variation orders delays, (3) quality factors such as unavailability of competent staff and unavailability of quality meetings, (4) productivity factors such as</td>
</tr>
</tbody>
</table>
absenteeism throughout the project and number of new project/year, (5) client satisfaction factors such as leadership skills of project manager, (6) environmental factors such as climate conditions and unnecessary waste.

Jatarona, Yusof and Saar, (2016)  

Malaysia  

(1) Lack of planning at early stage e.g. construction drawings by consultant, bill of quantities, specification not clearly stated, (2) late approval from local authorities, (3) late decision making by client, (4) contractors’ financial difficulties, (5) material supply problems, (6) late payment to the contractor by the client, (7) late payment to sub-contractors by main contractors and (8) lack of training for the technical personnel.

Source: Enshassi, Mohamed and Abushaban, (2009)

Table 2.2 classifies the commonalities in the factors influencing performance in classifications depending on their nature and mode of occurrence.

**Table 2.2: Common factors influence the performance by categories**

<table>
<thead>
<tr>
<th>Categories of factors</th>
<th>Factors influencing performance</th>
<th>Authors</th>
</tr>
</thead>
</table>
| Owner-related factors | Variations initiated by the owners  
Change of scope  
Lack of experience  
Change of orders  
Reducing/shortening of contract period  
Delay in decision making  
Poor project management practices  
Unrealistic expectations  
| Consultant-related factors | Lack of experience by the consultant  
Delays in design  
Late reviewing design documents | Aziz, Abdel-Hakam, 2016, Muhwezi, Acai and Otim, 2014 |
### Design-related factors
- Design quality
- Inadequate/ incomplete specification
- Quality of the design
- Availability of information

### Contractor-related factors
- Poor project planning
- Financial difficulties
- Poor communication
- Shortage of resources
- Inaccurate cost estimate

### External-related factors
- Weather condition
- Bribery/corruption
- Robbery
- Unforeseen site condition
- Regulatory changes

### Human-related factors
- Community unrest
- Lack of teamwork

(Sources: Researcher’s literature review)

#### 2.5 THE EFFECTS OF PERFORMANCE OF ROAD INFRASTRUCTURE

**2.5.1. Good effects of roads infrastructure performance**

Roads are necessary to the performance of the economy. They contribute to the productivity of the economy. Improvements on the economy are good sales volumes, gross regional product, property sales, and job creation amongst others (Joynt, 2009).

There are many benefits of performance in road infrastructure such as the following:

1. **Accessibility**
The major roads give access to commercial users to enjoy the benefits of fashionable businesses, industries, trades and assorted activities: they all depend on transport and its infrastructure. In addition, the movements of goods and services from place to place is vital for aspects of global and urban economic survival (Said & Shah, 2008).

(ii) Increase in commercial activities

Commercial activities such as banking, retail and wholesale businesses and professional services amongst others take the advantage to be near to the seat of governance. This cause a high demand for commercial space and its associated effects on commercial property values along main roads. Construction of roads increases significantly around for lettable spaces in commercial properties. The demand for commercial properties is affected by changes in population, legislation and the availability of good road networks (Olayiwola et al., 2005).

(iii) Job creation

The construction sector is an important source of employment creation due to its employment initiating capability and government expenditure with large influence on its expansion. The private sector influence on construction accounts for up to 60% of the total expenditure. The public sector and partnerships respectively account for up to 66.5% of government construction expenditure (Altma & Mayer, 2003). Road infrastructure generates higher rates of employment which improves the standard of living, women empowerment, and new business opportunities, amongst others (Masarova & Ivanova, 2013).

(iv) Availability of transport

Road transport investment (ROTI) is important as it increases the economic growth and development in the country. Furthermore, it boosts economic activities that tend to raise the living standard of the people, speeding up economic development and improving the well-being of people (Hlotywa & Ndaguba, 2017). The quality and availability of transport enables the raw material and finished goods to be shipped to different factories (Osea, 2013). The availability of transport also provides access to schools and hospitals and enables people to go to work (Pradham & Bagchi, 2013).

(v) Reduce cost

The shortened and smoother surfaced roads reduce the cost of vehicle operation. Agricultural producers’ benefit from quality roads as the transport cost is reduced which enables higher
prices to be obtained at the farm gate for goods that are produced. When transport becomes cheaper, more people can afford it (Robinson, 1999). Travelling time, fuel consumption and road maintenance costs are reduced due to the upgrading of roads.

(vi) Poverty alleviation

Poverty alleviation refers to the struggle against poverty by means of targeted policy interventions, addressing structural and social inequalities as well as addressing the cause of poverty. Lack of access to necessities and lower standard of living of a population group characterise poverty (Schachtebeck & Mbuya, 2016). Most poor people failed to access job opportunities and basic social services owing to a lack of access to transport to market for the jobs. Good access to basic services such as schools, clinics and firms is the key factor in sustainable poverty. Poor people value road infrastructures highly (ERF, 2001).

(vii) Good environmental impact

Roads are like real estate: it is all labour ‘location, location, location’. Construction of new roads can disturb the environment but if it is reserved for farming where most forest has already been cleared, high quality roads can be beneficial. Good roads make it much simpler to transport crops to market and import fertilizers which increase farm yields and profits and improve the livelihoods of rural residents. Moreover, they expose migrants out of vulnerable wilderness areas (Laurance, 2013).

(viii) Increase agricultural activities

Roads connectivity promotes access to economic and social services, generates an increase in agricultural income and facilitates productive employment. It promotes the expansion of markets, economies of scale and easy operation of factory markets. It increases productivity by facilitating the availability of fertilizer, seeds and pesticides; it aids the realization of better prices for the farmers for agriculture and allied products such as milk, and roads promote the production of agricultural commodities. Road infrastructure has a high impact on the production of highly perishable agricultural products such as fresh vegetables, milk, eggs, poultry, fresh fruits and others (Lokesha & Mahesha, 2017).

(ix) Foreign investment
Better infrastructure creates opportunities for the development of business and trade within countries in the region and creates the demand for goods and services that were not previously available at a reasonable price (Bonnett, 2008).

**Table 2.3: Good effects of road infrastructure projects**

<table>
<thead>
<tr>
<th>Item No</th>
<th>Good effects of Roads Infrastructure</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Accessibility</td>
<td>Said and Shah, 2008</td>
</tr>
<tr>
<td>2</td>
<td>Increase in commercial activities</td>
<td>Olayiwola, Adeleye and Oduwayne, 2005.</td>
</tr>
<tr>
<td>3</td>
<td>Job creation</td>
<td>Altma &amp; Mayer, 2003; Masarova &amp; Ivanova, 2013.</td>
</tr>
<tr>
<td>4</td>
<td>Availability of transport</td>
<td>Hlotywa &amp; Ndaguba, 2017; Pradham and Bagchi, 2013.</td>
</tr>
<tr>
<td>5</td>
<td>Reduce cost</td>
<td>Rahman et al., 2013</td>
</tr>
<tr>
<td>6</td>
<td>Poverty alleviation</td>
<td>ERF, 2001, Rahman et al., 2013</td>
</tr>
<tr>
<td>7</td>
<td>Good environmental impacts</td>
<td>Laurance, 2013; Fan, Zhang &amp; Zhang, 2002</td>
</tr>
<tr>
<td>9</td>
<td>Foreign investment</td>
<td>Lehovec, 2004; Bonnett, 2008</td>
</tr>
<tr>
<td>10</td>
<td>Increase agricultural activities</td>
<td>Lokesha &amp; Mahsha, 2017</td>
</tr>
</tbody>
</table>

Sources: Researchers’ literature review

**2.5.2 Bad effects of road infrastructure performance**

Performance of the project articulates the failure of construction projects. There are many components that cause poor performance and performance can be measured using different indicators such as time, cost, quality, client satisfaction, and health and safety factors, among others (Olatunj et al., 2016).
Poor performance may affect cash flows, actual cost of a project, far outweighing money spent, particular project exceeding the estimated cost, and damage to company reputation if the company cannot complete any project that is awarded on schedule (Oguya & Muturi, 2016).

There are numerous effects of poor performance. Negative effects due to poor performance can be summarised as follows:

(i) Abandonment of project  
(ii) Inappropriateness of chosen procurement system  
(iii) Cost overrun  
(iv) Time overrun  
(v) Reworks  
(vi) Extension of time or delays in completion of project on time  
(vii) Damage to company’s reputation  
(viii) Decrease in productivity  
(ix) Dispute between owner and contractor  
(x) Decrease in quality  
(xi) Ecology  
(xii) High road accidents  
(xiii) Creates stress to the contractor  
(xiv) Termination of contract

2.6 THE IMPACT OF STAKEHOLDERS ON THE ROAD INFRASTRUCTURE PROJECTS

2.6.1 Definition of stakeholders

Stakeholders are human beings and companies that are actively involved in the project or whose interests may be affected because of project execution or project completion. In construction stakeholders are the client, consultant, contractor, suppliers, community leaders, or service providers. Stakeholders can be divided into different categories. Some researchers say stakeholders are internal and external, some say stakeholders are inside and outside and the others say stakeholders are primary and secondary (Chinyio & Olomolaiye; 2010). Project stakeholders, as defined in A Guide to the Project Management Body of Knowledge (PMBOK® Guide) (PMI, 2008), are individuals and organizations who are actively involved in the project, or whose interests may be positively or negatively affected because of project execution or successful project completion. Stakeholders directly involved in decision making and operations of the project are considered as
primary or direct stakeholders whilst stakeholders without any direct relationship and operating remotely from the project are considered secondary, indirect or outside stakeholders (Newcombe, 2003). Below is figure 2.1 identifying the potential stakeholders in the construction industry (Cleland, 1999)

![Figure 2.1: Potential stakeholders for construction projects](Source: Cleland, 1999)

### 2.6.2 The general roles of stakeholders in construction projects

Construction projects have common characteristics in that they will always have a project doer, client and beneficiary. Roads construction projects has common stakeholders and they are unique stakeholders (Assefa, Worke & Mohammed, 2015). Two types of stakeholders in construction industry are identified, namely the positive impact stakeholders and the negative impact stakeholders.

The main aim to have stakeholders in a project is to align with project needs or objectives. However, stakeholders can influence the project, project deliverables and project team to achieve a set of outcomes that satisfy strategy business objectives or other needs (Waghmare & Bhalerao, 2016). Stakeholders can be a threat, an opposition party. A stakeholder varies from one stage of a project
2.6.3 Types of stakeholders

This study is focused on the internal/primary stakeholders such as client, consultant and contractor. Furthermore, there are the external/secondary stakeholders such as the community affected by the project, local authorities such as municipalities within the project and ward councilors involved, property owners, business forums, general road users and service providers of existing services such as Telkom, Eskom, Rand Water and Johannesburg water, among others.

2.6.3.1 Internal stakeholders

Internal stakeholders are those who have a legal contractual relationship with the project owner and are classified into need and supply sides stakeholders (Molwus, 2014). Internal stakeholders are the primary stakeholders, active decisions makers, have great influence in the community as well as the project and they must be involved in all project stages (Buertey et al., 2016). The major internal stakeholders in construction industry in countries such as South Africa and Ghana are clients,
contractors and professional consultants owing to their acceptance of the appointment of all stages of the project delivery (Tengan & Aigbavboa, 2017).

a. **Client**
A client is the person or firm responsible for commissioning and paying for the design and construction of a facility being commissioned. The success of the project depends as much on the client as it does on the consultants and contractors (Alinaitwe, 2008). The degree of client involvement is based on taking the right decision during the construction project process and that is determined by the weight of the client is experience. The common expectations of the client are the project delivery at high quality, low cost and finished on time. Client involvement in the construction process provides the link between the client and the project (Trigunarsyah & Sodaiman, 2016).

b. **Consultant**
The consultant engineer is like an employer’s agent. Consultants make sure that the project is completed to the right quality against technical specifications and design standards, on time and within budget, giving the client/employer value for money (Dadzie et al., 2012).

The impact or effects of consultants’ working long hours include industrial and social problems, family breakdown, physical, and psychological health problems in general and it also reduced alertness and concentration (Dadzie et al., 2012).

c. **Contractor**
Contractor is a self-employed independent business person who agrees (contracts) to do work for another party, usually for a fixed price. The failures of contractor are abandonment of project, liquidation /bankruptcy, damage to company’s reputation, loss of skilled workers, default on loan repayment by the contractor, and stress on the contractor, among others. (Dadzie et al., 2012).

### 2.6.3.2 External stakeholders

External stakeholders are those stakeholders without any contractual relationship with the project owner. However, they have some rights and interests in the project and are grouped into private and public stakeholders (Molwus, 2014). External stakeholders are secondary stakeholders that are mostly passive, undertaking decisions made by primary stakeholders and having little influence during the implementation phase (Buertey et al., 2016). The external stakeholders or secondary
stakeholders that this study concentrated on are the community affected by the project, the local authorities such as local municipalities together with ward councillors affected by the project, property owners that need to be compensated for their properties along the project, service providers for existing services that are disrupted by the progress of the project such as Telkom lines, Eskom cables, Rand Water or the Johannesburg water line, among others. Moreover, the road users also included as the external stakeholders as they have influence to encourage or stop the project owing to various reasons. The external stakeholders mentioned above have almost the same impact on a construction project; therefore their impact on construction projects are grouped together in this study.

a. Community affected by the project

Various government policies and regulations for South African and most of developing and developed countries exist to support the participation of small and medium enterprises, especially qualifying small enterprises (QSEs) and exempted microenterprises (EMEs). The hiring of local labour and providing training are amongst the government policies and regulations. There are stipulated targets on the tender document contract set by a client, which encourage the community participation, especially on road construction projects and that gives the community participation in construction projects (Rathenam et al., 2016). The Preferential Procurement Policy Framework Act 2000: Preferential Procurement Regulations, 2017 (PPPFA 2017) stipulates the pre-qualification criteria for preferential procurement for the bidders to sub-contracting 30% to EME or QSE sub-contractors (PPPFA, 2017).

The external stakeholders such as the community do not impact the construction project only; however, sometimes it is vice versa where the construction project impacts the external stakeholders such as the community around it. Communities are impacted by the following negative impacts amongst others: the noise, pollution, dust, parking area, access for emergency services, closure of the road, disruption of pedestrian access, power cuts and other important services. Noise normally caused by extra traffic, construction vehicles and heavy machinery causes the local businesses to close the doors of their businesses which reduces custom. Furthermore, the noise forces the residents keep their doors and windows closed at times and pets become disturbed by the noise (Jones, 2001). Dust causes the homes, vegetable gardens, and cars to be dirty and windows are always closed. It also causes the diseases such as asthma, bronchitis, conjunctivitis and coughing. Parking become scarce for shops nearby, bus stops are closed and access to homes is not easy; the closure of roads and pollution affect the residents
There is a positive impact that comes from the construction project to the community as well. Positive impacts such as job creation, poverty alleviation, and landscaping, new roads improve safety, transport improved through good road networks, and tourism increases which boosts local businesses (Jones, 2001; Hatta & Ali, 2013).

**a. Local authorities**

Local authorities such as municipalities, different government departments such as Labour, Water and Sanitation, GDARD (Gauteng Department of Agriculture and Rural Development) are regarded as external stakeholders in this study. They have a huge impact on the construction project. For instance, the Gauteng Department of Labour, the internal stakeholders (client and contractor) must apply for a construction work permit before commencing with any construction works on site. The notice regarding application for construction work permits for construction work in terms of Construction Regulations (2014) and the Occupational Health and Safety Act, 1993 should be submitted to the Department of Labour (Gyadu et al., 2013). The application should be done within 30 days before carrying out any work on site and must be done on the contract value of work of the amount exceeding R 30 million or CIDB grading level 7 and above (Government Gazette no 10113, 2014).

If the contract value of work of the amount does not exceed R 30 million or the CIDB grading level is below 7, there is no need to apply for a work permit. The work permit takes 30 days after tender has been awarded which has an impact on project commencing on time. The municipalities affected by the project have their do’s and don’ts’ in the area. These need to be followed by the internal stakeholders of the project (Researcher’s field work). In terms of Section 151 (1) of the National Water Act, Act 36 of 998, no person may use water otherwise than as permitted under this Act. Therefore, the contractor needs to apply for the water use license at the Department of Water and Sanitation before any construction commences on site (National Water Act). These are some of the highlights that the study indicates regarding the local authorities.

**b. Business forums**

Business forums are not new phenomena in the global market. They differ in the way they operate based on the different issues and labor needs between developing and developed countries (Nkosi, 2017). The business forums have their place in the construction industry and have had both positive and negative outcomes. One of the most empowering pro’s is that they introduce contractors to a new breed of subcontractors and a mixture of skilled and unskilled
labor that are willing to put in the effort to gain the reputation to continuously do business (Nkosi, 2017). The downside of business forums is that by appointing unskilled labor from the community, contractors risk compromising on the quality of work and the risk of time lost in rework. There is a lack of transparency encountered between the forum representatives and the community businesses as the forums tend to disclose information that they perceive as vital, which is not always the case. (Nkosi, 2017).

c. Ward councilors

Ward councilors can be defined as persons elected to represent a ward in a council. The Municipal Structures Act, 1998 defines a councillor as a member of a municipal council (Madumo, 2011). The ward councillor has a role on the construction project before it has even commenced, namely to introduce the project to the community, to ensure the community benefits from the project and to be part of the project steering committee and make sure the project steering committee is formulated (Researcher’s field work). In other projects, there may be more than one ward councillor affected by the project and those councillors are from different political organizations. It then becomes difficult for the project manager or internal stakeholders to accommodate their needs and expectations (Researcher’s field work). The ward councillor becomes part of appointing Community Liaison Officers (CLO’s) to assist contractors with appointing a workforce comprised of local labor (Nkosi, 2017). In project where there are more than one ward councilor, they agree to have one CLO or more depending on their agreement. Where CLO become one, the other wards that are affected by the project gain more employment as local laborers (Researcher’s field work).

d. Service providers for existing services

In most cases, existing services such as Eskom Cable, Telkom poles, Rand Water/ Joburg water pipes, among others, become obstacles of the construction project in progress. The existing services are usually identified during feasibility studies when initial reports and Geotech reports are conducted by the appointed professional engineers/consultants (Researcher’s field work). The client and the contractor become puzzled by these existing services if they had not identified the services during the feasibility study or if they had spotted the services but did not apply for a wayleave. The appointed contractor needs to apply for the relocation of those services to the relevant service providers in time. The contractor tends to takes long in applying for the relocation owing to financial constraints as the client only pays for the work done. The service
providers, on the other hand, take a long time to relocate the services owing to long waiting lists on their side. That causes time and cost overruns to client and contractor (Researcher’s field work). For instance, the project R82, the construction of a dual carriageway of road R 82/k57 (P1/1) from road D77 Eikenhof to D1073 Walkersville Phase 1B, was delayed by service providers and the contractor relocating existing Eskom services. This caused cost and time overrun to the client: it took approximately five months and cost approximately R 6,886,256.24 for the service to be rendered. The same applies to the upgrading and rehabilitation of Cedar Road D1027 from 2.95km Valley Road to 5.93km Runnymead Road - phase 1 whereby the contractor claimed the extension of time for a month at an amount of approximately R 1.5m. In other cases the contractor had to obtain a wayleave before applying for the relocation of existing services (Researcher’s field work).

e. End users/ Road users

The pedestrians are the most vulnerable road users and the safety needs and requirements of pedestrians and cyclists are considered in the planning, design and implementation of road infrastructure. Most of the end users raised their concerns about road safety. They identified shortage of road signs, no pedestrian bridges, and a shortage of a CCTV pilot surveillance, among others, that can reduce fatalities and vehicle accidents (SANRAL, 2018).

f. Property owners

“Most of the property owners affected by the project are being advised and informed on time to be aware of the coming project, and are being compensated. However, most of them remain living on the property until they are forced to move from the property when the construction is executed. Some of property owners sell their property to the new owners who are not aware of the upcoming project in the area and without knowledge to verify the validity of the property and the upcoming development where they are buying property. All of the above cause construction project delays and disputes (Researcher’s field work)”. Land acquisition is the huge restriction to the development of infrastructure in the country. People who surrender their land are given poor compensation and those who are already compensated resist relocating when the construction project needs to commence (Sahoo, 2011).

2.6.4 General impact of stakeholders on road infrastructure projects

Each project is unique, different from others, and therefore even the stakeholders’ impact differs depending on the project. Some stakeholders’ impact might be positive or negative. (Assefa, Worke
Communities’ economic, environmental and social outcomes can be affected if stakeholders and communities were not consulted from the beginning of projects (Morrissey, 2015).

People become more mobile and roads are accessible during all weather conditions. Police need to have good access to areas when chasing criminals to areas where there are a lot of criminals. People received training and obtain accreditation certificates that endorse them for market jobs in the future. Skills transfers are gained by SMMEs and QSEs to become contractors and upgrade their CIDB grading. Communities become well equipped, and able to take care of their road network (Little & Lachman, 2004). According to the CIDB (2013), for the main contractor to build a contractor’s track record, subcontracting out some works has a big impact as it reduces overheads, increases higher profit margins or better cash flow and also improves their CIDB grading. It also helps subcontractors that are entrants into construction industry to become main contractors. Subcontractors increase their productivity and clientele by servicing multiple clients with distinction (CIDB, 2013).

2.7 WAYS TO MITIGATE PERFORMANCE ON ROAD INFRASTRUCTURE PROJECTS

A good company reputation is critical; however, a bad company reputation is a significant warning to the reality of any business with reworks (Oguya & Muturi, 2016). The main aim of controlling a project is to make sure that the project finishes on time, within the allocated budget and achieving other project objectives (Olawale & Sun, 2010).

Below are ways to mitigate performance in road infrastructures projects:

(i) Good communication – This is the key component throughout the construction mitigation. It is vital that the community project liaison officer should be able to speak different languages, be available all the times when needed and be capable of resolving concerns and complaints.

(ii) Education and training - Continuous training courses should be done to improve the capability of personnel and professionals to carry out designs, supervision and construction works of all levels (Kamanga & Steyr, 2013).

(iii) Skills transfer - It is necessary for skills transfer to the youth as a number of youths receive qualification without skills on the ground to use those qualifications on site.

(iv) Quality management - It is very important in construction project to monitor quality to avoid reworks and cost overrun. A quality culture is an important perquisite to achieve
sustained competitive outcomes through continuous delivery of good quality products and services to the clients/end-user’s satisfaction (Sodangi et al., 2015).

(v) Proper planning - A well-planned project, carefully monitored, has a positive impact on the performance and profitability of the company. (Harris & McCaffer, 2005).

(vi) Engaging local municipalities and road agencies – Different municipalities need to increase their investment to roads infrastructure; provide long term vision to maintain roads infrastructure and involves in the construction of the roads.

(vii) Shortening of timeframe to respond – A short timeframe to respond in different aspects of the project is required.

The mitigations listed above are amongst other mitigations that might be used in the project.

2.7 MEASURES TO ASSESS PERFORMANCE OF ROAD INFRASTRUCTURE PROJECTS

2.7.1 Performance measurement definition

The following performance measurement definitions, among others, were identified:

Performance measurement is a process that decides the worth of the organization achieved their objectives and strategies by means of accumulating performance data and comparing the actual results with projections to decide outcome variances. It also improves the effectiveness and efficiency of such processes (Sodangi & Khamidi, 2015).

Alsulamy (2015) defined performance measurement as the process to determine to what extent the (general) aim and (specific) objectives of a project have been achieved. It can be undertaken to enhance an organisation’s ability to draw up superior plans, to better implement innovation and learning, and to permit incremental organisational development.

Rose et al., (2009), defined performance measurement as the process of evaluating performance relative to defined goals. It shows where the organizations are and where the organizations are going (Rose et al., 2009). Performance measurement is defined as a “…process of assessing progress toward achieving predetermined goals, including information on the efficiency with which resources are transformed into goods and services (outputs), the quality of those outputs (how well they are delivered to clients and the extent to which clients are satisfied) and outcomes (the results of a programme of activity compared to its intended purpose)” (Kulatunga, Amaratunga & Haigh, 2007).
2.7.2 Purpose of performance measurement

Performance measurement plays a major role on influencing human behaviour as what gets measured, get done and therefore it seen as key to achieving significant improvements in performance and for auditing and reviewing performance over time and against predefined targets. Performance management provide important inputs to assets management decision making (Sterrit, et al., 2017). A project is accepted as successful when it is completed on time, within the allocated budget and in a manner that specifications are well applied and stakeholders satisfied (Takim & Akintoye, 2003). In the development of performance measures, client and project stakeholders’ satisfaction has become the key success factor among other factors (Karna et al., 2013). The performance measurement’s aim is to connect company goals together with objectives to improve standard targets and productivity (Patel & Malek, 2016).

2.7.3 Performance measures tools or models

Alsulamy et al.,(2015) explained different types of performance measures as depicted in Table 2.4 below:

<table>
<thead>
<tr>
<th>Type of Performance measure</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>KPIs (Key Performance Indicators)</strong></td>
<td>Are concentrated on the procedure of performance through connecting the causes and effects. However, the KPIs depend on benchmarking, which is a primary tool of any measurement.</td>
</tr>
<tr>
<td><strong>KPOs (Key Performance Outputs)</strong></td>
<td>Are the final outputs of concluded events considered as lagging measures that have no effect on future. Despite this, they are useful in rethinking similar actions in future.</td>
</tr>
<tr>
<td><strong>Perception Measures</strong></td>
<td>Are used at any level, whether during implementation or in the results. As such, they can be conducted by means of questionnaires or survey.</td>
</tr>
</tbody>
</table>

(Source: Researcher’s field work)

Ngacho and Das (2015) identified two umbrellas of measures that assess the performance of construction projects globally, namely key performance indicators and critical success factors (See Table 2.5 below):
Table 2.5: Performance evaluation framework

<table>
<thead>
<tr>
<th>Key Performance Indicators (KPI’s)</th>
<th>Critical Success Factor (CSF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Project-related</td>
</tr>
<tr>
<td>Cost</td>
<td>Client-related</td>
</tr>
<tr>
<td>Quality</td>
<td>Consultant-related</td>
</tr>
<tr>
<td>Site disputes</td>
<td>Contractor-related</td>
</tr>
<tr>
<td>Environmental impact</td>
<td>Supply chain-related</td>
</tr>
<tr>
<td>Safety</td>
<td>Externally related factors</td>
</tr>
</tbody>
</table>

(Source: Researcher’s field work)

The study highlighted the factors that influence the performance, the effects of performance on road infrastructure projects, and the impact of stakeholders on the road infrastructure projects that can resolve performance problems. Therefore, the performance measures identified below might assist to assess the performance in road infrastructure projects in the Gauteng Province of South Africa. All developed and developing countries share common factors on performance measures used in construction industry such as the following:

i. **Cost factor**
   Some of the techniques used for cost control are project cost-value reconciliation, overall profit, profit or loss on each contract at valuation dates, labor/plant/material (actual versus forecast reconciliation), unit costing, standard costing, earned value analysis, program evaluation and review Technique (PERT/COST), and the leading parameter method. Software packages includes bespoke/in-house systems, Microsoft Project, Project Costing System (PCS), Asta Power Project, Primavera Sure Trak, Microsoft Excel, COINS and WinQS (Olawale & Sun, 2010).

ii. **Time factor**
   Most of the professional project teams believe that they use different techniques for planning and time control in the project. Other techniques used include the Gantt bar chart, followed by the critical path method. Those two are the most established techniques method in the construction industry. Milestone data programming technique, performance evaluation review technique (PERT), precedence network diagram (PND), elemental trend analysis/line of balance (LOB), and simulation are also used. The use of
software support is widespread. Three clear leading applications are Microsoft Project, Asta Power Project and Primave (Olawale & Sun, 2010).

iii. Quality factor
The quality factor in construction project is not merely concerned about adhering to the technical specifications but records the ability of the project to satisfy quality for the intended use. Quality of performance concentrates on removing defects in the constructed facilities through configuration, material specifications and functional performance. Poor quality of the project leads to redo which causes cost and time overruns (Ngacho & Das, 2015).

iv. Client satisfaction
Client satisfaction appears to be the most general indicator of the project success (Karma et al., 2013).

v. Health and safety factor
The construction industry is known as the most hazardous activity country wide. The measurement of health and safety concentrates on the project duration as most of accidents happen during that stage (Ali & Rahmat, 2009). Safety is influenced by the decisions made during project planning and design process. It also depends on the education and training of safety issues and vigilance among project stakeholders (Ngacho & Das, 2015).

vi. End user’s satisfaction factor
Public interest is the single largest factor sustaining the existence of the profession in construction and it is largely dependent on client’s satisfaction (Olatunji et al., 2016).

vii. Productivity factor
The company’s production is reduced when company resources are scarce or misused and good production is achieved when company’s resources are used to add value. In construction, the productivity is usually measured by labour productivity (Tangen, 2005). The productivity is always affected when the project experiences delays or reworks due to construction mistakes (Pekuri et al., 2011).

viii. Profitability factor
Profitability considers financial effects, while production concerns the whole process that takes place among purely physical phenomena. Profitability is the same as
production due to its relationship between output and input, but the relationship is finance; thus, the influence of price-factors (Pekuri et al., 2009).

ix. Defects factor

The defect factor may be used as one of the KPIs so that the work is handed over with zero defects.

The figure 2.3 below illustrates all the performance measures that may be applied in the construction industry:

![Framework for measuring project success](source)

Figure 2. 3: Framework for measuring project success

2.8 CONCLUSION

This chapter explored the generic performance of road infrastructure projects. Factors influencing poor performance, the effects of poor performance, ways to resolve poor performance, the impact of project stakeholders and the measures used to assess the performance of road infrastructure projects were discussed. The next chapter will focus on the discussion of the international
perspective on construction performance in road construction projects in relation to the research questions presented in Chapter 1.

CHAPTER THREE

INTERNATIONAL PERSPECTIVE: ROAD INFRASTRUCTURE

3.0 INTRODUCTION
This chapter focuses on performance of road infrastructure projects for Malaysia and India. It presents the background of the countries and their construction industries. In addition, detailed literature is reviewed for construction performance on road infrastructure projects in Malaysia and India. Also, this chapter analyses how challenges in Malaysia and India road construction projects are resolved and managed. This chapter further reviews sources of performance in the construction projects.

3.1 MALAYSIA

3.1.1 BACKGROUND NATURE OF CONSTRUCTION INDUSTRY
Malaysia is located on the continent of Southern Asia and contains into two non-contiguous regions, namely the Peninsular Malaysia bordered by Thailand to the north, the Strait of Malacca to the west, the Johor Strait in the south and the South China Sea to the east. Secondly, the East Malaysia region has Borneo Island to the north comprising two states, namely Sabah and Sarawak (Sibiya, 2015). It is a largest country consisting of more than 30 million citizens. The Malaysian official language is Bahasa Malaysia; nonetheless, English is still in common use. Malaysia is regarded as a Muslim country and the capital city is Kuala Lumpur. There are thirteen states and three federal territories. Malaysia has political organizations and systems. Malaysia constitutes the largest ethnic group at 65 %, followed by the Chinese at 26 %, Indians at 8 % and 10 % others. While Islam remains the dominant religion, Buddhism, Hinduism, Confucianism and Christianity are also widely practiced. Malay, Chinese and English are the main languages spoken (Department of Foreign Affairs and Trade, 2005).
3.1.2 MALAYSIAN CONSTRUCTION INDUSTRY

The Malaysia construction sector supplies socio-economic infrastructure for industrial growth and construction primary services such as residential, commercial space, parks, highways, roads, playgrounds, airports and infrastructure necessary for the country to develop and upgrade the living standard of the society (Khan, Liew & Ghazali, 2014). The statistics depict the number of people employed in the construction industry in Malaysia from 2010 to 2018. Around 1.29 million people were employed in the construction industry in Malaysia in 2018 (Statista, 2019).

There are different stakeholders in Malaysia construction industry like any other country. The construction stakeholders are contractors, consultants, clients (public or private) and suppliers among others and the Malaysian government is an important stakeholder through its agencies such as the Ministry of Works, the Department of Works (PWD), the Construction Industry Development Board (CIDB), the Construction Service Centre, the Board of Engineers, the Board of Architects and the Board of Surveyors (Kamal et al., 2012). The construction sector in Malaysia generates wealth and boosts the quality of life through rendering of government’s socio-economic policies into social and economic infrastructures and buildings. Approximately 800,000 job opportunities were created by the construction sector (Okinawa, 2010). The Malaysian construction sector is guided by the Construction Industry Board (CIDB), which was established under the Act of Parliament, namely 520 Lembaga Pembangunan Industri Pembinaan Malaysia Act in 1994. The CIDB purpose is to develop construction industry as a major contributor sector to the national
economy and ensure the construction industry can produce high-quality construction works (CIDB, 2004).

In 2016, the number of contractors increased by 5.8% to 72,246 compared to 68,255 contractors per their grades in 2015. The construction sector will continue to expand on new and existing civil engineering projects. The construction industry was expected to have a sustainable demand for approximately at RM170 billion for 2018 and RM 180 billion for 2018. The construction sector was projected to grow at 8.0% for 2017 and up to 10.3% for 2018 (CIDB, 2017). Table 3.1 below shows the contractors registered recently in Malaysian CIDB:

Table 3.1: Contractors registered by registration grade

<table>
<thead>
<tr>
<th>Grade</th>
<th>Bidding Limit</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td></td>
<td>34,485</td>
<td>33,991</td>
<td>34,068</td>
</tr>
<tr>
<td>G2</td>
<td>Not exceeding RM500,000</td>
<td>9,268</td>
<td>10,441</td>
<td>12,407</td>
</tr>
<tr>
<td>G3</td>
<td>Not exceeding RM1 million</td>
<td>8,825</td>
<td>8,875</td>
<td>9,375</td>
</tr>
<tr>
<td>G4</td>
<td>Not exceeding RM3 million</td>
<td>3,038</td>
<td>3,093</td>
<td>3,408</td>
</tr>
<tr>
<td>G5</td>
<td>Not exceeding RM5 million</td>
<td>4,130</td>
<td>4,287</td>
<td>4,746</td>
</tr>
<tr>
<td>G6</td>
<td>Not exceeding RM10 million</td>
<td>1,594</td>
<td>1,528</td>
<td>1,589</td>
</tr>
<tr>
<td>G7</td>
<td>Unlimited</td>
<td>5,332</td>
<td>5,618</td>
<td>6,206</td>
</tr>
<tr>
<td>G8</td>
<td>Foreign Unlimited</td>
<td>373</td>
<td>422</td>
<td>447</td>
</tr>
</tbody>
</table>

(Source: CIDB Malaysia, 2017)

There are four types of construction classification, namely commercial building construction, and residential building construction, which is in demand due to citizens who need residential area and residential building construction inspires citizens to buy houses which grows the construction industry in the country. Heavy engineering and infrastructure construction is the third classification type, which takes much longer to be completed compared to other types of construction owing to highways, airports and bridges. The last classification is industrial construction, which is in less demand compared to other types of construction and it is mostly used by the private sector (Okinawa, 2010).

Malaysian roads are classified in three ranks, the first of which are state roads, making up most of the network and are the responsibility of individual states. The second tier is the federal roads, which are under the remit of the Ministry of Works. Expressways are the third tier which are overseen by
private Malaysian companies on the build-operate-transfer (BOT) model and are thus toll roads (Oxford Business Group, 2011).

The Malaysian government concentrates on developing an integrated public transport system further and the construction usage and maintenance of expressways are subject to the Federal Roads Act, 1984. The expressways are two lanes in each direction of which majority have limited access (Trade Chakra Publications, 2009). The government of Malaysia concentrates on the development of rural roads to link the less developed parts of the Malaysia country with the main road network of inter-urban highways (Naidu, 2008: 215). Many inter-city highways and urban roads have been developed by the private sector as BOT projects and are toll roads (Naidu, 2008).

![Map 2: Major road network in Malaysia](Source: World Atlas)

### 3.1.3 PERFORMANCE IN THE MALAYSIAN CONSTRUCTION INDUSTRY

The construction sector in Malaysia enhances a country’s development projects and creates job opportunities ranging from professionals to labourers (Sodangi et al 2015).
Construction performance is specified as unsatisfactory and underachieving, especially in public projects which are frequently reported as time delayed and engulfed by disputes. The sector does not invest enough in training and it has low productivity (Jatarona et al., 2015). Malaysian infrastructure received the largest share of public sector development expenditure in the Malaysia budget. The amount of resources earmarked for infrastructure development increased from one Malaysia Plan to the next. Many of the inter-city highways and urban roads have been developed by the private sector as BOT projects and are toll roads (Naidu, 2008).

3.1.4 FACTORS INFLUENCING PERFORMANCE IN MALAYSIAN ROAD INFRASTRUCTURE

Time and money are the key elements of construction. Contractors are required to perform construction duties within a specified period and budget, just like any investor who invests money for a period and expects the repayment after specified period (Munyoki, 2014). It has already been explained in this study that the problems that experienced during construction differ depending on the different stakeholders on the project. The study concentrated on the clients, contractors and consultants’ challenges during road construction projects. The project success is determined by the completion time, project cost, within specification and stakeholders’ satisfaction. Furthermore, the project type, size and the level of sophistication of the project participants and experience also count (Jatarona et al., 2016).

The success of a project is safeguard by the client, contractor and consultant involved. Challenges and delays of the construction project can lead to bad relationships between the client, contractor and consultant. Furthermore, challenges can cause the cost of project to increase with extension of time (Sambasivan & Soon, 2007). Dispute normally arises between the client and contractor whereby one party blames another. Disputes are caused by inadequate contractor experience and payment issues by client. Clients complain about the improper planning and the labor supply, whereas the contractor complains about inability to pay for completed work (Sambasivan & Soon, 2007).

3.1.4.1 Quality management

Lack of supervision and work inspection in construction projects lead to rework which delays the project’s completion on time (Wambugu, 2013).

3.1.4.2 Material issues on site

Late delivery of materials on site and the quality of material can affect project progress and cause delay in the project completion on time (Wambugu, 2013). If the material does not match the quality
of the design or specifications, that material will be rejected and by looking for other material more time will be wasted that will affect the completion of the project (Munyoka, 2014). Shortage of material on site caused by supplier’s shortage or high demand of material can create problems on the project (Akomah & Jackson, 2016). Escalation of material prices caused by increments in material prices, border closures, fluctuations in the cost of building materials, fluctuations of the local currency in relation to the dollar, project material monopoly by some suppliers, resources constraints and inaccurate quantity take off among others are further causes of problems on site (Memon & Rahman, 2011).

3.1.4.3 Payment issues
Late or non-payment remains a chronic challenge in the Malaysian construction industry which affects the entire delivery chain (Abu Bakar, 2015). Payment problems are an old issue in the Malaysian construction industry. Service providers complain about either not getting paid or late payment (Azaman et al., 2013). Some contractors abandon their projects because of a shortage of funds and some contractors become bankrupt or even liquidated. Late payment or non-payment is caused by clients’ attitude, delays in certification by the consultant, breach of contract, disagreement on the valuation of work done by the consultant and contractor, issues on documentation, errors and others (Azman et al., 2014). Azman et al 2014, continued to say late or non-payment are paramount due to factors such as construction projects that are long, large construction project size, and payment terms.

Other factors that contribute are when the client deliberately delays payment for his or her own financial advantage, deliberately withholding payment for personal reasons (Ye & Abdul Rahman, 2010). The client’s employees normally hold the payment of service providers and most of the time they do this to secure a ‘gift’ from the service providers (Hasmori et al., 2012). Clients’ unsuccessful utilization of funds, contractors misunderstanding clients’ requirement of variation orders, faultiness of valuation for work done, oral instructions not confirmed by writing, technical problems such as wrongly calculated claims, errors in claims, and inadequate portfolio of evidence can all be the cause of late or non-payments to the contractor by the client (Azman et al., 2013). Malaysian survey results on late and non-payment show that 44, 1% of the contractors experienced late payment in government-funded projects while 53.3 % experienced the same on privately funded projects (CIDB 2006).
3.1.4.4 Contractor time management
Completing construction project within specified duration is a fundamental requirement, however, it is not easy to complete project within specified duration and it became a worldwide problem in construction industry (Hussin and Rahman, 2013). Carry on here
Time overrun is the result of not completing projects on time or on the completion date. Many researchers routinely report from different countries such as Malaysia that time management is one of critical challenges experienced by the construction industry (Memon et al., 2011).

3.1.4.5 Improper planning by the contractor
Improper planning causes’ extension of time comes with cost and time overruns in Malaysia and throughout construction projects globally (Memon, 2014).

3.1.4.6 Construction waste
Construction waste is normally created for different reasons such as changes in design, errors during construction, poor planning by the contractor and errors in material orders among others. Construction waste is taken seriously in Malaysia (Hussin & Rahman, 2013).

3.1.4.7 Changes by project owner
Changes made by the client due to inadequate definition for scope of works and lack of participation of the client at the design stage cause problems in terms of implementing the project and finishing it on time within a budget (Maarouf & Habib, 2011).

3.1.4.8 Upcoming new technology
The availability of new technology in the market might inspire the client or consultant to begin with the new technology (Ibrahim, 2013).

3.1.4.10 Late review of drawings and tender documentation by project consultant
Drawings means the drawings of the works as included in the contract and any additional and modified by the employer in accordance with the contract (FIDIC, 1999). Late review of tender documentation and drawings delays the contractor to price the tender for works that need to be done and that is usually caused by consultant who delays the process of reviewing the tender documentation (Murdoch & Hughes, 2008).
3.1.4.11 Late site instructions or change orders by project consultant

Most construction projects take long to be completed owing to unpredictable issues. Project can be well-planned; however, necessary changes might occur due to various reasons regarding the nature of construction projects (Maarouf & Habib, 2011). Variation orders determine cost and time of the project and it is normal to have variation orders in all types of construction projects. Variation orders refers to the adaption, change or modification of design, quality or quantity of work, omissions, additional of work including standard of any material to be used in that work, removal from site of any work, and materials which are not in accordance with the contract. Any additions, deletions or revision to project goals and scope are also considered as variations whether they decrease or increase the project cost or schedule (Maarouf & Habib, 2011).

3.1.4.12 Poor site monitoring and supervising by consultant

The reality on site is that most engineers do not spend much time on site as required. Other engineers come to site once or twice per week. The contractors take advantage by trying to speed up the work on site on the absence of the engineers (Maarouf & Habib, 2011).

3.1.4.13 Change orders by all project stakeholders

Changes may occur during a construction project. Some changes lead to design changes, design errors, additions to the scope of works or unknown conditions (Assbeihat & Sweis, 2015). Clients are accountable for any change orders in terms of the contractor’s time and cost performance. Change orders result in numerous changes of orders from the contractor including labour, supervision and equipment costs (Nor et al., 2016).

3.1.4.14 Risk management

Risk management is one of nine knowledge areas generated by the Project Management Institute (PMI). Risks are managed in construction projects to achieve project objectives such as time, cost, quality, safety and environmental sustainability. Construction statistics globally show that construction workers are three times more likely to be killed and twice as likely to be injured as workers in other occupations. The costs of these type of accidents are huge to the individual, employer or the community (Banaitiene & Banaitis, 2012). It is difficult to plan accurately and accordingly to avoid risks such as harsh weather like floods, earthquakes, labour unrest, community unrest, equipment breakdown, poor site management and unpredictable physical site conditions of the site, among others. The listed problems pose various risks such as low production, accidents and injuries on site (Okema, 2017).
3.1.4.15 HIV/AIDS
Most HIV/AIDS occurrence increased after the completion of several highway projects in Myanmar, China. Road construction projects contributed to the spread of HIV/AIDS by moving married men living away from their families to stay on construction sites. There are more people who use new road networks which causes an increase in HIV/AIDS disease. Road and infrastructure teams’ travel from one site to another and the distance from home exposing workers to trading sex establishments (Zhang & Chen, 2017).

3.1.4.16 Poor communication
There is a language problem in situations where foreign labors are hired to work on project. Foreign labors come from poor countries such as Bangladesh and Nepal (Valitherm, 2014).

3.1.4.17 External factors
External factors such as weather conditions, regulation changes, problems with neighbors and unforeseen site conditions also affect the project performance (Sambasivan & Soon, 2007).

3.1.5 THE EFFECTS OF PERFORMANCE OF ROAD INFRASTRUCTURE IN THE CONSTRUCTION INDUSTRY
Malaysian construction sector is an important gear in the wheel boosting the Malaysian economy. Construction activities are linked with the various stages of economic development of a country (Khan et al., 2014). The construction sector recorded productivity growth of 12.4% valued at RM 40,018 in 2016 as compared to 5.5% in 2015. The productivity level registered by all the sub-sectors surpassed the productivity level of RM 40,018 by the overall construction industry (Productivity Report, 2016/17). The construction industry is growing rapidly in Malaysia. Fundamentally, construction activities are derived from the local economic activities in Malaysia (Hamzah et al., 2012).

3.1.5.1 Bad effects on the Malaysian economy
3.1.5.1.1 Decrease in productivity
Productivity is about labour productivity, i.e. units of workplace or produced per man-hour ratio earned to actual hours. A decrease in productivity is normally caused by a lack of productivity standards, laws and regulations, building codes and others. Uncertain weather conditions have a huge impact on the decrease of productivity: if weather is hot, safety regulations should be applied. Inefficient management of construction resources can also result in low productivity (Shehata & El-Gohary, 2011). It is a significant component of every company’s success and competitiveness in the construction market. Productivity is a significant issue in the construction. Poor productivity becomes a concern as it affects the cost and the viability of the work in hand and eventually the industry itself (Enshassi et al., 2013).

3.1.5.2 Time overrun

Delays cause the disruption of work, loss of production, time-related issues, cost-related issues, third party claims and even termination of contract. A ‘sick project’ is the project that is experiencing delays in the construction period where gaps between actual work progress Compared to the work scheduled is more than 30% or the projects fail to be completed in the construction period (Hamzah et al., 2012). Many construction projects are carried out without carefully taking into account some factors that are considered unimportant and it causes an array of problems during a road project under construction that leads to delay in the completion of the project (Wafa & Singh, 2013).

Clients overlook a major problem, namely to cover the cost of the contract that has increased. The contractor experiences financial problems due to extra administrative costs such as renting equipment on site, extending the source of labour services and an increase in cash flow. Consultants have to sacrifice more time and the reputation of both consultants and contractors in performance measurement are affected. Finally, when a project is behind schedule, it causes problems and loss to all parties involved in the project, either directly or indirectly (Wafa & Singh, 2013). Sambasivan and Soon (2007) listed cost overrun, time overrun, disputes, litigation and total abandonment of the project as having a bad effect on the economy.

3.1.5.3 Dispute between owner and contractor
Diekmann and Girard (1995), hold that a dispute in any contract, question or controversy that must be settled beyond the jobsite management. The Construction Industry Institute (1995) outlined a dispute as a disagreement between the parties that cannot be resolved by on-site personnel. Both definitions highlighted the significance of onsite disputes as first occurring on site, then escalating through the company hierarchy. Disputes normally emerge due to disagreement and expenses during the construction project. Furthermore, disputes result in time overrun, cost overrun, litigation and even complete abandonment of project (Sambasivan & Soon, 2007).

Ayudhya (2011) mentioned that disputes that occur between client and the main contractor may arise from contractual relationships, time-related issues when the main contractor claims an extension of time for the completion of project, and money-related issues in regard to contractor payment of the value of variations or reimbursement of loss and expenses. In addition, quality-related issues are noted by the client as a result of faulty material and workmanship. Disputes hinder and even prevent the implementation of construction projects by increasing the duration of the project.

3.1.5.4 Cost overrun

Cost escalation due to project delay in road infrastructure projects is not unusual. Cost escalation occurs in most road construction projects (Kaliba et al., 2009). Three major causes of the modification of preliminary estimates reflect more detailed plans and specifications and changes in the scope of work (Hayat & Amaratunga, 2011). The Malaysia Contractors Association (2006) reveals that some contractors owed RM 100 billion to RM 200 million within four to five years, mainly in final payments. There are even contractors who have loans from the banks because of delay in payment. Delay in payment has a negative impact on contractors, especially contractors with little capital (Yusuf et al., 2012).

There are problems of the unreliability of supplies and the price of construction materials. These issues are the most prevalent in the Malaysian region and such problems lead to the poor performance of the construction deliveries (Olanrewaju & Aziz, 2015). The most significant issues causing cost overrun in Malaysian construction are the fluctuation of prices of materials, cash flow and financial difficulties faced by the contractor, and poor site management and supervision (Rahman et al., 2013).

3.1.5.5. Reworks
According to Hayat and Amaratunga (2011) during the post-disaster reconstruction stage, the functionality and serviceability of transport infrastructure has a huge impact on the overall rehabilitation process. Poor transport infrastructure has been among the factors that cause an increase in transportation cost and construction lead-time (Hayat & Amaratunga, 2011).

3.1.5.6 Decrease in quality

Decreasing quality decreases productivity due to rework and waste becomes a problem. Workers’ attitude and confidence are important factors influencing construction productivity (Zue, Wilkinson & Sendon, 2011).

3.1.5.7 Abandonment of projects

Abandonment of construction projects is a waste of resources, as well as being bad for a company’s reputation. The results of abandoned projects play a major role in the economy of a developing country such as Malaysia (Hoe, 2013). It is one of the most prevalent effects on delays and poor performance in the construction industry. All factors (client-related, consultant-related, contractor-related, and external factors) contribute to the abandonment of projects. Many projects are temporarily abandoned during a financial crisis, poor cash flow and economic conditions. Those abandoned projects become so prohibitively expensive that they have been abandoned permanently (Sambasivan & Soon, 2007).

3.1.5.8 Construction waste

Illegal dumping is currently a serious issue countrywide. Construction waste can be material waste or schedule wastes generated throughout the project from the pre-construction stage, rough construction stage and finishing stage. Construction waste has negative effects such as environmental pollution and severe ecological damage (Nagapan et al., 2012). Construction waste increases transportation charges which then increase the project cost, landfill fees and increased prices of raw materials. Construction waste can be threatening to the well-being of society (Nagapan et al., 2012).

3.1.5.2 Beneficial effects on the Malaysian economy

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Among the beneficial effects of roads infrastructure, the following were identified:

3.1.5.2.1 **Roads infrastructure reduces traffic congestion**

The Malaysian government continues to cater for the growing volume of trips by private vehicles by building new roads, expanding existing ones and constructing roads. By doing that, government is continuously accommodating the ever-increasing volume of traffic which is no longer tenable and new urban transport policy is imperative (Naidu, 2007).

3.1.5.2.2 **Tourism attraction**

Tourism uses mostly unskilled or semi-skilled labour. Furthermore, tourism development can affect the business climate for small enterprise development, the patterns of growth of the local or national economy and the infrastructure or natural resource base of the destination (Ashley et al., 2007).

Tourism rely mainly on transport and the construction industry must monitor the maintenance of roads, rails track and even other means of transport. It is important for all tourism stakeholders to take part in developing tourism. Transportation and good roads can be turned into tourism attraction elements. The benefits are reduced travelling time, shortened distances, lower transport costs, the geographical position of the road, and comfort (Mdusm, 2016).

3.1.5.2.3 **Poverty alleviation**

The National Infrastructure plan was introduced in 2012, with the aim of transforming South Africa’s economic landscape. One primary aim of the plan is job creation and improvement in service delivery. To achieve these goals, the government invested R827 billion in new and existing infrastructure. This initiative focused on transport infrastructure, ports of entry, electricity generating capacity and improving other public facilities. The aim is to promote economic growth in South Africa (Presidential Infrastructure Coordinating Commission, 2012).

3.1.5.2.4 **Increase investment**

Many joint ventures arranged with foreign construction companies promote Malaysian construction companies to invite more attractive investment concepts (Kerur, 2006).

3.1.6. **THE IMPACT OF STAKEHOLDERS ON ROAD INFRASTRUCTURE PROJECTS**

The effect of delays in construction projects which are due to poor performance are different according to the type of project. However, infrastructure development projects such as highway
can cause huge economic loss to the country as a whole apart from a delay in the construction of a house that only affects the respective client (Sambasivan & Son, 2007).

3.1.6.1. Accusation

The Malaysia Government has been accused of privatising road construction and has been condemned on that account. Naidu (2008), stated that people are saying the approach in which the private sector is indicated into the infrastructure sector, is authorized for political favouritism and cronyism.

3.1.6.1.2. Road fatalities

Roads accidents disproportionately affect the poor people such as pedestrians compared with those from wealthy families. Those less well-off drivers and passengers are also at greater risk of death than the more affluent ones (Lynch et al., 2004).

3.1.6.1.3 Roads traffic congestion

Mdusm (2016) argued that congestion leads to delays which waste time, energy and have a negative effect on the transportation system, especially during peak hours.

3.1.6.1.4 Social impact

Pomlaktong et al. (2013) believe that road development brought considerable negative social impacts such as the deterioration of urban areas, the rise in slum areas, an increase in ineffective land use and environmental impacts such as encroachment on forest areas, carbon dioxide emissions, massive energy consumption and water pollution (Pomlaktong et al., 2013).

The roads upgrade and rehabilitation benefit local people; however, it affects biodiversity. Many roads in Malaysia have been used to hunt animals for a living and for commercial purposes. Throughout Malaysia there is much poaching in forests for traditional Chinese medicine and game (Clements, 2013). On the other hand, internal stakeholders such the main contractors on the project are in payment default difficulties for loan and service agreements which affect their profits and the productivity of the construction industry. The high number of litigations are due to claims and disputes (Olanrewaju & Aziz, 2015).

3.1.6.5. Running multiple projects at a given time by the contractor
Running many projects at the same time by contractor can affect the quality of work on projects, owing to inadequate supervision. Both the quality and progress of construction can become affected if contractors undertake more projects than their capacity permits. Inadequate supervision invariably results in poor quality work and complaints from the client (Dolage & Pathmarajah, 2015).

3.1.6.6. Opportunities

There are many opportunities for Malaysian local contractors and professionals to offer their services abroad (Olanrewaju & Aziz, 2015).

3.1.7 WAYS TO MITIGATE PERFORMANCE OF ROADS INFRASTRUCTURE IN MALAYSIAN PROJECTS

Construction industry in Malaysia is faced with on-going problems such as performance on construction projects due to a number of factors such as time overruns, cost overruns, poor productivity and construction waste. Therefore, there is a need to mitigate the poor performance on road infrastructure projects (Nazirah, 2015). Some of the mitigation measures that may be applied are listed below:

3.1.7.1 Quality management

Good quality management makes the project successful. Quality can be improved by controlling and monitoring the quality of work significantly. Some of factors that need to be taken into consideration in quality improvement are communication, the availability of technical staff, ISO certification and good procurement. Contractors should apply new technology where necessary and build effective risk management teams. Daily supervision of material and progress of work on site is essential (Abas et al., 2015). Project managers’ and project stakeholders’ attitudes contribute to project success and the quality of work on site. Effective monitoring, feedback, technical capacity, leadership quality, power to take decisions, adequate capacity all contribute to running the project properly by the project manager (Munyoki, 2014).

3.1.7.2 Stakeholders’ management

Project stakeholders should work together and ensure that all disputes are mitigated during the construction period to avoid extension of time on projects and during the litigation process, if any dispute arises (Muhwezi & Otim 2014). Keeping stakeholders informed assists and encourages them to ensure the successful implementation of project strategies (Takim, 2009).
3.1.7.3 Arbitration
One or more arbitrators are appointed to resolve a dispute in a manner according to procedures laid down in the Arbitration Act 42 of 1965 (CIDB, 2003). Client-related and contractor-related issues in terms of contract agreement lead to disputes which need to be settled by an arbitration process. A competent third party can settle the disputes in a good-natured way without going to the courts (Sambasivan & Soon, 2006).

3.1.7.4 Litigation
At this stage of litigation, advocates are appointed by both parties involved in the dispute. The advocates present their sides of the disagreement in a court of law to convince the judge which party has the better legal case (CIDB, 2003). Client-related, labor-related, contract-related, and relationship-related issues as well as external factors normally escalate to disputes which need to be settled by the litigation process. Most of the parties involved in projects use litigation as a last resort to settle disputes (Sambasivan & Soon, 2006).

3.1.7.5 Running multiple projects at a given time
Contractors should appraise many factors that can hinder him/her before taking on a number of projects concurrently. The contractor should consider factors such as availability of equipment, machinery, financial resources and personnel, among others (Dolage & Pathmarajah, 2015).

3.1.7.6 Workshops
Workshops should be provided to teach senior management about their construction organizations (Wijekoon, 2013).

3.1.8 MEASURES TO ASSESS THE PERFORMANCE OF ROADS INFRASTRUCTURE PROJECTS
Performance measurement is a regular collecting and reporting of information about the inputs, efficiency and effectiveness of construction projects. Top management of organizations use performance measurements to evaluate the project performance and to improve efficiency and effectiveness in their organizations (Takin & Akintoye, 2003). Performance measures are defined as a process that is concerned with inputs and outputs. Inputs involve the knowledge, skills and
competencies which are required to reach the expected results while outputs involve meeting target, standard or indicators (Armstrong, 2006).

In the previous chapter, it was mentioned that most of all developed and developing countries share common factors to measure performance such as time factors, cost factors, quality factors, client’s satisfaction, end-user’s satisfaction, and health and safety factors, among others. The current study focuses on thee aspects, namely cost, time and quality performance measurement of the project.

3.1.8.1 Cost performance factor
Cost performance is important indication of project success. The construction industry has been facing cost performance problems which relate to the inability to complete projects within allocated budget (Rahman et al., 2013). Cost performance is the most important factor in measuring project performance because it indicates how much the project is over or under budget. Cost variance is used to measure the performance of engineering projects. Cost variance is calculated by the difference between the actual cost and the budgeted cost of a project (Ali & Rahmat, 2010).

3.1.8.2 Quality-performance factor
Quality performance is assessed by companies using a project management process which includes all activities required to oversee the project and attain the project objectives such as planning and controlling on a continual basis. Also assessed is the project’s product activities such as design/engineering, procurement and construction (Sodangi & Khamidi, 2015).

3.1.8.3 Time-performance factor
It is important to complete projects on the specified time stipulated on the project contract and the client, end-users and other stakeholders will be looking forward to project success (Lim & Mohamed, 2000).

3.1.9 LESSON LEARNT
It is advisable to use performance assessment to monitor and control projects to ensure favorable outcomes. The goals of assessing factors that influence the performance management and the mitigations could be better achieved if the approach is taken into consideration and implemented in the Malaysian construction industry. The study learnt that;

• Malaysia construction cost overruns are mostly caused by the fluctuation of material prices, cash flow and financial difficulties faced by the contractor, as well as poor site management and supervision.
• Communication problems have to be improved in order to increase the productivity, efficiency of work and safety on the construction site (Valitherm, 2014).

• Poor performance perceived by contractors and consultants are the same as those of the client, therefore all parties (client, consultant and the contractor) should contribute to the industry to mitigate the poor performance. The study can assist the practitioners (client, contractor, and consultant) and the academicians to have a better understanding of the dynamics of project management and in order to reduce the incidences of delaying the project (Sambasivan & Soon, 2006).

• Contractors from Malaysia rely on a suitable of sub-contractors, specialist contractors, material suppliers and equipment suppliers which might be the cause of poor performance (Bandyopadhyay et al., 2008).

3.2 INDIA

3.2.1 INDIAN HISTORY

India is officially called Republic of India, and is situated in South Asia. It has a population of 1,324,171,354 (2016 estimates). A total of 80% of Indian people are Hindu, 13% are Muslim and 2% are Christian which causes tension among the different religious groups. The president of India is Ram Nath Kovind. India is divided into three main regions, namely, a rugged mountainous Himalayan region in the northern part of the country, the Indos Gangetic Plain where largest-scale agriculture takes place; and the plateau region in the southern and central portions of the country. India has three major rivers, namely the Indus, Ganges and Brahmaputra (Wikipedia website-New Delhi). The union government comprises three branches which are the executive, legislative and judicial. India comprises 29 states and seven union territories. It is the sixth largest economy by market exchange rates at US$ 9.489 trillion, and the third largest by purchasing power party or PPP. India is one of the world’s fastest growing economies (Sheridan, 1995). India is home to two major language groups, the Indo-Aryans (about 74% of the population speaks that language) and Dravidian which about 24% population speaks. There is no national language. However, Hindi has the largest number of speakers and it is the official language of the government. English is used in business and administration (Sherind, 1995).
3.2.2 INDIAN CONSTRUCTION INDUSTRY

The Indian construction sector is considered to be the second largest employer and contributor to economic activity after the agriculture sector, accounting for 1.1% of India’s GDP of which the construction industry contributes 8% to the GDP. The construction sector employs more than 35 million people in India. Almost 50% of construction activities are infrastructure and the rest comes from industrial residential and commercial development and the like. The Indian construction industry’s value is estimated to be more than US$126 billion. The government has identified infrastructure as one of the key drivers of economic development in the country. Infrastructure investment increases from about 5% of GDP in the 10th five-year plan period to 9% in the 11th five-year plan period. India has the largest road network globally, followed by the United States and China. The annual growth of the road network in India is projected at over 12% for passenger traffic and over 15% for cargo traffic (Choi, 2014).

Organizations such as the NBCC (National Building Construction Corporation of India), BAI (Builders Association of India), NBO (National Buildings Organization) and BIS (Bureau of Indian Standards) contributed to the development of the construction industry. Furthermore, there are major segments in Indian construction industry, namely general contractors who deal with residential, industrial and commercial buildings; the second segment which comprises heavy
engineering construction contractors who construct the roads, highways, bridges, tunnels, ports and harbours; and thirdly, the special trade contractors who specialise in trade works such as carpentry, printing, plumbing, and electrical work, amongst others (Narayana, 2011). The industry is controlled by a handful of major companies involved in the construction activities across all segments; medium-sized companies specializing in niche activities; and small and medium contractors who work on a subcontractor basis and carry out the work in the field. In 2011, there were slightly over 500 construction equipment manufacturing companies in India. The sector is labour intensive and, including indirect jobs, provides employment to more than 35 million people (Shete & Kothawade, 2016).

Contractors in road construction make small profits – about 20-25 % less than those who are engaged in construction of real estates. Real estates has shown huge demand in the last decade. The Indian construction sector allows 100% foreign direct investment (FDI) in the real estate industry, thereby stimulating construction activities throughout the country (Bandyopadhyay et al., 2008). India’s roads are already congested and there is traffic everywhere; therefore, the country needs to improve the road infrastructure (Montgomery, 2008). The Indian government implemented the National Highways Development Project (NHDP) to upgrade, rehabilitate and widen major highways. The NHDP is implemented in seven phases of which 33,500 kms are already developed and 21000 kms are under implementation waiting for the awarding of contract. The private sector is utilised through contracting and public-private partnerships (PPPs) (Choi, 2014).

The Indian road network is divided into national highways, state highways or PWD roads and rural roads. The government of India estimates around US$ 27 billion plus private investment is required over FY12-FY17 to improve the country’s road infrastructure. Indian railways are the world’s second largest employer with a workforce of 1, 5 million. It is the largest system of passenger carriers in the world. It has the world’s fourth largest rail network comprising 115,000 km of track over a route of 65 000 km and 7,500 stations (Choi, 2014). There are currently 13 major ports in India under the jurisdiction of the central government of India and 180 non-major ports governed by the state government. However, only 60 non-major ports are currently operational. There are total of 454 airports in India, of which 90 are open for commercial service and 16 are designated as international airports. The busiest airports in India are those of Delhi and Mumbai. Furthermore, there is urban infrastructure which houses only 30 % of the Indian population. India is facing major constraints of water and solid waste management which are the responsibility of state government (Choi, 2014).
3.2.3 PERFORMANCE IN INDIAN CONSTRUCTION

Compliance with quality specifications and performing work to the expected quality level are the important performance measures that have been recognized since early days (Jha & Iyer, 2006). Performance measures improve the performance of the construction industries in several countries, including India, at various levels of socio-economic development (Loganathan et al., 2017). Many of the Indian medium sized and a few large road construction companies are still family-owned enterprises which experience a lack of professional management composition and culture. The construction industry acts as a catalyst to encourage the nation’s economy growth; however, many Indian government reports have condemned the construction industry’s poor performance in terms of productivity and quality systems in the country (Naik & Sharma, 2015).

Construction projects are more regularly than not plagued by poor performance such as cost overruns, low productivity, construction waste and compromised quality (Jusoh & Kasim, 2017). The construction industry in India has also encountered problems regarding performance issues. The performance challenge relates to a wasteful workforce, planning defects and the mentality of the construction workers. Large numbers of unskilled labourers and unregistered contractors...
become a problem when measuring performance (Nihas et al., 2013). The industry is having a hard time recognizing the origin of its own problem and has not developed a significant enough solution to overcome the large numbers of poor performing projects in terms of on time, on budget, and with high rates of customer satisfaction (Rivera et al., 2017).

Indian construction projects performance has not been well so far with infrastructure projects costing around 4.45 million dollars of which 40% are delayed and that delay ranges from one to 252 months. Under-performing in the construction industry is not limited to India but rampant in other countries nationwide. Construction industry improvement initiatives such as India (Ci3) and the Indian Institute of Technology (IIT) were formulated to identify and address critical challenges in the India context (Loganathan et al., 2017). Larger numbers of infrastructure projects in India have been delayed owing to various issues. Infrastructure plays a paramount role in the economic growth of India and it is one of the leading outsourcing hubs in the world (Shete & Kothawade, 2016).

3.2.4 FACTORS INFLUENCING PERFORMANCE IN THE ROAD INFRASTRUCTURE OF INDIA

Factors influencing poor performance in construction projects are mostly delays and schedule overruns which are common phenomena in projects worldwide, especially in the developing countries (Wanjari & Dobariya, 2010). India shows worst schedule performance compared to other nations. Factors that contribute to poor performance among others are identified below:

3.2.4.1 Cost implications

Cost overrun is defined as when the final cost of the project exceeds the original estimates. There are many factors that lead to cost overrun in construction projects. Some of the factors responsible for cost overrun in the construction are the price escalation of raw materials, high labor costs, disputes, and delays in planned activity (Wanjari & Dobariya, 2016). The Ministry of Statistics and Programme Implementation (MOSPI) stated that most of the Indian projects in the public sector are seriously affected by cost overruns owing to various reasons.

3.2.4.2 Time factor

When a project is behind the completion date specified on the contract agreement for delivery of final product, that is a time overrun and it is usually challenge in most projects. A project that is
completed within specified time on contract agreement saves time and money which is an indication of efficiency and an effective project management. However, it happens very rarely (Azhar et al 2008).

3.2.4.3 Poor quality
It is critical to achieve quality in construction projects because poor quality leads to reworks, and the dissatisfaction of client, contractor, designer and consultant (Shanmugapriy & Subramanian, 2015). Poor quality of roads infrastructure and high volumes of passengers and freight traffic, among others, expose the condition of Indian roads. There is an increasing demand for quality roads infrastructure in India (Sahoo, 2011). Loss of production, increase in cost, reworks and repairs, bad company reputations and loss of market share are the results of poor quality (Jha & Iyer, 2006).

3.2.4.4 Contractor issues
Dinesh (2016) also highlighted issues such as reworks, difficulties in financing projects or insolvency, conflict between sub-contractors’ schedules during execution, conflicts between contractors and other stakeholders, ineffective and inadequate early planning and scheduling of projects, poor estimation of project time and quantities of material required before contracting, and improper safety management by the contractor as serious issues when it comes to contractors’ performance (Dinesh, 2016).

3.2.4.5 Consultants’ inadequate experience
Consultants have their own challenges on projects which lead to poor performance such as inadequate experience of consultants’ engineering staff, delays in approving overall designs, shop drawings, incompetent or poor management by consultants, delaying to perform site inspections and testing (Dinesh, 2016).

3.2.4.6 External factors
External factors of unforeseen substances including force majeure have a negative impact on performance for roads infrastructure projects. The political complexities, price fluctuations or inflation, unforeseen site conditions, delay in regulatory approvals, change of laws and regulatory framework are examples of external factors (Devi & Anantharayanan, 2017).

3.2.4.7 Land acquisition
It is a huge restriction to infrastructure development countrywide. People who forego their land are given poor compensation and an undervalued market price of land and therein lies the recipe for many a dispute by the affected population, thereby impacting land acquisition. Infrastructure projects in India are generally affected and delayed owing to problems of land acquisition (Sahoo, 2011). Delays in land acquisition is one of several factors that delay the project. The reason for this is the resistance by the local community. The resistance occurs due to poor compensation and an under-valued price of land which lead to many disputes with the local community (Shete & Kothawade, 2016).

3.2.4.8 Poor communication
Poor communication leads to poor production on site. Researchers identified the source of poor communication on site as workers misinterpreting supervisors’ instructions, workers being uncertain of the work but afraid to ask, noise disruption on site (Olanrewaju, Tana & Kwan, 2017).

3.2.4.9 Collusion
This form of corruption includes abuse of power, bribery, extortion, fraud, embezzlement and money laundering. Corruption can be petty corruption which happens every day, through little payments that are extracted by public officials from the users of services paid to secure routine services such as getting invoices paid, certifying completion of the works or obtaining customs’ clearance for equipment and materials or grand corruption where the politicians, senior officials or major companies acquire public resources using their power, wealth and status. Grand corruption takes place during the early stages of a project and it involves financial rewards for one-off acts of corruption (Hawkins, 2013). Collusion leads to higher prices and significant cost overruns due to false claims, which reduce the resources available to government for other public services. Poor quality infrastructure leads to higher maintenance costs and shortens the lifespan of that infrastructure. Furthermore, government can be found liable for an accident caused by defective infrastructure for which it is responsible (Hawkins, 2013).

3.2.4.10 Conflicts
Conflicts vary in terms of legal, political and institutional frameworks, economic constraints and pressures, people’s culture, social structure, stakeholder interests, technical knowledge, environment and history, to name just a few influencing factors. In a construction project, conflicts may occur in one stage and evolve to the next (Chinyio & Olomolaiye, 2009).
3.2.4.11 Fraudulent practices and bribes
Fraud is one of the economic crimes which involve acts such as swindling, trickery, misinformation or deceit, false misrepresentation or concealment of facts for commercial gain. Bribes are illicit economic incentives used to obtain a favourable decision from a person in a position of power, for example, contractor selection, incorrect payment, and sacrificing quality (Effah et al., 2017).

3.2.5 THE EFFECTS OF PERFORMANCE OF ROAD INFRASTRUCTURE
Roads are the most important transport mode in India, carrying 60% of the freight turnover compared to 31% for railways. The highway projects undertaken are therefore crucial parts of India transport strategies and of high importance for the development of the country (Alder, 2016). Road transport accounts for 65% of freight movement and 80% of passenger traffic in India. National highways constitute about 1.7% of this road network, carrying more than 40% of the total traffic volume. Roads infrastructure has a beneficial effect on the Indian economy (Ghani et al., 2014). The negative effects of the road infrastructure is when the infrastructure projects encounter time overruns, cost overruns, disputes, arbitration, litigation and distrust by owner on interim payment certificates which lead to contractors’ cash flow problems, abandonment of projects, and difficulty in maintaining a company’s reputation, amongst others (Dinesh, 2016).

3.2.5.1 Cost overrun
Cost overruns are regarded as a disagreement between the actual cost of a project and its cost limit. It happens when the results of the cost target of a project exceeds its cost limits and where the cost limit of a project refers to the highest expenditure that the client is prepared to make on a completed building project (Memon, 2012). Shete and Kothawade (2016) identified factors such as slow decision making, poor schedule management, increase in material/machine prices, poor contract management, poor design/delay in providing design, rework due to wrong work, problems in land acquisition, wrong estimation/estimation methods, and long periods between design and time of bidding/tendering as the major causes of cost overruns.

3.2.5.2 Time overrun
Indian projects are experiencing time overrun varying from a few months to five or more years, thereby placing the project viability at risk. Land acquisition process and site hand over are the primary reasons for time overruns in the planning phase of a project (Shete & Kothawade, 2016).
3.2.5.3 Abandoned of projects

Abandoned of construction projects normally occur when contractors experience too many problems and realize that it is impossible to continue with construction works. Most of the projects that are abandoned in construction are buildings, roads, industrial structures, bridges, factories, dams, communication projects and many more. Roads projects are one of the projects that have been abandoned in most cases. The abandoning of project has effects on parties such as developers, contractors, consultants and clients, among others and the lawsuits, conciliation, cash flow problems and other issues follow (Doraisamy et al., 2014). Among the causes of abandoning projects are incorrect estimations, unskilled personnel, inadequate planning, poor risk management, misunderstanding of the work requirements, poor quality control by regulatory agencies, corruption, and communication gaps among the personnel (Doraisamy et al., 2014).

3.2.5.4 Disputes

Disputes may arise due to poor communication; unfair risk allocation; unrealistic time, cost and quality targets by the client; an adversarial industry culture; an inappropriate contract type or unrealistic information expectations. Inadequate brief, slow client responses, inaccurate design information, inaccurate design documentation, inappropriate contract forms, inadequate contract administration, and inappropriate contractor selection are regarded as common causes of disputes (Sinha & Wayal, 2013).

3.2.5.5 Reworks

Reworks are the activities in the field that have to be done more than once, or activities which remove work previously installed as part of the project regardless of source, where no change order has been issued and no change of scope has been identified by the owner. Reworks are normally caused by project scope changes, design changes or errors and quality deviation (Dougherty & Hughes, 2012).

3.2.6 THE IMPACT OF STAKEHOLDERS ON THE ROAD INFRASTRUCTURE PROJECTS

The main stakeholders in a construction project coalition are the client, the architect and the contractor. The interactions and interrelationships between these stakeholders largely determine the overall performance of a construction project, and have the crucial responsibility for delivering a
successful project. Stakeholders can be divided into internal and external stakeholders where internal stakeholders are those directly involved in an organization’s decision-making process such as owners, customers, suppliers, and employees while external stakeholders are those affected by the organization’s activities in a significant way such as neighbors, local community, public, or local authorities (Ganesh, 2016). The Indian construction industry’s stakeholders are the government, which is the client in this case, contractors, consultants, suppliers, industry associations and build-operate-transfer (BOT) contracts (Bandyopadhyay et al., 2008).

The stakeholder management must have social responsibilities towards supporting effective management. Knowledge gained by stakeholders is very important and that knowledge varies from full awareness up to total ignorance. If the stakeholder lacks sufficient knowledge, it is considered a driver affecting stakeholder impact on project. When the stakeholders gain knowledge in the project, that knowledge gained will help them to achieve their objectives in future projects. Stakeholders minimise the conflict on the project as they prefer transparent alternative solutions to the decision taken (Waghmate et al., 2016). Poor cost performance in the mainstream project and construction management literature are the responsibilities of the key stakeholders (clients, consultants, and contractors) to manage this chronic problem in the construction industry. Clients must ensure that the mode of financing for the project will not affect their ability to pay the contractor for the completed works on time and the contractor, on the other hand, should follow proper construction practices and have a very good track record. Furthermore, the consultant should manage the project team accordingly (Aneesa & Sabarinathan, 2016).

The effects of displacement spill such as loss of the traditional means of employment, changes of environment, disrupted community life and relationships, marginalization, and profound psychological traumas that are caused by land acquisition to the land owners all amount to negative impacts (Sahoo, 2011). The involvement of the necessary stakeholders at appropriate times, soliciting and respecting their opinions is important, whereas lack of trust between stakeholders is a critical deficiency in stakeholder management in the Indian context. Furthermore, lack of commitment of project participants, conflict amongst them, and their indecisiveness affect project schedules and cost performance in the Indian construction industry (Loganathan et al., 2017).

(a) External stakeholders
External stakeholders impact the project differently according to their potential threat or benefit to the implementation of the project. An external stakeholder analysis is essential for determining the
obligations that the developer and project manager have towards the external stakeholders in a project (Olander, 2006).

The basic problem is that if a facility is to be built, some external stakeholders will be negatively affected by that facility or by the implementation of the construction project leading up to it. It follows that, during implementing of a construction project, not all needs and concerns from external stakeholders can be fulfilled. The position that each stakeholder takes towards the project determines the direction of the impact this stakeholder has on the project decision-making process. The position taken is mainly due to concerns from stakeholder needs in relation to the project and how these have been treated by the project manager. The impact of external stakeholders’ changes throughout the life of the project depends largely on the perceptions external stakeholders have of the project (Olander, 2006). External shareholders may sound vague and have intangible expectations about tangible outcomes simply because they do not have the required knowledge and resources to conduct the realization of the project design and may not have all the understanding to take decisions about specific constraints of time, money and specifications. External stakeholders are not fully involved on project but influence the success of a project in a tangible way (Ramel, 2014).

The construction sector absorbs more employment for female workers in India. Female construction worker growth has been larger than male construction workers. Female construction workers are mainly involved in secondary work such as weight lifter, dust lifer, digging worker and brick handling. Female construction workers are involved in both the public and private sectors. The public sector provides more employment for female workers than the private sector and public sector growth has been large. However, the public sector has less disparity in wages in construction industries compares to the private sector (Gandhi, 2014).

(b) **Internal stakeholders**

Gibson (2000) like other researchers, explained internal stakeholders as those who are formally related to the real estate development project in question - property, customers and employees - while external stakeholders can be defined as those who in some way may affect the project. Project managers of the project are internal stakeholders of project that identify and interact with key stakeholders in the project system’s environment based on stakeholders’ common interests and needs of the project (Waghmare & Wagh, 2016). Generally, the main contributors in the construction industry are the client, consultant and the contractor:
Client: The government is the client on the infrastructure such as road projects. Most of the road projects are funded by the state (Otima & Alinaitwe, 2013). Clients employ construction contractors through bidding or tendering (Ngacho, 2013). Engineering consultants: Consultants’ functions differ and are determined by the clients’ needs. Generally, the engineering consultants’ services are to do works such as feasibility engineering investigations, designs and drawings works. They also estimate, plan, budge, prequalify sub-contractors, supervise construction works, oversee the administration of contracts and the controlling of project time, cost, quality and scope management (Otima & Alinaitwe, 2013). Engineering consultants also take technical, organizational and human responsibility for projects (Ngacho, 2013).

Construction contractors play an important role in the construction business as they carry out most of the construction activities (Otima & Alinaitwe, 2013). Contractor perform the construction in accordance with relevant technical management and contract specifications (Ngacho, 2013).

3.2.7 MITIGATING POOR PERFORMANCE OF ROAD INFRASTRUCTURE IN INDIA

Most of the studies have identified the problems that delay and cause poor performance in the construction industry without concentrating on finding solutions to mitigate those problems (Olawale & Sun, 2010). Below are some ways to mitigate poor performance in the Indian construction industry:

3.2.7.1 Public-private partnership (PPP)

Indian government is active in supporting PPPs financially and increasingly look for more private sectors to finance, build and operate infrastructure assets. However, PPPs have been far from satisfactory to meet the supply demand gap in the infrastructure facilities (Sahoo, 2011). Private sector participation is integral to these plans. PPPs have been identified as the most suitable mode for the implementation of projects and are rapidly becoming the funding norm. Their share of the total planned infrastructure improvements is projected to be around 30% (US$150 billion). Power and road projects top the list, and other transportation sectors such as railways, ports, and airports are also targeted for major investments (Montgomery, 2008).
3.2.7.2 Quality management
To increase good performance in the Indian construction industry, studying and improving the factors that affect the quality significantly can help (Shanmugapriya & Subramanian, 2015). Contractors must have well-maintained equipment to achieve the required quality and to minimize constant equipment breakdown on site as it influences contractors’ poor performance. Contractors and their workers must attend training programmes and organize quality control meetings to achieve high quality standards during production (Akomah & Jackson, 2016).

3.2.7.3 Land Acquisition Act of India
There is a need to amend the Land Acquisition Act of India in the regulatory framework on environmental and land acquisition issues. The use of technology such as satellites and alternative paradigm to the existing Land Acquisition Act can assist to fast track the process (Sahoo, 2011).

3.2.7.4 Collusion prevention
Paying public servants reasonable wages can minimize corruption while transparency and accountability of the procurement process can be enhanced by different ways such as using e-procurement and training people to monitor the procurement process. Separating profit and labor costs from the rates for materials and equipment in the bill of quantities (BOQ), audits, red flags and an anti-corruption system can prevent collusion (Hawkins, 2013).

3.2.7.5 Good planning management
Good planning of site and supervision of the project using proper methods such as regular meetings on development, employing proficient sub-contractors and suppliers, using proper channels for communication, utilizing the latest technology and understanding pre-construction planning would help to plan properly for construction mitigation of poor performance (Aziz et al., 2012).

3.2.7.6 Price escalation
The clause for price escalation should be removed from the tender documents and that cost should be borne by clients in case material costs have increased due to fluctuation or inflation (Wanjari & Dobariya, 2018).
3.2.7.7 Effective communication
Communication is a fundamental social activity that includes conversations, listening to co-workers, networking, gathering information, directing subordinates and transferring information through electronic devices such as smartphones or computers. All these activities are carried out in the construction projects to achieve success in the project (Ferrer, 2017). Regular communication among project participants during all project phases assist in project success (Shete and Kothawade 2016).

3.2.7.7 Policies and regulations
Indian government policies must encourage investments for both local and foreign private capital domestic infrastructure. The Indian government has introduced significant policy reforms which make the country a favorable destination for foreign investors such as 100% FDI under the automatic route for a broad range of sectors (Montgomery, 2008).

3.2.7.8 Reduce cost overrun
The methods that can help to reduce cost overruns include, among others, efficient planning, proper management of site and supervision of the project, suitable planning and arrangement of projects, proper methods for construction, regular meetings on the development of the project, and hiring proficient subcontractors and suppliers (Shibani & Arumugam, 2015). Project planning, monitoring, material prices and labour rates should be updated continuously in an attempt to stay within the defined scope of works, constantly tracking and measuring the progress (Shete & Kothawade, 2016).

3.2.7.9 Stakeholder management
Early involvement of major stakeholders, their ideas and opinions can reduce conflicts of interest in the project and promote their commitment. Building trust among the client, contractor, and other stakeholders will facilitate contractual and stakeholder management (Loganathan et al., 2017).

3.2.7.10 Time management
Enough time should be given for preparing feasibility studies, planning, design, information documentation and tender submission to avoid or minimize late changes (Shete & Kothawanda, 2016).
3.2.7.11 Dispute minimization
Project management involves minimizing scope changes, providing adequate time to plan; developing contract documentation; organizations’ practices, policies, procedures, culture and social responsibility of the firm; and bearing in mind the people perspective, especially the client and stakeholders (end-users) who need to be kept constant informed and integrated during the design phase (Sinha & Wayal, 2013).

3.2.7.12 Resolving conflicts
Procedures to tackle conflicts need to be established to simplify conflict evolvement between external stakeholders owing to their diversity (Waghmare & Wagh, 2016). Contract agreements should be used to bind internal stakeholders, whereby the rights and duties of the parties are set, as well as the risks each party ought to bear and whether these can be insured. Additionally, contracts usually establish the resolution procedures of conflicts possibly arising from their relationships. Conflict management can be added as the best approach system that can integrate the conflict between the parties (Moura & Teixeira, 2010).

3.2.8 MEASURES USED TO ASSESS THE PERFORMANCE OF ROAD INFRASTRUCTURE PROJECTS
The various parameters to measure performance are identified as cost, time, quality, productivity, client satisfaction, health and safety and environment (Patel & Malek, 2016). Construction performance can be approached in two ways, namely business performance of the organization and project performance. Performance measurement is the process of ensuring organization strategies that lead to the achievement of overall goals and objectives. Performance measurements quantify the efficiency and effectiveness of an action taken by the organization, attributed in the inadequacy of measures with construction companies claiming to have difficulties in identifying and selecting adequate performance measures related to their strategies and critical process (Ankrah & Proverbs, 2005).

Traditionally within the construction industry, performance has been measured in terms of cost, time and quality. Besides the traditional reliance measures of cost, time and quality, other framework measures include client satisfaction, environmental impacts, health and safety and profitability are used (Ankrah & Proverbs, 2005). Critical success factors are essential for the performance of construction projects and affect the objectives of construction projects such as budget, performance, quality and the completion of project in achieving success in construction.
projects in the Indian construction industry (Shibani & Arumugam, 2015). Iyer and Jha (2006) identify the four performance evaluation criteria as schedule, cost, quality, and no-dispute. There are many factors that contribute to the success and the failure of projects.

In table 3.2 the different researchers highlight the various types of performance measures in the Indian construction industry which are related to each other:

Table 3.2: Performance measures to assess road infrastructure performance in India

<table>
<thead>
<tr>
<th>Author</th>
<th>Measures</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ankrah &amp; Proverbs, 2005</td>
<td>Cost, time, quality, client satisfaction, environmental impacts, health &amp; safety, profitability</td>
<td>India</td>
</tr>
<tr>
<td>Shibani &amp; Arumugam, 2015</td>
<td>Budget, performance, quality</td>
<td>India</td>
</tr>
<tr>
<td>Iyer and Jha, 2006</td>
<td>Schedule, cost, quality, and no-dispute</td>
<td>India</td>
</tr>
<tr>
<td>Patel &amp; Malek, 2016</td>
<td>Cost, time, quality, productivity, client satisfaction, health and safety and environment</td>
<td>India</td>
</tr>
<tr>
<td>Takim, Akintoye &amp; Kelly, 2003</td>
<td>Time, quality, safety, client satisfaction, profitability, productivity</td>
<td>India</td>
</tr>
</tbody>
</table>

(Source: Researcher’s field work)

Cost

Construction cost is the most vital principle of project success and the consequence of project performance is expressed by cost and its variance from the budget. Measuring cost variance in construction is important to understand the performance of the project and its financial risks in its execution (Devi & Ananthanarayanan, 2017).

3.2.9 LESSON LEARNT

From the literature review on the Indian construction industry, a number of lessons can be learnt regarding the factors influencing the poor performance, ways to mitigate that poor performance and the performance measures taken;
Performance measurement is necessary to every construction project as it guides the construction team on cost, time and quality so that final project outcomes can be achieved. No “one-fits-all” approach to performance measures exists (Ankrah & Proverbs, 2005).

More quality and quantity of road network is needed in India, the reason being a high traffic volume with many passengers along freight exposes the bad condition of the road network infrastructure.

Communication in construction projects is the vital factor to project success. Poor communication has dooms the project to failure and all factors that influence poor performance will be the result of bad communication.

The construction project environment is dynamic in nature. Projects may vary during the construction phase. Therefore the study can help professionals to understand the schedule performance of a project, strategize factors selected on that particular schedule performance level and concentrate on the select factors instead of handling all the factors simultaneously (Iyer & Jha, 2006).

Organizations need to examine how to deliver clients’ requirements with the resources available and within the parameters specified. Changes in an individual’s attitudes, disposition and behavior can adversely influence organizational decision-making capacity, relationships, and individuals’ ability to solve problems and negotiate, especially over contractual claims (Sinha & Wayal, 2013).

The developers or clients should acknowledge the external stakeholder management process as an important task. They should communicate the various aspects of a project correctly with stakeholders, be they good or bad (Olander, 2006).

### 3.2.10 CONCLUSION

The purpose of this chapter was to highlight the international perspective on poor performance in the road infrastructure projects. Factors influencing poor performance, effects, the impact of stakeholders on road infrastructure projects and alternative ways to mitigate poor performance on road infrastructure projects were observed. Furthermore, analysing performance measures to assess performance in construction projects was reviewed. The following chapter gives the African perspective on the poor performance on road infrastructure.
CHAPTER FOUR

AFRICAN PERCEPTIVE – CONSTRUCTION ROAD INFRASTRUCTURE PERFORMANCE

4.0 INTRODUCTION

This chapter focuses on construction performance in the construction industry of Swaziland and Zimbabwe. The background of the countries and their construction industries is explained. In addition, detailed literature is reviewed on the occurrence of poor performance in road infrastructure projects in Swaziland and Zimbabwe. Also, this chapter analyses how poor performance in Swaziland and Zimbabwe are assessed and managed. Moreover, the effects of the poor performance in the road infrastructure projects are investigated. This chapter further reviews factors influencing poor performance in road infrastructure projects.

4.1 ZIMBABWE

4.1.1 ZIMBABWEAN BACKGROUND

In the 1880s, the British arrived with Cecil Rhodes and the British South African Company. In 1898, the name ‘Southern Rhodesia’ was adapted to become Zambeziyan in the honor of Cecil Rhodes’s official denotation for the region south of the Zambezi which much later became Zimbabwe. The Republic of Zimbabwe is in Southern Africa, between the Zambezi and Limpopo Rivers. The Zimabwean boarders are South Africa, Botswana, Zambia and Mozambique. The capital city of Zimbabwe is Harare. The country consist of approximately 16 million people with 16 official languages of which English, Shona and Ndebele are the most commonly used languages. Approximately 80% of the country’s citizens are Christians, which is followed by 63% of Pentecostal African churches. Hindus represent 0.1% and 0, 3% are Bahas (Zimbabwe Wikipedia website).

Former president Robert Mugabe became prime minister of Zimbabwe in 1980, after ZANU-PF won the elections following the end of white minority. Mugabe became the first Zimbabwe’s president after Zimbabwe independence (Gray, 2008). He was the president of Zimbabwe from 1987 until his resignation in 2017. During his presidency, Mugabe maintained the revolutionary socialist rhetoric of the cold war era, blaming Zimbabwe’s economic woes on conspiring Western capital countries (Holden, 2002). He was sanctioned by his anti-imperialist credentials and Archbishop Desmond Tutu called him “a cartoon figure’ (Hall & Silliman, 2005). In 2011
November, ZANU-PF sacked Robert Mugabe as party leader and appointed former vice-president Emmerson Mnangagwa in his place. Zimbabwe has a centralized government and it is divided into eight provinces and two cities with provincial states. See the table below:

<table>
<thead>
<tr>
<th>Province</th>
<th>Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulawayo</td>
<td>Bulawayo</td>
</tr>
<tr>
<td>Harare</td>
<td>Harare</td>
</tr>
<tr>
<td>Manicaland</td>
<td>Mutare</td>
</tr>
<tr>
<td>Mashonaland Central</td>
<td>Bindura</td>
</tr>
<tr>
<td>Mashonaland East</td>
<td>Marondera</td>
</tr>
<tr>
<td>Mashonaland West</td>
<td>Chinhovi</td>
</tr>
<tr>
<td>Masvingo</td>
<td>Masvingo city</td>
</tr>
<tr>
<td>Matabeleland North</td>
<td>Lupane District</td>
</tr>
<tr>
<td>Matabeleland South</td>
<td>Gwanda</td>
</tr>
<tr>
<td>Midlands</td>
<td>Gweru</td>
</tr>
</tbody>
</table>

(Source: Author’s literature review)

Zimbabwe has the highest adult literacy rate in Africa at 90.70% in 2013. The Zimbabwean education system consists of two years of pre-school, seven years of primary school and six years of secondary schooling before students enter the university in the country or abroad. There are seven public universities as well as four church-related universities that are fully internationally accredited. Zimbabwe’s economic decline since the 1990s is due to its hyperinflation. Taxes and tariffs are high for private enterprises. Government spending was predicted to reach 67% of GDP in 2007. In 2010, the economy collapsed. Cash became scarce on the market in the year 2017. (Zimbabwe-Wikipedia website). Zimbabwe’s economy was mainly agrarian, backed by a strong commercial farming sector. Maize was the country’s largest crop, while tobacco was the largest export crop, followed by cotton.
4.1.2 CONSTRUCTION INDUSTRY IN ZIMBABWE

The construction industry is an important sector of the Zimbabwean economy as it provides the means of production for other industries or commodities to be consumed. The industry plays a significant role in producing wealth and providing a better quality of life to the nation that is essential for development of the nation. It also contributed approximately 3% to the gross domestic product (GDP) in 2014 (Nyoni & Bonga, 2017). There are two distinct type of contractors, namely the traditional multinational companies and the newly established indigenous companies (Chigara et al., 2013). Zimbabwe has 88,100 km of classified road networks, including 15,000 km which is paved. The road network is divided into primary, secondary, tertiary feeder access roads and urban roads. The tertiary feeder roads are collectively referred to as the trunk road system that carries 70% of the vehicular traffic. The Zimbabwe Department of Roads manages the primary and secondary road networks while tertiary roads are managed by the District Development Fund (DDF) and the District Councils (DC). The Southern African Development Community (SADC) is a Zimbabwean signatory protocol on transport, communication and meteorology (African Development Bank Group 2012). The Zimbabwe National Road Administration (ZNARA) is responsible for managing
the roads fund and disbursing the local road authorities. Zimbabwe has an impressive backbone infrastructure including power supply, roads and water. It has strong road connections with SADC. Zimbabwe has one of the lowest percentages of roads in a good condition in the region. The quality of paved/sealed roads is worse than that of gravel roads and 50% of paved roads require costly rehabilitation (Pushak & Briceno-Garmenda, 2011). Public procurement as a significant part of the tender process in Zimbabwe. However, it is currently under scrutiny. It is very poor in the implementation of government projects and service delivery. Zimbabwe’s public procurement process is governed by the Procurement Act 22: 14 with Procurement Regulations Statutory instrument 70 of 2002 regulation and rules (Dzule & Naude, 2017).

Map 6: Zimbabwe Road Network
(Source: onlinemapfinder.com)

4.1.3 PERFORMANCE IN THE ZIMBABWEAN CONSTRUCTION INDUSTRY

Performance is an evaluation of how well individuals, groups of individuals, organisations or systems have reached a specific objective. Construction performance can be approached in two ways, namely the performance of an organization and project performance (Ankrah & Proverbs, 2005). There are a number of factors that determine construction projects performance, indicating whether the construction project will be successful or not. Factors contributing to failure or poor performance of projects are likely to be unavoidable factors such as weather conditions, labor
problems, intractable technical difficulties, and unforeseeable or controllable forces. However, none of these unavoidable factors have a great influence on project failures (Nwachuku & Emoh, 2011). Furthermore, the Zimbabwean construction industry is characterized by the hyperinflation which is the country’s foremost enemy, and the root cause of the construction industry crisis (Moyo & Crafford, 2010).

4.1.4 FACTORS INFLUENCING PERFORMANCE IN ZIMBABWEAN ROAD INFRASTRUCTURE

Nyoni and Bonga (2017) maintain that a lack of skilled labor, fraudulent practices, an inability to adopt best practices, corruption, nepotism and finance difficulties are some of the factors affecting construction projects in Zimbabwe. Externalities or unforeseen circumstances such as natural disasters, water conditions, conflicts, labor disputes, contractors’ financial difficulties, poor site inspection, clients’ variation orders, slow decision making, and cash flow problems are highlighted to be the causes of poor performance on construction projects (Tawanda, 2014).

FACTORS INFLUENCE POOR PERFORMANCES ARE BRIEFLY EXPLAINED BELOW:

4.1.4.1 Time factor

Delays in decision making, design changes and unforeseen challenges cause problems in time to performance (Njenga, 2014).

4.1.4.2 Risk factor

Clients may run risks by assigning a project to non-qualified contractors (Chang, 2016).

4.1.4.3 Cost factor

Cost overrun should be regarded as a vital issue in the management of construction projects globally, as it is not limited to a specific country. There are number of factors that cause cost overruns and those factor fall under client, contractor and the client (Aljohani et al., 2017). Contractors have many cost factors such as high interest rates charged by banks on loans received by contractors, reworks cost, delay payment to suppliers and sub-contractors, late delivery of materials and many more. The client has the following factors such as lack of experience in the construction industry, additional works, changes, reducing or shortening of contract period, and delays in decision making and work approval. The consultant factors are lack of design experience,
difference between selected bid and consultants’ estimates, inadequate monitoring and control procedure and many more (Aljohani et al., 2017).

4.1.4.4 Quality factor

Zimbabwe country’s global competitiveness ranked number 132 of an overall 144 countries which is the third weakest performing country compared to other SADC member states (World Economic Forum, the Global Competitiveness Report 2013-2014). SADC is concerned about Zimbabwe in terms of quality of the overall infrastructure and quality of the roads, railroad, port, air infrastructure and available airline seat kilometres as it is also poor. The poor quality reflects government’s lack of effort to improve the level of service provision as far as infrastructure is concerned (PPP Country Paper Zimbabwe, 2013).

4.1.4.5 Material issues

Early delivery of materials might affect the quality of the materials while on the other hand late distribution of materials will interrupt the work and delay the completion of projects (Tawanda, 2014). Unavailability of material such as bricks and cement on the domestic market is a huge problem. The shortage of material has a negative impact on time required to complete the project (Chigara & Mangore, 2012).

4.1.4.6 Communication factor

Poor communication is a major problem owing to misunderstandings between personnel and suppliers which lead to early or late supply of materials to the site (Tawanda, 2014) Zimbabwean contractors usually complain about insufficient communication, especially from consultants with regard to instructions. This causes delays in their projects (Nyoni & Bonga, 2016).

4.1.4.7 Poor resource management

Zimbabwe experienced a shortage of materials, liquidity crunch and inflationary tendencies which were major drivers of construction projects’ failure that occurred in 2008 (Chigara & Mangora, 2012). Ineffective resources management and increased wastage of resources on site reduced productivity. All the above increased the cost of resources and eroded the profit margins of the contractor, roping the clients into extra expenses that may jeopardize their budgets (Chigara & Mangora, 2012).
4.1.4.8 Poverty alleviation
Zimbabwe is battling with poor transport infrastructure, especially in rural roads. This is the one of the major causes of poverty. The Zimbabwean government has described its own country’s poor infrastructure as the biggest impediment to development. Lack of funding has seen many projects taking several decades before they kick off. Very few projects are funded on a project finance basis owing to a number of international investors who are reluctant to partner with the government (Mhlanga, 2016).

4.1.4.9 Corruption or bribery
Corruption means bribes in the form of gifts, or other advantages of various types. It can occur at all stages of the procurement process. The best-known forms of bribery include purchase terms personalised for a nominated vendor, avoidance of the bidding process (bid rotation, bid suppression, creation of complementary bids and disqualification of qualified applicants), poor quality goods delivered instead of the original contracted ones, and improper billing. Fraud schemes involving conflict of interest include transferring the employee’s customer base to one’s own company, purchases of over-priced goods from a company related to any employee of the affected company and the favouring of related companies within the bidding process (Tawanda, 2014).

4.1.4.10 Lack of skilled labour
Nyoni and Bonga (2016) note that a shortage of highly skilled and trained workers in the construction industry in Zimbabwe could be attributed to the high capital flight experienced in the country owing to economic hardships. Several personnel left the Zimbabwe construction industry to join the South African construction industry during the 2010 Soccer World Cup tournament where there was a huge infrastructure demand. South African construction industry embarked on a massive recruiting personnel to meet the deadline (Moyo & Crafford, 2010).

4.1.4.11 Political influence
In Zimbabwe, like any other African country, the public procurement process experiences problems of political interference. Political influence during the tender process insists that contracts are awarded to certain individuals or companies of their choice (Dzuke & Naude, 2017).
4.1.5 THE EFFECTS OF PERFORMANCE OF ROAD INFRASTRUCTURE ON THE CONSTRUCTION INDUSTRY

Zimbabwe’s GDP growth declined from 1.1% in 2015 to an estimated 0.5% in 2016. It was projected to increase by 1.3% in 2017 with the agriculture, tourism, manufacturing, construction and financial sectors all expected to improve. The country received above normal rainfall which is a major boost for the economy. The poor performance of government revenues against a background of high recurrent expenditure led to a large fiscal deficit. The fiscal deficit for 2016 was estimated at USD 1.042 billion (7.3% of the GDP) against a target of USD 150 million. The economy also continues to experience shortages in foreign currency required to fund critical inputs in most sectors of the economy and the high cost of production which has eroded competitiveness (Monyau & Bandara, 2017).

Albino (2012) mentioned the effects of cost overrun, time overrun, litigation, arbitration, abandonment and disputes which have negative impacts on the Zimbabwean economy while clash, claim, desertion and the reduction of growth in the construction industry are also recognized as bad effects (Graham, 2010). Delays negatively affect the growth of the economy and increase the final cost of the project and may also contribute to time overrun, litigation, arbitration and the abandonment of projects. It was also established delays significantly affect company profits, thereby affecting the growth of the economy (Tawanda, 2014).

Some construction projects in Zimbabwe are so large that they are usually run by both players in the private and public sector through the so-called public-private partnerships (PPPs). However, some conflicts erupt over certain issues and these cause delay and total abandonment of projects in some extreme cases (Nyoni & Bonga, 2017). Time overrun, cost overrun, rescheduling, bad contractual relationships, late payment, disputes, arbitration, litigation, company’s bad reputation, lack of productivity and efficiency and project suspension were identified as the effects of delaying project which contribute to poor performance in the Zimbabwe construction industry (Shiri, 2015).

In the case of cost overrun, the budgeted cost of the project exceeds the budgeted amount of the project and that become the client’s burden; the project might take longer to be completed than normal; and mismanagement of resources may occur (Shiri, 2015).

4.1.6 THE IMPACTS OF STAKEHOLDERS ON ROAD INFRASTRUCTURE PROJECTS

Stakeholder engagement is becoming a part of construction project practice in order to deliver excellent project outcomes. Therefore, stakeholder engagement should be regarded as a core
Element of any sustainable development plan. Stakeholders usually have their own interest in the project which may cause different priorities, conflict and dramatically increase the complexity of the situation (Nahas *et al.*, 2013). Negative reaction from the community against the project can be problematic which affects the project and the lack of participation from the stakeholder’s leads to dissatisfaction of the stakeholders with the project results (Chinyio & Olomolaiye, 2010). People resist change; therefore the public needs to be kept informed on every decision taken and every upcoming project to avoid disaster (Hensman, 1902).

Project goals and improvement of projects which benefit the community is the focal aim of the participation of stakeholders. The participation of stakeholders is a learning curve to all stakeholders involved and it encourages the public to share their knowledge with the regulatory authorities, fosters better-informed decisions and decreases the likelihood of project failure. Early stakeholders’ involvement can add benefits of diffusing opposition to a project. Better designed projects by consultants avoid costly delays (Buertey *et al.*, 2016). Stakeholder participation is fundamental to effectively addressing social issues in the design process. It has great potential to deliver better project outcomes and is key in identifying issues that might constitute risks to the project (Lynch *et al.*, 2004).

Construction projects have a negative impact on host communities as activities such as sales of alcohol and transactional sex which increases risky sexual behavior develops around labor camps. There are many accidents and diseases in the construction industry with risks like physical injury and HIV infection. Feelings of boredom, loneliness and isolation can result in disregard for health among construction workers while poor women engage in transactional and commercial sex with construction workers who have considerable disposable income (IOM, 2010).

Lack of roads signage has a huge impact on road infrastructure as it increases the number of road accidents in which pedestrians or end users of the roads are the group that suffer the most consequences. There are various factors affecting road safety in Zimbabwe such as the lack of segregated lanes for different road users, lack of pedestrian facilities for crossing busy roads, insufficient road lighting and the absence of road signs which may, for example, lead to the drivers exceeding speed limits. Segregated lanes, pedestrian crossings and speed limit boards, among others, are road signs that needs to be considered in road infrastructure (Muvuringi, 2012). Road transport injuries (RTI) impact poor people more than the rich. Poor people are at a higher risk such as pedestrians, passengers and motorcyclists. Although not all pedestrians are poor, it is assumed
that poor people who are pedestrians and passengers cannot afford to buy a vehicle. Furthermore, low socio-economic groups of people have less access to medical services and this results in disparities of recovery and survival (Sharma, 2008).

4.1.7 MITIGATING PERFORMANCE IN ZIMBAWEAN ROADS

INFRASTRUCTURE PROJECTS
Construction industry over the past decades used numerous project control methods such as the Gantt bar chart program evaluation and review technique (PERT) and critical path method (CPM). Nowadays, a variety of software packages has become available to support project control methods such as Microsoft Project, Asta Power Project, and Primavera, among others. Despite the different methods and software packages in practice, the construction industry still suffers time and cost overrun (Olawale & Sun, 2010). Ways to mitigate the poor performance, among others, are identified below:

4.1.7.1 Effective stakeholder management
If the stakeholders’ expectations cannot be achieved at the same time, compromise become worthwhile (Chinyio & Olomolaiye, 2010).

4.1.7.2 Effective communication
Effective communication should be implemented between project players involved in the implementation of construction projects. Regular communication with members of the project community is important for effective project performance (Tawanda, 2014).

4.1.7.3 Resource management
An effective resource management system enhances good business relationships between contractor and client to ensure a project is delivered on time and within the budget (Chigara & Mangora, 2012).

4.1.7.4 Project life cycle
Project life cycle is a series of activities which are necessary to fulfil project goals, objectives and planning in order to understand the sequence of programme that needs to be followed throughout the entire project. By following the sequence of programme, occurrence of errors is reduced and this enables budgeted funds for future use in construction. Furthermore, the project life cycle
captures and documents the best practice within the organization so that the process within each phase can continually be improved and can be applied on future similar projects and enable effective application of project management software application system that are integrated with all appropriate corporate information systems (Tawanda, 2014).

4.1.7.5. Risk management
The selection of the contractor to whom the client can confidently entrust the responsibility of executing satisfactorily has been primarily based on tender price alone: among competing tenderers, the lowest tender price is usually the key to winning a tender without ensuring quality which is an indispensable measure in project delivery (Chang, 2016).

4.1.7.6 Agencies
The government has been forced to craft different agencies to assist in numbers of factors that influence the poor performance of road infrastructure. In the case of poverty reduction one factor affecting road infrastructure performance is the government crafted Interim Poverty Reduction Strategy Paper (I–PRSP) formulated to deal with poor infrastructure and to attempt to diffuse poverty in Zimbabwe. Infrastructure is the backbone for economic growth and development, a key enabler for poverty reduction programmes and projects in Zimbabwe. I-PRSP builds a country’s development blueprint in Zimbabwe for sustainable socio-economic transformation (Mhlanga, 2012).

There is a need for PPP capacity in Zimbabwe for the financing, design, construction, operation and maintenance of the desired infrastructure. In Zimbabwe, the PPP is an independent agency reporting to the Ministry of Finance (MOF) to make ensure the most appropriate use of the limited financial resources in Treasury. PPP in Zimbabwe excludes contractual arrangements between the public and private sectors for the provision of service only, with significant private sector capital investment and no risk transfer. These contractual arrangements may be either service or management contracts or leases (Government of Zimbabwe, PPP Policy, 2013). There are regulations and policies that regulate matters and bind PPPs. PPPs are not limited to the size of the project, risk profile and complexity, market capacity, government’s public service delivery policies or end user requirements as factors driving the choice for a PPP (Government of Zimbabwe, PPP Policy, 2013). There are different types of PPPs outlined by the Zimbabwean PPP policy such as privatization, divestiture, BOT, BOO, BOOT, DFBO, DFBT and leases and those are possible PPPs
types with private risk. There are also PPPs such as outsourcing and joint venture with a certain risk. See figure 4.1 below:

Figure 4.1: Types of PPPs.
(Source: Government of Zimbabwe, PPP Policy, 2013).

4.1.8 MEASURES USED TO ASSESS THE PERFORMANCE OF ROAD INFRASTRUCTURE PROJECTS

The success of construction projects is critically significant for all project participants, especially for clients as well as the country economy (Abedi et al., 2011). Project performance can be measured and evaluated using different factors of performance measurements indicators that are related to various dimensions or groups such as cost, time, quality, client satisfaction, health and safety. Time, cost and quality are the most predominant factors. All project stakeholders will be interested in completion time and when it comes to cost, the client will be pleased by a project that is completed within budgeted total cost. However, the contractor or supplier will wish to maximize the profit margin between the actual costs of work and make a profit. A project is termed successful when it satisfies project objectives (Enshassi et al., 2009).

In the Zimbabwean construction industry both private and public sectors are experiencing cost and time overruns, the cause of which is the high labor costs which affect construction companies by
reducing the profit and impacting on the company’s reputation. The effective work measurement techniques are a considerable option for any construction industry (Moyo et al., 2014).

4.1.9 LESSON LEARNT

- The relationship that exists between hyperinflation and the Zimbabwean construction industry was exposed. Therefore the gap between the two needs to be used as a tool to develop hyperinflation in Zimbabwe.
- Zimbabwe’s country ranked 132 out of 144 countries as the third weakest performing country compared to other countries. Furthermore, it is battling with poor infrastructure generally; therefore there is a need for PPP capacity to rectify the country’s position in the SADC. Moreover, PPPs are needed to boost the service delivery of the country.
- Effective communication is the key of any project’s success. The project team, including stakeholders, should be encouraged to communicate regularly for any decision making on the project as it reduces construction errors and saves time (Tawanda, 2014).
- The Zimbabwean construction industry literature has been reviewed. However, it is not clear whether the highlighted factors which influence the poor performance in the Zimbabwean construction industry are the cause of poor performance or whether it is the Zimbabwean government which is failing the people of Zimbabwe. More research on factors influencing poor performance on roads infrastructure should be done to develop better performance measures to mitigate the poor performance.
- Factors that cause poor performance in construction projects in Zimbabwe were identified to assist construction project managers and policy makers to minimize or avoid negative impact of delays and poor performance in construction projects. Furthermore, it will help to develop new intervention strategies aimed to improve construction business performance in terms of sustainability, productivity, value to client, profitability and competitiveness (Nyoni & Bonga, 2017).

4.2 GHANA

4.2.1 GHANAIAN HISTORY

Ghana was the first sub-Saharan country in colonial Africa to gain independence in 1957. The country is in Western Africa, bordered by the Gulf of Guinea between Burkina Faso and Cote’d voire. In 1992, after approving a new constitution restoring multiparty politics, Rawlings won the presidential election. In 2004, John Kufuor succeeded him. John Atlas Mills took over as a Head of
State in early 2009. In 2010, Ghana was categorised as a lower middle-income country and now envisions becoming the first developed country in Africa between 2020 and 2029.

The population of Ghana is approximately 26,908,262 million (2017 estimates). Ghana’s country nationality is Ghanaian with ten (10) languages, namely asante, fante, boron (brong), dagomba (dangome), dagarte (dagaba), kokomba and akyem and English has been the official language since 2010. The capital city is Accra and president has been Nana Ado Dankiwa since January 2017. Ghana’s economy has market-based economy deficits and depreciating currency. Ghana is known to be well-endowed with natural resources. Gold and cocoa exports are major sources of foreign exchange. The country has an oil industry which boosted economic growth. The GDP real growth rate at 3.3% in 2016 compared with other countries in the world (CIA-World factbook, 2017).

Map 7: Map of Ghana
(Source: World Atlas Map)

4.2.2 GHANAIAN CONSTRUCTION INDUSTRY
The Ghanaian construction industry plays a crucial role in the socio-economic development of the country. The construction activities contribute an achievement of national socio-economic development goals by providing infrastructure, sanctuary and employment. Infrastructure includes hospitals, schools, townships, offices, houses and other buildings; urban infrastructure (including
water supply, sewerage, drainage); highways, roads, ports, railways, airports; power systems; irrigation and agriculture systems; telecommunications and others.

The Ghanaian construction industry has a catalytic effect on economic development with the highest multiplier effects which holds massive possibilities for stimulating growth, boosting projects transmit and creating employment. Furthermore, the industry has made an important contribution to both industrial output and overall GDP over the years (Osei, 2013). The key players in the Ghanaian construction industry are the clients among which are the Ministry of Water Resources, Works and Housing (MWRWH), design community supply chain, main contractors and sub-contractors, professional associations, stakeholders such as banks, trade unions and authorities. The MWRWH is responsible for the registration of contractors together with the Registration General Department under the Act no 179 of 1963 of the Companies’ Registration code (Osea, 2013).

Shaban (2008) stated that the local construction industry is one of the main economic engine sectors carrying the Ghanaian national economy. The Ghanaian construction sector contributed about 8, 2% to the GDP per annum. Roads are important in Ghana’s economy as they link all major cities, towns, villages and agricultural production areas to local, regional and national markets. Furthermore, the roads allow an excess of 97% of all passengers and freight traffic (Chileshe & Berko, 2010). The MOWWH has two categories, namely category D for general buildings of contractors and category K for civil works. Ministry registration is not essential; nevertheless, those contractors who are registered are the only contractors to tender for government contracts. The table 4.2 below shows the categories within the Ghanaian construction industry. Sub-scale building contractors (SSBCs), D1/D2 and K1/K2 are referred to as big firms (Amoah et al., 2011).

<table>
<thead>
<tr>
<th>Value Amount</th>
<th>Category D</th>
<th>Category K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to $ 75000</td>
<td>D4</td>
<td>K4</td>
</tr>
<tr>
<td>$ 75000 - $ 250 000</td>
<td>D3</td>
<td>K3</td>
</tr>
<tr>
<td>$250 000 - $ 500 000</td>
<td>D2</td>
<td>K2</td>
</tr>
<tr>
<td>Over $ 500 000</td>
<td>D1</td>
<td>K1</td>
</tr>
</tbody>
</table>

(Source: Ahadzie et al., 1995)

The construction sector globally is faced with numerous problems. It has become crucial to recognize the major causes at regional levels for solutions to ensure economic growth (Danso, 2014). Ghana’s road network consists of 50 000 km of which 13,366.8 km are highways or trunk
roads linking the national and regional capitals and major cities in neighbouring countries and major production centres; 4,064 km of urban roads which are within cities and major towns and move people and goods into cities economically, efficiently and safely; and 32,601.8 km of feeder roads providing access to small towns, villages and production centres, especially in agricultural centres (MoT, 2007).

Map 8: Ghana road network
(Source: BestCountryReports.com)

4.2.3 PERFORMANCE IN THE GHANAIAN CONSTRUCTION INDUSTRY
Baldrige National Quality Programme (BNQP) (2009) describes performance as outputs and outcomes from procedures, products and services that authorize evaluation and differentiation relatives to goals, standards, past results and other organisations. The projects achieve the best results if the performance is measured according to good and properly set standards. It is therefore necessary that when a project starts, the monitoring and control measures are carried out regularly (Opuch, 2016). The Construction Industry Development Board (CIDB, 2007) maintains that project failures are not only caused by contractors. Architects and engineers (consultants) also contribute to the failure of overall project performance.

Akomah and Jackson (2016) stated that performance is not a one-man show but the collective efforts of all within an organization. They continued to say there cannot be performance if there is no performer and performance itself it is a journey, not a destination. The performances of key
technical staff, skilled manpower coupled with an unskilled workforce greatly influence the performance of a building project. Performance in the Ghanaian construction industry is a major cause of concern amongst client groups and other stakeholders. In many cases, the contractors are blamed for poor performance and condemned for having limited knowledge of the application of requisite management techniques (Ahadzie, 2007).

There is little combination between stakeholders in the public and private sectors which includes Metropolitan, Municipals and District Assemblies (MMDAs), professional bodies’ — the Ghana Institution of Surveyors (GhIS), Ghana Institute of Architects (GIA), Ghana Institution of Engineers (GIE), Ghana Institute of Construction (GIOC) — and private firms. These professional bodies don’t have enough information in terms of imposing rules, regulations and professional standards, largely due to the lack of a legal mandate — membership is optional for most of these organisations.

The Ghanaian construction industry requires urgent leadership for the improvements that are generally required in the industry (Ofori-Kuragu et al., 2016).

The Construction Industry Development Authority (CIDA), under the responsibility of the Ministry of Water Resources, Works and Housing (MOWWA), leads the regulation, restricting, continuous improvement and development of the construction industry in Ghana with the goal of increasing the performance of the industry to derive optimum efficiency and effectiveness in its operations and outputs in order to improve the quality of life of Ghanaians (Ofori-Kuragu, 2014). The Ministry of Water Resources, Works and Housing and the Ministry of Roads and Highways are responsible for the classification of contractors. Neither of the two ministries has any regulatory systems in place to monitor the performance of contractors or regulate standards. Sanctions for non-performance on projects do not represent a sufficient deterrent measure to elicit high standards of performance amongst contractors (Ofori-Kuragu, 2014).

4.2.4 FACTORS INFLUENCING PERFORMANCE IN ROAD INFRASTRUCTURE PROJECTS

There are number of challenges that Ghanaian contractors face and every challenge has a way of influencing performance (Akomah & Jackson, 2016). These challenges as mentioned below and many other challenges contribute to the poor performance of Ghanaian construction projects. The challenges faced by Ghana construction sector are akin to those which are commonly seen in different reports or research studies in other developing countries (Ofori, 2012).
4.2.4.1 Poor performance by consultants
Consultants’ engineers initiate variation orders because of change in design, errors and omissions in design, conflicts between contract documents, and inadequate scope of work for contractor, design complexity and lack of knowledge (Dadzie et al., 2012).

4.2.4.2 Lack of feasibility studies
In most cases, the contractors often get to sites and realise that there are uncertainties that need to be resolved before commencing work within the areas. Furthermore, resolving uncertainties takes time and may affect the contractors’ performance (Akomah & Jackson, 2016).

4.2.4.3 Complexity and size of the project
The construction industry is complex in nature owing to its large numbers of parties as owners (the clients), contractors, consultants, stakeholders and regulators (Dadzie et al., 2012). The construction projects vary in terms of complexity in nature, location, type of contract, and communication between parties, and less experienced people in such situations can pose significant risks to project delay and cost overrun (Ahmed et al., 2003). The uniqueness of project activities, duration, value and the urgency of the project contribute to poor performance of the project. It is always the case that the clients are interested in when their amenity will be ready to use rather than now it will be completed (Dadzie et al., 2012).

4.2.4.4 Payments delays
Contractors must occasionally wait for months and sometimes years to receive payments from clients for works done. This practice is slowly killing a great deal of local businesses and rendering them incompetent. The contractors face financial difficulties due to late payment by the client, resulting in time and cost overruns and even the abandonment of projects (Akomah & Jackson, 2016). Payment for work done is a very big problem for contractors in Ghana. The complicated and administrative structure of payment to contractors is a challenge: even when government has given the approval for payment, parliament must approve the total amount (Laryea, 2010).

4.2.4.5 Underestimation of project cost
Ghanaian contractors’ underestimation and the use of wrong data in building rates create a challenge when a project commences. These practices have happened several times and led to miscalculation on how much credit or loan is needed for a project. During the execution phase, many become crippled financially and realise how much damage they have done to themselves (Akomah &
Jackson, 2016). The estimates that are initially presented by the contractors to the client or project owners cause conflict between the parties and delay the project (Shah, 2016).

### 4.2.4.6 Political influence

Political expediency in the real world overrides technical expediency. Obama said “Institutions must be allowed to work” (Dadzie et al., 2012). In Ghana, many contractors are recognized to have sympathy for particular political parties. This happens when a particular government comes into power and a particular contractor is recognized as being sympathetic towards an opposition party; that contractor wins hardly any work throughout the time of the new government. The contractors complain that the business environment is driven by politics and they realise that contractors are a very good source of raising money for financing political campaigns. Ghanaian contractors say politics in Ghana is a major problem (Laryea, 2010).

### 4.2.4.7 Poor workmanship

Workmanship is an important aspect as well as project quality while poor workmanship reduces the value of projects which are already in place. In most developing countries, local contractors are faced with poor workmanship which leads to unpaid work done by the client, hidden defects and similar faults that come up after the project completion. Poor workmanship also leads to rework by the contractor which is relevant to time overrun and affects productivity in the construction industry (Danso, 2014). The cause of poor workmanship is poor supervision of work, lack of skilled/trained workers as well as inadequate training of workers and many others (Ofori-Kuragu, 2016).

### 4.2.4.8 Lack of communication

There are many causes of poor communication such as late dissemination of instructions, unclear channels of information, and inexperienced interpretation of working drawings, among others. Miscommunication is a common occurrence in construction when work is passed down from one entity to another (Agbevade, 2017).

### 4.2.4.9 Poor quality of work

Design team experience, delay in producing design tender document, lack of adequate records, errors or omission in the document lead to poor quality of work (Dadzie et al., 2012).
4.2.4.10 Lack of plant/equipment
The Ghanaian construction industry rely mostly on labour than use of major equipment. Most of the contractors hire equipment. They are rare contractors that own equipment/plant and breakdowns become a major problem factor as contractors may retain old equipment which lacks planned maintenance. The construction plant/equipment differ in cost from 10-30% of the total cost of the project, depending on the degree of mechanisation (Danso, 2014).

4.2.4.11 Lack of funding
All Ghanaian contractors indicated that they are experiencing funding problems. The contractor does not have funds to pay the monthly salaries of the staff, it is difficult to procure materials, and there is no money to repair or maintain broken equipment or even to hire qualified professionals such as civil engineers, mechanical engineers and quantity surveyors (Laryea, 2010).

4.2.4.12 Bribery and corruption
Bribery and corruption are a huge problem for both contractors and consultants in Ghanaian construction sectors. Contractors and consultants frequently must pay kickbacks to the people involved in a project of which the total kickbacks were indicated to be around 10% (Laryea, 2010).

4.2.5 THE EFFECTS OF PERFORMANCE ON ROAD INFRASTRUCTURE PROJECTS

The Ghanaian culture is that if there is a case or dispute between the parties in construction projects, it is usually resolved by arbitration and mediation instead of litigation and by doing that, the contractors may lose a great deal of money which is bad (Laryea, 2010). Road construction projects in the country are often delayed. Researchers have proven that construction projects countrywide face delays in their completion which are accompanied by cost and time overruns. Construction project delays have an unacceptable effect on stakeholders of project to the contract which create aggressive relationships, distrust, litigation, arbitration, cash-flow problems, and a general feeling of nervousness between parties (Akomah & Jackson, 2016). Table 4.3 below indicates some of the effects of poor performance in construction projects.

Table 4.3: Effects of performance in Ghanaian construction industry

<table>
<thead>
<tr>
<th>Effects</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost overrun</td>
<td>Chileshe and Berko, 2010; Fugar and Agyakwa.</td>
</tr>
<tr>
<td>Company’s reputation</td>
<td>Laryea 2010.</td>
</tr>
<tr>
<td>Loss of productivity by the contractor</td>
<td>Pekuri et al., 2011; and Gyadu-Asiedu, 2009.</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Extension of time, abandonment of project</td>
<td>Chong and Leong, 2012; Seemwogerere, 2011; and Williams, 2003.</td>
</tr>
<tr>
<td>Time overrun</td>
<td>Assaf et al., 2011.</td>
</tr>
<tr>
<td>Accessibility</td>
<td>Ahmed et al., 2003.</td>
</tr>
<tr>
<td>Opportunities</td>
<td>Laryea, 2010.</td>
</tr>
<tr>
<td>Environmental effects</td>
<td>Ametepey and Ansah, 2014; Ahmed et al., 2014.</td>
</tr>
</tbody>
</table>

(Source: Bentivegna et al., 2002)

4.2.5.1 Cost overrun

Cost is one of the biggest issues in the construction industry which has to be considered throughout the project life circle. It is considered as one of the most important factors that cause the project to be delayed and fail at times if appropriate consideration is not taken into account. Cost overrun in project is caused by a number of issues such as poor performance by the service providers, increase in material prices and current inflation. Most of the projects were completed with cost overrun where the project rises to 30% of the initial contract value by the time the project is ready for completion (Shan, 2016). Cost overrun in Ghanaian road projects is an acceptable norm. It has become routine because projects are not well planned before initiated (Akomah & Jackson, 2016).

4.2.5.2 Time overrun

Time overrun is a common factor which frequently occurs in construction projects. In road construction many projects’ actual completion period increases by 160% and 120% in building projects compared to the initial estimated time (Shah, 2016). The extension of time happens when extra time is required to complete the project. Extension of time is the most critical effect of project delay. The extension of time leads to time overrun (Akomah & Jackson, 2016).

4.2.5.3 Accessibility

The unavailability of roads or incomplete road projects affect the transportation of market goods such as cocoa beans and other agricultural products to the ports and other parts of the country (Ahmed et al., 2003).
4.2.5.4 Company’s reputation
A company’s bad reputation gives a bad impression to local and foreign investors in the construction sector. A good reputation is critical to the health of a company but a bad one is a serious threat to the existence of any business. Thus, delay in construction projects will ultimately affect the reputation of any company, either directly or indirectly (Akomah & Jackson, 2016).

4.2.5.5 Loss of productivity
A common problem that affects project performance in the industry is low productivity (Gyadu-Asiedu, 2009). Productivity is always affected when the project experiences delays or reworks due to construction mistakes (Pekuri et al., 2009).

4.2.5.6 Abandonment of project
One consequence of the difficulty associated with accessing finance for contractors is a high frequency of abandoned projects and contract overriding due to non-performance of contractors (Ofori-Kuragu et al., 2014).

4.2.5.7 Opportunities
A big opportunity sometimes avails when consultants tend to overestimate the work or pay quantities provided in the bill of quantities without measuring the actual work done on site. This helps the contractors to make money. Furthermore, there is no penalty for delay and shortcomings on Ghanaian contracts because the clients tend to default on their responsibilities and it is an important opportunity for a serious contractor (Laryea, 2010).

4.2.5.8 Environmental effects
The construction impacts or effects are many and there are those that affect the surrounding environment. The dust, harmful gases, solid and liquid waste, fallen objects, ground movements, soil and ground contamination, construction and demolition waste, vibration, traffic, mud, hazardous emissions and odours, impacts on wildlife and natural features and archaeology are identified as environmental impacts (Ametepey & Ansah, 2014).

4.2.5.8 Rework
Rework is estimated to be greater than 10% of the total project cost in Ghana as it will need more time (Dadzie et al., 2012).
4.2.6 THE IMPACT OF STAKEHOLDERS ON ROAD INFRASTRUCTURE PROJECTS

The key stakeholders in the construction industry in Ghana are clients, professional consultants and contractors (Ahmed et al., 2014). Researchers such as Chinyio and Olomolaiye (2010) suggest that the stakeholders can be classified as internal stakeholders which is the project team, and the external stakeholders which is the outside project team for whom the project is being provided (Eyiah-Botwe, 2015). The external group of stakeholders are identified as local authorities (service providers) and the beneficiary community. Stakeholders’ engagement and participation in monitoring and evaluating and its implications results in project delivery in Ghanaian projects (Tengan & Aigbavboa, 2017).

Effective stakeholder management is evaluated as one of the critical success factors which view the activities and practices of stakeholder to address and balance stakeholders’ interests (Eyiah-Botwe et al., 2016). The challenges are complex, involving a multitude of causes, impacts and diverse stakeholders, all with their own vision of what ‘successful’ development can and should look like (Ahmed et al., 2014). Stakeholder management (SM) is the systematic process whereby stakeholders should be defined, identified, mapped and scrutinized. Moreover, taking into consideration the stakeholder satisfaction and by doing the stakeholders’ process above, the project manager would know the stakeholders’ roles and responsibilities, the communication process and its values. Ignoring stakeholders’ interest leads to late scope changes, opponents extending their power-based litigation and project delays (Olander & Landin, 2005). Stakeholders can influence project positively or negatively. Stakeholders’ negative influence that has detrimental effects and impacts the project needs to be managed while the positive stakeholders’ influence is an opportunity for project success (Olander & Landin, 2005). Stakeholder management (SM) (see figure 4.2) should entail systematic identification, analysis, planning actions, communication, and negotiation aimed at influencing project stakeholders (Eyiah-Botwe, 2014).

Figure 4.2: Stakeholders’ management process
(Source: Eyiah-Botwe, 2014)
Normally stakeholders in the construction industry have the power and capacity to influence positive changes to improve the state of the industry (Ofori, 2012).

### 4.2.7 MITIGATING PERFORMANCE OF ROAD INFRASTRUCTURE PROJECTS

The factors affecting performance on both developed and developing countries are almost the same; however, the mitigation or ways to minimise the poor performance might differ from country to country. The mitigation ways listed below are relevant to the Ghanaian construction industry, among others.

#### 4.2.7.1 Feasibility study

A feasibility study needs to be conducted before the project commences to determine and take note of certain issues (Akomah & Jackson, 2016).

#### 4.2.7.2 Adopting best practices

Productivity can be achieved or increased by working harder, faster or longer. In the real world, productivity cannot be achieved by only speed and harder work, without adopting best practices. True productivity (and profit) gains come from identifying and implementing the most efficient work process to satisfy the client’s needs (CIB report, 1996; Dadzie et al., 2012).

#### 4.2.7.3 New technology

The development of a web-based construction project performance monitoring system (PPMS) can aid project managers in exercising construction project performance indicators and can help consultants, senior project management, project directors, and project managers in monitoring and assessing project performance (Dadzie et al., 2012). Changing dynamic technology usage in the construction industry needs to be established for the company to establish robust evaluation systems to arrive at useful solutions (Akomah & Jackson, 2016). To ensure the success of projects, project management techniques and tools should be effectively utilised (Chileshe & Berko, 2010). Changes in the environment in which the construction industry operates make it necessary for practitioners to upgrade their knowledge periodically. Ghanaian construction practitioners must obtain knowledge of this technology and experience in its application. Materials and other technologies used in construction are also undergoing rapid change, and practitioners must keep up with these trends. These include the procedure of re-engineering, total quality management, lean production, supply chain management, and knowledge management (Ofori, 2012).
4.2.7.4 Quality management
The quality of equipment and materials, the quality of training and meetings and the assessment of organisational systems all have a significant influence on the quality of a building construction project. Good quality equipment increases productivity while the use of good quality raw material improves durability, aesthetics and fluidity in execution (Akomah & Jackson, 2016).

4.2.7.5 Education and training
Many of the construction projects in Ghana are becoming larger and more technical, and will require a higher quality of professional services and better control systems to meet the needs of the growing population. The need to invest in training skills is of supreme importance to the survival of the industry (Kwaku Ahmed et al., 2014). Laryea (2010) expressed the contractors’ view to say the Ghanaian government should set up a school to train all artisans. The contractors mentioned that they train their people through apprenticeships at the moment.

4.2.7.6 Partnership
Ghana contractors who want to increase and build their capacity should approach foreign companies who might like to sub-contract some of their work. This can help the Ghanaian contractors to develop their capacity, transfer knowledge and learn more about the industry (Laryea, 2010).

4.2.7.8 Communication management
Effective communication is essential for the successful delivery of performance goals. Good channels of communication that exist within the construction industry need to be managed. The channels such as meetings, telephone calls, face-to-face interactions, drawings and channels such as the Internet or websites and faxes are used in the construction industry. Effective communication needs to be managed properly using the dimensions such as accuracy, understandable, clarity of purpose, timeliness and completeness (Agbevade, 2017).

4.2.8 MEASURES USED TO ASSESS PERFORMANCE OF ROAD INFRASTRUCTURE
Performance measurement has been defined as the process of measuring the outputs arising from actions which organisations take as a means to improve performance (Ofori-Kuragu, 2013). There is a need to take measures to improve the performance of the Ghanaian construction industry. The other means of measuring performance is to ensure efficiency in the role of consultants’ performance during project execution (Gyadu-Asiedu, 2009).
Performance management and performance assessment can help government agencies develop a continuous system of improvement. Steady performance measures can help to disclose when a programme or service is not being delivered properly or effectively, which can result in insufficient services to the public. The work performance of contractors is very important to the people of Ghana so when constructional works are not done to the expectations of the Ghanaian public then name-calling of the contractor begins (Opuch, 2016).

Morris (1987) points out that there are three different measures to identify whether a project is successful or not. Project should perform functionality, management of the project must be clear and performance of the contractors during the process must match the client expectations. On the other hand, Chan (2004) suggested that the key to a successful project completion and delivery is correct estimation, monitoring time performance, cost performance and the comprehensive quality of the construction project (Shah, 2016).

4.2.8.1. Consultant performance

The engineer (consultant) is the employer’s agent. He ensures that the project is completed to the right quality against technical specifications and design standards, on time and within budget, i.e. gives the employer value for money. Some of the main duties of the consultant, according to the FIDIC IV, are reviewing and updating design details; monitoring contractor’s operations to ensure timely commencement of operation; reviewing contractor’s programme; carrying out quality control tests; reviewing contractor’s monthly invoices and certifying for payment; evaluating all claims for additional payment and applications for extension of time; and preparing monthly, quarterly and annual progress reports. There are supervising consultants who are engaged and paid to be responsible for the management of such important projects. Their role, however, is to complement the effort of contractors to ensure a successful completion of such projects (Dadzie et al., 2012).

4.2.8.2 Key performance indicators (KPIs)

The purpose of key performance indicators (KPIs) is that clients want their projects delivered on time, on budget, free from defects, efficiently, right first time, safely, and by profitable companies. The KPIs framework consists of seven main groups, namely time, cost, quality, client satisfaction, client changes, business performance, health and safety (DETR, 2000). However, this paper focuses on major three KPIs i.e. consultants/PMs, clients and contractors (Dadzie et al., 2012).
4.2.8.3 Critical success factors (CSFs)
Ngacho and Das (2015) highlighted the six performance dimensions (KPIs) of a construction project, namely time, cost, quality, safety, minimum site disputes and environmental impact and the identified six constructs are project-related factors, client-related factors, consultant-related factors, contractor-related factors, supply chain-related factors and external environment-related factors.

4.2.8.4 Client performance
The classification of construction clients is based on knowledge capability, company type and size and reason of ownership. Some clients are well educated, others are not (Dadzie et al., 2012).

4.2.9 LESSON LEARNT
- Proper planning and scheduling are necessary throughout the construction project, effective programming in order to keep track of each activity and its time of delivery. In addition, material prices must be checked regularly before/after estimation and before purchase. Furthermore, estimation of cost and design must not be undertaken lightly. Effective methods must be used to visualize the overall project view such as BIM technology. Proper communication must be established with all parties (collaborative BIM). Labor and contractors must be paid on time. Site health and safety practices must be in place. Monitoring the work is essential but motivating the team is more important for a successful project. Weather condition should be checked and monitored in advance. Lastly, regular meetings should be held with subcontractors and suppliers (Shah, 2016).
- Local or indigenous Ghanaian contractors ought to face up to the reality of competition and the dynamics of fashionable business in order to survive, grow and become major players in the construction industry in Ghana (Laryea, 2010).
- Communication improves work performance in the workplace and it requires to be monitored well. Effective communication is when information provided in the right format, at the right time and with the right impact (Agbevade, 2017).
- Stakeholder management (SM) should be adjusted to suit the Ghanaian context, and be considered for the entire project life cycle, bearing in mind that the project sponsor is the key stakeholder whose interest and influence are immense (Eyiah-Botwe, Owiredu & Adjei, 2014).
4.3 CONCLUSION
The purpose of this chapter was to highlight the Zimbabwean and Ghanaian perspectives on poor performance of road infrastructure in construction projects. The factors influencing poor performance, the stakeholders’ impact on road infrastructure projects, the effects of poor performance and ways to mitigate the poor performance were identified. Furthermore, the measures that assessed the performance in roads infrastructure projects were analysed. The following chapter gives a perspective on assessment of performance in the road infrastructure projects in Gauteng Province, South Africa.
CHAPTER FIVE

SOUTH AFRICAN CONSTRUCTION INDUSTRY

5.0 INTRODUCTION

This chapter reviews literature on the performance of road infrastructure projects. The chapter first presents the background to South Africa, the construction industry in South Africa, factors influencing poor performance in road infrastructure projects, and the effects and the impacts caused by poor performance on road infrastructure projects to the economy and stakeholders respectively. Furthermore, the chapter underlines the mitigations that may be applied to minimise poor performance as well as the performance measures used to measure performance in the construction industry.

5.1. OVERVIEW OF SOUTH AFRICA

South Africa (SA) is officially known as the Republic of South Africa. It is the southernmost country in Africa with a long coastline that stretches more than 2,500 km along two oceans (South Atlantic and the Indian) at 1,219,912 km². The Republic of South Africa’s neighboring countries are Namibia, Botswana, Zimbabwe, Mozambique, and the kingdoms of Lesotho and Swaziland. SA is the largest country in southern Africa and the 25th largest country in the world by the land area (Wikipedia website). South Africa contains some of the oldest archaeological and human fossil sites in the world (Deacon, 2001). Places such as the Cradle of Humankind in Gauteng Province have revealed extensive fossils, as well as Makapansgat in Limpopo and others. In the 4th and 5th centuries, Bantu-speaking people were settled near the Limpopo River (now the Northern border with Botswana and Zimbabwe). They absorbed the original Koisana speakers who were the Khoikhoi and San people. In 1652 after the Cape sea route discovery, Jan Van Riebeek established a state on behalf of Dutch East India Company at the Cape of Good Hope which became Cape Town (Hunt et al., 2005).

Great Britain occupied Cape Town between 1795 and 1803 to prevent it from falling under the control of the French first republic which had invaded the Low Countries (Stapleton, 2010). At the end of the Napoleonic wars, Great Britain became an integral part of the British Empire (Lloyd, 1997). In 1948 the National Party was the ruling party and classified all people into races due to apartheid where whites enjoyed the highest standard of living in all of the African continent. The Freedom Charter adopted in 1955 by the Congress Alliance demanded a non-racial society and an end to discrimination. In 1961 country became a republic.
F.W.de Klerk opened bilateral discussions with Nelson Mandela in 1993 for the transition of policies and government. In 1990, National Party dismantled discrimination when they lifted the ban on the ANC and other political organizations and released Nelson Mandela from prison after 27 years. In 1994, the African National Congress (ANC) won the election and Nelson Mandela became the first black president of the Republic of South Africa (Post-apartheid South Africa article, 2006). RSA is a multi-ethnic society encompassing a wide variety of cultures, languages and religions divided among a variety of ethnic groups speaking different African languages. There are eleven official languages, namely Afrikaans, English, Ndebele, Northern Sotho, Swati, Tswana, Tsonga, Venda, Xhosa and Zulu. However, English is recognized as the first public and commercial language.

Map 9: South African map

Source: www.places.co.za
The country has nine provinces listed in the table below:

**Table 5.1: Nine provinces of South Africa**

<table>
<thead>
<tr>
<th>Province</th>
<th>Provincial capital</th>
<th>Largest city</th>
<th>Area (km²)</th>
<th>Population (2017) estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Cape</td>
<td>Bisho</td>
<td>Port Elisabeth</td>
<td>168,966</td>
<td>6,498,700</td>
</tr>
<tr>
<td>Free State</td>
<td>Bloemfontein</td>
<td>Bloemfontein</td>
<td>29,825</td>
<td>2,866,700</td>
</tr>
<tr>
<td>Gauteng</td>
<td>Johannesburg</td>
<td>Johannesburg</td>
<td>18,178</td>
<td>14,278,700</td>
</tr>
<tr>
<td>Kwazulu-Natal</td>
<td>Pietermaritzburg</td>
<td>Durban</td>
<td>94,361</td>
<td>11,074,800</td>
</tr>
<tr>
<td>Limpopo</td>
<td>Polokwane</td>
<td>Polokwane</td>
<td>125,754</td>
<td>5,778,400</td>
</tr>
<tr>
<td>Mpumalanga</td>
<td>Nelspruit</td>
<td>Mbombela</td>
<td>76,495</td>
<td>4,444,200</td>
</tr>
<tr>
<td>North-West</td>
<td>Mahikeng</td>
<td>Rustenburg</td>
<td>104,882</td>
<td>1,214,000</td>
</tr>
<tr>
<td>Northern Cape</td>
<td>Kimberly</td>
<td>Kimberly</td>
<td>372,889</td>
<td>3,856,200</td>
</tr>
<tr>
<td>Western Cape</td>
<td>Cape Town</td>
<td>Cape Town</td>
<td>129,462</td>
<td>6,510,300</td>
</tr>
</tbody>
</table>

(Source: Author’s literature review)

The nine provinces are governed by a unicameral legislate elected every five years by political parties’ representatives. Those provinces are divided into 52 districts, eight metropolitan and 44 district municipalities. The districts municipalities are further sub-divided into 226 local municipalities. The metropolitan municipalities perform the functions of district and local municipalities. The capital cities of South Africa are Pretoria (executive), Bloemfontein (judicial) and Cape Town (legislative). The approximately total population in early 2019 was 58 065 097 (www.worldometers.info) The current president of the country is Mr. Cyril Matamela Ramaphosa.
In terms of economy, the country has a mixed economy and it is second largest in Africa after that of Nigeria. Some foreign capital was attracted after 1994 and in 2004 onwards economic growth eventually picked up. During president Zuma’s term, the government begun to increase the role of state-owned enterprises of the biggest state-owned company like Eskom, the electricity power monopoly, South African Airways (SAA) and Transnet currently known as PRASA, ports and railroad, without any profits made to date (SA economic research article). South Africa is a popular tourism destination and some of its revenue comes from tourism (SA Economic Research, 2005).

Regarding education in South Africa, SA has three tier systems of education starting with primary school, high school and tertiary education in the form of (academic) universities and universities of technologies. There are 23 public universities of which eleven are traditional universities, six are universities of technology and six are comprehensive universities.

5.2 OVERVIEW OF SOUTH AFRICAN CONSTRUCTION INDUSTRY
The construction industry contributes seriously to the South African economy country’s economy as it creates employment, and an income for people. Construction entails a complex interplay of client, consultants, contractors, tools, equipment and materials (Windapo, et al., 2013). Hence the contractor has a vital responsibility when it comes to the successful delivery of projects. Contractors are like any business people that have a role to manage the construction projects from initial stage of the project up to the project closeout/final stage (Harris & McCaffer, 2005). The construction industry in South Africa has its rises and falls. The most common fall has been the significant delays at the Eskom power plant projects. This has highlighted the importance of the industry for the country’s development and the challenges of the built environment (Van Wyk, 2003). The global recession which is closely linked to the economy is also one of the major causes of job insecurity in our South African construction industry. PWC (2013) state that the South African construction industry was particularly hit hard when the infrastructure development highs leading up to the 2010 FIFA World Cup were followed by a global recession and depressed growth.

Sean Jones states that “The South African construction industry, which many expect to go through a high growth phase this year, owing to an increased number of construction projects, and a greater focus on housing projects and large-scale infrastructure projects, is facing severe problems regarding construction project delivery. These problems stem from a lack of capacity, skills shortage and quality standards” (Engineering News:2014:1).
5.2.1 CONSTRUCTION INDUSTRY DEVELOPMENT BOARD (CIDB) OF SA

The Construction Industry Development Board (CIDB) is a national body established by an Act of Parliament (Act 38 of 2000) to oversee the sustainability and growth of construction enterprises across the country (CIDB, 2013). The CIDB sets national standards for construction delivery and contracts by means of a code of conduct and standardizing construction procurement based on best process. In South Africa, by law, contractors tendering for work by government establishment need to be registered on the CIDB database. Joint values (JVs) established on a contact-specific basis do not have to register provided that each partner of the joint venture is separately register.

The role of the CIDB is to facilitate and promote the improved condition of the construction industry to South Africa’s economy and society. Furthermore, the roles of CIDB are to ensure uniformly in construction procurement; efficient and effective infrastructure delivery; construction industry performance improvement; development of the emerging sector, including industry transportation and skills development (CIDB, 2014)

Table 5.2 below shows the contractors’ grading designations, tender limit designations and administration fees as requirements to register with CIDB.

<table>
<thead>
<tr>
<th>Contractor grading designation</th>
<th>Limit of tender value designation</th>
<th>Administration fees to applied grading designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>650 000</td>
<td>450</td>
</tr>
<tr>
<td>3</td>
<td>2 000 000</td>
<td>750</td>
</tr>
<tr>
<td>4</td>
<td>4 000 000</td>
<td>750</td>
</tr>
<tr>
<td>5</td>
<td>6 500 000</td>
<td>750</td>
</tr>
<tr>
<td>6</td>
<td>13 000 000</td>
<td>750</td>
</tr>
<tr>
<td>7</td>
<td>40 000 000</td>
<td>750</td>
</tr>
<tr>
<td>8</td>
<td>130 000 000</td>
<td>750</td>
</tr>
<tr>
<td>9</td>
<td>No limit</td>
<td>750</td>
</tr>
</tbody>
</table>

(Source: Authors field work)
5.2.2 OVERVIEW OF ROAD INFRASTRUCTURE IN SOUTH AFRICA

South Africa has road networks of about 747 000km which is the longest road network in Africa. The drive from Musina, South Africa’s northern border to Cape Town in the south is approximately a 2000 km journey on well-maintained roads. The Department of Transport is responsible for overall policy. Road construction/building and maintenance are the responsibility of SANRAL as well as the nine provinces and local governments. SANRAL is responsible for the network national roads, which cover approximately 16 200 km, 185 000 km of provincial roads, 66 000 km municipal network roads, and 185 000 km of provincial roads according to the South African Institute of Civil Engineering. National toll roads of approximately 19% are maintained by SANRAL while the rest have been allocated to private companies to develop, operate and maintain (SA’s transport network, 2017).

Roads play a significant role in the economic development of effective infrastructure as the precondition for national growth. By investing in roads infrastructure, the cost of transport and communication can be reduced. Roads can improve safety, capacity and traffic flow equality for all users, it also benefits economy, social and environmental quality (Technical Recommendation for Highways, 26:1). Moreover, roads make our life easier in many ways as they link province to
province even into other neighbouring countries of South Africa. They boost the economy of the country in terms of transporting goods, mineral resources in mining, farming and improve the access of different facilities such as schools, hospitals, shopping centres, work places and recreation centres (Levinson, 2004).

The delays, disruptions, poor site management, time and cost variations, skills and competence issues; lack of worker participation are among the challenges encountered in the course of executing construction projects, and there is no hesitation that substantial improvements in quality and efficiency are needed and are possible, Gigaba (2013).

5.2.3 OVERVIEW OF PERFORMANCE IN SA INFRASTRUCTURE

South Africa has an economic policy with a well-respected legal system of which construction contracts are regulated by English or Roman Dutch law with internationally recognized standard forms of contracts such as the FIDIC (1999), GCC (2015) 3rd edition, the JBCC (2000) and the NEC (Valentin & Vorster, 2012)

The physical possibility performance has two aspects, the first of which is the performance of a contract that must be objectively possible at the time of entering the agreement and if not, the performance is physically impossible and no enforceable agreement can come into existence (SACQSP,2014). The other aspect is that the performance must be at least determined or determinable. South African courts of law adopted four-point tests to determine whether or not performance is in fact objectively impossible at the time of contracting by proving the following:

- The impossibility of performance;
- The impossibility is not sufficient to destroy the contract;
- The impossibility is absolute, as opposed to relative; and
- The impossibility must not be the fault of either party.

Performance of the project can be regarded as a project which is completed on time, within the agreed budget and according to the set quality. These can be called the golden/iron triangle and can deem that the project is successful (Sibiya et al., 2015). The South Africa government also created the different national public works programmes to reduce problems such as poverty alleviation, high rate of unemployment and skill development (Mc Cutcheon & Parkins, 2009). The public works programme also contributes to the performance of the contractors in the construction industry. Performance measurement in construction is a complex and challenging task. Performance measurement in construction can be focused on industrial, corporate and unique projects using key
performance indicators (KPIs) and performance measurement systems (PMSs) (Haponava & Al-Jibouri, 2012).

The annual Construction Industry Development Board (CIDB:2008) reports that Indicators (CIIs) that measure the performance of the industry, focusing on clients, consultant and contractors is the way government operates in terms of tenders. The indicators suggest that the South African construction industry is not performing satisfactorily.

5.2.4 OVERVIEW OF ROAD NETWORK IN GAUTENG PROVINCE, SOUTH AFRICA

Aurecon and the Gauteng Department of Roads and Transport produced a report called Needs Analysis for the GPDRT Road Network, 2015/16. The principle objective of this report was to analyze the 5,846 km provincial roads under the jurisdiction of the Gauteng Province Department of Roads and Transport (GPDRT) to determine the impact of the current provincial funding on the future performance of these roads. Another objective was to determine the actual funding needs to eliminate any backlogs, and furthermore to quantify typical investments and investment allocation strategies needed to provide acceptable levels of service to road users while preserving the road network.

The Road Infrastructure Strategic Framework for South Africa (RISFSA) classification was used as a basis for development of the South African Road Classification and Access Management Manual (RCAM) classification system that deals with both rural and urban roads and also includes the aspect of access management. Both RISFSA and RCAM are used in all Gauteng provincial roads. The result of this saw the development of a technical recommendations document called TRH 26 (South African Road Classification and Access Management Manual version 1.0 of August 2012). RCAM is a six-class rural and urban road classification system.

Table 5.3: Road classification (Mobility/Access): RAMS 2016:3

<table>
<thead>
<tr>
<th>CLASS</th>
<th>FUNCTION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>Mobility</td>
<td>Principal arterial</td>
</tr>
<tr>
<td>Class 2</td>
<td></td>
<td>Major arterial</td>
</tr>
<tr>
<td>Class 3</td>
<td></td>
<td>Minor arterial</td>
</tr>
<tr>
<td>Class 4</td>
<td>Access/activity</td>
<td>Collector street</td>
</tr>
<tr>
<td>Class 5</td>
<td></td>
<td>Local street</td>
</tr>
<tr>
<td>Class 6</td>
<td></td>
<td>Walkway</td>
</tr>
</tbody>
</table>

(Source: Researcher’s field work)
To elaborate on this, the definitions of 'mobility' and 'access/activity roads' have been extracted from the Technical Recommendations for Highways (TRH) 26 and are given below. A road with a ‘mobility’ function is a type of road designed to protect and promote vehicle movement; activities allowed on ‘access/activity’ roads are not permitted on mobility roads. A road with an ‘access/activity’ function is any lower class collector and local road/street where the access functions are greater in number. The total length of the road network analyzed is approximately 4,321 km for paved roads and 1,335 km for unpaved roads. These road lengths are based on the visual assessments conducted for paved and unpaved roads during 2015. The total road network under the jurisdiction of the Gauteng Department of Roads and Transport (GPDRT) is 5,846 km.

Table 5.4: Network length by pavement type, 2015

<table>
<thead>
<tr>
<th>Road type</th>
<th>Length (km)</th>
<th>Length (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paved roads</td>
<td>4,456</td>
<td>77%</td>
</tr>
<tr>
<td>Unpaved roads</td>
<td>1,362</td>
<td>23%</td>
</tr>
<tr>
<td>Total</td>
<td>5,846</td>
<td></td>
</tr>
</tbody>
</table>

(Source: RAMS, 2016)

Many international and local studies have shown that VOC is related to the roughness of a road. For the purpose of this study, the VOC/IRI relationships for light and heavy vehicles were determined based on 2015 input costs. The average cost per vehicle-kilometer driven on the road network under the jurisdiction of the GPDRT was calculated as R6.73. The average VOC cost per one kilometer driven on paved roads is R6.71 and R9.36 on unpaved roads. The total associated...
road user cost for the estimated 12.7 billion vehicles-kilometers travelled on the GPDRT roads is approximately R85.6 billion in 2015. The distribution of vehicle operating cost on the GPDRT road network is shown in Figure. The VOC distribution between paved and unpaved roads corresponds to the distribution of annual vehicle-kilometers driven on the GPDRT roads.

![](image)

**Figure 5.2**: Vehicle operating cost comparisons for paved and unpaved roads, 2015

This study focuses on the Gauteng Provincial roads that are completed and currently running as well as the upcoming road construction projects in the Province. Below is the list of projects as per categories listed:

**Table 5.5: Some of road projects currently running in Gauteng Province**

<table>
<thead>
<tr>
<th>Item No</th>
<th>Project Name</th>
<th>Project Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rehabilitation of road P46/1 from Vereeniging to Alberton</td>
<td>R 50 000 000.00</td>
</tr>
<tr>
<td>2</td>
<td>Rehabilitation of road D904 between Road R82 in Evaton and Road 1.</td>
<td>R 21 560 428.63</td>
</tr>
<tr>
<td>3</td>
<td>Rehabilitation of road P243/1 from Vereeniging to Balfour Phase 2</td>
<td>R 65000 000.00</td>
</tr>
<tr>
<td>4</td>
<td>Repair and resurfacing of provincial road P41/1 from 0.84km to 5.61km west of Nigel approximately 4.77?</td>
<td>R 16 000 000.00</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Cost</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>5</td>
<td>R82 phase 3 between road D1073 (Walkersville) and 164 km? De Deur</td>
<td>R 700 000 000.00</td>
</tr>
<tr>
<td>6</td>
<td>K69-Upgrading 13km of road from Mamelodi to Lynwood.</td>
<td>R263 000 000.00</td>
</tr>
<tr>
<td>7</td>
<td>Upgrading of gravel road D1944 from km 9.58 heading towards km 22.833 (11.35km)</td>
<td>R 45 000 000</td>
</tr>
<tr>
<td>8</td>
<td>Road D670 from D2442 (KM 0.0) to D2765 (km 18.48) Bronkhorstspruit to Ekangala.</td>
<td>R 71 000 000.00</td>
</tr>
<tr>
<td>9</td>
<td>D1027 phase 2 – Rehabilitation of D1027(Cedar Road)</td>
<td>R 87 745 772.73</td>
</tr>
<tr>
<td>10</td>
<td>N14 Phase 2: Rehabilitation of Road P158/2 (N14) from Brakfontien Interchange km 0.0 to km 20.7</td>
<td>R 426 729 691.63</td>
</tr>
<tr>
<td>11</td>
<td>Construction of road K54 between road K22 (Old Bronkhorstspruit road and road K 69 (Hans Strijdom)</td>
<td>R450 000 000</td>
</tr>
<tr>
<td>12</td>
<td>Upgrading of Sebe Road in Evaton</td>
<td>R 28 000 000.00</td>
</tr>
<tr>
<td>13</td>
<td>K46 Phase 1- William Nicole between Witkoppen and PWV5 (Juskei River)</td>
<td>R 550 000 000.00</td>
</tr>
<tr>
<td>18</td>
<td>P88/1: Rehabilitation of Road P88/1 between road P73/1 and Road P3/6</td>
<td>R 237 169 720.34</td>
</tr>
<tr>
<td>19</td>
<td>K154: Gauteng Highlands: Grace view Access Rd to old Vereeniging (R82/P2-1) Phase 2 Detail Design &amp; Land proclamation</td>
<td>R 480 000 000.00</td>
</tr>
<tr>
<td>20</td>
<td>DRT 23/05/2016: Rehabilitation of Road P249/1 (R511) from km 6.58 to km 18.69 (Gauteng/ North West Boundary) (Tshwane Region).</td>
<td>R 131 399 204.96</td>
</tr>
</tbody>
</table>

(Source: Author’s field work)
5.3 FACTORS INFLUENCING THE PERFORMANCE OF ROAD INFRASTRUCTURE PROJECTS

Performance can be good or poor; however many researchers focus on poor performance by the service providers such as contractors, consultants, and suppliers. Poor performance by the contractors is caused by many factors such as poor delivery of good service to the end users, poor resources management, and poor management of funds, political interference and many other factors (Ugwu & Haupt, 2007). Contractor performance can be defined as a factor of time, sustainable development, quality and construction cost, the idea being that attainment of one facet of performance must not be at the cost of another (Hong & Proverbs 2003).

The South African roads construction faces construction issues such as personnel on site, safety, time constraints and changing of scope of the work. Moreover, there are indirect challenges that affect construction such as proclamation or landscaping issues which involve legal issues, finding that there are properties along the way where the road needs to be constructed, and if the proclamations were not done properly, the legal process comes in if the owner of the property is not satisfied (Muir, 2005). There are contractors’ factors, consultants’ factors and clients’ factors influencing poor performance of road infrastructure projects.

5.3.1. Change management

Change of management can be determined by the growth of the business, retirement, death, unsatisfactory performance or any other reason. Construction companies rely on the experience and skills of their management (Valentin & Vorster, 2012).

5.3.2 Cash flow

Contractors usually attach its long-term assets to acquire finance which severely impairs a company to continue with operations as construction industry relies heavily on working capital (Valentin & Voster, 2012). The significant impact of the debilitating effect on relationships and cash flow among employers, consultants, and contractors can lead to exhaustive disputes, arbitrations, and expensive litigations, clearly justifying such concerns as a chronic problem facing the construction industry (Kulemeka et al., 2015).
5.3.3 Critical success factor
Critical success factors are cost, time and quality and they have a significant impact on project results. Furthermore, they play a significant role in achieving the desired results with or without the moderate use of resources. Cost, time and quality work together in a project (Alsulamy et al., 2014).

5.3.4 Contractual factor
It is very important to the contractor to understand the type of contract that is being entered into. In construction contracts, the contractors are required to build the works and the employer is required to pay the contractors. Contracts will specify the work that needs to be done, the amount to be paid, the parties’ responsibilities and any event occurring outside parties’ direct control (O’Reilly, 2011).

5.3.5 Legal provisions
Most of the contractors fail to comply with all applicable laws, regulations, statutory provisions and agreements. The engineer should be provided with proof of compliance to the issues such as a water license if the contractor has obtained permission and permits for the execution of works by the contractor from any Act of Parliament, ordinance, regulation or by-laws of local or other statutory authorities. They may also fail to comply with the Occupational Health and Safety Act together with Environmental Act. (General conditions of contract for construction works, (GCC), 2010).

5.3.6 Procurement method chosen
The procurement methods used by the contractors and planning ability of contracts or projects are one of qualitative significant factors affecting project performance. This therefore implies that adequate attention should be paid in this area (Azhar et al., 2008).

5.3.7 Budget and funding
Poor budgeting is another cause of poor performance in Africa. Project clients have limited budgets for the funding of projects. Government has mandatory to work with emerging contractors who are still new in business and less experienced with limited budgets. Most of the emerging contractors cut corners to gain profit (CIDB, 2011).

5.3.8 Existing services and land/properties proclamation
Another challenge related to design are the existing services and land proclamation which always seem to be forgotten when the designs of projects are under way. The existing services and land proclamation becomes an issue and delays the project during the construction phase; therefore these issues need to be considered during the planning stage (Kamanga & Steyr, 2013).
5.3.9 Tender process
Unnecessary time lags between tender submission and contract award is one of the factors influencing poor performance in the construction industry (Emuze & Smallwood, 2012). Submission of documents such as performance guarantees, original SARS tax clearance, appointment and acceptance letters, Broad-based Black Economic Empowerment (B-BBBEE) certificates and others after the awarded tender or contract take more time than expected. That is the government restraint which leads to collusion and corruption. The consultant prepares the tender document as part of contracts, print required project drawings and other documents and if there are some errors occurred during preparation of contract documentations it will hinder the overall project process therefore all errors occurred must be rectified, captured and addressed during site briefing/clarification meeting and addendum must be issued to the bidders who attended the site briefing/clarification meeting before the execution of the project (Sunjka & Jacob, 2013).

5.3.10. Procurement management
According to the Project Management Body of Knowledge (PMI, 2011), procurement is used to obtain goods, services or scope from outside the organization. Every procurement method involves types of contracts used on the project (PMBOK® Guide, 2008). Projects in which clients are not happy with quality could probably be related to procurement-related barriers which include fraud and corruption in the appointment of contractors who were not capable of undertaking the necessary work. The CIDB report (2011) illustrates that the use of procurement systems in the public sector is only based on price and preference without considering the functionality or quality as a barrier to construction quality. The CIDB gives an example of 25% of provincial and local authority contracts awarded that were not adjudicated on basis of quality, and 13% of provincial and local authority contracts were not awarded in line with tender committee recommendations (CIDB, 2011).

5.3.11. Lack of detail specifications
Poor design reflection, unrealistic specifications and even continuous changes of design by the client are some of the design problems faced in delivering quality construction (CIDB, 2011). The CIDB (2011) continued with the investigation of the barriers to quality of design, specified quality and highlighted the concerns that are perceived regarding a deteriorating capacity that needs to be developed and maintaining technical standards, codes and specifications. Unprofessional design halts or delays the execution of a project as the design needs to be reviewed, amended and accepted or approved for construction works. Once the errors are identified, works are temporary suspended
until such errors are rectified. The errors normally occur in companies where the selection process of vendors is compromised. (Sunjka & Jacob, 2013).

Design issues which do not incorporate the expertise of construction process are difficult to construct on site. Time, budget and quality are affected by design problems which impact risk on projects. Normally in a project, design decisions are made by the consultant in the absence of the contractor and those decisions have constructability implications during the execution of the project (Kuo & Wium, 2014).

5.3.12 Barriers to the uptake of new knowledge
Road development projects in Africa concentrate on the basis of design specifications rather than performance specifications. Road pavement designs are prepared by consultants who must take responsibility for the performance of the road for a 15- or 20-year period (Emuze & Smallwood, 2012). Consultants are not in a position to take any risks on the design and therefore tend to resort to ‘tried and tested’ solutions, even if these result in high construction costs. Practitioners in the road sector in most parts of Africa tend to lack access to new knowledge and awareness of new innovations (Emuze & Smallwood, 2012).

Some of the challenges that face the road construction industry are little or no capacity at all levels of government, especially in municipalities, lack of essential skills necessary for the management of projects, undermining of engineering skills in municipalities, poor project scoping and specification, lack of knowledge relative to skills and resources required to implement projects, contract awards based mostly on poorly defined tender processes, lack of experienced employees capable of managing projects, and unnecessary time lags between tender submission and award (Emuze & Smallwood, 2012).

5.3.13 Standard and specifications
There are standard forms of contracts which bind both construction work and construction-related professional services such as pure design work and construction supervision work. It is vital for both contractor and consultant to be familiar with the relevant standard form of contracts which could be used for the type of construction work which the contractor will consider when tendering.

Public sector procurement in the roads sector is closely governed by standards and specifications (TRH, 1999). These standards and specifications must be updated to facilitate the implementation
of new technologies. Very few design engineers are prepared to recommend solutions that are not directly sourced from a design manual or other document formally recognized by their employer (TRH, 1999). Where engineers deviate from published ‘best practice’, they become liable for any failures that can be linked to the design decision (Debeer, 2000). This may be irrespective of whether the design manual is truly appropriate to the local environment. The standards are particularly inappropriate at lower traffic volumes (Kamanga & Steyr, 2013). Construction activities need best practices and tools to avoid rework and delays (Sunjka & Jacob, 2013).

5.3.14 Lack of proper planning

Definition of planning
Planning is a radical tool in project management used in order to meet the project scope, time and cost as the planning clarifies all activities and actions that will take place as well as milestones to be reached to attain the objectives of a project (Ibrahim, 2014). Any poor project planning of any project contract leads to project failure as a result of poor project management. It is also detrimental to the nation as a whole in its infrastructural growth process. Lack of proper project control systems, poor planning and poor work definition of scope lead to project failure or delays. According to the research of Inuwa et al., (2014), planning has a considerable effect on the outcome of projects.

5.3.15 Construction programme of works

Most of the contractors seem to fail to submit or produce construction programme of works to the engineer and client at early stage of the project. Submission of programme of works is one of the mandate or documentation required before commencement in order to meet the due completion date. Other contractors deliver or submit unrealistic programme of works to the engineer which delay the approval by the engineer as the programme needs to be adjusted. Sometimes that adjustment happened several times before any works executed. (General conditions of contract for construction works (GCC, 2010).

Project managers appointed by the contractors are expected to come up with workable plan to implement the project. A defective plan will lead to delay or failure in project completion and an inappropriate construction programme of works impedes the monitoring of the project progress against the stipulated time on contract (Sunjka & Jacob, 2013).

5.3.16 Poor contractor performance

Poor contractor performance results in poor quality and low productivity (Dlungwana et al., 2002).
Smallwood (2000), conducted a survey with the aim of investigating the client’s perception relative to contractor’s performance. The survey investigation reveals problems of poor productivity and poor quality. Smallwood’s findings further reveal problems of poor planning, poor management, and low skills level among workers to be the causes of poor contractor performance as perceived by clients (Smallwood in Dlungwana et al., 2002).

5.3.17. Performance guarantee

Due to lack of finance during the pre-construction stage during which the contractor needs to submit performance guarantee in required time, some contractors fail to do so which disqualifies the contractor from meeting that requirement. Moreover, during the construction phase, contractors experiencing cash flow problems are faced with incomplete construction works and sometimes even liquidation of that construction company (Mofokeng, 2012).

5.3.18 Human resources

The workforce is most valuable product in the workplace. The absence of a team member can cause a distortion in the planning of the day’s activities, reduce output and cause project delays. The most prevalent human resource problems are absenteeism, excessive overtime, unqualified staff and time constraints. Most of the workforce in the construction industry are seasonal not permanent and most of the workers on site spend more time moving from one site to another as per instruction from management. When contractors are under pressure, they engage workers to work overtime: that leads to tiredness and no reasonable output can be achieved when someone is tired and exhausted. It also causes poor quality of work done as well as accidents. Hiring of unskilled personnel hinders the execution of work on site as per specification and leads to mistakes during construction. More time is then spent on alterations and reworks (Ngosong, 2014).

5.3.19 Project duration period

The project time frame stipulated in the contract should be kept by the contractor. It becomes difficult as they fail to use the tools and techniques such as work breakdown structure that is construction schedule, precedence diagramming method and other techniques (Muir, 2005). The other causes of the contractor not finishing a project on time is the employer who intervenes by approving the variation orders late, giving instructions as well as unauthorized suspension orders. Works would have been completed by the original date as planned; however, the employer’s interventions of signing the variation orders late can cause the change in the scope of work. This
ends up as a breach of contract by the employer and if it is not the breach of contract, the employer needs to grant an extension of time for the completion (Meinesz, 2007).

5.3.20 Delivery of materials, plant and equipment

Delivery of materials, supplies and equipment may take a longer time than normal. The availability of some of the material depends on inflation. Most of the contractors do not have equipment and plant of their own; they depend on hiring which means they sometimes fail to get that equipment on time (Muir, 2005). Other delays are the late delivery of materials, plant and equipment caused by non-payment by the contractor.

5.3.21. Late payment by the employer

Emerging contractors are allowed to tender on certain CIDB grading categories of the tender value. That is done to avoid high levels of competition of contractors and the liquidation of companies at an early stage due to default, difficulty in paying back bank loans and running of contracts as per late payment by the employer (Thwala & Mvubu, 2008.) Late payment normally happens when agreed milestones for payment are not met or when there is no cash flow projection in the project implementation plan (Sunjka & Jacob, 2013).

5.3.22 Resources

The contract/project managers sometimes fail to plan their resources in time or fail to scrutinize the work tasks or activities and their interactions on the project with the expected duration of the project. Improper equipment selection and faulty equipment leads to delay of the project caused by time spent on repairs (Sunjka & Jacob, 2013). Ineffective and inefficient management of tools, equipment, materials and consumables are some of the most critical resource issues in road construction companies. Moreover, loss or theft of resources can also lead to costly replacements, as does the mismanagement of tools, equipment and materials. Theft can cause the company a lot of money by having to replace equipment and materials that are stolen. Theft affects every department of the company, from the accounting department which cannot manage to replace equipment and material on a limited budget to the project managers who have to scramble to avoid project delays when equipment is stolen. The warehouse manager is also affected by a shortage of tools, equipment and materials (Sawye, 2005).
5.3.23 Time and financial constraints

Definition of constraints

Constraints

Constraints are defined as constraining conditions, concerns or forces that restrict the performance of the construction environment (Kulemeka et al., 2015).

Constraints in details

The following aspects were identified as constraints on the contractors’ performance: uncertainties in supplies and continuous changes in material prices, payment certificates, procurement systems, access to finance, variation orders’ approval, access to plant and equipment, inappropriate contract conditions, maintenance of plant and equipment, contract disputes’ resolution, meeting deadlines, change of design, incomplete contract documentations, transportation of equipment and materials, overall control on site, shortage of skilled labor, public image, inadequate supervision by client, project planning and site management, technicality of know-how, corruption, theft and fraud by employees, taxation, breach of contract by public client and other constraints (Adams et al., 2007).

Other study revealed delay factors such as poor contract management, change in site conditions, shortages of materials, imported materials and plant items, design changes, cash flow problems, incomplete drawings, equipment breakdown and maintenance problem, price escalation, contractor’s construction program of works, late payment by the client, noncompliance with the contract conditions and many others (Kulemeka et al., 2015). Constraints found cause delays in construction projects are underestimate of project cost, poor supervision, difficulty in accessing bank credit, shortage of materials, poor professional management, late deliveries of materials, lack of program of works, delays by sub-contractors, poor design, breakdown of equipment, obtaining permit from municipality, lack of communication between parties, shortage of skilled labor, legal disputes, bad site conditions, accident during construction, too much public holidays and other sort of delays. (Fugar and Agyakwah-Baah, 2010).

5.3.24. Lack of risk management

According to the Project Management Institute (PMI, 2004), risk is an uncertain event, which, if it occurs, has an effect which can be positive or negative on one or more project objectives. There are many different explanations or definitions of risk as stated by different authors. The M1 Grayson Bridge in Gauteng, South Africa collapsed owing to improper planning of risk. Murray and Roberts
never took into consideration the factors of unforeseen circumstances such as the wind factor and the type of material used when they constructed that pedestrian bridge. According to Form-Scaff representative, Ewan Rudolph, Form Scaff did not have access to Murray and Roberts (M&R’s) construction methodology drawings and Form Scaff had no knowledge of the construction methodology that M&R used in building the temporary work. According to Rudolph’s statement, it is once more a lack of relevant information when making decisions. “It was evident that M&R was not ready to receive the preassemblies, as the required temporary works to support the girder assembly had not been completed. M&R’s representatives assured Form-Scaff that the temporary works would be ready in time,” said Rudolph (Mail and Guardian, 2016).

Risk information needs to be transmitted intra-organizationally; hence communication becomes an important aspect of risk management and risk identification (Edwards et al., 2009). External factors such as inclement weather, political influences and natural disasters such as flood, lightning strikes, strong wind need to be taken into account. In areas where there is frequent rainfall, inexperienced contractor/consultants do not account for weather projections in their project implementation plan. There are areas that usually experience natural disasters such as floods which are generally unpredictable. However, well-established project management organizations possess the requisite skills to manage natural disasters. Interference by political leaders is usually experienced in public sector projects (Sunjka & Jacob, 2013). Political influence also contributes to risk by interfering or requesting additional scope of work which was not captured in the original design. All of the above actions lead to poor project performance in terms of time and cost (Sunjka & Jacob, 2013).

5.3.25. Traffic volume

According to the Roads Asset Management System (RAMS), 12,468 million (approximately 12.5 billion) vehicle-kilometers are travelled each year on the GDRT (Gauteng Department of Roads and Transport) road network. The majority of traffic occurs on paved roads, where 76 % of the total network length carries 99% of the total traffic volumes on the Gauteng Province roads; therefore the life cycle needs to be analyzed as it will place a high emphasis on the preservation of the paved road network (RAMS, 2016).
5.3.26 Corruption in construction industry

The construction industry is always ranked as one of the most corrupt in the world owing to large payments to gain or revise contracts and disobedience of regulations which are common. The author further explained the impact of corruption is not limited only to the payment of bribes: Corruption also extends to the construction of poor quality infrastructure with low economic returns and low funding for maintenance. This is where the greatest impact of corruption is felt (Ngosong, 2015). In South Africa, the awarding of tenders or projects to the construction companies in the public sector depends on the technical and financial capability of the recent projects of the organizations. The corruption becomes part of the awards where the bid evaluation committee becomes corrupted when awarding the tenders (Oyewobi, Windapo & Cattel, 2014).

Most of public officials are very actively involved in the acts of corruption, especially in the soliciting of bribes and tender manipulation. This activity usually occurs with appointments and tender irregularities. Factors instrumental in corruption include the skills shortage within the construction industry, a perceived absence of deterrents and sanctions, and poor ethical standards. Procedural impediments, fear of victimization and personal attitudes all act as barriers to combating corruption. While confirming opportunity, pressure and self-justification as the three pillars of the Cressey ‘fraud triangle’ theory of corruption, the research findings suggest that a more dynamic interpretation of this model is advisable as processes are needed along with shifts towards higher standards of ethical behavior among public sector employees at all levels (Bowen & Edwards, 2012).

In South Africa, the experiences of construction practitioners and clients concluded that corruption is pervasive and that contractors, subcontractors and public officials are actively implicated in such
practices. Government officials frequently engage in nepotism, dishonesty and unfairness, tender irregularities and extortion of bribes and kickbacks while architects and engineers are guilty of negligence and financial maladministration (Effah et al., 2017). In the construction industry, corruption may occur in any phase of a project, namely project initiation, planning and design, bidding and construction, and operation and maintenance. Construction is a billion-dollar industry worldwide, much of which is linked to publicly financed projects. However, cost and time escalation and poor quality are commonplace due to weak governance and endemic corruption. Some causes of high rates of corruption in the construction industry are the fact that the construction industry has many close ties to the government and the industry involves complex, non-standard production processes that foster asymmetric information stocks between clients and providers (Kenny et al., 2010).

The construction industry involves a large number of participants in a complex contractual structure that leads to a variety of psychological human behavior and attitudes that promote corrupt activities (Nordin et al., 2012). Kenny (2009) surveyed the evidence of different types of corruption present in different sectors ranging from bribes designed to manipulate budget decisions, project selection, tender specifications, procurement outcomes or contract negotiations to cover poor quality construction practices and outcomes. The evidence indicates that corruption may be a consequence part of a system of decision-making that leads to poor construction, limited occupational safety and low returns to government infrastructure investment (Kenny, 2009).

Bribery, negligence, dishonesty, fraud, collusion and unfair practices are characteristics of stakeholders in the construction process such as architects (100%), quantity surveyors (94%), consulting engineers (67%) and contractors (60%). The mentioned participants stated that they had experienced professional neglect in South African construction with poor quality and workmanship indicated as the most common form of professional neglect. Corruption was ranked one of the most importance barriers in construction by contractors and project managers (CIDB, 2011).

5.3.27 Community unrest

The community unrest due to agitation by the community arguing about the way that contractors source local laborers and sub-contractors and train the locals presents a huge challenge to the execution of projects in that particular area. Community unrest results in a slower pace of project work and sometimes even total abandonment of project sites. Community unrest such as strikes, stoppage of projects by business forums, councilors’ interruptions, and spending more time on
negotiations regarding the community grievances all disrupt construction work (Sunjka & Jacob, 2013).

Community unrest or disruption can lead to uncertainty regarding the date of project completion (Atkinson, 2002). Public procurement in South Africa still faces enormous predicaments. These include, among others, a lack of proper knowledge, skills and capacity, non-compliance with SCM policy and regulations, inadequate planning and the linking of demand to the budget, accountability, fraud and corruption, inadequate monitoring and evaluation of SCM, unethical behavior, too much decentralization of the procurement system and the ineffectiveness of the black economic empowerment (BEE) policy (Ambe & Badenhorst-Weiss, 2012).

There are six variables of construction procurement, namely the source of funding, selection method, price basis, responsibility for design, responsibility for management and the extent of supply chain integration. The variable option depends on the client’s choice of type of procurement method. To deliver project within the agreed budget and time stipulated becomes a huge problem for many contractors which ends up with a wide gap between achieved and expected outcomes. Good procurement management can help the construction companies to achieve the objectives of the project and maintain value for money (Watermeyer, 2014).

According to Aigbavboa and Thwala (2015), some of the internal factors that cause the challenges in construction are the financial managerial ability of the contractors, lack of finances to pay upfront for performance guarantee, insufficient capital or good cash flow, poor estimating and job costing, and the debt by the contractors as most of the contractors are in debt as they misuse money that they get from projects. Most work stoppages were due to labor unrest, unrealistic expectations from business forums and unions as well as insufficient meetings with the community members. Community unrest with regard to labor would stem from SMEs being unhappy with being rejected from partaking in subcontracting work. Most black enterprises fail to even make it to the tendering processes owing to company registration processes not being complete, labor not registered for the Unemployment Insurance Fund (UIF) and all labor-compliant documentation, lack of financial resources to sustain them, lack of information to engage in tendering and insufficient skilled labor (Nkosi, 2017).
5.3.28 Government regulations

Government regulations and policies differ from one department to another. For instance, the roads construction can be done by the Department of Roads and Transport. However, there are other departments that need their protocol to be followed such as the Department of Labor, and the contractor must obtain a construction work permit approval to commence with construction work or activities (Government Gazette, 2014). According to the National Water Act 36 of 1998, the Department of Water affairs requires the contractor to obtain a water license. The environment issues affect construction significantly in that for construction on wetlands or parklands, the contractor must apply to the GDARD (Gauteng Department of Agricultural and Rural Development) which takes time for approval. Some environmental issues are erosion, sedimentation and inclement weather. Failure to adhere to environmental regulations will result in a project being delayed or terminated and the contractor being prevented to participate on future work opportunities or being fined.

5.4 THE EFFECTS OF POOR PERFORMANCE ON ROAD INFRASTRUCTURE

Road infrastructure is the responsibility of the public sector, hence the majority of road proposals are put forward by the public agencies such as SANRAL. Transport infrastructure impacts both the transport users and the non-users (Joynt, 2009). The cost of infrastructure in South Africa is ultimately borne by either tax payers, users or donors. However, tax payers remains important to the present day, therefore it is vital to determine the effects of roads projects as it is a drain to the economy and stakeholders of the country (Calitz & Fourie, 2007).

In a democracy, taxpayers are entitled to know how their money is spent in accordance with approved policies and that adequate safeguards are in place to prevent the misappropriation of funds. Good audit control and the provision of a clear audit rail are therefore central themes in a project procurement strategy (Marks & Fellowes, 2015). Public works projects undertake infrastructure that facilitate service delivery in respect of the socio-economy in South Africa to achieve economy growth. Public works is hampered by skills shortages that impact all spheres of government and hinder service delivery (Emuze & Smallwood, 2012).
The study highlighted some of the effects of construction projects in Gauteng Province from different researchers as indicated below:

**Table 5.6: Effects of poor performance in road infrastructure projects of South Africa**

<table>
<thead>
<tr>
<th>No</th>
<th>Effects of poor performance</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Extension of time, cost overruns, loss of profit, disputes, claims, Creates stress on the contractor, Acceleration losses, Litigation, Total project abandonment, Loss of skilled employees, Bankruptcy of the client, Arbitration, Termination of contracts, and Bad company reputation, among others.</td>
<td>Mukuka et al., 2015</td>
</tr>
<tr>
<td>2</td>
<td>Time overrun, Budget overrun, Poor quality completed project, Bad Public Relations, Bad Public Relations, Litigation, Arbitration, Disputes and claims and Total abandonment.</td>
<td>Sunjka and Jacob, 2013</td>
</tr>
<tr>
<td>3</td>
<td>Bankruptcy or liquidation, Leads to abandonment of projects, Results in formal dispute resolution, e.g. litigation/arbitration, Creates negative social impacts, cash flow problem, loss of skills workers, conflicts and default of loan repayment.</td>
<td>Ansah, 2011</td>
</tr>
<tr>
<td>4</td>
<td>Abandonment, Disputes, Arbitration, Lawsuits, Negotiations, Over cost, Overtime and Litigation</td>
<td>Haseeb, 2011</td>
</tr>
</tbody>
</table>

5.4.1 Bad effects of poor performance on economy

5.4.1.1 Increase in diseases

Projects may cause bad effects on the economic and social activity in the surrounding areas of the road such as high demands on health services and education due to construction camps around the community. Disease problems may arise both from those brought in and from their potential exposure to diseases against which they do not have immunity (Mukuka et al., 2015). CIDB indicated that HIV/AIDS runs rampant among South African construction workers largely because the labor force is migratory. Construction camps are a breeding ground for the spread of the pandemic and sexually transmitted diseases and workers on contract generally disregard the consequences of casual sexual relationships. People are infected due to not using condoms, duration
of time away from home and family, boredom and opportunity with multiple partners (Hlebela, 2009).

5.4.1.2 Schedule overrun

Mukuka, Aigbavboa and Thwala (2015) stated that extra time required to finish a given construction project beyond its original planned duration has a bad effect on the economy. Construction projects schedule overruns have negative impacts on all construction parties. The bad effects are the following:

5.4.1.3 Time overruns

Delay in land acquisition, delay in equipment erection, inadequate mobilization by the contractor, delay in forest clearance, fund constraints, change in scope of work, cancellation of tender, law and order problems, and delay in supply of equipment all contribute to time overrun (Salunkhe & Patil, 2014).

5.4.1.4 Cost overrun

Many projects have design changes problem as the client keeps on changing ideas; sometimes it is due to the nature of the geographical location. These cost overruns have been attributed to design changes (Barrie, 1998). Design changes found to be most important source of construction wastage (Proverbs, 2000). In South Africa, most of the overruns are caused by additional cost due to variation works, inflation or an increase in the cost of construction materials, delay of drawings, contractor’s bankruptcy or liquidation and other overruns (Monyane, 2013).

5.4.1.4 Dispute and claims

Lack of payment to contractors is a common cause of disputes in the construction industry (Ansah, 2011). All the problems in the construction industry begin when payment in the exact amount due by the date shown on the statement is not received. Disagreements then lead to arguments as relationships sour, and the stage is set for conflict; finger-pointing, blaming and judging, buck-passing and lawyers. Projects exceed initial time estimates and costs escalate and extensive delays are experienced (Artidi & Chotibongs, 2005).

5.4.1.5 Arbitration

Butler and Finsen (1993) observed that arbitration has become more formal and legalistic and expressed the hope that the advent of ADR would rekindle arbitration and provide it with appropriate techniques to sustain its use. Arbitration is a process that takes too long to reach resolution and costs too much, according to Baloyi and Agumba (2014). Eilenberg (2003) states
that arbitration is a widely-accepted form of alternative dispute resolution outside the court (Mashwama et al., 2016).

5.4.1.6 Total project abandonment
Many large construction projects are temporary or permanently abandoned owing to finance crises, natural disasters and companies’ changes (Mukuka et al., 2015).

5.4.1.7 Waste of resources
The waste streams differ largely between different construction phases and waste overlap from one construction phase to another and all this can be attributed to the attention given by the management to controlling material waste. Material wastage in building projects leads to many negative effects such as disputes between clients and contractors, increased cost, loss of productivity and revenue, and eventually termination of contracts.

5.4.1.8 Low productivity
Lack of contractors’ profitability was found to be one of the factors associated with failure. The main reason behind any enterprise, including contracting enterprises, is to generate maximum profit. One of the serious outcomes relating to the industry’s performance is believed to be poor management: this causes the South African productivity rate to remain low (Van Wyk, 2003).

5.4.2. Good effects on construction projects

5.4.2.1 Increase transport mode
Owing to road improvements, pedestrians may change to motorized transport and larger vehicles may come into service (Robisons, 1999).

5.4.2.2 Decrease transport cost
It is easier to make trips to farms or markets or other commercial centers. This benefits agricultural producers because reduced transport costs which makes higher returns on goods sold. Furthermore, transport becomes cheaper, therefore more people can afford it (Robisons, 1999).

5.4.2.3 Job creation
Women empowerment, new businesses opportunities, and higher employment level increase the standard of living (Masarova & Ivanova, 2013). The Preferential Procurement Policy Framework
Act (PPPFA 2017) set the prequalification criteria for all tenderers in South Africa which service providers like contractor’s needs to meet. Some of those requirements include hiring local laborers, sub-contracting some of the works and even conduct the training. All of the above lead to high availability of jobs during contracting of the projects.

5.4.2.4 Skills transfer
CIDB policy and regularity initiatives target the development of contractors to manage the development of sub-contractors as part of contractors’ performance reports. This gives sub-contractors a chance to gain more skills and upgrade their CIDB grading (CIDB, 2013).

5.5. THE IMPACTS OF STAKEHOLDERS ON ROAD INFRASTRUCTURE

5.5.1 Stakeholder overview
In South Africa, community leaders and municipalities are stakeholders in the project for political leaders to gain the majority of votes in times of election. However, those leaders (at least 80% of them) are not technically qualified as they occupy political posts; civil engineers at the national political level are rare. However, civil engineers can use political leverage to challenge the involvement in politics which can help them to gain more construction jobs and ensure good relationships with the government in terms of tendering (Abbot, 1996).
5.5.2 The roles and impact of stakeholders in the project

It is very important to identify the impact of stakeholders on a given project by identifying their necessary roles in the given project. Stakeholders’ roles must be known for them to be considered. The stakeholders may be grouped according to their grading, interest and attitude regarding project outcomes. Those three dimensions will determine whether the stakeholders are backing (support) or blocking (resist) the project outcomes (Assefa et al., 2015).

Some of the stakeholders have a negative impact on the project and some of the stakeholders have a positive impact in the project (PMI, 2014). Stakeholders can affect organizational functioning, goals, development and even survival. Stakeholders can be beneficial when they help to achieve goals but stakeholders can be disadvantageous when they oppose the mission and goals. All in all, stakeholders have the power to be a threat or a benefit to an organization (Chinyio & Olomolaiye, 2010). Some of the stakeholders who may be engaged in a project are property owners affected by the project and organizations of existing services that need to be relocated such as Telkom lines and Eskom cables (PMI, 2008).

Stakeholders need to be analyzed, the stakeholders of the project need to be identified, their expectations and their impact on the project. In addition, management strategies need to be developed to engage stakeholders in project decisions and execution.

Mofokeng (2012) states that all of the private and public sectors stakeholders need to be engaged to be part of the planning and implementation stage on the project before any construction works commence. Engaging stakeholders prior to the time a decision is reached is considered crucial for construction projects. Many problems can be overcome if the stakeholders are actively engaged in early planning and integrated into the project team, and if a systematic approach is used to identify and manage stakeholders in the project delivery process. The impact of stakeholders’ management can be the process which comprises problem-solving activities, minimizing project risks, and facilitating projects to move forward in a timely and effective manner (Yang & Shen, 2014).

The construction companies and organizations should consider practical stakeholder management training courses which include how to teach who project stakeholders are, what their stakes in the project are, and what challenges and threat they present. (Carol & Buchholtz, 2006) According to the South African Council for Project Construction Management Professions (SACPCMP), stakeholder management is the one of the most management knowledgeable areas where the
individuals, groups or organizations need to be identified as they have a massive influence on the construction project (SACPCMP, 2015).

Failure to deliver road projects on time by the contractor displeases both clients and road users who expect to benefit from the completion of the project on time. Moreover, projects delayed are very costly for contractors and different stakeholders of the projects (Kamanga & Steyr, 2013).

5.6 MITIGATING THE PERFORMANCE OF ROAD INFRASTRUCTURE

Various attempts were made by different researchers to determine factors contributing to project success delivery in construction. A number of factors have been proposed (Chan et al., 2004). Rapetsoa (2011) states the number of factors that can help in the success of projects are project-related factors, procurement related factors, project management factors, project participants-related factors and external factors (Rapetsoa, 2011).

Below are some of the ways to mitigate poor performance of road infrastructure in South Africa:

5.6.1 Road agencies

Road agencies can aid the delivery of the road projects as their mandate is to help on the different aspects of roads all over the country. The road agencies like SANRAL, JRA and others can be the solution to most of the challenges found in road construction in the Gauteng Province, South Africa. The South African Roads Agency Limited is a statutory company which can aid the effective delivery of roads project as its responsibilities are planning, design, construction, operation, management, control, maintenance and rehabilitation of national roads in South Africa. SANRAL also finances roads construction in accordance with government policy (SANRAL, 2015/16:8).

The other road agency that can aid is the Johannesburg Road Agency (JRA) core the core competencies of which are planning, design, construction, operation, control, rehabilitation and maintenance of the roads and storm water infrastructure in the City of Johannesburg. The JRA’s main responsibilities are construction and maintenance of bridges/culverts, traffic signals/traffic signal systems, footways for non-motorists, road signage and road markings; therefore JRA can be very helpful regarding the delivery of roads construction projects. These competencies and the mandate can aid the delivery of roads projects if the JRA were to become more involved in roads construction (JRA website).
5.6.2 Quality of work
The American Society of Civil Engineering (American Society of Civil Engineers (ASCE), 2012) defines quality as the delivery of required products and services in a manner that meets specifications and expectations of the owner as per design professionals and construction requirements and standards, applicable codes, laws and licensing requirements. A project delivery system has an impact on quality assurance and quality control. Quality assurance means planned and systematic actions established by the owner or its agent to initiate a level of confidence as per standards, codes and preferable criteria whereas quality control means plans, procedures, and resources. Quality can mean different things to different members of the project team, owners, design professionals and life cycle costs of the project (American Society of Civil Engineers (ASCE), 2012).

In construction projects, quality of work is associated with adherence to conditions of the contract and specifications stipulated in the contract documents in their entirety during the execution of the project. There are two distinct areas in which quality of work achieved is measured for success. The first one is by measuring and testing of construction materials forming the elements of the work product in situ or in the materials laboratory against a standard measure or specification. These materials must fulfill the prescribed characteristics in the contract documents for them to be incorporated into the construction process. Similarly, the work product must be within prescribed standard characteristics to be considered successful. This is generally fulfilled through the testing of the product at different stages during or after each construction activity process (Kulemeka, 2015).

The second aspect of quality of work concerns what beneficiaries see and feel when making use of the construction product. This is a product of workmanship. Workmanship has been defined in the Concise Oxford English Dictionary as the degree of skill with which a product is made or a job is done. Some aspects of workmanship are fulfilled automatically when project specifications are adhered to. For example, when the surfacing stone sizes are within tolerance, the road will be nice and smooth to drive on. Similarly, when the final layer of a road base is within the stipulated level tolerance, the road will be comfortable to ride on. However, the degree of riding comfort of a road, all other things being equal, will depend on how the level tolerance has been controlled within the lower and upper limits. The road will be more comfortable to ride on where the upper and lower tolerance limits have been maintained to the minimum than where they have been allowed to fluctuate from the uppermost to the lowermost limits. Consequently, Griffin (2009), when describing the organization and management, combined the phrases “quality of work” and
“workmanship.” He described quality of work as workmanship that involves the assign work. Quality is all about meeting the customer requirements (Kulemeka, 2015).

5.6.3 Engaging municipalities’ services
In early nineties, public-private partnerships (PPPs) became visible as the cutting-edge of long-term contractual arrangements between a private contractor and the government. It was guaranteed to be greater value for money compared to traditional public contracting because all transfers of design, operation and maintenance responsibilities and risks toward the private consortium are outlined (De Clerk & Demeulemeester, 2016).

5.6.5 Effective communication
Good communication is a free exchange of accurate and relevant information among teamwork in the right time that can mitigate the challenges facing roads construction projects. Communication among teamwork should be monitored, clear, honest, open and frequent but not excessive (ASCE, 2012). Project communication management is one of the ten knowledge areas in project management practices that employ the processes required to ensure timely and appropriate generation, collection, distribution, storage, retrieval and ultimate disposition of project information (Gavade et al., 2014).

By applying communication management strategies, the clear lines and responsibilities are established within the team where each and every team member knows his/her duties and responsibilities including the line of reporting. Regular face-to-face meetings with team members also help, as well as knowledge sharing and access to information to all team members, monitoring communication, follow-up and feedback (Muszynska, 2015). Client, consultant and contractor must understand the project’s objectives, purposes, scope, and nature of work and know who carries out which responsibilities and line of reporting (Inuwa et al., 2015).

5.6.6 Education and training in construction industry
Consultants and contractors should undergo continuous training courses to improve the capability of personnel and professionals carrying out designs, supervision and construction of all levels except top management (Kamanga & Steyr, 2013). The Civil Engineering Body of Knowledge advises civil engineers to seek a broad knowledge base on empowering themselves in thinking out of the box on how civil engineers do business, including how to manage projects, risk
management routine incorporation, handling of contracts, procurement and legal issues (Arumala, 2011).

The skills development of the business such as planning, financial control in terms of controlling cash flow, expenditures, budgeting and operational skills like scheduling, pricing of rates on the bill of quantities (BOQ) and ordering of materials are needed for the upcoming contractors, specially blacks, for their success of any enterprise (Thwala & Mvubu, 2008). Most contractors have related qualifications towards their field of work. However, they did training for a short period of time of which more internal training is needed (Thwala & Mvubu, 2008). A skills development policy is effective in both skills development and the National Skills Development Strategy which are both implemented through 25 Sector Education and Training Authorities (SETAs) which is a critical vehicle for SMME development, including contractors (DTI, 2008). Those types of sectors might make a difference in terms of improving skills to the construction industry and providing sustainable jobs to the people (DTI, 2008: xxvi).

5.6.7 Skills transfer
It is necessary for skills transfer to the youth as number of youth receive qualifications without skills on the ground to use those qualifications on site. According to Halderthay (2014), nearly half a million skilled workers in construction will go on pension in the next five years. Therefore, to overcome the skills gap, it is good that companies and government sectors employ talented workforce to assist in skills transfer to benefit the organization. Organizations need to invest in apprenticeships, learnerships and internships to train and develop the construction professionals for the future (Halderthay, 2014).

5.6.8 Legality of contract
The contractors and consultants needs to understand the legality of contracts like forms of contract, types of contract, law of contracts and other related aspects. Law of contract is fundamental to the operation of any building or engineering project. This law of contract applies to the main contract even the sub-contractors for specific works, employer and employee relationships, insurances, partnerships, hire purchase and sales of goods (Havenga et al, 2010). All three parties (client, consultant and contractor) should put in place policies that will help them retain their valuable
human resources, thereby reducing their high staff turnover. Most contracts stipulate the duration of a project or a time frame for completion of project.

The consequences of failing to mobilize must also be detailed, and include cancellation of contract. It is given that every contract includes a performance guarantee clause; therefore it is advisable that the performance guarantee payment clause should be stipulated so that if a duly issued payment certificate is not paid within the stipulated period, the contractor may demand his payment from the guarantor (Kamanga & Steyr, 2013). The so-called “time at large” clause is valid and must be taken into consideration by both parties. For example, an employer failed to address the issue of relocation of existing services before any work by contractor commences and as result thereof the contractor commences with work three months later after site handover. This condition clause might be included in a situation where works by the contractor were stopped by the community or some related issues (Meinesz, 2007).

5.6.9 Proper planning management

Communities affected by construction as their properties are along road reserve need to be proclaimed and notified in time during the planning stage of the project (Kamanga & Steyr, 2013). Stakeholders’ organizations such as Telkom, Eskom, Rand Water, and City Power should be involved during the initial or planning stage of the project to coordinate and cooperate with relocation of services. By involving those stakeholders’ organizations, it will help the recent contractor or organization to find the existing underground services by producing accurate and clear as-built drawings other than mapping underground services which were unknown (Goodrum, 2009). A well-planned project, which is carefully monitored has a direct positive impact on good performance and profitability of the contract and the company (Inuwa et al., 2015).

5.6.10 Timeframe to respond

“The timeframe to respond in different aspect of the project is required. The sensitive aspects such as payment response, delivery of materials, site instruction by resident engineer to the contractor, decision making by the project stakeholders and client response in every enquiry”. The Public Finance Management Act of 1999 (PFMA) determines that all contractual obligations (and accounts) must be settled within 30 days from their receipt [section 38(1) (f) read with Part 4, Regulation 8.2.3 of the Regulations in South Africa. Therefore the client needs to be taken into consideration and the payment response should be within 30 days (Maritz & Robertson, 2012).
The payment provisions and the processes associated with the monthly payment, the valuation of the variations to the contract ordered by the engineer and the claims made by the contractor for additional payments are stated by the CIDB through GCC 2004 (CIDB, 2008). “Time at large” can arise in a number of circumstances. The message in South African law is clear: where the contractor has a remedy in terms of its applicable contract, be it by way of an extension of time claim or otherwise, time will not be considered by the courts to be “at large” until such time as the contractor has exhausted its contractual remedies. It is imperative therefore to ensure that extension of time provisions in contracts are clearly drafted and understood to prevent a situation arising where there is in effect no contractual right to an extension of time and the situation of time being at large arises (Meinesz, 2007).

5.6.11 New technology
Accelerating use and demand of technology is more effective, time efficient, money saving and creating efficiency in construction companies. Within industries, occupations, and education groups, computerization is associated with reduced labour input of routine manual and routine cognitive tasks and increased labour input of non-routine cognitive tasks (David et al., 2003).

5.7 MEASURES TO ASSESS THE PERFORMANCE OF ROAD INFRASTRUCTURE
There are many performance measures that are identified by many researchers in developing and develop countries nationwide. However, the reality on the South African construction projects, especially the public construction projects, is that the various parameters used to measure performance lie with the accountability, service delivery, prioritization, end-user satisfaction (“Batho pele” meaning “putting people first”) and productivity (Author’s field work).

Performance measures play a major role influencing human behaviour, as ‘what gets measured, get done’, and therefore is seen as the key to achieve significant improvements in performance auditing and reviewing performance over time and predefined targets. Performance measures should be clearly linked to the strategic objectives of an organization to focus on what really matters and allow an organization to meet its own objectives (Sterritt et al., 2015).

The success of the construction project can be indicated by project performance depending on the various factors such as project complexity, type of contract used, relationship between stakeholders involves in the project, competency of the project manager and ability of key personnel on the project. Project performance judged and quantified by performance measures and performance
measures is the common method to collect and report the information related to inputs, efficiency and effectiveness of a construction project (Leong et al., 2014).

Time, quality and cost are major factors concerned in the performance measures of a project. Some of the criteria to be considered are the quality of workmanship, stakeholders’ ratification, health and safety, and new technology. Moreover, there are key components such as design performance, environmental management, end users’ expectation and satisfaction, clients’ satisfaction and commercial value. Of the above, time, cost, quality, health and safety, and client satisfaction are major variables to measure project performance (Leong et al., 2014).

Cost, time and quality are the basic and most important performance indicators in construction projects followed by other indicators such as safety, functionality and satisfaction (CIDB, 2014). The executive management needs to develop project objectives, support them and motivate those who will achieve those project objectives (Nassar, 2009). Time, cost and quality are regarded as traditional performance indicators in the construction industry internationally. However, there are several methods that can be used to assess the performance of the construction projects.

According to the CIDB (2014), the client satisfaction, the consultant agents’ satisfaction and the contractors’ satisfaction are not the same. On the completed projects, clients’ satisfaction is measured for project milestone dates achieved, contractors’ performance, consultant’s performance and quality of material used (CIDB, 2014). Contractors’ satisfaction is measured by their profitability, performance of the employers and their agents, quality of contract documentation, the management of variation orders and claims, payment delays and the performance of their materials suppliers. The consultants’ satisfaction with the time allowed by employers for planning, delays in the payment of professional fees and deviations by employers from their own approved procurement procedures are also measured (CIDB, 2014). The CIDB CII measures performance by project milestone achieved, construction cost versus budget, contractors’ performance, consultants’ performance and quality of material used (Maritz & Robertson, 2012).

Key performance indicators (KPI) are used to measure the performance of the process that is critical to its success. It is vital to identify performance indicators for benchmarking projects at the project selection phase to achieve good project performance (Njenga, 2014). According to Njenga (2014), benchmarking is a useful tool to evaluate a company as it helps companies to define the best possible indicators for comparison. Benchmarking’s aim is to compare the related organizations’
performance in respect of their capability and output (Njenga, 2014). The key performance evaluations such as quality of work, timely completion, tender estimation, tender preparation are measures of performance which help the contractors and consultants in the construction industry to identify their challenges and factors that can help them to aid the effectiveness of delivery of road construction project. The objectives or goals of contractors and consultants are not the same; however, their objectives or goals define the success or failure of the project (Kulemeka et al., 2015).

5.8 CONCLUSION

The construction industry in South Africa, like any other developing countries, is facing numerous challenges and problems in their procurement and delivery of quality road construction projects. From the literature reviewed in this chapter and personal experience, the study has highlighted problem factors such as planning, poor contractor performance, corruption, design-related problems, barriers to the uptake of new knowledge, overcoming time and financial constraints, standards and specifications, procurement management, human resources, budget and funding. These problems hinder the construction industry for the contractors and consultants to achieve their project goals and objectives within the allocated time and budget and attain the specified quality. Furthermore, the study highlighted the factors that influence the poor performance of roads projects, the effects of poor performance on road infrastructure projects and the impact of stakeholders on road infrastructure. Moreover, ways to mitigate the poor performance and the measures used to assess the performance were also highlighted.
CHAPTER SIX

RESEARCH METHODOLOGY

6.1 INTRODUCTION
This chapter of the research explains the research methodology adopted in carrying out this study in relation to the problem statement in order to meet the research objectives of the study. The geographical area where the study was conducted, the study design and population sample are also described. Furthermore, the instrument used in collecting the data, including methods implemented to maintain validity and reliability of the instruments are described in order to carry out the assessment of the performance of road infrastructure, the factors influencing poor performance, and the effects of and ways to mitigate poor performance of road infrastructure in the Gauteng Province of South Africa.

6.2 METHODOLOGY DEFINATION
Research methodology is a way to systematically solve the research problem. It is like a science of studying how research is done scientifically and the various steps adopted in the study (Kothari, 2004). Methodology is described as a coherent group of methods that complement one another and that have the ability to fit to deliver data and findings that reflect the research question and suit the researcher purpose (Henning et al., 2004).

6.3 THE RATIONALE OF STUDY
The significance of this research is to contribute to the elimination of the literature gap, to solve a wide range of business problems and to contribute to the level of professional development of the researcher. Most importantly, the study hopes to contribute on the body of knowledge on the subject of assessment of the performance of road infrastructure in the Gauteng Province of South Africa. The research considered the factors that influence the poor performance, the effects of poor performance and the ways to mitigate that poor performance in the road infrastructure projects. Furthermore the study highlighted the impact of project stakeholders and outline the measures used to assess the performance in the road infrastructure projects.
6.4 RESEARCH APPROACH AND DESIGN

According to the SACQSP (2000), there are three types of research methodology, namely quantitative, qualitative and combining or mixed methodology. The two research methodology approaches that are usually used by researchers are qualitative and quantitative research methodologies.

6.4.1 Research design

- **Quantitative research**

Quantitative research involves the collection of data so that information can be quantified and subjected to statistical treatment in order to support or refute alternate knowledge claims. Creswell asserts that quantitative research originated in the physical sciences, particularly in chemistry and physics. The researcher uses mathematical models as the methodology of data analysis. Three historical trends pertaining to quantitative research include research design, test and measurement procedures, and statistical analysis. Quantitative research also involves data collection that is typically numeric. Additionally, the researcher uses the inquiry methods to ensure alignment with statistical data collection methodology (Williams, 2007). Quantitative research is based on quantitative measurements of some characteristics. It is applicable to phenomena that can be expressed in terms of quantities (Kotori, 2010; Gray, 2010; Wynn & Williams, 2012).

- **Qualitative research**

Qualitative research refers to an inductive, emic, subjective and process-oriented method that is used to understand, interpret, and describe a theory of phenomena or setting. It is regarded as a systematic, subjective approach used to describe life experiences and give them meaning (Burns & Gove, 2003; Morse & Field, 1996:1999). Qualitative research is associated with words, language and experiences rather than measurements, statistics and numerical figures. Qualitative researchers are concerned with the ‘emic’ perspective to explore the ideas and perceptions of the participants. The researcher tries to examine the experience from the participant’s point of view in order to interpret his/her words, and he/she becomes involved and immersed in the phenomenon to become familiar with it (Kothari, 2004; Gray, 2010).

Kumar, 2011 defined qualitative research as the adherence to the concept of respondent concordance whereby a researcher makes every effort to seek agreement of respondents with interpretation, presentation of the situations, experiences, perceptions and conclusions.
Qualitative or case studies place more emphasis on a full contextual analysis of fewer events or conditions of their interrelations (Cooper & Schindler, 2003).

There are five different methods of qualitative research (Sauro, 2015):

1. **Ethnography**
   In ethnography, analyzing of target participants environment to understand the goals, cultures, challenges, motivations, and themes that emerge is needed. Ethnography has its roots in cultural anthropology where researchers immerse themselves within a culture, often for years. Rather than relying on interviews or surveys, experience the environment first hand as a participant or observer.

2. **Narrative**
   The narrative approach weaves together a sequence of events, usually from just one or two individuals to form a cohesive story. It is conducted in-depth interviews, read documents, and looks for themes; in other words, how an individual story illustrates the larger life influences that created it.

3. **Phenomenological**
   The phenomenological study is an appropriate qualitative method to describe an event, activity, or phenomenon. Combinations of methods such as conducting interviews, reading documents, watching videos, or visiting places and events, to understand the meaning participants place on whatever is being examined are used. The participants’ perspectives are very important as the researcher relies on them.

4. **Grounded theory**
   The grounded theory works together with a phenomenological study as it looks to provide an explanation or theory behind the events. Primary interviews and existing documents are used to build data theory. Grounded theory can help inform design decisions by better understanding how a community of users currently uses a product or perform tasks.
5. Case study

Case studies can be explanatory, exploratory or describing an event. A case study involves a deep understanding through multiple types of data sources. This research is conducted by adopting a quantitative method approach due to the people i.e. participants and the events i.e. construction projects that the researcher studies. The quantitative method is used to quantify the problem by way of generating numerical data or data that can be transformed into useable statistics. It is used to quantify attitudes, opinions, behaviors, and other defined variables and generalizes results from a larger sample population. Quantitative research uses measurable data to formulate facts and uncover patterns in research. Quantitative data collection methods are much more structured than qualitative data collection methods. Quantitative data collection methods include various forms of surveys, namely online surveys, paper surveys, mobile surveys and kiosk surveys, face-to-face interviews, telephone interviews, longitudinal studies, website interceptors, online polls, and systematic observations (Wyse, 2011).

The questionnaire survey was targeted at experienced construction practitioners from different construction and consultants companies. These questionnaires were to evaluate and analyse the causes of challenges facing road construction in the South African construction industry. A wide range of personnel involved in construction projects were interviewed using structured questionnaires. Respondents were randomly selected from Gauteng Province roads construction contractors and consultants.

- Conceptual research

Conceptual research is related to some abstract idea(s) or theory. It is generally used by philosophers and thinkers to develop new concepts or to reinterpret existing ones (Kotori, 2004). The conceptual research relates the existing body of literature. The researcher searches for the phenomenon of his/her research, theatrical concepts used to construct the conceptual model introduce a perspective: a way of looking at empirical phenomena (Jonker & Pennik, 2010).

- Empirical research

Empirical research relies on experience or observation alone, often without due regard for system and theory. It is data-based research, coming up with conclusions which are capable of being verified by observation or experiment (Kotori, 2004).
6.4.2 RESEARCH APPROACHES

6.4.2.1 Quantitative approach

The quantitative approach to gathering information focuses on describing a phenomenon across a larger number of participants, thereby providing the possibility of summarizing characteristics across groups or relationships. This approach surveys a large number of individuals and applies statistical techniques to recognize overall patterns in the relations of processes (Rhodes, 2014).

- **Inferential approach**
  The inferential approach forms a data base from which to infer characteristics or relationships of a population. It is research where a sample of population is studied (questioned or observed) to determine its characteristics and whether the population has the same characteristics (Daniel & Sam, 2011).

- **Experimental approach**
  The experimental approach is characterised by much greater control over the research environment and in this case some variables are manipulated to observe their effect on other variables (Daniel & Sam, 2011).

- **Simulation approach**
  The simulation approach involves the construction of an artificial environment within which relevant information and data can be generated (Daniel & Sam, 2011). Moreover, the simulation approach permits an observation of the dynamic behaviour of a system under controlled conditions (Kotori, 2010).

- **Qualitative approach**
  This type of approach is concerned with a subjective assessment of attitudes, opinions, and behaviour. Research in such a situation is a function of researcher’s insights and impressions. Such an approach to research generates results either in non-quantitative form or in the form which is not subjected to rigorous quantitative and analysis. Generally, the techniques of focus group interviews, protective techniques and depth interview are used (Kotori, 2010; Gray, 2010; Wynn & Williams, 2012).
6.5 RESEARCH DESIGN AND APPROACH USED FOR THE STUDY
A quantitative approach was adopted for this study, using a survey as the measurement instrument. Quantitative research requires objectively evaluating the data which consist of numbers trying to exclude bias from the researcher’s point of view. Quantitative deals with the statistical analysis and numerical data to provide quantitative information (Lund, 2005).

The main aim of research method chosen was to meet the objectives of this study, which are the identification of the factors influencing poor performance of the road infrastructure projects, the effects of poor performance of the road infrastructure projects as well as the ways to mitigate the poor performance of the road infrastructure projects in Gauteng Province, South Africa. Furthermore, the study highlighted the impact of project stakeholders and the measures used to assess the performance.

Questionnaire surveys were used as a primary data and desk research using data collected by others. The primary data collection was selected because it gives a accurate account of the characteristics such as behaviour, opinions, abilities, beliefs and knowledge of a particular individual, situation or group (Burns & Grove, 1993). De Vos et al. (2006) explained the method selected as it gives large portion of the sample population on the selected site which can be covered in a short period and it is the approach that uses a standardised research design.

6.6 TARGET POPULATION
Target population refers to the entire group of individuals or objects in which researchers are interested in generalizing the conclusions. The target population usually has varying characteristics and it is also known as the theoretical population (Hassan, 2010). The target population for this study comprised professionals such as road construction teams, architects, designers, engineers, quantity surveyors, project managers, company directors and the like who are registered with various professional bodies in South Africa. Most of the professionals working within this built environment are very knowledgeable and likely to have a in-depth knowledge of the factors influencing poor performance on road infrastructure projects in Gauteng Province, South Africa.

6.7 SAMPLING
Sampling is the act, process or techniques of selecting a suitable sample or a representative part of a population for the purpose of determining parameters or characteristics of the whole population (Latham, 2007). There are two methods of sampling, namely probability sampling which is also known as random sampling, and non-probability sampling, also known as non-random sampling or
convenience sampling. Types of sampling techniques were identified and classified under non-probability sampling, namely convenience sampling, quota sampling, purposive sampling and dimensional sampling (Wood & Harber, 1998). The preferable and adopted sampling in this study was random sampling because it gives all the participants an equal chance, the sample is very large in size and the targeted population presents the same performance or qualifications.

6.8 DATA COLLECTION

Data collection is regarded as a crucial stage in gathering all required information from the fundamental sources in achieving the man objectives of the study (Omran et al., 2011). The data were collected through primary and secondary sources. Primary data gathered for this study was used to collect data through a structured questionnaire commonly used in quantitative research which was designed according to the challenges revealed by the literature review. The data collection of this study was done through self-administered questionnaires survey and mail/e-mail/Internet surveys whereby the questionnaires were distributed to the research environment such as construction companies, consultants engineers firms, different site briefing for tenderers, site meetings of various projects in the Gauteng Province while the emails were used to different individuals who worked in the same environment of study and the follow-ups were made to such individuals. The secondary data were derived from an existing literature review search, which includes journals, publications of articles, books, Internet and even site experience on the field by the researcher.

6.8.1 INSTRUMENTS OF DATA COLLECTION

The choice of instrument of data collection depends on the characteristics of the respondents as well as the field of the research study. Furthermore, constraints such as the availability of funds, time and supervisors also contribute along the way. However, the main important task is to reach the research goal by developing an instrument which is reliable, accurate and economically available (Gangrade, 2015). The instrument used to collect data in this study was questionnaires. The type of instrument which is the questionnaire, was selected for the following reasons:

i. The questionnaire is a less expensive method than an interview, as it is simple to e-mail or distribute to the respondents with a minimum explanation.

ii. Questionnaires can be sent to a large number of individuals simultaneously.

iii. By distributing a questionnaire, a wide area can be covered and information obtained from more people.

iv. Questionnaires have standardized wording.

v. Questionnaires have a standardized order of questions.
vi. Questionnaires have standardized instructions for recording responses.

vii. Questionnaires ensure the same uniformity from one measurement situation to another.

viii. Respondents may have greater confidence because of the anonymity.

ix. Less pressure on the subject for immediate response (Gangrade, 2015).

The questionnaires were designed in medium of instruction language of South Africa which is English as all the respondents know English, and they can read and write since they are construction professionals. The respondents were assured of the anonymity of their responses. The questionnaire consisted of six sections, namely A, B, C, D, E and F. Section A was demographic data such as gender, company grade, and position held, among others. The information assists the researcher when analysing the results. Section B was aimed at establishing the factors that influence poor performance on the road infrastructure projects in the Gauteng Province of South Africa, Section C was aimed at establishing the effects of poor performance on the road infrastructure projects. Section D of the questionnaires identified the impacts of project stakeholders on the road infrastructure projects, while Section E highlighted the ways to mitigate the poor performance in the road infrastructure projects. Lastly, Section F explored the measures used to assess the performance of the road infrastructure projects in Gauteng Province of South Africa.

6.8.2 PERIOD OF COLLECTION AND DATA SIZE

Data was collected by the researcher during the months of August and September 2018. The researcher recorded the answered questionnaires on an Excel spreadsheet and followed up on the respondents to whom the researcher had sent the questionnaires. Instructions and guidelines were attached to the questionnaires to guide the respondents on how to answer the questionnaires. Out of 100 questionnaires sent out, 76 were received back which presents a 76 per cent response rate and all of the 76 were usable, and formed the basis of this study.

6.9 STATISTICAL MODES OF MEASUREMENT

A five-point Likert scale was used to determine the factors, effects, impacts, ways and measures to assess the performance of road infrastructure projects in the Gauteng Province of South Africa with regard to the identified factors from the reviewed literature. The adopted scale was as follows:

1. = Strongly disagree
2. = Disagree
3. = Neutral
4. = Agree
5. = Strongly agree
6.10 STATISTICAL PACKAGE FOR THE SOCIAL SCIENCE (SPSS)

The quantitative data collected was analysed with Statistical Package for the Social Science (SPSS), a computer program which is used for analysing data concerned with social phenomena. The software was used to generate various aspects of statistical information, including descriptive statistics, which provides a basic summary of all variables in the data (Henn et al., 2006). The benefits of using SPSS are that it allows for scoring and analysing quantitative data at speed and it can also be used to perform multivariate analysis. SPSS also helps to present the data in a logical format (Babbie, 2004), thereby reducing time spent on calculating scores. However, accuracy in results is highly dependent on inputs, hence the need to accurately capture data from the questionnaire.

6.11 MEAN ITEM SCORE (MIS)

The computation of the mean item score (MIS) was calculated from the total of all weighted responses and then relating it to the total responses on a particular aspect. This was based on the principle that respondents’ scores on all the selected criteria, considered together, are the empirically determined indices of relative importance. The index of MIS of a particular factor is the sum of the respondents’ actual scores (on the five-point scale) given by all the respondents as a proportion of the sum of all maximum possible scores on the five-point scale that all the respondents could give that criterion. Weightings were assigned to each response ranging from one to five for the responses of ‘Strongly disagree’ to ‘Strongly agree’ and ‘Never’ to ‘Always’. This is expressed mathematically below. The mean item score (MIS) was calculated for each item as follows:

\[
\text{MEAN} = \frac{(n_1 + 2n_2 + 3n_3 + 4n_4 + 5n_5)}{\sum \text{N}}
\]

where

\[n_1 = \text{Number of respondents for ‘Extremely unlikely’ or ‘Strongly disagree’};\]
\[n_2 = \text{Number of respondents for ‘Unlikely’ or ‘Disagree’};\]
\[n_3 = \text{Number of respondents for ‘Neutral’};\]
\[n_4 = \text{Number of respondents for ‘Likely’ or ‘Agree’};\]
\[n_5 = \text{Number of respondents for ‘Extremely likely’ or ‘Strongly agree’};\]
\[N = \text{Total number of respondents}.\]

After mathematical computations, the criteria are then ranked in descending order of their mean item score (from the highest to the lowest).
6.12 FACTOR ANALYSIS

Factor analysis is a unique technique that is designed to test hypotheses or indicate the significance of one group differing from another. Furthermore, factor analysis assists in reducing large sets of data and the other name of factor analysis is reduction technique (Tabachnick & Fidell, 2007). Three steps that are involved in factor analysis were identified. Step one is the assessment of the suitability of data for analysis. This step determines by the sample size the strength of the relationship among variables or terms. The larger the sample size, the better, and with smaller samples, the correlation coefficients among the variables are less reliable. In this study, other steps were taken to carry out factor analysis. Correlation matrix coefficients have been conducted to ensure visibility of coefficients greater than 0.3 and after the conduction of coefficients and finding that it is greater than 0.3, the Kaiser-Meyer-Olkin (KMO) and Barlett’s test were conducted. Step two was factor extraction. Factor extraction techniques were identified, namely principal components, principal factors, image factoring, maximum likelihood factoring, unweighted least squares and generalised least squares. Kaiser’s criterion, scree test and parallel are among other techniques. Kaiser’s criterion is used as it applies the eigenvalue rule to eliminate and extract factors. Any factor with an eigenvalue which is less than one (1) was eliminated; factors which are greater than one (1) were retained. Step three is factor rotation and interpretation which occurred at a later stage and is discussed in the following chapter (Pallant, 2007).

6.13 RELIABILITY

Reliability is the degree to which a test is free from measurement errors. The more measurement errors occur, the less reliable the test is (Fraenkel & Wallen, 2003). Reliability is a very important factor in any assessment; it is an aspect that contributes to validity and not opposed to validity. Reliability helps the researchers and educators to make comparisons that are reliable. The more the errors found in an assessment, the greater its unreliability and visa versa (Brun, 2010).

After completing the literature review, questionnaires were developed and those questionnaires were subjected to item judgement of the experts. The experts were consulted through several appointments made and the experts were the researcher’s supervisors from the University of Johannesburg and STATKON researchers. Those experts were used to assess the clarity and purpose of a research instrument to ensure the instrument’s content validity. Taber (2016) explained Cronbach’s alpha as a statistic commonly quoted by authors to demonstrate the tests and scales that have been constructed or adopted for research projects if they are fit for purpose. Cronbach’s alpha
purpose is to find out how well the items in a set positively correlate to one another. The questionnaires in this study were tested for their consistency reliability using Cronbach’s coefficient alpha determined by SPSS. The Cronbach’s coefficients alphas were calculated for sections B,C,D,E and F of the questionnaire to the purpose of study. When alpha value is

- > 0.9 = excellent
- > 0.8 = good
- > 0.7 = acceptable
- > 0.6 = questionable
- > 0.5 = poor
- < 0.5 = unacceptable.

6.14 DATA ANALYSIS
After data was collected and analysed, it was presented in frequency distributions and percentages of all the respondents. Frequency tables were drawn and from the data were presented in pie chart diagrams, bar graphs and tables.

6.15 ETHICAL CONSIDERATION
The focus of study is on the disciplines of the study standards and conduct to analyse values that are essential to collaborative work such as trust, accountability, mutual respect and fairness. The respondents participated on the basis of informed consent. The informed consent involved the obligation of the privacy and anonymity of respondents as of paramount importance. The acknowledgement of works of other researchers and authors used in any part of this dissertation with the use of Harvard referencing system was shown (Saunders et al., 2012). A written cover letter of permission to carry out this research study was obtained from the University of Johannesburg, Department of Construction Management and Quantity Surveying, Doornfontein Campus and was affixed to the sent-out questionnaires. Anonymity and confidentiality were maintained throughout the study. A written cover letter of permission is the one of the Codes of Ethical Practice within the University of Johannesburg.

6.16 LIMITATION OF THE STUDY
The research assessment was based on road infrastructure projects in the Gauteng Province and limited to construction professionals such as architects, quantity surveyors, engineers, project managers, construction managers, and contractors among others who volunteered to participate in the study. The limiting factors were the time required to complete the survey and the unwillingness of the other professionals to reveal information that would help with the research data.
The other limitation was that the assessment considered the Gauteng Province of South Africa only, whereas the poor performance of the road infrastructure projects is the case that is happening country wide in both developed and developing countries.

6.17 CONCLUSIONS

In this chapter, the research methodology used for the study was described, including the population, sample, data collection instrument, data analysis method, limitations of the study as well as strategies used to ensure ethical standards and also why questionnaires were adopted for research. The next chapter of this study presents the data analysis and the discussion of the data.
CHAPTER SEVEN

DATA ANALYSIS AND DISCUSSIONS OF THE DATA

7.1 INTRODUCTION
This chapter reveals the results of the data obtained from structured questionnaires which were circulated amongst the respondents of construction professionals such as architects, designers, engineers, quantity surveyors, project managers, company directors, construction managers, and contractors who are involved in construction projects in the construction industry of Gauteng Province in South Africa. The analysis of the data and interpretation of the results were obtained from the questionnaire survey and served as the basis of this quantitative analysis. The questionnaire comprised 14 questions, all of which were answered.

A total number of 100 questionnaires were distributed and 76 responses received, hence the analysis is based on the 76 who responded. These reflect a 76 per cent response rate. The first section of the questionnaires explores the background information of the respondents. The section looked at the factors that influence the performance of the road infrastructure projects. The third section investigates the effects of performance while the fourth section explained the impact of project stakeholders. The fifth section highlighted the ways to mitigate the performance on road infrastructure projects in the Gauteng Province of South Africa. The sixth section, which was the last section, outlined the measures used to assess the performance of road projects.

7.2 DATA ANALYSIS
The previous chapter indicated that the quantitative approach was utilized for this study and the approach chosen deals with statistical and numerical data to provide quantitative information (Lund, 2005). The sample population in this study comprised construction professionals such as project managers, quantity surveyors, resident engineers, construction managers, contractors among others from Gauteng Province and a total of 76 completed questionnaires were received. The sections below present the main results:
7.2.1 BACKGROUND INFORMATION
Section A represents the information about the respondents’ profiles. The information profile includes the respondents’ gender, educational qualification, number of years of experience within the construction industry, position within the organization, type of organization in which the respondents are working and the CIDB grading of their organization, if any.

7.2.1.1 Respondents’ gender
Figure 7.1 presents the gender distribution of 76 respondents. Males dominated with 51.30 % and 48.7 % were females.

![](image)

Figure 7.1: Respondents’ gender

7.2.1.2 Respondents’ years of experience in construction industry
Figure 7.2 presents the experience of the respondents in the construction industry, 27.6 % indicated 6-10 years experience, followed by 11-15 years in experience by 21.1%. Respondents with more than 20 years’ experience were only 11.8%, whereas the 1-5 years’ experience and less than 1 year experience were 17.1% and 10.5 % for less than 1 year experience which is equal to that of 16-20 years’ experience.
7.2.1.3 Respondents’ qualification

Figure 7.3 presents the respondents’ qualifications whereby the highest percentage has a diploma qualification or post-matric certificate at 36.8 %, followed by 34.2 % with a bachelor’s degree. Respondents with an honours degree are 15.85 %, a master’s degree was 9.2 % and respondents having matric only are 3.9 %.

Figure 7.3: Respondents’ qualifications
7.2.1.4 Respondents’ type of organization that they worked for
Figure 7.4 described the type of organization that the respondent worked for. A total of 35.5% respondents are employed in a contractor’s organization, 32.9% are clients and 31.6% work for a consultancy.

![Respondents' types of organization](image)

Figure 7.3: Respondents’ type of organization

7.2.1.5 Respondents’ profession
Figure 7.5 indicates that 32.9% of the respondents are civil engineers and 28.9% are project managers. Respondents who are construction managers and construction project managers are equal with 10.5%. The minority of the respondents are quantity surveyors and architects with 6.6% and 1.3% respectively. Respondents with other different professions number 7.9%. 
7.2.1.6 Respondents’ response on average days that client takes to pay service providers

Figure 7.6 shows the average time which the client takes to make payment for work done by the service providers. Most respondents (37.3%) indicated that the clients take an average of more than 21 working days to pay service providers, followed by 26.7% of respondents who indicate between 16-20 working days, 20% of respondents reported that the client takes between 11-15 working days, while only 5.3% of respondents responded to say clienta take five (5) days or less to pay service providers. The remaining 10.7% mentioned that the client takes between 6-10 working days.

Figure 7.6: Average number of days that clients take to pay service providers
7.2.1.7 Respondents’ number of projects executed in the past years

Figure 7.7 shows the projects executed by respondents in the past years. Respondents with 1-5 projects and 6-10 projects are equal with 33.8%; 13.5% executed between 11-15 projects; while 16-20 projects and more than 20 projects were executed with 6.6% each. Respondents with none of the projects executed in the last years numbered 5.4%.

![Figure 7.7: Respondents' projects executed in the past years](image)

7.2.1.8 Respondents’ CIDB grading

Figure 7.8 indicated the CIDB grading of the respondents. The majority of the respondents have CIDB grade 9 with 35.7%, followed by CIDB grade 8 (30.4%), and CIDB grade 7 (14.3%). The lowest percentage on grading is CIDB grade 3 by 1.8% of the respondents, followed by respondents with CIDB grading 5 (3.6%). CIDB grading 2 is held by 7.1% of the respondents.
7.2.2 SECTION B - FACTORS INFLUENCING THE PERFORMANCE IN ROAD INFRASTRUCTURE PROJECTS

7.2.2.1 Descriptive analysis results

Table 7.1 presents the factors that influence the performance in road infrastructure projects per category. The performance factors were tested for validity and internal reliability. A five-point Likert scale was used where: 1= Strongly disagree (SD), 2= Disagree (D), 3=Neutral (N), 4= Agree (A), 5= Strongly Agree (SA). Certain abbreviations and number of range were established to present results outcomes accordingly, namely CLRF 1-5, CTRF 1-4, CRRF 1-5, DRF 1-4, ERF 1-4 and HRF 1-5.

Table 7.9 below indicated the factors that influence the performance in road infrastructure projects per category, namely client-related factors, consultant-related factors, contractor-related factors, design-related factors, external-related factors and human-related factors. On the client-related factors, ‘delays in decision making’ with (M=3.90; SD=1.173, R=1) and ‘payment delays by the client’ with (M=3.41; SD=1.316, R=2) had a high impact in the performance in roads infrastructure projects. Furthermore, ‘variation initiated by the client’ with (M=2.86; SD=0.899, R=3) and ‘change of orders’ with (M=2.75; SD=1.180, R=4) had the lowest impact respectively.
‘Change of scope by the client’ with (M=3.04; SD=0.933, R=5) was the median factor above all client related factors. Of the consultant-related factors, ‘late reviewing design tender documents’ with (M=3.09; SD=1.298, R=1) rated number one to influence performance under consultant-related, followed by ‘inadequate site supervision’ with (M=2.80; SD=1.317, R=2). ‘Design errors by the design team’ with (M=274; SD=1.182, R=3) has a moderate impact as it was rated third and lastly, ‘lack of experience by consultant’ with (M=2.68; SD=1.309, R=4). Of the contractor-related factors, ‘financial difficulties/cash flow problem by the contractor’ ranked number one with (M=3.49; SD=1.194, R=1), followed by ‘delays in work progress caused by poor planning’ with (M=3.37; SD=1.100, R=2). ‘Unrealistic tender pricing by the contractor’ is regarded as a moderate factor with (M=3.41; SD=1.060, R=3) while ‘contractor’s poor workmanship’ was ranked second last with (M=3.24; SD=1.069, R=4). ‘Inadequate technical experience by the contractor’ rated last with (M=3.09; SD=1.335, R=5).

Of the design-related factors, ‘late approval of design drawings by client’ ranked first with (M=2.96; SD=1.232, R=1), second in rank was ‘poor quality of design’ with (M=2.92; SD=1.162, R=2). ‘Errors/omission in design’ with (M=2.86; SD=1.162, R=3) rated third whereas ‘late approval of design drawings by the client’ had a low impact on the performance of infrastructure projects with (M=2.65; SD=1.152, R=4). Regarding externally-related factors, ‘weather condition’ ranked first with (M=3.15; SD=1.094, R=1) and ‘bribe/corruption’ rated second with (M=3.03; SD=1.471, R=2). ‘Poor site condition’ was a neutral factor with (M=2.89; SD=1.142, R=3) and ‘unforeseen circumstances’ ranked last with (M=2.81; SD=1.268, R=4). In terms of human-related factors, ‘poor communication’ was the major problem rated number one with (M=3.32; SD=1.175, R=1), and ‘work absenteeism’ rated second with (M=3.04; SD=1.104, R=2). ‘Workers’ poor attitude’ with (M=3.03; SD=1.027, R=3) and ‘lack of teamwork’ with (M=2.85; SD=0.978, R=4) were deemed to be second last and last respectively.

**Table 7.1: Factors influencing the performance in road infrastructure projects**

<table>
<thead>
<tr>
<th>Factors</th>
<th>Mean</th>
<th>SD</th>
<th>Cronbach’s alpha</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Client-related factors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delay in decision making</td>
<td>3.90</td>
<td>1.173</td>
<td>0.589</td>
<td>1</td>
</tr>
<tr>
<td>Payment delays by the client</td>
<td>3.41</td>
<td>1.316</td>
<td>0.516</td>
<td>2</td>
</tr>
<tr>
<td>Change of scope by the client</td>
<td>3.04</td>
<td>0.933</td>
<td>0.664</td>
<td>3</td>
</tr>
<tr>
<td>Variation initiated by the client</td>
<td>2.86</td>
<td>0.899</td>
<td>0.640</td>
<td>4</td>
</tr>
<tr>
<td>Change of orders</td>
<td>2.75</td>
<td>1.180</td>
<td>0.613</td>
<td>5</td>
</tr>
<tr>
<td>Consultant-related factors</td>
<td>MIS</td>
<td>SD</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>------</td>
<td>--------</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td>Late reviewing design tender documents</td>
<td>3.09</td>
<td>1.298</td>
<td>0.797</td>
<td>1</td>
</tr>
<tr>
<td>Inadequate site supervision</td>
<td>2.80</td>
<td>1.317</td>
<td>0.808</td>
<td>2</td>
</tr>
<tr>
<td>Design errors by the design team</td>
<td>2.74</td>
<td>1.182</td>
<td>0.774</td>
<td>3</td>
</tr>
<tr>
<td>Lack of experience by consultant</td>
<td>2.68</td>
<td>1.309</td>
<td>0.808</td>
<td>4</td>
</tr>
<tr>
<td>Contractor-related factors</td>
<td></td>
<td></td>
<td>0.861</td>
<td></td>
</tr>
<tr>
<td>Financial difficulties/Cash flow problem by the</td>
<td>3.49</td>
<td>1.194</td>
<td>0.817</td>
<td>1</td>
</tr>
<tr>
<td>contractor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delays in work progress caused by poor planning</td>
<td>3.37</td>
<td>1.100</td>
<td>0.834</td>
<td>2</td>
</tr>
<tr>
<td>Unrealistic tender pricing by contractor</td>
<td>3.41</td>
<td>1.060</td>
<td>0.841</td>
<td>3</td>
</tr>
<tr>
<td>Contractor’s poor workmanship</td>
<td>3.24</td>
<td>1.069</td>
<td>0.833</td>
<td>4</td>
</tr>
<tr>
<td>Inadequate technical experience by the contractor</td>
<td>3.09</td>
<td>1.335</td>
<td>0.833</td>
<td>5</td>
</tr>
<tr>
<td>Design-related factors</td>
<td></td>
<td></td>
<td>0.856</td>
<td></td>
</tr>
<tr>
<td>Late approval of design drawings by client</td>
<td>2.96</td>
<td>1.232</td>
<td>0.853</td>
<td>1</td>
</tr>
<tr>
<td>Poor quality of design</td>
<td>2.92</td>
<td>1.162</td>
<td>0.784</td>
<td>2</td>
</tr>
<tr>
<td>Errors/Omission in design</td>
<td>2.86</td>
<td>1.162</td>
<td>0.806</td>
<td>3</td>
</tr>
<tr>
<td>Late approval of design drawings by client</td>
<td>2.65</td>
<td>1.152</td>
<td>0.823</td>
<td>4</td>
</tr>
<tr>
<td>External related factors</td>
<td></td>
<td></td>
<td>0.670</td>
<td></td>
</tr>
<tr>
<td>Weather Condition (rainy, frosty weather)</td>
<td>3.15</td>
<td>1.094</td>
<td>0.643</td>
<td>1</td>
</tr>
<tr>
<td>Bribe/Corruption</td>
<td>3.03</td>
<td>1.471</td>
<td>0.764</td>
<td>2</td>
</tr>
<tr>
<td>Poor site condition</td>
<td>2.89</td>
<td>1.142</td>
<td>0.476</td>
<td>3</td>
</tr>
<tr>
<td>Unforeseeen circumstances e.g. Tornado</td>
<td>2.81</td>
<td>1.268</td>
<td>0.492</td>
<td>4</td>
</tr>
<tr>
<td>Human-related factors</td>
<td></td>
<td></td>
<td>0.761</td>
<td></td>
</tr>
<tr>
<td>Poor communication between site personnel</td>
<td>3.32</td>
<td>1.175</td>
<td>0.716</td>
<td>1</td>
</tr>
<tr>
<td>Workers’ absenteeism</td>
<td>3.04</td>
<td>1.104</td>
<td>0.706</td>
<td>2</td>
</tr>
<tr>
<td>Workers’ poor attitude</td>
<td>3.03</td>
<td>1.027</td>
<td>0.697</td>
<td>3</td>
</tr>
<tr>
<td>Lack of teamwork between project teams</td>
<td>2.85</td>
<td>0.978</td>
<td>0.700</td>
<td>4</td>
</tr>
</tbody>
</table>

MIS = Mean Item Score, SD = Standard Deviation, R = Rank

7.2.2.2 Validity of the factors influence the performance in roads infrastructure projects
Validity and reliability were tested and found to be satisfactory. Section B of the factors that influence the performance in road infrastructure projects, namely the theoretical reliabilities, were used to determine the validity and reliability of the factors.

7.2.2.3 Empirical and theoretical reliabilities of the factors influencing performance in road infrastructure projects
Pallant (2013) explained that the values of alpha would range from 0.70 to 0.95 all values rounded off to one decimal place or two decimal places, Cronbach alpha <0.7 with items less than 10 in the scale, the optimal inter-item correlations mean should rage from 0.20 to 0.40 to be reliable. The current study shows the Cronbach alpha coefficients for the client-related factors (0.671), which was > 0.7. The inter-item correlation mean of 0.286 which was greater than the acceptable value used for the factor to be reliable, same as the external related factor with Cronbach’s alpha of >0.670 and the inter-item correlation mean of 0.357 was applied to made the factor reliable. Consultant-related factors (0.844), contractor-related factors (0.861), design-related factors (0.856) and human-related factors (0.761) were all reliable when rounded. The overall Cronbach’s alpha of the factors that influence the performance on the road infrastructure projects was 0.923 which is regarded as reliable and sufficient on the Cronbach’s alpha requirements (See Table 7.2).

Table 7.2: Theoretical reliabilities of factors that influence performance in road infrastructure projects

<table>
<thead>
<tr>
<th>Factors</th>
<th>Cronbach’s alpha</th>
<th>Inter-Item Correlation-Mean</th>
<th>No of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client-related factors</td>
<td>0.671</td>
<td>0.286</td>
<td>5</td>
</tr>
<tr>
<td>Consultant-related factors</td>
<td>0.844</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Contractor-related factors</td>
<td>0.861</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Design-related factors</td>
<td>0.856</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Externally-related factors</td>
<td>0.670</td>
<td>0.357</td>
<td>4</td>
</tr>
<tr>
<td>Human-related factors</td>
<td>0.761</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Overall of factors that influence the performance</td>
<td>0.923</td>
<td></td>
<td>26</td>
</tr>
</tbody>
</table>

7.2.3 SECTION C - EFFECTS OF PERFORMANCE ON ROAD INFRASTRUCTURE PROJECTS

7.2.3.1 Descriptive analysis results

Table 7.3 below revealed that the respondents strongly agreed that ‘cost overrun’ with (M=3.69; SD=1.019) and ‘time overrun’ with (M=3.59; SD=1.048) were the most significant effects of performance in road infrastructure projects, ranking number one and two respectively. The respondents further agreed that ‘conflict’ with (M=3.45; SD=0.957) rated number three followed by ‘disputes between owner and contractor’ with (M=3.36; SD=1.085), ‘loss of skilled workers’ with (M=3.36, SD=1.067) and ‘creates stress on the contractor’ with (M=3.36; SD=1.104) which
were both rated equally at number four. ‘Reworks’ deemed number five on the effects factors listed with (M=3.28; SD=1.053) followed by ‘termination of contract’ at number six with (M=3.21; SD=1.037). Furthermore, the respondents agreed that ‘default on loan repayment by the contractor’ with (M=3.16; SD=1.059) was a dominant effect. ‘Abandonment of project’ (M=3.12; SD=1.066) as well as ‘liquidation/bankruptcy’ with (M=3.12; SD=1.070) both ranked second last and last was ‘damage to company’s reputation’ with (M=2.99; SD=0.846).

Table 7.3: Effects of performance on road infrastructure projects’ ranking

<table>
<thead>
<tr>
<th>Item</th>
<th>Factors</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOPP 2</td>
<td>Cost overrun</td>
<td>173</td>
<td>3.69</td>
<td>1.019</td>
<td>1</td>
</tr>
<tr>
<td>EOPP 3</td>
<td>Time overrun</td>
<td>173</td>
<td>3.59</td>
<td>1.048</td>
<td>2</td>
</tr>
<tr>
<td>EOPP 9</td>
<td>Conflicts</td>
<td>173</td>
<td>3.45</td>
<td>0.957</td>
<td>3</td>
</tr>
<tr>
<td>EOPP 7</td>
<td>Disputes between owner &amp; contractor</td>
<td>173</td>
<td>3.36</td>
<td>1.085</td>
<td>4</td>
</tr>
<tr>
<td>EOPP 8</td>
<td>Loss of skilled workers</td>
<td>173</td>
<td>3.36</td>
<td>1.067</td>
<td>4</td>
</tr>
<tr>
<td>EOPP 11</td>
<td>Creates stress on the contractor</td>
<td>173</td>
<td>3.36</td>
<td>1.104</td>
<td>4</td>
</tr>
<tr>
<td>EOPP 4</td>
<td>Reworks</td>
<td>173</td>
<td>3.28</td>
<td>1.053</td>
<td>5</td>
</tr>
<tr>
<td>EOPP 12</td>
<td>Termination of contract</td>
<td>173</td>
<td>3.21</td>
<td>1.037</td>
<td>6</td>
</tr>
<tr>
<td>EOPP 10</td>
<td>Default on loan repayment by the contractor</td>
<td>173</td>
<td>3.16</td>
<td>1.059</td>
<td>7</td>
</tr>
<tr>
<td>EOPP 1</td>
<td>Abandonment of project</td>
<td>173</td>
<td>3.12</td>
<td>1.066</td>
<td>8</td>
</tr>
<tr>
<td>EOPP 5</td>
<td>Liquidation/Bankruptcy</td>
<td>173</td>
<td>3.12</td>
<td>1.070</td>
<td>8</td>
</tr>
<tr>
<td>EOPP 6</td>
<td>Damage to company’s reputation</td>
<td>173</td>
<td>2.99</td>
<td>0.846</td>
<td>9</td>
</tr>
</tbody>
</table>

7.2.3.2 Factors analysis results

Twelve factors that are the effects of performance on road infrastructure projects were subjected to exploratory factor analysis (EFA). Table 7.4 revealed the presence of a correlation matrix of ten variables. Two variables were omitted as communality was > 1 on both variables which are regarded as weak items or variables. Correlation matrix coefficients have been conducted to ensure visibility of coefficients greater than 0.3 and there were quite a number of correlations greater than 0.3 which tentatively suggests that factor analysis was appropriate (Hooper, 2012).

Omitted EOPP5 (Communality >1)
Omitted EOPP2 (Communality >1)

Table 7.4: Correlation matrix effects of performance

<table>
<thead>
<tr>
<th></th>
<th>EOPP1</th>
<th>EOPP3</th>
<th>EOPP4</th>
<th>EOPP6</th>
<th>EOPP7</th>
<th>EOPP8</th>
<th>EOPP9</th>
<th>EOPP10</th>
<th>EOPP11</th>
<th>EOPP12</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOPP1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EOPP3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EOPP4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EOPP6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EOPP7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EOPP8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EOPP9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EOPP10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EOPP11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EOPP12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 7.5 below indicates that the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO-test) value was 0.845, which was beyond the anticipated value of 0.6 (Kaiser, 1960), and the Barlett’s test of sphericity (Barlett, 1954) reached statistical significance of 0.000 (p˂0.05), supporting the factorability of the correlation matrix. Table 7.14 shows the anti-image matrix of correlations as a measure of sampling adequacy (MSA) which was beyond 0.5 as the indication of the factorability of the data set. Table 7.7 shows the communalities of the variables after extraction were above the acceptable 0.3 value except EOPP 1 and EOPP 12 variables with less than 0.3 value of communalities. However, the variables were kept due to the MSAs which were fine (Field, 2000).

**Table 7.5: KMO and Bartlett's test**

<table>
<thead>
<tr>
<th>Kaiser-Meyer-Olkin Measure of Sampling Adequacy.</th>
<th>0.845</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartlett's Test of Sphericity</td>
<td></td>
</tr>
<tr>
<td>Approx. Chi-Square</td>
<td>241,603</td>
</tr>
<tr>
<td>df</td>
<td>45</td>
</tr>
<tr>
<td>Sig.</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Table 7.6: Anti-image matrices effects of performance**

<table>
<thead>
<tr>
<th>Anti-image correlation</th>
<th>EOPP1</th>
<th>EOPP3</th>
<th>EOPP4</th>
<th>EOPP6</th>
<th>EOPP7</th>
<th>EOPP8</th>
<th>EOPP9</th>
<th>EOPP10</th>
<th>EOPP11</th>
<th>EOPP12</th>
</tr>
</thead>
</table>

155
<table>
<thead>
<tr>
<th>EOPP</th>
<th>Initial</th>
<th>Extraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOPP1</td>
<td>0.226</td>
<td>0.258</td>
</tr>
<tr>
<td>EOPP3</td>
<td>0.352</td>
<td>0.368</td>
</tr>
<tr>
<td>EOPP4</td>
<td>0.404</td>
<td>0.338</td>
</tr>
<tr>
<td>EOPP6</td>
<td>0.371</td>
<td>0.372</td>
</tr>
<tr>
<td>EOPP7</td>
<td>0.682</td>
<td>0.680</td>
</tr>
<tr>
<td>EOPP8</td>
<td>0.365</td>
<td>0.404</td>
</tr>
<tr>
<td>EOPP9</td>
<td>0.710</td>
<td>0.808</td>
</tr>
<tr>
<td>EOPP10</td>
<td>0.302</td>
<td>0.268</td>
</tr>
<tr>
<td>EOPP11</td>
<td>0.432</td>
<td>0.542</td>
</tr>
<tr>
<td>EOPP12</td>
<td>0.198</td>
<td>0.336</td>
</tr>
</tbody>
</table>

Measures of Sampling Adequacy (MSAs)

Table 7.7: Communalities of the effects of performance

Extraction Method: Principal Axis Factoring.
<table>
<thead>
<tr>
<th>Factor</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
<th>Rotation Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
<td>Cumulative %</td>
</tr>
<tr>
<td>1</td>
<td>4,337</td>
<td>43,371</td>
<td>43,371</td>
</tr>
<tr>
<td>2</td>
<td>1,116</td>
<td>11,161</td>
<td>54,532</td>
</tr>
<tr>
<td>3</td>
<td>0,843</td>
<td>8,432</td>
<td>62,964</td>
</tr>
<tr>
<td>4</td>
<td>0,786</td>
<td>7,855</td>
<td>70,819</td>
</tr>
<tr>
<td>5</td>
<td>0,694</td>
<td>6,936</td>
<td>77,755</td>
</tr>
<tr>
<td>6</td>
<td>0,621</td>
<td>6,206</td>
<td>83,961</td>
</tr>
<tr>
<td>7</td>
<td>0,574</td>
<td>5,735</td>
<td>89,696</td>
</tr>
<tr>
<td>8</td>
<td>0,451</td>
<td>4,514</td>
<td>94,210</td>
</tr>
<tr>
<td>9</td>
<td>0,401</td>
<td>4,013</td>
<td>98,223</td>
</tr>
<tr>
<td>10</td>
<td>0,178</td>
<td>1,777</td>
<td>100,000</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Axis Factoring.

Table 7.17 indicates the factor loading of the effects of performance on roads infrastructure projects. The total of ten variables loaded on two components and the results were strengthened by a scree plot test (Pallant, 2013). The results indicate the variables which clearly defined the effects of performance on roads infrastructure projects.

**Table 7.17: Rotated factor matrix of effects of performance**

<table>
<thead>
<tr>
<th>Factor</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOPP9</td>
<td>0.858</td>
<td>0.267</td>
</tr>
<tr>
<td>EOPP7</td>
<td>0.769</td>
<td>0.297</td>
</tr>
<tr>
<td>EOPP8</td>
<td>0.623</td>
<td></td>
</tr>
<tr>
<td>EOPP6</td>
<td>0.526</td>
<td>0.308</td>
</tr>
<tr>
<td>EOPP4</td>
<td>0.516</td>
<td>0.268</td>
</tr>
<tr>
<td>EOPP10</td>
<td>0.416</td>
<td>0.307</td>
</tr>
<tr>
<td>EOPP11</td>
<td>0.377</td>
<td>0.633</td>
</tr>
<tr>
<td>EOPP12</td>
<td></td>
<td>0.576</td>
</tr>
</tbody>
</table>
Table 7.8 of the total variance explained of the effects of performance on roads infrastructure projects revealed two components which had eigenvalues of above 1, namely (4.337 and 1.116). The components’ eigenvalues defined 43.37 % and 11.16 % respectively of the variance which indicates 54.532 % of the total variance before the rotation and 43.743 % after the rotation. The Kaiser’s eigenvalue which is greater than 1 was retained for interpretation (Fabrigar et al., 1999).

<table>
<thead>
<tr>
<th>Component</th>
<th>Eigenvalue Before Rotation</th>
<th>Eigenvalue After Rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOPP3</td>
<td>0.377</td>
<td>0.475</td>
</tr>
<tr>
<td>EOPP1</td>
<td>0.273</td>
<td>0.428</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.a

a. Rotation converged in 3 iterations.

Table 7.8 of the total variance explained of the effects of performance on roads infrastructure projects revealed two components which had eigenvalues of above 1, namely (4.337 and 1.116). The components’ eigenvalues defined 43.37 % and 11.16 % respectively of the variance which indicates 54.532 % of the total variance before the rotation and 43.743 % after the rotation. The Kaiser’s eigenvalue which is greater than 1 was retained for interpretation (Fabrigar et al., 1999).

Figure 7.1: Scree plot test of the effects of performance on roads infrastructure projects

7.2.3.3 Naming of components/factors of the effects of performance in road infrastructure projects as per 1st order of factor analysis

There are no rules for naming factors. However, it is important that names must best represent the variables within the factors (Young & Pearce, 2013).
Factor 1: Contractors’ internal issues
The factor 1 (CII 1) encountered 43.37% (Table 7.16) of the total variance of the effects of performance on road infrastructure projects which was valid. Factor 1 suggests that conflict, disputes between owner and contractor, loss of skilled workers, damage to company’s reputation, reworks, and default on loan repayment by the contractor were all contractors’ internal issues. Conflict is caused by different factors such as stakeholders’ interest, economic constraints in the construction industry (Chinyio & Olomdaye, 2009). Lack of communication, unrealistic cost and quality targets by the client among other factors were identified as the causes of disputes between the owner and the contractor (Sinha & Wayal, 2013). Several ways were mentioned in the study that can resolve contractors’ internal issues such as effective communication, skills transfer, and education and training among others (Kamanga & Steyr, 2013). The factor 1 defined the following variables EEOP 4, EOPP 6, EOPP 7, EOPP 8, EOPP 9, EOPP 10 and EOPP 11 (Table 7.17).

Factor 2: Contractors’ legal issues
Factor 2 (named CLI 2) comprises four variables (Table 7.16). The variables stated in the table 7.17 defined the contractors’ legal issues that might confront the contractor owing to challenges countered during the contract, such as termination of contract, abandonment of project and time overrun. When contractors experience too many problems making it impossible to progress with the project, contractors end up abandoning the project. That abandonment of the project is caused by incorrect rates estimates, unskilled personnel, and poor risk management, among others (Doraisamy et al., 2014). Time overruns due to factors like land acquisition delay, equipment breakdown, community unrest and change of scope of works among others should be avoided (Salunkhe & Patil, 2014). The legality of contracts between parties involved should be put in place as well as the policies and regulations that will help the parties fulfil their responsibilities (Kamanga & Steyr, 2013). The so called “time at large” clause is valid and it needs to be taken into consideration when legalizing the contract of both parties involved (Meinesz, 2007).

Factor 3: Validity of the effects of performance in road infrastructure projects
Validity and reliability were tested and found to be satisfactory. The overall number of observed variables were reduced into latent factors which led to two factors related to the effects of performance in road infrastructure projects. The maximum point for correlation coefficient was between 0.30 and 1.00 and was considered to be valid (Hooper, 2012).
Factor 4: Empirical and theoretical reliabilities of the effects of performance on road infrastructure projects

Pallant (2013) explained that the values of alpha would range from 0.70 to 0.95 with all values rounded off, to one decimal place or two decimal places. Cronbach alpha <0.7 with items less than 10 in the scale, the optimal inter-item correlations mean should range from 0.20 to 0.40 to be reliable. The current study shows the Cronbach alpha coefficients for the empirical factor of the contractors’ internal issues (CII 1) which is factor 1 (0.835) were reliable. The contractors’ legal issues (CLI 2) which is factor 2 (0.672) showing the Cronbach’s alpha of <0.7 and the inter-item correlation mean of (0.338) was used to determine the reliability of the factor 2. The theoretical factor of the effects of performance (0.869) which includes twelve items was reliable when rounded (See Table 7.9).

Table 7.9: Reliability status of the effects of performance in road infrastructure projects

<table>
<thead>
<tr>
<th>Empirical reliabilities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors/Components</td>
<td>Cronbach’s Alpha ((&gt;0.7))</td>
</tr>
<tr>
<td>Factor 1- Contractor’s internal issues (CII 1)</td>
<td>0.835</td>
</tr>
<tr>
<td>Factor 2- Contractor’s legal issues (CLI 2)</td>
<td>0.672</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Theoretical reliabilities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors/Components</td>
<td>Cronbach’s Alpha ((&gt;0.7))</td>
</tr>
<tr>
<td>Effects of Performance-Factor 1</td>
<td>0.869</td>
</tr>
</tbody>
</table>

7.2.4 SECTION D - IMPACTS OF STAKEHOLDERS ON THE ROAD CONSTRUCTION PROJECTS

7.2.4.1 Descriptive analysis results of the internal stakeholders’ impacts

Table 7.10 shows the results of the respondents who strongly agreed that ‘late payment to service providers’ with (M=3.59; SD=1.253) had a high impact on the road construction project, followed by ‘the client who failed to verify contractors’ qualifications’ with (M=3.58; SD=0.858) on the client-related factor. The respondents further agreed that ‘client knowledge to review design documents’ with (M=3.42; SD=1.063), ‘inadequate involvement by client during construction project’ with (M= 3.42;SD=1.148), ‘conflict between client and contractor due to client lack of
attention to provide necessary information for tendering’ with (M=3.29; SD=1.139) and ‘lack of understanding project feasibility study during planning phase’ with (M=3.19; SD=1.163) were among other factors that impacted road construction projects. ‘Lack of client knowledge to interpret the contract document and drawings’ with (M= 3.10; SD=1.311) rated third last under client-related factors followed by ‘establishment for acceptance criteria for completion certificate’ with (M= 3.04; SD=1.142) and ‘low level to approve project cost’ (M=3.04; SD=0.992).

Table 7.10 continued to explained the respondents’ data collected in consultant-related factors whereby ‘lack experience by consultant’ with (M= 3.17; SD=1.178) was the only impact that the respondents rated. On the contracto-related factors, ‘contractor takes too long to pay subcontractors’ (M= 3.80; SD= 0.979) was rated number one by the respondents followed by ‘lack of resources’ with (M=3.69; SD=1.1214). ‘Contractors’ poor performance’ with (M= 3.69; SD=0.929) had a moderate impact under contractor-related factors and lastly, ‘the lack of resources by the contractor’ with (M=3.35; SD=1.135).

**Table 7.10: Internal stakeholders’ impacts towards road infrastructure projects**

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Cronbach’s Alpha</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Client-related factors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLRI 9</td>
<td>Late payment to service providers</td>
<td>69</td>
<td>3.59</td>
<td>1.253</td>
<td>0.858</td>
<td>1</td>
</tr>
<tr>
<td>CLRI 7</td>
<td>Failure to verify contractor's qualifications</td>
<td>69</td>
<td>3.58</td>
<td>1.253</td>
<td>0.858</td>
<td>2</td>
</tr>
<tr>
<td>CLRI 2</td>
<td>Client knowledge to review design documents</td>
<td>69</td>
<td>3.42</td>
<td>1.063</td>
<td>0.863</td>
<td>3</td>
</tr>
<tr>
<td>CLRI 1</td>
<td>Inadequate involvement by client during construction project</td>
<td>69</td>
<td>3.42</td>
<td>1.148</td>
<td>0.866</td>
<td>4</td>
</tr>
<tr>
<td>CLRI 4</td>
<td>Conflict between client &amp; contractor due to client lack of attention to provide necessary information for tendering</td>
<td>69</td>
<td>3.29</td>
<td>1.139</td>
<td>0.857</td>
<td>5</td>
</tr>
<tr>
<td>CLRI 5</td>
<td>Lack of understanding project feasibility study during planning phase</td>
<td>69</td>
<td>3.19</td>
<td>1.163</td>
<td>0.861</td>
<td>6</td>
</tr>
<tr>
<td>CLRI 8</td>
<td>Lack of client knowledge to interpret the contract document and drawings</td>
<td>69</td>
<td>3.10</td>
<td>1.311</td>
<td>0.861</td>
<td>7</td>
</tr>
<tr>
<td>CLRI 6</td>
<td>Establishment for acceptance criteria for completion certificate</td>
<td>69</td>
<td>3.04</td>
<td>1.142</td>
<td>0.871</td>
<td>8</td>
</tr>
<tr>
<td>CLRI 3</td>
<td>Low level to approve project cost</td>
<td>69</td>
<td>3.04</td>
<td>0.992</td>
<td>0.866</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td><strong>Consultant-related factor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTRI 3</td>
<td>Lack of experience by consultant</td>
<td>69</td>
<td>3.17</td>
<td>1.178</td>
<td>0.872</td>
<td>1</td>
</tr>
<tr>
<td>CRR1 1</td>
<td>Takes too long to pay sub-contractors</td>
<td>69</td>
<td>3.80</td>
<td>0.979</td>
<td>0.870</td>
<td>1</td>
</tr>
<tr>
<td>CRR I 4</td>
<td>Lack of resources</td>
<td>69</td>
<td>3.69</td>
<td>1.214</td>
<td>0.864</td>
<td>2</td>
</tr>
<tr>
<td>CRR1 2</td>
<td>Contractors’ poor performance</td>
<td>69</td>
<td>3.62</td>
<td>0.929</td>
<td>0.865</td>
<td>3</td>
</tr>
<tr>
<td>CRR1 3</td>
<td>Contractors’ incompetent technical skills</td>
<td>69</td>
<td>3.35</td>
<td>1.139</td>
<td>0.857</td>
<td>4</td>
</tr>
</tbody>
</table>

7.2.4.2 Factor analysis results

Table 7.11 revealed the presence of a correlation matrix of fourteen variables. Three variables were omitted as communality was > 1 on one variable which was regarded as a weak item or variable. Two variables were omitted due to measures of sampling adequacy (MSAs). Correlation matrix coefficients have been conducted to ensure visibility of coefficients greater than 0.3 and there were quite a number of correlations greater than 0.3 which tentatively suggests that factor analysis was appropriate (Hooper, 2012).

Table 7.11: Correlation matrix of the internal stakeholders’ impact on road construction projects (1<sup>st</sup> Order of factor analysis)

Omitted CTRI1 (MSA = 0.457)
Omitted CTRI4 (MSA = 0.589)
Table 7.12 indicates the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO-test). The value was 0.781, which exceeded the required value of 0.6 (Kaiser, 1960). The Barlett’s test of sphericity reached statistical significance of p=0.000, p <0.05.

Table 7.12: KMO and Bartlett’s test of the internal stakeholders

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | 0.781 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 393.697 |
| df | 91 |
| Sig. | 0.000 |

Table 7.13 shows the anti-image matrices of the internal stakeholders’ impacts symbolising the measure of sampling adequacy (MSA) strengthen the factorability of data showing diagonal measures of above 0.50. Table 7.14 shows the communalities of the variables after extraction were above the acceptable 0.3 (Field, 2009).

Table 7.13: Anti-image matrices of the internal stakeholders’ impacts (1st order)

<table>
<thead>
<tr>
<th>Anti-image Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>CLR1</td>
</tr>
<tr>
<td>CLR2</td>
</tr>
<tr>
<td>CLR3</td>
</tr>
<tr>
<td>CLR4</td>
</tr>
<tr>
<td>CLR5</td>
</tr>
<tr>
<td>CLR6</td>
</tr>
<tr>
<td>STAKEHOLDER</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>CLRI1</td>
</tr>
<tr>
<td>CLRI2</td>
</tr>
<tr>
<td>CLRI3</td>
</tr>
<tr>
<td>CLRI4</td>
</tr>
<tr>
<td>CLRI5</td>
</tr>
<tr>
<td>CLRI6</td>
</tr>
<tr>
<td>CLRI7</td>
</tr>
<tr>
<td>CLRI8</td>
</tr>
<tr>
<td>CLRI9</td>
</tr>
<tr>
<td>CTRI3</td>
</tr>
<tr>
<td>CRRI1</td>
</tr>
<tr>
<td>CRRI2</td>
</tr>
<tr>
<td>CRRI3</td>
</tr>
<tr>
<td>CRRI4</td>
</tr>
</tbody>
</table>

Table 7.14: Communalities of the internal stakeholders’ impacts

---

a. Measures of Sampling Adequacy (MSA)
Table 7.15 of the total variance explained of the internal stakeholders’ impact of performance in roads infrastructure projects revealed four components which had eigenvalues of above 1, namely (5.360; 1.791; 1.131 and 1.038). The components’ eigenvalue defined the 38.29%; 12.791%; 8.081% and 7.415 % respectively of the variance which indicates 66.575 % of the total variance before rotation and 54,087 % after rotation. Four components based on the results of scree plot are depicted in figure 7.2.

Table 7.15: Total variance explained of the internal stakeholders’ impact

<table>
<thead>
<tr>
<th>Factor</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
<th>Rotation Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
<td>Cumulative %</td>
</tr>
<tr>
<td>1</td>
<td>5,360</td>
<td>38.288</td>
<td>38.288</td>
</tr>
<tr>
<td>2</td>
<td>1,791</td>
<td>12.791</td>
<td>51.079</td>
</tr>
<tr>
<td>3</td>
<td>1,131</td>
<td>8.081</td>
<td>59.160</td>
</tr>
<tr>
<td>4</td>
<td>1,038</td>
<td>7.415</td>
<td>66.575</td>
</tr>
<tr>
<td>5</td>
<td>0.837</td>
<td>5.977</td>
<td>72.552</td>
</tr>
<tr>
<td>6</td>
<td>0.581</td>
<td>4.151</td>
<td>81.754</td>
</tr>
<tr>
<td>8</td>
<td>0.477</td>
<td>3.410</td>
<td>92.545</td>
</tr>
<tr>
<td>11</td>
<td>0.375</td>
<td>2.676</td>
<td>95.221</td>
</tr>
<tr>
<td>12</td>
<td>0.312</td>
<td>2.225</td>
<td>97.446</td>
</tr>
<tr>
<td>13</td>
<td>0.185</td>
<td>1.322</td>
<td>98.768</td>
</tr>
<tr>
<td>14</td>
<td>0.172</td>
<td>1.232</td>
<td>100,000</td>
</tr>
</tbody>
</table>

Table 7.16 indicates the factor loading of the internal stakeholders’” impact of performance in road infrastructure projects. The total of fourteen variables loaded on four components and the results were strengthened by a scree plot test (Pallant,2013). Varimax with the Kaiser normalization rotation method was used and the method revealed the variables loaded on four factors. Most of the variables loaded strongly on factor 1, followed by factor 2 and factor 4 with equal variables, then by factor 3 with two variables.
Table 7.16: Rotated factor matrix of the internal stakeholders’ impacts (1st Order of factor analysis)

<table>
<thead>
<tr>
<th>Factor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLRI2</td>
<td>0.844</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLRI5</td>
<td>0.671</td>
<td>0.275</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLRI1</td>
<td>0.567</td>
<td>0.320</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLRI4</td>
<td>0.540</td>
<td>0.457</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLRI6</td>
<td>0.473</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLRI3</td>
<td>0.421</td>
<td>0.292</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLRI7</td>
<td></td>
<td>0.697</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLRI8</td>
<td></td>
<td>0.629</td>
<td>0.306</td>
<td></td>
</tr>
<tr>
<td>CLRI9</td>
<td></td>
<td>0.535</td>
<td>0.350</td>
<td></td>
</tr>
<tr>
<td>CRR11</td>
<td></td>
<td></td>
<td>0.906</td>
<td></td>
</tr>
<tr>
<td>CRR12</td>
<td></td>
<td></td>
<td>0.716</td>
<td>0.289</td>
</tr>
<tr>
<td>CRR13</td>
<td>0.279</td>
<td>0.328</td>
<td>0.299</td>
<td>0.635</td>
</tr>
<tr>
<td>CRR14</td>
<td></td>
<td>0.495</td>
<td>0.606</td>
<td></td>
</tr>
<tr>
<td>CTR13</td>
<td>0.322</td>
<td></td>
<td>0.386</td>
<td></td>
</tr>
</tbody>
</table>

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.\(^a\)

\(^a\) Rotation converged in 8 iterations.
Component 1: Management control

The factor 1 (ISI 1) encountered 38.288 % (Table 7.16) of the total variance of the internal stakeholders’ impact on road infrastructure projects which was valid. Factor 1 was named ‘management control’ by the variables group in factor 1. The component emphasized the cooperation of clients in terms of approving the project cost, reviewing the design document and the establishment for acceptance criteria for the completion certificate. Conflict between client and contractor is normally caused by the type of contractor. Therefore, establishing the legality of a contract is recommended to avoid conflict between the parties involved (Kamanga & Steyr, 2013).

Component 2: Client cooperation

Component 2 (ISI 2) was given ‘client cooperation’ as a name as many factors pointed to the client of the project. If the client does not pay the service providers on time, the service provider ends up in liquidation, default and having difficulties to repay the bank loans due to the late or non-payment by the client (Thwala & Mvubu, 2008). The component defined the following variables, namely CLRI 7, CLRI 8 and CLRI 9 (See Table 7.16)

Component 3: Site management control

Component 3 (ISI 3) gives the insight into the running of the construction site, how site construction is managed and supervised, and its challenges. Poor performance by the contractor results in poor quality and low productivity (Dlungwane et al., 2002). Planning management, site supervision by
applying proper methods such as proper communication, utilization of latest technology and regular meetings could help to manage a site properly (Aziz et al., 2012). The component defined CRRI 1 and CRRI 2 variables (See Table 7.16)

**Component 4 : Service providers’ capability**

Component 4 (ISI 4) explained the inability of the service providers who have limited knowledge of running the project. Service providers are like the client’s agent as they ensure that the project is completed on time, within budget and completed with the right quality and standard. Service providers give value for money to the client (Dadzie et al., 2012). The component defined the following variables: CRRI 3, CRRI 4 and CTRI 3 (See Table 7.16)

**7.2.4.3 Naming of components/factors of the internal stakeholders’ impact on performance of construction projects as per 2nd order of factor analysis**

Table 7.17 presents the availability of correlation between four factors below. The availability of correlation suggests that the data was suitable for factor analysis (Pallant, 2013).

<table>
<thead>
<tr>
<th>Correlation</th>
<th>SecD1_F1</th>
<th>SecD1_F2</th>
<th>SecD1_F3</th>
<th>SecD1_F4</th>
</tr>
</thead>
<tbody>
<tr>
<td>SecD1_F1</td>
<td>1.000</td>
<td>0.607</td>
<td>0.245</td>
<td>0.481</td>
</tr>
<tr>
<td>SecD1_F2</td>
<td>0.607</td>
<td>1.000</td>
<td>0.350</td>
<td>0.561</td>
</tr>
<tr>
<td>SecD1_F3</td>
<td>0.245</td>
<td>0.350</td>
<td>1.000</td>
<td>0.556</td>
</tr>
<tr>
<td>SecD1_F4</td>
<td>0.481</td>
<td>0.561</td>
<td>0.556</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Kaiser-Meyer-Olkin Measure of Sampling Adequacy. 0.706

Bartlett's Test of Sphericity

<table>
<thead>
<tr>
<th>Approx. Chi-Square</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>91.877</td>
<td>6</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table 7.19 of the anti-image matrices of the internal stakeholders’ impacts symbolising the measure of sampling adequacy (MSA) strengthens the factorability of data showing diagonal measures of above 0.50. Table 7.20 shows the communalities of the factors after extraction were above the acceptable 0.3 value except SecD1_F3 the value of which was below the accepted value. However, the factor remains as the MSA was fine (Field, 2009).

<table>
<thead>
<tr>
<th>Anti-image Correlation</th>
<th>SecD1_F1</th>
<th>SecD1_F2</th>
<th>SecD1_F3</th>
<th>SecD1_F4</th>
</tr>
</thead>
<tbody>
<tr>
<td>SecD1_F1</td>
<td>.709a</td>
<td>-0.467</td>
<td>0.064</td>
<td>-0.219</td>
</tr>
</tbody>
</table>
The second order of factor analysis shows four factors which were merged into one factor and the eigenvalue was above 1 (2.416). The eigenvalue explained (60.389 %) of the total variance (Table 7.21 and Table 7.22). The results of the scree plot test show only first component accounted for 60.389 % (Figure 3).

**Table 7.20: Communalities of the internal stakeholders’ impact (2nd Order factor analysis)**

<table>
<thead>
<tr>
<th></th>
<th>Initial</th>
<th>Extraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>SecD1_F1</td>
<td>0.400</td>
<td>0.422</td>
</tr>
<tr>
<td>SecD1_F2</td>
<td>0.466</td>
<td>0.584</td>
</tr>
<tr>
<td>SecD1_F3</td>
<td>0.314</td>
<td>0.279</td>
</tr>
<tr>
<td>SecD1_F4</td>
<td>0.488</td>
<td>0.648</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Axis Factoring.

**Table 7.21: Total variance explained of the internal stakeholders impact (2nd Order factor analysis)**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
</tr>
<tr>
<td></td>
<td>2,416</td>
<td>60,389</td>
</tr>
<tr>
<td>1</td>
<td>0.835</td>
<td>20,864</td>
</tr>
<tr>
<td>2</td>
<td>0.384</td>
<td>9.608</td>
</tr>
<tr>
<td>3</td>
<td>0.366</td>
<td>9.139</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 7.22: Factor matrix of the internal stakeholders impact (2nd order of factor analysis)**

<table>
<thead>
<tr>
<th></th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>SecD1_F4</td>
<td>0.805</td>
</tr>
<tr>
<td>SecD1_F2</td>
<td>0.764</td>
</tr>
<tr>
<td>SecD1_F1</td>
<td>0.649</td>
</tr>
<tr>
<td>SecD1_F3</td>
<td>0.528</td>
</tr>
</tbody>
</table>
Principal component analysis (PCA) criteria were used to test the validity of the internal stakeholders impact. The observed variables were reduced into four factors of internal stakeholders impacts, namely management control, client cooperation, site management and service providers’ capability which shows a number of correlations greater than 0.3 which tentatively suggests factor analysis to be appropriate. Section D1(Internal stakeholders impacts) of the internal stakeholders impact of the performance in road infrastructure projects applied empirical reliabilities to determine the validity and reliability of the factors (Hooper, 2012).

The Cronbach alpha reliability coefficient normally ranges between 0 and 1. The Cronbach alpha of 0.8 is probably a reasonable goal (Gliem & Gliem, 2003). The Cronbach alpha coefficients for four empirical factors were ≥0.70 which is above Factor 1- Management Control (ISI 1) with Cronbach’s alpha of 0.828, Factor 2 - Client Cooperation (ISI 2) with Cronbach’s alpha of 0.732, Factor 3 - Site Management Control (ISI 3) with Cronbach’s alpha of 0.797 and Factor 4 - Service Provider’s Capability (ISI 4) with Cronbach’s alpha of 0.706 were all above 0.70 of which all variables were reliable. For the second order of the internal stakeholders impact, the empirical and theoretical reliability were tested where Cronbach’s alpha was 0.873 which is above 0.7 and the

Figure 7.3: Scree plot of internal stakeholders impact (2nd Order of factor analysis)
factor was reliable. On the theoretical reliability, the client-related impact and contractor-related impact with Cronbach’s alpha of 0.845 and 0.822 respectively were tested and found to be reliable except the consultant-related impact of which the inter-item correlation mean of 0.284 was used to test the reliability which it was 0.30 and it is acceptable (Table 7.23).

Table 7.23: Reliability status of the internal stakeholders in road infrastructure projects

<table>
<thead>
<tr>
<th>Factors/Components</th>
<th>Cronbach’s Alpha (˃= 0.7)</th>
<th>Inter-Item-Correlation Mean</th>
<th>No of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1- Management Control (ISI 1)</td>
<td>0.828</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Factor 2 - Client Cooporation (ISI 2)</td>
<td>0.732</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Factor 3 - Site Management Control (ISI 3)</td>
<td>0.797</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Factor 4 - Service Provider’s Capability (ISI 4)</td>
<td>0.706</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

2nd Order of empirical reliabilities

<table>
<thead>
<tr>
<th>Factors/Components</th>
<th>Cronbach’s Alpha (˃= 0.7)</th>
<th>Inter-Item-Correlation Mean</th>
<th>No of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1- Internal Stakeholders Impact</td>
<td>0.873</td>
<td></td>
<td>14</td>
</tr>
</tbody>
</table>

Theoretical reliabilities

<table>
<thead>
<tr>
<th>Factors/Components</th>
<th>Cronbach’s Alpha (˃= 0.7)</th>
<th>Inter-Item-Correlation Mean</th>
<th>No of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client related impact</td>
<td>0.845</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>Consultant related impact</td>
<td>0.606</td>
<td>0.284</td>
<td>4</td>
</tr>
<tr>
<td>Contractor related impact</td>
<td>0.822</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>
7.3 EXTERNAL STAKEHOLDERS IMPACT ON ROAD CONSTRUCTION PROJECTS

7.3.1 Descriptive analysis results

The table 7.24 below indicates that community unrest (M=4.14; SD=1.071) took precedence on the list of external stakeholders impact on construction road projects followed by the slow response by existing service providers with (M=3.81;SD=1.036). ‘Stakeholders have negative impacts on projects’ (M=3.70; SD=1.063) and ‘stakeholders have an influence on the failure of the project’ (M=3.68; SD=0.956) are regarded as the highest external stakeholders impact on construction projects as the respondents agreed. The respondents further agreed that ‘stakeholders delay projects’ (M=3.66; SD=1.017) and ‘inadequate channel of communication between stakeholders’ (M=3.66; SD=1.096) were rated equally on number five by the respondents. The respondents revealed that ‘stakeholders’ bad relationship between each other’ (M=3.2;SD=1.107), ‘lack of technical capacity of stakeholders’ (M=3.48;SD=1.180) together with ‘stakeholders’ bad attitude towards project’ (M=3.47;SD= 1.029) and ‘regular changes of local authority’s rules, regulations and protocol’ (M=3.47;SD=1.144) on the same rank were part of external stakeholders impact on construction road projects. ‘Resistance to relocate by property owners after property compensation’ (M=3.45;SD=0.987), ‘stakeholders’ late involvement in the project (M=3.42; SD=1.166) and ‘stakeholders’ low enthusiasm’ (M=3.23;SD=1.149) were ranked third last, second last and last by the respondents as external stakeholders impact. Lastly, ‘the lack of time to participate on a project by stakeholders’ (M=3.18;SD= 1.135) had low impact on the external stakeholders impact on construction projects.

Table 7.24: External stakeholders impact factors on road construction projects

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Cronbach Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESI 12</td>
<td>Community unrest</td>
<td>73</td>
<td>4.14</td>
<td>1.071</td>
<td>0.867</td>
</tr>
<tr>
<td>ESI 13</td>
<td>Slow response by existing service providers</td>
<td>73</td>
<td>3.81</td>
<td>1.036</td>
<td>0.859</td>
</tr>
<tr>
<td>ESI 1</td>
<td>Stakeholders have negative impacts on projects</td>
<td>73</td>
<td>3.70</td>
<td>1.063</td>
<td>0.863</td>
</tr>
<tr>
<td>ESI 3</td>
<td>Stakeholders have an influence on failure of the project</td>
<td>73</td>
<td>3.68</td>
<td>0.956</td>
<td>0.859</td>
</tr>
<tr>
<td>ESI 2</td>
<td>Stakeholders delay projects</td>
<td>73</td>
<td>3.66</td>
<td>1.017</td>
<td>0.860</td>
</tr>
<tr>
<td>ESI 9</td>
<td>Inadequate channel of communication between stakeholders</td>
<td>73</td>
<td>3.66</td>
<td>1.096</td>
<td>0.869</td>
</tr>
<tr>
<td>ESI</td>
<td>Stakeholders’ bad relationship between each other</td>
<td>73</td>
<td>3.52</td>
<td>1.107</td>
<td>0.861</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------------------------</td>
<td>-----</td>
<td>------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>ESI 8</td>
<td>Lack of technical capacity of stakeholders</td>
<td>73</td>
<td>3.48</td>
<td>1.180</td>
<td>0.867</td>
</tr>
<tr>
<td>ESI 4</td>
<td>Stakeholders’ bad attitude towards project</td>
<td>73</td>
<td>3.47</td>
<td>1.029</td>
<td>0.860</td>
</tr>
<tr>
<td>ESI 14</td>
<td>Regular changes of local authority’s rules, regulations &amp; protocol</td>
<td>73</td>
<td>3.47</td>
<td>1.144</td>
<td>0.868</td>
</tr>
<tr>
<td>ESI 11</td>
<td>Resistance to relocate by property owners after property compensation</td>
<td>73</td>
<td>3.45</td>
<td>0.987</td>
<td>0.869</td>
</tr>
<tr>
<td>ESI 10</td>
<td>Stakeholders’ late involvement in the project</td>
<td>73</td>
<td>3.42</td>
<td>1.166</td>
<td>0.864</td>
</tr>
<tr>
<td>ESI 6</td>
<td>Stakeholders’ low enthusiasm</td>
<td>73</td>
<td>3.23</td>
<td>1.149</td>
<td>0.868</td>
</tr>
<tr>
<td>ESI 7</td>
<td>Lack of time to participate on project by stakeholders</td>
<td>73</td>
<td>3.18</td>
<td>1.135</td>
<td>0.864</td>
</tr>
</tbody>
</table>

### 7.3.2 Factor analysis results

Table 7.25 present the availability of correlation between twelve variables below. The availability of correlation suggests that the data was suitable for factor analysis (Pallant, 2013).

<table>
<thead>
<tr>
<th>Correlation Matrix of External Stakeholders Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ESI</strong></td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td><strong>ESI1</strong></td>
</tr>
<tr>
<td><strong>ESI2</strong></td>
</tr>
<tr>
<td><strong>ESI3</strong></td>
</tr>
<tr>
<td><strong>ESI4</strong></td>
</tr>
<tr>
<td><strong>ESI5</strong></td>
</tr>
<tr>
<td><strong>ESI6</strong></td>
</tr>
<tr>
<td><strong>ESI7</strong></td>
</tr>
<tr>
<td><strong>ESI8</strong></td>
</tr>
<tr>
<td><strong>ESI9</strong></td>
</tr>
<tr>
<td><strong>ESI10</strong></td>
</tr>
<tr>
<td><strong>ESI11</strong></td>
</tr>
<tr>
<td><strong>ESI12</strong></td>
</tr>
<tr>
<td><strong>ESI13</strong></td>
</tr>
</tbody>
</table>
Table 7.26 indicates the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO-test). The value was 0.804, which exceeded the required value of 0.6 (Kaiser, 1960). The Barlett’s test of sphericity reached statistical signature of p=0.000, p <0.05.

Table 7.26: KMO and Bartlett’s test of external stakeholders

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | 0.804 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 451.017 |
| df | 91 |
| Sig. | 0.000 |

Table 7.27 of the anti-image matrices of the external stakeholders impacts symbolising the measure of sampling adequacy (MSA) strengthens the factorability of data showing diagonal measures of above 0.50. Table 7.28 shows the communalities of the variables after extraction were above the acceptable 0.3 value (Field, 2009).

Table 7.27: Anti-image correlation of the external stakeholders impact

<table>
<thead>
<tr>
<th>ESI1</th>
<th>ESI2</th>
<th>ESI3</th>
<th>ESI4</th>
<th>ESI5</th>
<th>ESI6</th>
<th>ESI7</th>
<th>ESI8</th>
<th>ESI9</th>
<th>ESI10</th>
<th>ESI11</th>
<th>ESI12</th>
<th>ESI13</th>
<th>ESI14</th>
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</thead>
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</tr>
<tr>
<td>ESI1</td>
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<tr>
<td></td>
<td>0.144</td>
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<td></td>
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<td>ESI5</td>
<td>-</td>
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<td>0.329</td>
<td></td>
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<td>0.072</td>
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<td></td>
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<td>-</td>
<td>-</td>
<td>0.756</td>
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<td>0.176</td>
<td>0.033</td>
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<td>0.138</td>
<td>0.155</td>
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</tr>
<tr>
<td>ESI9</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-</td>
<td>0.134</td>
<td>-</td>
<td>-</td>
<td>-0.193</td>
<td>.784</td>
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<td>0.017</td>
<td>0.012</td>
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174
Table 7.28: Communalities of the external stakeholders impact

<table>
<thead>
<tr>
<th></th>
<th>Initial</th>
<th>Extraction</th>
</tr>
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<tbody>
<tr>
<td>ESI1</td>
<td>0.709</td>
<td>0.853</td>
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<tr>
<td>ESI2</td>
<td>0.668</td>
<td>0.674</td>
</tr>
<tr>
<td>ESI3</td>
<td>0.600</td>
<td>0.673</td>
</tr>
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<td>ESI4</td>
<td>0.578</td>
<td>0.587</td>
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<td>ESI5</td>
<td>0.657</td>
<td>0.805</td>
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<td>0.699</td>
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<td>ESI7</td>
<td>0.429</td>
<td>0.418</td>
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<td>ESI8</td>
<td>0.423</td>
<td>0.335</td>
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<td>ESI9</td>
<td>0.352</td>
<td>0.376</td>
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<td>ESI10</td>
<td>0.537</td>
<td>0.579</td>
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<tr>
<td>ESI11</td>
<td>0.389</td>
<td>0.405</td>
</tr>
<tr>
<td>ESI12</td>
<td>0.375</td>
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<td>ESI13</td>
<td>0.627</td>
<td>0.588</td>
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<tr>
<td>ESI14</td>
<td>0.524</td>
<td>0.580</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Axis Factoring.

Table 7.29 of the total variance explained of the external stakeholders impact of performance in roads infrastructure projects revealed four components which had eigen value of above 1 namely (5.393; 1.652; 1.343 and 1.222). The components eigen value defined the 38.52%; 11.80%; 9.59% and 8.73 % respectively of the variance which indicates 68.65 % of the total variance. Four components based on the results of scree plot on figure 7.4.
Table 7.29: Total variance explained of the external stakeholders’ impact

<table>
<thead>
<tr>
<th>Factor</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
<th>Rotation Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
<td>Cumulative %</td>
</tr>
<tr>
<td>1</td>
<td>5,393</td>
<td>38,518</td>
<td>38,518</td>
</tr>
<tr>
<td>2</td>
<td>1,652</td>
<td>11,803</td>
<td>50,321</td>
</tr>
<tr>
<td>3</td>
<td>1,343</td>
<td>9,595</td>
<td>59,916</td>
</tr>
<tr>
<td>4</td>
<td>1,222</td>
<td>8,730</td>
<td>68,647</td>
</tr>
<tr>
<td>5</td>
<td>0,846</td>
<td>6,040</td>
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<td>6</td>
<td>0,693</td>
<td>4,950</td>
<td>79,637</td>
</tr>
<tr>
<td>7</td>
<td>0,550</td>
<td>3,927</td>
<td>83,563</td>
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<tr>
<td>8</td>
<td>0,519</td>
<td>3,707</td>
<td>87,270</td>
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<tr>
<td>9</td>
<td>0,496</td>
<td>3,544</td>
<td>90,814</td>
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<td>10</td>
<td>0,371</td>
<td>2,651</td>
<td>93,466</td>
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<td>11</td>
<td>0,289</td>
<td>2,061</td>
<td>95,527</td>
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<td>12</td>
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<td>1,825</td>
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<td>14</td>
<td>0,170</td>
<td>1,217</td>
<td>100,000</td>
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</table>

Extraction Method: Principal Axis Factoring.

Table 7.30 indicates the factor loading of the external stakeholders’ impact on performance in road infrastructure projects. The total of twelve variables loaded on four components and the results were strengthened by scree plot test (Pallant, 2013). Varimax with Kaiser normalization. Rotation method was used and the method revealed the variables loaded on four factors. Most of the variables loaded strongly on factors 1, 2 and 4.

Table 7.30: Rotated factor matrix of external stakeholders impact

<table>
<thead>
<tr>
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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESI1</td>
<td>0.830</td>
<td></td>
<td></td>
<td>0.389</td>
</tr>
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<td>ESI2</td>
<td>0.738</td>
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<td>0.292</td>
</tr>
<tr>
<td>ESI3</td>
<td>0.673</td>
<td>0.362</td>
<td></td>
<td>0.295</td>
</tr>
<tr>
<td>ESI4</td>
<td>0,548</td>
<td>0,308</td>
<td>0,435</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>ESI14</td>
<td>0,739</td>
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<td></td>
</tr>
<tr>
<td>ESI10</td>
<td>0,679</td>
<td>0,307</td>
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<td></td>
</tr>
<tr>
<td>ESI13</td>
<td>0,624</td>
<td>0,355</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESI11</td>
<td>0,581</td>
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<td></td>
</tr>
<tr>
<td>ESI5</td>
<td>0,304</td>
<td>0,812</td>
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</tr>
<tr>
<td>ESI6</td>
<td>0,755</td>
<td>0,326</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESI12</td>
<td>0,330</td>
<td></td>
<td>0,552</td>
<td></td>
</tr>
<tr>
<td>ESI9</td>
<td></td>
<td>0,543</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESI7</td>
<td>0,326</td>
<td>0,508</td>
<td></td>
<td></td>
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<tr>
<td>ESI8</td>
<td>0,297</td>
<td>0,441</td>
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</tr>
</tbody>
</table>

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 9 iterations.

Figure 7.4: Screen plot test of the external stakeholders impact (1st Order of factor analysis)

7.3.3 Naming of components/factors of the external stakeholders impact on performance of construction projects as per 1st order of factor analysis

Component 1: External Stakeholders behaviour towards construction projects
The factor 1 (ESI 1) encountered 38,518 % (Table 7.29) of the total variance of the external stakeholders impact in road infrastructure projects which was valid. Factor 1 suggests that
stakeholders behaviour towards construction projects determined the success or failure of the project. The external stakeholders attitude, negative impact, lack of technical capacity on stakeholders and the unrest of the community contributed considerably on projects. Community unrest causes confusion regarding the completion date of the project by the contractor (Atkinson, 2002). External stakeholders are regarded as secondary stakeholders without a contractual contract with the owner of the project; however, they have a massive impact on projects (Molwus, 2014). Stakeholder management is the key role on projects (Quattrocchi, 2014). Factor 1 defined the following variables ESI 1, ESI 2, ESI 3 and ESI 4 (Table 7.30).

Component 2: Third party involvement as a stakeholder
The factor 2 (ESI 2) encountered 11,803 % (Table 7.29) of the total variance of the external stakeholders’ impact on road infrastructure projects which was a valid factor 2 suggesting that the involvement of the third party on a project causes a delay on projects. Factor 2 highlighted the third parties such as service providers of existing services, local authorities affected by the project, and property owners that need to relocate. Service providers of existing services seem to forget to relocate existing services during the construction of the project as they take their time to do so (Kananga Steryr, 2013). Furthermore, property owners who forgo their land tend to resist relocation owing to poor compensation and undervalued market price for their property (Sahoo, 2011). Factor 2 defined the following variables ESI 10, ESI 11, ESI 13 and ESI 14 (See Table 7.30)

Component 3: Stakeholders poor communication among each other
Factor 3 (ESI 3) encountered 9,595 % (Table 7.29) of the total variance of the external stakeholders impact on road infrastructure projects which was a valid factor 3 suggesting that stakeholders should have good effective communication among each other and have high enthusiasm for a project. Factor 3 defined the following variables ESI 5 and ESI 6 (Table 7.30).

Component 4: Stakeholders dedication to the project
Factor 4 (ESI 4) encountered 8,730 % (Table 7.29) of the total variance of the external stakeholders impact on road infrastructure projects which became valid, factor 4 suggesting that stakeholders must be dedicated to the project at all times by having time to participate on project, communicate with other stakeholders, keep informed and be part of decision making. Effective communication that is the way to go (Tawanda, 2014). Factor 4 defined the following variables ESI 7, ESI 8, ESI 9 and ESI 12 (Table 7.30).
7.3.4 Naming of components/factors of the external stakeholders impact on performance of construction projects as per 2nd order of factor analysis

The second order of the factor analysis merged four factors into one factor. The eigenvalue was above 1 (2,276) which described 56,910% of the variance (Table 7.29). The outcomes of variance resulted in a scree plot test that recommended that only the component 1 accounted for 56,910% (Figure 7.5).

Table 7.31: Correlation matrix of external stakeholders (2nd order )

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<tr>
<th></th>
<th>SecD2_F1</th>
<th>SecD2_F2</th>
<th>SecD2_F3</th>
<th>SecD2_F4</th>
</tr>
</thead>
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<tr>
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<td>0,491</td>
<td>0,504</td>
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<td>1,000</td>
<td>0,368</td>
<td>0,378</td>
</tr>
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<td>0,368</td>
<td>1,000</td>
<td>0,385</td>
</tr>
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<td>SecD2_F4</td>
<td>0,504</td>
<td>0,378</td>
<td>0,385</td>
<td>1,000</td>
</tr>
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Table 7.32: KMO and Bartlett's test of external stakeholders

<table>
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<tr>
<th></th>
<th>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</th>
<th>0,760</th>
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<tr>
<td>Bartlett's Test of</td>
<td>Approx. Chi-Square</td>
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<td>Sphericity</td>
<td>df</td>
<td>6</td>
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<tr>
<td></td>
<td>Sig.</td>
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</tbody>
</table>

Table 7.33: Anti-image matrices of external stakeholders

<table>
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<tr>
<th></th>
<th>SecD2_F1</th>
<th>SecD2_F2</th>
<th>SecD2_F3</th>
<th>SecD2_F4</th>
</tr>
</thead>
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<td>-0,323</td>
<td>-0,338</td>
</tr>
<tr>
<td>SecD2_F2</td>
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<td>.809*</td>
<td>-0,173</td>
<td>-0,183</td>
</tr>
<tr>
<td>SecD2_F3</td>
<td>-0,323</td>
<td>-0,173</td>
<td>.771*</td>
<td>-0,145</td>
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<tr>
<td>SecD2_F4</td>
<td>-0,338</td>
<td>-0,183</td>
<td>-0,145</td>
<td>.763*</td>
</tr>
</tbody>
</table>

a. Measures of Sampling Adequacy (MSA)

Table 7.34: Communalities of the external stakeholders

<table>
<thead>
<tr>
<th></th>
<th>Initial</th>
<th>Extraction</th>
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</thead>
<tbody>
<tr>
<td>SecD2_F1</td>
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<td>SecD2_F2</td>
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<td>0,323</td>
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<tr>
<td>SecD2_F3</td>
<td>0,289</td>
<td>0,395</td>
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</table>
Table 7.35: Total variance explained of the external stakeholders’ impact

<table>
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<th>Extraction Sums of Squared Loadings</th>
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</thead>
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<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
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</table>

Extraction Method: Principal Axis Factoring.

Table 7.36: Factor matrix of the external stakeholders’ impact (2nd order of factor analysis)

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<th>SecD2_F3</th>
<th>SecD2_F2</th>
</tr>
</thead>
<tbody>
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<td>0,645</td>
<td>0,628</td>
<td>0,568</td>
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</tbody>
</table>

Extraction Method: Principal Axis Factoring.

Figure 7.5: Scree plot test of the external stakeholders’ impact (2nd Order of factor analysis)

7.3.5 Validity of the external stakeholders’ impact
Validity and reliability were tested and found to be satisfactory. The overall number of observed variables were reduced into latent factors which led to four factors related to the external stakeholders’ impact on road infrastructure projects. The maximum point for correlation coefficient was between 0.30 and 1.00 and considered to be valid. Section D2 of the external stakeholders’ impact of the performance in roads infrastructure projects applied empirical reliabilities to determine the validity and reliability of the factors (Hooper, 2012).

7.3.6 Empirical reliabilities of the external stakeholders in road infrastructure projects

Pallant (2013) explained that the values of alpha would range from 0.70 to 0.95, all values rounded off to one decimal place or two decimal places. Cronbach alpha <0.7 with items less than 10 in the scale the optimal inter-item correlations mean should range from 0.20 to 0.40 to be reliable. The current study shows the Cronbach alpha coefficients for the empirical factory of factor1- external stakeholders’ behaviour towards construction projects (ESI 1) with Cronbach’s alpha of 0,839, factor2 - Third party involvement as a stakeholder (ESI 2) with Cronbach’s alpha of 0,803 and factor 3 - Stakeholders’ poor communication between each other’s (ESI 3) with Cronbach’s alpha of 0,774 were all reliable when rounded. Factor 4 - Stakeholders’ dedication to the project (ESI 4) with the Cronbach’s Alpha of 0,671 was not reliable and the inter-item correlation mean of 0,338 was used to determine the reliability. The 2nd order of the empirical reliabilities was conducted whereby the Cronbach’s alpha was 0,873 which was reliable. The theoretical reliability test merged all factors into one with Cronbach’s alpha of 0,873 which was reliable. (See Table 7.37)

Table 7.37: Reliability status of the external stakeholders’ impact on road infrastructure projects

<table>
<thead>
<tr>
<th>Factors/Components</th>
<th>Cronbach’s Alpha (≥ 0.7)</th>
<th>Inter-Item-Correlation Mean</th>
<th>No of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor1 - External Stakeholders’ behaviour towards construction projects (ESI 1)</td>
<td>0.839</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Factor2 - Third party involvement as a stakeholder (ESI 2)</td>
<td>0.803</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Factor 3 - Stakeholders’ poor communication between each other’s (ESI 3)</td>
<td>0.774</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Factor 4 - Stakeholders’ dedication to the project (ESI 4)</td>
<td>0.671</td>
<td>0.873</td>
<td>4</td>
</tr>
</tbody>
</table>

2nd Order of empirical reliabilities

181
<table>
<thead>
<tr>
<th>Factors/Components</th>
<th>Cronbach’s Alpha (≥ 0.7)</th>
<th>Inter-Item-Correlation Mean</th>
<th>No of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>External stakeholders’ impacts factors</td>
<td>0.873</td>
<td></td>
<td>14</td>
</tr>
</tbody>
</table>

**Theoretical reliabilities**

<table>
<thead>
<tr>
<th>Factors/Components</th>
<th>Cronbach’s Alpha (≥ 0.7)</th>
<th>Inter-Item-Correlation Mean</th>
<th>No of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors of the effects of performance on road infrastructure projects</td>
<td>0.873</td>
<td></td>
<td>14</td>
</tr>
</tbody>
</table>

**7.4 SECTION E - WAYS TO RESOLVE PERFORMANCE PROBLEMS IN ROADS INFRASTRUCTURE**

**7.4.1 Descriptive analysis results**

Table 7.38 presents the factors influencing the performance in road infrastructure projects per category. The performance factors were tested for validity and internal reliability. A five-point Likert scale was used where: 1 = Strongly disagree (SD), 2 = Disagree (D), 3 = Neutral (N), 4 = Agree (A), and 5 = Strongly agree (SA). Certain abbreviations and a number of ranges were established to present results outcomes accordingly, namely WRPP 1, WRPP 2, WRPP 4, WRPP 5, WRPP 6, WRPP 7, WRPP 8, WRPP 9 and WRPP 10.

Table 7.46 below shows the ways to resolve performance problems as the respondents rated the following: ‘skills transfer’ with (M=4.60; SD=0.678; R=1) was rated number one by the respondents followed by ‘education and training’ with 9M=4.53; SD=0.644; R=2). ‘Effective communication’ was rated number three with (M=4.44; SD=0.809; R=3) and ‘adequate planning’ rated number four with (M=4.11; SD=1.122; R=4). ‘Engaging local municipalities and road agencies’ was ranked fifth with (M=4.08; SD=0.882; R=5), ‘quality management was rated six’ with (M=4.07; SD=1.155; R=6) and ‘stakeholder management’ was ranked seventh with (M=3.83; SD=1.122; R=7). ‘New technology’ was rated third last with (M=3.72; SD=0.708; R=8), ‘public-private partnership’ was rated number nine with (M=3.69; SD=0.885; R=9) and last was ‘effective communication’ with the (M=3.24; SD=0.809; R=10).

**Table 7.38: Ways to resolve performance problems**
7.4.2 Factor analysis results

No exploratory factor analyses were done on this section as there was no consistency or correlation between the factors.

7.5 PERFORMANCE MEASURES THAT MAY BE USED TO ASSESS THE PERFORMANCE OF ROAD PROJECTS

7.5.1 Descriptive analysis

Table 7.39 below shows the quality factor with (M=4.46; SD=0.629) as the highest possible performance measure that may be used to assess the performance of road projects followed by the cost factor with (M=4.34; SD=0.810) and time factor with (M=4.34; SD=0.716) which were both rated number two. The respondents agreed that the client satisfaction (product) with (M=4.17; SD = 0.845), client satisfaction (service) with (M= 4.15; SD=0.856) and the end user’s satisfaction with (M= 3.94; SD=1,108) were among other performance measures factors that may be considered to assess the performance in road construction projects. The health and safety factor with (M= 3.94; SD =0,924) rated number six, followed by productivity with (M= 3.90; SD= 1,058) at number eight. The respondents revealed that defects with (M= 3.76; SD=1,213) has a low impact as performance measures as it was rated second last and last was the profitability with (M=3,55; SD= 1,011).

Table 7.39: Performance measures factors

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM3</td>
<td>Quality factor</td>
<td>71</td>
<td>4.46</td>
<td>0.629</td>
<td>1</td>
</tr>
</tbody>
</table>
7.5.2 Factor analysis results

Table 7.40 below indicated the presence of correlations within ten variables. The correlations were achieved, coefficients of 0.30 and above. The results shown on the data were suitable for factor analysis (Pallant, 2013).

Table 7.40: Correlation matrix of performance measures that may be used to assess the performance of road projects (1st Order of factor analysis)

<table>
<thead>
<tr>
<th></th>
<th>PM1</th>
<th>PM2</th>
<th>PM3</th>
<th>PM4</th>
<th>PM5</th>
<th>PM6</th>
<th>PM7</th>
<th>PM8</th>
<th>PM9</th>
<th>PM10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation</td>
<td>PM1</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM2</td>
<td>0.663</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM3</td>
<td>0.503</td>
<td>0.445</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM4</td>
<td>0.188</td>
<td>0.124</td>
<td>0.496</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM5</td>
<td>0.240</td>
<td>0.191</td>
<td>0.501</td>
<td>0.931</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM6</td>
<td>0.245</td>
<td>0.331</td>
<td>0.464</td>
<td>0.506</td>
<td>0.553</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM7</td>
<td>0.135</td>
<td>0.293</td>
<td>0.154</td>
<td>0.391</td>
<td>0.395</td>
<td>0.355</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM8</td>
<td>0.158</td>
<td>0.190</td>
<td>0.177</td>
<td>0.355</td>
<td>0.412</td>
<td>0.330</td>
<td>0.719</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM9</td>
<td>-0.037</td>
<td>0.286</td>
<td>0.371</td>
<td>0.396</td>
<td>0.333</td>
<td>0.486</td>
<td>0.644</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM10</td>
<td>0.111</td>
<td>0.200</td>
<td>0.317</td>
<td>0.347</td>
<td>0.380</td>
<td>0.459</td>
<td>0.505</td>
<td>0.616</td>
<td>0.484</td>
</tr>
</tbody>
</table>

Table 7.41 shows that the KMO test value was 0.747 which is well within the acceptable value of 0.6. The Bartlett’s test of sphericity reached significance at $p=0.00$ ($p<0.05$) which meant that the Barlett criteria were met (Hooper, 2012). The anti-image matrices as MSAs shown on table 7.42 sustained the factorability of data (Hooper, 2012).
Table 7.41: KMO and Bartlett's test of performance measures that may be used to assess the performance of road projects (1st Order of factor analysis).

<table>
<thead>
<tr>
<th>Kaiser-Meyer-Olkin Measure of Sampling Adequacy.</th>
<th>0.747</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartlett's Test of Sphericity</td>
<td></td>
</tr>
<tr>
<td>Approx. Chi-Square</td>
<td>414.586</td>
</tr>
<tr>
<td>df</td>
<td>45</td>
</tr>
<tr>
<td>Sig.</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table 7.42: Anti-image matrices of the performance measures that may be used to assess the performance of road projects (1st Order of factor analysis)

<table>
<thead>
<tr>
<th>Anti-image Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM1</td>
</tr>
<tr>
<td>PM1</td>
</tr>
<tr>
<td>PM2</td>
</tr>
<tr>
<td>PM3</td>
</tr>
<tr>
<td>PM4</td>
</tr>
<tr>
<td>PM5</td>
</tr>
<tr>
<td>PM6</td>
</tr>
<tr>
<td>PM7</td>
</tr>
<tr>
<td>PM8</td>
</tr>
<tr>
<td>PM9</td>
</tr>
<tr>
<td>PM10</td>
</tr>
</tbody>
</table>

a. Measures of Sampling Adequacy (MSA)

Table 7.43: Communalities of performance measures that may be used to assess the performance of road projects

<table>
<thead>
<tr>
<th></th>
<th>Initial</th>
<th>Extraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM1</td>
<td>0.522</td>
<td>0.599</td>
</tr>
<tr>
<td>PM2</td>
<td>0.574</td>
<td>0.774</td>
</tr>
<tr>
<td>PM3</td>
<td>0.544</td>
<td>0.510</td>
</tr>
<tr>
<td>PM4</td>
<td>0.882</td>
<td>0.902</td>
</tr>
<tr>
<td>PM5</td>
<td>0.886</td>
<td>0.903</td>
</tr>
</tbody>
</table>
Table 7.44 of the total variance explained of the performance measures that may be used to assess the performance of road projects shows that three components which had eigenvalues of above 1 were (4.365; 1.801; and 1.253). The components’ eigenvalue defined the 43.651 %, 18.015 % and 12.532 % respectively of the variance which indicates 74.198% of the total variance before the rotation and 65.486 % after the rotation. The three components based on the results of scree plot are depicted in Figure 7.6.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
<th>Rotation Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
<td>Cumulative %</td>
</tr>
<tr>
<td>1</td>
<td>4.365</td>
<td>43.651</td>
<td>43.651</td>
</tr>
<tr>
<td>2</td>
<td>1.801</td>
<td>18.015</td>
<td>61.666</td>
</tr>
<tr>
<td>3</td>
<td>1.253</td>
<td>12.532</td>
<td>74.198</td>
</tr>
<tr>
<td>4</td>
<td>0.672</td>
<td>6.723</td>
<td>80.921</td>
</tr>
<tr>
<td>5</td>
<td>0.617</td>
<td>6.174</td>
<td>87.095</td>
</tr>
<tr>
<td>6</td>
<td>0.437</td>
<td>4.374</td>
<td>91.469</td>
</tr>
<tr>
<td>7</td>
<td>0.346</td>
<td>3.460</td>
<td>94.929</td>
</tr>
<tr>
<td>8</td>
<td>0.247</td>
<td>2.466</td>
<td>97.395</td>
</tr>
<tr>
<td>9</td>
<td>0.200</td>
<td>2.002</td>
<td>99.398</td>
</tr>
<tr>
<td>10</td>
<td>0.060</td>
<td>0.602</td>
<td>100.000</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Axis Factoring.

The rotation method of varimax with Kaiser normalization using the first order of the factor analysis shows the variables loaded on the three components where most variables loaded on component 1, component 2 and component 3 were loaded equally by three variables in each (Table 7.43).
Table 7.45: Rotated factor matrix for performance measures (1st Order of factor analysis).

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM8</td>
<td>0.924</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM7</td>
<td>0.724</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM9</td>
<td>0.652</td>
<td>0.274</td>
<td></td>
</tr>
<tr>
<td>PM10</td>
<td>0.639</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM4</td>
<td></td>
<td></td>
<td>0.914</td>
</tr>
<tr>
<td>PM5</td>
<td>0.290</td>
<td></td>
<td>0.896</td>
</tr>
<tr>
<td>PM6</td>
<td>0.334</td>
<td>0.473</td>
<td>0.293</td>
</tr>
<tr>
<td>PM2</td>
<td></td>
<td></td>
<td>0.870</td>
</tr>
<tr>
<td>PM1</td>
<td></td>
<td></td>
<td>0.760</td>
</tr>
<tr>
<td>PM3</td>
<td></td>
<td>0.491</td>
<td>0.504</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.

Figure 7.6: Scree plot test of the performance measures (1st Order of factor analysis).

7.5.3 Naming of components of the performance measures that may be used to assess the performance of road projects as per 1st order of factor analysis

Component 1: Productivity factor
Component 1 (PM 1) which accounted for 43,651 % on Table 7.44 of the total variances of the performance measures that may be used to assess the performance of road projects was vital. The factor suggested that for any enterprise including contracting enterprises, the main reason is to generate maximum profit and poor performance causes the productivity to remain low (Van Wyk, 2003). This factor shows the production of the project which enables both the end users to benefit from the project and the service provider to gain by making a profit and gaining a good reputation for their companies. Component 1 defined variables, namely PM 7, PM 8, PM 9 and PM 10 (See Table7.45).

**Component 2: Client satisfaction factor**

Component 2 (PM 2) comprises the three variables on Table 7.44 which define the client requirements necessary in every construction project. Every client needs to be satisfied with the service provided, product delivered to him/her as well as the health and safety on the project. Client satisfaction and health and safety are the framework measures of the performance in the project (Ankrah & Proverbs, 2005). Any organization needs to examine and come up with a strategy to deliver clients’ requirements with the resources available, and a good attitude and behaviour (Iyer & Jha,2006). Component 2 defined the following variables PM 4, PM 5 and PM 6 (Table 7.45)

**Component 3: Performance evaluation criteria**

Component 3 (PM 3) comprises three variables on Table 7.44 which define the performance evaluation criteria that may be used to assess the performance on construction projects. Cost, quality and time were described as performance criteria (Shibani & Arumugam,2015). Performance measures are necessary in every construction projects as they guide the construction team on cost, time and quality to finalise the project outcomes and what is achieved (Ankrah & Proverbs, 2015). Component 3 defined the following variables PM 1, PM 2 and PM 3 (Table 7.45).

7.5.4 Naming of components of the performance measures that may be used to assess the performance of road projects as per 2nd order of factor analysis

| Table 7.46: Correlation matrix performance measures(2nd Order of factor analysis) |
|-----------------|-----------------|-----------------|
|                 | SecF_F1         | SecF_F2         | SecF_F3         |
| **Correlation** |                 |                 |                 |
| SecF_F1         | 1,000           | 0,530           | 0,235           |
| SecF_F2         | 0,530           | 1,000           | 0,429           |
| SecF_F3         | 0,235           | 0,429           | 1,000           |
The second order of factor analysis shows three factors which were merged into one factor and the
eigenvalue was above 1 (1,808). The eigenvalue explained (60,256 %) of the variance (Table 7.44).
The results of the scree plot test show only first component accounted for 60,256 % (Figure 7.6).

### Table 7.47: KMO and Bartlett’s test performance measures (2nd Order of factor analysis)

<table>
<thead>
<tr>
<th>Measure of Sampling Adequacy.</th>
<th>0.581</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartlett’s Test of Sphericity</td>
<td>38,491</td>
</tr>
<tr>
<td>Approx. Chi-Square df Sig.</td>
<td>3</td>
</tr>
</tbody>
</table>

### Table 7.48: Communalities performance measures (2nd Order of factor analysis)

<table>
<thead>
<tr>
<th>Initial</th>
<th>Extraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>SecF_F1</td>
<td>0.281</td>
</tr>
<tr>
<td>SecF_F2</td>
<td>0.379</td>
</tr>
<tr>
<td>SecF_F3</td>
<td>0.184</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Axis Factoring.

### Table 7.49: Factor matrix of performance measures (2nd Order of factor analysis)

<table>
<thead>
<tr>
<th>Factor</th>
<th>SecF_F2</th>
<th>SecF_F1</th>
<th>SecF_F3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor</td>
<td>0.978</td>
<td>0.541</td>
<td>0.438</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Axis Factoring.

### Table 7.50: Total variance Explained of the performance measures (2nd Order of Factor Analysis)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
</tr>
<tr>
<td>1</td>
<td>1,808</td>
<td>60,256</td>
</tr>
<tr>
<td>2</td>
<td>0,772</td>
<td>25,730</td>
</tr>
<tr>
<td>3</td>
<td>0,420</td>
<td>14,014</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Axis Factoring.
7.5.5 Validity of performance measures that may be used to assess performance on road infrastructure projects

Principal component analysis (PCA) criteria were used to test the validity of the performance measures. The observed variables were reduced into three factors of performance measures, namely production factors, client satisfaction factors and performance evaluation criteria which show the number of correlations greater than 0.3 which tentatively suggests factor analysis to be appropriate (Hooper, 2012).

7.5.6 Empirical and theoretical reliabilities of the performance measures that may be used to assess performance on road infrastructure projects

The Cronbach alpha reliability coefficient normally ranges between 0 and 1. The Cronbach alpha of 0.8 is probably a reasonable goal (Gliem & Gliem, 2003). The Cronbach alpha coefficients for three empirical factors, namely Factor 1 - Productivity factor (PM 1) with Cronbach’s Alpha of 0.847, Factor 2 - Client satisfaction factor (PM 2) with Cronbach’s Alpha of 0.856 and Factor 3 - Performance evaluation criteria (PM 3) with Cronbach’s Alpha of 0.760 were ≥0.70 which is above 0.70 indicating all variables were reliable. The second order of the empirical reliability

![Scree Plot](image_url)

**Figure 7.7: Scree plot test of performance measures (2nd Order of Factor Analysis)**
achieved 0.848 of Cronbach’s alpha which was above 0.70 therefore the variables are considered reliable (Table 7.51). The theoretical reliability achieved with 0.848 Cronbach’s Alpha which considered reliable.

Table 7.51: Reliability statistics of the performance measures that may be used to assess the performance of road projects

<table>
<thead>
<tr>
<th>Empirical reliabilities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors/Components</td>
<td>Cronbach’s Alpha (≥ 0.7)</td>
</tr>
<tr>
<td>Factor 1 - Productivity factor (PM 1)</td>
<td>0.847</td>
</tr>
<tr>
<td>Factor 2 - Client satisfaction factor (PM 2)</td>
<td>0.856</td>
</tr>
<tr>
<td>Factor 3 - Performance evaluation criteria (PM 3)</td>
<td>0.760</td>
</tr>
</tbody>
</table>

2nd Order of empirical reliabilities

| Factors of performance measures | 0.848 | 10 |

<table>
<thead>
<tr>
<th>Theoretical reliabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors/Components</td>
</tr>
<tr>
<td>Performance measures that may be used to assess the performance of road projects</td>
</tr>
</tbody>
</table>

7.6 CONCLUSION

Data collected from professionals such as road construction teams, architects, designers, engineers, quantity surveyors, project managers, company directors and the likes who are registered with various professional bodies in South Africa. Data was collected through structured questionnaires divided into six sections which were discussed in this chapter. The next chapter discusses the findings from Chapter seven. The findings discussion will link the results to the research questions and research objectives which were formulated in the first chapter of the study.
CHAPTER EIGHT

DISCUSSION OF THE RESEARCH FINDINGS

8.1 INTRODUCTION.
This chapter discusses the findings presented in Chapter seven. The results are linked to the literature review in Chapters two, three, four and five appropriate to the research questions.

8.2 BACKGROUND INFORMATION
This section discusses the respondents’ background information with regard to demographic attributes such as gender, years of experience in the construction industry, respondents’ qualifications, type of organizations that the respondents work for, professions, duration of the client to make payment for work done, number of projects executed in the past years and respondents’ companies’ CIDB grading.

8.2.1 BACKGROUND INFORMATION RESULTS
Seventy-six questionnaires received back, of which 51,3% were male and 48,7% were female. The results indicated that the males still dominate in the construction industry. However, females are also involved in the construction industry. Findings relating to the respondents as to how many years of experience they have in the construction industry, 10,5% of the respondents indicated that they have less than one year’s working experience and the same percentage indicated 16-20 years of working experience, 17,1% had been working in the construction industry for approximately 1-5 years, while 27,6% of the respondents have worked in the construction industry for about 6-10 years. Approximately 21,1% of the respondents had 11-15 years of working experience in the construction industry. At least 11,8% of the respondents had more than 20 years of working experience in the industry. The findings further revealed that 36,8% had a diploma or post-matric certificate, followed by 34,5% of the respondents with bachelor’s degree qualifications. Approximately 12% of the respondents had honours degrees and 7% respondents had master’s degrees. Only 3% of the respondents had a matric or grade 12 certificate. The findings revealed that 35,5% were working for the contracting sector, 32,9% of the respondents were clients and 31,6% of the respondents were under the consulting sector. The results showed that all sectors participated
in this survey. Approximately 32.9% of the respondents were civil engineers, 28.9% were project managers, 10.5% of the respondents were construction managers’ and construction project managers. At least 6.6% of the respondents were quantity surveyors and 7.9% of the respondents held the other qualifications. The results showed the average length of waiting for the client to make payment for work done: 36.8% of the respondents agreed that the client took more than 21 working days, 26.7% of the respondents agreed that client took between 16-20 working days, 19.7% said it took 11-15 working days, while 10.5% of the respondents agreed that client took 6-10 working days. At least 5.3% of the respondents agreed that the client took less than five working days. Findings revealed that 5.3% of the respondents had not executed any projects in the past years while 32.9% of the respondents had executed 1-5 projects and 6-10 projects in the last years. A total of 13.2% of the respondents had executed 11-15 projects, 6.6% of the respondents had executed 16-20 projects and more than 20 projects in the past years. The findings revealed the construction grading of the respondents indicating that 5.3% were on construction grading 2; 1.3% of the respondents were on construction grading 3; 2.6% of the respondents were on grading 5; and 5.3% were on grading 6. Approximately 10.5% were on construction grading 7 and 22.4% were on construction grading 8. Lastly, 26.3% of the respondents were on construction grading 9.

8.3 RESEARCH QUESTION 1

What are the factors influencing the performance of road infrastructure in the Gauteng Province of the South Africa?

The study identified the factors influencing the performance of road infrastructure projects and the dominant factors were grouped as follows: the client-related factors, consultant-related factors, contractor-related factors, design-related factors, external-related factors and the human-related factors. The results from the descriptive analysis method were used to answer the this question. The results are presented below:

8.3.1 Client-related factors

8.3.1.1 Findings

Based on the respondents’ responses, ranking (R) of the weighted average of the mean item score (MIS) and standard deviation (SD) listed results on table 7.9, it was observed that the most dominant factors that influence the performance of road infrastructure projects on client-related factors were: ‘delays in decision making’ with (M=3.90; SD=1.173; R=1) and ‘payment delays by the client’ with (M=3.41; SD=1.316; R=2) which had a high impact on the performance in road
infrastructure projects. Furthermore, ‘change of orders’ with (M=2.75; SD=1.180; R=3) and ‘variation initiated by the client’ with (M=2.86; SD=0.899; R=4) had the lowest impact. ‘Change of scope by the client’ with (M=3.04; SD=0.933; R=5) was the median factor above all client-related factors.

8.3.1.2 Discussion

The study conducted by Azman et al., (2014) agrees with the findings from the current study. They emphasized that payment problems are an old issue that has been happening in the construction industry which impacts the cash flow of the service providers (Azman et al., 2014). Ye and Abdul (2010) argue that the clients deliberately delay payment for their own financial advantage to secure ‘gifts’ from service providers (Ye & Abdul, 2010). Furthermore, the study by Maarout and Habib (2011) confirms that the changes made by the client due to lack of participation of the client during the design stage cause problems and the inadequate definition for the scope of work (Maarout & Habib, 2011).

8.3.2 Consultant-related factors

8.3.2.1 Findings

The ranking scores calculated revealed the most dominant factors that influence the performance in road infrastructure projects by the consultant as follows: ‘Late reviewing of design tender documents’ with (M=3.09; SD=1.298; R=1) was rated number one to influence performance under consultant-related factors followed by ‘inadequate site supervision’ with (M=2.80; SD=1.317; R=2). ‘Design errors by the design team’ with (M=2.74; SD=1.182; R=3) has a moderate impact as it was ranked third and lastly, ‘lack of experience by consultant’ with (M=2.68; SD=1.309; R=4).

8.3.2.2 Discussion

The study agrees with the view of Wambugu (2013) that generally, lack of supervision and work inspection on construction projects lead to rework which delays the project’s completion on time (Wambugu, 2013). It is interesting that the study indicated that the nominated consultant takes time to review and rectify all the mistakes on the tender document which might cost the client money (Murdoch & Hughes, 2008). Furthermore, Maarout and Habib (2011) mentioned that most of appointed consultants do not spend much time on site as required (Maarout & Habib, 2011). The study continued to show that the consultants being slow on projects such as inadequate experience and incompetent or poor management of site lead to poor performance (Dinesh, 2016).
According to Dadzie et al., (2012), a consultant is the employer’s agent, therefore it is vital to assess consultant performance as the consultant ensures the project is completed in time, at the right quality and within budget. Moreover, the consultant gives the employer value for money (Dadzie et al., 2012).

8.3.3 Contractor-related factors

8.3.3.1 Findings

The contractor-related factors comprising financial difficulties and cash flow problems by the contractor ranked number one with (M= 3.49; SD=1.194; R=1), followed by delays in work progress caused by poor planning with (M=3.37; SD= 1.100; R=2), unrealistic tender pricing by the contractor (M=3.41; SD= 1.060; R=3), contractors’ poor workmanship (M=3.24; SD=1.069); R=4 and inadequate technical experience by the contractor which was rated last with (M=3.09; SD=1.335; R=5).

8.3.3.2 Discussion

Dinesh (2016) fully agrees with the findings as he believed that contractors’ issues of inadequate early planning and scheduling of projects and improper safety management among others are serious matters which affect contractors’ performance. The study agrees that the contractors like to finance in long-term assets which lead to cash flow crisis (Kulemeka et al., 2015). Nyoni and Bonga (2016) emphasize the shortage of highly skilled and trained workers in the construction industry. A radical issue too in project management is a good planning to meet project objectives such as time, budget, scope as it clarifies all activities and actions that will take place and milestone (Passenheim et al., 2009). Inuwa et al., (2014) in their research studies revealed that project poor planning is the disastrous outcome of project failure.

8.3.4 Design-related factors

8.3.4.1 Findings

Among the design-related factors, late approval of design drawings by client ranked first with (M=2.96; SD =1.232; R=1), second in rank was poor tender design (M=2.92; SD=1.162; R=2). Errors/omission in design with (M=2.86; SD=1.162; R=3) rated third whereas late approval of design drawings by the client had a low impact on the performance of infrastructure projects with (M=2.65; SD=1.152; R=4).
8.3.4.2 Discussion
The study agrees with the research done by Maarouf and Habib (2011) that the most variation orders are the adaption of modifications of design, quality or quantity, omissions, additions, deletions or revisions to scope of work considered as variations and all the above are caused by the design team (Maarouf & Habib, 2011). Adzie et al., (2012) emphasize the way the design team produces design tender document late and in those design tender documents it is found that there are errors or omission in the document that lead to poor quality of work. Many researchers such as Blake Dawson Waldron (2006), Yiu and Cheung (2004), Kumaraswamy (1997) and Conlin et al. (1996) highlighted most of the design-related factors that contribute to the performance of road infrastructure projects.

8.3.5 External-related factors
8.3.5.1 Findings
Of the external-related factors, weather conditions ranked first with (M=3.15; SD=1.094; R=1) and bribery and corruption rated second from the list with (M=3.03; SD=1.471; R=2). Poor site conditions was a neutral factor with (M=2.89; SD=1.142; R=3) and unforeseen circumstances ranked last with (M=2.81; SD=1.268, R=4).

8.3.5.2 Discussion
Sambasivan and Soon (2007) agreed with the results of findings as they emphasized that external factors such as weather conditions, regular changes, and unforeseen site conditions were among other external factors that affect project performance. Okema (2017) believes that to plan accurately means to avoid risks such as weather conditions, earthquakes, and unpredictable physical site conditions by taking precautionary measures. Therefore, risk management is essential and should be adopted by all professionals to prevent unforeseen circumstances. Bribery and corruption are a huge problem for both contractors and consultants in Ghanaian construction sectors. Contractors and consultants frequently must pay kickbacks to the people involved in a project of which the total kickbacks were indicated to be around 10% (Laryea, 2010).

8.3.6 Human-related factors
8.3.6.1 Findings
Among the human-related factors, poor communication was the major problem rated number one with (M= 3.32; SD=1.175; R=1) and worker absenteeism was rated two with (M=3.04; SD1.104;
Workers’ poor attitude with (M=3.03; SD=1.027; R=3) and lack of teamwork with (M=2.85; SD=0.978; R=3) were deemed to be second last and last respectively.

8.3.6.2 Discussion
Abevade’s (2017) studies agree with the current study by highlighting the issue of unclear lines of communication, inexperience on the interpretation of work drawings as being the common causes of ineffective communication. Furthermore, lack of training of the workers and lack of skills transfer create problems such as reworks, non-payment to work done, time overrun and cost overrun (Ofori-Kuragu, 2016). Muszynska (2015) disagrees with the study as he outlined that clear lines of responsibilities must be established within the team where every project member knows his/her duties and responsibilities, including the line of reporting (Musynska, 2015).

8.4 RESEARCH QUESTION 2
What are the effects of poor performance of roads infrastructure on the participants of delivery of the project?
The study revealed the effects of poor performance of roads infrastructure on the participants of delivery of the projects and the dominant factors were identified. The results from descriptive analysis method and factor analysis method were used to answer this question. The results are presented below.

8.4.1 Findings
Based on the ranking calculated using mean item scores (MISs) and standard deviation (SD), the results revealed that cost overrun with (M=3.69; SD=1.019; R=1), time overrun with (M=3.59; SD=1.048; R=2), conflict with (M=3.45; SD=0.957; R=3), disputes between owner and contractor with (M=3.36; SD=1.085; R=4), loss of skilled workers with (M=3.36; SD=1.067; R=4), stress on the contractor with (M=3.36; SD=1.104; R=4), reworks with (M=3.28; SD=1.053; R=5) followed by termination of contract at number six with (M=3.21; SD=1.037; R=6), default on loan repayment by the contractor with (M=3.16; SD=1.059; R=7), abandonment of project (M=3.12; SD=1.066; R=8), liquidation/bankruptcy with (M=3.12; SD=1.070; R=8) and damage to company’s reputation with (M=2.99; SD=0.846; R=9). From the exploratory factor analysis, only two factors were identified. The variables from questionnaire results were all extracted under two factors termed “contractor’s internal issues and contractor legal issues” respectively.
8.4.2 Discussion
These findings agreed with those of Hamzah et al., (2012), Wafa and Singh (2013) from Malaysia, Memon (2012), Doraisamy et al., (2014) from India, Albino (2012), Tawanda (2014) from Zimbabwe, Shan (2016), Akomah and Jackson (2016) from Ghana, Mukuka et al., (2015), and Ansah (2011) from South Africa. As the construction industry is dynamic in nature, the professionals should learn to apply schedule performance to avoid featuring on all listed effects of poor performance in road infrastructure projects.

8.4.3 Implications of findings
The empirical findings of this study revealed that reworks, damage to company’s reputation, disputes between owner and contractor, loss of skilled workers and conflicts are the main effects of performance in road infrastructure projects. The stress of the contractor, time overrun and abandonment of projects are minimal factors. The theoretical findings are agreement with the findings of the study.

8.5 RESEARCH QUESTION 3
What are the impacts of stakeholders on the road infrastructure projects?
The study indicated the impacts of stakeholders in the roads infrastructure on the participants of delivery of the projects. The research question was divided into two sub-sections, namely the impacts of internal stakeholders and the impacts of external stakeholders on the road infrastructure projects. The results from the descriptive analysis method and factor analysis method were used to answer this question. The results are presented below.

8.5.1 Findings of the internal stakeholders
Late payment to service providers ranked first with (M=3,59; SD=1,253; R=1), clients who failed to verify contractors’ qualifications with (M=3,58; SD=0,858;R=2), client knowledge to review design documents with (M=3,42; SD=1.063;R=3), inadequate involvement by client during the construction project with (M= 3,42;SD=1,148;R=4), conflict between client and contractor due to clients’ lack of attention to provide necessary information for tendering with (M=3,29;SD=1,139;R=5), lack of understanding project feasibility study during planning phase with (M=3,19;SD=1,163;R=6), lack of client knowledge to interpret the contract document and drawings with (M= 3,10; SD=1,311;R=7), establishment for acceptance criteria for completion certificate with ( M= 3,04; SD=1,142;R=8) and stakeholders low level to approve project cost
The descriptive results explained the respondents’ data collected in consultant-related factors where lack experience by consultant with (M= 3.17; SD=1.178; R=1) was the only impact of the consultant-related factors that the respondents rated. On the contractor-related factor, contractors take too long to pay sub-contractors (M= 3.80; SD= 0.979; R=1), lack of resources with (M=3.69; SD=1.1214; R=2), contractors’ poor performance with (M= 3.69; SD=0.929; R=3) and lack of resources by the contractor with (M=3.35; SD=1.135; R=4).

8.5.2 Discussions of the internal stakeholders
The descriptive findings of the fourteen items defining the impacts of internal stakeholders on the road infrastructure projects established that the client involvement is very important as it provides the link between the client and the project (Trigunarsyah, 2016). Working long hours by the consultant creates lots of problems, family breakdown, and physical and psychological health problems (Dadzie et al., 2012). Authors like Molwus (2014), Alinaitwe (2008) and Buertey et al. (2016) believe that internal stakeholders are those who have a legal contractual relationship with the project sponsor. To identify the impacts of internal stakeholders, the validity and reliability were discussed. The results revealed that the Cronbach alpha coefficients of the empirical factor were ≥0.70 on both the first order and the second order reliabilities.

8.5.3 Findings of the external stakeholders
Based on the ranking calculated using MISs and SD, the results indicated that community unrest was ranked first (M=4.14; SD1.071,R=1), followed by slow response by existing service providers with (M=3.81;SD=1.036;R=2). Stakeholders have negative impacts in projects (M=3.70; SD=1.063;R=3), stakeholders have influence on failure of the project (M=3.68; SD=0.956;R=4), stakeholders delay projects(M=3.66; SD=1.017;R=5), inadequate channel of communication among stakeholders (M=3.66; SD=1.096;R=6), stakeholders’ bad relationship between each other (M=3.2;SD=1.107;R=7), lack of technical capacity of stakeholders (M=3.48;SD=1.180;R=8), stakeholders’ bad attitude towards project (M=3.47;SD= 1.029, R=9), regular changes of local authority’s rules, regulations and protocol (M=3.47;SD=1.144,R=10), resistance to relocate by property owners after property compensation (M=3.45;SD=0.987,R=11), stakeholders’ late involvement in the project (M=3.42; SD=1.166,R=12) stakeholders’ low enthusiasm (M=3.23;SD=1.149,R=12) and the lack of time to participate on project by stakeholders (M=3.18;SD= 1.135,R=13).
On the factor analysis results, the validity and reliability of the scale were determined. The construct validity of factors was adequately on the four factors. Cronbach’s alpha coefficients per empirical factor were reliable and the validity was achieved. Factor 4 was not reliable and the inter-item correlation mean of 0.338 was used to determine the reliability.

8.5.4 Discussions of the external stakeholders
Mofokeng (2012: 41) stated that stakeholders need to be engaged at the beginning of project before any construction works commence to avoid any misunderstanding. Findings revealed that the influence of stakeholders has a major impact on the success or failure of the project, hence this study agrees with the literature review which indicated that some of the stakeholders have a negative impact on the project and some of the stakeholders have a positive impact in the project (PMI, 2013). The study emphasises the valid point of having effective stakeholder management as a critical success factor which could help to view the activities and practices of stakeholder to address and balance stakeholders’ interests (Eyiah-Botwe et al., 2016).

8.6 RESEARCH QUESTION 4
How can the poor performance of the road infrastructure in the Gauteng Province of South Africa be mitigated?
Data related to the mitigation of or solution to poor performance of road infrastructure projects were identified and applied to this research question on how to mitigate the poor performance.

8.6.1 Findings
The responded were asked to rank the factors that can resolve performance problems in the road construction project: skills transfer with (M=4.60; SD=0.678; R=1) was rated number one by the respondents followed by ‘education and training’ with 9M=4.53; SD=0.644; R=2). ‘Effective communication’ was rated number three with (M=4.44; SD=0.809; R=3) and ‘adequate planning’ rated number four with (M=4.11; SD=1.122; R=4). ‘Engaging local municipalities and road agencies’ was ranked fifth with (M=4.08;SD=0.882,R=5), ‘quality management was rated six’ with (M=4.07;SD=1.155;R=6) and ‘stakeholder management’ was ranked seventh with (M=3.83,SD=1.122,R=7). ‘New technology’ was rated third last with (M=3.72;SD=0.708;R=8), ‘public-private partnership’ was number nine with (M=3.69;SD=0.885;R=9) and last was ‘effective communication’ with the (M=3.24;SD=0.809;R=10).

8.6.2 Discussion
The findings from the following authors agree that skills transfer, education and training, effective communication is key to resolve poor performance on road construction. According to Kamanga & Steyr, (2013), Consultants and contractors should undergo continuous training courses to improve the capability of personnel and professionals carrying out designs, supervision and construction of all levels except top management. The skills development of the business such as planning, financial control in terms of controlling cash flow, expenditures, budgeting and operational skills like scheduling, pricing of rates on the bill of quantities (BOQ) and ordering of materials are needed for the upcoming contractors, specially blacks, for their success of any enterprise (Thwala & Mvubu, 2008). According to SANRAL, (2015), Road agencies can aid the delivery of the road projects as their mandate is to help on the different aspects of roads all over the country. The road agencies like SANRAL, JRA and others can be the solution to most of the challenges found in road construction in the Gauteng Province, South Africa. In construction projects, quality of work is associated with adherence to conditions of the contract and specifications stipulated in the contract documents in their entirety during the execution of the project (Kulemeka, 2015). The second aspect of quality of work concerns what beneficiaries see and feel when making use of the construction product. Effective communication is a free exchange of accurate and relevant information among teamwork in the right time that can mitigate the challenges facing roads construction projects. Communication among teamwork should be monitored, clear, honest, open and frequent but not excessive (ASCE, 2012 & Inuwa et al., 2015).

8.7 RESEARCH QUESTION 5

What measures are used to assess the performance of road infrastructures in the Gauteng Province of South Africa?

The study outlined the measures used to assess the performance of roads infrastructure in the Gauteng Province of South Africa. The results from the descriptive analysis method and factor analysis method were used to answer this question. The results are presented below.

8.7.1 Findings

The results from descriptive analysis show the quality factor ranked first with (M=4.46; SD=0.629; R=1) and the cost factor with (M=4.34; SD=0.810; R=2) and time factor with (M=4.34; SD=0.716, R=2) were both rated number two. The client satisfaction (product) with (M=4.17; SD = 0.845; R=3), client satisfaction (service) with (M= 4.15; SD=0.856; R=4), end user’s satisfaction with (M=3.94; SD=1,108; R=5). Health and safety factor with (M= 3.94; SD =0.924; R=6), productivity with (M= 3.90; SD= 1.058, R=7). The defects with (M= 3.76; SD=1,213; R=8) and profitability
with \(M=3.55; \ SD=1.011; \ R=9\). The validity and reliability of the scale were determined. The construct validity of factors was adequate on the three factors. Cronbach’s alpha coefficients per empirical factor were reliable and the validity was achieved.

**8.7.2 Discussion**

The findings of authors such as Asiedu (2009), Opuch (2016) from Ghana, Abedi et al. (2011), Moyo et al. (2014) from Zimbabwe, Ankrah and Proverbs (2005), Iyer and Jha (2006) from India, Armstrong (2006) and Rahman et al. (2013) from Malaysia agree with the study that the factors such as cost, quality and time performance are the important factors to measure project performance. Those factors are referred to as part of the project management process.

**8.8 CONCLUSION**

The information and data collected from respondents through structured questionnaires to establish the dominant factors that influence performance in road infrastructure projects, the effects of poor performance of road infrastructure on the participants of delivery of the project, the impacts of stakeholders on the road infrastructure projects, ways to mitigate the poor performance of the road infrastructures in the Gauteng Province of South Africa and measures used to assess the performance of road infrastructures, in the Gauteng Province of South Africa were presented and analyzed in relation to research questions. The findings from the research analysis and results could address the research question. The next chapter will be the conclusions of the research in relation to the research objectives of the study and recommendations will be offered.
CHAPTER 9

CONCLUSIONS AND RECOMMENDATIONS

9.0 INTRODUCTION

The main aim of this research was to establish the dominant factors that influence performance in road infrastructure projects, the effects of poor performance of road infrastructure on the participants of delivery of the project, the impacts of stakeholders on the road infrastructure projects, ways to mitigate the poor performance of the road infrastructures in the Gauteng Province of South Africa and measures used to assess the performance of road infrastructures in the Gauteng Province of South Africa. This chapter presents the conclusions and recommendations of the research study discussed in relation to the objectives of the study. The research objectives were as follows:

1. To determine the factors influencing the poor performance of roads infrastructures in the Gauteng Province of South Africa;
2. To investigate effects of poor performance of roads infrastructure on the construction industry;
3. To determine the impacts of stakeholders in the roads infrastructure projects;
4. To suggest ways to mitigate poor performance of the roads infrastructure in the Gauteng Province of South Africa; and
5. To identify measures used to assess the performance of roads infrastructure

9.1 RESEARCH OBJECTIVE 1

To determine the factors influencing the poor performance of roads infrastructures in the Gauteng Province of South Africa.

The main aim of this research was to establish the dominant factors that influence the poor performance of roads infrastructure in the Gauteng Province of South Africa. The literature review revealed the dominant factors that influence the performance on road infrastructure projects as the client-related factors comprising variations initiated by the owners, change of scope, lack of experience, change of orders, reducing/shortening of contract period, delay in decision making, poor project management practices, and unrealistic expectations payment delays. The consultant-related factors comprise design errors, inadequate site supervision, and lack of experience while the contractor-related factors comprise delays in work progress caused by poor planning, financial difficulties and cash flow problems of the contractor, and unrealistic tender pricing by contractors, among others. The literature reviewed the design-related factors, the human-related factors and the external-related factors while considering previous studies globally where the
factors that influence the performance of road infrastructure were identified. The case study in Malaysia revealed that any success of the project is determined by the project completion time, cost, scope and stakeholders’ satisfaction (Jatarona et al., 2016). The questionnaire survey obtained from the randomly selected respondents revealed that the following factors were rated as the main factors that influence the performance of road infrastructure projects in the Gauteng Province of South Africa: Regarding the client-related factors, delays in decision making and payment delays by the client were the main factors. Consultant-related factors listed were late reviewing design tender documents and inadequate site supervision by the consultant. The contractor-related factors most rated by the respondents were financial difficulties and cash flow problem by the contractor, delays in work progress caused by poor planning and unrealistic tender pricing by the contractor. External related factors were weather conditions which were ranked as the most dominant factor, followed by bribery and corruption. Lastly, of the human-related factors, poor communication was the major problem rated number one as well as worker absenteeism.

9.2 RESEARCH OBJECTIVE 2

To investigate the effects of poor performance of road infrastructure on the construction industry

The second objective of the study was to determine the effects of poor performance of road infrastructure in the Gauteng Province of South Africa. Several effects were identified. These included cost overrun caused by change of scope and extension of time, time overrun caused by the variation orders, conflict needing to be managed all the time to avoid disputes between owner and contractor, and the loss of skilled workers due to several reasons such as death and retirement. Therefore skills transfer is needed so that skilled workers can pass the knowledge on to the new manpower before they retire. Poor performance creates stress on the contractor as the contractor will experience problems such as reworks, termination of contract, default on loan repayment by the contractor, abandonment of project, liquidation or bankruptcy and damage to the company’s reputation.

9.3 RESEARCH OBJECTIVE 3

To determine the impacts of stakeholders on the roads infrastructure projects

The third objective of the study was to determine the stakeholders’ impact on the road infrastructure. The study revealed that any stakeholders, whether bad or good, have an impact on the project. The
study grouped the stakeholders into two, namely the internal stakeholders and the external stakeholders. Regarding the external stakeholders, the following impacts were listed: community unrest had a higher impact than others on external stakeholders as many projects are generally halted due to community unrest demanding jobs and better wages. A slow response by existing service providers can also stop the project as the existing services such as electric poles and water pipes are along the road where the project has to be carried out. Stakeholders have negative impacts on projects as stakeholders have an influence on the failure of the project, for example, stakeholders delay projects by disagreeing on the decisions taken on the project, or by inadequate channels of communication between stakeholders. Stakeholders’ bad relationships among each other cause projects to suffer. Other causes are a lack of technical capacity of stakeholders, stakeholders’ bad attitude towards projects, regular changes of local authority’s rules, regulations and protocol, resistance to relocate by property owners after property compensation, stakeholders’ late involvement in the project, stakeholders’ low levels of enthusiasm and the lack of time to participate on projects by stakeholders. The internal stakeholders have the following impacts: late payment to service providers, clients who fail to verify contractors’ qualifications, client knowledge to review design documents, inadequate involvement by clients during construction projects, conflict between clients and contractors due to clients’ lack of attention to provide necessary information for tendering, and a lack of understanding of project feasibility study during planning phase. Lack of client knowledge to interpret the contract document and drawings, establishment for acceptance criteria for completion certificate and low level to approve project cost are further factors.

9.4 RESEARCH OBJECTIVE 4

To suggest ways to mitigate poor performance of the roads infrastructure in the Gauteng Province of South Africa.

The study revealed several ways that can mitigate the poor performance of the road infrastructure projects. Education and training of the organizations’ employees are very important as knowledge is power. Skills transfer should be done from those skilled employees who are about to retire to the upcoming employees. In addition, the stakeholder management process as one of the project management processes is vital in providing a plan on how to monitor project stakeholders and their expectations. Finally, adequate planning, quality management, engaging local municipalities who can assist to deliver the projects on time, shortening the timeframe to respond by the project sponsor,
adopting new technology, partnering with public-private partnerships and effective communication are all the medicine of project success.

9.5 RESEARCH OBJECTIVE 5

To identify measures used to assess the performance of roads infrastructure

The last objective was to identify measures used to assess the performance of road infrastructure projects in the Gauteng Province of South Africa. The literature review conducted revealed the following as the main measures: the quality factor should be monitored and the cost factor and time factor should be evaluated. The client satisfaction and end user’s satisfaction are regarded as the final approvers of the product; therefore both should be satisfied. The health and safety factor is a necessary precaution on every project. Productivity, lack of defects and profitability are good factors to measure project performance.

9.6 CONCLUSION

From literature review the dominant factors that influence the performance in road infrastructure projects have been highlighted. Those factors are client-related, consultant-related, contractor-related, design-related, human-related and external-related factors. Findings from the current study prove that good and bad performance in the road infrastructure projects are caused by numerous factors including project stakeholders such as client, consultant and contractor, among others. Client-related factors include variation initiated by the client, change of scope by the client, delay in decision making, change of orders and payment delays by the client. The consultant-related factors are listed as design errors by the design team, inadequate site supervision, lack of experience by consultant and late reviewing of design tender documents. Contractor-related factors are delays in work progress caused by poor planning, financial difficulties and cash flow problems by the contractor, contractors’ poor workmanship and unrealistic tender pricing, while the design-related factors are poor quality of design, errors and omissions in design, inadequate or incomplete specifications, and the late approval of design drawings by client. The external-related factors are as follows: weather conditions (rainy, frosty weather), bribery and corruption, poor site conditions and unforeseen circumstances e.g. tornado, while the human-related factors are lack of teamwork among project teams, poor communication among site personnel, workers’ poor attitude, workers’ absenteeism and poor working conditions.
Regarding the effects of road infrastructure projects, the reworks among other effects of performance may cause the abandonment of projects by the contractor, liquidation or bankruptcy of the companies, damage to companies’ reputation, termination of contract, conflicts among the projects stakeholders, and disputes between owners and contractors. On the other hand, the loss of skilled workers is regarded as a moderate effect of the performance of road infrastructure projects as the company can lose skilled workers due to retirement, death or illness. Default on loan repayment by the contractor creates stress on the contractors’ side, originating from issues such as non-payment or late payment by the client, and broken equipment on site that might cause delays on the contractor’s side. All the above effects listed contribute to the performance of any construction projects.

Furthermore, the impact of stakeholders on construction projects affect the project in a positive or negative way depending on stakeholders’ attitude towards the project. There is general recognition of the factors that influence the performance of road infrastructure projects that need attention. The current study identifies the ways to resolve the performance problems in road infrastructure projects. The project participants can choose different mechanisms or ways to resolve performance problems while the study highlighted several ways such as education and training, skills transfers, stakeholder management, adequate planning, quality management, engaging local municipalities and road agencies, shortening the timeframe to respond, new technology, public-private partnership and effective communication.

9.7 RECOMMENDATIONS

There are many factors that influence the performance of road infrastructure projects. Some of the factors that influence the project performance cannot be avoided or eliminated, external related factor like weather conditions (rainy, frosty weather), bribery and corruption, poor site conditions and unforeseen circumstances, for example, tornados. Therefore, the following recommendations should be taken into consideration:

- Project participants in this study meaning the client, consultant and contractor should work like a team to execute and complete the project in professional manner, within specified time, within cost and quality.

- Since the construction project environment is dynamic in nature and all projects are different to each other, construction professionals need to understand the schedule performance of their project.
• Effective communication is the key of any project success. Poor communication handicap the project and all the factors that influence poor performance are examples of poor communication. Therefore, communication channels need to be established and all project teams should communicate regularly in every decision taken to avoid construction errors, conflicts and any disputes.

• It is recommended that poor performance should always be avoided in order to save time and costs that might rise due to reworks and legal costs due to disputes, if any.

• Performance assessment can be the order of the day where top management of the organization use performance measures to adjudicate/evaluate project performance.

• A positive impact on performance and profitability of the organization comes from proper planning; therefore, planning is a vital to any project’s success.

9.8 RECOMMENDATION FOR FURTHER STUDIES
The following recommendation is made in terms of further research:

• The impact of IT technologies, robotic and automation in road maintenance project in South Africa

It appeared that there is little or no published date on the impact of IT technologies, robotic and automation in road maintenance project in South Africa. Hence, the professionals in construction industry especially on roads projects would give more content on these for the benefits of the newly upcoming contractors and consultants.
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Dear Sir/Madam

LETTER OF INVITATION FOR RESEARCH SURVEY

The Department of Construction Management and Quantity Surveying at the University of Johannesburg, Doornfontein campus, South Africa, is conducting a research project titled 
ASSESSMENT OF THE PERFORMANCE OF ROADS INFRASTRUCTURE IN THE GAUTENG PROVINCE OF SOUTH AFRICA - PARTICIPANTS’ PERSPECTIVE.

We kindly request that you complete the following short questionnaire. Answering this questionnaire will take approximately 20 minutes of your time. Your response is of the utmost importance to us. To protect your anonymity, please do not enter your name or contact details on the questionnaire. Should you wish to know the findings of this research, the results will be available at the Department of Construction Management and Quantity Surveying.

Should you have any queries or comments regarding this survey, you are welcome to contact me telephonically at: +27822611369 or e-mail me at winnie.mushatu@gauteng.gov.za

Thanking you in advance.

SW MUSHATU

QUESTIONNAIRE ON ASSESSMENT OF THE PERFORMANCE OF ROADS INFRASTRUCTURE IN THE GAUTENG PROVINCE OF SOUTH AFRICA.

PLEASE ANSWER THE FOLLOWING QUESTIONS BY CROSSING (X) ON THE RELEVANT BLOCK

Example on how to complete questionnaire:

Gender
SECTION A: BACKGROUND INFORMATION

This section of the questionnaire refers to the background or biographical information. Although we are aware of the sensitivity of the questions in this section, the information will allow us to compare groups of respondents. Once again, we assure you that your response will remain anonymous. Your co-operation is appreciated.

1. Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>1</td>
</tr>
<tr>
<td>Female</td>
<td>2</td>
</tr>
</tbody>
</table>

2. How many years of experience do you have in the construction industry?

<table>
<thead>
<tr>
<th>Years of Experience</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1 year</td>
<td>1</td>
</tr>
<tr>
<td>1-5 years</td>
<td>2</td>
</tr>
<tr>
<td>6-10 years</td>
<td>3</td>
</tr>
<tr>
<td>11-15 years</td>
<td>4</td>
</tr>
<tr>
<td>16-20 years</td>
<td>5</td>
</tr>
<tr>
<td>More than 20 years</td>
<td>6</td>
</tr>
</tbody>
</table>

3. State your highest educational qualifications

<table>
<thead>
<tr>
<th>Qualifications</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Matric (Grade 12) certificate</td>
<td>1</td>
</tr>
<tr>
<td>Diploma or Post matric</td>
<td>2</td>
</tr>
<tr>
<td>Bachelor’s Degree</td>
<td>3</td>
</tr>
<tr>
<td>Honours ’s Degree</td>
<td>4</td>
</tr>
<tr>
<td>Master’s Degree</td>
<td>5</td>
</tr>
<tr>
<td>Doctorate</td>
<td>6</td>
</tr>
</tbody>
</table>

4. Which of the following best describes the company you are working for?

<table>
<thead>
<tr>
<th>Company Type</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Public sector client firm</td>
<td>1</td>
</tr>
<tr>
<td>Private sector client firm</td>
<td>2</td>
</tr>
</tbody>
</table>

5. What is your profession?

<table>
<thead>
<tr>
<th>Profession</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect</td>
<td>1</td>
</tr>
<tr>
<td>Civil engineer</td>
<td>2</td>
</tr>
</tbody>
</table>
6. How long does the client take to make payments for work done?

<table>
<thead>
<tr>
<th>Duration</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 working days or less</td>
<td>1</td>
</tr>
<tr>
<td>Between 7-14 working days</td>
<td>2</td>
</tr>
<tr>
<td>Between 15–21 working days</td>
<td>3</td>
</tr>
<tr>
<td>Between 22-30 working days</td>
<td>4</td>
</tr>
<tr>
<td>More than 30 working days</td>
<td>5</td>
</tr>
</tbody>
</table>

7. What is the total number of projects executed in the last years?

<table>
<thead>
<tr>
<th>Number of Projects</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5 projects</td>
<td>1</td>
</tr>
<tr>
<td>6-10 projects</td>
<td>2</td>
</tr>
<tr>
<td>11-15 projects</td>
<td>3</td>
</tr>
<tr>
<td>16 – 20 projects</td>
<td>4</td>
</tr>
<tr>
<td>More than 20 projects</td>
<td>5</td>
</tr>
</tbody>
</table>

8. What is your company’s CIDB grading?

<table>
<thead>
<tr>
<th>CIDB Grading</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1</td>
<td>1</td>
</tr>
<tr>
<td>Grade 2</td>
<td>2</td>
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<tr>
<td>Grade 3</td>
<td>3</td>
</tr>
<tr>
<td>Grade 4</td>
<td>4</td>
</tr>
<tr>
<td>Grade 5</td>
<td>5</td>
</tr>
<tr>
<td>Grade 6</td>
<td>6</td>
</tr>
<tr>
<td>Grade 7</td>
<td>7</td>
</tr>
<tr>
<td>Grade 8</td>
<td>8</td>
</tr>
<tr>
<td>Grade 9</td>
<td>9</td>
</tr>
</tbody>
</table>
SECTION B: FACTORS INFLUENCE THE PERFORMANCE IN ROADS INFRASTRUCTURE PROJECTS

Please indicate your answer using the following 5-point scale: 1 = Strongly disagree (SD), 2 = Disagree (D), 3 = Neutral (N), 4 = Agree (A), 5 = Strongly agree (SA)

9. To what extent do you agree with the following to be the factors that influence performance on road infrastructure projects?

<table>
<thead>
<tr>
<th>CLIENT-RELATED FACTORS</th>
<th>Strongly</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLRF 1 Variation initiated by the client</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>CLRF 2 Change of scope by the client</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>CLRF 3 Delay in decision making</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>CLRF 4 Change of orders</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>CLRF 5 Payment delays by the client</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONSULTANT-RELATED FACTORS</th>
<th>Strongly</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTRF 1 Design errors by the design team</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>CTRF 2 Inadequate site supervision</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>CTRF 3 Lack of experience by consultant</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>CTRF 4 Late reviewing design tender documents</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTRACTOR-RELATED FACTORS</th>
<th>Strongly</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRRF 1 Delays in work progress caused by poor planning</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>CRRF 2 Financial difficulties/ Cash flow problem by the contractor</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>CRRF 3 Inadequate technical experience by the contractor</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>CRRF 4</td>
<td>Contractor’s poor workmanship</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>CRRF 5</td>
<td>Unrealistic tender pricing by contractor</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**DESIGN-RELATED FACTORS**

<table>
<thead>
<tr>
<th>DRF 1</th>
<th>Poor quality of design</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRF 2</td>
<td>Errors/ Omission in design</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>DRF 3</td>
<td>Inadequate/ incomplete specification</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>DRF 4</td>
<td>Late approval of design drawings by client</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**EXTERNAL-RELATED FACTORS**

<table>
<thead>
<tr>
<th>ERF 1</th>
<th>Weather conditions (rainy, frosty weather)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERF 2</td>
<td>Bribery/ Corruption</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>ERF 3</td>
<td>Poor site conditions</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>ERF 4</td>
<td>Unforeseen circumstances e.g. tornado</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**HUMAN-RELATED FACTORS**

<table>
<thead>
<tr>
<th>HRF 1</th>
<th>Lack of teamwork between project teams</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRF 2</td>
<td>Poor communication between site personnel</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>HRF 3</td>
<td>Workers’ poor attitude</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>HRF 4</td>
<td>Workers’ absenteeism</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>HRF 5</td>
<td>Poor working conditions</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**Section C: EFFECTS OF POOR PERFORMANCE IN ROADS INFRASTRUCTURE PROJECTS**

10. To what extent do you agree with the following being the effects of poor performance of roads infrastructure projects in the Gauteng Province in South Africa?
### EFFECTS OF PERFORMANCE

<table>
<thead>
<tr>
<th>EOPP 1</th>
<th>Abandonment of project</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOPP 2</td>
<td>Cost overrun</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>EOPP 3</td>
<td>Time overrun</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>EOPP 4</td>
<td>Reworks</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>EOPP .5</td>
<td>Liquidation /Bankruptcy</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>EOPP 6</td>
<td>Damage to company’s reputation</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>EOPP 7</td>
<td>Dispute between owner and contractor</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>EOPP 8</td>
<td>Loss of skilled workers</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>EOPP 9</td>
<td>Conflicts</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>EOPP10</td>
<td>Default on loan repayment by the contractor</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>EOPP11</td>
<td>Creates stress on the contractor</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>EOPP12</td>
<td>Termination of contract</td>
<td>1</td>
<td>2</td>
<td>3</td>
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</tr>
</tbody>
</table>

### SECTION D: IMPACTS OF STAKEHOLDERS IN THE ROADS CONSTRUCTION PROJECTS

11. To what extent do you agree that the stakeholders have a negative impact on the road infrastructure projects?

<table>
<thead>
<tr>
<th>INTERNAL STAKEHOLDERS, (Client, Consultant &amp; Contractor) negative impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CLIENT-RELATED IMPACT</strong></td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td>CLRI 1</td>
</tr>
<tr>
<td></td>
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<tr>
<td>CLRI 2</td>
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<td>CLRI 3</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>CLRI 4</td>
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<tr>
<td>CLRI 5</td>
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<tr>
<td>CLRI 6</td>
</tr>
<tr>
<td>CLRI 7</td>
</tr>
<tr>
<td>CLRI 8</td>
</tr>
<tr>
<td>CONSULTANT-RELATED IMPACT</td>
</tr>
<tr>
<td>CTRI 1</td>
</tr>
<tr>
<td>CTRI 2</td>
</tr>
<tr>
<td>CTRI 3</td>
</tr>
<tr>
<td>CTRI 4</td>
</tr>
<tr>
<td>CONTRACTOR-RELATED IMPACT</td>
</tr>
<tr>
<td>CRRI 1</td>
</tr>
<tr>
<td>CRRI 2</td>
</tr>
<tr>
<td>CRRI 3</td>
</tr>
<tr>
<td>CRRI 4</td>
</tr>
</tbody>
</table>

EXTERNAL STAKEHOLDERS (Community, Property owners, Service providers of existing services, Local authorities, Road user, Business forums) negative impact
<table>
<thead>
<tr>
<th>ESI</th>
<th>Impact</th>
<th>Strongly</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Stakeholders have negative impacts in projects</td>
<td>1</td>
<td>2</td>
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<tr>
<td>2</td>
<td>Stakeholders delays projects</td>
<td>1</td>
<td>2</td>
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<tr>
<td>3</td>
<td>Stakeholders have influence on failure of the project</td>
<td>1</td>
<td>2</td>
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<tr>
<td>4</td>
<td>Stakeholders bad attitude towards project</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Stakeholders bad relationship between each other</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Stakeholders low enthusiasm</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>7</td>
<td>Lack of time to participate on project by stakeholders</td>
<td>1</td>
<td>2</td>
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<tr>
<td>8</td>
<td>Lack of technical capacity on stakeholders</td>
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<td>2</td>
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<td>9</td>
<td>Inadequate channel of communication between stakeholders</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>10</td>
<td>Stakeholders late involvement in the project</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<tr>
<td>11</td>
<td>Resistance to relocate by property owners after property compensation</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>12</td>
<td>Community unrest</td>
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<td>2</td>
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<td>4</td>
<td>5</td>
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<tr>
<td>13</td>
<td>Slow response by existing service providers</td>
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<td>2</td>
<td>3</td>
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<td>5</td>
</tr>
<tr>
<td>14</td>
<td>Regular changes of local authority’s rules, regulations &amp; protocol</td>
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<td>2</td>
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**SECTION E: WAYS TO RESOLVE PERFORMANCE PROBLEMS ON ROADS INFRASTRUCTURE PROJECTS**
12. To what extent do you agree with the following to be the ways to resolve performance problems in roads infrastructure projects?

<table>
<thead>
<tr>
<th>WAYS TO RESOLVE POOR PERFORMANCE</th>
<th>Strongly</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly</th>
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</thead>
<tbody>
<tr>
<td>WRPP 1 Education and training</td>
<td>1</td>
<td>2</td>
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<tr>
<td>WRPP 2 Skills transfers</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>WRPP 3 Stakeholder management</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>WRPP 4 Adequate planning</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>WRPP 5 Quality management</td>
<td>1</td>
<td>2</td>
<td>3</td>
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</tr>
<tr>
<td>WRPP 6 Engaging local municipalities and road agencies.</td>
<td>1</td>
<td>2</td>
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<td>4</td>
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<tr>
<td>WRPP 7 Shortening timeframe to respond</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<tr>
<td>WRPP 8 New technology</td>
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<td>2</td>
<td>3</td>
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<tr>
<td>WRPP 9 Public-private partnership</td>
<td>1</td>
<td>2</td>
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<tr>
<td>WRPP 10 Effective communication</td>
<td>1</td>
<td>2</td>
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SECTION F: PERFORMANCE MEASURES THAT MAY BE USED TO ASSESS THE PERFORMANCE OF ROAD PROJECTS

13. To what extent do you agree with the following to be the performance measures to assess the performance of road infrastructure projects?

<table>
<thead>
<tr>
<th>PERFORMANCE MEASURES</th>
<th>Strongly</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly</th>
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<tbody>
<tr>
<td>PM 1 Time factor</td>
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<td>2</td>
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<tr>
<td>PM 2</td>
<td>Cost factor</td>
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<tr>
<td>PM 3</td>
<td>Quality factor</td>
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<td>2</td>
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<tr>
<td>PM 4</td>
<td>Client satisfaction (product)</td>
<td>1</td>
<td>2</td>
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<tr>
<td>PM 5</td>
<td>Client satisfaction (service)</td>
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<tr>
<td>PM 6</td>
<td>Health and safety factor</td>
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<td>3</td>
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<td>PM 7</td>
<td>Profitability</td>
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<td>2</td>
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<tr>
<td>PM 8</td>
<td>Productivity</td>
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<tr>
<td>PM 9</td>
<td>End user’s satisfaction</td>
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<td>2</td>
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<tr>
<td>PM 10</td>
<td>Defects</td>
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